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Endoscopic saphenous vein harvesting for hemodialysis vascular access creation in the forearm: A new approach for arteriovenous bridge graft

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ABSTRACT: When superficial arm veins are not suitable to create a native