

**Abstracts from the**  
**9th Congress of the Vascular Access Society**



**April 15-18, 2015**  
**Barcelona, Spain**

**Guest Editors**  
**Ramón Roca-Tey**  
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► **Thursday 16<sup>th</sup> April**  
**CASE REPORTS | 8:00 - 9:00 | AUDITORIUM**

**8:00 - 8:12 | 215**

**TRANPOSED SUPERFICIAL FEMORAL VEIN FISTULA: DURABILITY DESPITE EARLY COMPLICATIONS**

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**Introduction and Objectives:** We report on a 64-year-old female (PW) who had complications post right transposed superficial femoral vein fistula (tSFVF).

PW, diagnosed with type I diabetes mellitus aged 14 years, developed diabetic nephropathy. In 2006 she was placed on the transplant list.

**Material and Methods:** In 2007 peritoneal dialysis commenced and after 16 months she underwent kidney-pancreas transplant. The kidney did not function. Imaging showed graft infarction and it was explanted. She dialysed on a temporary left internal jugular line. 4 weeks later the pancreas graft infarcted and was explanted. A tunnelled right internal jugular line was placed.

Her course was complicated by a vancomycin resistant enterococcus wound infection requiring debridement, 6 months Warfarin therapy for pulmonary embolism, and Clostridium Difficile colitis.

Subsequent to wound healing and nutritional recuperation, an upper limb fistula was planned. There were no suitable veins so a left brachioaxillary 4-6 mm tapered PTFE graft was placed. Thrombectomy was required at 11 months but was unsuccessful. A left subclavian line was inserted. 1 month later a right brachioaxillary 6 mm PTFE graft was placed. She dialysed for 6 months until this graft too thrombosed.

Access was challenging and anxious to avoid further prosthetic, a tSFVF was created (March 2010). This was complicated by:

- Compartment syndrome right calf - fasciotomies on day 4 (subsequently closed).
- Ischaemic foot day 11 due to steal syndrome – reconfiguration of tSFVF by proximalisation procedure using 4-7 mm tapered PTFE graft.
- Foot-drop - full mobility with sticks.
- Thrombosis of tSFVF at 4 months - radiological thrombectomy and venoplasty.

**Results:** Since July 2010 no intervention has been required and nearly 5 years later the patient continues to dialyse using this fistula. The flow in the fistula was 800mls/min in September 2014 without any significant areas of stenosis on duplex scanning.

**Conclusion:** The tSFVF is advocated as an alternative to thigh prosthetic loop graft fistulae. The rationale is the provision of a more durable fistula, avoiding a prosthetic that is at risk of infection in the leg. The surgical procedure is complex and risks various complications including compartment and steal syndromes. Despite suffering these complications, our perseverance has resulted trouble free dialysis for 5 years for PW. No thigh prosthetic graft has lasted that long in our experience. A recently published series of tSFVF reports primary patency rates of 91%+/-4% at 1 year and 45%+/-11% at 9 years, with secondary patency rates at 1 and 9 years of 84%+/-5% and 56%+/-9%, respectively (Bourquelot P et al. J Vasc Surg 2012;56:440-5).

**8:15 - 8:27 | 99**

**SURGICAL AND ENDOVASCULAR SIMULTANEOUS TREATMENT OF THROMBOSED PROSTHETIC GRAFTS FOR HEMODIALYSIS IN HYBRID OPERATING ROOM**

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**Introduction and Objectives:** The most common complication of prosthetic graft for haemodialysis is thrombosis.

This important complication often requires rescue procedures to extend the life of the graft. The salvage procedures of thrombosed prosthetic

graft may be performed with either conventional surgical or endovascular techniques.

**Material and Methods:** We report the case of a 51-year-old female with end stage renal disease (ESRD) related to Adult Polycystic Kidney Disease.

Patient was referred to our unit of vascular and endovascular surgery, (Mauriziano Hospital Turin Italy) in order to create an arteriovenous shunt by using a prosthesis graft after different attempts to perform a native arteriovenous fistulas were failed.

We put in place a AV graft U-loop type into her right forearm (Atrium FLIX-ENE™ tri-laminate construction PTFE) which was able to guarantee a regular and patent access for haemodialysis over a period of three months.

After that period a complication occurred and the total thrombosis of vascular access was detected.

Patient again was referred to our behalf twenty days after the graft occlusion and in order to attempt the salvage of the shunt we performed a combined surgical-endovascular treatment in our Hybrid operating room.

To achieve this goal first we de-clotted the graft; we performed a mini-incision over the graft surface and with the help of a Fogarty catheter over the wire it was possible to retrieve the clots with the help of the balloon visible under fluoroscopy.

At the same time an angiogram showed the complete patency of the shunt and an arterial and venous significant residual stenosis at the site of the anastomosis, responsible of the occlusion, were detected and treated with the angioplasty using a Bard LUTONIX 035 drug coating balloon (DCB).

**Results:** The Intraoperative technical success was 100% with a complete restoration of a pulsed flow into the graft.

At six months of follow-up the graft patency was regular without restenosis, false aneurysms or infection.

**Conclusion:** The combined simultaneous surgical-endovascular approach in hybrid operating room maximizes the use of different available techniques and appear to improve success rate to save a thrombosed graft for haemodialysis, even many days after the event occurs.

**8:30 - 8:42 | 176**

**ULTRASOUND GUIDED-ANGIOPLASTY, A SUITABLE ALTERNATIVE IN SOME PATIENTS**

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**Introduction and Objectives:** Percutaneous transluminal angioplasty (PTA) has been the central therapeutic modality used to treat dialysis vascular access (VA) dysfunction. The gold standard imaging modality for performing it is digital subtraction angiography. Some centers recently reported their technical success with ultrasound-guided PTA.

**Material and Methods:** The authors report their first case experience with this modality. A 73 year-old, diabetic male with end stage kidney disease on hemodialysis for 5 years, and a brachiocephalic fistula for 4, was referred due to increase of aneurysms, prolongation of hemostasis time, recirculation increase and blood flow (BF) decrease >25% from the baseline (1300 ml/min). Regarding patient's history, it should be highlighted a mild degree of steal syndrome after the fistula creation, which improved over time. Doppler ultrasound (DU) was used as the imaging modality to identify stenosis.

**Results:** Three hemodynamic significant stenosis were diagnosed; BF 700 ml/min; Resistance Index (RI) 0,62. The guidance of the placement of a 8 mm diameter angioplasty balloon allowed a successfully dilation of the stenosis. The BF was evaluated immediately after dilations, to prevent overcorrection and steal syndrome recurrence. Final BF was 1195 ml/min, with clinical improvement of the aneurysms tension, without any sign of steal syndrome or any complications related to the procedure. Final angiography was performed to confirm final results. Three month clinical follow-up and surveillance show a well-functioning fistula with stable flow rates.

**Conclusion:** Ultrasound guidance may provide a valid and safe tool in the localization and treatment of peripheral VA stenosis. Main advantages of this modality include lack of radiation exposure for both patient and health-care professionals; less expensive; and possible future procedures in the dialysis chair, without all the hard radiological apparatus. Contrast allergy or

contraindication (like CKD with good renal residual function, before hemodialysis start) is one of the most important current indications for this modality, nevertheless diabetic patients with multiple stenoses and a high risk of steal syndrome development may also be future candidates. These patients would benefit from a "controlled" procedure with simultaneous BF evaluations and selection of which stenosis should be dilated, not only based on their anatomy, but mainly on their hemodynamic features. This successful case contributes with valuable information on its clinical application.

**8:45 - 8:57 | 53**

#### **DRIL PROCEDURE FOR HEMODIALYSIS ACCESS-INDUCED LOWER LIMB ISCHEMIA**

*Jan Tordoir*

MUMC, Maastricht, The Netherlands

**Introduction and Objectives:** Hemodialysis access-induced distal ischemia (HAIDI) is a less frequent complication of brachial artery-based arteriovenous fistulas (AVF) in the upper extremity. Distal ischemia in the lower extremity is even more rare and mostly associated with the use of transposed superficial femoral vein AVFs. In this report we describe a patient with HAIDI, complicating a lower limb AVF, which was successfully treated by a distal revascularisation and interval ligation (DRIL) procedure.

**Material and Methods:** A 48 years old non-diabetic female patient with end-stage renal disease due to polycystic kidney disease, had intermittent hemodialysis (HD) treatment for over a period of 10 years. Multiple angio accesses and central vein catheters in the upper extremity had failed. In addition, bilateral central vein obstruction, not eligible for endovascular treatment, precluded the placement of arteriovenous grafts in the upper extremity. Because of inability for peritoneal dialysis and failed renal transplants, the decision to perform a lower limb access was taken. A right saphenous vein and subsequently superficial femoral vein transposition failed after 24 months of use. The contralateral saphenous vein was too small for vascular access creation and it was decided to perform a transposition of the superficial femoral vein at the left thigh in a straight subcutaneous tunnel with anastomosis to the popliteal artery above the knee. Within 6 months after operation, the patient complained of progressive pain in the foot, ultimately leading to rest pain.

AVF flow reduction by banding (flow reduction from 1428 to 694 ml/min) led to temporary relief of complaints and an increase in the ankle-brachial index (ABI). Rebanding was done twice without long-lasting results. Finally, it was decided to perform a DRIL procedure. An ovine graft (Omniflow; Bionova™) was interposed between the proximal superficial femoral artery with the distal anastomosis to the infraglenar popliteal artery. Interval ligation was performed 2 cm proximal of the distal anastomosis. Completion angiography and ABI measurement were peroperatively performed to measure outcome.

**Results:** Rest pain disappeared immediately after operation with a raise in the ABI (from 0.26 to 0.74). The access flow was similar before and after operation (pre 1454 ml/min; post 1246 ml/min). The AVF was needed one day after operation without problems and continued over the next months. The vascular access and bypass remained patent for a follow up of 16 months.

**Conclusion:** The DRIL procedure may be an ultimate solution to treat disabling ischemia in the lower extremity, induced by transposed femoral vein AVFs.

**Introduction and Objectives:** Stenosis of arterio-venous fistulae (AVF) is a common problem and can lead to venous thrombosis and fistula failure. In cases where radiological angioplasty is unsuccessful or early or frequent restenosis occurs, a useful alternative is a surgical patch angioplasty. Autologous vein or synthetic Dacron/PTFE have been commonly used but Bovine Pericardium Patch (BPP) is an alternative. Our aim was to review our experience with AVF salvage using BPP with primary outcomes of restenosis, infection, bleeding and fistula failure.

**Material and Methods:** AVF requiring rescue BPP were identified from a prospectively kept renal access database (Cyberren®) over a 3yr period from January 2012-January 2015. Case notes were reviewed for patient demographics, type of VA (AVF/AVG), position of stenosis, previous angioplasties, post procedural infections, restenosis and re-intervention rates & fistula failure if it did occur.

**Results:** 28 BPP angioplasties were performed in 27 patients with equal gender distribution. The mean age of patients was 60+/-5.7yrs. Diabetes and hypertension were the main causes of renal failure (42%). Of the 28 AVF requiring salvage, 19(68%) were at the elbow, 5(18%) wrist, 2(7%) forearm and 2(7%) in the lower limb (1 composite Bovine AVG/1 thigh AVF). There were no arterial stenosis, all were venous with the majority(61%) perianastomotic (within 3cm of anastomosis).

All had previous attempts at radiological fistuloplasty (median = 2, IQR 1-3). All patients were patched with a XenoSureBiologic™ (LeMaitre) patch.

Median follow-up from patch angioplasty is 340 days (IQR 72-577), with no patient lost to follow up. After a 6-week period from the procedure the patched segment could be needed if required. During follow up no patch infections, return to theatre for bleeding or patch blowouts occurred. 80% did not require further intervention, of the 5 that did all were due to further stenosis. The majority were at another site of which 3 were treated the interventional angioplasty, but one patient had aggressive restenosis at both junctions of the patch with the native vein and in the midsection of the patched venous segment, requiring a further patch plasty at an interval of 21 months. In all only 2 AVF's failed over the 3 years. There were no deaths.

**Conclusion:** Our experience of BPP angioplasty for AVF stenosis shows it to be a robust alternative to vein or synthetic patches, demonstrated by no patch infections, bleeding or loss of fistula to thrombosis at BPP site. There is also the added bonus that the patch can be used in infected areas and can be needed.

**11:45 - 11:57 | 157**

#### **VONAPANITASE (PRT-201, RECOMBINANT HUMAN TYPE I PANCREATIC ELASTASE) FOR IMPROVED ARTERIOVENOUS FISTULA OUTCOMES - LONG-TERM RESULTS**

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**Introduction and Objectives:** Arteriovenous fistulas (AVFs) lose primary unassisted patency and secondary patency interfering with their use for hemodialysis resulting in additional surgical and endovascular procedures. A phase 2 study (main study) suggested that PRT-201 was well-tolerated and may prolong AVF primary unassisted patency. Subjects completing 1 year of follow-up in the main study without loss of secondary patency entered an extended follow-up period to obtain additional information.

**Material and Methods:** Subjects undergoing placement of a new AVF were treated in a randomized, double-blind trial with a single-dose of PRT-201 10 µg, 30 µg, or matching placebo applied topically to the external surface of the AVF for 10 minutes at the time of AVF placement. Follow-up visits occurred at 2, 6, and 12 weeks and then every 3 months thereafter. Data from the main study and extended follow-up were combined to analyze primary unassisted patency, secondary patency, corrective procedures performed on the AVF, assisted and unassisted use for hemodialysis, and functional primary and secondary patency. This analysis was planned to occur after the last subject enrolled was followed for a minimum of 3 years.

### **► Thursday 16<sup>th</sup> April**

**LATE BREAKING CLINICAL TRIALS | 11:30 - 12:15 | ROOM 5**

**11:30 - 11:42 | 111**

#### **A 3-YEAR EXPERIENCE OF BOVINE PERICARDIAL PATCH ANGIOPLASTY FOR RECALCITRANT OR RECURRENT VENOUS STENOSIS IN VASCULAR ACCESS**

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**Results:** Of the 151 patients (radiocephalic  $n = 67$ , brachiocephalic  $n = 84$ ) treated in the main study (10  $\mu\text{g}$   $n = 51$ , 30  $\mu\text{g}$   $n = 49$ , placebo  $n = 51$ ), 92 completed the main study without loss of secondary patency and 92 entered the extended follow-up period. 63 were still active at the time of the analysis. Results of the analysis will be available for presentation at the meeting.

**Conclusion:** Topical application of PRT-201 to the AVF at the time of surgical placement improved primary unassisted patency over 1 year. Long-term follow-up data can be used to explore the durability of this effect and assess the effect of PRT-201 on related outcomes such as secondary patency, corrective procedures, use for hemodialysis, and functional patency.

#### 12:00 - 12:12 | 173

##### BIOENGINEERED BLOOD VESSEL: PRECLINICAL AND FIRST-IN-MAN TESTING

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**Introduction and Objectives:** In recent years the field of tissue engineering has made great scientific progress resulting in the development of a number of prototype tissues for both preclinical and early clinical testing. Of these tissues, the engineering of replacement blood vessels is one of the most mature technologies with wide ranging clinical application in the field of cardiovascular surgery. We have developed a novel tissue engineered blood vessel that has been tested in an array of clinically relevant cardiovascular animal models and has now entered first-in-man clinical testing as a vascular access graft for hemodialysis.

**Material and Methods:** Bioengineered blood vessels (HAV – Humacyte Acellular Vessel) have been grown and tested in a set of preclinical models of arterial replacement, coronary artery bypass grafting and vascular access for hemodialysis. To date, 6 sites in the US and Poland have implanted 60 vessels in patients to be used as a vascular access graft for use in hemodialysis with ongoing clinical follow-up; all patients had previously undergone between 1 and 9 access creation procedures.

**Results:** In each of these preclinical settings (swine, canine and primate) the vessels were well-tolerated and functioned as intended. The vessels exhibited excellent mechanical properties prior to implant, comparable to those of native human vein and artery. Furthermore, the mechanical properties of the vessel (suture retention and burst pressure) strengthened after implantation and vessels did not exhibit hemodynamically significant intimal hyperplasia. These vessels placed into the primate upper arm could be accessed by needle puncture (simulating hemodialysis) and hemostasis was rapidly achieved following needle removal. At explant, histological analysis demonstrated the vessels were well integrated into the host tissue and repopulated with native host cells typical of native blood vessels. Further, the implanted material was immunologically well tolerated in a xenogenic (human to baboon) animal model that did not involve any immunosuppression. Based on these preclinical data sets, first-in-man testing has been initiated for these bioengineered blood vessels for hemodialysis access. All implanted vessels have been suitable for hemodialysis access with excellent flow rates, no evidence of structural degeneration or immunologic rejection.

**Conclusion:** This emerging technology has the potential to be an alternative to conventional synthetic vascular prosthesis, and if it functions as intended, may even be an alternative to autologous vein grafts/fistulas, which have served as the standard for vascular access and vascular reconstruction throughout the body.

#### ► Thursday 16<sup>th</sup> April

##### BASIC RESEARCH | 12:15 - 13:30 | ROOM 3

#### 12:15 - 12:22 | 118

##### ARTERIOVENOUS FISTULA REMODELING IN A RAT AVF MODEL

Timmy Lee

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**Introduction and Objectives:** Neointimal hyperplasia development and poor vascular remodeling are the most common etiologies of arteriovenous fistula maturation (AVF) failure. The aim of this study was to evaluate in a rat AVF model: serial arterial and venous morphometric changes and changes in expression in the artery and vein of key remodeling proteins, matrix metalloproteinase 2 and 9 (MMP-2 and MMP-9), and endothelial nitric oxide synthase (eNOS).

**Material and Methods:** AVFs were created using an end to side anastomosis between the femoral vein and artery in 16 week old Sprague-Dawley rats. These rats were sacrificed at 7, 14, 21, and 28 days after creation. Morphometric analyses of the arterial and venous anastomosis of fistula were performed, as well as contralateral control (non-fistula) vein and artery.

Immunohistochemical analysis from the fistula vein and arterial anastomosis was performed to evaluate expression of MMP-2 and MMP-9, and eNOS.

**Results:** A progressive increase in average intima/media area ratio was seen at the arterial and venous anastomosis, respectively, at 7, 14, 21, and 28 days compared to the non-AVF control artery and vein. Average intima/media ratio was significantly greater at venous anastomosis compared to arterial anastomosis at all time points. MMP-2 and 9 expression at the arterial and venous anastomosis was substantially elevated early after AVF creation and remained elevated until 28 days. eNOS expression at the arterial and venous anastomosis progressively increased and peaked at 21 days.

**Conclusions:** Our results suggest a progressive remodeling pattern in both the vein and artery after AVF creation. Further pathophysiologic insight of the role MMPs and eNOS play in AVF remodeling after AVF creation may improve our understanding of AVF maturation failure and identifying potential targets for therapies.

#### 12:25 - 12:32 | 119

##### A NOVEL MODEL OF BALLOON ANGIOPLASTY INJURY IN RAT ARTERIOVENOUS FISTULA

Timmy Lee

University of Alabama at Birmingham, Birmingham, United States

**Introduction and Objectives:** Balloon angioplasty remains the primary therapy to treat arteriovenous fistula (AVF) maturation failure and AVF stenosis. However, balloon angioplasty procedures injure the vascular endothelium, leading to recurrent and aggressive neointimal hyperplasia development. The lack of a rodent model to study balloon angioplasty injury is a major gap in the field as it hinders insight into the pathogenesis of balloon angioplasty injury in AVF and development of better therapies to prevent and treat balloon angioplasty injury to prolong AVF patency. The aim of this study was to develop a rat model of balloon angioplasty injury in AVF.

**Material and Methods:** Balloon angioplasty of 16 week old Sprague-Dawley rats were performed: in the femoral vein immediately prior to creation of AVF (end to side anastomosis of the femoral vein to femoral artery) (group 1) and in AVFs (end to side anastomosis of the femoral vein to femoral artery) at the juxta anastomosis 14 days after creation (group 2). We assessed for changes in neointimal hyperplasia development and expression of key vascular remodeling proteins, matrix metalloproteinases 2 and 9 (MMP-2 and MMP-9) at serial time points following balloon angioplasty.

**Results:** In group 1, the average intima/media area ratio of the venous anastomosis at 14 and 21 day post-angioplasty and AVF creation was  $1.99 \pm 0.05$  and  $9.27 \pm 6.4$ , respectively, with a progressive increase in staining primarily within the neointima for MMP-2 and 9 from 14 to 21 days. In group 2, the average intima/media area ratio of the venous anastomosis was  $2.80 \pm 0.10$  and  $11.7 \pm 5.2$  at 14 and 21 days after balloon angioplasty, respectively, with also a progressive increase in MMP-2 and 9 staining primarily within the neointima from 14 to 21 days. The average intima/media area of AVF at the venous anastomosis without any balloon angioplasty was  $3.45 \pm 0.60$  and  $4.56 \pm 0.51$  at 14 and 21 days, respectively, after AVF creation.



**Conclusions:** Our novel rat model of balloon angioplasty injury in AVF displays similar features to balloon angioplasty injury in humans. Rat AVFs developed progressive venous neointimal hyperplasia development with early remodeling following balloon angioplasty injury. Our balloon angioplasty model will allow for future studies to evaluate the pathophysiologic mechanisms of balloon angioplasty injury in AVF and test therapies to prolong AVF survival after balloon angioplasty procedures.

12:35 - 12:42 | 129

#### AN EXPERIMENTAL APPROACH TO THE GENESIS OF PERIVASCULAR VIBRATIONS OR WHAT IS THE CAUSE OF THE THRILL?

*Ulf Krueger*

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**Introduction and Objectives:** An arteriovenous fistula (AVF) requires relatively high blood flow rates to guarantee adequate hemodialysis and prevent thrombosis. The high flow rate leads to flow disturbances, which are severe enough to produce perivascular vibrations. A palpable "thrill" is traditionally associated with the creation of a sufficient AVF. Nevertheless, the cause of this phenomenon remains unclear.

**Material and Methods:** An AVF model was constructed from tubes and a y-connector, which simulates the circulation from the brachial artery to the brachial vein. Immediately behind the anastomosis (y connector, respectively), a truncated finger of a latex glove was inserted to simulate a strongly compliant vein. The non-pulsatile perfusion was performed with distilled water using a centrifugal Bio-Pump (BioMedicus, Inc. USA). A micro-semiconductor pressure transducer (IBW78, TU Dresden, Germany) with a cutoff frequency of 4 kHz was inserted into the latex balloon for local pressure measurements. The realtime frequency analysis was carried out by the LabVIEW software (National Instruments). Additionally, the fistula was investigated by Computational Fluid Dynamics (CFD, ANSYS 12.1, ANSYS Ltd., USA) with a high time resolution (time steps 1 millisecond) using the same boundary conditions.

**Results:** On the balloon surface, perivascular vibrations were already palpable at laminar flow rates. The local pressure curve showed small fluctuating components superimposed to the mean pressure. The frequency analysis of the pressure fluctuations revealed the highest magnitudes between 5 and 50 Hz, but they continued till frequencies of 80 Hz to a lesser degree. CFD results: The pressure distribution at the vein wall showed strong and high frequency oscillations.

**Conclusions:** The frequency spectrum of the local pressure fluctuation could not explain the vibration frequencies in the order of 1000 to 3000 Hz at laminar flow rates as noted in [1]. It remains unclear whether a full superposition of all the local pressure fluctuations could lead to such high vibration frequencies. The time step range of the CFD calculation was too long to prove pressure fluctuations near 2000 Hz. Further investigations are necessary.

#### References

1. Fillinger MF, Reinitz ER, Schwartz RA, et al. Graft geometry and venous intimal-medial hyperplasia in arteriovenous loop grafts. *J Vasc Surg.* 1990;11:556-566.

12:45 - 12:52 | 138

#### COMPARISON OF SPIRAL AND CONVENTIONAL ARTERIOVENOUS GRAFTS USING COMPUTATIONAL METHODS

*Efstratios Kokkalis<sup>1</sup>, Peter R. Hoskins<sup>2</sup>, Prashant Valluri<sup>2</sup>, George A. Corner<sup>3</sup>, J. Graeme Houston<sup>1</sup>*

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**Introduction and Objectives:** Prosthetic arteriovenous grafts are used as the second most common approach of permanent vascular access. Stenosis in the distal anastomosis section remains the main reason of occlusion. Disturbed haemodynamics are known to cause endothelial dysfunction and stenosis. A novel prosthetic spiral graft, designed to create a stabilised single spiral flow in its distal anastomosis section, has shown promising initial clinical results. This study compared the spiral graft with a conventional graft using an image-guided computational approach.

**Material and Methods:** Each graft was positioned in a loop surgical configuration and connected with appropriate vessel mimics creating a vascular-graft phantom. Both phantoms had identical and physiologic geometries. The phantoms were integrated in a flow rig and cross section velocity and vorticity maps were acquired in the outflow of the grafts using vector Doppler ultrasound imaging.

Subsequently, the phantoms were scanned with computed tomography (Biograph mCT, SIEMENS, Germany), and their inner 3D geometry was segmented with Amira (FEI, France). The flow within these geometries was simulated using computational fluid dynamic methods (ANSYS Inc., USA) and Reynold numbers 600 and 900. Flow maps and quantitative data from the computational approach were validated with the vector Doppler analysis. A flow dynamics comparison was applied between the outflow of the spiral and the conventional graft.

**Results:** A double-spiral flow, composed of a dominant and a smaller vortex, was revealed in the proximal outflow of the spiral graft. The smaller vortex was dissipated 5 cm downstream from the outflow and a single spiral was created. A double-spiral flow was found in the outflow of the conventional graft. The tangential velocity, circulation and helicity was compared downstream from the outflow of the grafts and found higher for the spiral device. Wall shear stress was determined in anastomotic locations associated with endothelial dysfunction and found higher for the spiral product. No significant difference was detected in pressure drops induced from the two tested devices.

**Conclusions:** The single spiral flow downstream from the spiral graft outflow inhibited flow separation, stagnation and instability and induced coherent haemodynamics. The increased tangential velocity, circulation and helicity in the outflow of the spiral graft indicated increased in-plane mixing, which is considered atheroprotective. The increased wall shear stress observed for the spiral prosthesis is believed to prevent atherosclerosis. These outcomes suggest that the spiral graft can induce stronger and stabilised secondary flow phenomena downstream from the distal anastomosis that may protect the vascular walls from atherosclerosis.

12:55 - 13:02 | 160

#### CASPASE-3 EXPRESSION IS REDUCED BY FLOW IN A HUMAN WHOLE VEIN PULSATILE FLOW MODEL

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**Introduction and Objectives:** The role of pathological flow in promoting negative vessel remodelling is well established and low wall shear stress (WSS) is a potent inducer of endothelial cell (EC) driven neointimal hyperplasia. In vascular access the characteristic sites of venous pathology occur where flow disruption is maximal. However, the cellular and molecular processes, which translate this process, are still poorly understood and are largely derived from artificial in vitro cell culture models. EC injury leading to apoptosis has been shown to activate pro-fibrotic pathways and the aim of this study was to assess the effect of flow on venous EC apoptosis in an ex vivo whole vein model.

**Material and Methods:** Fresh human gonadal veins from cadaveric (cGV) and living kidney transplant donors (IGV) were collected. Phase 1 divided veins transversely into two lengths. The first formalin fixed at time zero (T0), the second placed in preservation solution (UW) at 4 degrees C for 24 hours and then formalin fixed (T24). For Phase 2 cGVs were divided into three parts, two parts were dealt with exactly the same course as in phase 1, the third part was attached to a novel flow model allowing hypothermic pulsatile flow of UW for 24 hours (T24F).

Immunohistochemical staining for Caspase-3, a marker of apoptosis, was performed and assessment using cell counting and qualitative assessment of vessel morphology performed by two independent blinded pathologists.

**Results:** 15 donor veins were assessed. Five IGV and five cGV in phase 1, and five cGVs in phase 2.

Where flow was absent a significant rise in the mean number of Caspase-3 +ve cells occurred at T24. cGVs in general had a higher baseline T0 and T24 expression than LD.

In Phase 2 T24 veins showed a significant increase in Caspase-3 expression (mean = 2.81x;  $p = 0.0001$ ) over baseline (T0) samples. In contrast, T24F samples showed preservation, or reduction of baseline expression (mean = 1.07;  $p = 0.0001$ ).

Comparing expression of Caspase-3 from baseline between T24 and T24F significantly higher levels of apoptosis are seen in the no flow samples ( $p = 0.0001$ ).

**Conclusions:** Activation of Caspase-3 leading to EC apoptosis is associated with EC injury. Mediators of such EC injury include pathological flow and using in vitro cell culture models pulsatile laminar flow has been shown to maintain EC integrity. This study confirms that within a fresh human whole vein pulsatile flow reduces EC apoptosis whereas absence of flow is pro-apoptotic. The significance of up-regulation of Caspase-3 is the downstream activation of pro-fibrotic mediators and promotion of negative remodeling and neointimal hyperplasia.

**TABLE 1** - Living gonadal veins in phase 1 showing the average number of Caspase-3 positive cells per 40 × Power field at baseline (T0) and after 24 hours (T24)

Vein No.	T0	T24	No of folds increase in expression
1	2.5	22.8	9.1
2	1.8	3.25	1.8
3	1	3.25	3.2
4	6	10	1.6
5	4.8	5.2	1.1

**TABLE 2** - Cadaveric gonadal veins in phase 1 showing the average number of Caspase-3 positive cells per 40 × Power field at baseline (T0) and after 24 hours (T24)

Vein No.	T0	T24	No of folds increase in expression
1	8.25	31	3.8
2	6	38.4	6.4
3	2	25	12.5
4	1	26.8	26.8
5	11	30.2	2.7

### 13:05 - 13:12 | 167

#### HYSTOMORPHOMETRIC CHANGES IN CEPHALIC VEINS AS A RESULT OF ARTERIOVENOUS FISTULA

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**Introduction and Objectives:** Arteriovenous fistula (AVF) remains the preferred vascular access for chronic hemodialysis in patients with chronic kidney disease (CKD). However, the rate of early AVF failure rises up to 50% of all AVF. Histological and morphometric analysis of the vein segments of the fistula prior the creation and after the failure has been done, but assessment of the effect of the AVF on the veins is not done.

**Material and Methods:** Vein samples from 20 patients were collected at the time of the creation of AV fistula near the site of the AV anastomosis. Histological and morphometric analysis was performed on these samples. At the time of failure, within 90 days of creation, another AV anastomosis was

created proximal on the same vessels and another sample was collected and sent for analysis.

**Results:** In all of the samples we had found various degrees of intima-media thickness and luminal stenosis. When we compared the results before and after creation of the new fistula we found statistical increase in intima-media thickness and luminal stenosis at the time of AVF failure.

**Conclusions:** Most of the cephalic veins in patients with CKD had morphometric abnormalities at the time of the creation of the AVF, i.e. enhanced intima-media thickness and luminal stenosis. At the time of AVF failure these abnormalities increase.

Finding novel therapies that can reduce these changes may delay AVF failure and prolong the life of AVF.

### 13:15 - 13:22 | 56

#### LIPOSOMAL PREDNISOLONE INHIBITS VASCULAR INFLAMMATION AND ENHANCES MATURATION OF ARTERIOVENOUS FISTULAS IN MICE

*Chunyu Wong<sup>1</sup>, Taya Bezhaeva<sup>1</sup>, Carolien Rothuizen<sup>1</sup>, Bart Metselaar<sup>2</sup>, Floris Verbeek<sup>3</sup>, Alexander Vahrmeijer<sup>3</sup>, Anouk Wezel<sup>4</sup>, Erik Stroes<sup>5</sup>, Anton Jan Van Zonneveld<sup>1</sup>, Ton Rabelink<sup>1</sup>, Paul Quax<sup>3</sup>, Joris Rotmans<sup>1</sup>*

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**Introduction and Objectives:** Arteriovenous fistulas (AVFs) for hemodialysis access have a 1-year primary patency of only 60%, mainly as a result of maturation failure that is caused by insufficient outward remodeling (OR) and intimal hyperplasia (IH). The exact pathophysiology remains unknown, but the local inflammatory vascular response is thought to play an important role. Corticosteroids are powerful inhibitors of inflammation that suffer from unwanted side effects when given systemically. In the present study, we evaluated the effect of prednisolone on AVF maturation using a targeted liposomal delivery method in a murine model of AVF failure.

**Material and Methods:** First, the effect of liposomal prednisolone on vascular smooth muscle cells (VSMCs) and macrophages was evaluated in vitro. Next, AVFs between the jugular vein and common carotid artery were created in an end-to-side manner in C57BL/6 mice. The animals were then injected (dose 10 mg/kg) with liposomal prednisolone phosphate, liposomal PBS, prednisolone phosphate or PBS at days 0, 2, 5 and 10. Fluorescent-labeled liposomes were injected in a separate group of mice. At time of scarification (day 14), the labeled liposomes were visualized using near-infrared fluoroscopy. In addition, histomorphometric analysis of the venous outflow tract was performed and the composition of the venous wall was evaluated using immunohistochemistry.

**Results:** Incubation with liposomal prednisolone resulted in a strong reduction of IL-6 and MCP-1 in cultured macrophages while no effect of VSMC proliferation was observed. The in vivo studies revealed that the fluorescent liposomes were mainly detected in macrophages in the anastomotic area of the AVF.

Histomorphometrically, mice treated with liposomal prednisolone had an increased venous circumference and lumen ( $p < 0.01$ ;  $p < 0.03$ ) when compared to the PBS group.

Furthermore, we observed a strong reduction in infiltrating CD45<sup>+</sup> leucocytes in the liposomal prednisolone group that was mainly attributable to a reduced granulocyte influx.

**Conclusions:** Liposomes proved to be an effective delivery method to target vascular inflammation in AVFs. Treatment with liposomal prednisolone results in enhanced outward remodeling of murine AVF. Clinical trials should reveal if liposomal prednisolone reduces non-maturation of AVF in hemodialysis patients.

► **Thursday 16<sup>th</sup> April**  
**VASCULAR ACCESS SURVEILLANCE | 15:00 - 16:00 |**  
**ROOM 6**

15:00 - 15:07 | 45

**CAN AGGRESSIVE POSTOPERATIVE ULTRASOUND SURVEILLANCE ENHANCE AVF MATURATION? A PROSPECTIVE RANDOMIZED TRIAL**

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**Introduction and Objectives:** To increase the usage of the autogenous arteriovenous fistula (AVF), close postoperative surveillance by an experienced physician is recommended, but currently there is no agreed protocol. This prospective, randomized, controlled study aims to test whether aggressive surveillance with routine duplex ultrasound and active intervention can enhance maturation rate of autogenous AVF.

**Material and Methods:** 150 patients undergoing autogenous AVF creation at Seoul National University Hospital were enrolled. Immediately after the operation, patients were randomly assigned to a group of postoperative visit at 2 and 4 weeks with physical exam only (Control group, n = 76) or to a group of postoperative visit at 2 and 4 weeks with routine duplex ultrasound and physical exam (Duplex group, n = 74). Physical exam was done by an experienced vascular surgeon, and duplex exam was conducted by a certified registered vascular technologist (RVT). Both group had duplex examination at postoperative visit at week 8 and maturation rates were compared. Maturation was defined as successful first use before postoperative 8<sup>th</sup> week or venous rim flow over 500 ml/min at the final duplex exam. In addition we also sought to determine the patient and anatomic variables predictive of fistula maturation.

**Results:** Among 150 patients, 118 patients (Control group, n = 59; Duplex group, n = 59) were included in the final analysis. The groups were well matched for age, comorbidity, medications and preoperative anatomic characteristics. 11 patients from the control group and 10 patients from the duplex group had undergone surgical or percutaneous intervention for abnormalities detected during the postoperative visits. Overall maturation rate was 79.7% at postoperative 8<sup>th</sup> week and there was no significant difference between the duplex group and the control group (44/59 (74.6%) vs. 50/59 (84.7%), p = 0.170). Factors positively associated with maturation were presence of coronary artery disease (p = 0.006), diabetes as the etiology of the renal failure (p = 0.002), usage of antiplatelet or anticoagulant (p = 0.014), and preoperative cephalic vein diameter (p = 0.033).

**Conclusions:** Postoperative surveillance with routine duplex ultrasound has no significant advantage over surveillance with physical examination alone by an experienced vascular surgeon in terms of autogenous AVF maturation.

15:10 - 15:17 | 175

**DOES PRE- AND POST-ANGIOPLASTY DOPPLER ULTRASOUND EVALUATION HELPS PREDICTING VASCULAR ACCESS OUTCOME? A PROSPECTIVE TRIAL**

*Maria Guedes-Marques<sup>1</sup>, Pedro Maia<sup>1</sup>, João Cruz<sup>2</sup>, Dulce Carvalho<sup>1</sup>, Fernando Neves<sup>1</sup>, Aníbal Ferreira<sup>1</sup>, Carlos Oliveira<sup>1</sup>, Carlos Barreto<sup>1</sup>, Telmo Carvalho<sup>2</sup>, José Ibeas<sup>2</sup>, Pedro Ponce<sup>1</sup>*

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**Introduction and Objectives:** The effectiveness of angioplasty can be assessed by several methods. KDIGO Guidelines recommend that treated lesion should have <30% residual stenosis and clinical parameters should significantly improve. Access blood flow (ABF) is one of the most used parameters. The primary end point was to determine how ABF variation achieved after angioplasty predict vascular access (VA) outcome. Secondary end points were to determine if Resistance Index (RI) differential, and final radiologic and functional result could also predict outcome.

**Material and Methods:** Prospective study performed during seven weeks, November-December 2014, in 80 patients with dysfunctional VA. Referral to angiography was based on monitoring and surveillance parameters. Doppler ultrasound (DU) morphologic and hemodynamic evaluation was performed before and after the procedure.  $\Delta$ ABF (ABFafter – ABFbefore) and  $\Delta$ RI were

calculated. Variables like gender; age; VA type; VA time; aneurisms; mural thrombus; number and location of stenosis; final radiologic and functional result, were also evaluated. Correlation between DU and angiography regarding stenosis detection was evaluated.

Resulting data analyzed using SPSS 20.0. Patient's access-related events are currently being recorded (thrombosis, intervention). First three months results will be presented in April.

**Results:** Patients with VA thrombosis were excluded due to limited initial hemodynamic evaluation. DU was made to 80 patients before angiography. Twenty-six patients were excluded after the initial evaluation due to abnormalities absence confirmed with angiography, and impossible endovascular resolution. Fifty-four patients were submitted to complete DU evaluation. Two thirds (61,1%) male; age  $68 \pm 15$  y; VA time  $36 \pm 29$  months; initial ABF  $537 \pm 248$  ml/min; final ABF  $1013 \pm 354$  ml/min;  $\Delta$ ABF  $476 \pm 345$  ml/min; initial RI  $0,543 \pm 0,136$ ; final RI  $0,451 \pm 0,115$ ;  $\Delta$ RI  $-0,092 \pm 0,090$  (Table 1). Most common VA types were brachioaxilar graft (48%) and brachiocephalic fistula (28%). Eighty-five stenosis were detected, mainly located in graft/vein anastomosis (26%); 48% of the patients had aneurisms; and 17% had mural thrombus (Table 2). Optimal final anatomical and functional result was considered in 85% patients. The number and location of the stenosis was highly correlated between DU and angiography methods (Pearson 0,828; p 0,000).

**Conclusions:** Regarding diagnostic technique, ultrasound is highly correlated with angiography, and has several advantages.

Angioplasty caused a two-fold increase of ABF and a significant decrease in RI with immediate clinical beneficial impact. To the best of our knowledge, this

TABLE 1

	Mean $\pm$ SD
Age (years)	68,22 $\pm$ 14,53
Vascular access time (months)	36,41 $\pm$ 28,65
Initial Blood Flow (ml/min)	537,09 $\pm$ 248,41
Initial Resistance Index	0,543 $\pm$ 0,136
Final Blood Flow (ml/min)	1013,80 $\pm$ 354,32
Final Resistance Index	0,451 $\pm$ 0,115
$\Delta$ ABF	476,70 $\pm$ 345,47
$\Delta$ RI	-0,092 $\pm$ 0,090

TABLE 2

	Frequency	%
Gender		
Male	33	61,1
Female	21	38,9
Type of vascular access		
Distal radioccephalic fistula	8	14,8
Brachiocephalic fistula	15	27,8
Brachioaxilar graft	26	48,1
Brachioabasilic graft	3	5,6
Fistula with graft	2	3,7
Stenosis location		
Intra anastomosis	4	4,7
Postanastomosis	11	12,9
Venous Middle third venous	5	5,9
Venous Proximal third	8	9,4
Cephalic arch	7	8,2
Central	4	4,7
Graft/Artery anastomosis	1	1,2
Intra graft	11	12,9
Graft/Vein anastomosis	22	25,9
Graft drainage vein	12	14,1
Artery	0	0
Aneurisms		
No	28	51,9
Yes	26	48,1
Mural thrombus		
No	45	83,3
Yes	9	16,7



is one of the first studies evaluating how ABF and RI respond to angioplasty, and how that can help predict long term outcome.

15:20 - 15:27 | 181

## SECOND GENERATION SURVEILLANCE METHODS PREVENT THROMBOSIS AND INCREASE ASSISTED PATENCY RATE IN NATIVE ARTERIOVENOUS FISTULAE. A RANDOMIZED CLINICAL TRIAL

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**Introduction and Objectives:** The usefulness of access blood flow (QA) measurement is an ongoing controversy. Although all vascular access (VA) clinical guidelines recommend monitoring and surveillance protocols to prevent VA thrombosis, randomized clinical trials (RCT) have failed to show consistently the benefits of QA based surveillance protocols. We present a 3 years follow-up multicenter, prospective, open label, controlled RCT, to evaluate the usefulness of QA measurement using two complementary second generation surveillance methods (SGSM), Doppler ultrasound (DU) and Ultrasound dilution method (UDM), in a prevalent hemodialysis population with native arteriovenous fistula (AVF).

**Material and Methods:** Classical monitoring and surveillance methods are applied in all patients, the control group (n = 104) and the experimental group (n = 105). Besides this DU and UDM are performed in the experimental group every three months. When QA is under 500 ml/min, there is a >25% decrease in QA or a hemodynamic significant stenosis the patient goes for fistulography, surgery or close clinical/surveillance observation. Thrombosis rate, assisted primary patency rate, primary patency rate and secondary patency rate are measured.

**Results:** After two years follow up we found a significant reduction in the thrombosis rate (0,027 thrombosis/patient/year in the QA group compared with 0,081 thrombosis/patient/year in the control group.  $p = 0,036$ ). Assisted primary patency rate was higher in QA group than in control AVFs (HR 0,34 CI 0,11-1,08.  $P = 0,050$ ). There was no significant difference in non assisted primary patency rates between groups (HR 1,33 CI 0,75-2,3.  $p = 0,319$ ). There was a non-significant improvement in secondary patency rate in the experimental group (HR 0,71 CI 0,30-1,66.  $p = 0,427$ ).

**Conclusions:** We provide evidence that QA surveillance combining doppler ultrasound and a dilution method prevents thrombosis and increases assisted primary patency rate in AVF.

15:30 - 15:37 | 213

## MULTIDISCIPLINARY APPROACH TO THE MANAGEMENT OF HAEMODIALYSIS PATIENTS WITH AUTOGENOUS ARTERIOVENOUS FISTULA

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**Introduction and Objectives:** The role of ultrasound in management of patients on haemodialysis using autologous arteriovenous fistula (AVF) remains under debate. The challenges faced in vascular access, where outcomes are not exclusively influenced by single factors such as pre dialysis care, pre-operative work up, assessment or surgical techniques, however, are a consequence of multiple factors and the multidisciplinary team. Recognising the multifactorial nature of AVF this observational study examined the multidisciplinary approach to management of vascular access, where the decision to intervene was based on clinical or dialysis parameters.

**Material and Methods:** All patients presenting with End Stage Renal Disease (ESRD) were referred to the access clinic where they underwent both physical and ultrasound examination. Fistula type was determined at this clinic. Following surgery, patients were placed in a routine surveillance programme. All patients presenting with an ultrasound detected stenosis were discussed

at a routine monthly Multidisciplinary Meeting (MDM). The decision to intervene was determined by clinical or dialysis abnormalities in addition to the presence of a stenosis. In the absence of any other clinical or dialysis parameter the patients remained on conservative management.

**Results:** Throughout the study period 265 patients were assessed. There were 70 patients who did not have a fistula, leaving 195 patients who were eligible. A total of 229 fistulae were formed. There were 85 females and 110 males with a median age of 74.4 and 73.9 respectively (Table 1). There were no urgent thrombectomies and all interventions were planned.

**Conclusions:** The recognition of stenosis in an AVF allows close monitoring of an "at risk group" of the haemodialysis population and allows planned intervention (surgical or radiological). This reduces the emergency component to dialysis access maintenance and improves quality of life. It reduces hospital stay and limits surgical intervention.

This study confirmed ultrasound to be an integral part of patient assessment prior to fistula formation by determining the parameters most suitable in the creation of an AVF. It does recognise the complexity of the disease process and the need to include all dialysis parameters in the decision to intervene. It highlights those patients with a potential reversible problem within the fistula and allows timely informed intervention.

TABLE 1

	Female	Male
Total Subjects	85	110
Median Age at assessment (years)	74.4	73.9
Patency at 6/12	69%	80%
Interventions	14%	17%
Urgent thrombectomies	0	0

15:40 - 15:47 | 222

## DOPPLER ULTRASOUND: A POWERFUL TOOL FOR HEMODIALYSIS VASCULAR ACCESS

*Maria Guedes Marques<sup>1</sup>, José Ibeas<sup>2</sup>, Carlos Botelho<sup>1</sup>, Pedro Maia<sup>1</sup>, Pedro Ponce<sup>3</sup>*

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**Introduction and Objectives:** Complications of vascular access (VA) for hemodialysis are major causes of morbidity and mortality. The most common complication of hemodialysis access is thrombosis due to flow-limiting stenosis. National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF-KDOQI) recommends that accesses should be monitored regularly for the detection of stenosis, and treated with elective angioplasty or surgery prior to thrombosis. NKF-KDOQI guidelines recommend Doppler ultrasound (DU) for surveillance, but trials have not been unanimous about its benefit on VA patency. The aim of this study was to evaluate the accuracy of DU for patency, as well as to highlight additional data provided by this method.

**Material and Methods:** A transversal study was conducted on 40 patients on hemodialysis. Blood flow measured by DU (DU-Qa) was evaluated in the humeral artery. In the same week, blood flow was measured with the blood temperature sensor (Blood Temperature Monitor), Fresenius Medical Care (BTM-Qa). Data were analyzed with SPSS, 20.0. We compared both Qa measurements and evaluated their correlation using the paired t-test and Pearson coefficient. Kruskal Wallis and Mann-Whitney Test were made to find if Qa values varied significantly with different factors related to the VA.

**Results:** We evaluated 40 patients in hemodialysis with a mean age of 64,5 ± 13,7 y; average time on HD of 51,4 ± 47,3 months, and average time of VA of 47,6 ± 42,1 months. Mean DU-Qa was 1032,5 ± 468,7 mL/min, and mean BTM-Qa was 1012,0 ± 492,9 mL/min. Paired T test between BTM and DU methods revealed a mean difference of only 20,55 mL/min, with a p-value of 0,624 (>0,05). Correlation coefficient of Pearson was 0,851, p-value 0,000 (<0,05) (graphic 1). DU-Qa varied significantly with VA type ( $p = 0,021$ ), motive of DU request ( $p = 0,006$ ), artery characteristics/stenosis ( $p = 0,048$ ), as well as, the presence

(p 0,038), location (p 0,031) and number of stenosis (p 0,034). On the other hand, BTM-Qa only varied significantly with the presence (p 0,039) and number of stenosis (p 0,012). Anastomosis and vein characteristics, as well as the hemodynamic meaning of the stenosis didn't affect any of the Qas (BTM and DU). **Conclusions:** BTM represents a good indirect method of DU-Qa measurement. However they vary differently with VA-related factors. Various silent abnormalities were detected with DU. DU provides a more accurate evaluation of VA because it provides both anatomic and hemodynamic data to further knowledge regarding the etiology of stenosis and other abnormalities that compromise VA well-functioning.

15:50 - 15:57 | 108

#### ASSESSING PERCUTANEOUS TRANSLUMINAL ANGIOPLASTY RISK USING COLOR DOPPLER ULTRASONOGRAPHY

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**Introduction and Objectives:** Maintenance of well-functioning vascular access is essential for the smooth continuation of hemodialysis treatment in patients. The aim of this study was to assess stenosis using color Doppler ultrasonography as well as to investigate a possible association between percutaneous transluminal angioplasty and hemodynamic parameters.

**Material and Methods:** A retrospective review of the medical records of 372 patients with renal failure treated with dialysis via radial artery vascular access were included in this study. Data were analyzed using binomial logistic regression analysis and the receiver operating characteristic curve. The cutoff point for hemodynamic parameters was determined to explore the predictors of percutaneous transluminal angioplasty.

**Results:** The optimal cutoff point for brachial artery resistance index over 0.61 (FPF: 0.18, TPF: 0.78, and likelihood ratio: 16.56), and brachial artery flow volume under 665 ml/min (FPF: 0.08, TPF: 0.658, and likelihood ratio: 22.87).

**Conclusions:** These parameters could be markers for assessing percutaneous transluminal angioplasty risk in hemodialysis patients.

### ► Thursday 16<sup>th</sup> April HEMODIALYSIS CATHETER (I) | 17:30 - 18:30 | AUDITORIUM

17:30 - 17:37 | 27

#### FIBRIN SHEATH FORMATION AND INTIMAL THICKENING AFTER CATHETER PLACEMENT IN DOG MODEL: ROLE OF HEMODYNAMIC WALL SHEAR STRESS

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**Introduction and Objectives:** Although the pathology of stenosis has been extensively discussed in many studies, the exact etio-pathogenesis of the disease is not fully understood, we hypothesize that the key factor which influences whether a venous wall will undergo stenosis, is the hemodynamic wall shear stress (WSS) that is generated when extracorporeal circulation occurs after a catheter is inserted. For this reason, we used extracorporeal circulation and computer modeling techniques to generate a WSS profile for the blood flow through the catheter to evaluate its performance, and to examine the fibrin sheath formation and the development of intimal hyperplasia in the superior vena cava wall that are adjacent to the central venous catheters in dogs.

**Material and Methods:** Tunneled silicone 14.5-F catheters were inserted into the left jugular vein in eight dogs. The dogs were separated into two groups according to catheter indwelling time of 14 and 28 days. All dogs underwent extracorporeal circulation three times a week. Multi-Detector Computed

Tomography Venography (MDCTV) examination was used to examine the catheter tip thrombus. After the animals were sacrificed, histological and immunohistochemistry evaluations were performed to confirm specific cell populations. We used computer modeling to generate wall shear stress profiles for the blood flow through the catheter.

**Results:** Catheter-related sheaths were identified in all catheter specimens, but there was no fibrin sheath around the catheter tip. There were also differences in wall shear stress between the different venous wall sites. Differences in vein wall thickening at different sites have been found both at 14 days (I/M ratio S1 vs S2: p = 0.01, S3 vs S4: p<0.01) and 28 days (I/M ratio S1 vs S2: p<0.01, S3 vs S4: p<0.05).

**Conclusions:** After catheter placement, fibrin sheath formation partially covered the catheter. Meanwhile, focal areas of intimal thickening were also seen in the venous wall adjacent to the sites of high wall shear stress. These findings indicate an important role of wall shear stress profiles in fibrin sheath formation and intimal thickening.

17:40 - 17:47 | 46

#### IS ROUTINE CHEST RADIOGRAPHY (CX-RAY) NECESSARY AFTER SONOGRAPHIC-GUIDED INSERTION OF PERMANENT CENTRAL VEIN CATHETER (CVC) FOR HAEMODIALYSIS (HD)?

*J. Kowalczyk, M. Ragosin, M. Kalonji, N. Zinyenge*

The Glynwood Hospital, Johannesburg, South Africa

**Introduction and Objectives:** The placement of CVC into internal jugular vein (IJV) or subclavian vein (SCV) carries up 12% complication rate. A routine standard CX-ray is recommended by DOQI guidelines to locate the tip of CVC and exclude ipsilateral pneumo- or haemothorax. The recent literature suggests that CX-ray control should be obtained only in junction with clinical suspicion of an immediate complication. The purpose of this study is to define criteria to routinely perform CX-ray after insertion of a CVC for HD.

**Material and Methods:** The data was collected prospectively from September 2013 through December 2014. All CVC were inserted into the IJVs under sonographic guidance and with use of fluoroscopy in operating theatre under general (GA) or local (LA) anaesthetic. The criteria to perform post-procedural CX-ray were:

- more than 1 pass of the needle to enter the IJV
- difficult insertion of the guide wire or catheter (incorrect position, unusual resistance, kinking or looping)
- air in the syringe with a clinical suspicion of pneumothorax (unequal air entry on auscultation of the lung fields)
- unexplained drop of saturation below 90% longer than 30 sec during anaesthesia
- rise in ventilatory airway pressure above 30 cm H<sub>2</sub>O for longer than 30 sec
- unusual position of the catheter on intra-operative fluoroscopy
- irrational feeling of an operator that there is a complication related to the procedure

**Results:** 181 CVC were inserted into the IJV. 136 (75.1%) catheters were placed into the R IJV and remaining 45 (24.9%) into L IJV. 164 procedures were performed under GA and 17 under LA. In 23 (12.7%) cases a post-procedural CX-ray was performed. The indication for CX-ray were: more than 1 pass of the needle to locate IJV-12, kinking and resistance on guide wire during insertion - 8, no identification of the IJV - 2, air bubbles in the syringe - 1. There was no haemo- or pneumothorax in all 23 cases. No extravasation of the contrast on venography recorded. The tips of the catheters were in the upper or mid zone of the (R) atrium. No kinking or noting of the catheters on completion of the procedure was noted.

**Conclusions:** It seems that the routine CX-ray is not necessary after sonographic-guided insertion of CVC performed in operating theatre with utilization of fluoroscopy. Indications for a post-procedural CX-ray need to be clearly defined based on a large trial.

17:50 - 17:57 | 51

#### CATHETER-LOCKING OF TUNNELLED CATHETERS FOR CHRONIC HEMODIALYSIS, COMPARISON OF THREE DIFFERENT INTERDIALYTIC REGIMENS

*Jose Luis Merino, Patricia Domínguez, Blanca Bueno, Luca Caserta, Cristina Pérez, Diego Tofiño, Jessica López, Yésica Amézquita, Beatriz Espejo, Alicia Gómez, Vicente Paraíso*

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TABLE 1 (ABS 51)

Four weeks with each catheter-locking solution	5% heparin locking solution (HLS)	20 UI/ml heparin locking solution (HLS)	46.7% trisodium citrate locking solution (TCLS)	5% HLS vs 20 UI/ml HLS	5% HLS vs TCLS	20 UI/ml HLS vs TDLS
First dialysis hour flow access (ml/min)	293 ± 11	289 ± 16	291 ± 11	p = 0.26	p = 0.09	p = 0.59
Last dialysis hour flow access (ml/min)	287 ± 16	290 ± 16	288 ± 14	p = 0.28	p = 0.57	p = 0.11
First dialysis hour arterial pressure (mmHg)	168 ± 19	171 ± 20	163 ± 21	p = 0.99	p = 0.97	p = 0.86
Last dialysis hour arterial pressure (mmHg)	179 ± 19	185 ± 19	178 ± 21	p = 0.87	p = 0.64	p = 0.96
First dialysis hour venous pressure (mmHg)	168 ± 30	167 ± 26	169 ± 27	p = 0.71	p = 0.61	p = 0.34
Last dialysis hour venous pressure (mmHg)	172 ± 35	167 ± 35	170 ± 31	p = 0.52	p = 0.56	p = 0.69
Kt/V (Daugirdas)	1.2 ± 0.2	1.23 ± 0.1	1.24 ± 0.2	p = 0.03	p = 0.2	p = 0.14
Number of HD with reversal of catheter lines	29 (15.7%)	30 (23.8%)	22 (14.8%)	p = 0.36	p = 0.41	p = 0.33
Number of HD with extra-thrombolytic use (urokinase)	24 (13%)	13 (10%)	14 (9.4%)	p = 0.21	p = 0.14	p = 0.13

**Introduction and Objectives:** The patency of catheters for hemodialysis (HD) is one of the crucial aspects in daily practice. Currently, evidence supporting the use of various locking solutions to prevent thrombosis is limited and there is not a pattern that has been proven more efficacy than others. We show the comparison of three catheter-locking patterns applied in the routine practice in our centre in order to evaluate if they had differences in the permeability of tunnelled catheters for HD.

**Material and Methods:** All of the patients with tunnelled catheters of our dialysis unit were initially dialyzed with 5% heparin locking solution. Consecutively thereafter for 4 weeks half of the patients were locked with Citra-Lock® (46.7% trisodium citrate) and the other half were locked with (Fibrilín®) (sodium heparin 20 IU/ml). Sequentially once after this period patients received the other type of catheter-locking for the next four weeks.

**Results:** We included 16 patients, eight men and eight women with a mean age of 68 ± 14 years, with an average dialysis time of 45 ± 53 months, median of 35 months and a range of 216-5 months. All of them had tunnelled catheters, 13 in the right jugular, 2 in the left jugular and one in the femoral vein. The average number of previous catheters was 1.1 ± 1.5, with a range of 5-0. Half of the patients had had at least one prior catheter. The average time with the catheter was 23 ± 20 months, median of 16 months and a range of 75-4 months. We have evaluated the average first dialysis hour flow access, last dialysis hour flow access, first dialysis hour arterial pressure, last dialysis hour arterial pressure, first dialysis hour venous pressure, last dialysis hour venous pressure and Kt/V (Daugirdas) at the end of dialysis. We have also analyzed the number of HD with reversal of catheter lines and the number of HD with extra-thrombolytic use (urokinase) to evaluate the permeability results with each catheter-locking solution. We have no observed statistical difference between the different catheter-locking solution in this study period.

**Conclusions:** The different formulations exhibit a similar permeability in the overall results. Catheter-locking with low doses of heparin (20 IU/ml) may have the same efficiency from the functional point of view than other formulations. Administering this formulation may simplify catheter-locking, reduce handling and decrease the possible systemic complications.

18:00 - 18:07 | 94

#### TUNNELLED CENTRAL VENOUS CATHETERS FOR HAEMODIALYSIS INSERTED BY ULTRASONOGRAPHY IN A COUNTY HOSPITAL: FOUR YEARS OF EXPERIENCE

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**Introduction and Objectives:** Although the tunnelled venous catheter (TVC) is not considered the vascular access (VA) of first choice in most haemodialysis (HD) patients (pts), it has become necessary in some pts to start or remaining on HD program.

To analyze the characteristics of pts in whom a TVC was inserted in the nephrology department of the Hospital de Mollet (HM) during four years.

**Material and Methods:** We analyzed retrospectively both incident and preva-

lent pts from HM or our satellite HD facility in Granollers (DG) who underwent TVC placement between July 2010 and December 2014. The TVC insertion was performed always guided with ultrasound by the same nephrologist and using the same methodology in all cases.

**Results:** Seventy-five TVC were inserted in 69 pts (male 55%, mean age 72.2 yr, 84% pts with at least one comorbidity, 71% diabetes). Almost all TVC were palindrome type (90.7%) and were inserted in a right internal jugular position (87.3%) most as outpatients (62.7%). The most frequent procedure (73.4%) was tunnelling a temporary catheter due to acute-on-chronic renal disease secondary to cardiac failure. Fifty-six pts (82.7%) were prevalent (mean time on HD 9.44 months). Most of the remaining incident pts didn't had predialysis nephrology care (9/13, 69.2%). Of them, it was possible arteriovenous access placement and CTC removal during the follow-up (7/9, 77.7%). However, it was not possible arteriovenous access placement and TCV removal in none incident pts who received predialysis nephrology due to heart disease. Not immediate complications were shown but 17 late complications were recorded due to TVC dysfunction (n = 13) that require fibrinolysis and 4 sepsis that led to TVC removal.

#### Conclusions:

1. The most frequent cause of TVC placement in incident pts was acute-on-chronic renal disease secondary to cardiac failure.
2. In over 70% of incident pts with TVC there is possible an arteriovenous access placement.
3. The TVC is a good option for the incident patients with cardiorrenal syndrome.
4. The palindrome catheter shows a low rate of infectious complications.

18:10 - 18:17 | 100

#### ADEQUACY OF HEMODIALYSIS WITH PALINDROME TUNNELED CATHETERS VS. ARTERIOVENOUS FISTULAS: A SINGLE-CENTER OBSERVATIONAL STUDY

Pablo Molina, Marco Montomoli, Belén Vizcaino, Nuria Martínez-Martínez, María J. Lidón, Sandra Beltrán, Cristina Castro-Alonso, Mercedes González-Maya, José L. Górriz, Luis M. Pallardó Department of Nephrology, Dr Peset University Hospital, Valencia, Spain

**Introduction and Objectives:** Poor function of hemodialysis (HD) catheters due to flow and recirculation problems commonly leads to increase the length of dialysis sessions for achieving adequate dialysis dose, being one of the leading causes of unplanned catheter removal in HD patients. As opposite to commonly used HD catheters with a staggered tip design, Palindrome catheters have a symmetric tip design, providing better flow rates and lower risk of recirculation even if reversal of the lumens is performed to correct inadequate inflow. The present study assessed the effectiveness of the Palindrome catheter compared to arteriovenous (AV) fistula in achieving adequate dialysis dose in a 4-hour thrice weekly in center HD regimen.

**Material and Methods:** This single-center, prospective, observational, non-inferiority study enrolled all HD subjects with Palindrome catheter (n = 16) or arteriovenous (AV) fistula (n = 49), attending our Unit from January 2013 to June 2014 with a 4-hour thrice weekly HD regimen. Patients with other tunneled

cuffed catheter or other HD regimen were excluded. Primary outcomes were the measurement of recirculation rate and the proportion of HD sessions which obtained a Kt of at least 45L, and an effective convective volume of at least 18L, with each one of the different vascular access. Recirculation rate and Kt were assessed in every dialysis session by thermodilution and the conductivity-based online clearance measurement, respectively. A target blood flow rate of 400 ml/min and a FX100 Helixone dialyzer were prescribed in all the sessions.

**Results:** 3,899 sessions were analyzed (Palindrome catheter: 611, 16%; AV fistula: 3288, 84%). The recirculation rate was similar in both groups (Table 1). Although the dialysis parameters were better in the AV fistula group, more than 90% of the sessions performed with Palindrome catheter achieved adequate diffusive and convective dialysis doses.

**Conclusions:** Palindrome catheters provided a low risk of recirculation. Although arteriovenous fistula should remain the first choice of vascular access, in 4-hour thrice weekly HD patients, the use of a Palindrome catheter could avoid to increase the length of the dialysis sessions in majority of patients, even when convective therapies are performed. Randomized trials are warranted to confirm these findings.

TABLE 1

Characteristics	Palindrome catheter (n = 611)	AV Fistula (n = 3288)	p
Recirculation rate	13 ± 4	57 ± 8	<0.001
Kt >45L (n, %)	2879 (98%)	24.6 ± 5.1	<0.001
Convective volume >18L (n,%)	1068 (98%)	346 ± 45	<0.001
On line HDF (n,%)	1094 (33%)	-225 ± 35	<0.001
Venous pressure (mmHg)	157 ± 38		n = 29
Male Gender (%)	69		
Dialysis Vintage (months)	66 (33-143)		
Diabetes (%)	0		
Distal/Proximal AVF (%)	28/72		
CO (mL/min)	7457 ± 1644		
NYHA I	10		
NYHA III	5		

#### 18:20 - 18:27 | 105

##### OUR EXPERIENCE IN COMPLEX HEMODIALYTIC CENTRAL VENOUS CATHETER'S INSERTION

*Giacomo Calcarà<sup>1</sup>, Domenico Patanè<sup>1</sup>, Stefania Giuffrida<sup>1</sup>, Paola Bisceglie<sup>1</sup>, Giuseppe L'Anfusa<sup>1</sup>, Pierantonio Malfa<sup>1</sup>, Walter Morale<sup>2</sup>, Giuseppe Seminara<sup>2</sup>, Domenico Di Landro<sup>2</sup>*

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**Introduction and Objectives:** Central venous catheters (CVCs) for hemodialysis have high rate of complications due to infection and failure, so the need of replacement, resiting and exchange is very frequent with consequential development of stenotic and occlusive lesions that lead depletion of traditional venous access increasing challenge to find a good site for CVC's insertion. The purpose of this study was to describe our experience in evaluation and management of complex CVC's insertion and to define technical requirements to run challenging situations.

**Material and Methods:** We retrospectively reviewed 583 patients underwent CVCs's insertion at our hospital between 2010 and 2014. We defined as "complex CVC" those catheters inserted in not usual sites or requiring previous percutaneous angioplasty (PTA) or stenting; in most of these cases preliminary venous Computed Tomography (CT) is performed.

Complex CVC's insertions are usually evaluated and performed in Interventional Radiology (IR) Unit using venous CT, ultrasound, angiography and per-

cutaneous angioplasty as the case. 429 CVCs (74%) showed normal access's site and were placed in Nephrology and Dialysis Unit; 154 CVCs (26%) were inserted in IR, we divided two groups: 1) 95 CVCs with normal access and standard insertion; 2) 59 Complex CVCs where a "salvage" access technique was used: 10 patients underwent transcollateral vein access (3 in Azigos vein, 4 in intercostal veins, 3 in other collaterals); 1 patient underwent translumbar inferior vena cava central venous catheter's insertion; 8 patients underwent puncture of an occluded vein, cross of the occluded segment and PTA if it needed; 40 patients underwent transcatheter venous occlusion insertion with previous PTA in the whole cases and stenting sometimes.

**Results:** CT had a crucial role to locate best puncture site and to plan appropriate treatments as well as our widely assorted stock to deal with different situations. Post-procedural technical success was 100%; all patients were able to perform dialysis after catheter's insertion.

**Conclusions:** Operators are often required to find solutions to save central venous dialytic access; techniques we described can be useful to face these challenges with several choices available. Preliminary exact knowledge of venous anatomy is mandatory for every patient to correctly plan these procedures and to reduce correlated risk before attempting; CT is an essential help to detect lesions and study venous anatomy. An high level angiography system, a widely assorted stock and a familiarity with these procedures should be sought to take on these challenges.

#### ► Thursday 16<sup>th</sup> April

#### HEMODYNAMICS | 17:30 - 18:30 | ROOM 5

#### 17:30 - 17:37 | 81

##### HIGH-FLOW AVF AND HEART FAILURE: COULD THE INDEXATION OF BLOOD FLOW RATE HAVE A ROLE IN THE IDENTIFICATION OF PATIENTS AT HIGHER RISK?

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**Introduction and Objectives:** High-output cardiac failure (HOCF) secondary to an AVF is a well-described phenomenon in HD. Although is suggested that only high-flow AVFs cause HOCF, there are no accepted criteria defining a high-flow AVF because data describing HOCF in ESRD are limited to case reports. One study has indicated that patients at greater risk for the development of HOCF are those with vascular access blood flow (Qa) ≥2.000 mL/min.

Purpose of this study was to evaluate, in patients bearing a fistula with Qa ≥2.000 mL/min, the presence of symptoms of heart failure, the relationship between Qa and cardiac output (CO), and the presence of echocardiographic alterations. Finally, our aim was to draw an identikit of the patient at higher risk for HOCF.

**Material and Methods:** We selected 29 incident ESRD or transplanted patients bearing an AVF with a Qa ≥2.000 mL/min who were evaluated at our institutions between May 2012 and April 2014. All patients were assessed for the presence of heart failures' symptoms (NYHA Classification). AVFs were studied with colour-duplex ultrasound and Qa was measured. Transthoracic echocardiography was also effected and CO was calculated. Qa and CO were assessed in mL/min and then indexed for height 2.7 (mL/min/m<sup>2.7</sup>).

**Results:** Characteristics of patients are reported in Table 1. The relationship between Qa and CO was not linear when both variables were assessed in mL/min, but it became linear when they were indexed for height 2.7 (mL/min/m<sup>2.7</sup>). ROC curve analysis showed that when Qa was indexed for height 2.7, Qa values ≥603 mL/min/m<sup>2.7</sup> predicted the occurrence of HOCF with good accuracy (sensitivity 100%, specificity 60%, area under curve 0.75, efficiency 86%). At the echocardiography, pts with Qa ≥603 mL/min/m<sup>2.7</sup> were characterized by a more severe increase of LV mass (LVM), LV diastolic volume (LVDV), LA volume (LAV) and by a higher incidence of grade II-III of diastolic dysfunction than other patients (Table 2).

**Conclusions:** In the attempt to give a definition of high flow fistula, Qa should not be evaluated in mL/min but the relation between flow rate and body



size should be thoroughly considered; in fact, the effect of Qa may differ in individuals with different body size. In our patients, a Qa value  $\geq 603$  mL/min/m<sup>2.7</sup> was able to predict the occurrence of heart failures' symptoms. The association of such Qa value with some echocardiographic alterations (severe increase of LVM, LVDV, LAV and diastolic dysfunction grade II-III) could allow us to identify patients at higher risk for HOCF.

**TABLE 1** - Demographic and clinical characteristics

	n = 29
Age (years)	50.9 $\pm$ 10.9
Male Gender (%)	69
HD vs Transpl (n)	22 vs 7
Dialysis Vintage (months)	66 (33-143)
BMI	24.3 $\pm$ 4.5
Diabetes (%)	0
Cardiovascular Disease (%):	
Myocardial Infarct	3
Stroke	10
Periph Vascular Dis	7
Distal/Proximal AVF (%)	28/72
Qa (mL/min)	3068 (2319-3752)
CO (mL/min)	7457 $\pm$ 1644
Symptoms of HF (n):	
NYHA I	10
NYHA II	14
NYHA III	5

**TABLE 2** - Echocardiographic parameters

AVF Blood Flow (mL/min/m <sup>2.7</sup> )	<603 (n = 6)	$\geq 603$ (n = 23)	P
LV Mass (gr/m <sup>2.7</sup> )	47 $\pm$ 7	63 $\pm$ 18	0.003
LV Diast Vol (ml)	109 $\pm$ 14	140 $\pm$ 42	0.007
LA Volume (mL/m <sup>2</sup> )	39 $\pm$ 5	53 $\pm$ 23	0.015
EF (%)	58 $\pm$ 10	57 $\pm$ 11	NS
Diastolic Dysfunction (%)	17	70	0.019

**17:40 - 17:47 | 117****IS THERE A RELATIONSHIP BETWEEN ARTERIOVENOUS ACCESS FLOW AND CARDIOVASCULAR RISK FACTORS IN HAEMODIALYSIS PATIENTS?**

Ivo Laranjinha<sup>1</sup>, Patrícia Matias<sup>1</sup>, Ana Azevedo<sup>1</sup>, Carina Ferreira<sup>1</sup>, Tiago Amaral<sup>1</sup>, David Navarro<sup>2</sup>, Inês Aires<sup>2</sup>, Célio Gil<sup>1</sup>, Aníbal Ferreira<sup>2</sup>

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**Introduction and Objectives:** An adequate haemodialysis (HD) vascular access flow (Qa) is required to a more efficient dialysis and to improve patient's outcome. However, a high Qa may cause high output cardiac failure and adverse cardiovascular (CV) outcomes.

The aim of this study was to determine relationship between higher Qa and CV risk factors, like pulse pressure (PP), left ventricular mass index (LVMI), left ventricular ejection fraction (LVEF) and vascular calcification, in prevalent HD patients.

**Material and Methods:** The study population was divided in two groups according to the Qa (<1.5 L/min and  $\geq 1.5$  L/min). All patients enrolled in the study underwent an echocardiographic examination and vascular calcifications were evaluated by plain radiographic films of hands and pelvis. Qa were evaluated using the Fresenius Medical Care Blood Temperature Monitor (BTM) at 300 mL/min.

We performed a cross-sectional study in 336 prevalent HD patients with a mean age of 66.4 years, 62.5% males, 36.3% diabetics, and with a median HD time of 48 months. Thirty-two percent of the patients had a Qa  $\geq 1.5$  L/min.

**Results:** We found that patients with Qa  $\geq 1.5$  L/min were younger (p<0.001), had higher serum albumin (p = 0.015), lower PP (p = 0.031) and lower vascular calcification score (p = 0.017). However, these patients had a significantly higher LVMI (p = 0.013) and lower LVEF (p = 0.015).

In a multivariable analysis, Qa  $\geq 1.5$  L/min was negatively associated with LVEF (p = 0.028) in a model adjusted for age, diabetes, coronary disease and LVMI.

**Conclusions:** Our study shows that higher Qa ( $\geq 1.5$  L/min) may have an adverse cardiac impact by leading to an increase in LVMI and to a decrease in LVEF. This study also emphasizes the need for a routine echocardiography evaluation in patients with higher Qa. These results need to be confirmed in prospective studies.

**17:50 - 17:57 | 209****IS THERE HIGH FLOW ARTERIOVENOUS (AV) ACCESSES ASSOCIATED WITH WORSE HAEMODIALYSIS?**

Ivo Laranjinha<sup>1</sup>, Patrícia Matias<sup>1</sup>, Ana Azevedo<sup>1</sup>, David Navarro<sup>2</sup>, Carina Ferreira<sup>1</sup>, Tiago Amaral<sup>1</sup>, Inês Aires<sup>2</sup>, Célio Gil<sup>1</sup>, Aníbal Ferreira<sup>2</sup>

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**Introduction and Objectives:** An AV access flow (Qa) of 400-600 mL/min is usually sufficient for an effective haemodialysis (HD), but some continue maturing and become high flow accesses. Some authors postulated that a high flow AV access might shift a significant portion of freshly dialyzed blood from the cardiac output to the AV access, which could decrease HD efficiency. High flow accesses could also have cardiac consequences, such as left ventricular dilatation. However, the classic presentation of high cardiac failure secondary to high flow access is rare.

We performed a 1-year retrospective study in order to evaluate if high flow accesses were associated with reduced HD efficiency and overhydration in prevalent HD patients.

**Material and Methods:** To assess HD efficiency we calculated the mean Kt/V value for each patient (Kt/V was measured in all HD sessions during 1 year) and the percentage of these sessions in which the Kt/V were less than 1.4. Patient's hydration status was evaluated using bioimpedance spectroscopy (Body Composition Monitor - Fresenius Medical Care). Patients were classified according to their hydration status in normohydrated (absolute fluid overload between -1.1 and +1.1 L), overhydrated (when extra-cellular water volume was above 1 L) and severely overhydrated (fluid overload above 2.5 L).

**Results:** The study included 336 prevalent HD patients with a mean age of 66.4 years, 62.5% males, 36.3% diabetics, with a median HD time of 48 months. Seventeen percent of the patients had a high flow AV access (defined as Qa  $> 2$  L/min). Qa was evaluated using the Fresenius Medical Care Blood Temperature Monitor (BTM) at 300 mL/min.

We found that patients with Qa  $> 2$  L/min attain Kt/V  $> 1.4$  more frequently (p = 0.037), however the mean of Kt/V value was not different. Hydration status was also not different between patients with Qa  $> 2$  or  $\leq 2$  L/min. Mean blood pressure control and heart rate (evaluated by mean systolic and diastolic and mean heart rate at HD beginning) was similar between groups.

In a multivariable analysis, the presence of an AV access with Qa  $> 2$  L/min was positively associated with percentage of sessions with Kt/V  $> 1.4$  (p = 0.04).

**Conclusions:** Our results suggest that, contrarily to what had been postulated, patients with high flow accesses could have a more efficient HD because they achieve more frequently a Kt/V  $> 1.4$ . In our study, high flow AV accesses were not associated with overhydration.



**18:00 - 18:07 | 84****MODIFICATION OF CARDIAC HEMODYNAMICS OCCURRING AFTER HIGH FLOW REDUCTION BY PROXIMAL RADIAL ARTERY LIGATION OF RADIAL-CEPHALIC FISTULA FOR HAEMODIALYSIS**

*Jacopo Scrivano<sup>1</sup>, Laura Pettorini<sup>1</sup>, Teresa Rutigliano<sup>2</sup>, Giuseppino Massimo Ciavarella<sup>2</sup>, Luciano De Biase<sup>2</sup>, Giorgio Punzo<sup>1</sup>, Paolo Menè<sup>1</sup>, Nicola Pirozzi<sup>1</sup>*

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**Introduction and Objectives:** AVF induces adaptive modifications of both left (LV) and right ventricle (RV). These modifications might evolve to LV hypertrophy, impaired function of right sections with pulmonary hypertension and high output heart failure.

When high flow AVF ( $Q_b > 2 \text{ L/min/1.73 m}^2$ ), along with increased cardiopulmonary recirculation ( $\text{CPR} = Q_b/\text{CO} > 20\%$ ) exist, its reduction is suggested. As described by Bourquelot, proximal radial artery ligation (PRAL) is effective in flow reduction of distal radio-cephalic AVF (RCAVF).

We compared echocardiographic (ECHO) finding before (T0) and 1 and 6 months (T1, T6) after PRAL.

**Material and Methods:** 6 consecutive patients with a high flow RCAVF, increased CPR and symptoms of impaired cardiac function.

The patients characteristics are exposed in Table 1.

We evaluated, by ECHO, tricuspid anular plane systolic excursion (TAPSE), pulmonary artery systolic pressure (PAPs), right ventricle telediastolic diameter (RV TDD), right ventricle ejection fraction (RV EF) at T0, T1 and T6. Modifications of CPR ( $\Delta \text{CPR}$ ) and AVF  $Q_b$  ( $\Delta Q_b$ ) were assessed before and 1 month after PRAL.

During preoperative ECHO, a dynamic evaluation of TAPSE before (T0b) and after manual compression (T0c) of AVF anastomosis was performed.

**Results:**  $Q_b$  was  $2,3 \pm 0,3 \text{ L/min/1,73 m}^2$  at T0 and  $1,0 \pm 0,1 \text{ L/min/1,73 m}^2$  at T1 (flow reduction  $56 \pm 5,2\%$ ,  $p < 0,001$ ). CPR was  $36,5 \pm 10,4\%$  at T0 and  $18,5 \pm 7,0\%$  at T1 ( $17,9 \pm 11,9\%$  CPR reduction,  $p = 0,005$ ). An early (24h) improvement of cardiac functional status was observed in all pts. ECHO parameters are exposed in Table 2.

We find a positive correlation (by Pearson's coefficient) between:  $\Delta \text{TAPSE T0b/T0c}$  and  $\Delta \text{TAPSE T0/T1}$  (0.84) as well as  $\Delta \text{TAPSE T0b/T0c}$  and  $\Delta \text{TAPSE T0/T6}$  (0.73);  $\Delta Q_b \text{ T0/T1}$  and  $\Delta \text{PAPs T0b/T1}$  (0.74) as well as  $\Delta Q_b \text{ T0/T1}$  e  $\Delta \text{PAPs T0b/T6}$  (0.66);  $\Delta Q_b \text{ T0/T1}$  and  $\Delta \text{RV TDD T0/T1}$  (0.61) as well as  $\Delta Q_b \text{ T0/T1}$  and  $\Delta \text{RV TDD T0/T6}$  (0.96)

**Conclusions:** After a successful reduction of RCAVF flow, significant haemodynamic changes occur. Our results seems to outline the effect of volume/pressure stress over the right section related to an high flow RCAVF ( $\Delta Q_b$  vs  $\Delta \text{PAPs}$  and  $\Delta \text{RV TDD}$ ). The preoperative dynamic manoeuvre during ECHO ( $\Delta \text{TAPSE T0b/T0c}$  vs  $\Delta \text{TAPSE T0/T1}$ ) could represent an adjunctive tool to asses AVF related heart impairment.

**TABLE 1 - Patient characteristics**

Age (yrs)	67 ± 10
Sex	5 M 1 F
NYHA class	IV: 1 pt; III: 1 pt; II: 3 pts; I: 1 pt
Functional status	3 ESRD; 2 CKD V K/DOQI; 1 Tpx
AVF vintage (yrs)	7 ± 6

CKD: chronic renal disease; ESRD: end storage renal disease; Tpx: transplantation.

**TABLE 2 - ECHO parameters before and after PRAL**

	T0 b	T0 c	T1	T6	$\Delta \text{T0b/T1}$	$\Delta \text{T0b/T6}$
TAPSE (mm)	16,6 ± 5,0	21,5 ± 0,8	22,5 ± 2,5	22,5 ± 3,3	5,6 ± 3,6 (p = 0,03)	5,8 ± 3,6 (p = 0,04)
PAPs (mmHg)	45,8 ± 10,3		36,0 ± 11,6	30,8 ± 6,8	0,5 ± 0,7 (ns)	15 ± 10 (p = 0,014)
RV TDD (mm)	30,1 ± 4,8		29,5 ± 5,9	29,3 ± 4,6	0,6 ± 4,8 (ns)	0,8 ± 5,9 (ns)
RV EF (%)	56,3 ± 7,9		56,5 ± 12,3	63,5 ± 8,8	0,1 ± 7,1 (ns)	7,1 ± 5,6 (ns)

Δ: difference.

**18:10 - 18:17 | 52****VASCULAR ACCESS IN CARDIAC DYSFUNCTION UNDER 30% OF LEFT VENTRICULAR EJECTION FRACTION (LVEF <30%)**

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**Introduction and Objectives:** Cardiac dysfunction in the patient with end-stage renal disease (ESRD) is a key determinant for their mortality. The Japanese Society for Dialysis Therapy recommends either the superficialization of the brachial artery or the hemodialysis catheter placement in case that the patients have a low cardiac function. In turn, the shunt vessels have several advantages compared to such two blood access in clinical medicine. Hence, it might be important to reevaluate the efficacy and the safety of the shunt vessels in patients with cardiac dysfunction. Here we retrospectively examined the clinical outcomes of either the arteriovenous fistula (AVF) or the arteriovenous graft (AVG) in such patients in our hospital.

**Material and Methods:** From January 2011 to December 2014, a total of either 57 AVF or AVG were performed in 48 patients (31 males, 17 females, average age 73.7 ± 11.3 years, 23 Diabetes Mellitus, 28 OMI, 8 DCM) with LVEF <30%. This percentage was 0.02% at our institute (total number of AVF and AVG 2594 cases).

**Results:** We performed 35 AVF (10 snuffbox, 10 distal forearm, 8 middle forearm, 7 cubital region), 18 AVG (10 radial artery-upper arm brachial basilic vein or brachial vein bypass, 3 radial artery-median cubital vein bypass, 3 brachial artery- upper arm brachial basilic vein or brachial vein loop bypass, 1 radial artery-forearm basilic vein bypass, 1 brachial-axillary vein bypass), and 4 superficialization of the brachial artery.

Postoperative acute phase mortality (<14 days) was 6 while the late mortality was 25% due to pneumonia, congestive heart failure, or acute myocardial infarction) in patients with AVF.

We had 3 cases with postoperative acute death with AVG that anastomosed of brachial artery with 6 mm artificial graft. Alternatively, the 4-7 mm tapered graft was also used to reduce anastomosis hole in 2 cases. In particular, the clinical outcome using the 5 mm artificial graft connected with the radial artery showed better outcome than 6 mm artificial graft.

**Conclusions:** Our retrospective study shows that the surgical strategy should be carefully determined. We recommend that the snuffbox can be used for AVF anastomosis and the radial artery can be suitable for AVG in patients with low cardiac function. The tapered graft is also useful for brachial artery anastomosis.

**18:20 - 18:27 | 31****EFFECTS OF WALL SHEAR STRESS IN VENOUS NEOINTIMAL HYPERPLASIA OF ARTERIOVENOUS FISTULAE**

*Lan Jia, Hua Li Wang, Fang Wei, Bo Hai Yu, Zhi Lu, Bo Wang*

Institute of Urology & Key Laboratory of Tianjin, 2<sup>nd</sup> Affiliated Hospital of Tianjin Medical University, Tianjin, China

**Introduction and Objectives:** An arteriovenous fistula (AVF) is the preferred vascular access for maintenance hemodialysis patients. Its dysfunction is often due to venous stenosis, which is mainly caused by neointimal hyperplasia. Additionally, hemodynamic forces, especially wall shear stress (WSS), as a mechanical stimuli to venous wall have a significant role in neointimal hyperplasia. The purpose of this study was to evaluate the association between WSS and neointimal hyperplasia.

**Material and Methods:** An 'end-to-side' AVF was created between the right femoral artery and vein of canines. Canines were sacrificed at 7 and 28 days post-surgery. The velocity and WSS in the three-dimensional computational model of AVF were simulated using computational fluid dynamics (CFDs). The four typical sites of the vein evaluated in this study, chosen according to the hemodynamic analysis, included the arteriovenous anastomosis (A-V), the juxta-anastomotic segment (J-V), the juxta-ligation segment (L-V) and the proximal vein (P-V). The specimens were hematoxylin-eosin stained and the intima-media thickening was then measured.

**Results:** Neointimal hyperplasia was more obvious in the inner wall of the J-V and L-V (low-and-disturbed WSS) sites compared with the P-V and A-V sites, and the outer wall of the L-V and J-V segments (high-and-laminar WSS) ( $p < 0.01$ ).

**Conclusions:** In this study, we described the hemodynamic condition in the AVF and found that neointimal hyperplasia predisposed to occur in the inner wall of venous segment near the anastomosis. We also found that not only the neointimal hyperplasia has a strong inverse correlation with WSS levels, but also is related to flow patterns.

► **Thursday 16<sup>th</sup> April**  
**ENDOVASCULAR TREATMENT | 17:45 - 18:35 |**  
**ROOM 6**

17:45 - 17:52 | 229

**LONG TERM FOLLOW UP OF VENOUS ANEURYSM IN NATIVE ARTERIO-  
VENOUS FISTULA**

*Nc Liew, L. Lee, Z. Hanipah*

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**Introduction and Objectives:** The management of true venous aneurysm (VA) in vascular access is still a contentious issue. Little is known about the natural history of VA; even its definition is debatable. VA is associated with arteriovenous fistulae of long term patency and is a 'sign' of longevity of a native fistula. VA however is known to be associated with ruptures, bleeding, overlying skin infection, stenosis and thrombosis. Current literatures are mainly reports concerning its management, from ligation and excision, to various methods of partial aneurysmorrhaphy, followed by suture repair, plication, rotation flap or patch venoplasty. There have even been recent reports of repair by stent grafting.

The indication for intervention is clear when the aneurysm ruptures or threatens to bleed (thinned out skin or overlying ulceration), or when there is dysfunction due to stenosis or thrombosis. What is unclear is whether routine aneurysm repair is indicated and whether it impacts patency.

The objective of this study is to review the results of long term follow-up of a cohort of patients with VA that have been managed conservatively.

**Material and Methods:** All patients with VA on a native arteriovenous fistula, on follow-up in the renal access clinic are registered into this study. Besides history and clinical examination, ultrasonographic evidence of true aneurysm is established. The definition of VA is taken as a true aneurysm of veins of larger than 3 times or more when compared to the native vein proximal to the aneurysm. The aneurysm must be larger than 3-cm. The duration of the VA formation (from occurrence according to patient) is recorded as history of aneurysm. The actual duration of VA is recorded as the index registration till the last censure, follow-up, fistula failure or when intervention is needed. The complications that arose were recorded. No attempt is made to repair the VA unless there are indications of a high risk of rupture or fistula dysfunction (high venous pressure or poor flow).

**Results:** Sixty-seven patients with VA are recruited. Five patients with incomplete follow-up data were excluded. The follow-up period varies from 1 to 10 years. 75% of the patients have associated hypertension and diabetes. Seven (11.3%) of the patients had threatened bleed or had bled and underwent ligation/repair of the fistula. Seven (11.3%) of the patients developed thrombosis of the fistula. Five (8.1%) developed dysfunction of the fistula due to poor flow and underwent further intervention. Two (3.2%) of patients had associated limb swelling attributed to central vein stenosis and had venoplasty/ligation. Two (3.2%) fistulae were ligated and excised due to fear of rupture and for cosmetic reasons.

**Conclusions:** Venous aneurysm is associated with long-term patency of the fistula. The feared complication of rupture or bleed is uncommon and can be pre-emptively repaired if diagnosed early. It is also associated with stenosis that could lead to access failure and thrombosis. Until a better natural history is defined, these aneurysms are better managed conservatively but surveillance for complication is mandatory.

17:55 - 18:02 | 85

**EARLY FAILURE OF AUTOGENOUS DISTAL ARTERIOVENOUS FISTULA  
DUE TO FOREARM ARTERY STENOSIS: ENDOVASCULAR TREATMENT**

*Jacopo Scrivano<sup>1</sup>, Emanuela Cordova<sup>1</sup>, Roberto Pirozzi<sup>2</sup>, Laura Pettorini<sup>1</sup>, Matteo Baldinelli<sup>3</sup>, Giorgio Punzo<sup>1</sup>, Paolo Menè<sup>1</sup>, Nicola Pirozzi<sup>1</sup>*

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<sup>3</sup> Nephrology and Dialysis Unit, INI Medicus, Rome, Italy

**Introduction and Objectives:** Autogenous distal arteriovenous fistula (dAVF), considered the gold standard of vascular access for haemodialysis, suffers from high rate of early failure: 10-50%. A possible cause of this complication is delayed maturation associated to forearm artery stenosis located proximally to the anastomosis. In these cases the endovascular treatment by percutaneous angioplasty, has been shown just in 2009 (Turmel-Rodrigues and Raynaud), to represents a helpful option to enable the maturation of these vascular access. We describe a single-centre experience on endovascular treatment of dAVF complicated by delayed maturation associated to forearm artery stenosis.

**Material and Methods:** We treated 18 patients with diagnosis of low-flow immature AVF due to forearm artery stenosis, from January 2007 to July 2014. All of them were evaluated by clinical examination and Color Doppler Ultrasound one month after the creation of the access.

The patients characteristics are exposed in Table 1.

**Results:** All patients were treated by PTA alone, without any stent placement; all the interventions ended with patent fistulas. Mean blood flow raised from  $304.1 \pm 70.5$  ml/min preoperatively, to  $671.6 \pm 145.1$  ml/min at one week after the procedure ( $p < 0.01$ ). One year primary and secondary patency were 82,4% and 92,3% respectively (Kaplan Meyer analysis). Radial artery rupture occurred in two patients. This complication has been treated successfully with prolonged low-pressure balloon inflation. Any haemodialysis access induced distal ischemia (HAIDI syndrome) has been observed.

**Conclusions:** Endovascular approach by PTA is a helpful and minimally invasive procedure for treatment of delayed maturation of distal arteriovenous fistula associated with forearm artery stenosis. Despite the very strong risk factor for HAIDI syndrome of this population (diabetes 77%, peripheral vascular disease 88%), any such case has been observed, due to the distal location of the anastomosis.

**TABLE 1 - Patients characteristics**

Patients	18 (16 M/2F)
Age (years)	63.8 $\pm$ 13.5
Diabetes mellitus	14 (77.7%)
Hypertension	17 (94.4%)
Peripheral vascular disease	16 (88.8%)
Type of fistula	Radio-cephalic: 16 (88.8%) Ulna-basilic: 2 (11.2%)
Type of stenosis	Radial artery: 13 (72.1%) Ulnar artery: 2 (11.2%) Radial artery and cephalic vein: 3 (16.6%)
Functional status	HD with CVC: 10 (55.5%) HD with another AVF: 2 (11.2%) CKD K/DOQI St.V: 6 (33.4%)

Haemodialysis HD, central vein catheter CVC, chronic kidney disease CKD.

**18:05 - 18:12 | 103****DRUG-ELUTING BALLOON FOR THE TREATMENT OF FAILING DISTAL HEMODIALYTIC RADIO-CEPHALIC ARTERIOVENOUS FISTULAS: OUR EXPERIENCE IN TREATMENT OF JUXTA-ANASTOMOTIC STENOSES**

*Stefania Giuffrida<sup>1</sup>, Domenico Patanè<sup>1</sup>, Giacomo Calcarà<sup>1</sup>, Paola Bisceglie<sup>1</sup>, Giuseppe L'Anfusa<sup>1</sup>, Pierantonio Malfa<sup>1</sup>, Walter Morale<sup>2</sup>, Giuseppe Seminara<sup>2</sup>, Domenico Di Landro<sup>2</sup>*

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<sup>2</sup>Nephrology and Dialysis, Cannizzaro Hospital, Catania, Italy

**Introduction and Objectives:** Stenotic lesions of radio-cephalic arteriovenous shunts occur mainly in the anastomotic site up to 64% of cases. The aim of this was to evaluate the effectiveness of Drug-eluting Balloons (DEB) for treatment of juxta-anastomotic stenoses of failing distal radio-cephalic hemodialytic arteriovenous shunt.

**Material and Methods:** Without any biomedical financial interests or potential conflict of interest, after approval by the local hospital's Ethical and Scientific Review Board, 26 consecutive patients with juxta-anastomotic stenosis of distal radio-cephalic hemodialytic shunt were treated with standard percutaneous angioplasty (PTA) completed with drug-eluting balloon and data obtained were compared with a control group having similar features, consisting of 106 patients treated only with standard PTA. Main objective was to evaluate Surviving Time and primary patency (PP) in the two groups, defined as absence of dysfunction of the vascular access, in accord with the Kidney Disease Outcomes Quality Initiative recommendations, patent lesion or residual stenosis <30% and no need for further reintervention of the target lesion (TLR). Primary patency (PP) at 6, 12 and 24 months were evaluated, with echocolor Doppler and phlebography, for both groups.

**Results:** Immediate post-procedural technical and clinical success was 100% for all the patients; we had only one technical failure in repeated treatments. 6, 12 and 24 months PP was respectively 92%, 77% and 46% in patients treated with standard PTA and DEB and 83%, 45% and 39% respectively in patients treated just with standard PTA. There was a statistically significant difference (P-value = 0.017) in Surviving Time and Survival free TLR between the two groups.

**Conclusions:** The use of drug-eluting Balloons, after standard angioplasty, seems to improve primary patency and decrease reinterventions of target lesion in juxta-anastomotic stenoses of failing native dialytic arteriovenous shunts with a statistically significant difference between the two groups.

**18:15 - 18:22 | 125****ANALYSIS OF THE 757 PTA CASES BY THE ULTRASONIC GUIDE FOR THE VASCULAR ACCESS OCCLUSION**

*Masanori Wakabayashi*

Bousei the first Clinic, Shizuoka, Japan

**Introduction and Objectives:** For the cases that administered the percutaneous transluminal angioplasty (PTA) by the ultrasonic guide for the vascular access occlusion in our hospital, I considered the usefulness from initial results.

**Material and Methods:** We examined 757 patients with occluded lesions from the 10,830 ultrasound-guided PTA patients treated at this facility from April 2004 through December 2014. The procedure was performed on 565 artificial vessels, including 553 acute occlusions and 12 chronic occlusions, and 192 autogenous vein including 109 acute occlusions and 83 chronic occlusions. Ultrasonic equipment used consisted mainly of the Logiq S6 (GE Healthcare, Japan) equipped with an 11 MHz linear probe. Patients underwent endovascular or surgical thrombectomy prior to ultrasound-guided PTA.

**Results:** Acute success (dialysis possible) was achieved in 553 (97.9%) artificial vessel patients and 180 (93.8%) autogenous vein patients. Early occlusion (within 2 weeks) occurred in 42 patients (5.5%), all artificial vessel acute occlusion patients. The primary patency rate (up to intervention of the intra-vascular treatment) was for one month 89.1% and for three months 64.5%. Assistance in the form of intraoperative fluoroscopy was required in 9 cases. Seven cases required surgical revascularization. Serious complications occurred in 4 of 757 cases (0.5%).

**Conclusions:** Ultrasound-guided treatment provided high success rates in vascular access of occluded lesions.

**18:25 - 18:32 | 147****REVASCULARIZATION OF CENTRAL VENOUS OCCLUSIONS WITH DEDICATED VENOUS STENTS TO SALVAGE OR CREATE UPPER EXTREMITY VASCULAR ACCESS**

*Niek Zonneveld<sup>1</sup>, Rick De Graaf<sup>1</sup>, Jorinde Van Laanen<sup>1</sup>, Magda Van Loon<sup>1</sup>, Jan Tordoir<sup>1</sup>*

Maastricht University Medical Center, Maastricht, The Netherlands

**Introduction and Objectives:** Central venous occlusive disease (CVD) complicates vascular access maintenance in hemodialysis patients. Percutaneous transluminal angioplasty with or without stent placement is advocated as the preferred treatment. In contrast to iliofemoral venous obstruction, primary stenting for CVD has not yet been accepted. Reported patency rates are unsatisfactory, which is possibly due to suboptimal stent design. Currently, dedicated venous stents are suggested to perform better in the venous vasculature, due to higher radial force and flexibility. Here, we present the results of dedicated venous stents for treating upper extremity central venous occlusive disease.

**Material and Methods:** Consecutive vascular access patients with a symptomatic ipsilateral CVD referred to a tertiary center between January 1<sup>st</sup> 2010 and January 1<sup>st</sup> 2015 were analysed retrospectively. For all patients there was an intention to treat principle. Primary endpoints were primary, lesion, and access patency rates. Follow-up duration is set to one year after intervention. All used definitions are in concordance with the reporting standards for percutaneous interventions in dialysis access.

**Results:** 19 Patients (12 male, mean age 64.9 ± 10.4 years) were analysed. The indication was access salvage in 16 cases (9 upper arm and 3 forearm AVF, 4 AVG), and access creation in 3 patients. Technical success rate was 100% without any complications. Access via the common femoral vein was used in 79%. Anatomic location of intervention was the subclavian vein (26%), innominate vein (32%), both (16%), or other (26%). The sinus-Venous stent (Optimed, Ettlingen, Germany) was used in 84% of the cases, with diameters varying between 12 and 16 mm, and length between 60 and 150 mm, dependent on the anatomical location of the occlusion. Mean follow-up time was 9.6 months. Primary patency rates at 3, 6, 9, and 12 months are 68, 32, 25, 25%. Lesion patency rates at 3, 6, 9, and 12 months are 89, 51, 44, 44% respectively. Access patency rates are 95, 89, 89, 67% at the respective intervals. Four patients were successfully transplanted during follow-up, and two died. The average number of additional interventions to maintain access patency is 1.8 per patient per year.

**Conclusions:** Central vein revascularization by means of dedicated venous stents show promising lesion and access patency rates. Although the rationale for flexible, high radial force, dedicated venous stents in CVD treatment seems to be supported by our results, randomized clinical trials should be conducted to assess (long-term) results of dedicated venous stenting in CVD.

**► Friday 17<sup>th</sup> April****VASCULAR ACCESS CARE (I) | 09:00 - 09:40 | ROOM 5****09:00 - 09:07 | 97****LAMINATE MEDICAL EXTERNAL SUPPORT TECHNOLOGY THAT IMPROVES VASCULAR ACCESS MATURATION RATES - FIRST PRESENTED INTERIM RESULTS**

*Tammy Gilon*

Laminate Medical Technologies, Tel Aviv, Israel

**Introduction and Objectives:** Patients in need of dialysis treatment depend on vascular access. Arteriovenous fistulas, while better than other access methods, often do not mature into adequate access points and fail to allow cannulation and supply adequate flow rates. VasQ, is a new external support device, implanted over the arteriovenous fistula, while not necessitating any interference with the surgical anastomosis suturing. Targeting the juxta-anastomotic area, the VasQ adjusts anastomosis geometry, regulates flow patterns, and supports the venous wall thereby facilitating fistula maturation.

We present a First in Human prospective study, enrolling 20 patients scheduled for creation of a new brachiocephalic arteriovenous fistula and following them for 6 months. Study objectives included assessment of the implantation procedure and fistula maturation rates.

**Material and Methods:** Patients were eligible if they were referred for creation of a new brachiocephalic fistula with non-stenotic vein and artery  $\geq 3$  mm, and free of significant co-morbidities which can prevent study completion. VasQ devices were threaded proximally on the vein prior to anastomosis suturing and subsequently lowered distally onto the anastomosis after completion. Patients were followed for 6 months post-procedure, with Doppler ultrasound examinations performed at 1, 3, and 6 months. Fistula was considered matured if Doppler measurements showed venous outflow  $\geq 500$  ml/min and vein diameter  $\geq 5$  mm.

**Results:** Between June 2014 and January 2015, two surgeons in one center implanted VasQ in 20 patients. Device implantation easily integrated with the routine fistula procedure. All patients were free from any device related complications. One patient died following a myocardial infarction. At 1 and 3 months fistula maturation rate was 84% and 87%, mean outflow rates were 1214 ml/min and 1521 ml/min, and vein diameters were 6.6 mm and 8.4 mm respectively.

**Conclusions:** Comparing to the DAC study which is the most extensive study that has been conducted in the field of vascular access, maturation rates are extremely high and conclusively proves the importance and novelty of the Laminare technology.

09:10 - 09:17 | 22

#### IMPROVING EDUCATION ACCESSIBILITY: INTRODUCTION OF A VASCULAR ACCESS E-LEARNING MODULE IN AUSTRALIA

Monica Schoch<sup>1</sup>, Dianne Du Toit<sup>2</sup>, Frank Grainer<sup>3</sup>, Channele Osborne<sup>4</sup>, Justin Hamilton<sup>5</sup>, Debi Cowan<sup>6</sup>

<sup>1</sup>Deakin University, Geelong, Australia

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<sup>5</sup>Bairnsdale Regional Health Service, Bairnsdale, Australia

<sup>6</sup>Central Coast Local Health Network, Newcastle, Australia

**Introduction and Objectives:** Vascular access guidelines and training are often unit specific but the core principles of vascular access care remain transferable. The Nephrology Educators Network vascular access e-learning module aims to minimize wasted time developing and keeping multiple individual vascular access training packages up to date by utilizing current resources to develop a peer reviewed, accessible, evidence based e-learning module and sharing this on the ONE (Online Nephrology Education) platform

**Material and Methods:** Vascular access education is delivered from a variety of sources such as educators, senior staff and vascular access nurses within renal units. This e-learning module developed by vascular access practitioners allows these units the opportunity to provide a national learning package with general consensus on terminology and up to date evidence based practice to their staff.

**Results:** This module provides an interactive experience for the learner, with the use of hot spot technology, virtual ultrasound imaging, video education, self-directed learning and self-test questioning.

**Conclusions:** The clinical application of this module is to reinforce the underpinning knowledge of anatomy and physiology of vascular access, standardize the practice benefits to patients and nurses moving between dialysis units, improve accessibility by transitioning learning to smart phones and tablets, encourage the utilization of new technology such as use of point of care ultrasound in dialysis units and provide an opportunity for international collaboration related to vascular access e-learning concepts.

09:20 - 09:27 | 195

#### PERSONAL SELF-CARE VASCULAR ACCESS

Pilar Caro, Rosa Marchante, Raquel Amann, Ramon Delgado  
Clinica Ruber, Madrid, Madrid, Spain

**Introduction and Objectives:** The vascular access (VA) is pivotal for the hemodialysis patient.

**Aims:** (1) To assess the patient's acceptance of personal written self-care VA information (2) To assess the nursing staff belief of the impact of self-care VA on patients.

**Material and Methods:** We conducted a retrospective cohort study with seventy one patients with mean age of 72,05 years from November 2013 to December 2014.

A small notebook with the type of VA (fistula, graft or catheter), a photograph of that VA, its creation and first use date, its maintenance care displayed with text and pictures, the emergency situations and the contact phones,

were delivered to each patient. In the next days, we checked if they had understood this information. The patient and nursing staff filled out an inquiry in the sixth and twelfth month

#### Results:

- (1) A 70,4% of the patients (p) had read at least once the information provided and a 54,2% of p. more than once; a 89,5% of p. checked the fistula or graft worked; a 16,2% of p. demanded help's nurses, and finally a 72,5% of p. knew the VA care, and, when, why and how to contact us.
- (2) Older patients read the information less frequently (p 0.02)
- (3) Patients from another dialysis center knew less about how to check VA function and requested less help from nursing than patients who had begun dialysis in our center
- (4) Dependent patients had less interest and information about the whole care of VA (p<0.004)
- (5) Seven patients contacted us during the study period: 4 patients for not noticing the graft worked and 3 patients for having stained the dressing catheter
- (6) Nurses noticed that although they were initially required to answer questions more frequently and were asked for help by patients, these were reduced over time.

No differences were found depending on the type of VA.

#### Conclusions:

- Personal written self-care information allows the patient the possibility to consult it multiple times.
- Nurses have a key role due to their close proximity to the patient.
- It is necessary to include in the VA care, anyone in the patient's home environment.
- The dialysis patient is essential in VA multidisciplinary team.

09:30 - 09:37 | 38

#### THE EFFECT OF A POSTOPERATIVE EXERCISE PROGRAM ON ARTERIOVENOUS FISTULA MATURITY: A RANDOMIZED CONTROLLED TRIAL

Néstor Fontseré Baldellou<sup>1</sup>, Gaspar Mestres Alomar<sup>2</sup>, Xavier Yugueros Castellnou<sup>2</sup>, Teresa Lopez Alonso<sup>1</sup>, Anna Yuguero Ortiz<sup>1</sup>, Vicenç Riambau Alonso<sup>2</sup>, Francisco Maduell Canals<sup>1</sup>, Federico Oppenheimer Salinas<sup>1</sup>

<sup>1</sup>Nephrology Department, Vascular Access Unit, Hospital Clinic, Barcelona, Spain

<sup>2</sup>Vascular Surgery Department, Vascular Access Unit, Hospital Clinic, Barcelona, Spain

**Introduction and Objectives:** Exercises after AVF creation has been suggested as helpful to improve maturation; however, its usefulness has only been examined in indirect, non-comparative studies or small trials. A randomized controlled trial was performed in order to identify if a postoperative controlled exercise program could increase 1-month AVF maturation.

**Material and Methods:** Between June 2013 and November 2014, all patients with stages 5-5D chronic renal disease, candidates to primary AVF performance in our center, autonomous, able to understand and perform the exercise program and follow-up visit, were included. Demographical data, preoperative and intraoperative measures (arterial and venous diameter and flows pre- and after-surgery, AVF performed) were recorded. After surgery, all patients were randomized to exercise group (asked to follow a previously designed controlled exercise program) or control group (asked not to perform specific exercise, usual lifestyle), with single-blind control. 1-month postoperatively, clinical maturation (expertise nurse inspection) and ecographical maturation (ultrasound exam: flow  $>500$  mL/min, venous diameter  $>5$  mm and depth  $<6$  mm) was assessed in all patients.

**Results:** 72 patients were randomized, 3 were lost on follow-up, and 69 were finally analyzed. Sample mean age was 66.8 years (SD 13.8), 70.0% men, 65.2% in pre-dialysis. After surgery (42.0% were distal AVF), patients were randomized (31 control, 38 exercise group). 1-month after surgery, clinical and ecographical maturation was assessed in 88.4% and 78.3% of AVF respectively (Kappa = 0.539). Exercise group showed a non-significant tendency towards more clinical and ecographical maturation than control group (94.7% vs 80.6%, P = 0.069; and 81.6% vs 74.2%, P = 0.459). A stepwise logistic regression was performed to control previously analyzed confounding factors asymmetrically distributed (AVF localization), showing that exercise group was related to more clinical, but not ecographical maturation (OR 5.861, 95 CI: 1.006-34.146 and OR 2.403, 0.66-8.754).

**Conclusions:** Postoperative controlled exercise program after AVF creation increases 1-month clinical AVF maturation. It can reinforce our effort to recommend exercise programs after AVF performance.



► Friday 17<sup>th</sup> AprilHEMODIALYSIS CATHETER (II) | 12:00 - 12:30 |  
ROOM 5

12:00 - 12:12 | 58

**NEUTROLIN™, A CATHETER LOCK SOLUTION (CLS) WITH NO REPORTED HUMAN RESISTANCE, SIGNIFICANTLY REDUCES THE RATES OF INFECTION AND THROMBOSIS IN HEMODIALYSIS PATIENTS ENROLLED IN A POST-APPROVAL SURVEILLANCE STUDY***Markus Hollenbeck<sup>1</sup>, Beate Iwig<sup>2</sup>, Michael Scholl<sup>2</sup>, Hendrik Schlee<sup>2</sup>, Nadim Abdul-Rahman<sup>2</sup>, Ralf Kuehn<sup>2</sup>, Christoph Wanner<sup>2</sup>*<sup>1</sup>Department of Nephrology and KfH Kidney Center, Knappschafts Krankenhaus, Bottrop, Germany<sup>2</sup>Division of Nephrology, University Hospital, Wuerzburg, Germany

**Introduction and Objectives:** Catheter Related Bloodstream Infections (CRBSIs) and thrombosis are the major complications in hemodialysis (HD) patients. DOPPS data emphasized that 30-50% of HD patients develop infection over a 3-6 month period. The incidence of HD catheter thrombosis is high up to 46%. Therefore, in patients who require CVC there is a strong mandate to eliminate catheter associated infection and thrombosis. This study evaluates the use of Neutrolin™, CLS comprised of Tauridolone 1.35%, Citrate 3.5% and Heparin 1000 units/mL in reducing infection and thrombosis in HD patients.

**Material and Methods:** Sixty HD patients at 6 dialysis centers in Germany were enrolled in Neutrolin Use Monitoring Program (NUMP), representing 3329 dialysis sessions over a 10 month period (January to October 2014), for a total of 7768 hemodialysis catheter days. Selected clinical data such as diagnosis, cause of dialysis, medications, vital signs, Qb, Kt/V, infection, thrombosis and other complications were collected and reported to a central institute for analysis. The primary outcome of our study is to monitor safety and efficacy of Neutrolin in preventing infection and thrombosis in HD patients.

**Results:** We studied 60 patients (36 male and 24 female), the mean age of 73 years (range, 36 to 83) with diagnosis of diabetic nephropathy, vascular nephropathy or other renal diseases. At 10 months follow up, the rate of thrombosis and infection were 0 and 0.13 per 1,000 catheter days respectively. These data show that use of Neutrolin is associated with significant reduction in the infection rate (96.3%) when compared to the literature documented benchmark infection rate 3.5 per 1,000 catheter days and 100% reduction in the rate of thrombosis as compared to the reported range of 0.5-3.0 episodes of thrombosis per 1,000 catheter days. No significant adverse drug reactions that led to the discontinuation of Neutrolin use were reported. Two patients experienced occasional transient dysgeusia which was not associated with any consequences.

**Conclusions:** The results of our study support the use of an antimicrobial CLS, Neutrolin, in reducing CVC related complications of infection and thrombosis in HD patients. To confirm and further expand the results of present study, our plan is to continue to monitor and report the rates of infection and thrombosis for a total of 200 patients that are being enrolled in NUMP program.

12:15 - 12:27 | 221

**REMOVAL OF STUCK CENTRAL VENOUS CATHETER: A SAFE AND RELIABLE METHOD***Ilaria Fiorina<sup>1</sup>, Pietro Quaretti<sup>1</sup>, Franco Galli<sup>2</sup>, Lorenzo Paolo Moramarco<sup>1</sup>, Giacomo Forneris<sup>3</sup>, Giovanni Leati<sup>1</sup>, Riccardo Corti<sup>1</sup>, Alessandra Massoglia<sup>4</sup>*<sup>1</sup>Interventional Radiology Unit, IRCCS Policlinico San Matteo, Pavia, Italy<sup>2</sup>Nephrology and Dialysis, IRCCS Fondazione Salvatore Maugeri, Pavia, Italy<sup>3</sup>Nephrology and Dialysis, Ospedale Giovanni Bosco, Torino, Italy<sup>4</sup>Nephrology and Dialysis, Ospedale Civile, Vigevano, Italy

**Introduction and Objectives:** Stuck catheter is a device impossible to remove from the central vein using standard removal technique. It is an unusual complication, related to the formation of a fibrin sheath with reactive tissue around the device, but it's a life-threatening condition because of high risk of thrombosis and infection. The entrapment is generally unnoticed until the time of removal; so this event is probably under-recognized and under-reported.

We report the largest series of stuck devices, successfully extracted from the adherences at the central veins through an endoluminal dilatation in a tertiary center.

**Material and Methods:** Indwelling line was cut in the subcutaneous tunnel close to the cuff and an introducer sheath was placed into the stump of the stuck catheter, to avoid air embolism and blood loss.

Then a stiff guidewire was negotiated into the inferior vena cava under fluoroscopy, to avoid cardiac perforation by the wire. Endoluminal dilation with high-pressure angioplasty catheter was performed along the entire length of the stuck catheter to break the adherences. The catheter and sheath were then removed together, leaving the guidewire for the insertion of an eventual new replacement catheter.

We removed 11 cases of stuck central venous catheter (CVC) for long-term hemodialysis, one of which with the tip of the catheter embedded at the tricuspid valve and a case of double lines stuck catheter in superior vena cava syndrome, and 4 cases of retained totally implantable venous access devices (TIVAD or port) used for chemotherapy.

We treated 7 males and 8 females (age ranging from 51 to 73 years).

There wasn't a major prevalence of one side (7 left jugular vein, 8 right jugular vein).

Prolonged catheter dwelling time was noticed (from 2 to 12 years, average >6 years).

**Results:** Endoluminal balloon dilatation was performed under local anesthesia in an angiographic room by interventional radiologists and nephrologists. Overall we removed 13 stuck lines (5 bilumen, 5 twins, 1 untunneled CVC with a dwell time about 4 years) and 4 ports, without complications.

**Conclusions:** Removal of CVC may be risky and causing severe complications. Endoluminal balloon dilatation, when performed by experienced physician under fluoroscopic guidance, may represent a simple and effective retrieval method of a retained device from the central veins, that can be fit on the basis of type and caliber of the catheter, not requiring another vascular access or expensive instrumentation.

► Friday 17<sup>th</sup> AprilVASCULAR ACCESS CREATION (I) | 15:00 - 16:00 |  
ROOM 6

15:00 - 15:07 | 68

**TORONTO EXPERIENCE WITH THE HEMODIALYSIS RELIABLE OUTFLOW (HERO) GRAFTS; A SINGLE CENTRE EXPERIENCE***Elisa Francesca Greco, Joyce Hunter, Common Andrew, Daniel Marcuzzi, Vikram Prabhudesai, Mark David Wheatcroft, Michael Anthony Moloney, Vernon Campbell*

St. Michael's Hospital, Toronto, Canada

**Introduction and Objectives:** Renal failure is an increasing disease burden in our population. Vascular access is a life line for patients requiring hemodialysis, but not infrequently the complications of central venous stenosis and occlusion preclude effective autogenous vascular access. The HeRO graft allows patients that are catheter-dependent, approaching catheter-dependency, or have failing fistulas/grafts due to central venous stenosis to have an arteriovenous (AV) graft. We reviewed our centre's experience with the HeRO graft in patients requiring hemodialysis.

**Material and Methods:** We performed a retrospective review of HeRO grafts at St. Michael's Hospital, Toronto, Canada. We analyzed our patient demographics, inclusion criteria, pre-operative comorbidity status, procedural success, patency, re-intervention rates, complications, and mortality.

**Results:** Fourteen HeRO grafts have been inserted since February 2011 with strict adherence to the manufacturer's indications for use (IFU). The mean age was 54 years old. Twelve of fourteen were inserted in men. All patients had exhausted upper extremity AV fistula and graft options. Seven patients had bilateral central venous stenosis or occlusion. One patient had superior vena cava stenosis without clinical obstruction. No patient had clinical or radiological superior vena cava (SVC) obstruction. All 14 HeRO grafts were successfully implanted at the index operation. Six patients required further intervention; four grafts required thrombolysis, one had external compression causing stenosis, and one graft had to be explanted post-operative day 1 for steal syndrome. In the patients requiring thrombolysis, 2 were critically ill when the graft thrombosed, 1 was due to hypotension, and 1 was due to sub-therapeutic anti-coagulation. However, in each instance the thromboly-



sis procedure was relatively straightforward. To date, 6 patients continue to dialyze via their HeRO grafts, 6 patients are deceased and one patient had a renal transplant.

**Conclusions:** Patient selection is imperative for successful HeRO graft insertion and use; specifically, patients without SVC obstruction, without congestive heart failure, with adequate sized brachial artery (>4 mm), and without significant distal arterial disease in the arm. In addition, we modified the HeRO arterial limb by replacing the standard ePTFE with an early puncture graft. Anti-platelet therapy and avoidance of hypotension are important factors preventing thrombosis in HeRO grafts in our population. Overall, we have found the HeRO graft to be a useful adjunct in patients with challenging vascular access. Patient selection and adequate aftercare are paramount.

#### 15:10 - 15:17 | 230

##### USEFULNESS OF MAPPING FOR FISTULA CREATION IN HIGH RISK PATIENTS. CONTROLLED STUDY OF 334 CASES WITH 5 YEARS FOLLOW UP

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**Introduction and Objectives:** Strategies to prevent vascular access (VA) thrombosis include mapping and early stenosis diagnosis. Ultrasound (US) use can substantially change the practice given that intervene in these steps. It has been suggested the usefulness of mapping for prevention of immediate failure in patients with higher risk but recommendation is not well established. On the other hand, the role of surveillance in arteriovenous fistula (AVF) remains controversial. The aim of the study is to evaluate the usefulness of ultrasound mapping in AVF patency in high risk patients for fistula failure.

##### Material and Methods:

1. Prospective cohorts study. Reference University Hospital.
2. Multidisciplinary team: nephrologist, vascular surgeon, interventional radiologist and nursing.
3. Mapping: 2 groups
  - 3.1. Control Group. Preoperative physical examination by a specific vascular surgeon
  - 3.2. Study Group. Preoperative ultrasound examination by a nephro-surgical team. The election of the location for AVF creation was decided as distal as possible, taking into account the Glomerular Filtration to avoid the risk of fistula failure and catheter placement in patients closer to dialysis starting.
  - 3.3. VA Surveillance Protocol (both groups): by US in outpatient nephrology clinic & dialysis unit
4. Treatment: By protocol. Surgery/angioplasty depending stenosis location. In juxtaanastomotic area: surgery; rest of the territory: angioplasty.
5. Outcomes: Secondary Patency. Kaplan-Meier (Log-Rank test)
6. Data Record: NephroCloud®

##### Results:

1. n = 334. Control Group: 77; Ultrasound Group 257
2. Age: 64.2 ± 15, Gender: 56% Male, 44% female
3. AVF location: radial 50%, brachial 50%
4. After stratifying by risk factors for fistula failure, the patency to 1, 2, 3, 4 and 5 years was:
  - 4.1. >75 y.o. Control: 45%, 45%, 45%, 45%, 45%; US: 76%, 65%, 65%, 65%, 65% (p = 0.08)
  - 4.2. Sex = female. Control: 51%, 47%, 41%, 41%, 41%; US: 69%, 63%, 63%, 63%, 63% (p = 0.06)
  - 4.3. Radial artery: Control: 55%, 48%, 48%, 48%, 48%; US: 66%, 59%, 59%, 59%, 59% (p = 0.2)

4.4. Combination >75 y.o. + female: Control: 28%, 28%, 28%, 28%, 28%; US: 74%, 61%, 61%, 61%, 61% (p<0.05)

4.5. Combination: >75 y.o. + female + radial: Control: 20%; US: 81%, 62%, 62%, 62%, 62% (p<0.005)

**Conclusions:** - US mapping can be helpful for AVF planning in high risk patients for fistula failure.

- The results of secondary patency in patients with the combination of older age, female sex and distal vessels can be comparables to general dialysis population.

#### 15:20 - 15:27 | 86

##### ARTERIOVENOUS FISTULA WITH SUPERFICIALIZED BRACHIAL ARTERY IS AN EFFECTIVE VASCULAR ACCESS IN HIGH-RISK PATIENTS FOR FISTULA IMMATURITY

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Shizuoka General Hospital, Shizuoka City, Japan

**Introduction and Objectives:** Autogenous arteriovenous fistulas (AVFs) have been shown to be superior to arteriovenous grafts (AVGs) or central venous catheter, because of the lowest rate of complications. However, fistulas have higher non-maturation rate, especially in elderly people. In immature cases, prescribed blood flow can't be attained, even if cannulation of the vessels is adequate.

In Japan, traditionally, brachial artery superficialization has been an alternative vascular access for patients in whom a conventional AVF or AVG cannot be created, such as those with severe ischemic steal syndrome, concomitant heart failure, or venous hypertension with central vein occlusion.

We create AVFs and superficialize brachial arteries simultaneously in high-risk patients for immature. The brachial artery has generally adequate caliber for blood drawing. In these cases, the superficialized arteries are used as outflow routes and AVFs as returning routes. Therefore Single cannulation of AVF is minimally required, and AVF maturation isn't necessarily needed.

**Material and Methods:** From September 2011 to August 2014, we performed 714 vascular access related surgeries in our hospital. In patients with high risk of immature fistulas, we created 24 AVFs with brachial artery superficialization. The median age of the patients was 78 years, and 16 were males (66.7%).

The indication for AVFs with brachial artery superficialization is:

1. vein diameter is less than 2 mm and/or artery diameter is less than 2 mm
2. cannulation site of vein is less than about 10 cm long: too short for 2 cannulation

In 11 cases (45.8%), the diameter of the vessels was less than 2.0 mm. In 13 cases (54.2%), cannulation site was too short.

Operative technique: After creating AVF, the brachial artery is exposed with the side branches ligated, and is fixed just under the skin of the upper arm during the same surgery.

**Results:** One patient died from sepsis due to central venous catheter infection before initial cannulation. Except for that case, all patients underwent successful two-needle cannulation with a prescribed blood flow. The first and successful cannulation was achieved at a mean interval of 17 days (range, 12-547 days) after creation. The two patients underwent cannulation more than 30 days after surgery (58, 547 days), because their vascular accesses were created far before introduction of hemodialysis treatment. Patients were followed after surgery for a median of 186 days (range, 15-967 days), and in this interval, 5 patients (20.8%) died. At 12 months, primary patency was 76.9% and secondary patency was 88.9%.

**Conclusions:** AVF creation with brachial artery superficialization is an effective method in high-risk patients for fistula immaturity.

#### 15:30 - 15:37 | 107

##### FOGARTY CATHETER IN HEMODIALYTIC ARTERIO-VEIN FISTULA'S SURGICAL CONFECTION: OUR EXPERIENCE, EARLY AND PRIMARY FAILURE

*Walter Morale<sup>1</sup>, Domenico Patanè<sup>2</sup>, Stefania Giuffrida<sup>2</sup>, Giuseppe Seminara<sup>1</sup>, Giacomo Calcarà<sup>2</sup>, Paola Bisceglie<sup>2</sup>, Giuseppe L'Anfusa<sup>2</sup>, Pierantonio Malfa<sup>2</sup>, Domenico Di Landro<sup>1</sup>*

<sup>1</sup>Nephrology and Dialysis, Cannizzaro Hospital, Catania, Italy

<sup>2</sup>Interventional Radiology, Cannizzaro Hospital, Catania, Italy

**Introduction and Objectives:** Fogarty Catheter are commonly used to remove fresh thrombi or emboli from vasal lumen; use of this catheters is not usual in Arterio-Venous Fistula's (AVF) confection cause its potential risk to

damage basal wall with consequential early thrombosis or stenosis' or aneurismal lesion's development.

The aim of this study was to evaluate the effectiveness of Fogarty Catheter properly used in reducing primary and early failure in AVF confection.

**Material and Methods:** We retrospectively reviewed 805 AVF performed at Nephrology and Dialysis's Unit of our Hospital between 2005 and 2010.

201 (25%) were complex AVF and were excluded from evaluation; 604 (75%) were distal or proximalized AVF and were divided in two groups: 1) 390 AVF performed without use of Fogarty; 2) 214 AVF with Fogarty used during surgical confection.

We usually use Fogarty after arterio-venous anastomosis confection or, just in some cases, before its complete closure, performing soft venous outflow dilatation for a length not exceeding 2-4 cm, anastomosis' dilatation and, sometimes, arterial inflow dilatation, close to anastomosis, for a length not exceeding 2 cm. Fogarty dilatation is so performed in all juxta-anastomotic region and in AVF's swing segment, the segment of the vein mobilized for arterial anastomosis.

**Results:** Primary and early failure rate was 9% (36 pts.) and 11% (43 pts.) respectively in the first group (without use of Fogarty during confection of AVF), and 3% (8 pts.) and 8% (14 pts.) respectively in the second group (treated with Fogarty during shunt creation).

Relative Risk (RR) of early and primary failure between the two groups was 0.6 (95% IC = 0.34-1.10; P = 0.10) and 0.42 (95% IC = 0.20-0.90; P = 0.02) respectively.

In the second group no aneurismal lesion has been detected two years after confection and stenosis' incidence was lower than the first group.

**Conclusions:** Our experience shows that a Fogarty catheter correctly used, with juxta-anastomotic dilatation of length not exceeding a few centimeters, is safe and effective in reducing primary failure of AVF. During the study we hadn't any complication; region treated with Fogarty seems to show lower stenosis's incidence in short and middle time.

#### 15:40 - 15:47 | 136

##### COMPARATIVE OUTCOMES OF PRIMARY NATIVE FISTULAS TO GRAFTS IN EXTREMELY OLD PATIENTS

*Hyunsoo Kim*

Seoul National University Hospital, Seoul, Korea

**Introduction and Objectives:** The native arteriovenous fistula (AVF) is the accepted gold standard for hemodialysis access in terms of access longevity, patient morbidity, and health care costs. Given that the life expectancy of general population rises longer and longer same as of HD patients, we compared outcomes of native AVF and arteriovenous graft (AVG) to validate fistula first strategy in extremely old patients ( $\geq 80$  years).

**Material and Methods:** We reviewed 79 consecutive patients who received either native AVF or AVG between June 2009 and Sep 2013 at Seoul National University Hospital. Data were collected retrospectively under Institutional review board approval.

**Results:** A total number of 79 patients analyzed in this study. There are 65 patients of native AVF formation and 14 patients of AVG formation. The mean age of two groups is 83.4 years and 85.2 years (P = 0.06). There is no significant difference in sex distribution. The AVF group consisted of radiocephalic (N = 33, 50.8%), brachiocephalic (N = 31, 47.7%) and radial artery-forearm basilic vein transposition (N = 1, 1.5%). The AVG group categorized to forearm loop (N = 10, 71.4%) and upperarm straight (N = 4, 28.6%). The maturation failure rate was 38.5% (N = 25) in native AVFs and was 7.1% (N = 1) in AVGs (P = 0.03). Before the first use of dialysis access, twenty-one patients (31.2%) required radiologic (N = 15, 25.0%) or surgical (N = 6, 9.2%) interventions in the AVF group while radiologic (N = 3, 21.4%) or surgical (N = 1, 7.1%) in the AVG group (P = 1.00). In terms of patency rate, native AVFs showed similar primary (P = 0.148) and secondary patency rates (P = 0.167) and higher primary assisted patency rates (P = 0.017) than prosthetic AVGs.

**Conclusions:** In patients over 80 years of age, the native AVF showed substantial maturation failures and similar patency rate to the prosthetic AVG. Therefore it may be beneficial to apply more stringent criteria on native vein selection and rather to adopt AVG more liberally in this age group.

#### 15:50 - 15:57 | 153

##### PREDICTION OF THE MATURATION OUTCOME OF THE RADIOCEPHALIC ARTERIOVENOUS FISTULAS BASED ON MORPHOLOGICAL AND FUNCTIONAL PARAMETERS OF BLOOD VESSELS

*Tamara Jemcov<sup>1</sup>, Igor Koncar<sup>2</sup>, Marko Dragas<sup>2</sup>, Nikola Ilic<sup>2</sup>, Ilija Kuzmanovic<sup>2</sup>, Andreja Dimic<sup>2</sup>, Nenad Jakovljevic<sup>2</sup>, Lazar Davidovic<sup>2</sup>, Milan Radovic<sup>1</sup>*

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<sup>2</sup> Clinic of Vascular and Endovascular Surgery, Clinical Center of Serbia, Belgrade, Serbia and Montenegro

**Introduction and Objectives:** Although native radiocephalic arteriovenous fistula (RCAVF) is the best vascular access for hemodialysis (HD), a significant failure-to-mature rate is a barrier to overcome. Aim of the study was to investigate the influence of different morphologic and functional parameters on AVF maturation, to define the most important factors and suggest (according to obtained results) a clinical algorithm for prediction of the radiocephalic AVF maturation.

**Material and Methods:** A prospective, observational study was performed on 122 patients (66 men) with terminal kidney failure who underwent native radiocephalic AVF creation. Internal diameters of cephalic vein (CvD) and radial artery (ARd), venous distensibility (VD), resistance index (RI) and endothelial function by flow mediated dilatation (FMD) were determined by ultrasound examination before AVF placement. AVF maturation was observed by measuring blood flow (Qa) and CvD. Depending on attained maturity criteria up to 8 weeks (Qa  $\geq 500$  mL/min, CvD  $\geq 5$  mm), patients were divided in two groups: group 1 (n = 109) successful maturation and group 2 (n = 13) failure to mature.

**Results:** Successful AVF maturation was achieved in 89% of pts. ROC analysis defined the limits of variables relevant for early AVF success (CvD  $> 1.8$  mm, ARd  $> 1.6$  mm, VD  $> 0.4$  mm). Logistic regression analysis confirmed the results obtained by ROC analysis and multiple regression analysis singled out the VD as the most important parameter influencing the outcome of AVFs maturation (OR = 7.22). Based on the obtained results, clinically simplified equation with scoring applicable to everyday practice was made in order to predict the early outcome of AVF maturation.

Logit (p) =  $1.11 \times (\text{CvD}) + 1.97 \times (\text{VD}) + 0.61 \times (\text{ARd}) - 4.83$ .

**Conclusions:** The key parameters for the success AVFs maturation are functional and morphological: VD, ARd and CvD. Based on their preoperative measurements it is possible to predict the outcome of AVF maturation.

TABLE 1 - Risk score of success early AVF maturation with clinical application

Score	Risk category	Clinical application
3,5-4,5	Very high risk	Consider another option for vascular access (AVG, tunnel CVC)
4,5-7	High risk	Detailed preoperative evaluation and AVF creation with special care and continuous supervision to final maturity
7-9	Moderate risk	Acceptable risk of AVF creation
9-10	Low risk	High probability of success AVF

#### ► Friday 17<sup>th</sup> April

##### VASCULAR ACCESS CREATION (II) | 17:30 - 18:40 | ROOM 5

#### 17:30 - 17:37 | 158

##### EARLY CANNULATION GRAFT FOR REDUCTION OF CENTRAL VENOUS CATHETERS

*Matteo Tozzi<sup>1</sup>, Marco Franchin<sup>1</sup>, Giuseppe Ietto<sup>1</sup>, Luca Quarti<sup>1</sup>, Carlo Jovane<sup>2</sup>, Fara Rostami Zarrabi<sup>1</sup>, Patrizio Castelli<sup>1</sup>*

<sup>1</sup> University of Insubria, Varese, Italy

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**Introduction and Objectives:** We presented our experience on early cannulation graft to reduce the use of central venous catheters (CVC). Our experience is based on Acuseal by W.L. Gore for Prostetic vascular access (pVA) in unfit patients for autogenous vascular access (aVA).

**Material and Methods:** From 2011 to 2014 we performed 65 pVA. The pVA were constructed within a single vascular unit from Varese University Teaching Hospital. Patients had a mean age of 63,6 years (range 34-85 years), M:F 44:21. All our patients had an average of at least 2.2 previous aVA, and an average of 3.6 previous positioning of cvc.

30 patients (46%), at surgery, performed by dialysis cvc (12 final, 18 temporary) 25 in the jugular vein, and 5 in the femoral vein. 18 patients (27.6%) have performed the operation without the placement of cvc to malfunction or thrombosis of the pre-existing and have dialysate after an interval of 12-30 h after surgery.

**Results:** In 28 cases was possible to use the access 24 hours after surgery and the removal of the catheter occurred after the first dialysis in patients with temporary cvc with an average stay of 2.4 days (range 1-8 days), while for patients with cvc tunneled within 15 days after surgery (range 3-15 days). In two cases for the appearance of hematoma the access was used after 7 days postoperatively. During the follow-up in only 2 cases was placed one temporary cvc to perform hemodialysis (1 patient undergoing emergency aortic valve replacement with thrombosis of postoperative, 1 patient with thrombosis during holidays) in the remaining cases, thrombosis was treated within 48 hours with subsequent using dialysis access.

**Conclusions:** In our experience, the use of acuseal graft for early cannulation has allowed us to reduce the number and the permanence of cvc; this practice in our center allows to reduce the percentage of cvc from 18.6% (2011) to 11.9% (2014). The use of these graft will allow us to reduce the stenotic lesions of TSA and CVC related bacteremia.

17:40 - 17:47 | 159

#### VASCULAR ACCESS IN THE OBESE: SUPERFICIALISATION OF NATIVE RADIO-CEPHALIC AND BRACHIO-CEPHALIC FISTULAE

*Richard P.T. Evans, L. Meecham, P. Buxton, P. Kaur, J. Legge, L. Papp, O. Ehsan, A.D. Pherwani*

University Hospital of North Midlands, Stoke On Trent, United Kingdom

**Introduction and Objectives:** The Department of Health estimates that currently in the UK, 61.3% of the population are overweight or obese (BMI >25). Fistulae in the obese often fail to mature or prove inadequate to needle due to excessive depth (>6 mm). This study is a summary of our experience with brachio and radio-cephalic vein superficialisation in the obese.

**Material and Methods:** From May 2008 to October 2012 22 patients underwent superficialisation of the cephalic vein following radio-cephalic or brachio-cephalic AVF creation. Data were obtained from a prospective database (Cyberen®) and retrospectively analysed.

**Results:** The study included 23 AVF in 22 patients (7 male, 15 female) of which, 13 were brachio-cephalic and 10 radio-cephalic. The mean age of the patients was 56 (median 60, range 19-78). The mean BMI was 36.7 (median 32, 25-58). 6 Week post procedure duplex ultrasonography recorded the mean fistula depth to be 7.7 mm (median 8 mm, 5-15 mm) and mean flow rates were 961 ml/min (median 800 ml/min, 320-1968 ml/min).

Of the 23, 21 fistulae matured successfully. There were no procedure related complications. During follow up 2 patients underwent transplantation prior to fistula use and 3 patients died of unrelated causes. The remaining 16 fistulae remain in use and under access surveillance.

**Conclusions:** Superficialisation of brachio/radio-cephalic fistulae is an excellent option to optimise the cephalic vein for needling, assisting primary patency. Superficialisation of the cephalic vein helps maintain long term functional access in overweight and obese patients.

17:50 - 17:57 | 163

#### INTERMEDIATE RESULTS OF USING SPIRAL FLOW AV GRAFT: IS IT A BREAKTHROUGH SOLUTION TO A DIFFICULT PROBLEM?

*Hosam F. El Sayed*

Houston Methodist Hospital, Houston, United States

**Introduction and Objectives:** AV access grafts are used in those patients where there are no available superficial veins for native AV fistula creation. Their usable life and patency rates are far from being ideal requiring frequent interventions to maintain their use for dialysis. Their failure is usually related to neointimal hyperplasia leading to stenosis of the venous outflow near the venous anastomosis. Studies have shown that, Spiral laminar flow is the normal pattern of flow in most of the large and medium sized vessels in vivo as well as many functioning native AV fistulas. The Spiral flow graft has a design that creates a spiral laminar flow at the venous end that is a hypothetically reduces intimal hyperplasia and graft failure. We here report the midterm results of the largest reported series of using the graft in AV access.

**Material and Methods:** After IRB approval, a prospective study of using Spiral Flow graft for AV access in our institution between Jan 2012 to Dec 2014 was performed. Enrolled patients had no suitable superficial veins for native AV fistula creation. Patient demographics and comorbidities were recorded. Kaplan Meier curve analysis was used to calculate patency rates compared to historic controls of straight ePTFE and heparin bonded grafts in our institution. Complications were also recorded

**Results:** 48 cases were included. The access site was the upper arm (32), the forearm (13), and chest wall (3). Mean age of 61 and mean follow up of 14 months. At 12 month, the assisted primary and secondary patency rates were 70% and 82%, respectively that was significantly better than historic controls using straight ePTFE and heparin bonded grafts in our own institution. Complications included 4 graft infections; 3 severe steal syndrome, 4 seromas and 3 arm swelling. There were only 2 early graft failures.

**Conclusions:** Spiral flow grafts are a valid successful option for AV access. One year results are superior to using straight ePTFE and heparin bonded grafts. This may be explained on the basis of the hemodynamic environment created by the spiral laminar flow and may be a significant contribution to preventing neointimal hyperplasia and hence AV access graft failure.

18:00 - 18:07 | 166

#### ARTERIAL STIFFNESS CORRELATES WITH ARTERIOVENOUS FISTULA OUTCOMES

*Damian McGrogan<sup>1</sup>, Mark Jesky<sup>1</sup>, Paul Cockwell<sup>2</sup>, Stephanie Stringer<sup>1</sup>, Nicholas Inston<sup>2</sup>*

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**Introduction and Objectives:** Aortic pulse wave analysis is considered the gold standard for assessing arterial stiffness as it gives the clearest pathophysiological significance since the majority of the buffering of pulse waves is performed by the aorta. Non-invasive Vicorder® measurements provide information regarding peripheral and central blood pressures in addition to pulse wave velocity and augmentation index. We sought to correlate vascular access outcomes against assessment of arterial stiffness.

**Material and Methods:** 654 patients are currently enrolled in the Renal Impairment In Secondary Care (RIISC) study of which 70 have proceeded to vascular access formation. Patients enrolled in the RIISC study undergo BP Tru and Vicorder assessment. Information regarding demographics, peripheral and central blood pressure, pulse wave velocity and augmentation index were correlated against the 6 week patency rates.

**Results:** Primary failure rate of arteriovenous fistulas was 30%. Statistically significant variables for failure included smaller vein size ( $p = 0.007$ ) and lower augmentation index ( $p = 0.032$ ). Higher pulse wave velocity ( $p = 0.063$ ) and peripheral diastolic blood pressure ( $p = 0.073$ ) were non-significantly associated with failure of vascular access.

**Conclusions:** In this study, small vein size and lower augmentation index are associated with early failure of vascular access. Novel predictors of vascular access outcomes may allow for tailored, patient specific vascular access planning however further prospective studies are necessary to confirm these findings.



**18:10 - 18:17 | 194****THE IMPACT OF ULTRASOUND VEIN MAPPING ON OUTCOMES FROM ARTERIOVENOUS FISTULAE**

*Emma Aitken, Ram Kasthuri, David Kingsmore*  
Western Infirmary, Glasgow, United Kingdom

**Introduction and Objectives:** It is well-recognised that vessel size is predictive of outcome from arteriovenous fistula (AVF) creation. Ultrasound vein mapping permits assessment of the arteries and veins pre-operatively, however it's benefit to arteriovenous patency has not clearly been demonstrated.

**Material and Methods:** Ultrasound vein mapping was introduced at our institution in July 2010 for selected patients in whom suitable vessels for AVF formation could not be identified by clinical examination. All vein mapping scans were discussed at a Multidisciplinary Team Meeting and operative plan agreed. Minimum arterial and venous diameter required to attempt AVF creation was 2 mm. Immediate and 6 week functional patency were compared for all patients who had an AVF created prior to the introduction of vein mapping (January 2009-September 2010 [n = 354]) and following the introduction of vein mapping (October 2010-October 2013 [n = 912]).

**Results:** 33.5% of patients (n = 306) who had AVF created post-2010 had pre-operative vein mapping. There was no difference in immediate patency of either radiocephalic (RCF) or brachiocephalic (BCF) fistulae pre- and post-introduction of vein mapping (76.5% vs. 77.1%; p = 0.78 and 86.5% vs. 84.5%; p = 0.82 respectively). Similarly there was no difference in functional patency at 6 weeks between the cohorts (RCF: 54.2% vs. 51.3%; p = 0.73, BCF: 71.4% vs. 67.2%; p = 0.34). A greater proportion of RCF/forearm AVF were created in the period following the introduction of vein mapping (42.6% vs. 22.3%; p,0.01). Only two patients who had pre-operative vein mapping had exploration of the antecubital fossa without vessel found for access creation, compared to 15 patients prior to the introduction of vein mapping.

**Conclusions:** There was no difference in overall difference in AVF patency rates following the introduction of pre-operative ultrasound vein mapping. However, more distal AVF were created following the introduction of vein mapping without compromising outcomes.

**18:20 - 18:27 | 210****VASCULAR ACCESS TYPES IN PATIENTS STARTING HEMODIALYSIS WITH FAILED KIDNEY TRANSPLANTS: A RETROSPECTIVE ANALYSIS**

*Naveed Ul Haq, Mohammed Mahdi Althaf, Mohamed Said Abdelsalam, Abdulrahman Ali Khormi, Hassan Ali Harbi, Mamdouh Nasser Albaqumi, Khalid Al Meshari, Lutfi Abdullah Korbi, Hassan Ali Aleid*  
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**Introduction and Objectives:** Native arteriovenous fistulae (AVF) are preferred while central venous catheters (CVC) are least suitable vascular access (VA) in patients with end stage renal disease (ESRD) requiring hemodialysis (HD). Despite clinical benefits of AVF, as much as 80% of patients start HD with a CVC. One of the factors thought to be responsible for this high CVC rate is late referral to nephrologist in the course of chronic kidney disease. We retrospectively analyzed the type of VA at the time of initiation of HD in renal transplant recipients closely followed by nephrologists who subsequently failed their renal allograft. If the early referral to nephrologist improves AVF use, these patients should have a higher prevalence of AVF at the time of initiation of HD.

**Material and Methods:** We reviewed charts of all patients at our center who failed their kidney transplants between January 2002 to April 2013. Study was approved by the local IRB. Data regarding planning of VA by nephrologist including patient demographics, documented discussion about dialysis with patient, glomerular filtration rate (GFR) 6 months before starting HD and at last clinic visit before HD started, time of referral for VA creation, ordering vascular mapping, and the subsequent type of VA at the start of dialysis was gathered and analyzed.

**Results:** Total of 83 patients failed their transplant after having a successful functioning allograft during study period. Data was inaccessible in 6 patients. The paper and electronic charts on remaining 77 patients were analyzed. 11 patients started peritoneal dialysis after failing transplant while 66 went on HD. Out of these 66, 32 had a previous functioning VA while 34 needed a VA. Demographics of these patients are shown in Table 1.

11/34 patients (32%) had a GFR <15 ml/min six months before initiation of HD. Average time from first documented GFR <20 ml/min to initiation of HD was 62 days (range 0-307 days). 21/34 (61%) had a documented GFR <15 ml/min on last clinic visit before HD initiation. Only 11/34 (32%) had documented renal replacement therapy discussion, 8/34 (24%) had VA creation referral, and only 7/34 (21%) had vein mapping for VA creation. 30/34 (88.3%) started HD with a CVC while 4/34 (11.3%) started HD with an AVF (p<0.0001).

**Conclusions:** Early referral to nephrologist by itself may not adequately improve VA care amongst patient with ESRD. Other more important factors need to be examined for improvement of VA care in these patients.

**TABLE 1 - Baseline characteristics of patients starting HD post failed transplant without prior functional vascular access**

Total number of patients 34

Male 53% Female 47%

Age 40 ± 18 years

Cause of ESRD: Diabetes Mellitus 18% Glomerular Nephritis 15% Unknown etiology 20% Others 47%

Other significant comorbidities: Diabetes Mellitus 38% Hypertension 76% Peripheral Vascular Disease 9% Coronary Artery Disease 15%

Renal Replacement modality pre transplant: Hemodialysis (HD) 82% Preemptive transplant 18%

Vascular access pre transplant for those on HD: Arteriovenous Fistula 53% Tunneled Catheter 29%

Transplant type: Cadaveric Renal Transplant 26% Living Related Renal Transplant 68% Living non-Related Renal Transplant 6%

**18:30 - 18:37 | 227****EFFECT OF TRANSDERMAL NITROGLYCERIN ON NEWLY CREATED ARTERIOVENOUS FISTULA FOR HEMODIALYSIS**

*P. Paul Zachariah, George Kurian, Rajesh R. Nair, Anil Mathew*  
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**Introduction and Objectives:** Arteriovenous fistula (AVF) is the lifeline for a hemodialysis patient. But has a 40% primary failure rate; and issues of lack of fistula maturation or stenosis. After an AVF surgery there is abrupt increase in blood flow from a high pressure arterial system to a low pressure venous system. Increase in flow is due to the vascular distension. Nitroglycerin being a vasodilator can augment the flow. In this study we attempted to study the hemodynamic effects of transdermal nitroglycerin patch (tNTG) on a newly created AVF.

**Material and Methods:** Study was double blind randomized controlled prospective trial of patients with chronic kidney disease who underwent AVF creation; randomized into two arms (placebo and tNTG); followed till treatment efficacies were measured. Sixty patients were enrolled and doppler studies were done periodically. Statistical analysis was done to compare the significance of the variables.

**Results:** Baseline physical and doppler characteristics between the two arms were comparable. Changes in flow volume (FV), venous and arterial peak systolic velocity (PSV) were significant. FV in the tNTG arm increased from 1037.61 ml/min ± 293.03 ml/min to 1501.40 ml/min ± 526.92 ml/min after intervention, as compared to 1071.42 ml/min ± 317.67 ml/min to 1207.51 ml/min ± 393.90 ml/min in the placebo arm (p value 0.030). % increase in the FV was 12% (placebo) and 44% in the tNTG arm (p value 0.001). Changes in the venous diameter were significant in both arms; but % increase was 1% and 6% in the placebo and tNTG arms respectively (p value 0.01). % increase

in the venous PSV was 10% and 28% in the placebo and tNTG arms respectively (p value 0.01).

**Conclusions:** Blood flow and vasodilatation are paramount for a well matured AVF. Attempts to modulate these factors can result in an improved AVF. Patients are more prone to respond to local interventions that improve endothelial function or alter the hemodynamic profile. Although hemodynamic profile and doppler indices improved in both arms, % increase were 3 to 5 times higher in the tNTG arm. Hemodynamic profile can be enhanced using tNTG.

► **Saturday 18<sup>th</sup> April**  
**VASCULAR ACCESS CARE (II) | 11:30 - 12:00 |**  
**ROOM 5**

11:30 - 11:37 | 50

**IMPLEMENTATION OF THE BUTTONHOLE PUNCTURE TECHNIQUE FOR VASCULAR ACCESS IN A HEMODIALYSIS UNIT: RESULTS AND ASSESSMENT OF THE PATIENTS**

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**Introduction and Objectives:** The buttonhole (BH) technique of puncturing of the arteriovenous fistulas (AVF) is an alternative to the classical staggered puncture. We present preliminary results of incorporating the BH puncture technique of AVF in our dialysis unit.

**Material and Methods:** From September-2013 until December-2014 twelve patients have been initiated on BH technique, 8 men and 4 women, mean age  $62 \pm 12$  years, with an average dialysis duration of  $44 \pm 38$  months, median: 30 and range: 15-10. The median time with the vascular access (VA) at the beginning of the technique was 31 months (range: 27-5). The types of AVF were: 4 left radio-cephalic, one right radio-cephalic, 6 left humerus-cephalic and one right brachio-cephalic. Eight patients had presented a previous VA. Previous puncture techniques were rope-ladder in 8 patients, area in 2 patients and a combination of both techniques in two cases. Three patients received acenocoumarol and six antiplatelet agents (ASA).

**Results:** Five consecutive and eight no consecutive dialysis sessions were necessary to achieve a proper tunnel of puncture. No patient suffered major complications. The average time on buttonhole technique until december-2014 was  $9.7 \pm 8$  months, median of 9 months, range: 3-2. Hemostasis post-dialysis times have been reduced, previous BH technique time was  $21 \pm 10$  minutes vs  $13 \pm 4$  minutes after buttonhole (P: 0.004). No differences were observed in the VA flow (previous BH Qb:  $355 \pm 33$  ml/min vs after BH Qb:  $365 \pm 24$  ml/min, P = 0.06). A survey was performed, where 1 showed no improvement and 10 showed absolute improvement. The mean response to whether the patient had improved over the previous BH technique was 9.1. All patients responded with 10 if they were performed again the BH technique. Comparing the perception of pain previous to BH technique and after implantation BH technique (1 maximum pain and 10 no pain) was 4.7 vs 8.8, respectively (P<0.001), in favor of BH. No serious infectious events have been observed in this follow-up period. Two patients have discontinued the BH technique, one patient due to a brain hemorrhage and the other one because he has received a kidney transplant. At the end of the study three patients performed self-puncture.

**Conclusions:** The BH technique is an alternative puncture technique for dialysis patients. Self-puncture, reduction in hemostasis time or a lower perception of pain are potential beneficial aspects. A wider diffusion of this technique in the hemodialysis units would allow more experience and a better knowledge of BH technique. A highly motivated nursing staff is necessary for its implementation.

11:40 - 11:47 | 142

**REAL TIME ULTRASOUND GUIDED TO HELP DIFFICULT ARTERIOVENOUS FISTULAS CANNULATION FOR HEMODIALYSIS SESSION**

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 Nephrology and Dialysis Unit, Bachir Ben Nacer Hospital, Biskra, Algeria

**Introduction and Objectives:** After creation of an arteriovenous fistula and wait her maturation, the cannulation of this one must be easy in usual way

but sometimes the cannulation can become a real challenge for the nurses because the vein is tortuous or devious or there is a hematoma created previously and hampering the vein area. It's the same thing for the old fistulas, they can be easy to cannulate for a long time and becoming difficult to cannulate because there is a large layer of neointimal fibrosis which constitutes without a significative stenosis. In this experience we have used a real time ultrasound guided needling three or four times by the nephrologists with the assistance of the nurses and the nurses continued the cannulation alone without ultrasound in the next session just following the last ponction site. In this experience we excluded patients with fail to mature fistulas and grafts.

**Material and Methods:** This experience was conducted on population of mixed patients; eight with a new fistulas creations and four with old fistulas attending in the hemodialysis unit of the Bachir Ben Nacer hospital in Biskra, Algeria.

During 4 months period, 12 patients with difficult arteriovenous fistula needling have benefited to a real ultrasound guided cannulation to perform their hemodialysis session after recognizing that their fistulas were difficult to cannulate by the nurses.

The ultrasound guided was performed by an 8 Mhz linear probe, after performing a quick cartography of the fistula to recognize the anatomy variations, layers of neointimal fibrosis or other abnormality, we performed a transversal imaging and ultrasound guided cannulation with 16 gauge needle for hemodialysis.

**Results:** For 7 new fistulas: 3 radiocephalic fistulas, 4 brachiocephalic fistulas, the needling was performed with success following the success of the nurses needling without ultrasound. For the four old fistulas the ultrasound guided cannulation has allowed to avoid the layer of neointimal fibrosis which hampers the well functioning of the hemodialysis session following by the success of the nurses. One patient, with a new brachioabasilic fistula has had a failure cannulation by the nurses after the success with the ultrasound guided.

**Conclusions:** This experience allowed us to avoid the difficult cannulation of the new and old fistulas and to decrease stress and attempts of the cannulation by the nurses avoiding thus hematoma, false aneurysm, arterial puncture, surgery and to increase the longevity of the old fistulas.

11:50 - 11:57 | 226

**BUTTONHOLE AS THE TECHNIQUE TO AVOID THE LOSS OF COMPLEX VASCULAR ACCESS: 5 YEARS OF FOLLOW UP**

*Ruben Iglesias<sup>1</sup>, X. Vinuesa<sup>1</sup>, C. Grau<sup>1</sup>, L. Picazo<sup>1</sup>, A. Liesa<sup>1</sup>, M. Garcia<sup>1</sup>, Joaquim Vallespin<sup>2</sup>, J.R. Fortuño<sup>3</sup>, José Ibeas<sup>4</sup>*

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**Introduction and Objectives:** Buttonhole technique is associated to fewer complications in relation to the other canulation techniques, especially with pain level, hemostasis and canulation problems. However, recent publications throw doubt on the safety of the technique and relate it to local and systemic infections. In this context, there is no set systematic indication for buttonhole in high risk arteriovenous fistulae (AVF).

Assess the efficacy and safety of using the buttonhole technique to puncture highly complex fistulae.

**Material and Methods:** Design: Within the framework of a prospective case-control study to assess the buttonhole technique, we carried out a pilot study to evaluate efficacy and safety of this technique in high complex fistulae.

Field: Nephrology unit. Hospital HD unit, 150 chronic patients.

Length: September 2009 to December 2014.

Inclusion criteria: Prevalent patients with autologous AVF's. Patients included those with highly complex puncture accesses.

Sample: 34 patients.

Main variables: Access patency, function (average flow, ekt/v), tunnel maturation, complications (local and systemic infections, haematoma, extravasations, aneurism and pseudoaneurism), technique indication and end of use. Kaplan-Meier survival.

Screening: Dialysis adequacy, physical examination and access and buttonhole tunnel ultrasound screening.

Event: End of using technique due to related complications

**Results:** Sample features: 47% females, 53% males. Average age: 60 years. Diabetes mellitus 62%, Hypertension 94%. AVF: Humeral 70.6%, Radial 29.4% of which 50% are in forearm. Complex puncture: 85.3%. Patients with



2 or more previous accesses: 44'1%. Kaplan-Meier survival: 6 months 80'3%, 1 year 80'3%, 2 years 72'2%, 3 years 60%. Technique indication: Short puncture section 76'5%, pain in 11'8%, patient request 5'9%, self puncture 2'9%, aneurismatic AVF 2'9%. End of use: Event cases (4 technical difficulties, 2 for pain, 1 patient request, 1 thrombosis).

AVF function: Average QB 315 ml/min, eKT/V 1'33.

Average tunneling time: Arterial 24'2 days, venous 25'9 days.

Self puncture: 14'7% 3 of them complex puncture.

Complications: Aneurisms(0), pseudo aneurisms(1), local infection(2), bacteremia(2), extravasation(2), PTA(1), thrombectomy(1).

**Conclusions:** Buttonhole could be an elective technique indicated to avoid loss of complex VA.

Tunnel ultrasound surveillance can help avoid complications in the puncture. The savings in aggressive procedures even preserving theoretically lost vascular access may justify their use in such patients from the cost and morbidity point of view.

## ► Saturday 18<sup>th</sup> April

### QUALITY INDICATORS | 12:00 - 13:00 | ROOM 6

12:00 - 12:07 | 48

#### EVOLUTION OF VASCULAR ACCESS MANAGEMENT IN ITALY: COMPARISON OF TWO SURVEYS FIFTEEN YEARS APART

*Decenzio Bonucchi<sup>1</sup>, Lucia Palmieri<sup>2</sup>, Silvia Arletti<sup>1</sup>, Gianni Cappelli<sup>2</sup>, Carlo Lomonte<sup>3</sup>, Massimo Lodi<sup>3</sup>, Mario Meola<sup>3</sup>, Monica Spina<sup>3</sup>, Marcello Napoli<sup>3</sup>*

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**Introduction and Objectives:** In past years Italy was acknowledged for the high nephrology commitment in vascular access (VA) management, leading to a very high prevalence of native vascular access (AVF). Afterwards the dialysis setting strongly changed due to ageing and increasing co-morbidities in dialysis patients (DP). A relevant increase in central venous catheter (CVC) was perceived.

**Material and Methods:** We therefore aimed to review the data obtained by a published survey (Nephrol Dial Transplant. 1999 Sep; 14(9): 2116-8). A new survey containing the same questions as in 1998 (table) was sent at the end of 2013 to dialysis centres in Italy; it was done on behalf of the Vascular Access Study Group (Italian Society of Nephrology) and 165 answers were received. We thank all the participating centres. An additional part of the questionnaire was oriented to know the leading activities (CVC, AVF and prostheses (P) of interventional nephrologists and allied professionals.

**Results:** Table compares management, prevalence of CVC, monitoring and interventional radiology features between 1998 and 2013. As regards volume of activities, nephrologists performs 73% of CVC procedures. Among the different VA accomplished by nephrologist, CVC account for 51.6% of procedures, AVF 42.4% and P 6%.

**Conclusions:** Our data reinforce the awareness of a worsening scenario of VA also in Italy. Though the nephrologists still manage VA, CVC are growing both in incident DP and in chronic DP. This means that timely referral is not achieved by many centres. Owing to vascular burden exhaustion, alternative forms of treatment should be developed, as peritoneal dialysis and palliative care of aged and frail kidney patients.

In addition, nephrologists have to face the most risky procedures, CVC being the most prevalent procedure in today workload. Legal aspects and structural requirements of this activity should be adequately taken into account. The widespread variability of VA strategy along the country suggest the usefulness of a nationwide organisation, built on the model of organ transplantation.

**TABLE 1 - Comparison of 1998 and 2013 surveys**

		1998 %	2013 %
The VA manager	Nephrologist	48.8	69
	Vascular surgeon	18.4	2.3
	Nephrologist and vascular surgeon	26.4	28
	Nurse or others	6.4	0.7
CVC at first dialysis	Less than 20%	52.4	32.6
	20-40%	22	27.5
	More than 40%	25.2	39.8
Prevalence of CVC in chronic patients	5% or less	73.7	5.8
	6-10%	16	13.6
	11-15%	5.8	16.5
	16-20%	3.7	25.2
	More than 20%	0.8	38.8
Monitoring		20	83.3
Centers with Interventional radiology	>10 procedures/year	27.2	66.4
	<10 procedures/year	11.7	26.3
		88.3	73.6

Percentages in right columns refer to dialysis centers. VA = vascular access; CVC = central venous catheter; VP = venous pressure; AP = arterial pressure.

12:10 - 12:17 | 55

#### USE OF LONG-TERM CATHETERS IN JAPAN

*Akira Miyata, Satoshi Hamanoue, Chiaki Kawabata, Ai Maekawa*  
Kumamoto Red Cross Hospital, Kumamoto, Japan

**Introduction and Objectives:** The Japanese society for dialysis therapy (JSDT) published the second edition of 'Guidelines for Vascular Access Construction and Repair for Chronic Hemodialysis' in 2011. Also JSDT is collecting statistics every year concerning dialysis by using questionnaires to the medical facilities which are performing hemodialysis therapy, and additionally collecting dates about the vascular access every 10 years. In this presentation, we will describe the characteristics for use of the long-term catheters of Japanese hemodialysis therapy and the differences from other developed countries in Europe and Americas.

**Material and Methods:** The 'Guidelines for Vascular Access Construction and Repair for Chronic Hemodialysis', the statistics of JSDT for dialysis, and data from DOPPS were compared and analyzed.

**Results:** The annual surveys by JSDT have been done to the dialysis facilities in Japan. This statistics can be thought as s most reliable clinical data to know the Japanese current situation of dialysis therapy. In 2012, we had the 4233 answers obtained from 4279 facilities, which corresponds to 98.7%.

In every 10 years, recently year 2008, additional topic to the annual general questionnaires was performed about vascular access. 4072 answer out of 4124 facilities (98.7%) were analyzed in 2009. This data is not quite new, but considering the newest DOPPS data of Japan is showing a quite similar trend, it can be still reflecting the recent situation of vascular access of Japan. From this study we found only 0.5% out of chronic HD patients are using long-term catheters in Japan. On the other hands, in DOPPS data in 2010 showed 1.6% patients were treated by long-term catheters. This small discrepancy may happen, not because of the difference between year 2009 and 2010, but because the number of population or survey methodology. Even though there is some mismatch of statistics in use of long-term catheters between those studies, Japan has a very big gap comparing with countries like Canada (52%), Belgium (42,6%), Sweden (35,7%), or Spain (30.0%) in the use of long-term catheters.

**Conclusions:** As one of major purpose of the Japanese guidelines for the long-term catheters are to avoid fetal complications like sepsis, the use of long-term catheters were clearly less than other developed countries in Europe and Americas. To prepare the very rapid demographic change, the material and structure of long-term catheters should be more resistant against the complications like catheter infection and obstruction.

12:20 - 12:27 | 140

**IMPACT ON VASCULAR ACCESS CARE AND SAFETY OF AN INTERVENTIONAL NEPHROLOGY PROGRAM IN AN ACADEMIC CENTER IN THE MIDDLE EAST***Naveed Ul Haq, Maram Abdulrahman Al-Banyan, Mohamed Said Abdelsalam, Mohammed Mahdi Althaf*

King Faisal Specialist Hospital &amp; Research Center, Riyadh, Saudi Arabia

**Introduction and Objectives:** Management of vascular access (VA) plays a fundamental role in the care of patients with End Stage Renal Disease (ESRD). Despite known importance, patients with ESRD do not always get optimal VA care. The advent of interventional nephrology (IN) seems to have improved VA care in patients with ESRD in the United States. The purpose of this study was to evaluate the safety and impact on VA care of an IN program in an academic center in the Middle East.

**Material and Methods:** An IN program was established at King Faisal Specialist Hospital and Research Center in Riyadh Saudi Arabia in September 2013. We reviewed all cases done from September 2013 to January 2015. Data on procedures in terms of indication, type, outcome, total procedural time, total fluoroscopy time, radiation dose, contrast dose, and complication rate was gathered and interpreted. We also compared the vascular access statistics in our hemodialysis unit before and after the implementation of the program.

**Results:** A total of 590 procedures were performed during the study time. Indications for procedure included low VA flow (59%), clotted VA (10%), poor arteriovenous fistula (AVF) maturation (8%), and others including tunneled dialysis catheter (TDC) related procedures (23%). Overall success rate was 99%. Success rate was 100% for arteriovenous graft thrombectomy, 95% for AVF thrombectomy, and 99.5% for angioplasty. There were no grade 3 complications while the overall complication rate was 1%. There were no complications needing ER visit or hospital admission. The average procedure time was 40 minutes 10 seconds. Average fluoroscopy time was 1 minute 45 seconds. Average contrast dose was 14.85 ml. Type of procedures included 57 thrombectomies, 199 angioplasties, 130 TDC insertions, 22 accessory vein ligations, 6 stent placements. 396 (67%) of the procedures were done as out-patient, only 34 (6%) patients were electively admitted for procedures. The reason for admission included chronic warfarin use (12), complicated medical history (15), and patients requesting general anesthesia (7). The TDC use rate amongst ESRD patients in our hemodialysis unit dropped from an average of 16% before the start of the program to 8% at the end of study time ( $p < 0.001$ ).

**Conclusions:** In conclusion, an IN program in an academic center in the Middle East is not only safe but had a great impact on improving VA care for patients with ESRD. In addition, it leads to significant reduction in ER visits and VA related admissions to the hospital.

12:30 - 12:37 | 190

**CENTER-RELATED FACTORS ASSOCIATED WITH VASCULAR ACCESS USE IN GERMANY***Gero D. Von Gersdorff<sup>1</sup>, Mathias Schaller<sup>1</sup>, Dieter Bach<sup>2</sup>, Markus Hollenbeck<sup>3</sup>*<sup>1</sup> University Hospital of Cologne, Department of Medicine II - QIN-group, Cologne, Germany<sup>2</sup> KfH-Curatorium for Dialysis and Kidney Transplantation, Neu-Isenburg, Germany<sup>3</sup> Knappschaftskrankenhaus and KfH-Kidney Center, Bottrop, Germany

**Introduction and Objectives:** Central venous catheters (CVC) for vascular access for hemodialysis (HD) are associated with increased morbidity and mortality. CVCs are often placed as a last resort in the absence of a viable alternative and therefore CVC use may be associated with factors that constitute barriers to the creation of AV-fistulas. We analyzed dialysis-center related factors associated with CVC use in a large, current cohort of chronic HD patients in Germany.

**Material and Methods:** The database of a large non-profit provider was queried for all patients (pts) who dialyzed between 2011 and 2014 for more than 90 days. A CVC was defined as the primary vascular access when multiple accesses were present and if it was used for more than 30 days. We considered center characteristics such as size, region, population (urban versus rural area), and having a specialized vascular access surgery center (SASC) on site. Patient-related factors were age, gender, heart failure (HF), peripheral vascular disease (PVD), and diabetes (DM).

**Results:** 28,091 pts were observed for a mean of 805.1 (+/- 503.1) days. Median age was 73 (61 - 80) years, 40.2% >75 years old, 38.5% female, 36.5% HF, 27.2% PVD, and 40.1% DM. Overall CVC use was 20.3% and showed a small increase over time from 19.5% in 2011 to 21.8% in 2014. This trend was similar in most regions but rates differed between 10% and 27%. Smaller centers had significantly more catheters (24.9%) than larger centers (20.1%;  $p < 0.01$ ) and CVC use was lower in urban than in rural areas (14.6% vs. 21.7%,  $p < 0.01$ ). Centers with a SASC on site had significantly less CVC than other centers (12.8% versus 20.7%;  $p < 0.01$ ).

**Conclusions:** We report CVC use in a large representative cohort of HD pts in Germany. Using a conservative definition, rates of CVC use were higher compared with DOPPS data and showed a small increase over time. Differences in CVC use were associated with location and size of the dialysis center and with on-site cooperation with a specialized vascular access center.

Factors influencing the facility-related increase of CVC use should be a subject for further investigation in order to reduce CVC rates in hemodialysis patients.

12:40 - 12:47 | 69

**THE 12-MONTH PATENCY RATE AFTER A FIRST PTA FOR FAILED ARTERIOVENOUS FISTULA: COMPARISON BETWEEN LOW-PRESSURE AND HIGH-PRESSURE BALLOON DILATION (YOROI STUDY)***Shigehiro Doi<sup>1</sup>, Toru Kawai<sup>2</sup>, Yasufumi Kyuden<sup>3</sup>, Takayuki Naito<sup>4</sup>, Mariko Asai<sup>5</sup>, Shunsuke Takahashi<sup>6</sup>, Masaaki Murakami<sup>7</sup>, Takao Masaki<sup>1</sup>*<sup>1</sup> Hiroshima University Hospital, Hiroshima, Japan<sup>2</sup> Chuo Naika Clinic, Kure, Japan<sup>3</sup> Kure Kyosai Hospital, Kure, Japan<sup>4</sup> Hiroshima Prefectural Hospital, Hiroshima, Japan<sup>5</sup> Harada Hospital, Hiroshima, Japan<sup>6</sup> Kure Medical Center, Kure, Japan<sup>7</sup> Shizuoka General Hospital, Shizuoka, Japan

**Introduction and Objectives:** Recently, improved patency rates were observed in patients with a failed hemodialysis fistula who underwent low-pressure balloon dilation rather than complete balloon expansion, even when there was residual stenosis. In this study, we investigated the 12-month patency rates after low- and high-pressure dilation in patients who underwent a first percutaneous transluminal angioplasty (PTA) for a failed arteriovenous fistula (AVF).

**Material and Methods:** A multicenter, prospective, randomized, non-inferiority trial was performed to compare low- and high-pressure dilation. A YOROI (Kaneka Medics, Osaka, Japan) balloon with a diameter of four mm was used to dilate stenotic lesions. The balloon was inflated to a pressure of 8 atm in the low-pressure group and 30 atm to achieve complete expansion in the high-pressure group. The 12-month patency rates after balloon angioplasty were determined by the Kaplan-Meier method, and the rates between the two groups were compared by a log-rank test. We also investigated the incidence of complications.

**Results:** There were 63 patients enrolled who received a first PTA: 29 in the low-pressure group, and 34 in the high-pressure group. One patient in the low-pressure group dropped out due to peripheral ischemia after PTA. One patient in the high-pressure group died during the observation period. The 12-month patency rates were not significantly different between the low- and high-pressure groups.

**Conclusions:** These results suggest that complete balloon expansion does not affect patency rates.

12:50 - 12:57 | 23

**A NOVEL CLASSIFICATION SYSTEM FOR AUTOGENOUS ARTERIOVENOUS FISTULA ANEURYSMS IN RENAL ACCESS PATIENTS***Domenico Valenti, Hiren Mistry, Matthew Stephenson*

Department of Vascular Surgery, King's College Hospital, London, United Kingdom

**Introduction and Objectives:** Arteriovenous fistulae constructed for haemodialysis access are prone to aneurysmal degeneration. This can lead to life-threatening sequelae such as aneurysmal rupture. The literature includes various guidelines on the management of certain aspects of access related aneurysm formation however no classification system exists to guide reporting or prognostication. We aimed to create a universally acceptable classification for these aneurysms and establish guidance about their management.

**Material and Methods:** We clinically examined, duplex scanned and photographed all of the autologous arterio-venous fistulae in our local renal failure population in January 2010 in order to categorise morphology. We then followed up the cohort for two years prospectively to assess outcomes, primarily of rupture or surgical intervention for bleeding.

**Results:** 344 patients were included (292 currently needing their fistula; 52 with low creatinine clearance awaiting dialysis). 43.5% of dialysed patients had aneurysmal fistulae. We propose a classification system as follows: Type 1a: dilated along the length of the vein; Type 1b: Post anastomotic aneurysm; Type 2a: Classic 'camel hump'; Type 2b: Combination of Type 2a and 1b; Type

3: Complex and Type 4: Pseudoaneurysm. Six fistulae needed emergency surgery for bleeding in the two year follow-up period and five of these were Type 2 aneurysms. The remaining one was in the non-aneurysmal group although it had become aneurysmal by the time it bled.

**Conclusions:** Type 1 aneurysms are much commoner in patients who have not yet needed their fistula and have a relatively innocuous course although Type 1a aneurysms should be monitored for high flow and physiological consequences thereof. Type 2 aneurysms are associated with needling of AV fistulae. They are at significant risk of rupture and need to be monitored carefully or treated prophylactically.

## VASCULAR ACCESS CARE

### 01

#### PLASTIC HAEMODIALYSIS CANNULA: IS THIS THE ALTERNATIVE TO STEEL NEEDLES WE HAVE BEEN WAITING FOR?

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**Introduction and Objectives:** Plastic haemodialysis cannulas (PHCs) are an alternative to steel needles for arterio-venous vascular access and have been widely used in Japan for more than 20 years. Advantages of PHCs include lower profile for gauge, length for deeper fistulae, and less chance of infiltration/migration from arm movement. Despite this, steel needles remain standard care for haemodialysis vascular access in Australia. The aim of this study was to report our experience using PHCs for haemodialysis vascular access at a single center.

**Material and Methods:** Between October 2013 and March 2014, patient and dialysis practice variables including access type, PHCs gauge, indication, effective blood flow rates, maximum arterial and venous pressures and use of ultrasound were recorded in all patients undergoing cannulation with PHCs. Descriptive statistics were calculated and reported as number (%) for categorical data and median plus range for continuous data.

**Results:** 226 PHCs were inserted into 23 patients over 107 dialysis sessions by 7 dialysis nurses. The most common indications for PHCs were deep fistulae, difficult cannulation, or previously infiltrated vessels. This was reflected in ultrasound use in 83% of cases (187/226). Effective blood flows  $\geq 300$  mL/min were achieved in 87% (72/83 sessions). The remainder achieved between 230 and 280 mL/min. Median (and range) of arterial and venous pressures were 140 (40-200) and 130 (100-200) mmHg respectively. In the majority of instances 15 G cannulae were used (218/226). 24 attempts failed due to PHCs initial technique failure, of which only two resulted in infiltration.

**Conclusions:** PHCs can achieve desirable flow parameters with few complications, providing diversity and flexibility in haemodialysis cannulation options. They have shown to be useful in patients with difficult arterio-venous vascular access. Larger prospective randomized studies are required to assess the difference between PHCs and steel needles in terms of haemodialysis parameters, clinical outcomes such as access patency, and patient preference.

### 02

#### VASCULAR ACCESS (VA) NEEDLING THROUGH CATHETER-FISTULA: EFFECT ON PAIN AND HEMODIALYSIS (HD) ADEQUACY

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**Introduction and Objectives:** The use of new needle designs for VA puncture may improve the quality of life of patients (pts) and the parameters of HD efficacy.

**Objectives:** To evaluate whether there are differences in the intensity of the pain perceived by the pts and HD adequacy (Kt Index) after brachial arteriovenous fistula (AVF) puncture through catheter-fistula (CF) or standard needling (SN).

**Material and Methods:** We performed a prospective, controlled, nonrandomized study during 2 months (24 HD sessions) to compare needling by CF (cases) versus SN (controls) in prevalent HD pts dialyzed by brachial AVF. The same patient was the case and the control when the CF (12 sessions) and the conventional 15 G needle (12 sessions) were used, respectively.

The CF is a biocompatible puncture cannula composed by an internal metal needle intended to AVF puncture and an external fluoroelastic catheter (15 G) that remains inside the arterialized vein. The pain related either with needling or with needle withdrawal was quantified using a validated

visual analogue scale (VAS) and the Short-Form McGill Pain Questionnaire (SF-MPQ).

**Results:** We analyzed 14 prevalent HD pts (mean age 68.4  $\pm$  10.43 years; 71% male; 28.6% diabetic nephropathy; mean time on HD 36.57  $\pm$  18.28 months) dialyzed by brachiocephalic (50%), brachiocephalic (21%) or brachiocephalic (29%) fistula. During both needling and needle withdrawal, the VAS was significantly lower for CF (2.07  $\pm$  0.73 and 0.76  $\pm$  0.39) compared to SN (2.88  $\pm$  0.99 and 1.85  $\pm$  0.95) (for both comparisons,  $p < 0.001$ ). No significant difference was found when comparing the SF-MPQ score during HD session between CF and SN (0.03  $\pm$  0.07 versus 0.11  $\pm$  0.26,  $p = 0.13$ ). The venous pressure (mmHg) recorded during the first and last hour of HD session was significant lower for CF (171.2  $\pm$  15.5 and 174.4  $\pm$  16.7) compared to SN (194.9  $\pm$  15.1 and 198.0  $\pm$  20.1) (for both comparisons,  $p < 0.001$ ). The Kt index obtained was significantly higher for CF (51.1  $\pm$  3.6 L) compared to SN (48.4  $\pm$  3.1 L) ( $p < 0.001$ ). No AVF leakage episodes were recorded with CF and only one by SN ( $p = NS$ ).

**Conclusions:** Comparing with SN, CF use improves HD adequacy (Kt index) and the quality of life by reducing the perceived pain during needling or needle withdrawal (visual analogue scale).

### 03

#### NURSING REPORT FOR VASCULAR ACCESS ON HEMODIALYSIS: MONITORING AND SURVEILLANCE

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**Introduction and Objectives:** Vascular access is a fundamental pillar to achieve best quality hemodialysis treatment. This vascular access should allow continued safe approach into the bloodstream and provide sufficient flow to achieve the programmed dose of dialysis with no complications.

**Objectives:**

- \* Monitor and survey VA using the Nursing Report sheet, identifying complications.
- \* Ensure continuity of nursing care related to VA using the Nursing Report sheet.
- \* Prevent thrombosis by early detection of stenosis, the most common cause of failure in VA fistula.

**Material and Methods:** Monitoring: is defined as the examination of VA by physical inspection and palpation for signs that are suggestive of dysfunction. In our unit this monitoring is performed during each hemodialysis session for every single patient.

**Surveillance:** the periodic evaluation of VA by parameters that help us detect dysfunction problems:

Kt/V, URR (urea reduction rate), Qb (blood flow rate), arterial pressure, venous pressure, anticoagulation, recirculation. Such surveillance remain registered in the monthly vascular access nursing report of each patient.

The report consists of an annex on vascular access dysfunction, created to facilitate communication between nursing and vascular surgery consultation when the access situation requires.

According to the report sent by vascular surgeon, a second annex is made with a drawing of the arm, with the most used veins and arteries and their pathway in the fistula or artificial AV graft.

**Results:** Decrease thrombosis of the fistula/Graft by detecting a possible stenosis, through the monitoring and surveillance of the data recorded daily.

- Ensure continuity of care, due to the inclusion of all parameters about the care of vascular access in the report.
- Adequate maintenance of AV through a good health education given to the patient.
- Decreased number of diagnosis of NANDA, NIC/NOC related to the VA.

**Conclusions:** We have proven the importance of using the vascular access nursing report in terms of benefits for the patient. It is a very useful tool for nurses, since both the monitoring and surveillance of access are an effective method for early detection of dysfunctions such as stenosis and thrombosis.



It allows us to assess the level of knowledge and implementation of interventions, necessary for the proper maintenance of the vascular access (4120) and be able to develop a program of health education activities.

#### 04 IMPORTANCE OF TRAINING IN VASCULAR ACCESS TO PATIENT IN HDD: CONTINUITY OF CARE

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**Introduction and Objectives:** Home Hemodialysis (HDD) is a treatment option that is growing in Spain so it is important to work on the diffusion of this modality as a new choice for renal patients.

HDD can foster fundamental aspects in the treatment of CKD like promoting patient autonomy and improving quality of life.

The patient is responsible for the technique so a training program is necessary, giving importance to the management of vascular access (VA). A thorough training for nurses will aim to ensure the survival of VA, avoiding complications such as infection, embolism and hemorrhage.

Therefore the goals we set are:

- Define a proper vascular access training program and minimize the risk of complications.

**Material and Methods:** A working group in the Hemodialysis Unit of the Hospital de Poniente in Almería was created, formed by three nurses and a nephrologist, and supported by a HDD specialist nurse.

Meetings were held to unify criteria for the training program by providing written support guides adapted to each patient to ensure individualized care. A training schedule was made and a check-list was passed and once completed the patient was ready to perform treatment at home.

Once at home, visits were planned to reassess the procedure.

We will discuss two patient cases: one with Permanent Jugular Catheter and another with Radial Native Arteriovenous Fistula (Buttonhole).

**Results:** Both patients carried out the training program as scheduled and they were successful.

For the patient with permanent catheter the apprenticeship in vascular access care lasted two weeks. We followed a treatment schedule of five days a week and we had to adapt training to certain characteristics, such as being left-handed, have visual deficits and an amputation of his left foot.

As for the patient carrying the radial AVF, it took ten days to develop the Buttonhole tracks, and another week to teach the patient how to remove the scabs and cannulate with dull needles.

**Conclusions:** As nurses, it is very satisfying and rewarding to see our patients performing dialysis treatments at home, observing how they handle their vascular access without any help, but mostly how they protect it. Our role is to instill that maintaining vascular access in the best conditions directly influences the quality of dialysis. Consistency and continuous evaluation minimizes the risk of errors and ensures the survival of access.

#### 05 VWING'S FOR ARTERIOVENOUS FISTULAS WITH CANNULATING PROBLEMS

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**Introduction and Objectives:** In hemodialysis patients a well functioning arteriovenous fistula (AVF) is of utmost importance for adequate access. Sometimes, after creation and sufficient maturation of autogenous AVF's, the fistula's vein could be laying too deep in the subcutaneous tissue. Another venous problem is hypermobility. In these patients cannulating is very difficult or impossible with a high risk to lose the AVF. A technical solution for these problems is a recently developed Venous Window Needle Guide (VWING), which is a titanium port, sutured at the AVF vein subcutaneously. The VWING is palpable under the skin and the AVF can easily be cannulated through the VWING by the button hole technique.

Aim of our study was to evaluate the first VWING implantations in patients with cannulating problems.

**Material and Methods:** Four patients were studied in our hospital. One patient with a hypermobile radio-cephalic fistula and three patients with a deep laying brachio-cephalic fistula. The mean age was  $54 \pm 10$  years. The AVF's were all

matured and were created for more than 2 months. In each patient 2 VWING's were implanted, according to the instructions for use of the company. The mean follow-up period after implantation was  $10,3 \pm 6,4$  months.

**Results:** The operative procedures were uncomplicated in all patients. No infections or wound problems were observed during the postoperative period. After minimally 6 weeks postoperatively all patients were cannulated percutaneously through the VWING into the AVF successfully. During the whole follow-up period no serious cannulating problems were observed.

**Conclusions:** In conclusion, in our small series of patients, excellent results were observed after implantation of VWING's in patients with serious cannulation problems. Well matured autogenous AVF veins with access problems could be maintained with this technique.

#### 06 SEVEN DEADLY SINS IN DIALYSIS ACCESS

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**Introduction and Objectives:** The medieval idea of "The Seven Deadly Sins", resulting in dreadful torture in The Purgatory, has given inspiration to make a list of seven issues of suboptimal dialysis planning and handling, which may place dialysis patients in great torture and threat of health.

The purpose is to give short statements of "do and don't" in dialysis access practice to stimulate discussion and reflection.

**Material and Methods:** The statements are based upon well accepted recommendations combined with personal clinical experiences as access surgeon and will be illustrated by clinical examples and materials.

**Results:** As "sins" the following list was chosen:

1. Not to promote peritoneal dialysis as the ideal first modality for many dialysis patients.
2. Accept of long term Central Venous Catheter access in young patients.
3. A-V fistula on same side as subclavian CVC or pacemaker lines.
4. Having no early and careful control program after A-V fistula creation.
5. Ignore or postpone clinical evaluation of re-bleeding from puncture sites.
6. Closure of infected or necrotic A-V fistulas without trying a reconstruction.
7. Pride: Not having a critical attitude towards own access practices and results.

**Conclusions:** Although many of these statements are widely accepted, others are not. Promoting peritoneal dialysis, even as an acute first modality, may meet many obstacles among patients and clinicians, although all materials demonstrate superior survival for PD patients. Long term CVC's may be acceptable at elderly patients with short life expectancy, although often giving annoying functional problems. But it is a disaster to find all upper central veins closed in a young dialysis patient. Subclavian catheters or other lines should never be placed in a (potential) dialysis patient without prior discussion with an access surgeon. And placing an A-V fistula in an arm with existing ipsilateral subclavian pacemaker line will in our experience result in arm oedema and necessary fistula closure. Early control of new A-V fistulas is now recommended in guidelines and should be effective to catch up potential non-maturation (e.g. by ultrasound examination), which may eliminate non-maturation by early revision(s). Re-bleeding and necrosis, which go hand in hand, may be life threatening and require immediate surgical evaluation and treatment, then almost all native fistulas may be saved. The last sin - "Pride" - speaks for itself, and is actually the first sin in the ancient medieval list.

#### 07 CARE OF THE VASCULAR ACCESS PRE AND POST OPERATION

*Monika Inger Dubeck*

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**Introduction and Objectives:** In 2010, we only had a 40% functioning rate with our A-V fistulae in our region.

We were lacking an effective structure in our methodology, and we implemented changes to our working methods in the three hospitals in our region. Our changes in methodology included an improvement in the preparation for A-V fistulae, as well as a way of protecting the patients' blood vessels before A-V fistula surgery.

**Material and Methods:** We developed a template for the radiologist to note down information about the vessels' diameter. We have also developed a bracelet that all patients use which informs that the arm is not to be used for blood tests.

We have expanded upon access maps from a national register (DiAD), which we now use in our daily operations as guidance during puncture, access-related problems and Angio PTA intervention.

**Results:** We now have a unified methodology and estimated 85-95% functioning rate with A-V fistulae.

**Conclusions:** The templates are now used by all dialysis clinics and radiologists in the region. The Bollnäs Bracelet is now used by many dialysis clinics across Sweden, and it is also used in Norway. The patient's use of the bracelet gives the vascular surgeon better conditions during the creation of an A-V fistula. A simple but very effective method that is also inexpensive. These bracelets should be offered to more patients in the interest of protecting their vessels.

## CLINICAL CASES

08

### DEXTROCARDIA AND TUNNELLED CENTRAL VENOUS CATHETER FOR HAEMODIALYSIS

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**Introduction and Objectives:** Tunnelled Central Venous Catheter (CVC) insertion is regularly undertaken by the radiology department of our teaching hospital. We report the unusual case of CVC insertion in a woman with Dextrocardia requiring acute haemodialysis. Dextrocardia is a rare congenital condition affecting less than 1 percent of the general population.

**Material and Methods:** Case presentation: We present a the case of a 64 year old woman admitted to our facility with chest pain on a chronic history of fatigue and SOB with limited exercise tolerance. This patient had a significant medical background including chronic kidney disease, CCF (LVEF 30%), Bi-ventricular AICD, Ischaemic Heart Disease, Hypertension, Diabetes type 2, Dextrocardia, Obesity and OSA.

During her admission, she developed acute on chronic renal failure which lead to uraemic pericarditis and acute hyperkalaemia, acute pulmonary oedema and subsequently type 2 respiratory failure. She was admitted to ICU for vasopressor support and Continuous Veno Venous Haemo Dialysis (CV-VHD) via a right internal jugular non-tunnelled CVC for 8 days. On discharge from ICU, ongoing dialysis was required so a tunnelled CVC was required.

**Results:** Radiology staff inserted a tunnelled CVC into the right internal jugular vein. Unfortunately this catheter provided poor flow when connected to the haemodialysis machine. Nursing staff reported these findings and arrangements were made to revise the CVC position. A left internal jugular vein CVC was inserted using CT landmarks. This CVC provided expected blood flow for the duration of her admission. The right CVC was removed under fluoroscopic guidance leaving the left sided CVC and cardiac defibrillator wires in correct alignment.

**Conclusions:** The aim of this case presentation is to highlight the unusual and rare condition of dextrocardia. This case study also reminds staff inserting, using, looking after or removing these lines, a working knowledge of the applied anatomy of the central veins is essential.

09

### ONE STEAL SYNDROME.....TWO PROBLEMS

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**Introduction and Objectives:** There are several complications of vascular access for hemodialysis which contribute to morbidity, mortality, costs and to renal patients' bad quality of life.

One of the most feared complications is the steal syndrome. It is related to the peripheral limb ischemia in which the vascular access was performed due to the preferred distribution of blood flow to the vessels of the vascular access. The very scarce distal blood flow to the extremities of the limb is responsible for the symptomatology.

We present a particular case of steal syndrome, where a vascular access was performed in a previously established arterial hypoperfusion of the limb, not recognized at the time of fistula placement.

**Objective:** To report a unusual situation related to the creation of a vascular access in a member with previous deficient arterial blood supply.

**Material and Methods:** We performed clinical and imagiological evaluation of a patient with a steal syndrome of vascular access including a computed tomographic angiography (CTA).

**Results:** We present a female patient, 81 years old, with chronic kidney disease (CKD), stage 5 and severe hypertension. A vascular access (brachiocephalic arteriovenous fistula in the left arm) was performed in March 2011. Two months later, the fistula was functioning but the patient showed signs of hypoperfusion and muscular atrophy of the ipsilateral limb vascular access. There was an asymmetry of the blood pressure in both arms: 200/77 mmHg, right arm; 122/61 mmHg, left arm. A CTA revealed a chronic total occlusion of the subclavian artery in its entire length and axillary artery to the middle third of the humeral artery. The flow downstream of the left upper limb was performed by collateral vessels originated upstream of the occlusion. The fistula was closed in 30/05/2011.

**Conclusions:** The authors present what initially seemed to be a common case of steal syndrome but with a more careful examination we could find more problems like a bad artery behind the fistula. The CTA of arterial vessels identified a subclavian artery thrombosis with reperfusion of the axillary artery through collateral circulation.

This case could lead us to consider the need of checking always the blood pressure in both arms before every surgical procedure to create a vascular access. Such a simple routine could prevent problems like the one we present here.

The physical and semiological evaluation is fundamental in the vascular access surgery, in order to prevent serious complications such as we describe... a steal syndrome... two problems.

10

### CASE REPORT: ILIAC VEIN PATCH ANGIOPLASTY TO ACCOMMODATE PTFE LEG AV FISTULA FOR RESCUE VASCULAR ACCESS

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**Introduction and Objectives:** We present a case of external iliac vein patch angioplasty to accommodate rescue vascular access via a leg arterio-venous fistula (AVF) for a patient with central venous stenosis.

**Material and Methods:** A 35 year old female with anti-glomerular basement membrane antibody disease required rescue vascular access for haemodialysis. Despite adequate anticoagulation with Warfarin twelve long term central venous cannulae, to facilitate dialysis, had thrombosed causing stenosis of brachiocephalic veins; right external iliac vein and occlusion of the left common iliac vein. A previous right Brachio-basilic fistula had occluded within 1 year. No other upper limb options for AVF were available.

A right external iliac vein bovine patch angioplasty was performed to restore venous patency with a PTFE AVF between common femoral artery and common femoral vein for last ditch dialysis access.

**Results:** At 17 months follow up the fistula remains widely patent with 2 litres/min flow rates and no recurrent stenosis to the treated iliac vein. She has not required any further surgical or intervention radiological procedures to maintain fistula or central venous patency.

**Conclusions:** Central venous stenosis or occlusion is common for patients requiring dialysis, especially those with multiple previous long term central venous cannulae. If stenosis is present AVF will inevitably fail. Venous patch angioplasty in these cases is a successful technique, allowing AVF formation and long term patency.

Central venous stenosis can be treated successfully with patch angioplasty to accommodate AVF formation for rescue vascular access; this is a lifesaving intervention for patients requiring dialysis.

11

### EXPERIENCE WITH BALLOON CATHETER "NSE"

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**Introduction and Objectives:** In Japan, a NON SLIP ELEMENT (NSE) balloon catheter has been available for use in vascular access intervention therapy (VAIVT) since May 2013. The NSE is categorized as a type of slipping-proof device, but is considered to have effects similar to those of cutting-type catheters given its structure. Between May 2013 and November 2014, we used

the NSE in 139 patients undergoing VAIVT. Here we report our experiences and precautions regarding its use.

**Material and Methods:** Product Specifications: The NSE stands for non-slip element. Its specifications are as follows: balloon diameter, 4.0-6.0 mm; balloon length, 20 or 40 mm; shaft diameter, 3.4-3.8 mm; corresponding guide wire, 0.018 inch; sheath size, 5-6 Fr. The balloon portion has three plastic elements that are arranged at 120° intervals, and those three elements are wrapped inside the balloon folding before the first inflation. Those features serve to improve balloon profiles and maintain the stability of the elements at the time of initial inflation. The elements not only prevent slipping, but are also likely to exert a cutting action on the inner membrane.

**Results:** Cases: The following cases are of interest. (1) An 84-year-old woman with left forearm AVF. She had stenoses at the site of anastomosis and the nearby vein for which percutaneous transluminal angioplasty (PTA) was performed using the NSE. The balloon was advanced through the twisted anastomosis site with no problem and was successfully inflated. (2) A 57-year-old woman with left forearm AVF. She had a stenosis in the cubital vein for which PTA was performed using the NSE. Observation of the stenosis site using Optical Coherence Tomography revealed cuts into the inner membrane by the elements at 120° intervals. (3) A 60-year-old woman with left arm AVF. She had a stenosis in the outflow vein for which ultrasound-guided PTA was performed using the NSE. The elements could be observed with ultrasound. As only the proximal and distal elements are joined together, and free at the balloon portion, they are not always arranged at 120° intervals at the second or later inflation.

**Conclusions:** The NSE may be possible to extend the duration of patency, given its potential to expand stenosis in a manner minimally invasive to the inner membrane. However, due to its high reimbursement price compared to the standard type, it will be desirable to use it while taking the medical economic aspect into consideration.

## 12

### TUNNELLED TRACT OF LONG TERM CATHETER FROM THE ELBOW TO RIGHT JUGULAR VEIN TO AVOID A BILATERAL PAINFUL GYNecomastia

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**Introduction and Objectives:** The most tunneled tract of long term catheter is made in the chest for the neck veins and in the legs or the abdomen for the femoral veins but for our patient the tunneled tract in the chest was not possible because he had a bilateral painful gynecomastia.

**Material and Methods:** We performed a double lumen tunneled catheter in the upper arm for 68 years old patient undergoing hemodialysis who has exhausted other possibilities, such as arteriovenous fistulas or grafts.

We started performing with a 14 F double lumen tunneled catheter in the right jugular vein (RJV) with a tunneled tract in the chest but after few days, the patient has been affected by a bilateral painful gynecomastia which the catheter increasing the pain when the nurses manipulated it.

After non response to a medical treatment we have switched the tunneled tract from the chest to the elbow and exchange the catheter length from 26 cm to 55 cm keeping the same vein (RJV) and the same diameter of the double lumen catheter (14 French).

**Results:** This technique has avoided all manipulations in the chest, the patient didn't have pain in the upper arm, the catheter reached 300 ml/min of blood flow, and we have noticed that the patient was psychologically satisfied like a patient who had an arteriovenous fistula in the elbow.

We have noticed that we hadn't catheter related bloodstream infection comparing with the last catheter which has been tunneled in the chest but we have had more exit site infections in the elbow which resolved with systemic and local antibiotics.

The patient died three months later by another cause with a functioning catheter.

**Conclusions:** In the classic forms, the tunneled tract of the long term catheters is made in the chest for the neck veins and in the legs or the abdomen for the femoral veins but we can exchange the path and the site of this one when you can't make it in the classic forms. We have noticed the psychological positive effect of this form of tunneled tract in the patient like an arteriovenous fistula in the elbow.

## 13

### PSEUDOANEURYSM BURSTING OUT THE SKIN IN NATIVE ARTERIOVENOUS FISTULA

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**Introduction and Objectives:** The pseudoaneurysm is caused by the tear through all the layers of the vessel allowing blood collection to form outside the blood vessel but remaining in continuity with the vessel lumen. The blood is contained by the surrounding tissues and flows in and out of the pseudoaneurysm's cavity during systole and diastole. The pseudoaneurysm has two components: a cavity and a neck by which the cavity communicates with the lumen of the vessel.

**Material and Methods:** A 20 years young woman with end stage renal disease undergoing hemodialysis 12 hours per week with a brachio basilic native arteriovenous fistula (AVF) was brought to our unit 24 hours after undergoing his session with skin necrosis in the area of her AVF. The skin necrosis was pulsating, his diameter was two centimeters with oozing in the outlines, but was not growing. There were no signs of infection, the skin was normal in the outlines of the necrosis. After a few seconds a continuous jet spurted out to the middle of the skin necrosis necessary a compressive bandage and transferring in surgeon emergency unit.

**Results:** After a surgical exploration the diagnosis held was a pseudoaneurysm bursting out the skin. The pseudoaneurysm was arising from the basilic vein due to a needle trauma; the needle had lacerated the vein and had created a five millimeters wound. The fistula has been stopped because there were a lot of defects in the vein and the skin. The patient has got a temporary catheter while waiting the creation of another AVF.

**Conclusions:** For this patient the pseudoaneurysm has been constituted one or two hour after stopping bleeding and leaving the hemodialysis unit. The pseudoaneurysm grew up and reached the skin, he produced a skin necrosis and burst it out without the patient aware of pseudoaneurysm formation, fortunately he has burst out in the hospital otherwise the patient had done a hemorrhagic choc.

## 14

### TWO CASES OF CUFFED CATHETERS PROLAPSING IN THE MEDIASTINUM

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**Introduction and Objectives:** We report on two cases at our hospital in which, when placing a cuffed catheter, a prolapse occurred within the mediastinum.

#### Material and Methods:

Case 1. The patient was a 70-year-old male with chronic kidney disease due to nephrosclerosis. After creation of an arteriovenous fistula in the lower right arm at our hospital in 1990, hemodialysis was introduced. After 15 years of hemodialysis, access failure occurred, and because creating other access was difficult, a cuffed catheter was placed in the right internal jugular vein. After about 7 months, he repeated exit site infection and blood removal failure was observed, 1 year and 4 months after placement, a cuffed catheter was placed in the left internal jugular vein. From the time of reinsertion, blood removal was not possible, and in a CT, a prolapse within the mediastinum was confirmed. Bedside removal of the catheter was no problem. The left brachial artery was superficialized, the cuffed catheter in the right jugular vein was reinserted, and hemodialysis was done.

Case 2. The patient was a 85-year-old female with chronic kidney disease due to nephrosclerosis. The implantation of arteriovenous graft in the lower left arm was performed, and obstruction occurred in the early postoperative period. Upon creation of an arteriovenous fistula in the right lower arm, steal syndrome occurred, and a cuffed catheter was inserted in the right internal jugular vein, with the introduction of hemodialysis in April 2012. In November, sick sinus syndrome developed, and a pacemaker was inserted from the left subclavian vein. There was a failure of blood removal, and despite repeated insertion of a cuffed catheter in the right internal jugular vein and right femoral vein, there was no improvement. Superficialization of an right brachial artery was performed, but the artery was narrow, and needle insertion was difficult. In June 2014, upon placement of a cuffed catheter in the left internal jugular vein, blood removal was impossible, and in a CT, a prolapse within the mediastinum was confirmed. Under general anesthesia, the cuffed catheter was removed under a thoracotomy, and subsequently, blood



was removed from left and right brachial arteries, while with the cuffed catheter in the right femoral vein, retransfusion was performed.

**Conclusions:** Both cases involved placement in the left internal jugular vein. In the X-rays, the prolapse within the mediastinum was not seen, and diagnosis was performed using CTs. The method for removing catheters therefore has not yet been established.

## 15

### THE USAGE OF THROMBIN IN CASE OF PSEUDOANEURYSM AFTER PUNCTURING OF FISTULAE

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**Introduction and Objectives:** 64 year old man with Diabetes Mellitus, hypertension. The right leg is amputated below the knee; the left is amputated in the level of forefoot. Operated and irradiated due to anal cancer. The patient was operated with left radiocephalic arteriovenous fistulae 2006. Due to bleeding reoperated (2008) with a bit of PTFE graft. Due to the PTA consuming multiple stenoses below and above the graft operated with loop brachio-basilic forearm fistulae (2014-11). During the first puncturing of the fistulae one week after the operation gained a pseudoaneurysm on the "arterial" part of fistulae. To solve the problem we used the injection of Thrombin with the protection of inflated balloon with good result. Now we use the fistulae without any problem.

**Material and Methods:** 1 ml Thrombin.

**Results:** Complet occlusion of the pseudoaneurysm.

**Conclusions:** Thrombin can be used in case of pseudoaneurysm.

## 16

### PROSTHETIC REINFORCEMENT OF VENOUS ANEURYSMORRHAPHY IN THE MANAGEMENT OF AN ANEURYSMAL FISTULA WITH PERSISTENT CENTRAL VENOUS STENOSIS

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**Introduction and Objectives:** We report the use of the Braun ProVena Peripheral sleeve to revise an aneurysmal brachiocephalic fistula (BCF) with an associated central stenosis.

A 37-year-old female developed post partum renal failure. Her past medical history included systemic lupus erythematosus and psychosis. Whilst still predialysis a left BCF was created. However, prior to commencing dialysis she received a living related renal transplant from her father in 2009. The transplanted kidney had thrombotic microangiopathy and she required to commence haemodialysis in January 2013 using the BCF.

**Material and Methods:** The left BCF had become dilated and serpentine. The flow through the fistula was 900 ml/min but the venous pressure was >200 mmHg. A fistulogram revealed a stenosis at the confluence of the cephalic and subclavian vein. Balloon angioplasty failed to durably resolve the high fistula pressure and was repeated 6 months later. Dialysis continued for a further 12 months, however the draining vein continued to dilate. Surgical revision was planned. At operation in October 2014 the cephalic vein was grossly aneurysmal with myointimal hyperplasia and calcification. The cephalic vein was fully mobilised and divided in the upper arm. It was plicated, excising the aneurysmal segments. The plicated vein was covered with a 7 mm Braun ProVena Peripheral sleeve. This was then tunnelled subcutaneously and anastomosed to the axillary vein.

**Results:** At 1 month post operatively the flow through the fistula was 1000 ml/min. The maximum diameter of the cephalic vein was 9 mm. The patient is now successfully dialysing using the revised left BCF.

**Conclusions:** Prosthetic reinforcing of venous aneurysmorrhaphy is controversial. The advantage is that it should prevent recurrent aneurysmal dilatation. Limitations are that the button hole technique must be substituted by standard laddering and the presence of prosthetic is of concern with regard to infection. The ProVena graft is promoted as a safe alternative to abandoning the use of aneurysmal fistulae with surgical ligation thus preserving precious venous access. Primary patency rates of >90% at 1 year have been reported. This case describes the successful combination of a ProVena graft and aneurysmorrhaphy to deal with an aneurysmal fistula with a persistent central stenosis.

## 17

### AGGRESSIVE ENDOVASCULAR TREATMENT OF A BRACHIAL-AXILLARY GRAFT THROMBOSIS

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**Introduction and Objectives:** We present the case of a 79 years old lady with chronic renal disease in dialysis. She had a brachial-axillary graft in use and history of several failed access in both arms.

She had a graft thrombosis that was solved by surgical thrombectomy and deployment of self-expandable stent through a stenosis in the axillary anastomosis. The angiographic and clinical results were good and the access was used without problems.

Five months later the patient developed a new graft thrombosis.

**Material and Methods:** In the operating room, under Rx view, we noticed that the stent structure was critically damaged with loss of lumen.

We performed surgical thrombectomy of the graft but it was impossible to pass the thrombectomy catheter through the stent, we passed a guide-wire through the stent structure (was imposible to cannulate the stent lumen).

Finally we performed a high-pressure balloon angioplasty that broke the stent structure and created a new lumen to the axillary vein.

**Results:** The angiographic result was good and the graft the graft was again in use so no vein catheter was needed for dialysis.

After the use of the graft without any problems during 1 month, we considered this treatment as a "not long-term solution" so we scheduled a graft interposition to the proximal axillary vein.

**Conclusions:** We consider that endovascular techniques can solve difficult situations like in this case, avoiding complicate surgeries in the emergency and the use of temporary vein catheters.

On the other hand some of those solutions are not a long term solutions and we should consider them as a "bridge" that allows the use of the access prior to a definitive solution.

## 18

### HYBRID OPERATING ROOM. LEADING-EDGE TECHNOLOGY IN THE TREATMENT OF COMPLICATIONS OF THE VASCULAR ACCESS

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**Introduction and Objectives:** The Hybrid Operating Room (OR) is new technology that expands the diagnostic and treatment capabilities also in the treatment of complications of the vascular access.

The hybrid OR allows the surgical team to immediately shift a diagnostic interventional procedure to surgical intervention with the scanning bed becoming an OR table in a moment's notice.

**Material and Methods:** We reported the cases of two patients with giant aneurysmal enlargement of the cephalic veins in the arm successful treated by using this new technological approach.

A 69-year-old female and a 40 years old male were referred to our unit of vascular and endovascular surgery, many years after the creation of a native and patent AV brachiocephalic fistula, both presenting with symptoms related with the development, over the years, of giant aneurysmal enlargement of the cephalic vein.

The aneurysmal dilatation of both patients were located at the proximal end of the brachiocephalic fistula; the length in diameter was more than 5 cm, associated with a tight stenosis of the subclavian vein (more than 70%) The availability of a hybrid OR (Siemens Artis Zeego Robot) allowed us to performed a combined successful endovascular-surgical treatment.

Both patients underwent first surgical repair of their giant aneurysms by performing a aneurysmorrhaphy in order to reduce the diameter and keep the patency of the fistula. After the surgical approach, at the same time it was possible to make an angiogram which confirmed the previously stenosis detected by duplex scan. Both the patients were treated with a ballooning angioplasty at high pressure (Bard Dorado®). In the female patient the technical success was achieved with the angioplasty alone of the subclavian vein stenosis; in the male patient the elastic recoil suddenly occurred and required the placement of a cover stent (GORE® VIABAHN® Endoprosthesis) at the site of the caephalic junction with the subclavian vein to get the target.



**Results:** The Intraoperative technical success was 100% in both patients with restoration of a normal flow at the site of stenosis and and the achievement of acceptable uniformity in diameter of the native AV fistula after surgical and endovascular treatment.

**Conclusions:** The ability to convert the interventional room to an operating room is an exciting development in vascular access surgery.

Surgical and endovascular treatment of complicated AV access is a simple, safe and rapid in Hybrid operating room. It exemplifies our ongoing commitment to safe high quality patient care, and gives us a new tool to save more fistulas.

## 19

### DELAYED FRACTURED STENT – WHAT NEXT?

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**Introduction and Objectives:** Arteriovenous fistula (AVF) is the lifeline for a hemodialysis patient but with issues of lack of fistula maturation and hemodynamically significant stenosis. Metallic stents aid to preserve the patency of a vascular access. In addition to understanding the indications of stent deployment knowing the complications are also essential.

**Material and Methods:** This 62 years old lady with end stage renal disease twelve years ago. She had undergone surgery for arteriovenous fistula creation twice (left radio-cephalic and brachio-cephalic) both of which failed. In the meantime she had to be initiated through a right uncuffed internal jugular catheter and continued on thrice weekly. A right brachio-basilic was created followed by staged superficialisation after two months. After two months of use, we observed prolonged bleeding from the venous needle site after its removal in addition to arterial flow interruption during the session of hemodialysis. Fistulogram was done promptly which revealed a concentric stenosis at the level of anastomosis and long tight stenosis in the basilic vein. She underwent angioplasty of the stenosis in the basilic vein together with a stent placement. Post stenting angiogram showed minimal residual stenosis. Angioplasty of the anastomotic lesion was attempted but failed hence an arteriovenous fistula revision was done.

**Results:** The access was performing well for six months, then showed elevated venous pressures. Fistulogram was done which showed a fractured stent. We excised the stenotic portion and swapped it with a PTFE graft. Her subsequent sessions of hemodialysis have continued to be uneventful.

**Conclusions:** Complications of venous stent include misplacement, migration, fracture and distortion. Stent fractures have been reported while in use for coronary artery disease and peripheral vascular disease. Most commonly stent fracture occurs early and in a linear orientation secondary to physical compression due to an unrelenting stenosis. Also in patient on hemodialysis due to accidental trauma due to the needle puncture. Options for managing a stent fracture include re-stenting and use of newer stents. In a more sophisticated setup the use of stent graft is ideal. However a surgical bypass with PTFE graft like in our case seems to be a suitable alternative.

## CATHETERS

## 20

### SUCCESSFUL SWITCH TO SAFETY – SOUTH AFRICAN EXPERIENCE WITH A NEW PASSIVE SAFETY PERIPHERAL INTRAVENOUS CATHETER

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**Introduction and Objectives:** A prospective, non-blinded, observational multicenter study was conducted to evaluate the clinical performance and acceptability of a new passive safety intravenous (IV) catheter.

**Material and Methods:** Ten Anaesthetists at two South African medical centers, Charlotte Maxeke and Steve Biko (five clinicians from each center) currently using conventional, non-safety, catheters with a straight hub configuration were trained on the use of the Safety Catheter (Jelco Intuit IV Safety IV Catheter™) and then performed 20 consecutive Safety Catheter insertions.

Clinical performance was measured following each catheter insertion, and overall acceptability was assessed after all study insertions were completed. Descriptive statistics were used to summarize data and proportions with corresponding 95% confidence intervals (CI).

**Results:** A total of 192 Safety Catheter insertions (24 G-16 G) were performed with 139 of the straight hub configuration evaluated as part of the study. 97.0% (CI 92.5%, 99.2%) of the insertions evaluated, were rated clinically acceptable. Clinicians agreed the Safety Catheter eliminated the risk of needlestick injury in 97.0% (CI 92.5%, 99.2%) of all insertions evaluated. The insertion success rate and first venipuncture success rates were 97.0% (CI 92.5%, 99.2%) and 84.6% (CI 77.1%, 90%), respectively. Ten statements related to each step of the insertion process were assessed (from removing the needle from its sheath, to securing the catheter to the patient), and 7 of the 10 had agreement ratings of >90%, with all statements rated at >80%. All 10 clinicians (100%) agreed that the Safety Catheter was easy to use.

**Conclusions:** Results of the study showed that clinicians familiar with using conventional catheters were able to successfully switch to a passive safety device and maintain high insertion success rates. Clinicians reported a positive experience with the Safety Catheter, with 80% of the clinicians stating they would recommend using the device over other catheters they have used. It is to be expected that clinicians currently using conventional catheters would notice differences during the insertion process of a safety device, such as disconnecting the needle from the catheter hub assembly due to the addition of the safety mechanism. Moving from using conventional catheters to safety catheters could be a small part of a broader effort to prevent sharps-related injuries and associated blood-borne infections to health care workers.

## 21

### ANALYSIS OF SURVIVAL OF OLDER PATIENTS WITH ILIAC VEIN TUNNELED CUFFED CATHETERS ON MAINTAINED HEMODIALYSIS

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**Introduction and Objectives:** While the population continuously ages, more and more older patients undergo dialysis. As tunneled cuffed catheters (TCCs) are widely used in older hemodialysis patients, iliac vein tunneled cuffed catheters have been used for older patients who have exhausted all options for placement of a permanent access in all four extremities. However, until now little is known about the survival of these patients. In this report, we reviewed the survival of older patients with iliac vein tunneled cuffed catheters, and compared them to a group of matched control patients receiving an internal jugular vein dialysis catheter.

**Material and Methods:** A total of 70 older patients with iliac vein tunneled cuffed catheters on maintained hemodialysis were included in this study. We used 14.5 French percutaneous permanent hemodialysis catheters with lengths of 23 to 45 cm for iliac veins (Covidien, Mansfield, MA, USA). Catheters were placed into left iliac vein. There were also 94 Patients with internal jugular vein tunneled cuffed catheters as control group. The baseline anthropometric and laboratory parameters were measured. The catheter dysfunction and catheter related complications were documented.

**Results:** There was high incidence of catheter dysfunction rate in the study group compared with internal jugular vein group ( $X^2 = 4.635$ ,  $P = 0.031$ ); meanwhile, there were low rate of catheter related infection and CVD events in iliac tunneled cuffed catheter group ( $X^2 = 4.137$ ,  $P = 0.042$ ;  $X^2 = 5.719$ ,  $P = 0.017$ ). Kaplan-Meier survival curves showed that the morbidity of mortality was enhanced among iliac vein tunneled cuffed patients compared with internal jugular vein catheter group ( $X^2 = 5.912$ ,  $P = 0.023$ ). Furthermore incidence of catheter dysfunction and CVD events were the independent risk factors of mortality for the older patients with iliac vein tunneled cuffed catheter on maintained hemodialysis by cox regression model.

**Conclusions:** Older hemodialysis patients with iliac vein tunneled cuffed catheter had a short survival time. Those with catheter dysfunction and CVD events were in a high risk of mortality.

## 22

**COMPLICATIONS OF PERCUTANEOUS PLACEMENT OF TUNNELED DIALYSIS CATHETERS: OUTCOME A SINGLE CENTER**

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**Introduction and Objectives:** The percutaneous catheterization of central veins is used in nephrological practice as a temporary or permanent dialysis access. The preferred site for catheter insertion is right internal jugular vein, however, in many dialysis patients, especially with the history of previous catheter use, other access sites need to be used. The clinical outcome and complications of percutaneous placement of tunneled dialysis catheters were presented.

**Material and Methods:** During the year, data of all patients from 2012 to 2013 were reviewed. 101 cuffed tunneled catheters were placed in 98 patients by the same team of nephrologists. Arrow Cannon II catheter was used in 93 cases, Bard Hemo Split in 8 cases. Both IJV were located with ultrasound and the preferred vein was marked on the skin. After insertion both arms of the catheter were tested for patency, flushed with heparinized saline, filled with respective volume of heparin solution and control chest X-ray was performed.

**Results:** In 51 cases catheter was inserted into right internal jugular vein in, in 20 cases into left internal jugular vein. Right and left subclavian veins were used in 8 and 17 cases, and right and left femoral veins in 3 and 2 cases, respectively. Local hematomas and no prolonged wound bleeding was the most common complication of insertion procedure, similar on the right and left side (66% vs. 55,5%). In one case, after left In 1 case thoracic duct was punctured. There were no cases of immediate malfunction when the catheter tips were properly positioned. Malposition of the catheter tips occurred only with left internal jugular vein insertion. They included malposition into the right innominate vein (2 cases), and into vena azygos (4 cases). In all cases position of catheter tips were corrected under fluoroscopic control by partial withdrawal of the catheter and subsequent insertion.

**Conclusions:** Bleeding and hematoma formation appears to be the most common and important complication of percutaneous placement of tunneled dialysis catheters. Malposition of the catheter tip into innominate vein or vena azygos was specific and relatively common complication of left internal jugular vein access (6 out of 20 insertions). Especially during catheterization of left internal jugular vein fluoroscopy should be used to control guide wire and catheter passage and to correct malposition as soon as possible.

## 23

**RISK FACTOR ANALYSIS FOR TUNNELED CATHETER INFECTION ON HEMODIALYSIS – FIVE-YEAR ONE CENTER EXPERIENCE**

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**Introduction and Objectives:** Infection, mainly related to vascular access, is one of the main causes of morbidity and a preventable cause of death in hemodialysis patients. The presence of the catheter increases the risk of bacteremia in hemodialysis patients. Risk factors are nasal colonization with *Staphylococcus aureus*, prolonged use of catheters, previous bacteremia, another dose of iron, low hemoglobin, low albumins, diabetes mellitus, and surgical procedures. The aim of this study was prevention of catheter sepsis and timely disclosures of existing and effective cures.

**Material and Methods:** 185 patients with tunneled catheters as vascular access for hemodialysis were included into the study. The study was conducted between January 1, 2008 and January 3, 2013. Out of 185 patients, 60% (111) were male and 40% (74) were female, while the average age was 67.48 +/- 13.9 years. The duration of hemodialysis treatment was 108.9 +/- 16.54 months.

**Results:** Over the study period, 19 patients developed bacteremia associated with the use of catheter as a vascular approach. The incidence of infection was 3.5 cases per 1000 catheter days. Ten patients (5.2%) developed an infection in the first three months after the day of catheter placement, and the remaining 29 (15.8%) patients after one year of the use of catheter as a vascular approach. Regarding the causes of infection, in 33% patients these were gram-positive pathogens, in 56% patients gram-negative pathogens, and in 11% patient it was polymicrobe flora. According to the protocol and pend-

ing the outcome of susceptibility testing (antibiogram), all the patients were prescribed with antibiotic treatment therapy. In 14 (75%) patients tunneled catheter was removed and replaced with temporary catheters for hemodialysis treatment. In 25% patients, was antibiotic-lock solution was injected into the catheter. There were no significant differences ( $p < 0.05$ ) in age, duration of dialysis treatment, hemoglobin levels, iron, transferrin saturation, ferritin and albumin in patients without infection and those who developed an infection. Only one patient has had a nasal colonization with *Staphylococcus aureus*. One patient developed severe thrombocytopenia, followed by sepsis and a lethal outcome due to heavy gastrointestinal bleeding.

**Conclusions:** This study confirms the relatively high incidence of bacteremia with tunneled double-lumen silicone catheters and its potential complications. Proper care and use of catheters, making the unique protocols of care and treatment algorithm. Our goal is to prevent the catheter sepsis, and to promptly detect the existing and a fast treatment of the same. Possible preventive actions are discussed according to the risk factors.

## 24

**OUTCOME OF A SERIES OF FORTY TUNNELLED HEMODIALYSIS CATHETERS INSERTED THROUGH THE COMMON FEMORAL VEIN**

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**Introduction and Objectives:** To determine the incidence of catheter dysfunction and catheter-related infections in a series of patients with tunneled hemodialysis catheters inserted through the common femoral vein.

**Material and Methods:** All femoral tunneled catheters inserted in the unit of Interventional Radiology of our centre from 2009-2013 were reviewed. Data were collected from the hospital database. Demographic information, cardiovascular risk factors, previous insertions of tunneled catheters, side of insertion, rate of dysfunction, cause of the dysfunction, rate of infective complications associated to the catheter and rate of exchange were evaluated.

**Results:** Forty catheters were implanted in 29 patients (29 new insertions and 11 exchanges), 21 men and 8 women. Mean patients age was 63,3 years (range 32 to 89). 35 catheters (87,5%) were inserted through the right common femoral vein and 5 (12,5%) through the left common femoral vein. Thirteen catheters (32,5%) presented malfunction due to low blood flow during dialysis, with a fibrin sheath identified in 10 patients and inferior vena cava stenosis in 3 patients. Twelve catheters (30%) were removed electively when other vascular access was available (arteriovenous fistula/grfts in 7 patients), due to initiation of peritoneal dialysis (2 patients) or renal transplant (1 patient). Two catheters were exchange because of retraction of the cuff from the subcutaneous tunnel. Four catheters were removed for catheter-related infection (10%); catheter related infection rate 0,87/1000 catheter-day). Five patients were lost to follow-up.

**Conclusions:** Although affected by a high rate of complications, the femoral vein offers an alternative site for insertion of hemodialysis tunneled catheters in patients who have exhausted other conventional sites.

## 25

**EFFECTIVENESS OF SYSTEMIC ANTIBIOTIC THERAPY ASSOCIATED WITH ANTIBIOTIC LOCK THERAPY IN THE TREATMENT OF CENTRAL VENOUS CATHETER-RELATED BACTEREMIA PERMANENT (CRBSI) HEMODIALYSIS: RESULTS OF A COHORT STUDY**

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**Introduction and Objectives:** Catheter-related blood stream infection (CRBSI) is a major complication in hemodialysis patients.

The aim of the study was to compare, in patients with CRBSI, the effectiveness of systemic antibiotic therapy (SAT) with SAT plus Lock Therapy (ALT).

**Material and Methods:** This was a cohort study. From January 2008 to December 2011 all episodes of CRBSI (n = 48) were treated with SAT (cohort 1); from January 2012 to December 2014 all CRBSI (n = 44) ALT was added to SAT (cohort 2).

Table I reports the characteristics of cohorts.



Poisson regression was used to model count data, the dependent variable was the number of pCVC removal due to CRBSI.

**Results:** The success rates in the cohort 1 and 2 were 77 and 89% respectively. The removal of pCVC was due to the persistence of CRBSI after 7 days, relapses of CRBSI and septic metastases.

Among the Gram positive, the most frequently isolated were *Staphylococcus epidermidis* (45%) and *aureus* (30%), among the Gram negative were *pseudomonaceae* (52%). The antibiotics mainly used were vancomycin (72%), aminoglycosides (35%), quinolones (28%).

The mean duration of therapy was 21 days.

The variables statistically significant were the cohort with an "Incident Rate Ratio" 0.31 ( $p = 0.02$ ) and the age (IRR 0.94,  $p = 0.06$ ).

**Conclusions:** The extensive use of pCVC implies special care in the management of CRBSI. Patients treated with TAS + ALT have a IRR removal CVCP lower about 70% than the other group. The aspect of prevention, including surveillance, to recognize and treat early a CRBSI, remains crucial.

TABLE 1

Cohort	Patients	Age	Vintage	Diabetes	pCVC	CRBSI	CRBSI (1000 days/pCVC)
	(n)	(years)	(years)	(%)	(days)	(n)	
2008-2011	131	73.5	4	20	54377	48	0.88
2012-2014	124	70.5	3.9	25	64534	44	0.68

## 26

### REPLACEMENT OF TUNNELLED HEMODIALYSIS CATHETERS USING A DIFFERENT TUNNEL: A NEW PROCEDURE TO CHANGE MALFUNCTIONING CATHETERS

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**Introduction and Objectives:** The most common complications of central venous catheters are catheter malfunction and infection. Malfunction of tunnelled hemodialysis catheters are caused by intraluminal thrombus, occlusion or malposition of the catheter tip, catheter kinking, and formation of a fibrin sheath not amenable to be treated with tissue-plasminogen activator administered by the indwelling catheter or by infusion.

Exchanging the catheter over a guide-wire is considered the proper procedure of replacement for patients with tunnelled dialysis catheters. This approach preserves future venous accesses and avoids known risks of additional catheter placement.

Frequently, the subcutaneous tunnel previously performed, can be used. However, sometimes it is not possible due to infection of the tunnel, skin ulceration or an inadequate tunnel length, too short for housing a longer catheter. In these cases a new subcutaneous tunnel must be made but with preservation of the intravenous access.

**Material and Methods:** Since January 2007 to December 2014 we made 178 procedures of replacement of hemodialysis central catheters, by using a new subcutaneous tunnel. The interventional procedures were performed under fluoroscopic guidance.

**Results:** All procedures were possible and allowed us a more effective and easier treatment of the fibrin sleeve and we observed a lower risk of infection in the new tunnel. We demonstrate key concepts of replacement.

**Conclusions:** In patients undergoing hemodialysis in whom is necessary to change the tunnelled catheter due to infection or dysfunction, catheters placed in the same venous access but using a new subcutaneous tunnel, will preserve future vascular insertion locations and will reduce the risk of complications.

## 27

### COMPLICATIONS OF TUNNELLED-CATHETERS FOR HAEMODIALYSIS OUR EXPERIENCE

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**Introduction and Objectives:** The main objective is to evaluate the type and incidence of complications in the tunnelled-catheters inserted for dialysis in our Interventional Radiology Department.

**Material and Methods:** This is a retrospective study of all the patients who required a vascular access for haemodialysis and in which a tunnelled catheter was inserted over the last 13 years. We used double lumen catheters made of polyurethane material.

**Results:** 1000-tunnelled catheters were placed in 718 patients for haemodialysis in our institution over the last 13 years. 60,3% were men and 39,7% were women, with a median age of  $64.45 \pm 13.01$  years (24-90).

The median duration of HD treatment was 1 year with an average duration of 2.17 years (range 0-14). Haemodialysis was the initial treatment in 36%. The most frequently used vascular access was the right jugular vein in 77%, the left jugular vein in 18,1% and other vascular access in 4,9%.

Catheter removal was indicated when insufficient flow was noticed after two or more consecutive sessions.

Post-procedure complications occurred in 45,9% of the patients with an average time of 93 days. Thrombosis and catheter obstruction in 29,3%, deep venous thrombosis in 2%, insufficient flow in 29% and accidental extrusion of the catheter in 3,1%, Catheter removal in 53.1%.

In 188/717 patients the catheter was replaced more than once and in 88/718 more than 3 times.

**Conclusions:** Tunnelled-catheters for haemodialysis are associated with a high rate of complications that required the removal or replacement of the catheter. Thrombosis and insufficient flow remain the main complications associated with haemodialysis catheters.

## 28

### THE PLACEMENT OF PERMANENT DUAL LUMEN DIALYSIS CATHETERS (PDLDC) INTO A CENTRAL VEIN WITH ONLY THE USE OF A GUIDE WIRE. THE EXPERIENCE OF A RENAL UNIT

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**Introduction and Objectives:** Hemodialysis is a method of renal replacement therapy, which helps maintain the life of patients with end-stage chronic kidney disease (CKD). Vascular access is essential and this may be achieved either through a permanent fistula or via permanent dual lumen dialysis catheter (PDLDC) with a subcutaneous tunnel. Despite the effort for limited use of PDLDC, these catheters remain for months or years. We describe our experience from the placement of PDLDC into a central vein (internal jugular, subclavian, femoral vein) with only the use of guide wire.

**Material and Methods:** In the Dialysis Unit of "G.PAPANIKOLAOU" hospital and during the period from March 2003 to April 2014, we placed 185 PDLDC in 122 patients. All PDLDC were placed by nephrologists. For the insertion of the PDLDC, neither a vessel dilator nor the peel-away sheath of the set has been used. All these patients had a temporary hemodialysis catheter (TC) placed in a central vein for at least 3 weeks.

PDLDC were placed through a guide wire, which passed through a temporary catheter (TC), into the internal jugular vein in 152 cases, into the subclavian vein in 21 cases and into the femoral vein in 12 cases while the TC was removed. Next, through a subcutaneous tunnel that was created, the PDLDC was moved to the exit site of the guide wire and the guide wire was passed opposite through the venous exit site of PDLDC until it comes out from the venous exit site. Similarly the PDLDC was passed through the guide wire and placed into a central vein. The safety of the method concerning infection prevention and the good patency of the catheter was secured by good nursing care, before and while the patient was wearing the PDLDC and after the replacement of the TC with the PDLDC.

**Results:** During the placement there were no complication, while, after the initial placement a dysfunction of the PDLDC was observed in 38 patients due to "bad" location, thrombosis or infection and three changes were required on average, while 5 patients reported that the catheter had been removed on its own.



**Conclusions:** We concluded that the placement of PDLDC with only the use of guide wire, as described above, is an easy and safe permanent catheter placement method, while, nursing care is considered to be important concerning the prevention of infection complications and the good patency of the catheter.

## 29

### THE CENTRAL VENOUS TUNNELED CATHETER IN HAEMODIALYSIS: FIRST TUNISIAN EXPERIENCE

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**Introduction and Objectives:** The making of a vascular access is the main step allowing an adequate hemodialysis and in good conditions. In this context the tunneled catheter (KTT) may be an alternative.

We propose to evaluate the indications of placement of KTT, identify complications related to the use of KTT and contributing factors, assess the survival and performance of the technique and propose recommendations for the indications and the use KTT.

**Material and Methods:** We conducted a retrospective study on 52 cases of KTT placed at 49 patients collected in the Nephrology Dialysis service and Kidney Transplantation Rabta, Tunis between 2008 and 2011.

**Results:** The mean age of patients was 55.58 years  $\pm$  13.5 years. Our population included 29 women and 23 men. Among our patients, 34.6% were diabetic, 46.2% had hypertension and 21.2% had underlying heart disease. The glomerular nephropathy was the most frequent with 55.2%. The average hemodialysis duration was 1111.35 days or 37 months. The most common indication of KTT was the absence of arteriovenous fistula (AVF) in 65.4% of cases, other indications were: poor survival, depletion of the venous capital, mediocalcosis and immunosuppression in respectively, 30.7%, 34.6%, 34.6% and 36.5%. The right internal jugular vein was the insertion site of choice with 78.8%. The posterior approach was the way of choice used in 88.5%. The overall incidence of immediate complications was 19.2%. The mean blood flow rate was 294 ml/min, the mean PRU was 69.57% and the Kt/V average was 1.49. 31.4% among our patients had a dysfunction. Hemodialysis period represent the dysfunction risk factor of KTT the most important ( $p = 0.006$ ). In our patients 29% had an infectious complication. The mean time to onset of infection was 190.83 days. Staphylococcus was isolated in 40% of cases. No infectious risk factors have been objectified in the study. The mean duration of use of KT was 238 days. The only single factor determining the survival of KTT was the number of KTT put at the same patient.

**Conclusions:** More than a quarter of the population is on dialysis through a catheter. Despite concerted efforts, much remains to be done in making time for a permanent vascular access. The KTT represents an interesting alternative in the meantime ensuring good hemodialysis, despite a higher risk of dysfunction and especially of infection.

## 30

### REDUCED MANIPULATION OF HAEMODIALYSIS CATHETER PREVENTS INFECTION OF EXIT SITE

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**Introduction and Objectives:** Haemodialysis (HD) catheters use increases bacteremia risk (2.5-5.5 episodes/1000 catheter-days) and morbi-mortality in the elderly population undergoing HD. HD catheter (HDC) related-infection comes from two sources: germs migration from the skin through the exit-site (ES) or direct biofilm transluminal colonization. Preventing of infection related to HDC is priority. Adequacy HD Guidelines (K/DOQI, 2006) recommend: develop written care plans for ES disinfection, handling and dressing after each session and hand hygiene, use of gloves and masks by professionals and patients.

The aim of the study is to evaluate a protocol for the ES dressing and handling of HDC, and its effect on preventing ES infection and associated bacteremia.

**Material and Methods:** Cohort study was conducted with stable HD patients carrying both tunnelled (TC) and non-tunnelled catheter (nTC) during nine months (04/2014 to 12/2014). Two dressing methods were done: handling/dressing for each session (daily dressing: DD), performed to nTC or TC and, handling/weekly dressing (WD) for TC, using transparent and semipermeable dressing pad which allows to observe the state of the ES. ES were classified according to their characteristics: GOOD: intact dry skin; QUESTIONABLE: intact but not dry or slightly reddened skin and INFECTED: swollen and oozing. Manipulation for any reason must include: hand hygiene, gloves and mask (patient too).

**Results:** 31 catheters (22 tunnelled, 71%) in 18 patients (17 men, 54.8%); 10 (55.6%) used >1 catheter (1.7/patient). Location: right internal jugular (TC, 61.3%) and right femoral (nTC, 25.8%). We study 1696 HD sessions (94.2 sessions/patient) for 270 days. The table shows ES status frequencies and type of dressing performed.

138 sessions (8.1%) change from DD to WD due to existence of blood remnants (47.8%). 155 extra WD (9.1%) for presence of wet/unstuck dressing pad. Exudate in 20 sessions (1.17%) with 12 negative microbiological outcomes (61.1%). 5 sessions ES INFECTED (incidence 0.22 episodes/catheter-year). One episode of bacteremia with infected ES and removal of TC (0.12 episodes/1000 catheter-days).

**Conclusions:** 1) Classifying ES status is a good tool to unify criteria among professionals. 2) Establishing care plan of handling/dressing HD catheters prevents onset of infection and episodes of ES bacteremia.

TABLE 1

	Dressing type		
	Daily	Weekly	Total
nTC	221 (100%)	0 (-)	221
TC	127 (36, 4%)	504 (63, 6%)	531
	ES state		
	Good	Questionable	Infected
Good	285 (36, 3%)	501 (63, 7%)	786
Questionable	58 (95, 1%)	3 (4, 9%)	61
Infected	5 (100%)	0 (-)	5
$J^2 = 88,3, p < 0,0001$			

## 31

### POST-INSERTION ASSESSMENT AND FOLLOW-UP PROGRAMME OF TUNNELED CENTRAL VENOUS CATHETERS IN 2013, THE FIRST RESULTS

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**Introduction and Objectives:** It is well known that tunneled central venous catheters (tCVCs) are considered inferior to dialysis shunts. Despite this, in the last years the use of the tCVCs as a long term catheter access is increasing. Reasons vary – the population on dialysis is getting older and their comorbidities are often contraindication to a shunt construction, late referrals do not enable construction of a permanent subcutaneous access, and there is also a group of patients who decline the shunt because they are afraid of pain during its cannulations. Because of this increase on tCVC use we think it is time to set up a systematic assessment and follow-up programme for this kind of vascular access.

**Material and Methods:** We measured the blood flow at pre-pump pressure -250 mmHg during the first dialysis session after the catheter's placement in all tCVCs that we inserted in 2013 and then we followed up the catheters till 31st Oct 2014. We recorded patients' characteristics, the site of placement, complications during the implantation, possible later dysfunction and the reasons of extraction. Using the data collected during the above specific period, the Kaplan-Meier of survival of the tCVCs was calculated.

**Results:** In 2013, altogether, 116 tCVCs were inserted in 112 patients (mean age of was 67,2  $\pm$  12,9 years, 54% men, 46% women, 47% of patients were





diabetics). Majority of the tCVCs (88%) were placed in the right internal jugular vein. During the first dialysis session 68% tCVCs provided blood flow of minimally 300 ml/min with "normal" tubes connection, 16% tCVCs provided blood flow of minimally 300 ml/min with "reversed" lines, 8% tCVCs could not reach the blood flow 300 ml/min. The follow-up revealed that 34% tCVCs were extracted with the main reason being a development of a mature shunt. Mean time from the placement of the tCVC till the extraction for the mature shunt was 139 days. Just the minority of extractions was due to complications with tCVCs. There were no serious complications during tCVCs' insertions. The Kaplan-Meier curve of tCVCs' survival is shown below.

**Conclusions:** Our observational programme showed a good survival of tCVCs, low incidence of infection complications and quite low incidence of low blood flow and other mechanical problems with catheters. All in all, our observations gathered a lot of important data, that will be used to improve both our tCVCs implantation programme and the post-insertion care in long-term perspective.

### 32

#### INFECTIOUS COMPLICATIONS RELATED TO CENTRAL VENOUS HEMODIALYSIS (HD) CATHETERS

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**Introduction and Objectives:** Many patients with end stage renal disease are dialyzed using a central venous catheter (CVC). Late referrals for creating permanent AV access as well as thrombosis of AV fistula or graft are some of the reasons for placing CVC's. The quality of life of these patients is significantly lower than in patients with AV fistula due to a number of complications, particularly infections. The aim of our retrospective study was to investigate the incidence and risk factors for bloodstream infection (BSI) among patients with a double-lumen CVC for HD and to identify the microorganisms isolated from the bloodstream.

**Material and Methods:** From January 2007 to December 2011, 829 CVCs were inserted in 476 patients (588 in males, 241 in females). The most CVCs were placed in the right jugular vein - a total of 578 catheters (69.7%), followed by 168 in the femoral (20.3%) and 83 in the subclavian vein (10%). There were 32614 catheter-days. Catheter BSI was determined on the following criteria: positive blood cultures, clinical and laboratory signs of systemic infection and exclusion of other causes of bacteremia.

**Results:** During the five-year follow-up, we identified 114 catheter associated BSI. The overall rate of infection was 3.49 per 1000 catheter days. For jugular CVC, infection rate was 2.96/1000 catheter days, subclavian CVCs 3.27/1000 catheter days and for femoral CVC 4.7/1000 catheter days. As expected, the most commonly isolated microorganisms were Gram-positive cocci (72.4%), particularly *Staphylococcus epidermidis* (49.6%) and *Staphylococcus aureus* (34.2%). Among the gram negative bacteria, *Pseudomonas aeruginosa*, *Escherichia coli*, *Klebsiella pneumoniae* and *Proteus mirabilis* accounted for 27.6% of the isolates. There was a strong positive correlation between the rate of infection and the catheter indwell time ( $r = 0.194$ ,  $p < 0.05$ ) but not with the demographic characteristics of the patients. A slightly higher level of infections was noted in right-sided CVC but the difference had no statistical significance. Blood cultures verified that the Gram-negative bacteria (85%) were the most susceptible to meropenem and Gram-positive bacteria (95%) to vancomycin. Infections were treated with a three-week course of antibiotic therapy. Regarding outcome, there were 11 deaths from sepsis during the course of treatment.

**Conclusions:** There is a moderate incidence of the catheter related BSI in our facility. The greatest risk for infection represents the length of the catheter use. The most common pathogens are gram-positive bacteria which direct the initial empiric antibiotic therapy to vancomycin.

### 33

#### HEMODIALYSIS TUNNELED CENTRAL VENOUS CATHETERS: FIVE YEARS SINGLE CENTER EXPERIENCE

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**Introduction and Objectives:** Tunneled central venous catheters used for hemodialysis (THC), are a common cause of complications. Catheter malfunction

secondary to thrombosis or malposition of the catheter, and catheter-related bloodstream infections (CRBI) are common occurrences.

**Material and Methods:** We looked at the outcome of a group of 170 patients (pts) receiving chronic HD treatment via a tunneled-cuffed catheters during the 5-year period. Criteria for catheter removal were (1) persistent bloodstream infection (2) catheter dysfunction. Event rates were calculated per 1,000 catheter days, and Kaplan Meier analysis was estimated for THC cumulative survival.

**Results:** 262 THC were included in the analysis and were grouped by insertion site of the catheter: (TFC)  $n = 135$ ; (TJC)  $n = 59$ , (TSC)  $n = 68$ . Duration time of THC, average 129-429 days (median -TFC = 149, TJC = 310 TSC = 365). Mostly of THC were removed because of malfunction 44% of TFC, 47% of TJC and 60% of TSC. Infection rate were: TFC -0.64 episodes/1000 catheter days; TJC -0.45 and TSC -0.19. 27 catheters had 56 episodes of CRBI and they were successfully treated with antibiotics (systemically and antibiotic "lock" therapy) without the need for catheter removal. The most common isolated microorganisms were Gram-positive. Antibiotic therapy was statistically significant for catheters survival in group with TSC. Risk factors were most likely to result in colonization or infection with multiresistant species: advanced age (odds ratio [OR], 1.2 to 14.1); prolonged hospital stay (OR, 1.3 to 17.5); and exposure to broad-spectrum antimicrobial drugs (OR, 1.6 to 25.1). Statistically significant difference was found between the groups in terms of previously placed catheters ( $p = 0.000$ ), and the number of previously thrombosed AVF ( $p = 0.0017^*$ ).

**Conclusions:** Our data showed a high survival rate of THC in pts undergoing HD, with low incidence of CRBI. Tunneled femoral catheters have shorter duration time compared to jugular and subclavian catheters but they can be an option for hemodialysis, because the percentage of complications in this group was not high, and sometimes they are placed in pts whom other VA modalities were unavailable or failed. Careful application of standard protocols and well educated dialysis staff contributed to achieve this results.

### 34

#### RETROSPECTIVE EVALUATION OF HEMODIALYSIS CATHETERS PLACED IN EMERGENCY IN A RENAL WARD

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**Introduction and Objectives:** The central hemodialysis catheters are a must in a vascular emergency dialysis context or in cases of acute renal failure (ARF), or in end-stage chronic kidney (IRCT) without permanent vascular access. These catheters expose these patients to an infectious and thrombotic risk. The aim of our study was to evaluate the impact of the use of temporary central venous catheters in our patients, and the most common complications that arise, including infectious and thrombotic. To allow our practices with European and American best practice recommendations of vascular access.

**Material and Methods:** From January 2012 to December 2012, 203 patients have benefited from the introduction of central catheters in hemodialysis Nephrology. We conducted this study to evaluate the indications of the catheter, the site, the number and evolution, in these patients.

**Results:** Of 203 patients included in our study, 99 women and 104 men is a sex ratio of 1.05. The mean age of patients was 38.8 years (4.5 - 82 ans). The indication for catheter in 141 patients was the IRA while 62 patients were admitted IRCT 75% for the initiation of hemodialysis and 25% admitted with vascular dysfunction.

The total number of catheters was 229, an average of 1.12 catheter/patients, 66% were femoral (85% right and 15% left), and 34% jugular rights.

The catheters were in place for a period of 1 to 23 days with an average duration of 5.6 days/patient in the IRA, and from 1 to 36 days with an average duration of 3, 6 day/patient for ESRD.

The establishment of a second catheter was indicated in 13% before the onset of complications such as: infection in 51%, 19% and thrombosis dysfunction in 23%.

The catheters were removed, in the IRA patients after improvement of renal function in 76% of cases or death in 31%.

The catheters were removed, among ESRD patients before transferring to another center hemodialysis in 66% after catheterization tunneled in 16%, ahead of peritoneal dialysis withdrawal in 1.6% or in cases of death in 17%.

**Conclusions:** The severity of complications of CVC, especially infectious and thrombotic we encourage perform in a second step a prospective study of the putting in CVC requirements, and its complications in order to give our vascular practices to those of good practice recommendations access.

## 35

# **SERRATIA MARCESCENS BACTERAEMIA IN HEMODIALYSIS PATIENTS WITH TUNNELLED CATHETERS DUE TO COLONIZATION OF ANTISEPTIC SOLUTION**

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**Introduction and Objectives:** The application of antiseptic solution for handling tunnelled catheters is recommended in patients undergoing haemodialysis. These catheters have less risk of infection compared to non-tunnelled. Routine antiseptic procedures in handling catheters are crucial to avoid complications. We report an outbreak of *Serratia marcescens* bacteraemia in our haemodialysis unit.

**Material and Methods:** The first case of bacteraemia related to *Serratia m.* was detected in December 2014, in less than 24 hours another case with the same germ was detected in our Unit. A probable epidemiological outbreak was suspected. A screening of all risk patients (carriers of catheters, graft or button-hole technique) was conducted.

**Results:** Six cases of bacteraemia related to *Serratia m.* were identified. All cases had tunnelled catheters; in five cases the clinical picture was similar with fever and hypotension during the dialysis session. In one case the presentation was asymptomatic and was detected by blood cultures. Pericatheter exudates cultures were negative. The attack rate was 31.6% (6 of 19 patients with catheters). The mean age of affected patients was 73 ± 9 years. The mean time on dialysis of affected patients was 36 ± 28 months (median 31 months, range: 83-7 months), the median time of catheter implantation was 31 ± 27 (median 25 months, range: 83-7). All patients with grafts or button-hole technique showed negative blood cultures. Gentamicin intravenous doses (1 mg/kg/day) with catheter lock solution with ciprofloxacin post-dialysis were administered for 3 weeks. After the treatment the patients were asymptomatic and new episodes were not evidenced. No major complications were observed. Control blood cultures after antibiotic therapy were negative. 48 hours after the detection of the outbreak the health authorities reported the presence of lots of antiseptic (chlorhexidine 0.5% and 5%) colonized by *Serratia m.* This fact was considered the source of contagion and new cases were not observed after the removal of the antiseptic.

**Conclusions:** The presence of bacteraemia due to unconventional germs should warn us and an investigation is mandatory. The manipulation of catheters is the main route of bacteraemia in these patients. To be a carrier of dialysis catheter increases the risk of complications and supports all efforts to reduce their number in haemodialysis units.

## 36

# **OPTIMIZED CATHETER-RELATED BACTEREMIA IN DIALYSIS: 6-YEAR PROSPECTIVE STUDY USING ONLY UNIVERSAL MEASURES**

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**Introduction and Objectives:** Catheter related bacteraemia in tunneled catheters (CRB) causes high mobility and mortality in patients in chronic hemodialysis programs. It has been suggested that catheter locks using antibiotics reduce the incidence of CRB after clinical trials, but on the control group of these studies is showed high rates of CRB, which creates controversial discussion. The aim of the current study is to prove the effectiveness of universal asepsis measures to obtain an optimum CRB rate in a long-term study in one centre.

**Material and Methods:** Design: Prospective cohorts study, single centre  
Follow up time: 6 years (2008-2013)

Tunneled catheters: Optiflow, Hemostar, Hemosplit, Equistream (Bard Access Systems, New Jersey, USA) and Palindrome (Covidien, Mansfield, Massachusetts, USA)

Analysed days/catheter: 107,420

Catheter placement: US and radiology by an interventional radiologist

Follow up: Chronic hemodialysis hospital unit. Nurses and nephrologists.

Universal asepsis measures.

Heparin lock.

CRB is considered present either when blood culture is positive and once another catheter-related focus has been ruled out, or when there is negative blood culture only related to the catheter. All available samples were analyzed when bacteraemia was discovered: blood, sputum, urine, faeces, pleural liquid, peritoneal liquid, cephalorquidic liquid, exudates, etc and the results. BRC rate is assessed × 1000 days/catheter.

Database: NephroCloud®

Results

CRB 2008 to 2013: 0.57, 0.47, 0.31, 0.1, 0.43 and 0.37 respectively.

**Results:** The catheters being assessed, the follow up days and catheter-related bacteraemia were analysed, the germ was classified and treatment given: medical vs catheter withdrawal.

**Conclusions:** Only universal measures, without using antibiotic lock or anticoagulants other than heparin, can achieve an optimum rate of catheter-related bacteraemia, which is cost effective and prevents possible resistance to antibiotics and side effects of other anticoagulant drugs.

## 37

# **INFLUENCE OF VASCULAR ACCESS TYPE ON KEY CLINICAL AND LABORATORY PARAMETERS IN CHRONIC HAEMODIALYSIS PATIENTS**

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**Introduction and Objectives:** Vascular access is considered one of the most important factors that determine the success of chronic hemodialysis programmes. This study compares clinical measures of adequacy, anemia, nutrition and inflammation in prevalent hemodialysis patients by access type.

**Material and Methods:** We retrospectively studied patients at two outpatient dialysis centres during 13 months (November 2013-November 2014) to determine the influence of vascular access in adequacy, anemia, nutrition and inflammatory markers.

**Results:** 103 of 204 patients were included – 66 fistulas, 9 grafts and 28 central venous catheters (CVC).

On univariate analysis, CVC patients were older and graft patients were younger. Fistula patients had the lowest admission rate. In a multivariate analysis, graft and fistula patients presented significantly higher albumin levels compared with those dialysed with a CVC ( $p < 0.01$ ). Hemoglobin, C-reactive protein (CRP), spKt/v, recombinant human erythropoietin (EPO) and iron supplementation doses did not differ ( $p > 0.01$ ) between groups.

After adjustment for significant factors on the studied clinical outcome measures, the results showed that hemoglobin is higher in patients with higher albumin levels and is lower in patients with higher ferritin levels.

In a multivariate analysis by logistic regression, only serum albumin was a predictor of requirement of higher EPO doses. The variables considered were gender, age, serum albumin and type of vascular access.

**Conclusions:** Outcomes were similar between the three groups except serum albumin, which was significantly higher in patients with fistulas and grafts. Considering the identical levels of CRP between the three groups, we believe higher serum albumin may have been the result of a better overall health status in graft and fistula patients. However, a prospective study using high-sensitivity assays for CRP and other serological markers of inflammation like IL-6 and TNF- $\alpha$  is needed to better elucidate the impact of vascular access on inflammatory status in dialysis patients.

Serum albumin might be an important predictor of both baseline hemoglobin and EPO sensitivity in chronic hemodialysis patients. Understanding factors that impact serum albumin concentration may improve our ability to alter the natural history of outcomes.

## OTHER

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# INVESTIGATING THE INFLUENCE OF HEMODYNAMICS ON VASCULAR REMODELLING OF AN ARTERIOVENOUS FISTULA USING COMPUTATIONAL FLUID DYNAMICS

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**Introduction and Objectives:** The creation of an arteriovenous fistula offers a unique example of vascular remodelling and adaption. Yet, the specific factors which elicit remodelling events which determine successful maturation have not been unambiguously determined. Computational fluid dynamics (CFD) is increasingly been employed to investigate the interaction between local hemodynamics and remodelling and can potentially be used to assist in clinical risk assessment of maturation or failure. The accuracy of these simulations are reliant on in-vivo measurements of flow and pressure and these models will only be deemed relevant if they can replicate these conditions and important phenomena of the flow field. The objectives of this study were to (i) demonstrate numerical simulations are capable of estimating the hemodynamics of an arteriovenous fistula and (ii) assess the influence of these parameters on vascular remodelling.

**Material and Methods:** Two patients referred for fistula creation were recruited under institutional review board approval. Direct in-vivo measurements of the pressure distribution within the arterial and venous segment were acquired and were used as a benchmark for numerical simulations to replicate. A structured hexahedral mesh of a representative fistula model was generated and a CFD analysis was conducted utilising Star CCM+ (CD Adapco).

Following this a published case assessing remodelling of a brachiocephalic fistula was considered to assess the influence of hemodynamic parameters on remodelling. The lumen geometry was reconstructed for each longitudinal time point and a CFD analysis was conducted. Distributions of spatial, temporal and cyclic gradients of wall shear stress were assessed for each time point and were qualitatively compared against a region which developed a constriction.

**Results:** A favourable comparison was observed between the pressure distribution of the in-situ and in-vivo cases. A large pressure drop across the anastomosis was observed in both cases with a difference of 10.45% between the cases. For the reconstructed brachiocephalic case, outward remodelling coincided with a reduction in shear stress over time. Regions of low shear stress were absent in an area which developed a constriction instead metrics identifying regions of flow reversal and temporal gradients of shear were found to qualitatively overlap with this region.

**Conclusions:** Numerical models are capable of demonstrating important flow features of an arteriovenous fistula and can be used to assess variations amongst hemodynamic parameters and subsequent lumen changes that occur during maturation. Identifying factors which dictate remodelling will help toward developing an effective treatment or strategy to promote maturation and aid fistula patency.

## QUALITY INDICATORS

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# ARE EARLY CANNULATION ARTERIOVENOUS GRAFTS (ECAVG) A VIABLE ALTERNATIVE TO TUNNELED CENTRAL VENOUS CATHETERS (TCVCs)?: AN OBSERVATIONAL "VIRTUAL STUDY" AND HEALTH ECONOMIC ANALYSIS

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**Introduction and Objectives:** Early cannulation arteriovenous grafts (ecAVG) are advocated as a alternative to tunneled central venous catheters (TCVCs). A real-time observational "virtual study" was performed to evaluate a strat-

egy of ecAVG as a replacement to TCVC as a bridge to definitive access creation.

**Material and Methods:** Data on complications and access-related bed days were collected prospectively for all TCVCs inserted over a six-month period (n = 101). The feasibility and acceptability of an alternative strategy of ecAVGs was also evaluated. All patients were followed-up for 6 months. Health economic analysis comparing the two strategies was performed using observed figures from the TCVC cohort and previously published complication rates of ecAVGs. Autologous access in the form of native fistula was the goal wherever possible.

**Results:** 24.7% (n = 35) of TCVCs developed significant complications (including 17 culture-proven bacteremia and one death from line sepsis). Patients spent an average of 11.9 days/patient/year in hospital as a result of access related complications and wait for TCVC insertion delayed discharge in 35 patients (median: 6 days). ecAVG were a practical and acceptable alternative to TCVCs in over 80% of patients. Over a 6 month period, total treatment costs per patient were £5,882 in the TCVC strategy and £4,954 in the ecAVG strategy, delivering potential savings of £927 per patient. Although ecAVGs had higher procedure and re-intervention costs reflecting longer procedure time and device costs (£3,014 vs. £1,836), these were offset by significant reductions in septicaemia treatment costs (£1,322 vs. £2,176) and in-patient waiting time bed costs (£619 vs £1,870).

**Conclusions:** Adopting ecAVGs as an alternative to TCVCs in patients requiring immediate access for haemodialysis may provide better individual patient care and deliver cost savings to the hospital.

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# REDUCING SURGEON RADIATION EXPOSURE DURING DIALYSIS ACCESS ANGIOPLASTY

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**Introduction and Objectives:** Dialysis access angioplasty is performed with the surgeon positioned close to the X-ray tube, creating a risk of exposure to radiation exceeding recommended dose limits. Therefore, we evaluated surgeon exposure to radiation during dialysis access angioplasty. We also investigated reductions in radiation exposure when surgeons were positioned further away from the X-ray tube and while using a cover, and when they left the angiography room during digital subtraction angiography (DSA).

**Material and Methods:** We measured fluoroscopy time, number of contrast frames, overall exposure dose and surgeon radiation exposure for 61 dialysis access angiography procedures performed at our hospital. The equipment was a PHILIPS Allura Xper FD20/20 X-ray machine. Surgeon radiation exposure was measured using an Aloka PDM-117 portable X-ray dosimeter. Surgeon radiation exposure levels were measured at two positions: (1) directly next to the X-ray tube, and (2) one meter away from the X-ray tube under the cover of a protective board. We also separately measured the radiation doses for fluoroscopy alone at (1) and (2) to determine if there was a reduction in radiation exposure if the surgeon left the room during DSA.

**Results:** We found that during dialysis access angioplasty, X-ray fluoroscopy time was 33 (21-80) seconds, the number of contrast frames was 51 (42-89) and the overall exposure dose was 6,906 (3,681-13,684) mGy/cm<sup>2</sup>. Surgeon radiation exposure decreased significantly from 96 (59-201) µSv at (1) to 14 (6-32) µSv at (2) (p<0.001). Surgeon radiation exposure during fluoroscopy alone was significantly reduced at both (1) (4 (2-9) µSv) and at (2) (0 (0-1) µSv) (p<0.001).

**Conclusions:** Performing dialysis access angioplasty 18 times per month with the surgeon directly next to the X-ray tube and present during both fluoroscopy and DSA would lead to a total level of exposure to radiation exceeding the radiation dose limit (100 mSv/5 years) recommended by the International Commission on Radiological Protection (ICRP). However, the level of radiation exposure is significantly reduced if the surgeon is positioned further from the X-ray tube, uses a cover and leaves the angiography room during imaging.



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**ASSESSING UK TRENDS IN VASCULAR ACCESS IMAGING FOR HAEMODIALYSIS PATIENTS – RESULTS FROM REDVASQI**

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**Introduction and Objectives:** This study carried out by the Renal Dialysis Vascular Access (ReDVA) consortium aimed to explore variance of UK tertiary centres practice on imaging and intervention of arteriovenous fistulas for haemodialysis and identify areas needing research.

**Material and Methods:** An online questionnaire survey was designed to assess practice trends of preoperative and postoperative imaging, surveillance, intervention and management. This was piloted prior to an approved final version. Large tertiary centres were identified through the UK Renal Registry and contacted for participation. Results were qualitatively analysed. Respondents' predisposition towards highly negative or positive opinions was explored.

**Results:** Fifty UK tertiary centres met the inclusion criteria. Response rate was 24%. Respondents had a mean number of 355 haemodialysis patients (95% CI +/-189) and 4.25 satellite units (95% CI +/-1.5) under their supervision. Responses showed high adherence to guidelines for preoperative mapping (96%) and imaging of central veins (93%). A weighted 20% mentioned structured surveillance, and 55% used assisted maturation techniques. 58% use imaging with clinical examination for maturation assessment. 83% mentioned standard balloon angioplasty as preferred primary intervention for cephalic arch stenosis. A weighted 70% use magnetic resonance imaging, with ~25% were aware of the contrast agent used and had previously encountered nephrogenic systemic fibrosis. Majority of respondents were found clustering within the plotted 95% confidence interval area - neither a highly negative or positive opinion tendency ( $R^2 = 0.6$ ).

**Conclusions:** Where the guidelines did not have recommendations or only made opinions (poor or conflicting evidence base), there was greater variance in practice trends. Some respondents did show highly positive or negative opinion tendencies. Paucity of evidence base likely plays a role in this. Low response rate did not allow for a subgroup analysis, but areas that require further research were identified. Clarification of the evidence base can help formulate practice recommendations and reduce variability in practice.

## 42

**SYSTEMATIC REVIEW AND META-ANALYSIS OF VASCULAR ACCESS OUTCOMES IN ELDERLY PATIENTS**

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**Introduction and Objectives:** The age structure of the end-stage renal disease (ESRD) population has changed considerably over the past 20 years with an increasing proportion of older patients (>75 years) receiving dialysis. The significant increase in the number of elderly dialysis patients and the unique challenges they represent for vascular access provision are poorly reflected in guidelines regarding vascular access formation. The last systematic review of vascular outcomes in elderly patients was published in 2007 and since then a number of studies have been published on this important issue. We sought to review the current literature and update the meta-analysis.

**Material and Methods:** Searches of Pubmed, Medline, Embase and the Cochrane Library were performed using the following a combination of the following search terms: brachiocephalic fistula, radiocephalic fistula, snuff box fistula, arteriovenous fistula, vascular access with elderly to identify articles published before 31 December 2014 in English, dealing primarily with the creation of dialysis access for elderly patients. In addition, the references cited in selected articles were reviewed for any further relevant available studies. Elderly was defined as anyone aged over 60. The primary outcomes

for this study were primary and secondary patency rates at 12 months. Secondary outcomes were for patency rates of elbow and wrist fistulas.

**Results:** Overall primary and secondary vascular access patency rates for elderly patients were 53.6 (47.3-59.9%) and 71.6% (59.2-82.7%) respectively. A statistically significant higher primary patency rate (OR 0.72, 0.55-0.93) and secondary patency rate (OR 0.76, 0.58-1.00) was observed for brachiocephalic AVF.

**Conclusions:** These results support previously reported meta-analyses stating that brachiocephalic fistula have higher primary and secondary patency rates. The lower overall primary patency rates in elderly patients supports the premise that these differences should be considered when planning vascular access for elderly patients.

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**PREDICTION OF DIALYSIS GRAFTS LONG-TERM PATENCY**

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**Introduction and Objectives:** Dysfunction and loss of patency of dialysis arteriovenous grafts (AVG) are a serious cause of dialysed patients morbidity. Various risk factors associated with shorter AVG patency have been suspected by some authors, but the results were controversial. The aim of this study was to assess if affiliated diseases, biochemical markers and other parameters of arteriovenous grafts (AVGs) influence their patency in a large Vascular Access Centre.

**Material and Methods:** We conducted a retrospective study that included patients, who underwent creation of AVG in our institution and that were patent for at least 3 weeks after AVG creation. We included the following variables into the analysis: comorbidities (ischemic heart disease, diabetes mellitus, chronic heart failure, arterial hypertension, hyperlipidemia), smoking status, drug use (beta blockers, ACE inhibitors, statins), basic laboratory values (platelet count, haemoglobin level, fibrinogen, cholesterol and triglycerides) and graft characteristics (feeding artery, shape of the graft). The data was assessed using log-rank (Cox-Mantel) test. The differences were shown using Kaplan-Meier graphs. The data was assessed for 1000 days of observation.

**Results:** Overall 338 patients were included in the study. For the observation period, significantly higher risk of access failure was associated with presence of ischemic heart disease (p-value 0,0035). Higher levels of blood cholesterol levels were associated with longer survival of the graft in 1000 days surveillance (with p-value 0,04). Lower fibrinogen blood levels showed association with shorter survival with borderline significance (p-value 0,0516).

**Conclusions:** Ischemic heart disease negatively influences the cumulative patency of vascular access. Higher cholesterol blood levels are associated with lower AVG failure risk in 1000 days period, which probably corresponds to the worse disease status of the lower cholesterol patients.

## 44

**HEMODIALYSIS QUALITY IN PATIENTS WITH TUNNELED CENTRAL VENOUS CATHETERS IN THE FIRST YEAR**

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**Introduction and Objectives:** Older age, diabetic and hypertensive complications in the majority of patients on the hemodialysis limited possibility of creation well functioned arteriovenous fistula (AVF) which is the main reason for higher prevalence of using tunneled central venous catheters (CVC).

**Material and Methods:** In this prospective trial perform from January 2013 to January 2014 we observed 42 patients on the hemodialysis: 25 (60%) with AVF and 17 (40%) with CVC inserted within one year before observation started. Average age of patients with AVF were 68,1 year and they spent 5,3 years on the hemodialysis before observation. Patients with CVC spent 3,3 years on the hemodialysis before observation with average age of 67,3 years. Diabetic patients were represented in both groups: 7 (28%) in AVF and 6 (35%) in CVK, there were 8 (32%) hypertensive patients in AVF, and 4 (24%) in CVK group. In both groups were estimated Kt/V, hemoglobin levels, C-reactive protein (CRP) and albumin in 5 consecutive measurements every 3 months. Differences between two groups were estimated by t-test.





**Results:** Patients with created AVF had Kt/V 1.6 in the beginning of study and 1.4 in the end, while the patients with CVC had Kt/V 1.4 in the beginning and 1.2 in the end of the study which was significant difference ( $p = 0.008$ ) between two groups. Anemia status expressed by hemoglobin levels were little lower than recommended target levels; in the both groups 107 g/L. Inflammatory status was estimated by CRP levels: 7.6 (mg/L) in AVF and 10.6 in CVC group. Nutritional status was estimated by albumin levels: 26 (g/L) in AVF and 25.8 in CVC group. There was no difference in the anemia, inflammatory and nutritional status. There was no infectious episodes and dysfunction of CVK.

**Conclusions:** CVCs are more and more used for vascular access in the hemodialysis patients when other forms of vascular access are not available. This study confirm satisfactory adequacy of dialysis via this form of vascular access in the first years after insertion but still inferior than AVF, so it can be used as alternative vascular access only when creation of AVF is not possible.

#### 45

##### STUDY ON PERIPHERAL CIRCULATORY MOVEMENT OF CHRONIC RENAL FAILURE PATIENTS' LIMBS WITH ARTERIOVENOUS FISTULA

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**Introduction and Objectives:** Chronic renal failure patients on hemodialysis need to have good vascular access. Forming a arteriovenous fistula (AVF) affects peripheral circulation. This time, we used "peripheral capillary observation unit M320" (produced by JMC Corporation, Japan; [http://homepage2.nifty.com/JMC\\_u-rois/index\\_E.html](http://homepage2.nifty.com/JMC_u-rois/index_E.html)), observed capillary of nail root parts and examined peripheral circulation with a fine particle analyzer.

We measured the peripheral circulation of chronic renal failure patients' limbs with AVF and those without AVF, and studied the effects.

**Material and Methods:** We observed 17 chronic renal failure patients (11 males and 6 females, average age  $63.2 \pm 10.4$  years old). Their primary illnesses are diabetic nephropathy (7 patients), IgA nephropathy (2 patients), nephrosclerosis (2 patients), rapidly progressive glomerulonephritis, glomerulonephritis (1 patient) and unknown (3 patients). We compared the AVF limbs of chronic renal failure patients and their limbs without AVF, measuring peripheral blood flow and peripheral blood velocity. We used Medix Ver.3.0 (blood flow velocity analysis software: JMC Corporation, Japan) as a fine particle analyzer and analyzed the blood flow rate, blood vessel diameter and blood stream.

**Results:** The average peripheral blood flow of limbs with AVF was  $13656 \pm 6921 \mu\text{m}^3/\text{sec}$ , and that of limbs without AVF was  $11395 \pm 5337 \mu\text{m}^3/\text{sec}$ . There was not a significant difference. However, the average peripheral blood velocity of limbs with AVF was  $106.9 \pm 20.7 \mu\text{m}/\text{sec}$ , whereas that of limbs without AVF was  $92.1 \pm 24 \mu\text{m}/\text{sec}$ . There was a significant difference.

**Conclusions:** We had been concerned about peripheral blood flow declining. However, according to the result of this time, there was not a significant difference of blood flow. Instead, the peripheral blood velocity of limbs with AVF was faster than that of limbs without AVF. This information was obtained because we have come to observe peripheral blood flow easily. We would like to study if we can apply this way when we examine AVF failure and examine steal syndrome in the future.

#### 46

##### ON THE MATTER OF SELECTION OF VENOUS ACCESS SYSTEMS AND PROFESSIONALS INVOLVED IN THEIR INSTALLATION

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**Introduction and Objectives:** Treatment of cancer is impossible without provided venous access. But who is to make this choice, and who - the direct installation? There must be an integrated approach involving oncologists, surgeons and anesthesiologists.

**Material and Methods:** in 2010 - 2014 year we conducted a training on "Selection and installation of venous access systems" for 150 doctors of different specialties: 71 oncologists (47.4%), 67 anesthesiologists (44.7%), and 12 interventional radiologists (7.9%). The training included workshops in operating theatres with demonstration of a subclavian venous catheters and ports combined with the theoretical course or only theoretical classes. In addition, we analyzed the approaches to provide venous access in 7 oncology clinics of the Russian Federation.

**Results:** the technique was completely mastered only by 11 physicians (7.4%), the majority - interventional radiologists (7 physicians), 31 surgeon and anesthesiologist. In each of the 7 clinics a problem of choice of venous access was not considered. In 4 clinics peripheral veins were used for introduction of chemotherapy. Only after the development of severe complications they began to use subclavian catheters. In 3 clinics subclavian catheters were used from the beginning of treatment. In all clinics inserting a subclavian catheter was a duty of anesthesiologists. Thus in 50% of cases due to the complications associated with the installation and exploitation of the subclavian catheter the course of anti-tumor treatment was interrupted.

**Conclusions:** required a comprehensive and targeted training of doctors directly in the field of venous access, as the doctors of any of the existing specialization do not have all the necessary skills for this. Anesthesiologists have difficulties in cutting and suturing of tissue, surgeons and interventional radiologists - in puncturing blood vessels. In this case, the optimal training of such specialists is to be from interventional radiologists, as most of them do not only possess general surgical skills, but also able to effectively apply the intraoperative fluoroscopy.

## TREATMENT OF COMPLICATIONS

#### 47

##### INITIAL EXPERIENCE WITH A NEW DRUG-ELUTING BALLOON FOR TREATMENT OF CRITICAL STENOSIS IN PROSTHETIC VASCULAR ACCESS

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**Introduction and Objectives:** Vascular access stenoses surveillance and care still represent a critical challenge for physicians and surgeons. Literature has largely underlined how transluminal percutaneous angioplasty (PTA) generally ensures only a limited extension in time patency. Additionally vascular damage produced during PTA accelerates itself neointimal hyperplasia progress. Nevertheless, National Kidney Foundation (NKF) Kidney Disease Outcomes Quality Initiative (KDOQI) Guidelines and Society for Vascular Surgery (SVS) Guidelines recommend prophylactic transluminal angioplasty of all stenoses superior to 50% of vessel diameter. However, literature has considered only marginally use of new device. While, introduction of drug-eluting balloons (DEB) has resulted in an improvement in PTA outcome in many vascular districts, very little is already known about the employment of these new devices in hemodialysis fistula stenoses. Purpose of this preliminary study is to present our single center results about employment of a new Paclitaxel releasing high pressure balloon dilatation catheter [APERTO Over-The-Wire® (OTW), Cardionovum, Bonn].

**Material and Methods:** All critical stenosis of prosthetic vascular access detected during 12 months in 2014 were treated with PTA employing an APERTO OTW® balloon. Recruitment criteria was stenosis superior to 50% of vascular lumen detected during routine ultrasound surveillance or during surgical revision of thrombosed fistula. After discharge clinical evaluation and ultrasound was monthly. In all cases we performed a direct puncture of the graft.

**Results:** We treated 30 stenoses; In 24 cases (80%) a PTA alone has been performed in angiography theatre; in the remaining 6 cases (20%) angiographic control and PTA was done intraoperatively in surgical theater. Treatment was technically successful in all cases. Intraprocedural thrombosis was observed only in one case (3.3%) and patient was immediately treated with surgical thrombectomy. No patient was lost during the follow-up; the mean follow-

up time was  $4.7 \pm 2.1$  months (range, 1 – 7). Mean latency between PTA and cannulation was  $29 \pm 8$  hours. Permanent graft failure was 0% at 6 month. We did not observed local complication. Assisted patency was 100%, 98% and 96.5% at 1, 3 and 6 months, respectively.

**Conclusions:** In our experience the new DEB proved to be safe and effective. Main limitation of present study is the brief follow-up time. However, procedure-related complications were absent and patency rates are superior if compared to standard.

#### 48

##### REPEATED LOW PRESSURE TECHNIQUE

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**Introduction and Objectives:** Unlike intervention therapies for other areas of the body such as the coronary and lower limb arteries, Vascular Access Intervention Therapy (VAIVT) may cause unphysiological flows within the body. If the artery in VAIVT treatment is expanded too much, causing excess unphysiological flow, the body will suppress the flow in an attempt to reduce stress to the heart. In addition, we are also concerned with injuries to the vein intima when it is expanded with balloons. There is a possibility that the thickening of vein intima after VAIVT will be accelerated.

**Material and Methods:** In response, we have changed the way we expand the balloon during VAIVT. In the past, we have expanded the veins using large-sized balloons with high pressures, but now, we are using small-sized balloons with repeated low pressure. We start by inflating the balloon using low pressure, and gradually increase the maximum pressure while repeatedly inflating and deflating the balloon 5 times every 30 seconds. Our goal is not to achieve full expansion at stenosis point, but to keep the access flow rate above 400 ml/min. Hence, we have also changed the balloon from a semi-compliant balloon to a super-non-compliant balloon named Conquest in order to expanding more effectively under low pressure. In this presentation, the cases shown are 41 AVF using Conquest.

**Results:** In conclusion, using our new technique, the average pressure is 8 atm, while the average balloon size is 4.8 mm. The patency rates are 70% at 3 months and 30% at 6 months after VAIVT treatment. In fact, the patency rate was still 100% 50 days after VAIVT had been carried out. This shows that there is no loss in effectiveness when comparing this new method to the previous one. In addition, there have been no cases of ruptured veins because we have been using low pressures.

**Conclusions:** Using this technique, we have managed to avoid side effects that occur due to acute obstruction such as ruptured veins, hematoma and vein spasms. This method of expansion may seem to be more troublesome, but it has the advantages of being effective, safe, and reducing side effects by reducing the stress caused to the heart. We do not want to cause unnecessary stress to the patient's heart outside of hemodialysis. Hence, we recommend this method as a way to maintain a good patency rate while avoiding excessively high flows.

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##### FISTULA LIGATION AND CARDIAC FUNCTION IN KIDNEY TRANSPLANT RECIPIENTS

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**Introduction and Objectives:** Despite improving patients survival following renal transplantation, high rates of cardiovascular morbidity and mortality remain. While symptomatic heart failure is caused by arterio-venous fistulae (AVF), it is still unclear whether a wellfunctioning fistula should be ligated after successful kidney transplantation.

**Material and Methods:** Between 2010 and 2014, kidney transplantation was performed on 220 patients at our department. Among those recipients, 6 patients underwent fistula ligation because of well functioning graft confirmed by protocol biopsies. Serum creatinine level, hemoglobin, blood pressure, echocardiography (ejection fraction, chamber dilation, systolic and diastolic dysfunction, posterior wall thickness, left ventricular (LV) mass and cardiac output), brain natriuretic peptide (BNP) and cardiothoracic ratio (CTR) were analyzed retrospectively before and after AVF ligation. All 6 patients received immunosuppressive therapy and not changed during the study period.

**Results:** The study included five male and one female patients; the mean patient age was  $57.5 \pm 10.7$  years. The mean period from creation of AVF and transplantation was  $1194.2 \pm 1557.9$  days. The mean period from transplantation to AVF ligation was  $1284.8 \pm 1131.9$  days. The mean follow-up period after AVF ligation was  $160.5 \pm 74.9$  days. Serum creatinine was  $1.40 \pm 0.25$ , which decreased significantly to  $1.29 \pm 0.25$  mg/dl before and after AVF ligation ( $p = 0.004$ ). However, no significant differences were observed in hemoglobin, BNP, blood pressure and CTR. In echocardiography, only LV mass decreased from  $198.6 \pm 66.2$  to  $169.7 \pm 49.1$  before and after AVF ligation ( $p = 0.03$ ).

**Conclusions:** AVF ligation performed in a kidney transplant recipient with stable allograft function seemed to have more beneficial effect on graft function as well as cardiac remodeling during short-term follow-up.

#### 50

##### OUTCOMES OF NON-NEEDED AND NEEDED ANEURYSMAL ARTERIOVENOUS FISTULAE

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**Introduction and Objectives:** Aneurysmal autogenous arteriovenous fistulae (AAVF) in renal access patients have been poorly described in the literature. A novel classification based on their morphology was recently described to aid recognition and management. Using this criteria, we assessed the natural history of AAVF in both non-needed and needed population in order to provide prognostic criteria for their management.

**Material and Methods:** Using our database of renal access patients, we performed a subset analysis comparing clinical characteristics and outcomes at 2 years between non-needed and needed AAVF groups, namely: bleeding, patency and thrombosis.

**Results:** Within our original population of 344 AVF followed up to 2 years, we identified 52 (15%) non-needed AVF and 292 (85%) needed AVF. Of the non-needed AVF, 7 were aneurysmal (5 type 1a, 2 type 1b); there were 127 aneurysmal AVF in the needed group (15 type 1a, 4 type 1b, 78 type 2a, 25 type 2b, 5 type 3). A subset analysis comparing AAVF (types 1a and 1b) in the non-needed (7) and needed (19) groups did not show any significant difference in the incidence of bleeding or thrombosis requiring interventions, or functional patency. Statistically significant associations were observed with age and flow rates in terms of aneurysmal development in both the non-needed and needed groups. Younger patients were more likely to develop aneurysmal changes generally and within the non-needed subset group. Aneurysmal AVF also had significantly higher flow rates ( $1669$  vs  $1251$  ml/min,  $p < 0.0001$ ) with the difference persisting in both subsets of non-needle and needed groups.

**Conclusions:** Age and flow rates are factors for developing aneurysmal changes in autogenous AVF. Non-needed AVF that develop aneurysmal changes will invariably be of type 1. Type 1 AAVF in both non-needed and needed populations can be safely monitored as per routine surveillance as these are not at risk of developing significant complications.

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##### THE USE OF TRANSRADIAL ACCESS FOR PERCUTANEOUS INTERVENTION OF DYSFUNCTION ARTERIOVENOUS ACCESS

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**Introduction and Objectives:** Percutaneous radial artery access is a well-established modality for intravascular intervention across a wide variety of specialties and procedures. Interesting, utilizing a transradial approach (TRA) for the percutaneous investigation and intervention of AV access appears to have gone underutilized by many clinicians skilled in the care of grafts and fistulas in favor of direct puncture of the AV access. The advantages to TRA are quite clear; there is a lower risk of bleeding complications, pseudoaneurysms or AV fistulae are uncommon, and there is a minimal need for bed rest or extremity immobilization.

**Material and Methods:** We present a review of the TRA technique and report our experience with 34 cases of TRA for endovascular intervention of dysfunctional AV access.

**Results:** A total of 34 TRA procedures were performed on 20 patients over a 16 month period. Indications for intervention were as follows: suspected venous outflow stenosis (36%); suspected perianastomotic stenosis (21%); thrombosis (18%); poor maturation of fistula (15%); other (9%). Interventions performed



include venous balloon angioplasty ( $n = 16$ ), perianastomotic angioplasty ( $n = 15$ ), percutaneous thrombectomy ( $n = 6$ ), venous stent placement ( $n = 5$ ), and coil embolization ( $n = 2$ ). The procedural success rate was 100%. There were no clinically significant complications, and importantly no clinical evidence of hand ischemia or radial artery occlusion. Case duration as well as radiation exposure as measured by fluoroscopy time are below institutional reference ranges. **Conclusions:** A well-established modality among the interventional community, transradial access for AV fistula and graft intervention is underrepresented. With careful patient selection and technique, TRA can be applied to essentially all indications for AV access intervention and offers a wide range of benefits above traditional direct puncture. Furthermore case duration and radiation exposure are diminished with the adoption of TRA. Limitations based on patient selection and device profile remain; however as this technique is more widely adopted, industry will undoubtedly work to accommodate the shift.

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**TREATMENT AND EVALUATION OF VAIPT-RELATED COMPLICATIONS***Naru Sasagawa*

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**Introduction and Objectives:** Although vascular access (VA) is the lifeline for hemodialysis patients, its complications make it difficult for patients to undergo regular hemodialysis. Our VA specialty hospital accepts patients who have issues with VA from all over Japan, and provides VA intervention therapy (VAIPT) for approximately 3,200 patients annually. In this article, we discuss the causes and treatments of VAIPT-related complications that we have experienced.

**Material and Methods:** This retrospective study was conducted in 3,036 patients who underwent VAIPT at our hospital during the 18-month period from January 2012 to June 2013.

**Results:** Among the 3,036 patients, 30 (0.98%) presented with complications. The mean age was 75.8 years. Among the patients who presented with complications, 14 (46.7%) had diabetes, seven (23.3%) had chronic glomerulonephritis, and three (10.0%) had nephrosclerosis as the primary disease. Complications at the time of sheath insertion included two blood vessel injuries caused by a guide wire (GW), one wrong insertion into an artery, and two hematoma formations at the site of sheath insertion. Complications during VAIPT included one blood vessel injury by GW and 19 blood vessel injuries by balloon. Complications following VAIPT included two hematoma formations following sheath removal and three VA occlusions.

The sites of blood vessel injury included nine anastomosis sites, four forearms, and one blood vessel prosthesis. The balloon sizes used were 5 mm in 13 patients, 6 mm in five patients, and 7 mm in two patients.

Among the 20 patients with blood vessel injury, 11 were healed by low-pressure inflation of the identical balloon, three underwent angioplasty from the outside of the skin, and three underwent stent placement, among whom one underwent stent removal due to rehemorrhage, and this patient was subsequently forced to experience AVF closure. One patient underwent vascular prosthesis replacement, one underwent AVF banding and reconstruction, and one underwent pseudoaneurysm resection and AVF reconstruction.

**Conclusions:** Potential causes of complications related to VAIPT include poor GW maneuver, insufficient GW insertion, poor tracking of GW running course, oversized balloon, pressurizing time, hemostatic method at the time of sheath removal, and duration of procedures. These causes of complications tended to be found with part-time doctors.

The end-to-side anastomosis in arteriovenous fistula, which requires large exfoliated areas, caused blood vessel injury by venous fibrotic adhesion in many cases. Therefore, smaller balloons should have been selected.

Surgeons lacking experience should conduct VAIPT with experienced surgeons.

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**PERMANENT CENTRAL VENOUS CATHETERS. STRATEGIES IN DIFFICULT PROCEDURES**

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**Introduction and Objectives:** To present our experience in permanent central venous catheters (PCVC): tunnelled catheters for dialysis and catheters

with implanted port placed in our institution, describing our complications and alternatives in difficult accesses.

**Material and Methods:** We retrospectively reviewed 2212 imaging-guided PCVC in the last 13 years (1003-tunnelled catheters for dialysis and 1209-tunnelled catheters with port). These procedures were performed in an interventional radiology operating room under fluoroscopy guide. All catheters were implanted under local anaesthesia in aseptic conditions. We have identified access vein using ultrasound guide.

We have studied our complications describing our solutions in difficult accesses using alternatives routes.

**Results:** Catheters with implanted port underwent a total of 6.3% of complications (most common were thrombosis and infection), they needed changing the point of puncture in 2.4%. Accesses route were: 90.8% right jugular vein, 6.5% left jugular vein, 1.7% other accesses. Age average was  $61.2 \pm 12.22$  years, and complications appeared with median of 96,50 days (range 19-782).

Tunnelled catheters for dialysis suffered a total of 45,9% complications (most common was poor blood flow in 25%), it was necessary to change the point of puncture in 53,1%. Age average was  $64,45 \pm 13.01$  years, and complications appeared with median of 93.0 days.

The most severe complications occurred in patients with progressive venous occlusion of accesses. We present and describe these alternatives routes in: recanalization of occluded veins, alternative femoral catheter placement, translumbar catheterization of the IVC and collateral veins catheterization.

**Conclusions:** High understanding of venous anatomy and technical options is mandatory to procedure success in these challenging cases.

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**AXILLARY ARTERY TO DISTAL FEMORAL VEIN GRAFT FISTULA AS ALTERNATIVE OPTION FOR FEMORAL ARTERY OBSTRUCTION OR STENOSIS IN PATIENTS RECEIVING DIALYSIS***Dan Song*

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**Introduction and Objectives:** The population of end-stage renal failure patients dependent on hemodialysis continues to expand with an increasing number of patients having failed access on both upper extremities. Femoro-femoral fistula can be an option, but some patients have unsuitable femoral artery due to repeated cannulation or atherosclerotic change of vessels. So, we performed 3 cases of bypass between axillary artery to distal femoral vein as an alternative option in this situation.

**Material and Methods:** Axillo-femoral bypass via subcutaneous 6-mm polytetrafluoroethylene bridge graft was performed to 3 patients undergoing hemodialysis with stenosis or obstruction of femoral artery, who already failed with both upper extremity access. Cannulation on the new access was made 1~2 months after the operation, under the preference of surgeon. Long-term patency was evaluated by telephone questionnaire.

**Results:** No intraoperative or immediate post-operative occlusion of fistula was observed. There was no operation-related death. 2 postoperative complications were developed in 2 patients, including seroma and steal syndrome. Postoperative steal syndrome on ipsilateral foot was observed in one patient, and orthostatic hypotension subsequently followed.

**Conclusions:** Bypass between axillary artery to distal femoral vein can be an alternative option in patients with both femoral artery obstruction. Further studies should be followed to validate the patency and feasibility of axillo-femoral bypass

## 55

**PRELIMINARY RESULTS OF ENDOVASCULAR REVASCULARIZATION WITH HYDRODYNAMIC THROMBECTOMY CATHETER OF THROMBOSED ARTERIOVENOUS GRAFTS: OUR EXPERIENCE FOR 3 YEARS**

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**Introduction and Objectives:** Thrombosis is the most frequent complication encountered in the maintenance of arteriovenous grafts (AVG). Percutaneous declothing with endovascular techniques and treatment of the underlying stenosis represent an alternative to surgical thrombectomy.



We evaluate the efficacy and safety of Hydrodynamic Thrombectomy Catheter in the salvage of thrombotic vascular grafts in patients with end-stage renal disease under hemodialysis.

**Material and Methods:** This retrospective study includes 70 thrombotic AVG in 39 patients (22 men; 67 years old) treated with endovascular thrombectomy between January 2008 and March 2011. We use mechanical hydrodynamic thrombolysis with the Angiojet-DVX catheter in all cases followed by angioplasty ( $\pm$  stenting) of the anatomical lesion responsible for the thrombotic event. Outcomes included the technical success, clinical success, complications and primary and secondary patency. Procedural success was defined as angiographic confirmation of blood rate flow restoration, presence of a pulsatile thrill along the graft, and successful resumption of at least one hemodialysis treatment. Primary patency was defined as time to the next intervention, and secondary failure as the time to permanent AVG failure. Mann Whitney test and Kaplan-Meier were used to statistically analysis.

**Results:** A total of 70 thrombectomies were performed during this period in 25 AVG in the upper arm and 14 in the lower limb, respectively. Localization of the stenosis was 57% in venous anastomosis, 18% arterial and venous anastomosis, 10% both anastomosis and graft, 1.4% alone graft and 14% no evidence of stenosis. Average time from occlusion to thrombectomy was less than 48 hours in most cases (84%). Technical success was 97% and clinical success was 86%. Angioplasty in one or more lesions was performed in most cases. Complications occurred in 7 patients. All of them were minor complications except one case of anastomosis rupture that required surgery. Uncovered/covered stent deployment also was used in 9 patients. Primary patency was 73, 56, 42% at 1, 3 and 6 months respectively, and 24% at one year. Secondary patency was 61% at 12 months. Patients with a residual thrombus after thrombectomy present a significant lower permeability (12 procedures vs. 58;  $P = 0.002$ ) without changes in according to residual stenosis less than 30% versus no stenosis (62 procedures vs. 19;  $P = 0.486$ ).

**Conclusions:** Percutaneous mechanical thrombectomy with the AngioJet DVX catheter is a safe technique with a high clinical success rates in the treatment of occluded dialysis grafts. An accurate follow up seems to be necessary to prevent new thrombosis.

## 56

### LOCAL HEMODYNAMIC CHANGES AND HAND EDEMA AFTER LONG-STANDING AVF CLOSURE IN KIDNEY-TRANSPLANT PATIENTS

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**Introduction and Objectives:** Patients with long-standing arteriovenous fistula (AVF) that require AVF closure after kidney transplantation (usually because of high flow), suffer a local postoperative cascade of hemodynamic changes in the arm that can produce early and late local complications (hand edema, venous thrombosis, late arterial aneurysms). Some of these local complications still remain unclear. The objective of this study is to analyze these early hemodynamic changes and disclose if patients that will suffer hand edema follow different or more pronounced hemodynamic changes.

**Material and Methods:** All patients with functional kidney-transplant and long-standing AVF (more than 2 years) that required AVF ligation in our institution, during 2014, were prospectively included. AVF infection, spontaneous thrombosis, severe steal syndrome, pseudoaneurysms or central venous occlusions were excluded. Preoperative data, and ultrasound measures during pre and intra-operative period were registered (brachial, radial artery, and main venous flows). Postoperative arm edema was clinically controlled, and 1-month ultrasound control was repeated.

**Results:** 17 long-standing AVF were closed during the study period, 9 distal and 8 proximal accesses, with systematic venous aneurysms resection to avoid venous thrombosis. Median brachial flow decreased progressively (2714, 451 and 333 ml/min in the preop, immediate postop and 1-month control;  $P < 0.001$  and  $P = 0.002$ ), and radial flow reactively increased after AVF ligation but decreased 1-month later (29.9, 101.2 and 66.8 ml/min in proximal AVF and -236.1, 86.0 and 47.5 ml/min in distal AVF;  $P = 0.001$  and  $P = 0.002$ ). 8 cases (47%) referred significant painful hand edema and blush

after AVF ligation, that lasted for a median of 7 days (range 4-30). Patients with and without postoperative edema showed no differences in preoperative data or AVF localization. However, patients with edema showed a non-significant tendency towards higher preoperative access flow (3380 vs 2121 ml/min brachial flow in patients with and without edema;  $P = 0.211$ ), similar changes in the immediate postop, and significant higher decrease in late 1-month radial flow (-70% vs -6%,  $P = 0.040$ ).

**Conclusions:** After AVF closure, global arm flow (brachial) tend to progressively decrease during first month, and distal flow (radial) show immediate reactive increase, and posterior 1-month decrease. Hand edema can occur in almost half of patients, and it is related to a more pronounced decrease in distal flows during first month after surgery, probably as a result of excessive immediate reactive arterial hyper-flow that is corrected 1-month later.

## 57

### PLICATION TECHNIQUE IN HIGH-FLOW FISTULAS

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**Introduction and Objectives:** The high flow rate through an arteriovenous access is a complication that adversely affects cardiac function. In Japan, systemic vascular insufficiency ('steal syndrome') has been reported by Kanno et al., drawing attention to issues other than those concerning cardiac load. The primary purpose of the treatment for high flow rates is to restrict blood flow, and in our hospital, we have been performing artery banding as well as anastomosis modification. A total of 58 patients underwent banding over a three-year period from January 2010 to December 2012. Of those cases, this report reviews and discusses 29 cases performed by the author.

**Material and Methods:** Procedures: Anastomosis modification is a method of plication involving narrowing of the diameter of the anastomosis site by tucking and suturing. First, the artery and vein at and in the vicinity of the anastomosis site are detached. Then, under the condition where blood flow is blocked, the distal side of the anastomosis site is tucked up and sutured from outside the vessel to reduce the diameter of the anastomosis. This procedure is performed while measuring blood flow intraoperatively using an ultrasonic device in order to achieve the target value. The target value is 40% or less of the preoperative blood flow rate.

**Results:** Cases: Fourteen men and 15 women. The mean age was 58.5 years old. The mean duration of dialysis was 9 years and 5 months. The primary disease was chronic glomerulonephritis in 13 patients, diabetic nephropathy in 6, nephrosclerosis in 2, polycystic kidney disease in 2, and other diseases in 6. Three patients underwent arteriovenous plication, 16 underwent artery banding, and 10 underwent anastomosis modification. Complications included poor blood removal in 1 patient (reoperation at postoperative day 1), and occlusion in 2 patients (14 and 22 months postoperatively, respectively). The mean operation time was 137 minutes. Flow rate through the shunt was measured in the brachial artery using an ultrasonic device. Mean flow rates were 2,843 ml/min preoperatively, 854 ml/min immediately postoperatively, and 909-1,091 ml/min 1-2 years postoperatively.

**Conclusions:** The primary purpose of plication is to reduce blood flow, and the fact that no recurrence of high flow rate has been noted even several years postoperatively should deserve recognition. High flow rate through the shunt is one of the major complications of VA, as specified in the Japanese VA guidelines. Continued efforts will be necessary to pursue safer and more reliable treatment.

## 58

### THE SIMPLE AND EASY SHEATH REVERSE TECHNIQUE AT THE TIME OF THE PTA ENFORCEMENT FOR MULTIPLE STENOSIS LESIONS

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**Introduction and Objectives:** Currently, the first choice for VA stenosis is PTA. However, unlike PTA of the other location which is possible to create the entry site apart from the treatment site, sometimes it is not possible to keep a distance between the entry site and the treatment site. Therefore, we would





like to report a simple technique which enables a treatment with one sheath by revering the sheath in these cases.

**Material and Methods:** It was carried out on the case which a distance between stenoses for treatment was more than 6 cm apart, and was difficult to treat both by placing one entry site from the center or the end of the stenosis. A site of the puncture was placed on the center location between stenoses. The sheath used for the treatment was 3 cm length sheath with tip mark (Medikit Co. Ltd, Japan).

For puncture, the location with sufficient vessel Lumina between stenosis was selected.

First of all, insert a puncture needle to the vessel by puncture vertically to a skin. After that, set down the needle to either direction to insert, then insert a guide wire per normal and insert a sheath. After that, treat stenosis location by using an appropriate balloon catheter.

Next, bend the attached guide wire to "U" shape about 40 mm from the tip, then insert to the sheath. We confirm that the wire tip was inserted from sheath to the blood vessel. Then we pull the wire and make sure the bend is on the top of the sheath and arranged opposite of the blood vessel and the top part to allow it through sheath's side.

We pull the sheath slowly while paying attention that the top of sheath does not come out. We confirm that the wire is in a straight line from the opposite side and insert the other sheath to the opposite side of the blood vessel.

**Results:** By using only one sheath, it was able to treat all treatment cases including case of arteriovenous graft (AVG).

**Conclusions:** There are two points to note. First of all, it is important to puncture vertically, when puncture against a vascular wall. Second point is the handling of case which pulled out the sheath came out from the vessel. I want to speak matters that require attention about these two points.

We believe this procedure is as an effective and a simple method for PTA of VA with multiple stenosis portions.

## 59

### SHUNTLESS VASCULAR ACCESS UNDER ULTRASOUND-GUIDED PUNCTURE

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**Introduction and Objectives:** Sufficient functional vascular access (VA) is very important in patients undergoing haemodialysis to maintain stability during dialysis and have a good prognosis. However, it is sometimes difficult to puncture the affected VA. Ultrasound (US) is a useful device for grasping and puncturing the target VA. The aim of this study was to examine the effectiveness of a shuntless VA under US-guided puncture.

**Material and Methods:** We reviewed three patients who underwent shuntless VA under US-guided puncture.

#### Results:

Case 1: An 80-year-old woman with chronic renal failure (CRF) due to chronic pyelonephritis underwent haemodialysis for three years and ten months. Moreover, she had several failed arteriovenous fistulas (AVFs) and arteriovenous grafts (AVGs). Because of several VA problems, infections and dementia, we conducted a US-guided puncture of the occluded left cubital shunt and inserted a needle into the left brachial artery for blood removal. The left saphenous vein above the knee was punctured for blood return. This method was continued for twenty-two months (275 times) until hospital transfer.

Case 2: A 75-year-old woman with CRF due to diabetic nephropathy underwent haemodialysis for four years and seven months. She had several failed AVFs and narrow superficial left brachial artery. She strongly refused graft implantation, and we conducted the US-guided puncture of the occluded right cubital shunt and inserted the needle into the right brachial artery for blood removal. The right basilic vein was punctured for blood return. This method was continued for more than three years and seven months (550 times) until hospital transfer.

Case 3: A 70-year-old woman with CRF due to diabetic nephropathy underwent haemodialysis for one year. She had failed AVG and refused new graft implantation before starting haemodialysis. Upon admission to our clinic, we conducted the US-guided puncture of the occluded left forearm AVG near the arterial anastomosis and inserted a needle into the left brachial artery for blood removal. The left basilic vein was punctured for blood return. These methods were conducted under US-guidance for one year.

**Conclusions:** The advantages of these shuntless VA include usage of occluded vascular access, no load for cardiac function and usefulness in difficult cases of vascular access construction. This method could be one of the most useful applications of US-guided punctures.

## 60

### PERCUTANEOUS ANGIOPLASTY OF JUXTA-ANASTOMOTIC STENOSIS OF FAILING DISTAL RADIO-CEPHALIC HEMODIALYTIC ARTERIOVENOUS SHUNT: OUR TECHNIQUES IN COMPARISON

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**Introduction and Objectives:** Stenotic lesions of radio-cephalic arteriovenous shunts occur mainly in the juxta-anastomotic site up to 64% of cases; juxta-anastomotic area is the region within 3 cm of the arteriovenous anastomosis and it is the critical zone of distal radio-cephalic AVF (Arterio-Venous Fistula) for higher frequency of lesion's presentation and lower patency rates vs non-anastomotic stenosis. The purpose of our study it was to describe our techniques of PTA (Percutaneous Transluminal Angioplasty) for treatment of juxta-anastomotic stenosis of failing distal radio-cephalic hemodialytic arteriovenous shunt and evaluate the effectiveness of venous and anastomosis's PTA in compare with venous PTA alone.

**Material and Methods:** We reviewed 175 patients with distal radio-cephalic hemodialytic AVF with Echo-Color-Doppler (ECD) evidence of venous juxta-anastomotic stenosis without any dynamically significant anastomosis's stenosis, treated at our hospital between 2008 and 2011, having at least 1 year follow up. Two groups were recognize: 1) 103 patients treated with venous and anastomosis's PTA; 2) 72 patients treated just with venous PTA; all cases in absence of dynamically significant anastomosis's stenosis at ECD.

Treatment is performed with retrograde access in venous outflow or with antegrade access in arterial inflow, according to the site of stenosis; we always cross juxta-anastomotic stenosis and anastomosis with thin guide-wire (0.014") which is retrogradely advanced into the proximal radial artery or antegradely in efferent vein.

Main objective was to evaluate Surviving Time in the two groups, defined as absence of dysfunction of the vascular access, in accord with the Kidney Disease Outcomes Quality Initiative recommendations, patent lesion or residual stenosis <30% and no need for further reintervention of the target lesion (TLR). Primary patency (PP) at 6, 12 and 24 months were evaluated, with echocolor Doppler for both groups.

**Results:** Immediate post-procedural technical and clinical success was 100% for all the patients. Patients treated with venous and anastomosis's PTA showed higher survival rate free of target lesion reintervention in compare with patients underwent only venous PTA with a statistically significant difference (P-value = 0.0001) in Surviving Time.

**Conclusions:** We always treat venous juxta-anastomotic stenosis of distal radio-cephalic hemodialytic AVF with venous and anastomosis PTA whether in presence or not of dynamically stenosis at anastomosis.

The use of this technique seems to be effective and to improve primary patency and decrease reinterventions of target lesion in juxta-anastomotic stenoses of failing distal radio-cephalic arteriovenous shunts with a statistically significant difference between the two group examined.

## 61

### EARLY RESULTS USING BRAIN NATRIURETIC PEPTIDE (BNP) AS A MARKER FOR THE EFFICACY OF SECONDARY EXTENSION TECHNIQUE (SET) IN IMPROVING MYOCARDIAL FUNCTION IN DIALYSIS PATIENTS WITH HIGH FLOW FISTULAS

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**Introduction and Objectives:** The association of dialysis fistulas and heart failure believed to be due to high cardiac output. (BNP) which is secreted by the cardiac ventricles in response to excessive stretching of heart muscle cells has been used as a marker of heart failure with 80% sensitivity. We report our early experience in using BNP levels to test the efficacy of (SET) in improving myocardial function by reducing fistula flow.

**Material and Methods:** Seven patients with high fistula flows (>3 L/m, all brachio-cephalic) and raised BNP underwent SET between 2012 and 2014. SET involves extending the anastomosis from brachial to either proximal radial or ulnar arteries. We measured BNP levels, fistula flow and Clinical improvements both pre and post operatively.

**Results:** There was a dramatic drop of BNP levels (by more than 50% within 2 - 4 weeks) and immediate reduction of fistula flow (by 50-70%) in all seven patients. Although there was an overall clinical improvement of patient's symptoms this was difficult to quantify. No interposition grafts were required.

**Conclusions:** Our small study shows that SET is an effective way of reducing fistula flow. It also shows that BNP may be a reliable marker in assessing the impact of the technique on cardiac function. We plan to continue our study with more patients and longer follow up to assess the long term efficacy of the technique.

## 62

#### EARLY EXPERIENCE WITH VIABAHN STENT-GRAFTS TO TREAT CEPHALIC ARCH STENOSIS IN HEMODIALYSIS PATIENTS WITH IPSILATERAL ARTERIOVENOUS FISTULAS

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**Introduction and Objectives:** One of the commonest causes of brachiocephalic arteriovenous fistula (AVF) failure is cephalic arch stenosis, estimated to be present in up to 40% of patients. Despite its relatively high prevalence there is no single, proven, durable method of treatment. Angioplasty, stenting and stent-grafting have previously been described, with the latter possibly offering improved long-term patency as published in a small-randomized control trial. We report our 2 year experience of treating this lesion with the Viabahn stent-graft.

**Material and Methods:** We performed a retrospective review of all patients at our institution with cephalic arch stenosis treated with Viabahn stent-grafts between 2012 and 2014. Serial angiographic follow up was performed on all subjects as per our institutional practice in all patients whom undergo AVF interventions. Information on re-stenosis and re-interventions was recorded along with any complications. Kaplan-Meier analysis was used to estimate patency.

**Results:** Between 2012 and 2014 a total of 28 patients with cephalic arch stenosis and a functioning ipsilateral AVF were treated with at least 1 Viabahn stent-graft after failed angioplasty with a high-pressure balloon. Technical success was 100%. Primary patency rates at 1, 3, 6 and 12 months were 100%, 79%, 74% and 50%. A total of 8 patients required repeat interventions in the follow-up period (5 angioplasty and 3 further stent-grafting for stent-graft associated re-stenosis). No complications were encountered.

**Conclusions:** This retrospective review demonstrates that Viabahn stent-grafts are safe and effective when used to treat cephalic arch stenosis, with patency results comparable and potentially more favorable than those previously reported with angioplasty and bare-metal stenting.

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#### A BULLET PROOF GRAFT TO PROMOTE SAFE, RELIABLE, AND IMMEDIATE HEMODIALYSIS ACCESS

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**Introduction and Objectives:** Cannulation injuries account for a significant portion of arteriovenous graft (AVG) complications such as hematoma, pseudoaneurysm formation, bleeding, thrombosis, infection, and loss of access. Patients suffer from significant pain secondary to an expanding hematoma, and bleeding from a ruptured pseudoaneurysm or excoriated graft can lead to rapid exsanguination or death. Hospitalization costs secondary to cannulation related complications lead to millions in healthcare expenditures. To address these issues, we have developed a novel, immediate cannulation graft that is easily identifiable, self-sealing, and prevents graft degradation and posterior wall penetration. The Bullet Proof graft (BPG) features a puncture resistant lateral and posterior surface, which assures access to the flow lumen without concern for posterior wall injury, hematoma, or patient harm. Currently, there is no approved AVG that offers immediate access and specific protection from needle cannulation injury.

**Material and Methods:** In bench top testing, the BPG was tested against the three leading "early cannulation" grafts (ECGs) on the market (Vectra, Acuseal, Flixene) to evaluate the grafts ability to self-seal, and to resist posterior wall penetration. Each graft was placed on a closed circuit pump at 1000 ml/min, and a pressure of 150 mmHg during the testing, using a blood-like solution. BPG was also compared to a standard ePTFE graft (SG) in a porcine model of dialysis access to test cannulation durability and post cannulation

hemostasis. Over the course of 2 weeks, both grafts were accessed 60 times, 5 months equivalence of dialysis cannulations.

**Results:** The needle easily penetrated the anterior and posterior walls of the ECGs resulting in unceasing fluid spray from anterior and posterior puncture sites. The BPG resisted posterior wall puncture and the anterior wall exhibited minimal fluid droplets that ceased quickly. The BPG resisted posterior wall puncture, hematoma formation, and hemorrhage in the animal model. Conversely, the SG sustained significant posterior wall injury, developed large hematomas, with rapid blood loss. BPG time to hemostasis following needle removal was nearly immediate and on average 120 times shorter than the SG with no application of pressure (5 sec vs 10 min).

**Conclusions:** BPG performance was superior to that of the control grafts in all areas tested. The BPG design mitigates several modes of AVG failure by allowing for immediate cannulation, improving technician cannulation errors, and reducing graft degradation, bleeding, and infection. This novel graft design could improve outcomes for vascular access patients by the reduction of graft related cannulation injuries and facilitation of home hemodialysis.

## 64

#### USEFULNESS OF MONITORING LASER DOPPLER SKIN PERFUSION PRESSURE FOR EVALUATING ISCHEMIC STEAL SYNDROME IN HEMODIALYSIS PATIENTS

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**Introduction and Objectives:** Ischemic steal syndrome is an uncommon, but recognized complication of vascular access (VA) in hemodialysis patients. Laser Doppler measurement of skin perfusion pressure (SPP) was recently developed for evaluation of the lower extremities in patients with peripheral arterial disease. SPP can assess the peripheral microcirculation without being influenced by edema and vascular calcification. In this study, we investigated the peripheral microcirculation by SPP monitoring in patients with dialysis-associated steal syndrome (DASS).

**Material and Methods:** Between January 2013 and December 2014, a total of 11 hemodialysis patients aged 68 ± 12 years with suspected DASS were enrolled in this study. All patients had at least one of the following symptoms in the access arm: coldness, numbness, refractory wound, cyanosis, pain, or necrosis. The duration of hemodialysis was 14 ± 6 years. SPP was measured at a finger on the VA side, and the relationship between changes of SPP and symptoms after treatment was investigated. We adjusted VA flow according to SPP changes during surgery.

**Results:** In all patients, initial SPP was less than 50 mmHg. All patients complained of coldness in the hand with VA. Seven patients in whom SPP was less than 30 mmHg noted numbness of the hand, while three patients with low SPP levels (<20 mmHg) complained of severe pain in the hand. Four of the 11 were treated conservatively. The remaining 7 patients were treated by surgical intervention, including ligation of the VA in four and reducing fistula flow in three. In six of the seven patients undergoing surgery, the mean SPP increased from 21 ± 5 mmHg to 41 ± 10 mmHg and symptoms improved. One of the seven surgical patients showed no change of SPP postoperatively, and digital necrosis was not alleviated. SPP was correlated with symptoms, and changes of SPP during surgery predicted the efficacy of treatment.

**Conclusions:** SPP monitoring by the laser Doppler method may provide useful information for evaluation and treatment of DASS.

## 65

#### THE INCIDENCE AND MANAGEMENT OF CENTRAL VEIN RUPTURE DURING PTA FOR HEMODIALYSIS ACCESS PATIENTS

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**Introduction and Objectives:** To evaluate the incidence and management of central vein rupture during PTA for central vein stenosis/occlusion in hemodialysis patients.



**Material and Methods:** Between 1998 and 2013, 3103 PTAs were performed for central vein stenosis (2437)/occlusion (666) in hemodialysis patients (M:F = 1445:1658, brachiocephalic:subclavian = 1735:1368) using various techniques. PTA or stenting were performed regardless of vein rupture when the guide wire passed through the stenosis/occlusion. The incidence of central vein rupture according to the location, sex, right vs left, thrombosis, stenosis or occlusion were analyzed using Chi-Square test. Percutaneous managements of central vein rupture were also evaluated.

**Results:** Central vein rupture was documented by fistulography in 12 cases (0.39%). All ruptures occurred in occluded lesions (brachiocephalic: subclavian = 9: 3) and none in stenotic lesions ( $p = 0.00$ ). There were no statistically significant differences in location ( $p = 0.409$ ), sex ( $p = 0.811$ ), right vs left ( $p = 0.081$ ), and thrombosis ( $p = 0.331$ ). Causes of central vein rupture were: guide wire induced rupture in 9, sharp recanalization with Colapinto needle in 2, and during balloon dilation in one case. Central vein rupture were managed by stenting ( $n = 5$ ), low pressure balloon tamponade in the rupture site ( $n = 2$ ), and balloon occlusion of proximal inflow vein and observation ( $n = 5$ ). In 5 patients, recanalization of central vein failed.

**Conclusions:** Central vein rupture occurs very rare during PTA, and the majority can be easily managed by percutaneous techniques. When a guide wire can pass through the occlusive lesion, PTA could be performed even if central vein rupture occurs.

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### THE NECROTIC, INFECTED OR BLEEDING A-V FISTULA: CAN IT BE SALVAGED?

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**Introduction and Objectives:** Necrosis, infection or bleeding from A-V fistulas is serious and potentially life-threatening complications. We have the impression of an increasing rate during the last decade, and decided to review our results from these complications during the last ten years.

**Material and Methods:** From our database of access operations and from patient and dialysis records all cases with native A-V fistula revision, closure or severe bleeding was analyzed, and cases with necrosis and/or severe infection were extracted.

**Results:** From the periods 2005-2014 we identified 32 cases of AV-fistulas with necrosis or severe infections. There were a total of 25 patients and some had 2 or 3 times with necrosis. We operated 31 cases and in one case the patient died due to unobserved bleeding during night while waiting for operation. This one case will not be included in this material. In 4 (13%) cases we could not save the fistula. When look at the parameters like diabetic, but-tonhole, antibiotic, necrosis or bleeding the 4 cases were comparable with the overall group. Two of the cases were from other departments and when we operated them the patients already got severe infections including endocarditis and spondylolitis. After operation their clinical status got better with normalised infections parameters. The AV-fistulas could not be safe but the patients life was saved. All 4 patients got a new functioning AV-fistula. The average age for the AV-fistula from the day making until necrosis or severe infections was 86,4 month (16; 259) or 7,2 year (1,3; 21,6). Ten patients/13 cases (40%) are dead by now but all with functioning AV-fistulas. Post operation for necrosis seventeen patients (55%) need revision of the fistula because of thromboses or stenosis. The time before the need for the operation varied from 10 days to 49 month, average time was 8 month. In two patients we closed the AV-fistula because the patients got kidney transplantation and wished to close it down.

**Conclusions:** Necrosis or infection in A-V fistulas is life threatening. When operated in time we can save the AV-fistulas in 87% of cases and stop the complications like severe infections or death. Over time 55% needs revision of the AV-fistula after operation for necrosis but all patients got functioning AV-fistulas. The conclusion is:

1. It is important to operate immediately when a necrotic AV-fistula is discovered to avoid complications.
2. To follow the patients post-operation to make sure the AV-fistulas are still working.

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### SKIN NECROSIS IN NATIVE ARTERIOVENOUS FISTULA

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**Introduction and Objectives:** Skin necrosis (SN) like flat spot in native arteriovenous fistula (AVF) is very common lesion taken often for a banal complication but sometimes this lesion can cause a copious hemorrhage by falling scab. In the most common times this lesion is caused by a trauma needle and has a spontaneous healing, but sometimes when the conditions are favorable like a high blood flow, aneurysm and neointimal fibrosis (NIF) this lesion can grow up and require emergent surgery.

**Material and Methods:** We performed a native AVF examination with clinical and ultrasound (US) assessment of 140 patients who undergone hemodialysis session in the hemodialysis unit of the Bachir benacer hospital in Biskra, Algeria. For the most patients the trauma needle had caused a flat spot with a spontaneous healing only for three patients. For the first it was brachiocephalic (BC) fistula, the spot was on the top of an aneurysm, he grew up in height made by several layers of SN with a 1.5 cm in height and 1.2 cm in the base and he assumed the appearance of a pyramid. In the US assessment the base of the spot was over a layer of NIF and the blood flow was 1600 ml/min. For the second patient it was BC fistula, the spot was on the top of an aneurysm, he grew up in breadth with 1 cm diameter, in the US assessment, the spot was over a layer of NIF and the blood flow was 1400 ml/min. For the third patient it was a BC fistula, the SN has started by two spots in the top of an aneurysm then they spread for all the aneurysm, it was not caused by trauma needle and in the US assessment the SN was over a layer of a NIF.

**Results:** For our three patients with a BC fistula and a high blood flow, the SN didn't have a spontaneous healing and caused by trauma needle for two and without any causes for the third. For these three fistulas only the surgery was the solution with spot removing. SN is favoring by high blood flow, aneurysm, NIF and needling in the same site.

**Conclusions:** SN in native AVF can become a real delayed bomb which needs emergent surgery. The clinical examination of the fistula by the nurses and the physicians remains the one solution to avoid a fatal complication.

## 68

### SURGICAL SALVAGE OF INFECTED POLYTETRAFLUOROETHYLENE (PTFE) UPPER ARM ACCESS BY PTFE JUMP GRAFT

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**Introduction and Objectives:** Infection is the one of the fatal complication of the polytetrafluoroethylene (PTFE) upper arm access. We report surgical salvage of infected PTFE access by bypassing with PTFE.

**Material and Methods:** A 66-year-old female was admitted to hospital with infected PTFE upper arm access. She had tortuous right arm and 3 occluded PTFE access on the left forearm. On the artery side of the graft, there was focal erythema, skin necrosis and pus was drained from it. On the culture, methicillin resistant staphylococcus aureus was diagnosed. Vancomycin was used, but pus drainage and skin necrosis persisted.

**Results:** She received PTFE jump graft for infected graft. The infected segment was removed and wide excision and massive irrigation was done for the infected skin and subcutaneous tissue. Ultrasound study showed compatible amount of blood flow for dialysis and the access was used for dialysis just after the operation.

**Conclusions:** Partially infected graft can be salvaged by PTFE jump graft.

## 69

### NEAR-INFRARED SPECTROSCOPY (NIRS) IN VASCULAR ACCESS. A NEW APPLICATION FOR INVOS®SPECTRA

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**Introduction and Objectives:** The In-Vivo Optical Spectroscopy (INVOS) system non-invasively monitors the mixed arteriovenous saturations providing

real-time data to detect ischaemia. We sought to examine its utility in the context of vascular access by;

- a) assessing reactive hyperaemia following a vascular occlusion test in normal individuals and;
- b) by monitoring the preoperative, intraoperative and postoperative values in patients with steal syndrome undergoing banding of the efferent vein.

**Material and Methods:** Vascular Occlusion Test (VOT)

We applied an INVOS®spectra sensor to the thenar eminence of both hands of 15 healthy volunteers and performed real-time monitoring of the mixed arteriovenous saturations throughout the VOT. A sphygmomanometer was then inflated to suprasystolic pressure of the non-dominant arm for 5 minutes. The cuff was then released and following normalisation of values to baseline the procedure repeated on the dominant arm.

**Banding for Steal Syndrome**

We applied an INVOS®spectra sensor to the thenar eminence of both hands of 2 patients undergoing banding for Steal Syndrome. Recordings were taken in the immediate preoperative period, intraoperatively, day 0, day 1 and day 14 postoperatively.

**Results:** Vascular Occlusion Test (VOT)

15 healthy volunteers were studied with a mean age of 38 yrs of which 9 were male and 14 right hand dominant. Mean baseline readings showed a 2% higher reading on the dominant than non-dominant arm. On release of the sphygmomanometer, levels showed a significantly reduced mean peak level in the non-dominant arm (83%) than the dominant arm (92%);  $p = 0.013$ .

**Banding for Steal Syndrome**

Baseline arteriovenous readings were significantly less in the fistula arm than the non-fistula arm by approximately 10%. Following banding of the fistula, the readings in the fistula arm rose to approximately 10% higher than the non-fistula arm and remained higher in the immediate postoperative period (Day 0 and day 1). At day 14 review, the fistula hand readings had returned to lower than those seen in the non-fistula hand however the difference was less at approximately 8%.

**Conclusions:** The INVOS®spectra offers an exciting new opportunity to diagnose preoperative endothelial disease prior to vascular access formation. Additionally, the system offers real-time monitoring of the hyperaemic response seen in vascular access banding. Further studies are required to accurately describe its usefulness.

## 70

### EXTENDED VEIN RESECTION FOR TREATMENT OF AVF INFECTION: A CASE REPORT

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**Introduction and Objectives:** AVF infection is one of the critical AVF complications. In some cases, treatment and management is not easy, especially in sepsis.

**Material and Methods:** A 32-year-old man presented with the right arm swelling due to venous hypertension. He had a brachiocephalic AVF in the right arm. Past history is as follows 1) Chronic haemodialysis started due to MOF by traffic accident at 17 years old. 2) ABO incompatible living related renal transplantation at 30 years old. After transplantation, the graft is functioning well. Serum creatinine level is about 1.5 mg/dl. Immunosuppressants are Tacrolimus hydrate (Prograf), mycophenolate mofetil (Cellcept) and prednisolone. The patient is immunocompromised host.

**Results:** For treatment of venous hypertension, we tried PTA but the guide wire did not pass through the obstruction, then the AVF was closed by ligation. One month later, he was admitted to our hospital due to AVF infection and sepsis. After one week treatment with antibiotics, surgery was done. Under local anesthesia, the AVF was exposed and massive thrombus was seen in the brachiocephalic vein. For treatment of infection, the brachiocephalic vein was resected and the wound was open. One month later, the patient discharged.

**Conclusions:** AVF infection in immunocompromised host was successfully treated by extended vein resection.

## 71

### ULTRASOUND GUIDED ANGIOPLASTY FOR TREATMENT OF PERIPHERAL STENOSIS OF ARTERIOVENOUS FISTULA

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**Introduction and Objectives:** Arteriovenous (AV) fistulae are favoured over synthetic grafts for use for hemodialysis. However, native AV fistulae are often complicated by stenosis limiting the efficacy of dialysis or resulting in thrombosis. Treatment of these stenosis by angioplasty is useful in improving the functioning of AV fistulae. Majority of the angioplasties are carried under C arm guidance. The present study evaluated efficacy of ultrasound in guiding angioplasty for stenotic lesions in the fistulae.

**Material and Methods:** Between January 2012 and July 2014, 32 angioplasties were carried out under ultrasound guidance in 24 patients (Mean age 46.3±9.8, M:F 15:9) in a day care setting. Two experienced operators carried out the procedure under local anesthesia. Ultrasound (Sonosite) was used for diagnosis of stenosis and measurement of AV fistula flow. A high frequency linear intraoperative probe was used for guidance. Angioplasties were carried only when the fistula flow was below 250 ml/min in presence of a structural lesion. Conquest Balloon (Bard) was inflated at the site upto a maximum pressure of 24 atm.

**Results:** There were 10 juxtaanastomotic stenosis in radiocephalic fistulae, 12 stenosis in relation to the cannulation site in both radio and brachiocephalic fistula, 9 stenosis in the draining vein of both radio and brachiocephalic fistulae and one stenosis in the AV PTFE graft vein junction. 90.6% lesions were successfully treated with angioplasty resulting in improvement in flow from 120 ± 88 to 450 ± 126 ml/min.

One patient developed a perilesional hematoma resulting in thrombosis of access. Two patients had tight lesions which were could not be optimally dilated and opted for proximal anastomosis. 6 patients had recurrence of lesions at a mean interval of 6.5 mo after the primary procedure and required a repeat intervention. The only patient with graft angioplasty presented with thrombosis at 2 months. The overall patency at 1 year was 81.25%.

**Conclusions:** Ultrasound guidance for angioplasty is an effective method with good outcomes in selected dialysis patients with peripheral stenosis of AV fistula.

## 72

### SINGLE CENTER THIRD WORLD EXPERIENCE WITH AV FISTULA PSEUDOANEURYSMS

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**Introduction and Objectives:** Our center is a tertiary care center in northern India and receives referrals for pseudoaneurysms complicating AV fistulas. In this retrospective study we examine the factors in treatment of this complication at our center.

**Material and Methods:** Between 1 Jan 2014 and 31 Dec 2014 23 cases (17 males and 6 females, mean age 42 years with range 24 to 55 yrs) of AV fistula pseudoaneurysm were operated at our center.

Uremic symptoms and CKD stage IV/V were the present at the time of diagnosis for all patients. Diabetic nephropathy was diagnosed in 5 cases.

Only one patient presented with torrential bleed requiring immediate surgery. All patients were operated within 24 hours of admission following dialysis to correct metabolic derangements. Twenty one patients were operated under supra-clavicular brachial block and 2 patients received general anesthesia. The surgical treatment was decided on intraoperative examination of the artery. Five patients underwent primary restoration of arterial continuity. The remaining 18 underwent ligation of the AV fistula artery and vein. Patients routinely received 2 weeks therapy with vancomycin and 10 days therapy with amikacin.

**Results:** AV fistula was brachiocephalic in 19 cases and radiocephalic in the remaining 4. All cases except one were referrals from outside centers.

All except one patient presented within 3 - 14 days of creation of AV fistula. All except one had history of sentinel bleed. All except one had an internal jugular vein catheter in situ or history of recent removal of internal jugular vein catheter.

None of the patients had ischemic changes before or after surgical treatment.





Of the patients who underwent primary repair of the fistula artery 3 were explored for rebleed and required ligation.

One patient had wound dehiscence with persistent soft tissue infection requiring debridement.

Three patients had positive fungal cultures with aspergillus species and were treated with amphotericin. There were no positive bacterial cultures.

**Conclusions:** The experience at our center is influenced by existing in a third world country with many of our patients being diagnosed as suffering renal disease when already in CKD stage IV/V and requiring dialysis at the time of diagnosis. The factors influencing the presentation of AV fistula pseudoaneurysms in our setting may be internal jugular vein catheter related sepsis, poor aseptic technique at the time of AV fistula surgery and poor surveillance following creation of the AV fistula. Patients seem to tolerate ligation of the AV fistula without ischemia. Primary repair is not recommended. In most cases.

### 73

#### HYBRID MANAGEMENT OF THROMBOSED PROSTHETIC ACCESS FOR HEMODIALYSIS

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**Introduction and Objectives:** One of the main causes of prosthetic graft thrombosis in hemodialysis patients is central vein stenosis. The aim of the study was to examine early and mid-term results of combined graft thrombectomy + angioplasty/stenting of central vein stenosis (hybrid procedure).

**Material and Methods:** All patients had an acute thrombosis of upper extremity graft access for hemodialysis. Interventions were performed in a dedicated hybrid operative room. Surgical thrombectomy of the graft was the first-step procedure, followed by angiogram of the venous outflow. Angioplasty was performed if stenosis >60% was found in the anastomoses or in the venous outflow. Stenting was performed when residual stenosis >60% persisted after angioplasty.

**Results:** Fifteen patients (5 males, 10 females) were submitted to 21 hybrid procedures for their thrombosed upper extremity graft. Immediate technical success was 100%. No early deaths were observed. At day 30 primary and secondary patency were 61.9 and 85.7%, respectively. At a mean follow-up period of 13.6 months primary and secondary patency were 14.3% and 28.6% respectively.

**Conclusions:** Hybrid management of thrombosed graft for hemodialysis appears to be a safe procedure and avoids two-times interventions. It requires an adequate operative room.

### 74

#### EXHAUSTED VASCULAR ACCESS: A PROPOSED CLASSIFICATION

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**Introduction and Objectives:** Outcomes from haemodialysis have evolved over recent years such that patients may exhaust vascular access options. The extent of the problem of access failure is difficult to determine, as there are no uniform definitions or classification allowing studies to be performed. In addition the outcome of novel treatments for VA failure is difficult to determine without standardisation. The aim of this study is to propose a classification of vascular access failure that is practical to apply to clinical and research applications.

**Material and Methods:** A simple classification is proposed using an anatomical stratification. This classification was applied within a large dialysis population to patients referred to the complex access clinic.

**Results:** Based on a progressive anatomical grading of: I - Upper arm option exhausted, II- lower limbs option exhausted and III all options exhausted. These can be further subdivided anatomically follows:

- I a. Axillary vein obstructed
- b. Subclavian vein obstructed
- c. Brachiocephalic vein obstructed
- d. SVC obstructed
- II a. Iliac vein obstruction
- b. IVC obstruction
- c. Arterial compromise
- III a. Non conventional access position (IVC line/atrial graft)
- b. no access available (withdrawl from dialysis)

**Conclusions:** It is estimated that the numbers of patients who have exhausted definitive access options will increase. This simple classification allows the scope of the problem, and proposed solutions to be identified and subsequently studied and compared. The classification may also be applicable to transplantation-listed patients where prioritisation policies may be instituted and iliac vessel preservation is desirable.

### 75

#### EARLY RESULTS OF ENDOVASCULAR REPAIR OF FAILING DIALYSIS ARTERIOVENOUS FISTULAS

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**Introduction and Objectives:** Dysfunctioning arteriovenous fistulas (AVF) increase morbidity, mortality and hospital admission rates in dialysis patients. The most frequent long term complication is a stenosis in the outflow, which has a high risk of obstruction (failing AVF). With an endovascular approach, physicians try to preserve patients venous capital and avoid the use of central venous catheters, accomplishing a minimally invasive approach, with a very low rate of complications.

**Material and Methods:** 26 Patients (26 AVF) underwent some kind of endovascular intervention in our hospital between 2010 and 2014 in order to restore a good flow in the fistula. 8 of the AVF were no-native. In the native group (NG) only one AVF thrombosed in the short term after surgery. Arterial stenosis were in 4 cases in the AV anastomosis, in 12 cases in the vein above the AVF and in one case in subclavian artery. The treatment was PTA in all of the cases except in one, where a stent was deployed after a suboptimal result.

7 of the 8 AVF prosthetic grafts were totally occluded, requiring surgical thrombectomy (the other one was still patent when operated on). Stenosis at venous anastomosis was the cause in all cases: 6 were treated with a coated stent, and 2 a with bare stent. Fistula patency rates were calculated with Kaplan-Meier method.

**Results:** Immediate overall surgical success was 100%. Overall primary patency rates were 87% and 38% at 6 months and 1 year, respectively. Secondary patency rates were 88% and 62% at 1 and 3 years, respectively. No statistical differences were found between prosthetic and autogenous group. No mayor complications occurred (5 cases of postpunction hematoma). Average hospital stay was 0.32 days per intervention. The average rate of reintervention was 1.3. Median follow up is 23 months.

**Conclusions:** Our results are still preliminary due to the small number of patients and time of follow up. Endovascular procedures allow us to treat failing AVF with a low morbidity rate, but more studies with more patients and follow-up time are needed in order to estimate the benefit for the patients.

## VASCULAR ACCESS CREATION

### 76

#### THE EFFECT OF POSITION ON ARTERIAL AND VENOUS GEOMETRY IN THE ARM: A SINGLE CASE OBSERVATIONAL STUDY

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**Introduction and Objectives:** The suitability of a subject's arm for arteriovenous fistulae creation is often examined by ultrasonic imaging. However, while this is sufficient as a diagnostic tool, the absence of 3-dimensional geometry does not facilitate further investigation by means of computational fluid dynamics (CFD) to illuminate information such as wall shear stress, velocity profiles and flow structures. Magnetic Resonance Imaging (MRI) provides such 3D information, but given the spatial restriction of the MRI bore, few positions are available for scanning the arm. As no ideal position is determined, the effect of arm position on vascular geometric structures is examined in a single case and commented on.

**Material and Methods:** A healthy subject was scanned in a Siemens MAGNETOM Trio MRI scanner in two positions, lying prone with the arm outstretched above the head or lying supine with the arm down by the side. The scanning area was of the upper arm focusing on the brachial artery, the basilic vein and the cephalic vein. Both scans were converted to 3D faceted data and aligned using the humerus bone. Overall geometric configurations were compared between scan positions. Slice area segments were also compared between vessel pairs at the corresponding distance along the vessel path.

**Results:** Overall appearance between both cases show variation in vessel shape with the brachial artery pair having a helical shape in the prone position and straighter in the supine position. The cephalic vein shape remained similar with the prone position appearing less taut. The basilic vein appeared fuller in the prone position (a), while the vessel was compressed in the supine position (b), making reconstruction of the vessel and clarification between nearby vessels difficult.

**Conclusions:** The vessel shape and position is affected by scanning position with the venous vessels showing the most sensitivity to shape and structure changes.

## 77

### PRE-OP GROUP AND SAVE SAMPLES ARE UNNECESSARY FOR ROUTINE ARTERIO-VEIN FISTULA SURGERY

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**Introduction and Objectives:** The Renal Surgical Unit performs 500 fistula procedures per year. Patients attend a pre-operative clinic, where blood is drawn including a Group and Save sample. We aimed to determine how many patients subsequently required a blood transfusion, and the financial cost involved in taking unused samples.

**Material and Methods:** Retrospective analysis of all patients attending the clinic over two years. The local patient database was correlated with the Pathology IT system to identify the relevant samples and subsequent units of blood used or returned.

**Results:** 737 visits were made to clinic. 609 patients had an identifiable sample, with 576 (95%) viable samples. 6 patients (0.01%) required transfusion, and none of these were intraoperative or as an emergency.

All patients requiring transfusions had a history of chronic anaemia or idiopathic thrombocytopenia.

The laboratory cost of processing the samples varies between £1.57 and £4.35.

**Conclusions:** The vast majority of all fistula patients do not require transfusions post-operatively. The total annual cost of group and save samples was almost £800. As less than 1% of these patients make use of this, and no transfusions were required in emergency situations, the expense is not justifiable, and the routine collection of samples in this population should stop.

Nationally there is a workload of 14000 fistula operations a year. Dependent on local costs, ceasing the collection of samples for this indication could save £22,000-£61,000 a year.

## 78

### ARTERIOVENOUS FISTULA FORMATION – DOES DIABETES REALLY MATTER?

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**Introduction and Objectives:** Within the UK there are an estimated 2.5 million diabetic patients who require insulin, a number which is expected to double by 2025.

Arteriovenous fistula formation is challenging, with up to half failing to mature adequately to support dialysis therapy. Fistula maturation is a complex multifactorial process, with the effect of diabetes on vessel augmentation during fistula formation remaining unclear.

**Aim:** To compare outcomes of diabetic and non-diabetic patients undergoing formation of a new upper limb AVF and assess whether diabetes has a prognostic effect on outcome.

**Material and Methods:** A retrospective cohort study was designed looking at diabetic vs non diabetic patients, undergoing upper limb fistula formation. The primary outcome was time taken for successful maturation of the fistula between the two groups.

The brachiocephalic group was made of 98 diabetic patients and 94 non diabetic patients. The radiocephalic group was made of 10 diabetic patients and 9 non diabetic patients. Patients were followed for a period of 12 months post fistula formation.

**Results:** No significant difference was observed in patients who have diabetes undergoing either radiocephalic or brachiocephalic fistula formation, in terms of successful maturation, primary failure or incidence of complications.

**Conclusions:** This study suggests that creating an AVF in diabetic patients should not be discouraged and that diabetes is not a prognostic factor regarding outcome. Although there are recognised vascular complications with diabetes, the relationship of these with fistula success remains uncertain, by fully optimising the patient prior to any surgical procedure should not increase risk of failure.

## 79

### ASSOCIATION OF CORONARY ARTERY CALCIFICATION AND ARTERIAL MICRO-CALCIFICATION OF THE VASCULAR ACCESS IN INCIDENT HEMODIALYSIS PATIENTS

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**Introduction and Objectives:** We have reported that arterial micro-calcification (AMC) of vascular access has a negative impact on access patency and cardiovascular mortality in hemodialysis (HD) patients. Reasons behind increased cardiovascular mortality in AMC are not fully understood, but it is believed that aortic stiffness is a major contributing factor. Whereas, coronary artery calcification (CAC) is quite common in HD patients and it is known as predictor of future cardiovascular events and all-cause mortality in HD patients. The aim of this study was to explore the relationship between AMC and CAC in HD patients.

**Material and Methods:** 95 HD patients who received vascular access operation were included in this study. The AMC was diagnosed by pathologic examination of arterial specimen by von Kossa stain, which was acquired during the operation. All patients underwent a multi-detector computed tomography (MDCT) imaging procedure and coronary artery calcium score (CACS) was calculated. Patients were classified into two groups, according to the CACS, as high ( $\geq 100$ ), in 56 patients, and low ( $< 100$ ), in 39 patients. We compared AMC and several parameters between the patients with high and low CACS groups.

**Results:** Mean age was  $65.4 \pm 12.7$  years and the male gender was 63.2% ( $n = 60$ ). The incidence of AMC was 55.8% ( $n = 53$ ). The mean CACS was  $456.7 \pm 697.2$  and distributed from zero to 3880. Patients with high CACS group were older ( $69.6 \pm 9.5$  vs.  $59.4 \pm 14.1$ ,  $p = 0.007$ ), and showed a significantly higher prevalence of diabetes mellitus (75.0% vs. 53.8%,  $p = 0.027$ ). High CACS group showed high incidence of AMC compared to low CACS group (71.4% vs. 33.3%,  $p < 0.001$ ). By binary logistic regression, AMC was independently associated with high CACS (OR: 4.228, 95% confidence interval [CI]: 1.513-11.817,  $p = 0.006$ ).

**Conclusions:** The present study suggests that AMC is closely associated with CAC in incident HD patients.

## 80

### ALTERNATIVE VENOUS OUTFLOW BY BRACHIAL TO JUGULAR VEIN VASCULAR ACCESS FOR HEMODIALYSIS IN THE EXHAUSTED UPPER EXTREMITIES

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**Introduction and Objectives:** Shunt creation is usually performed from the distal arm (wrist) to the proximal arm (axillary loop) as long as there is no central stenosis. In patients with central vein stenosis, creating vascular access could induce venous hypertension in the upper extremity. In such patients, one could consider using ipsilateral IJ vein as an AV outflow vein as a last option of using the particular arm.

**Material and Methods:** From 2001 to 2011, 32 patients were analyzed retrospectively who had arteriovenous hemodialysis access with jugular vein. All patients had ipsilateral subclavian or axillary vein stenosis. The preserved internal jugular vein and innominate vein were preoperatively confirmed with Doppler echocardiography and contrast venography.



**Results:** The mean age of the patients was  $57.6 \pm 12.3$  years, and the mean follow-up period was  $43.5 \pm 27.4$  months. The primary patency was 74%, 54%, 32%, 15% and 5% at 6 months, 1, 2, 3 and 4 years, respectively. The secondary patency was 97%, 93%, 93%, 89%, 79%, 72% at 6 months, 1, 2, 3, 4, and 5 years, respectively. In the analysis of complications, 1 steal syndrome, 2 seroma, 1 hematoma, 3 arm swelling, 2 infection, 1 pseudoaneurysm, 1 puncture site bleeding, 8 stenosis, and 13 thrombosis cases were noted.

**Conclusions:** Brachial-jugular arteriovenous graft showed satisfactory results in terms of patency and complication. It could be a good outflow vein for arteriovenous fistula for chronic renal failure patients who have subclavian or axillary vein stenosis or occlusion, if the internal jugular vein is preserved.

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### LONG TERM OUTCOMES OF ARTERIOVENOUS GRAFTS FOR HEMODIALYSIS IN LOWER EXTREMITIES

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**Introduction and Objectives:** The lower extremity began to get received attention as vascular access site in that patient who have exhausted upperarm vessel. Experience with arteriovenous graft in lower extremities has been disappointed because of high infection rates and severe limb ischemia. We report our experience with hemodialysis access in the lower extremity.

**Material and Methods:** During the period January 2003 to December 2011, a retrospective review of sixty arteriovenous graft of lower extremities was performed. Age, sex, etiology of endstage renal disease and complications were tabulated. Primary and secondary patency rates were determined.

**Results:** The average age was 56 years, 38 patients were female. Renal failure was associated with hypertension in 40 (67%) patients, diabetes in 28 (47%) patients and cardiovascular disease in 9 (15%) patients. Follow-up period was 8 ~ 108 months. 54 patients had both central vein stenoses. 7 (12%) cases were primary failure. There was no operation related death. Primary and secondary patency rate were 66%, 90% at 1 year, 40%, 90% at 2 years, 27%, 87% at 3 years and 18%, 87% at 5 years, respectively. There were 99 postoperative complications that were developed in sixtyseven patients, including thrombosis (30), proximal vein stenosis (56), infection (9), bleeding with hematoma (1), perigraft seroma (3), steal syndrome (2) and pseudoaneurysm (4).

**Conclusions:** The lower extremity arteriovenous graft seems to be a viable option with patients who is unable to use any of their upper extremity veins.

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### COMPLICATIONS OF ARTERIOVENOUS FISTULAS AND ARTIFICIAL GRAFTS IN PATIENTS WITH CHRONIC RENAL FAILURE

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**Introduction and Objectives:** The present study was designed to assess the frequency and characteristics of complications of arteriovenous fistula (AVF) and artificial graft (AG) used as vascular access in chronic renal failure (CRF) patients, and their effect on fistula outcome.

**Material and Methods:** We retrospectively reviewed 114 AVF and 17 AG using polytetrafluoroethylene (PTFE) constructed in two main reference hospitals from December 2008 to December 2014 to record the complications to guide management options. The association between age, sex, comorbidities (hypertension and diabetes), fistula type, and complications was sought. Chi square and student t-test were used for statistical comparisons and  $p < 0.05$  was assumed to be significant.

**Results:** Most patients were females ( $n = 67$ , 55.3%). The mean age was 54.3 years (range, 29-89). Comorbidities seen included hypertension ( $n = 91$ , 75.2%), diabetes mellitus ( $n = 39$ , 32.2%), and other chronic systemic comorbidities ( $n = 14$ , 11.5%). AVFs constructed were mainly radiocephalic ( $n = 72$ , 63.1%) and brachiocephalic ( $n = 42$ , 36.8%). AGs were mainly loop ( $n = 12$ , 70.5%) and bridge ( $n = 5$ , 29.4%), all constructed in the upper extremities. The median follow-up period was 36 months (range, 1-72). The cumulative patency rates during this period for radiocephalic and brachiocephalic AVFs were 61.1% and 73.8%, respectively ( $p > 0.05$ ). Those for loop and bridge AGs were 33.3% and 20%, respectively ( $p < 0.05$ ). During mean follow-up period, complications occurred in 39.4% in AVFs and 76.4% in AGs ( $p < 0.05$ ). The most common complication in both AVFs and AGs was thrombosis (27.1% vs 82.3%,  $p < 0.05$ ). Other early and late complications such as pseudoaneurysm, venous hypertension and steal syndrome were seen to be in similar rates (AVFs 3.5% vs AGs 5.8%, 4.3% vs 5.8% and 3.5% vs 5.8%, respectively,  $p > 0.05$  for each) except bleeding/edema and infection (7.8% vs 23.5% and 4.3% vs 17.6%, respectively,  $p < 0.05$  for each).

**Conclusions:** Complication rates in hemodialysis access surgery is high and inevitable (especially for PTFE) considering the tough management of CRF in such over the middle-age patients with many comorbidities. Closer follow-up of vascular access sites by primary physician is a must to diagnose problems early and may allow the best chance of long-term function.

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### GORE® HYBRID GRAFT FOR PROSTHETIC VASCULAR ACCESS. LESSONS LEARNED FROM AN INITIAL EXPERIENCE

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**Introduction and Objectives:** The number of patients with multiple failed hemodialysis access is increasing, therefore in most cases, when an arteriovenous fistula (AVF) cannot be used or performed, the construction of a synthetic arterio-venous grafts (AVG) should precede the placement of a Central Venous Catheter (CVC). However, AVGs are prone to aggressive venous neointimal hyperplasia (VNH), which is responsible for outflow stenosis and access thrombosis. Endoluminal sutureless anastomosis by means of nitinol reinforced section using Gore®Hybrid Graft (GHG) has been demonstrated to have better hemodynamics at the venous outflow with a supposed reduction of VNH, thus potentially improving graft patency. We present our preliminary experience with the GHG for prosthetic vascular access.

**Material and Methods:** Between February 2013 and October 2014, fourteen patients had a GHG implanted for prosthetic vascular access. None of the patients was a suitable candidate for AVF creation and they all had history of multiple failed accesses. Follow up was performed at 1-3-6 and 12 months after implantation using duplex ultrasound. Cumulative patency rate was calculated using Kaplan-Meier method. Complications and interventions to restore access function were recorded.

**Results:** The GHG were implanted successfully in all patients. The graft configuration was brachial-axillary in 10 patients, brachial-basilic at the arm pit in 3 patients and one femoro-femoral adductor loop. No patient was lost during a mean follow up time of  $217 \pm 188$  days (range 11-582). A graft (brachial-basilic) was explanted 7 days after implantation due to prosthetic infection. A patient died of myocardial infarction, two months after surgery, with a functional AVG. Graft thrombosis occurred in 5 cases due to outflow stenosis near the end of the nitinol reinforced section. They were all treated successfully with surgical thrombectomy along with non-compliant balloon angioplasty or with stent-graft placement. Permanent graft failure was observed in 2 cases. Cumulative patency rate was 86% and 70%, respectively at 6 and 12 months.

**Conclusions:** In our initial experience, the GHG appeared to be useful and reliable, particularly in challenging cases. This device reduces surgical dissection and vessel manipulation, allowing rapid and safe anastomosis even in deeper anatomical locations. Although endoluminal sutureless anastomosis reduces turbulence in the axillary/subclavian vein, valves can turn into stenoses at the edge of GHG, due to the high access flow. The selection of the nitinol reinforced section landing zone, the position of side branches in the outflow vein and stent-graft sizing could affect long term outcomes. Further studies are needed to validate these issues on graft's patency.



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**EFFECT OF OPERATING DOCTORS TRAINING ON OUTCOME OF ARTERIOVENOUS FISTULA (AVF) AND ARTERIOVENOUS GRAFT (AVG)***Kenji Tsuchida, Jun Minakuchi, Narushi Yokota, Shu Kawashima*

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**Introduction and Objectives:** A well-functioning vascular access (VA) is a mainstay to perform an efficient hemodialysis (HD) and hemodiafiltration (HDF) procedure. There are mainly two types of VA: native arteriovenous fistula (AVF) and arteriovenous graft (AVG) in Japan. The patency rate for AVF at 1 year, reported in the literature, varies from 56% to 79% and factors affecting the patency have been reported sex, age, primary disease, and the duration of dialysis. However, the most important factor that affects the patency rate is considered to be a surgeon of experience. The object of present study is to investigate the effectiveness of operating surgeon training on survival of AVF and AVG.

**Material and Methods:** Retrospective study of all vascular access surgery over a six-half year period at a single center was studied. The operating surgeon was identified from categorised by grade and internal medicine or surgery: Beginner (experience period; less than 6 months), Intermediate (from 6 months to 5 years), advanced (more than 5 years) surgeon. Fistula patency was used as the primary outcome measure and was determined from patients' case-notes and from a prospectively collected electronic record of dialysis sessions. Patency was defined as "used for dialysis" if the AVF was used for dialysis for at least 3 consecutive sessions.

**Results:** Eight hundred and forty four cases were used for analysis. In 60 cases (32%) the operating surgeon was the consultant, in 53 cases (29%) a trainee was supervised by a consultant, in 56 cases (30%) a trainee performed the operation independently and in 17 cases (9%) the grade of the operating surgeon could not be established. Primary patency rates by operating doctors did not differ significantly: internal medicine; Beginner (440 days patency), Intermediate (745 days), advanced (716 days), surgery: Beginner (568 days), Intermediate (690 days), advanced (803 days) in AVF and Beginner (100 days), Intermediate (183 days), advanced (527 days), surgery: Beginner (238 days), Intermediate (176 days), advanced (353 days) in AVG.

**Conclusions:** This study showed significant differences in AVF patency rates between Beginner and Intermediate by internal medicine and surgery doctors. In AVG, if there is more than 5 years of experience, enough patency is not obtained. Allocation of appropriate cases can result in training obtaining similar outcomes as advanced, demonstrating that dialysis access surgery can provide good training opportunities for junior doctors without detriment to patient care.

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**FEASIBILITY OF BASILIC VEIN TRANSPOSITION AVF AFTER SIDE TO SIDE BRACHIOCEPHALIC AVF***Jung Kee Chung*

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**Introduction and Objectives:** Basilic Vein Transposition AVF (BVT AVF) was considered 3<sup>rd</sup> optional procedure and its efficiency was well accepted in spite of high operative morbidity. Upper arm brachio-cephalic AVF (B-C AVF) was 2<sup>nd</sup> optional procedure and sometimes by using perforating branches side to side (S-S) B-C AVF would be made to maintain high basilic vein fistula flow. Under the background of S-S B-C AVF, later BVT AVF could be more easily performed and better results were expected.

**Material and Methods:** We made BVT AVF 16 cases since 2002 and previous S-S BC AVF group (SS group) and other procedures (such as S-E B-C AVF or GraftAVF) group (OT group) were separated and clinical parameters were compared to evaluate the advantage of side to side anastomosis.

**Results:** 6 cases of SS group and 9 cases of OT group were compared as below (SS group/OT group)

- 1) Age distributions (years) were 61.1 ± 10.7/63.0 ± 12.0
- 2) M:F ratio were 5:2/7:2
- 3) Intervals between previous operations and BVT AVF (months) were 51.2 ± 13.3/47.6 ± 12.4
- 4) Diameters of basilic vein(mm) were 4.3 ± 0.5/3.9 ± 0.4 (p>0.05)
- 5) Complications such as hematoma cases were 2/2
- 6) Maturation periods (wks) were 4.7 ± 1.8/4.6 ± 1.2
- 7) 1 year primary & secondary patency rates were 100%,100%/88.9%, 88.9% and 3 years P2 S PR were 87%, 87%/78.8%, 88.9% (p>0.05)

**Conclusions:**

- 1) Both groups had no difference in age, sex, complications, maturation periods and waiting periods.
- 2) In SS group preop basilic vein diameters were slightly enlarged (p>0.05) and 1,3 year patency rates were slightly better but not significant (p>0.05) So during 2<sup>nd</sup>ary procedures side to side brachio-cephalic AVF would be more recommendable expecting better results in BVT AVF procedures.

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**TIMING OF VASCULAR ACCESS CREATION IN PATIENTS BEFORE HEMODIALYSIS INITIATION: OBSERVATIONAL STUDY IN JAPAN***Masahito Miyamoto<sup>1</sup>, Kotaro Suemitsu<sup>2</sup>, Masaaki Murakami<sup>3</sup>, Yugo Shibagaki<sup>4</sup>*<sup>1</sup>Yokohama Daiichi Hospital Vascular Access Center, Yokohama, Japan<sup>2</sup>Kansai Rosai Hospital, Hyogo, Japan<sup>3</sup>Shizuoka General Hospital, Shizuoka, Japan<sup>4</sup>St. Marianna University School of Medicine Hospital, Kawasaki, Japan

**Introduction and Objectives:** We find it difficult to determine the appropriate timing of arteriovenous fistula (AVF) creation in preparation for hemodialysis (HD). In some cases, more than six months elapse before HD is initiated following AVF creation, and because of this, vascular access (VA) failure develops, which requires VA intervention therapy (VAIVT) or reoperation before HD initiation. At times, the patient dies before HD initiation without using AVF. We investigated renal function at the time of AVF creation and the incidence of VA failure or death before HD initiation. We also compared the risk of VA failure or death by the length of period from AVF creation to HD initiation, and examined the preferable timing of AVF creation.

**Material and Methods:** We retrospectively investigated 309 patients who underwent AVF creation before HD initiation in three hospitals in Japan. Patients who had VA failure within seven days after AVF creation were excluded from this study.

We defined seventy-one patients in whom more than six months had elapsed following AVF creation to HD initiation as the early creation group, and 238 patients who underwent AVF creation within six months as the late creation group. The incidences of VA failure and death before HD initiation in both groups were analyzed as well as renal function at the time of AVF creation and background factors.

**Results:** Multiple logistic analysis revealed that eGFR at the time of AVF creation in the early creation group was significantly higher to that in the late creation group (eGFR 9.2 ± 2.4 vs 7.0 ± 1.9 ml/min, P<0.0001). eGFR deterioration rate was also significantly lower in the early creation group (ΔeGFR -0.27 ± 0.21 vs -0.73 ± 4.01 ml/min/month, P<0.0001). Nevertheless, the incidences of VA failure and death were significantly higher in the early creation group (P<0.0001) in which eight patients required VA therapy and six patients died before HD initiation. ROC analysis showed that the sensitivity and specificity of events of VA failure or death before HD initiation, and 58.0% and 79.0% given the cutoff value of 8 ml/min or more for eGFR (P = 0.0020).

**Conclusions:** The period from AVF creation to HD initiation was longer in patients who had relatively higher eGFR and lower eGFR deterioration rates, resulting in the higher risk of VA failure or death before HD initiation. Nephrologists and VA surgeons should be careful not to be too early in a timing of AVF creation.

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**THE SLF GRAFT FOR HEMODIALYSIS – MIDTERM RESULTS OF THE FIRST EUROPEAN SERIES***Wolfgang J. Hofmann*

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**Introduction and Objectives:** Stenosis at the venous anastomosis, causing graft occlusion, still is the Achilles heel of AV grafts used as hemodialysis access. According to the current literature, hemodynamics at the anastomotic site play a substantial role in the generation of neointimal hyperplasia.

The spiral laminar flow technology intends to reduce neointimal hyperplasia at the venous anastomosis by producing natural spiral laminar flow (like the flow pattern encountered in human arteries). We present the midterm results of the first European series using the SLF technique in AV access grafts.





**Material and Methods:** This prospective series includes all SLF access grafts implanted between September 2010 and August 2012. SLF AV grafts were used only if, according to pre-operative duplex mapping, patients were not suitable for generation of any type of autologous fistula.

Follow up consisted of duplex mapping every three months, if there was suspicion of impending shunt failure, patients had additional duplex scanning. Primary and secondary patency rates and complications during follow up are reported.

**Results:** Sixteen SLF grafts were implanted in 15 patients (3 women 12 men, age median 61.5 years). Prior to implantation of the SLF graft patients had median 2 (0 – 24) shunt procedures.

Follow up was median 18 months (1 to 42) months. We encountered 4 shunt occlusions of which 2 could be managed by thrombectomy. Four shunts had to be explanted (two because of infection, two due to severe steal syndrome). Primary patency at 18 months-calculated according to Kaplan Meier -was 68.5%, secondary patency was 75%.

**Conclusions:** Bearing in mind that this series represents patients selected negatively, the results are satisfying. The implantation of PTFE grafts is a well-accepted method to gain AV access for hemodialysis. Changing the hemodynamic flow pattern at the venous anastomosis seems to be a valuable tool to improve patency of these AV access grafts.

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### CLINICAL IMPORTANCE OF INTRAOPERATIVE CEPHALIC VEIN DISTENSIBILITY: AS A PREDICTOR OF MATURATION OF RADIOCEPHALIC ARTERIOVENOUS FISTULA

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**Introduction and Objectives:** Radiocephalic arteriovenous fistula (RCAVF) is a choice of vascular access for hemodialysis, but incidence of maturation failure is quite high. Even though, preoperative duplex ultrasonography scan (DUS) give guidelines to choose suitable vessels for AVF formation, the maturation failure of RCAVF is not overcome yet. We aimed this study to investigate preoperative or intraoperative factors which can predict maturation failure after RCAVF formation.

**Material and Methods:** Retrospective medical record review was performed for 134 patients who were undertaken RCAVF formation by one vascular surgeon from November 2009 to December 2012. Preoperative DUS was performed for cephalic vein mapping and postoperative DUS was done at 1 and 6 weeks after RCAVF formation. We measured size of radial artery and cephalic vein (before and after dilation) using a compass during operation. Patients were divided into two groups according to a presence of maturation failure and we compared the two groups in general characteristics, preoperative DUS findings, intraoperative findings and postoperative DUS findings.

**Results:** Maturation failure was occurred in 30 patients (22.4%) and it was significantly common in female, patients whose primary renal disease was chronic glomerulonephritis and who had a previous history of AVF formation ( $p = 0.0095$ ,  $0.0048$  and  $0.014$ , respectively). There was no difference in intraoperative radial artery size, preoperative DUS cephalic vein size and intraoperative cephalic vein size before dilation. Intraoperative cephalic vein size after dilation and the difference of cephalic vein size before and after dilation was different between the two groups with statistical significance. ( $p = 0.0004$  and  $0.0004$ , respectively). On multivariable analysis, only the difference of cephalic vein size before and after dilation was important to mature RCAVF ( $p = 0.009$ , adjusted OR  $0.302$ , 95% CI  $0.122$ - $0.746$ ).

**Conclusions:** Distensibility of cephalic vein is essential to determine maturation of RCAVF.

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### PRE-OPERATIVE BIOLOGICAL MARKERS IN PREDICTING OUTCOME OF FISTULA FORMATION

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**Introduction and Objectives:** Native Arteriovenous fistulas are the gold standard for haemodialysis vascular access. Unfortunately they have a high failure rate of maturation. In this study we aimed to assess different pre-operative biological and anatomical markers in predicting fistula maturation.

**Material and Methods:** Our prospectively collected cohort study included consecutive patients who underwent fistula formation for dialysis. Pre-operative markers assessed included venous & arterial diameters, systolic & diastolic blood pressure, haemoglobin, cholesterol, triglyceride and folate levels.

**Results:** 115 patients were included with a median age of 65 (range: 18-84). Our results showed that a larger venous diameter was associated with a significant improvement in maturation. The other markers did not show any significant difference in outcome.

**Conclusions:** Prospective randomized studies with larger cohorts are needed to further assess the prognostic role of pre-operative biological markers in predicting outcome of fistula maturation and those at risk of failure to mature.

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### EVERY EFFORT TO MAKE AV FISTULA SMALLER - THE TECHNIQUE OF FINE SUTURE AND RESULTS

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**Introduction and Objectives:** Dialysis patients might have been suffering from excess blood flow with their vascular access. A larger size fistula causes most of the problems such as varicose veins, venous hypertension and steal syndrome locally. Besides, some patients complicate high output cardiac failure, also congestive cardiac failure as well in such a situation. What anastomosis size would be most appropriate for primary arterio-venous fistulas (AVF) on forearm. Although surgeons had widely discussed this proposition long time, they could not draw sound conclusions until now.

**Material and Methods:** That's vital to consider the best place for making radio-cephalic fistulas. The joint level of a dorsal vein would be strongly recommended for that in common cases. Add a transverse skin incision just 1 cm in length between a radial artery and a cephalic vein. First, the dorsal vein should be cut off in advance to reduce stresses upon the anastomosis and to prevent subsequent venous hypertension. Secondly, patency of the cephalic vein beyond the elbow should be examined with 3 Fr Fogarty® catheter. Then isolate a radial artery carefully not to make a kink. We usually use our original vascular clamps (Technoclamp®) on the artery and the vein. The clamps have been basically developed only for using in AVF operation. Incise the vein and the artery with a sharp blade to make a 3 mm window. Side-to-side anastomosis is begun at the back wall from the distal corner with 7-0 polypropylene (Prolene® CV-1). Place at least 3 stitches in 1 mm, namely 12 or more stitches are left in total. Suture on the front wall is started from the proximal corner in similar fashion.

**Results:** The primary patency for AVF was 83.6% at 1 year and 63.9% at 3 year respectively, also secondary patency showed 87.2% and 71.8% for each in 101 patients in the beginnings. However, based upon the latest results, the secondary patency at 3 years improved to 79.1% in the 52 cases. Evaluation by using the transit-time method revealed that blood flow of radial arteries increased to approximately 200 ml a minute immediately even after the end of the minimum anastomosis. Despite the observation over 10 years, any patients complicating excess blood flow have not been seen in those having AVF by this method.

**Conclusions:** We are certain that just 3 mm arterio-venous anastomosis could be appropriate for primary radio-cephalic AVF practically.

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### FEMORAL VEIN TRANSPOSITION FOR ARTERIOVENOUS HEMODIALYSIS ACCESS

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**Introduction and Objectives:** When all access options in the both upper extremities have been exhausted and obstructed due to both central vein stenosis or obstruction, we should consider a arteriovenous fistula (AVF) at lower extremities. Construction of prosthetic arteriovenous access (AV graft) for hemodialysis in the lower extremities result in a high incidence of graft failure and infection. In this aspect, autologous access in lower extremities is valuable than AV graft. So, we report our experience of transposition of the femoral vein (tFV).

**Material and Methods:** From January 2012 to January 2014, 10 patients who underwent tFV in Soonchunhyang University Hospital were enrolled in this study. All patients had exhausted both upperarm extremities veins and

had central vein obstruction. All complications were recorded and statistical analysis of patency was performed using life-table method. Patients' records were retrospectively analyzed. The patients underwent a thorough history taking and physical examination which included inspection of the extremities for edema, asymmetry of blood flow and pulse, investigation of proximal vein patency with fistulogram and Doppler ultrasonogram.

**Results:** The mean age was 65.6 years, with 6 males and 4 females. Renal failure was associated with both Diabetes and hypertension in 4 patients and Hypertension only in 5 patients, and neither diabetes nor hypertension in 1 patient. Prosthetic graft was used in 4 patients due to shortness of femoral vein. There was no immediate failure and postoperative infection. 8 patients experienced minor complications (lymphocele, 6; hematoma, 3; delayed wound healing, 1). 2 patients experienced mild complications (immediate outflow stenosis, 1; obstruction due to thrombosis, 1), and all treated with percutaneous balloon angioplasty. 1 patient experienced major complication (acute distal ischemia), and treated by reducing AVF size (changing anastomosis site more proximally). The primary failure was occurred in 2 patients. The secondary patency rate at 6, 12, 18 month was 100, 100, 100, respectively.

**Conclusions:** Femoral vein transposition AVF for hemodialysis access in lower extremities is a valuable than AV graft because of lower complications and higher patency. So, transposition of Femoral vein can be an option in patients with no accessible vessels in upper extremities.

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### PREOPERATIVE IMAGING IN ARTERIOVENOUS FISTULA FORMATION: A SYSTEMATIC REVIEW

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**Introduction and Objectives:** Arteriovenous fistulas (AVF) are the preferred vascular access for haemodialysis. However primary failure in native AVF is still a major problem due to complications such as thrombosis and maturation failure. In recent studies, preoperative ultrasound in combination to clinical examination has been shown to improve outcomes, although there is no general consensus. This study aims to evaluate the extent of which preoperative imaging is used in vascular access through a scoping review.

**Material and Methods:** Electronic databases, MEDLINE, EMBASE and the Cochrane library were searched for studies which included an imaging assessment prior creation of fistula (up to August 2014). Two reviewers independently identified eligible articles and extracted data from randomised controlled trials (RCTs) and cohort studies.

**Results:** A total of 1362 articles were reviewed, with 175 studies full texts identified. A final total of 45 studies met the inclusion criteria. The majority of the included studies were found to use ultrasound assessment (n = 23), followed by venography (n = 9), magnetic resonance angiography (MRA) (n = 4) and computational tomography angiography (CTA) (n = 1).

**Conclusions:** In combination with physical examination, ultrasound mapping and venography were the main methods available for preoperative assessment. In addition, due to improving technology and non-contrast enhanced techniques, MRA and CTA may also warrant further review. Further analysis will investigate if these imaging modalities can provide additional diagnostic information, alleviating from premature failure of AVFs.

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### PREOPERATIVE EXAMINATION FOR ARTERIOVENOUS ACCESS IN HAEMODIALYSIS: INSIGHT INTO CLINICAL PRACTICE GUIDELINES

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**Introduction and Objectives:** Arteriovenous fistulas (AVF) are the preferred vascular access for hemodialysis but have a high incidence of primary failure, particularly at the radiocephalic site (1). Recent studies have shown routine

preoperative vascular ultrasound in addition to clinical assessment improves the AVF patency rates (2). This study aims to assess the content and consistency of international clinical practice guidelines in terms of pre-operative recommendations.

**Material and Methods:** Guideline databases and nephrology societies websites were used to search for vascular access practice guidelines that included recommendations on pre-operative assessment (up to April 2014). Key guidelines (NDOQI, ERBP, CARI and CNS) were identified and compared using the Appraisal of Guidelines for Research Evaluation (AGREE) II instrument (3) by three observers (DC, AK, JA). All scores were calculated as scaled domain score and between group differences calculated using analysis of variance. Inter rater reliability was assessed by intraclass correlation coefficient (ICC).

**Results:** Overall, guideline recommendations for pre-operative assessment include physical examination (4/4) with majority also recommending ultrasound for planning (3/4). Venography was recommended in suspected cases of central venous stenosis (2/4). The application of magnetic resonance angiography (MRA) and computed tomographic angiography (CTA) have been mentioned in suggestion to care (2/4).

Guideline methodology rigour was variable between the guidelines (p<0.02). This may be due to different search strategies and different methods of updating guidelines. Agreement was found between observers in overall ranking of the guidelines and inter rater reliability was found to be significant (ICC, p<0.005).

**Conclusions:** Physical examination, ultrasound mapping and venography are the main methods available for pre-operative assessment. Further work will include a systematic review of recent pre-operative imaging studies with MRA or CTA in order to see if these modalities can offer additional information as compared to the conventional methods recommended in the guidelines.

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### MULTIPLE FAILED FISTULAE: THE LOWER LIMB OPTIONS

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**Introduction and Objectives:** We summarise of our experience with long saphenous vein (LSV) and superficial femoral vein (SFV) leg fistulae with an aim to establish a preference as to which fistula to create when all upper limb options have been exhausted.

**Material and Methods:** Retrospective analysis of lower limb fistulae formed from 08/09/2009 to 01/01/2015.

**Results:** In all, 11 patients underwent lower limb fistula formation (mean age of 56. years, range 31-70). For 3 patients this was their first fistula due to upper limb venous occlusion. In the remaining 8 patients the average number of fistulae formed prior to lower limb AVF formation was 3.75 (range 2-6) with a mean time of 35.5 months (range 4-66 months) from primary AVF to lower limb AVF.

3 patients underwent LSV fistula formation. Following initial maturation two fistulae thrombosed. One fistula is still patent at more than 4 years but has required 5 angioplasties, 1 stent and 2 patch placements to maintain patency. All 8 SFV fistulae matured successfully. 1 patient died a month post surgery from colonic perforation. 1 patient required formal evacuation of a haematoma. 1 SFV fistula has required angioplasty and has subsequently been scheduled for surgical patch angioplasty. The 6 fistulae remain in active use, (2-15 months).

**Conclusions:** In our experience of LSV fistulae are problematic with multiple complications when compared to SFV fistulae. Current evidence demonstrates that PTFE lower limb grafts have a reduced patency and increased complication rate compared to SFV fistulae.

SFV fistulae are a good alternative to LSV and PTFE fistulae when all other access has failed.

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### FOCUSSED TRAINING IN RENAL ACCESS SURGERY – INTERIM QUALITATIVE DATA FROM A PILOT STUDY AT BRIGHTON AND SUSSEX UNIVERSITY HOSPITALS NHS TRUST, UK

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**Introduction and Objectives:** Renal access training for vascular surgeons in the United Kingdom is variable. Published data from the Dialysis Outcomes



and Practice Patterns Study demonstrates a clear association between training exposure and subsequent fistula failure rates. This pilot aims to explore the experiential benefits of focussed training.

**Material and Methods:** A focussed training programme was designed and implemented. The programme consisted of 8 full-day theatre lists, 4 half-day theatre lists and 4 out-patient clinics with 'hands-on' duplex ultrasonography. Surveys were distributed in order to establish surgical caseload exposure and the candidates' perceptions of their surgical abilities at the outset and upon completion of the programme.

**Results:** The programme was undertaken by a group of 8 surgeons comprised of senior surgical trainees, staff grade surgeons and post-CCT fellows. Data for operative case load exposure was obtained for 75% (6 of 8) of the candidates; over 8-weeks a mean of 55 cases were operated upon by each of the candidates of which 34 were undertaken as the primary surgeon. Qualitative data responses were received from 87.5% (7 of 8) of the candidates.

100% (7 of 7) of the responding candidates described themselves as having insufficient experience to create a basic fistula without closely directed supervision prior to starting the programme.

On completion 85.7% felt able to undertake basic fistula surgery without direct supervision and would be capable of offering a basic renal access surgery service in their own practice.

100% described advantages to their practice outside of renal access surgery.

**Conclusions:** Despite their seniority, the candidates had limited confidence and capability in renal access surgery prior to undertaking the programme.

The programme resulted in qualitative improvements in the candidates' perceptions of their abilities and the majority felt able to practice independently after a comparatively short time-frame.

All candidates felt that the programme offered significant advantages to other areas of clinical practice.

Further work is looking at quantitative changes in capability through the application of procedural assessment tools.

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### PREDIALYSIS ARTERIOVENOUS FISTULA CREATION IN ELDERLY PATIENTS

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**Introduction and Objectives:** The growing population of elderly and inclusion them into dialysis requires satisfactory and safe vascular access. Advanced age appears as an exclusive factor negatively influencing dialysis practice. Starting renal replacement therapy with an arteriovenous fistula (AVF) increases patient survival following dialysis initiation. Therefore, early creation of an AVF is strongly recommended.

**Material and Methods:** A 2-year single institution experience of the success rate, survival and complications of arteriovenous fistula (AVF) creation before dialysis initiation is reported. Study cohort: all patients (pts) who underwent AVF creation before need for dialysis (n = 196, male 105 and female 91) divided in two groups (gr): A gr <65 years of age (n = 108) versus B gr > 65 years of age (n = 88), and three subgroups - diabetic pts (Ad = 27, Bd = 37), -hypertensive pts (Ah = 27, Bh = 39) and others (Ao = 52, Bo = 13).

**Results:** Mean glomerular filtration rate (eGFR) at creation in Ad group was higher (16,52 ± 4,5 ml/min vs. 12,1 ± 3,1 ml/min, p = 0,0001) at patients vs Bd. We found statistically significant difference in eGFR at starting HD only in elderly patients with diabetes: Ad -13.6 ± 6.6 ml/min vs Bd -9.5 ± 3.5 ml/min (p = 0.0023\*). Ninety-eight percent of AVF were localized on the forearm: 92% in the distal and 8% in the proximal part. In B group only 9 pts underwent second AVF and 3 pts had a third AVF creation (more frequently in females). During the study period, in Bgr 75% (n = 66) of pts a mature fistula was used as their first dialysis access, 11% (n = 10) were still without dialysis and 14% (n = 12) started HD with central venous catheters (non-maturing AVF before need for HD or AVF thrombosis). Duration time of AVF until puncture: A -Age <65 yrs 127 ± 288 days; B Age > = 65 yrs 175 ± 203 days (p = 0.18). Greater hematocrit (HR, 1.04; 95% CI, 1.01 to 1.09) and albumin level (HR, 1,79; 95% CI, 1,37 to 2.33) showed an independent association with survival.

**Conclusions:** The age becomes less important barrier in modern medicine era. Elderly patients should not be denied creation of AVF as a rule. The outcome of AVF benefits more from acknowledging individual vas-

cular conditions than age of the patients. Our study proved that forearm fistula is feasible in elderly patients and may successfully serve for hemodialysis.

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### HOW MUCH TIME IS NEEDED IN CKD 5 PREDIALYSIS FOR A PROGRAMMED START OF A RENAL REPLACEMENT THERAPY (RRT)?

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**Introduction and Objectives:** The late referral to a nephrologist and a non-optimal start of RRT increases the morbimortality in these patients.

To consider an optimal beginning of Renal Replacement Therapy (RRT) it is needed to be used a permanent access in the first dialysis.

To analyse the percentage of non functional vascular access made in CKD5 Predialysis, that finally cause an initiation of non optimal RRT.

**Material and Methods:** In 2013, 37 AVFswere performed for 34 CKD 5 predialysis patients (Mean age 73 years (max 88-min 48), 34 PATIENTS

HTA/No HTA 32 (94%) 2 (6%)

Ischemic Cardiopathy (IC)/Non C. 6 (18%) 28 (82%)

Episodes of Congestive Heart failure (CHF)/Non failure 6 (18%) 28 (82%)

Peripheral arthropathy (PA)/No Peripheral arthropathy 5 (15%) 29 (85%)

DM/No DM 11 (32%) 23 (68%)

**Results:** After undergoing a decision-making program, if the patient end up choosing HD, the request is made to vascular surgery in order to create a vascular access. The average MDRD when AVF was ordered was 11 ml/min, beginning of HD the average time was 6 month. from AVFand beginning HD.

Average time from request vascular surgery until AVF surgery. 77 days (Min7- Max237)

Evolution of the 37 fistulas made in 34 CKD stage 5 predialysis:

- 16 of these patients continue in stage 5 pre dialysis (of these 16, as November of 2014, only 10 of them have a functional vascular access).

- 18 patients started a RRT:

- one patient received an pre-emptive graft.

- 2 patients begun with Peritoneal Dialysis due to access failure and the lack of place for a new AVF.

- 15 underwent to HD (8 with a functional access and 7 with a central venous catheter due to AVF thrombosis).

The percentage of patients that went through a CKD clinic and started HD in an optimal way with a functional AVF was 53%.

Causes of failure

Thrombosis 19 AVFs

Lack to maturation 8 AVFs

Steal syndrome 1 AVF.

**Conclusions:** For an optimal beginning of HD, according to some medical guidelines, at least a 12 month follow-up in a CKD clinic is needed. But this is not sufficient if there is not any monitoring of the final results.

In the population studied, only 53% had an optimal RRT start, and 47% started RRT with a CVC in spite of having go through an optimal schedule.

The time between ordering the AVF and the HD start influence an optimal RRT start, but it is also needed any kind of AVF monitoring before its use due to a high thrombosis rate and non functioning AVFs.

TABLE 1

	Male	Female	Total
<65 years	4	4	8 (24%)
65-75 years	5	3	8 (24%)
>75 years	9	9	18 (52%)
Total	18 (53%)	16 (47%)	34 (100%)



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**ARE THERE ANY CLINICAL VALID RULES FOR THE MATURATION OF ARTERIOVENOUS FISTULAS (AVF) IN HAEMODIALYSIS AND CKD 5 PREDIALYSIS POPULATION?**

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**Introduction and Objectives:** The early failure of the fistulas contributes to a low rate of functioning vascular Access. The lack of maturation of the AVF and the early thrombosis in an aged population lead to the increase in the use of the central vascular access in hemodialysis with its complications.

**Objective:** To apply a risk factor score that predicts the lack of maturation of the Fistulas as well as to analyse the clinical characteristics that might lead to such an outcome.

**Material and Methods:** Results and evolution: In 2013, 66 AVF were done in our unit, 19 distals and 17 proximals and 2 PTFE to 63 patients [34 (54%) in CKD 5 pre-dialysis and 29 (46%) in HD]. with an average age of 72.4 years.

Causes of failure (53%- 35 AVFs)

Thrombosis 24 AVFs (68%) 16 AVFs early thrombosis

8 AVFs late thrombosis

Lack to maturation 9 AVFs (26%)

Steal syndrome 1 AVF (3%)

Arterial bleeding 1 AVF (3%)

Re-surgery within 24 h due to thrombosis (13%). 8 patients

**Results:** Comorbidities: we used Risk Equation Determining Unsuccessful Cannulation Events and Failure to Maturation in Arteriovenous Fistulas (University Health Network-Toronto General Hospital and the University of Toronto).

**Conclusions:** Conclusions: Of the studied population, 75% had more than 65 year, 70% of them had a low-moderate risk factor for AVF maturation (CVD, PDV, Age >65 years and White race). When we apply the score to our population, we observe that male sex, hypertension, and the location of the distal AVF, had a high predictive positive value in comparison to classical risk factors.

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**REDUCTION OF SHEAR STRESS IN THE NATIVE VEIN BY USING AN ALTERNATIVE TECHNIQUE OF CONSTRUCTING VENOUS ANASTOMOSIS IN ARTERIOVENOUS GRAFT**

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**Introduction and Objectives:** Native autogenous arteriovenous fistulas generally have superior patency and intervention rates compared to prosthetic grafts (AVG). Main disadvantages of these high-flow AVGs are turbulent flow and fibrotic changes in the anastomotic region. We present our experience and long-term outcome with a new surgical approach to shear stress reduction in AVG venous anastomotic region.

**Material and Methods:** We have constructed 38 AVGs with our new technique where we use 1 cm of standard prosthetic graft and insert it into the native vein. We make two continuous sutures through the vein wall and the outer layer of the PTFE graft circulatory in two different positions, first one at the distal end of the native vein and the other one at the edge of the graft. To evaluate our technique we have prospectively collected data regarding our patients' complications and long-term outcome.

**Results:** Between Feb 2013 and Dec 2014 we constructed 38 AVG fistulas using our new technique (18 male (47%), mean age 64.1 ± 13.6 years). Primary patency at 6 months was 74% and at 18 months 59%, secondary patency was 96% and 88%, respectively. Mean number of interventions per patient during the whole follow-up period was 0.74 ± 1.39 and in the first year only 0.55 ± 1.08. Despite of short follow-up period (mean follow-up 10.2 ± 6.9 months, range: 1-23 months), 15 AVGs (39.5%) were still patent 1 year after construction and mean estimated time to graft failure was 21.0 ± 1.1 months.

**Conclusions:** With our novel surgical procedure we are able to construct a more geometrically-correct shape of venous AV anastomosis, resulting in laminar flow and less fibrotic changes in the anastomotic region. Our intervention rate is lower compared to standard AVG construction techniques. We didn't observe more frequent or additional side effects related to this technique. We propose our technique to be a feasible and effective method

of AVG construction with better hemodynamic characteristics and higher patency than with standard AVG construction technique.

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**INITIAL EXPERIENCE OF POLYCARBONATE-UROTHANE VASCULAR GRAFT (AVFLO) FOR HAEMODIALYSIS ACCESS**

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**Introduction and Objectives:** Although autogenous fistula is the preferred option for haemodialysis access, but patients with no suitable veins often require synthetic grafts for haemodialysis access. PTFE grafts are most widely used for many years. Newer Polyurethane grafts are used as an alternative due to their ability to self seal at puncture site. present data shows our initial experience with such grafts.

**Material and Methods:** In our institute 450 vascular access are created annually out of which about 10% are synthetic grafts. Between January 2012 to December 2014 seven (7) patients consented for Polyurethane (AVFlo) grafts. Mean age was 57 years, Male to female ratio 4:3. All grafts were put under brachial block. All patients received cefazoline. Six were straight grafts and one was loop graft. Next due dialysis after putting graft was done via AVFlo.

**Results:** Three patients had early thrombosis (with in first month). One patient opted for PTFE graft, Two patients underwent thrombectomy with correction of kink in the graft. In one patient no definitive etiology was found and graft salvaged by thrombectomy only One patient died due to MI on post operative tenth day. At one month patency was 4/6. Secondary patency was 5/5 at mean follow up of 7.4 month. There was no perigraft haematoma, no systemic or local reaction to the graft, we did not report any graft infection.

**Conclusions:** Newer Polyurethane grafts (AVFlo) provide satisfactory option for haemodialysis access but with high thrombosis rate caused by kinking due to softer consistency of these grafts.

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**PROPHYLACTIC FOGARTY CATHETER DILATATION OF VEINS SMALLER THAN 2.5 MM AFTER COMPLETION OF THE ANASTOMOSIS DURING ARTERIOVENOUS FISTULA CREATION**

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**Introduction and Objectives:** To report our results using a different technique consisting of prophylactic dilatation of the cephalic vein after completion of the anastomosis.

**Material and Methods:** A total 22 patients, aged between 35 to 65 years of age, with a cephalic vein diameter of 1.5 to 2.5 mm received an institutionally adopted technique for arteriovenous creation. Patients having reoperations, aneurysmatic or thrombosed veins and multiple risk factors were not considered eligible. All patients were assessed with duplex scanning ultrasonography at 15<sup>th</sup> day after the operation and at the time of follow-up.

**Results:** Mean cephalic vein diameter was 2.02 ± 0.28 mm and mean radial artery diameter was 2.32 ± 0.55 mm. At 15<sup>th</sup> day visit, 21 of 22 patients (95.4%) had patent arteriovenous fistula. Mean time of follow-up was 12.18 ± 1.30 months and was complete in 20 of 21 patients with a patent fistula. Overall patency was 18/22 (81.8%) and mean cephalic vein diameter was found to be significantly increased in patients with survived AVFs (2.00 ± 0.29 vs. 4.37 ± 0.47, p<0.001, n = 18).

**Conclusions:** Fogarty catheter dilatation of the cephalic vein after completion of the anastomosis during arteriovenous fistula creation is effective and safe in patients with small calibrated veins.

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**EARLY EXPERIENCE WITH A NOVEL SELF-SEALING NANOFABRIC VASCULAR GRAFT FOR EARLY HEMODIALYSIS ACCESS**

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**Introduction and Objectives:** To report initial experience regarding the use of novel self-sealing electrospun nanofabric graft.





**Material and Methods:** A total of 21 patients, aged between 22 and 64 (male: female ratio = 11:10) underwent AVflo vascular access graft implantation to forearm. Information for patency at 6<sup>th</sup> month and 12<sup>th</sup> month after the operation was obtained. Cannulation for hemodialysis was allowed 8 hours after the operation, as needed.

**Results:** Cannulation was performed before 12<sup>th</sup> hour of implantation in two patients, between 12<sup>th</sup> and 24<sup>th</sup> postoperative hours in ten patients and between 12<sup>th</sup> and 24<sup>th</sup> postoperative hours in the remaining 9 patients. Primary patency was 17/21 (80.9%) at 6<sup>th</sup> month and 15/21 (71.4%) at 12<sup>th</sup> month. Secondary patency was 19/21 (90.4%) at sixth month and 17/21 (80.9%) at 12<sup>th</sup> month.

**Conclusions:** AVflo self-sealing graft allows for early cannulation after implantation and thus may potentially eliminate the need for central venous catheters in selected patients.

TABLE 1

Variable	n
Male gender	11 (52.3%)
Mean age	56.61 ± 12.84
Diabetes	12 (57.1%)
Peripheral arterial disease	3 (14.2%)
Tobacco use	3 (14.2%)
Mean time from onset hemodialysis (years)	3.42 ± 1.56
Number of patients with previous AVFs	15 (71.4%)
Mean number of previous AVFs	2.04 ± 0.62
Patients with CVCs placed within last 6 months	17 (81.0%)

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## SYSTEMATIC REVIEW OF THE ULNAR-BASILIC ARTERIOVENOUS FISTULA FOR HAEMODIALYSIS

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**Introduction and Objectives:** A critical factor in the survival of renal dialysis patients is the surgical creation of vascular access. The fistula first initiative has promoted arteriovenous fistulas (AVF) as the vascular access of choice. To preserve as many future access options as possible, it is recommended by multiple guidelines that the most distal AVF possible should be created in the first place. Generally snuff box and radio-cephalic are accepted and well described sites for AVFs however the forearm ulnar-basilic AVF is seldom used or recommended. The aim of this study is to assess and systematically review the evidence base for the creation of the ulnar-basilic fistula to critically appraise whether more attention should be given to this site.

**Material and Methods:** Electronic databases were searched for studies involving the creation of ulnar-basilic fistulas for dialysis in accordance with PRISMA guidelines. The primary outcomes for this study were 1-year primary and secondary patency rates. Secondary outcomes were rates of dialysis access associated steal syndrome and infection.

**Results:** Following strict inclusion/exclusion criteria by 2 reviewers, eight studies were included in our review. Weighted pooled data reveals 1-year primary patency rate for ulnar-basilic AVFs of 52.6% (46.5-58.3%) with a secondary patency rate of 69.2% (62.6-74.9%). Dialysis access associated steal syndrome and infection rates were low.

**Conclusions:** Our study has shown that the ulnar-basilic AVF may be a viable alternative when a radio-cephalic AVF is not possible and dialysis is not required urgently. It has adequate 1-year primary and secondary patency rates and extremely low risk of steal syndrome. Whilst it may be more challenging for both surgeons and dialysis nurses to make it a successful vascular access it offers a further option of distal access which may be overlooked.

## VASCULAR ACCESS SURVEILLANCE

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## ARE THERE ANY RISK FACTORS TO DEVELOP HIGH FLOW ARTERIOVENOUS ACCESSES IN HAEMODIALYSIS PATIENTS?

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**Introduction and Objectives:** Chronic haemodialysis (HD) requires an adequate vascular access, with arteriovenous (AV) access (fistula or graft) being the first choice.

High flow access (arbitrarily defined as access flow (Qa) greater than 2 L/min) have been related to systemic and cardiac consequences. Although risk factors for the development of a high flow access remains unknown.

The aim of this study was to evaluate patients and access characteristics that can be related to the development of a high flow AV access.

**Material and Methods:** This cross-sectional study included 336 prevalent HD patients with a mean age of 66.4 years, 62.5% males, 36.3% diabetics, and with a median HD time of 48 months. Seventeen percent of the patients had a high flow AV access. Qa were evaluated using the Fresenius Medical Care Blood Temperature Monitor (BTM) at 300 ml/min.

**Results:** Patients with high flow accesses were younger ( $p = 0.001$ ) but were in HD for a longer time ( $p = 0.023$ ), and had lower prevalence of diabetes ( $p = 0.004$ ). In respect to access characteristics we found that  $Qa \geq 2$  L/min was more frequent in longer duration vascular accesses ( $p = 0.001$ ), in fistulas comparatively to grafts ( $p = 0.005$ ) and in proximal accesses than in distal ( $p = 0.016$ ).

In a multivariable analysis,  $Qa \geq 2$  L/min was negatively associated with age at HD beginning ( $p < 0.001$ ) and diabetes ( $p = 0.028$ ) and positively associated with HD vintage ( $p < 0.001$ ), duration of the AV access ( $p = 0.001$ ), and proximal construction of the access ( $p = 0.001$ ).

**Conclusions:** Our study shows that younger patients, non-diabetics, with longer time in HD and with longer duration proximal fistulas may develop more frequently high flow accesses.

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## RE-VISITING THE RISKS OF CONTRAST ENHANCED MRI IN VASCULAR ACCESS IMAGING

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**Introduction and Objectives:** Gadolinium based contrast agents (GBCA) have been linked to occurrence of nephrogenic systemic fibrosis (NSF). This has triggered public-health advisory bodies to issue safety guidelines on its use. As a result, the incidence of NSF has seen a decrease, as has the published use of contrast enhanced magnetic resonance imaging (MR) in vascular access. Understanding of the events that lead to these recommendations can increase clinical awareness and the implications of using gadolinium agents in renal insufficiency.

**Material and Methods:** We searched electronic-databases to review the published evidence of NSF, its reported pathoclinical manifestations, diagnostic pathway, treatments options and its incidence. We also reviewed guidelines and published manuals on contrast safety to correlate how the evidence had influenced advisory bodies.

**Results:** The use of MRI with GBCA in vascular access imaging has seen a decline. If CE MRI is to be used, low and medium risk gadolinium contrast agents are the choice, as identified by the European Medicines Agency. Dosage should be minimal but effective. Only in dialysis dependent patients should a post scan dialysis session be arranged - minimum 3 hours and 3 consecutive days. NSF reporting has been passive and dependent on clinical manifestations. It can occur from months to years after exposure and can have a sub clinical course. No single laboratory test is gold standard for diagnosis. No consistently successful treatment has been proposed. Transplantation can arrest disease progression.

**Conclusions:** CE MRI can provide information to guide treatment but clinical risks and benefits should be assessed. Clear documentation of date, dose and type of formulation used is necessary. The Girardi score should be used for diagnosis and positive results reported to NSF registries. Effective and safe research is needed on the low risk formulations in the long term. The true incidence of NSF maybe under-reported. In cases of confirmed NSF, renal transplantation should be made a priority.

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# FLOW VOLUME AND RESISTANCE INDEX PREDICT EARLY ACCESS FAILURE IN ARTERIOVENOUS FISTULAE

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**Introduction and Objectives:** This study aimed to prospectively monitor patients who underwent arteriovenous fistulae (AVF) surgery using ultrasonography (US) and to assess their data to predict early access failure of AVF.

**Material and Methods:** Thirty-six patients with newly created AVF in our hospital (men, 22; mean age, 72 years) were included. Access flow was periodically assessed on Doppler ultrasonography before, 1 day, and 1 week after AVF creation. The flow volume (FV) and resistance index (RI) of the brachial artery were measured. Outcome was the first intervention with either percutaneous angioplasty (PTA) or surgical revision within 40 days after access creation.

**Results:** From the day before surgery to postoperative day 1, the overall FV significantly increased from 62 to 349 mL/min ( $P<0.0001$ ) and the overall RI significantly decreased from 1.0 to 0.64 ( $P<0.001$ ). Six patients required PTA or surgical revision within 40 postoperative days (intervention group [IG]), whereas 30 patients did not (non-intervention group [NIG]). FV significantly increased from day 1 to week 1 in the NIG ( $P<0.0001$ ), but not in the IG. RI also significantly decreased from day 1 to week 1 in the NIG ( $P<0.0001$ ), but remained unchanged in the IG. The maximum flow volume and minimum RI on day 1 in the IG were 235 mL/min and 0.63, respectively. Sensitivity and specificity were 100% and 87%, respectively, when the FV cutoff to detect early access failure on day 1 was defined as 235 mL/min; and 100% and 63%, respectively, when the RI cutoff was defined as 0.63.

**Conclusions:** Access FV and RI on day 1 after surgery are useful to predict early access failure of AVF and plan intervention.

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# A NOVEL SEMIAUTOMATIC TECHNIQUE FOR VOLUME FLOW MEASUREMENT COMBINING VECTOR FLOW IMAGING AND SPECTRAL DOPPLER

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**Introduction and Objectives:** Vector flow ultrasound imaging of blood flow is available in a commercial ultrasound system (B-K Medical: Pro Focus Ultra View 800). Vector flow imaging is a FDA approved, advanced color Doppler technique demonstrating flow directions by vectors and colours in the color box in the B-mode image. The technique has recently been applied to combine spectral Doppler velocity measurement with vector based automatic estimate of Doppler angle and vessel diameter, thus automatically delivering volume flow. Using also automatic setting of sample volume, PRF and beam-steering it is a potential simplification of conventional volume flow measurement technique, overcoming the operator dependent, and often inaccurate, estimate of Doppler angle and vessel diameter.

**Material and Methods:** Measurements were performed on flow phantoms with properties similar to A-V fistula vessels, and with laminar, symmetrical and non-symmetrical flow profiles. Results from the two techniques were compared and related to true volume flow. Similarly comparative measurements were performed on multiple sites in A-V fistula vessels in dialysis patients.

## Results:

1. Doppler angle: In non-symmetric, distorted flow differences up to 3-4° were seen between the two techniques. At a 60° Doppler angle this will result in 9-12% error in the velocity estimate. The live vector arrows show pulse cycle fluctuations and flow variations along the vessel, which illus-

trate that it is too simplistic to regard the flow direction as just parallel to the vessel wall when estimating the Doppler angle. Vector flow imaging may also guide in choosing measurement areas with less disturbed flow.

2. Vessel diameter: The vessel diameter estimate was sensitive to color Doppler gain, thus making gain adjustments necessary for more correct automatic positioning of the diameter markers. This was however difficult due to the color flow image hiding the B-mode vessel wall image. After freezing the image, the color overlay may be removed, and then further manual diameter correction was often necessary. Without this correction overestimates of volume flow could be high (25%(-50%)). After manual correction, the two techniques gave fairly similar results.

**Conclusions:** The often tortuous and irregular A-V fistula vessels with disturbed flow is obviously a great challenge to reliable volume flow measurements.

The automatic Doppler angle estimation is a true improvement, and the automatic settings may speed up the measurement process. The automatic diameter estimate, however, needs further development.

A new, improved version of this novel and promising technique is available soon for similar testing, and will be incorporated in the presentation.

## 108

# IMAGE (CT, ULTRASOUND AND ANGIOGRAPHY) IN THE HIPOPERFUSION ISCHEMIC SYNDROME IN PATIENTS ON HAEMODIALYSIS

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**Introduction and Objectives:** To understand the clinical importance of the Distal hypoperfusion ischemic syndrome (DHIS) in haemodialysis patients and the importance of a correct diagnosis using duplex Doppler ultrasound (DDU), angiography and CT.

**Material and Methods:** The image confirms the diagnosis and finds the etiology cause in order to make a treatment.

Although the diagnosis of hand ischemia is based on physical examination, image studies are very useful for detecting the true cause of ischemia and for selecting an appropriate therapeutic strategy.

There are three distinct etiologies:

1. Blood flow restriction to the hand (arterial occlusive disease proximal or distal to the AV access anastomosis).
2. Excess blood flow through the AVF (true steal).
3. Lack of vascular (arterial) adaptation to increase flow demand from the AVF.

DDU allows to know the blood flow volume through AV access, the direction of the flow in the artery distal to anastomosis, diagnostic of stenosis in the proximal and distal arteries, waveform of the radial artery and changes upon compressing the access. Angiography CT allows to diagnose central and peripheral arterial stenosis.

Arteriography or angiography must undergo to confirm the stenosis and in the same setting treat vascular obstructive lesions.

**Results:** We describe our experience in 46 patients with DHIS in which we did DDU (n = 46), AngioTC (n = 11) and angiography (n = 8), the image findings and their relation with literature.

**Conclusions:** DHIS should be detected by clinical investigation and the cause should be identified by both non-invasive imaging and angiography.

The angiography must be done to enhance the arterial inflow or to access distal revascularization.

## 109

# EARLY ENDOVASCULAR TREATMENT OF STENOSIS IN VASCULAR ACCESS BEFORE THE FIRST CANNULATION IN HEMODIALYSIS PATIENT

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**Introduction and Objectives:** It was reported that of the patency rates of the vascular access such as arteriovenous fistula (AVF) and arteriovenous graft (AVG) in hemodialysis (HD) patients were not high. But the vascular access patency after early endovascular treatment is still undetermined.

The aim of this study was to evaluate the patency of vascular access after early endovascular treatment.

**Material and Methods:** This study was a retrospective single center study that included 89 HD patients who underwent early endovascular treatment after the vascular access creation between June 2004 and December 2012.



Early endovascular treatment was defined as endovascular intervention of significant stenosis detected in venography before the first cannulation or within 2 weeks of the first cannulation. Vascular access patency was followed-up for 1 year after percutaneous transluminal angioplasty (PTA).

**Results:** The mean age was  $60.8 \pm 14.6$  years and 43.8% (n = 39) of the patients were male. Diabetics were 62.9% (n = 56) of the patients. AVF operation was conducted in 73.0% (n = 65) of patients and AVG operation was 27.0% (n = 24). In AVF, main stenosis sites were anastomosis site (n = 12), swing point (n = 35) and mid vein (n = 18). Central vein was not included. In AVG, main stenosis sites were venous anastomosis (n = 21) and mid vein (n = 3). Arterial anastomosis, graft and central vein were not included. 98.9% (n = 88) of the patients had immediate radiologic and clinical success. The one patient performed reoperation because of venous rupture during PTA. The patency rate for 6 months was 89.9% (n = 80/89) and the patency rate for 1 year was 74.2% (n = 66/89).

**Conclusions:** This study suggests that early endovascular treatment of stenosis in the vascular access before the first cannulation is effective. We found that the primary patency rates of AVF and AVG were high. Our results suggest that early endovascular treatment may improve primary patency rates of vascular access in HD patient.

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## VASCULAR ACCESS MANAGEMENT USING ULTRASONOGRAPHY DURING HEMODIALYSIS

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**Introduction and Objectives:** Vascular access (VA) is essential for hemodialysis (HD) therapy and needs to function properly to provide high quality dialysis. In 2009, we began to use a screening method which evaluates VA function using ultrasonography of a brachial artery while the blood pump is stopped during HD.

**Material and Methods:** The study period from 2008 to 2013 was divided into 12-month intervals (early stage: 12-months before ultrasonography implementation, stage 1: the first 12-months, stage 2: the second 12-months, stage 3: the third 12-months, stage 4: the fourth 12-months, and stage 5: the last 12-months). Changes in the following were examined by period: the number of cases with percutaneous transluminal angioplasty (PTA), number of ultrasonography evaluations, and brachial artery blood flow volume (FV), resistance index (RI), and flow velocity before PTA.

**Results:** In the early stage, there were 244 cases of PTA, 20 cases of thrombectomy, and 9 cases of reconstruction after occlusion. The number of PTA decreased over the years after VA function evaluation using ultrasonography. In stage 3, there were 137 cases of PTA, 4 cases of thrombectomy, and 1 case of reconstruction after occlusion. The number of ultrasonography evaluations was 542 in stage 1, 1113 in stage 2, and 1767 in stage 3. The pre-PTA FV significantly decreased from stage 1 to stage 2 but was approximately 350 mL/min thereafter. The number of PTA decreased after ultrasonography implementation. There were 147 cases of PTA in stage 4. However, 11 cases of thrombectomy, and 10 cases of reconstruction after occlusion, showing the increased numbers from stage 3. In the most recent stage of stage 5, in addition to ultrasonography findings, physical findings were taken into account to determined indication of PTA. As a result, there were 201 cases of PTA, 11 cases of thrombectomy, and 5 cases of reconstruction after occlusion.

**Conclusions:** In conclusion, ultrasonography is a useful method for quantitative evaluation of VA function. However, it is also important to perform VA management based on physical finding.

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## VASCULAR GRAFT ACCESS FOR HEMODIALYSIS: ASSOCIATED COMPLICATIONS, THERAPEUTIC PROCEDURES AND PATENCY IN THE LAST THIRTEEN YEARS

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**Introduction and Objectives:** Surveillance and monitoring of vascular access (VA) for hemodialysis (HD), allows a greater detection and early treatment

of related complications, which will increase their patency; although this is a constant controversy in these topics.

**Objectives:** 1.-To establish the complications and therapeutic procedures associated with the use of vascular graft accesses (VGA) in our HD unit. 2.-To analyse VGA patency in our HD unit.

**Material and Methods:** A two comparative periods in a 13 years retrospective study: A Period (VA Monitoring: 2006-2013) and B period (No VA monitoring: 2000-2005). Analyzed data: 1.-Demographical data, major comorbidities and diagnostic procedures. 2.-Related complications: stenosis, thrombosis, aneurysms, pseudo-aneurysms, rupture and infection in VGA. 3.- Therapeutic Interventions: angioplasty, thrombectomy and withdrawal in VGA. 4.- Patency: primary (1<sup>st</sup>), secondary (2<sup>nd</sup>) and assisted patency rates. **Results:** 107 HD patients. 109 VGA. 55 excluded (39% <6 months duration). 54 VGA analyzed (Period A: 46 pat, 26 VGA). No significant differences between groups regarding sex, age, aethiology, time on HD, comorbidities and 2<sup>nd</sup> VGA patency ( $30.5 \pm 25.3$  vs  $31.6 \pm 25.5$  months) were observed. After A period, a global trend to a greater number of total diagnostics procedures (A vs B period:  $54 \pm 2.1$  vs  $35 \pm 1.2$  total procedures, p = 0,10), complications ( $65 \pm 2.5$  vs  $47 \pm 1.7$ , p = 0,18) and therapeutic interventions ( $48 \pm 1.8$  vs  $26 \pm 0.9$  in total, p = 0,11) were observed. However, a statistical significance (\*p<0.05), regarding lower number VGA total accesses ( $28 \pm 1.1$  vs  $38 \pm 1.4$ ), a shorter 1<sup>st</sup> patency ( $8.5 \pm 11.1$  vs  $23.1 \pm 22.9$  months) and a greater assisted patency ( $21.9 \pm 18.8$  vs  $8.4 \pm 19.6$  months) in A period were observed.

**Conclusions:**

1. Surveillance and monitoring of vascular access resulted in a greater number of diagnostic procedures and therapeutic interventions in our study.
2. The surveillance and monitoring methods used in our center allowed us an earlier detection of vascular graft access dysfunction, increasing both primary and assisted patency and reducing the number of vascular grafts per patient in our HD unit.

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## SURVIVAL OF TUNNELED HEMODIALYSIS CATHETERS AFTER PERCUTANEOUS PLACEMENT

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**Introduction and Objectives:** Tunneled catheters are becoming increasingly used as a provisional or permanent dialysis access. Easy way of insertion and good long-term patency make them competitive to fistulas in some groups of patients.

**Material and Methods:** Late complication and survival of 180 tunneled catheters inserted from June 2010 to December 2013 in 171 unselected hemodialysis patients were analyzed. The observation was ended in June 2014.

**Results:** The cumulative time of observation was 2103,5 patients-months and median observation was 9 months (range 0,5-45 months). Only 19 out of 180 catheters were removed due to complications (12 for infections, 4 due to malfunction and 3 because of mechanical damage). Majority of catheters were removed electively: 27 after maturation of arterio-venous fistula (AVF), 4 after kidney transplant, 5 after transfer to peritoneal dialysis and 3 due to recovery of renal function. At the end of the observation 58 catheters were still in use and 64 patients died with the functioning catheter. When censored for elective catheter removal and patient death, 88,2% catheters survived 1 year. Catheter survival was significantly better in older patients (over 65 years in comparison to patients <65 years, p = 0,046).

**Conclusions:** Nearly 90% of all inserted catheters served the patients well, being reliable dialysis access as long as it was needed. Among them over 30% of the inserted catheters were in use at the end of the observation period and over 30% of patients died with the functioning catheter. The results of tunneled catheters survival are encouraging and they should be taken into consideration during decision-making on vascular access, especially in the older patients.

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## WHY WE DO NEED DIALYSIS ACCESS SURVEILLANCE PROGRAMS

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**Introduction and Objectives:** A durable and well-functioning vascular access (VA) is mandatory for efficient dialysis treatment. Almost all VA guidelines



recommend surveillance programs to detect progressive stenosis before it results in acute access thrombosis. However, many clinical trials have questioned the value of such an approach. In the present study we compared the effort required to re-establish a sufficient dialysis access in case of failing or thrombosed VA.

**Material and Methods:** From January 2013 until June 2014 a total of 1601 interventions and operations for dialysis access were performed in our clinic. Of these 481 were for failing (272, 56,5%) or thrombosed (209, 43,5%) VA. All patients were prospectively followed for kind of admission, need of bridging with central venous catheters (CVC), type of intervention and complications.

**Results:** Patients with failing VA were admitted on an elective basis in 90,4%, whereas thrombosed VA presented as emergency admission in 98,6%. 83% of patients with failing VA had native fistulas, whereas in the thrombosed group native and partial or complete alloplastic VA accounted for 1/3 each. Acute or long term CVC bridging was necessary in failing VA in 4,5%, in thrombosed VA in 34,5%. A thrombosed VA yielded a 3 fold higher risk of local postoperative complications (recurrent thrombosis, bleeding, 21% vs. 7%) and need of operative revision (17% vs. 5%). Subgroup analysis revealed that many of the patients with a failing VA had a tunneled CVC in place (19%) or were not yet on dialysis, but 97% of patients with thrombosed VA depended on that VA. Spectrum of interventions was similar in all groups, angioplasty and revision of anastomoses being the most frequent actions accompanied by thrombectomy in thrombosed VA. In native VA the fistula vein (21%) and the AV-anastomosis (39%) were the main target regions, in grafts the distal anastomosis (85%).

**Conclusions:** Acute VA thrombosis necessitates unplanned emergency admission and treatment which is inconvenient for both patient and vascular surgeon. Optimal preoperative workup is not possible and results in frequent postoperative problems. CVC bridging is often required and comprises great risks for precious central veins. Alloplastic VA seem to be more prone to develop acute thrombosis, probably because physical examination alone does not reveal signs of progressive underlying stenosis as easily as in native fistulas. Therefore surveillance programs especially for alloplastic VA should be implemented.

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##### THE CURRENT STATUS OF THE VASCULAR ACCESS FOR LONG-TERM HEMODIALYSIS/HEMODIAFILTRATION PATIENTS IN JAPAN

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**Introduction and Objectives:** In Japan, patients are often on long-term hemodialysis (HD)/hemodiafiltration(HDF) treatment. Vascular access is a lifeline for dialysis patients and the proper maintenance of vascular access is one of the key factors that make long-term HD/HDF possible. In this study, we investigated the conditions of vascular access in the patients undergoing the chronic HD/HDF in Japan and our hospital group to examine the relationship between vascular access and long-term treatment.

**Material and Methods:** We studied the conditions of vascular access in 899 patients who were receiving the chronic HD/HDF including those who had been on dialysis treatment over 20 years as of December 2014.

**Results:** There were 125 patients who had been on dialysis treatment over 20 years, the longest being 37 years, which accounted for 13.9 percent of the total. The primary diseases were: two cases of diabetes and the rest were chronic glomerulonephritis. There were 105 patients with AVF while there were only 20 with AVG (16.0 percent). However, as for the 774 patients who had been on dialysis treatment for less than 20 years, 91 patients had AVG (11.7 percent), which indicated the increase in the rate of AVG along with the prolongation of dialysis treatment. In addition, JSDT registry reported it seems the same results in this study, which suggests that AVG increases in proportion to the prolongation of dialysis treatment.

**Conclusions:** There is an increase in the incidence of diabetic nephropathy and elderly dialysis patients as well as the increase in the patients undergoing long-term dialysis for 20 years or more in Japan. The method of access mainly used for patients who had been on dialysis treatment over 20 years, which is very rare even on a global scale, was AVF. However, it is unavoidable to shift to AVG for the cases of vein deterioration due to long-term usage. The method of access using AVG on long-term patients is expected to further increase.

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##### IMPLEMENTATION OF A PROCEDURE TO PREVENT INFECTIONS RELATED TO VASCULAR ACCESS - RESULTS OF AN IN-HOSPITAL HAEMODIALYSIS UNIT

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**Introduction and Objectives:** Haemodialysis (HD) patients often have infectious complications, especially vascular access related infections (VARI) which are associated with higher morbidity and mortality. In 2010 a procedure to prevent VARI was developed in a HD Unit and its implementation has been audited since then. The aim of this study is evaluate and characterize the impact of a procedure to prevent VARI in a hospital outpatient hemodialysis facility.

**Material and Methods:** In 2009 a Vascular Access Team was created (nephrologists, nurses and a vascular surgeon) and several clinical measures to decrease VARI were started. Between 2009 and 2014 the team recorded all the infections of arteriovenous fistulas (AVF) and arteriovenous grafts (AVG). For catheters with cuff all the exit site, tunnel infection and bacteraemia associated to the catheter were considered and for catheters without cuff we recorded all the bacteraemias associated to the catheter. The time in risk of each vascular access was also documented. The rate of infection between pre (2009) and post intervention (2011 to 2014) was compared and the year of 2010 was considered a transition period. The rate difference of VARI between the pre and post intervention was calculated by chi-square test.

**Results:** The study included 148 patients, with a total of 1910 months at risk. The comparison between pre and post intervention showed a decrease in VARI (4.15 infections per 100 patient-month versus 1.0 infection per 100 patient-month [ $p<0.05$ ]) and in blood stream infections related to HD access (24.9 infections per 100 patient-month to 0.33 per 100 patient-month [ $p<0.05$ ]). The pre intervention rate of infection was 12.7 and 41.7 per 100 patient-month for HD catheter with and without cuff, respectively. In AVF the rate was 1.5 patient-month and 3.4 per 100 patient-month for AVG. The post intervention rate of VARI decreased to 3.68 and 16.17 per 100 patient-month for catheter with and without cuff, respectively, and there were no infections in AVF and AVG. All types of access reduced VARI ( $p<0.05$ ). In post interventional period agent isolation occurred in 73.3% of VARI, mainly gram positive. Four patients needed hospital care (26.7%) and 1 died in sepsis (5.3%).

**Conclusions:** The decrease of VARI rate after the implementation of this procedure suggests that a surveillance program in HD units is important to prevent and reduce VARI. VARI rate was higher in patients with HD catheters, especially in non-cuffed. Gram positive bacteria are the most common group of agents in VARI.

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##### CLINICAL UTILITY OF THE NEW (CAVEA2T2) SCORING SYSTEM FOR PREDICTING RADIO-CEPHALIC ARTERIOVENOUS FISTULA SURVIVAL

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**Introduction and Objectives:** Radio-cephalic arteriovenous fistula (R-C AVF) creation for renal access therapy is regarded as the gold standard for patients with end-stage renal failure requiring haemodialysis treatment. Duplex ultrasonography has proved to be a useful tool in preoperative assessment. Recently, the CAveA2T2 scoring system was published (ipsilateral Central venous access, Age >73 years, anastomosed Vein <2,2 mm, lower limb angioplasty and absent intra-operative thrill), although it has not been implemented in clinical practice.

The aim of our study was to assess the predictive ability of the CAveA2T2 score in the survival of R-C AVF performed in our center and the subsequent application in surveillance strategies.

**Material and Methods:** Retrospective single-center study. Patients undergoing forearm radio-cephalic fistula formation were identified between January 2009 and January 2013. Demographic variables and comorbidities were collected.

The CAveA2T2 score was applied (1 point was assigned for each of the first three variables and 2 points for the latter two).



Primary patency rates were calculated at 6 weeks, and at 6, 12 and 24 months.

**Results:** A total of 34 radio-cephalic forearm fistulae (median age 61.7 ± 13.1 years) were identified; 79% were male and 85% were left sided. Major comorbidities were hypertension 82%, diabetes 41%, dyslipidemia 32% and peripheral vascular disease 29%. The median Chalon index was 7.8 ± 3.4. The median CAVeA2T2 score was 1.53 ± 0.6 (8.8% ipsilateral central venous access, 20.6% >73 years, 17.6% vein <2.2 cm, 29.4% lower limb arteriopathy and 23.5% absent intra-operative thrill). A total of 7 patients (20.6%) underwent a fistula-preserving intervention, comprising 5 open surgical procedures and 2 endovascular procedures. The overall patency rate (18.5%) was 13.7 ± 3.9 months. Primary patency rates at 6 weeks and 6, 12 and 24 months were 82.4%, 52.9%, 41.2% y 14.7%, respectively. Increasing score was associated with a decrease in overall patency rates (≥2) (log-rank, X2 16.8, dif 1, p = 0.0001) and stratification of the CAVeA2T2 score into three groups (scores 0-1, 2, 3+) retained its significance (log-rank, X2 17.1, dif 2, p = 0.0001).

**Conclusions:** In this study, CAVeA2T2 score proved to be a useful tool, easy-to-apply and highly predictive of R-C AVF survival. Due the results obtained, patients with score higher than two, will be followed with a more exhaustive R-C AVF surveillance in our center. Until date the evidence is limited, so future studies are required to design clinical protocols including CAVeA2T2 score.

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## A NOVEL FACTOR FOR PRIMARY ARTERIOVENOUS FISTULA FAILURE: HYPERINSULINISM

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**Introduction and Objectives:** Vascular access dysfunction is an important cause of morbidity for dialysis patients and a major contributor to hemodialysis cost. Increasing fistula maturation rates is still a challenge for nephrologists. A major problem with the arteriovenous fistula (AVF) is the high frequency of primary failure, either due to early thrombosis or lack of maturation. Herein, we aimed to investigate the role of hyperinsulinism as a new factor in primary AVF failure which is strongly related intimal damage.

**Material and Methods:** Totally 119 patients (73 M, 46 F) with a recent diagnosis of ESRD underwent a AVF creation by vascular surgeon. Preliminary results were presented at World Congress of Nephrology 2009, Milan, Italy. The presence of thrill was recorded on first postoperative day. Functioning access was defined as successful cannulation with two needles and a minimum blood flow of 250 ml/min for at least a complete dialysis treatment after 4 weeks of AVF creation. Insulin resistance was evaluated by homeostasis model assessment (HOMA-IR) (HOMA-IR = fasting insulin (mU/L) × fasting glucose (mg/dl)/405). The significant factors differed between patients with and without primary AVF failure, were included in logistic regression analysis to demonstrate independent predictors of primary AVF failure.

**Results:** Primary AVF failure (pAVFF) was detected in 27 (22.7%) of patients. The significantly different parameters between patients with and without primary AVF failure are demonstrated in Table 1. The remaining parameters (age, sex, BMI, serum Calcium, phosphorus, Parathyroid hormone hemoglobin, blood pressure, site of AVF, presence of catheters were similar) Table 1 Comparison parameters between with and without primary AVF failure. The logistic regression analysis of preoperative parameters revealed following OR and 95% CI values: HOMA-IR 1.205 (1.063-1.366) (p = 0.004), serum albumin 0.398 (0.178-0.892) (p = 0.025), Daily proteinuria 1.307 (1.012-1.688) (p = 0.041). When presence of postoperative thrill on AVF which was a postoperative strong clinical factor was added to analysis, HOMA-IR and serum albumin had remained as independent predictor of primary AVF Failure.

**Conclusions:** To our knowledge, there is no previous study investigating the role of hyperinsulinism in pAVF failure. Higher expression of the IGF-related peptides was previously reported in the stenotic (neo)intima of AVF. Our study indicates that hyperinsulinism or insulin resistance may be a metabolic reason of primary AVFs Failure which emphasizes the role of endothelium. We also observed that hypoalbuminemia is an undetermined significant risk factor.

TABLE 1

	pAVFF present n = 27	pAVTT absent n = 92	P
Postop tril (%)	33.3	83.7	<0.0001
24 saatlik Idrarda Protein (gr/gün)	3.0 ± 2.4	1.5 ± 1.7	0.001
Insülin (U/ml)	22.7 ± 19.9	11.7 ± 9.2	<0.0001
HOMA-IR	6.1 ± 5.3	3.2 ± 2.7	<0.0001
Albümin (gr/dl)	2.7 ± 0.9	3.2 ± 0.7	0.004
BMI (Kg/m <sup>2</sup> )	24.4 ± 5.3	23.9 ± 4.4	ns

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## CHANGES OF FLUID DISTRIBUTION DETERMINED BY MULTIFREQUENCY BIOELECTRICAL IMPEDANCE AFTER ARTERIOVENOUS FISTULA CREATION

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**Introduction and Objectives:** After the vascular access creation, the blood flow of access side's brachial artery become several times better. The increased arterial blood flow is returned to heart through the out-flow veins, and leaves to systemic circulation. Vascular access creation is thought to affect general circulation states. However, little was known about changes of fluid content after vascular access creation. We investigated how the changes of blood flow due to vascular access creation affect fluid distributions.

**Material and Methods:** During the period from July to December 2014, 13 patients received arteriovenous fistula creation. All patient was measured the blood flow of brachial artery and the body water distribution at the timing of just before access creation and one week after access creation. The blood flow of brachial artery was measured by pulse Doppler ultrasonography. The body water distribution was measured by multifrequency bioelectrical impedance method. Moreover, we researched about factors that may concern.

**Results:** Before the fistula creation, the blood flow volume of brachial artery was 92 ml/min (median). One week after fistula creation, the blood flow volume of access side's brachial artery increased to 456 ml/min (median). Body weight, total body water and extracellular water of whole body did not change significantly. But the body water distribution analysis about each limb revealed that the total body water and extracellular water of access side's upper limb was increased significantly. The patients with more blood flow showed a tendency of more water distribution of same side's upper limb.

**Conclusions:** Vascular access creation affects the body water distribution.

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## VASCULAR ACCESS SURVEILLANCE: 10 YEARS OF EXPERIENCE WITH AN OPEN\* ACCESS CLINIC

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**Introduction and Objectives:** In 2005 the Access Clinic was established with the purpose to unite all procedures concerning preparing, monitoring and diagnosing vascular accesses and to promote a-v fistulas in preference to tunneled catheters.

**Material and Methods:** The equipment was an ultrasound Doppler scanner, a mobile bed-side scanner and an access flow monitor (Transonic). The staff

was an access nurse (15 hrs/week) and an access surgeon (6 hrs.two days/week). Data were extracted from our database of access operations and retrospectively from patients Medical records.

#### Results:

1. The number of hemodialysis patients decreased from 270 patients in 2008 to 215 in 2014,
2. The rate of dialysis on a-v fistulas increased from 71% in 2005 to 91% in 2014.
3. The number of referrals to the Access Clinic increased from 219 in 2006 to 731 in 2014.
4. Referrals from 2013 + 2014, analyzed for indication and outcome, are shown in Table 1.

**Discussion:** Referrals for a new access problem resulted in operation in more than 1/3, which indicates that open referral to the Clinic was not misused and probably is a cost effective strategy. The somewhat lower rate of operations (20%) in patients on planned control may indicate a more liberal attitude among the surgeons for careful control of a known potential problem. But may also be one reason for a low and stable rate of thrombectomies (6-7% per year) in spite of our hemodialysis patients increasing age and comorbidity. The low referral to the Radiological Department (1%, mostly central vein stenosis), demonstrate an effective (and probably cost effective) use of ultrasound by the access surgeons, who perform all peripheral PTA treatments using ultrasound and X-ray in Theater.

**Conclusions:** The Access Clinic has become an indispensable function in our access management, which we believe is highly cost effective. Ultrasound investigations performed by the surgeons is essential in control and diagnosis and an effective tool in detailed planning of the operation. The establishment of the Access Clinic has stimulated the nursing staff to look for fistula complications and use of bed-side ultrasound has been promoted; all to the benefit of our dialysis patients.

\*Open for direct referral by dialysis staff and physicians from nephrology departments.

TABLE 1

Referrals by 2013 + 2014: N 1332	Total	Results: % of referral group				
Referral groups:		Op./ PTA	Referral to radiology	New ctrl. Access Clinic	No control	Other measures
Preop. vein mapping	200 (15%)	90%	1.5%	1%	5.5%	2.5%
First postop. ctrl. (incl. after rev/PTA)	292 (22%)	8%	1%	55%	35%	1.4%
Ctrl. of known problem	447 (33%)	20%	0.4%	62%	17%	1.3%
New A-V fistula problem	393 (29%)	36%	1.3%	25%	29%	9%

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##### THE EFFICACY OF A DUAL SURVEILLANCE SYSTEM FOR ARTERIO-VEINUS FISTULAS (AVF) IN IMPROVING ACCESS PATENCY

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**Introduction and Objectives:** Maintenance of AVF patency is essential to ensure uninterrupted dialysis. AVFs are prone to failure due to stenosis and various methods of surveillance have been used to detect stenosis. So far no single surveillance tool has been found to be effective. We report our experience with a dual surveillance system and its efficacy in improving access patency.

**Material and Methods:** Between April 2012 & April 2013 All AVF in two dialysis units were regularly monitored using Transonic flow measurements and Sonosite imaging. Fistulas with drop of access flow on two consecutive occasions were imaged by dialysis nurses with Sonosite and were then reviewed in a weekly surveillance clinic run by a vascular surgeon and held on the dialysis unit. AVF with inconclusive imaging results were investigated further using Duplex scanning in the vascular lab. Subsequently early decisions were made regarding fistulograms/Fistuloplasty.

**Results:** Out of 77 fistulas that required investigation 44 required radiological interventions. Only one fistula was lost. 3 fistulas required frequent interventions over a short period of time and were identified as failing, back up fistulas were created and central lines were avoided.

**Conclusions:** Transonic monitoring system alone has a positive predictive value of 70%. Duplex scanning has a similar value and can be operator dependent. Multi method monitoring appears to yield better results as it detects both functional and anatomical abnormalities.

Dual monitoring system is effective and improves access patency. It also minimises unnecessary interventions.

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##### ARTERIOVENOUS FISTULA SURVIVAL: A TUNISIAN EXPERIENCE

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**Introduction and Objectives:** The arteriovenous fistula (AVF) failure is one of the most common morbidity in hemodialysis (HD) patients. The study of the AVF patency and its affecting factors reveals the populations with high-risk of access failure. The aim of our work was the study of the AVF primary and secondary patency and the factors that may affect them.

**Material and Methods:** It was a retrospective study interesting AVF created before the end of 2009 in patients with end stage renal disease (ESRD) undergoing chronic HD. The end of the follow-up was in December 31, 2013. Actuarial survival was calculated by using Kaplan-Meier survival analysis. Differences between groups determined by using log-rank test for univariate analysis and by using cox regression method for multivariate analysis. Demographics epidemiological, clinical, biological, pharmacological, radiological and fistulae characteristics were studied.

**Results:** We have included 126 AVF that were created in 111 patients, 22.5% were aged more than 65 years, 39.6% were diabetic, 68.5% were hypertensive and 26.1% had peripheral vascular disease. The primary patency rates were 82% at six months, 78% at one year, 69% at two years, 61% at four years and 42% at five years. The secondary patency rates were 83% at six months, 80% at one year, 74% at two years, 70% at four years and 69% at five years. In a multivariate cox regression model, HD jugular catheter use during more than three months and a serum C-reactive protein >5 mg/l were confirmed to be the independent factors of AVF primary patency impairment. The patients aged <65 years, a referral time to a nephrologist more than six months before the ESRD, an antiplatelet therapy and a phosphoremia >45 mg/l were confirmed to be the independent factors of AVF secondary patency improvement.

**Conclusions:** The patency rates in our study join those of the literature. The peculiarity of our study was the positive effect of the hyperphosphoremia on the AVF patency. An early referral to the nephrologist and an AVF creation and maturation before ESRD are essential for this vascular access survival. These are the main means to avoid HD catheters and their inflammatory effects. Furthermore, the antiplatelet prescription is mandatory, unless there is contraindication.

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##### A NEW COMPUTERIZED SYSTEM FOR SURVEILLANCE OF PROSTHETIC VASCULAR ACCESS

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**Introduction and Objectives:** Outflow stenoses is still the most common cause of prosthetic vascular access (pVA) thrombosis and abandonment. Nevertheless, role of arteriovenous fistula (AVF) surveillance is still largely



debated. We want to present a new real-time application designed for pVA surveillance called SPIDER.

**Material and Methods:** SPIDER is a database for collection and analysis of clinical and instrumental data oriented to stage-five chronic kidney disease (CKD) patients undergoing haemodialysis through a prosthetic vascular access (pVA). In our purpose SPIDER would be a real-time automated resource for pVA surveillance. Surgical staff and haemodialysis nurses are responsible for data entering in a Structured Query Language (SQL) database throughout on-line forms. Access to SPIDER from hemodialysis centres and data entry will be allowed by tablet computers equipped with a third generation of mobile telecommunication technology. Abnormalities in dialysis parameters (venous pressure, QB, difficulties in cannulation and haemostasis reported by nurse) will generate an alert sent to the project manager. Data trend will be analysed by SPIDER in real-time. Programme will generate automatically alert when oddities are detected. Alert will be followed by an immediate clinical and ultrasound analysis performed by a surgeon.

**Results:** Objective of our program is to assess the efficacy of a computerized program for pVA surveillance and to evaluate if an early management of pVA defects can prevent thrombosis or graft loss. Effectiveness of the program will be estimated in terms of primary assisted graft patency and increased graft survival. Expected result will be the reduction of pVA thrombosis in an estimated 58.7% with a consequent increase in primary patency to 92% at 12 month.

**Conclusions:** Introduction of a real-time automated system can help physicians and nurse to better survey patients finding pVA stenosis and malfunctioning before thrombosis occurred. In our purpose, early complication management will drive us to ensure an increased graft survival.

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### COMPLICATIONS OF ARTERIOVENOUS FISTULA NATIVES IN HEMODIALYSIS

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**Introduction and Objectives:** The creation of an arteriovenous fistula (AVF) is the means of choice in this population. Because of its durability and lower incidence of complications. Although complications have serious consequences for both the medical and socio-economic. The aim of our study was to report the incidence of various complications and their management, and identify risk factors (RF) influencing their occurrence, and therefore the survival of AVF.

**Material and Methods:** This is a retrospective study conducted over 6 years in our center. We include all our hemodialysis patients who presented early complications and late in their native AVF, who started dialysis with minimal loss of one year. We analyzed demographic parameters, dialytic, clinics, and characteristics of the AVF. To clear the RF predictive of occurrence of complications of this first.

**Results:** We included 25 hemodialysis patients, with a sex ratio of 11 female/14 homme. The average age is 44 years (27-74 ans). The average age was 15 years hemodialysis (2-30 ans), the causal nephropathy is unknown in 68%. 28% of our patients are hypertensive and 12% diabetic, 32% have already submitted a thrombotic event including 37.5% type of thrombosis of the AVF. Obesity is observed in 8% of our patients. On examination Clinique 36% had poor venous capital. The making FAV was conducted before the start of hemodialysis in 36% of patients, 64% to non-functional vascular access. These were FAV radiocubitales in 50% and sat on the non-dominant limb in 52% of our patients a puncture delay <4 weeks was found in 24%. The occurrence of complications was early in 8% of patients. 52% had thrombosis, 28% stenosis, 12% of false aneurysms, and 4% hyperdébite et an infection of the AVF, respectively. The Doppler ultrasound was performed in 60% of patients. Was retained complicated FAV in 28% of our patients with conservative treatment, while 32% and 16% benefited from making a new FAV and establishing a long-term tunneled catheter respectively. FDR influencing the occurrence of stenosis and hyperdébite are diabetes and hypertension with ( $p = 0.04$ ) and the trombotique event history is predictive of early failure ( $p = 0.09$ ).

**Conclusions:** A head injury most malfunctions is the stenosis, its detection combines clinical monitoring, analysis of hemodialysis settings, the Doppler and flow measurement of the AVF. The management of FAV is multidisciplinary involving radiologists surgeons, nephrologists and dialysis staff; without forgetting the essential role of the patient himself in the preservation of its FAV.

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### RISK FACTORS FOR FAILURE EARLY IN VENOUS FISTULA ARTERIOVENOUS HEMODIALYSIS

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**Introduction and Objectives:** The native AVF is currently regarded as the vascular access of choice because of its reliability and durability. Nevertheless, it is burdened with a significant rate of early failures complicating the planned management of vascular access. The aim of our work was to identify among our hemodialysis patients risk factors (FDR) of early failure, and so highlight avenues for optimizing thereafter the initial strategy Access Management vascular hemodialysis in this specific population.

**Material and Methods:** Data on FAV conducted between January 1994 and December 2014 in our dialysis center, were retrospectively collected. Early failure was defined as primary non-function due to early thrombosis (before any puncture) or non-maturation. The level of surgeon expertise is defined by level A > FAV/year level B < 5 FAV/year Statistical analysis was performed using the Sphinx software. A univariate comparison of the characteristics of fistulas have presented an early failure was performed first (au using the chi-square test), a value of  $p < 5\%$  bilateral was considered statistically significant.

**Results:** 92 native AVF in 66 patients were performed between January 1994 and December 2014. Premature failure occurred dans 14 cases (15.2%). The mean age of patients was 38 years (20-68 years). A sex ratio of 9 man/9 woman. 35.7% were hypertensive, 7.1% have diabetes Initial nephropathy is unknown at 85.7%, Obesity is found in only one patient (7.1%), an event, thromboembolism was noted in 42.9% of patients, the FAV are proximal in 71.4% of cases, and the level of expertise of the surgeon is a level a in 50% of cases. L'analyse statistical identified four independent risk factors: a site distal, female gender, surgical expertise, and diabetes.

**Conclusions:** The establishment of a multidisciplinary consultation fistulas will help reduce the incidence of premature failure of native fistulas. This approach is expected to effectively plan the achievement of functional AVF and limit the use of alternative vascular access, such as temporary catheters, greatly increasing the incidence of infectious complications or thrombosis, cost, and mortality these already vulnerable patients.

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### IMMUNOHISTOLOGIC CHANGES IN EARLY ARTERIOVENOUS FISTULA FAILURE

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**Introduction and Objectives:** The problems associated with vascular access present major reason for morbidity and mortality in patients on chronic hemodialysis. Although arteriovenous (AV) fistula is the preferred choice for vascular access, uncritical insisting on creating AV fistula had led to increased number of AV fistula failure especially early failure which account to up to 50% of all fistula failures. Early fistula failure is fistula that is not developed for use or failed within 90 days of creation. The mechanism of early AV fistula failure is not clear. The most common finding is intimal hyperplasia. The classical theories postulate that it is acquired, but there are new theories which speculate that it is present before creation. The purpose of this study is to perform the immunohistologic exploration of the venous tissue samples from the AV fistula which are connected with the creation of the AV fistula and can cause early fistula failure.

**Material and Methods:** Vein samples from 20 patients were collected at the time of the creation of AV fistula near the site of the AV anastomosis. Immunohistological analysis was performed on these samples. At the time of failure, within 90 days of creation, another AV anastomosis was created proximal on the same vessels and another sample was collected and send for analysis. The following markers were examined: Vimentin, TGFB and Ki67.

**Results:** The expression of the markers was different. Even before the creation of the AV fistula, there was increased expression of Vimentin and TGFB, it was increased at the time of failure, but not significantly. The expression of Ki67 was minimal both before and after.

**Conclusions:** There is increased inflammation and oxidative stress in the AV fistula veins in patients with CKD before creation of the AV fistula, they are increased after the creation, but not significantly. The inflammation and oxidative stress alone are not sufficient for development of AV fistula failure.

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**THERMODILUTION METHOD IN DIAGNOSTIC OF ACCESS DYSFUNCTION VASCULAR - EXPERIENCE OF A CENTER**

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**Introduction and Objectives:** It is currently recommended in addition to monitoring the vascular access (MVA) also surveillance that can be performed by indirect measurement of intra-access blood flow (Qa). This method has been considered a good predictor of arteriovenous fistula (AVF) and arteriovenous grafts (AVG) dysfunction. The aim of this study is assess the importance of a surveillance protocol in prevention of vascular access (VA) thrombosis.

**Material and Methods:** A prospective study of 82 VA where we included all patients undergoing AVF or AVG periodic evaluation of Qa by thermodilution technique, over 9 months. In all Qa measurements, MVA criteria were recorded. Four criteria were defined for performing angiographic exam and/or angioplasty and/or surgery: 1) Presence of Qa alarm (AL): AVF <400 ml/min/AVG <600 ml/min or reduction rate ≥25% in two consecutive determinations without changes to MVA. Whenever possible, the Qa was confirmed by a second assessment; 2) ≥1 change in MVA without Qa AL; 3) criteria 1) + 2); 4) thrombosis in the absence of 1) and 2). In all Qa AL a follow up of 3 months was made. We evaluated the angiographic results and the patency of access.

**Results:** In 9 months, 211 Qa reviews were carried out on 82 accesses (62 AVF; 20 AVG), 79 with Qa AL but in 32 cases (40.5%) with no confirmation of Qa AL in the following review. In 7 of the 37 interventions isolated Qa modification was verified, mostly in AVGs (Table 1). The patency of VA with isolated Qa AL without intervention at 3 months was 92.3%. In 8 interventions (6 AVFs), Qa did not suggest VA dysfunction. The overall rate of intervention was 0.53 interventions/patient/year (Qa AL) vs 0.14 interventions/patient/year (without Qa AL) [IRR 3.63, p<0.01]. In a follow up period of 6.9 ± 2.3 months, every successful access were patent. No thrombosis occurred without previous Qa AL.

**Conclusions:** The significant number of events with a Qa AL not confirmed in the second assessment, without need of intervention, highlights the importance of Qa repetition whenever possible, in the absence of other changes in the MVA. In our experience, assessment of Qa by thermodilution proved to be a useful method in the VA dysfunction diagnosis, especially in AVGs without change in MVA. Predominantly in AVF, MVA continues to play an important role. Monitoring and surveillance of VA by thermodilution method seem to complement each other in the evaluation of VA dysfunction.

TABLE 1

Criteria for ordering intervention (%) n = 37	AVF	AVG	Significant lesions detections with need of intervention
1) 18.9% (n = 7)	14.3% (n = 1)	85.7% (n = 6)	100%
2) 23.8% (n = 8)	100%	0%	75%
3) 54.8% (n = 22)	54.6%	45.6%	100%
4) 0%	NA	NA	100%

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**PATENCY RATES OF THE ARTERIOVENOUS FISTULA FOR HEMODIALYSIS IN A HETEROGENEOUS POPULATION: A RETROSPECTIVE STUDY**

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**Introduction and Objectives:** The aim of this study was to analyze the outcome of conduit creation in our institution. Hemodialysis population change over time and it is said that AVF (arteriovenous fistula) performance is decreasing as a result. Our aim was to analyze the performance of autologous AVFs and grafts in our current heterogeneous population.

**Material and Methods:** Between the 1<sup>st</sup> of January 2009 and 31<sup>st</sup> of December 2013 all consecutive patients who underwent construction of an autologous AVF or implantation of dialysis grafts created at two hospitals were included. Patient characteristics and details were collected retrospectively from digital patient files and prospectively recorded database on hemodialysis patients.

**Results:** A total of 252 AVFs were created in 210 patients. The mean age was 57,5 years and the majority (53,9%) was male. 53,5% was Caucasian, 30,1% Black and 16,2% other. 86,1% of the patients had hypertension, 37,3% had diabetes, 27,7% was an active smoker. The mean follow up was 1,84 years. The included AVFs consisted of 46,4% radio-cephalic fistulas, 33,7% brachio-cephalic fistulas and 19,8% other (majority brachio-basilic AVFs and grafts). A total of 271 percutaneous transluminal angioplasty (PTA) or surgical interventions were performed. The majority (52,4%) of the patients underwent no intervention, 21,4% had one intervention, 12,3% had two interventions, 4,3% had three interventions and one patient had 10 interventions. When primary abandonment was included, the primary patency rates were 43% and 29% at 12 and 24 months respectively. Primary assisted patency rates were 46% and 38% at 12 and 24 months respectively. The secondary patency rates were 85% and 68% at 12 and 24 months respectively.

**Conclusions:** The primary patency rates we found are lower and the secondary patency rates are higher when comparing with the systematic review on patency rates of arteriovenous fistula for haemodialysis, published in the American Journal of Kidney disease in 2014 (primary patency rates were 60% and 51% at 12 and 24 months respectively. Secondary patency rates were 71% and 64% at 12 and 24 months respectively).

One possible explanation is that we monitor flow in all our patients and if the flow reduction is >25% we perform a duplex ultrasound scan and if a significant (>50%) stenosis is found we perform a PTA in most of the cases. This finding is consistent with the assumption that flow surveillance and pre-emptive interventions lead to better secondary patency rates.

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**PERCUTANEOUS ULTRASOUND-GUIDED ANGIOPLASTY OF AVF STENOSIS - EFFECTIVE AND SAFE ALTERNATIVE TO FLUOROSCOPY**

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**Introduction and Objectives:** AVF patency is essential for efficient hemodialysis. Early diagnosed fistula stenosis could be treated by minimally invasive methods. Percutaneous balloon angioplasty becomes a standard initial procedure. Fluoroscopy-guided PTA in patients with borderline renal function can effect in GFR decrease due to the contrast-induced nephropathy. Another risk for patients is radiation. Ultrasound-guided transluminal procedures are safe, effective and low-costed alternative to fluoroscopy-guided methods.

**Material and Methods:** Significant AVF stenosis were discovered in 39 patients. The stenosis were identified using ultrasound color Doppler imaging. All the patients were qualified to percutaneous ultrasound-guided PTA. Fistula flow rate was measured before and after stenosis dilatation.

**Results:** From June 2013 to November 2014 total of 46 ultrasound-guided balloon angioplasty were performed - 39 primary operations and 7 reinterventions. 44 procedures were performed with good hemodynamic effect. Two failures were noticed - 1 patient required open surgery and 1 procedure ended with serious vein lesion leading to AVF lose. From 39 patients 6 required another intervention due to the restenosis occurred in 2-6 months (one of patients twice). 44 operations were elective. In 2 urgent cases with clotted fistula patency was restored by open thrombectomy followed by ultrasound-guided stenosis dilatation.

**Conclusions:** Percutaneous ultrasound-guided angioplasty of AVF stenosis is safe and effective alternative to fluoroscopy-guided methods. The procedure is short, low-costed and minimally invasive. Primary assisted patency rate was satisfactory. Dilated AVF is ready to use directly after PTA.

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**THE SIGNIFICANCE OF AN ULTRASOUND DETECTED STENOSIS IN ARTERIOVENOUS RADIOCEPHALIC FISTULA**

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**Introduction and Objectives:** The presence of an ultrasound detected stenosis in a fistula should not alone determine intervention, rather its impact on the haemodynamics within the fistula. Comparison between clinical and dialysis parameters may determine the usefulness of ultrasound as a predictor of potential thrombosis in the surveillance of arterio-venous fistulae (AVF).





Vein Diameter (VDIAM) x vein peak systolic velocity (VPSV) may provide a simple surrogate for volume flow. They are easier to measure, repeatable and independent of operator experience or initial machine pre-sets. Similarly Artery diameter (ADIAM) and Artery PSV (APSV) may provide a surrogate for arterial volume flow.

**Material and Methods:** All patients with an autologous radio cephalic fistula were entered into an ultrasound surveillance programme. They were assessed at 6/52, 3/12 and 6/12. A stenosis was defined as greater than (x 3.0) increase in the PSV peripheral to and through the stenosis, with evidence of either hyperplasia within the lumen or a luminal reduction of more than 50%.

In addition a surrogate marker for Volume flow in the cephalic vein was calculated as VPSV x VDIAM. APSV and ADIAM were also recorded.

**Results:** A total of 60 radio cephalic (r-c) fistulae were followed up to 6 months.

In r-c fistulae APSV, ADIAM, the product of APSV and ADIAM, VPSV, VDIAM and the product of VPSV and VDIAM were investigated at 3 mths and 6 mths. (Table 1 VPSV x VDIAM was used as a surrogate marker for volume flow. The fistulae were divided into three groups; Normal, Stenosis (as per definition) and fistulae with+ a stenosis where an intervention was planned. Intervention included requiring a new fistula.

There was a significant difference at 3 and 6 months for all venous parameters when comparing the intervention and stenosis group. There was also a significant difference between the normal and intervention group for all parameters. The arterial diameter was the only parameter that was not significant ( $p = 0.7671$ ).

**Conclusions:** Based upon current definition the presence of a stenosis does not mandate intervention on an AVF. This study supports the need to define the haemodynamic impact of a stenosis on the function of a fistula and its impact on dialysis efficiency. Consideration should be given to further evaluation of PSV x Vessel Diameter as surrogate markers of volume flow.

TABLE 1

r-c fistula at 3 months	Normal (n = 17)	Stenosis detected (n = 24)	Intervention required (n = 17)	ANOVA
APSV	2.16 ± 0.71	1.45 ± 0.70	1.22 ± 0.67	0.0007
Artery diam	4.84 ± 0.61	4.61 ± 0.73	4.13 ± 0.78	0.0187
APSV*Adiam	10.2 ± 2.95	6.67 ± 3.29	5.14 ± 3.05	<0.0001
VPSV	1.61 ± 0.65	1.07 ± 0.43	0.78 ± 0.23	<0.0001
Vein diameter	7.31 ± 1.15	6.28 ± 1.15	4.63 ± 0.79	<0.0001
VPSV*Vdiam	11.4 ± 3.70	6.67 ± 2.92	3.59 ± 1.08	<0.0001

TABLE 2

r-c fistula at 6 months	Normal (n = 13)	Stenosis detected (n = 15)	Intervention required (n = 13)	ANOVA
APSV	2.17 ± 0.80	1.53 ± 0.57	1.22 ± 0.54	0.002
Artery diam	4.99 ± 0.74	4.87 ± 0.75	4.75 ± 0.92	0.7671
APSV*Adiam	10.6 ± 3.60	7.38 ± 2.74	5.83 ± 3.06	0.0016
VPSV	1.76 ± 0.74	1.20 ± 0.49	0.67 ± 0.22	<0.0001
Vein diameter	7.77 ± 1.32	7.07 ± 1.25	5.94 ± 1.35	0.0036
VPSV*Vdiam	13.2 ± 4.46	8.36 ± 3.39	3.83 ± 1.08	<0.0001

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## ENDOSCOPIC SUPERFICIALISATION OF ARTERIOVENOUS FISTULAE

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**Introduction and Objectives:** It is common in obese patients, that a well-functioning arteriovenous fistula (AVF) cannot be needled satisfactorily because it lies too deep under the skin. Commonly a distance between the vein and the skin greater than 6 mm is considered critical. Superficialisation of an AVF has been shown to be an effective option to optimise the cephalic vein for needling. Common techniques used for superficialisation are open vein transposition, lipectomy or ultrasound-guided liposuction. We present a novel technique of superficialisation, performing liposuction under endoscopic control.

**Material and Methods:** The procedure was used in two obese patients with well-functioning AFSs, one with a forearm, the other with an upper arm radio-cephalic AVF. In both patients the cephalic vein could not be needled easily because it lied more than 10 mm below the skin. As the first step of the procedure, we applied ultrasound-guided tumescence anaesthesia to separate the vein from the overlying skin. Then two 5 mm incisions to either side of the vein at the distal end of the AVF were used to introduce a 5 mm endoscopic videocamera and a 5 mm endoscopic suction device. The vein was then freed from the overlying skin and excess fat overlying the vein aspirated under endoscopic control.

**Results:** In one patient, needling has been performed without any complications for several months. The other patient still awaits the first attempt of needling.

**Conclusions:** Endoscopic control of liposuction over a deep lying AVF has not been described in the literature. We are convinced that it renders superficialisation of a deep lying AVF safer, as it reduces the risk of vein injury and does not prolong the procedure. This minimally invasive technique avoids long skin scars associated with open vein transposition and provides excellent aesthetic results.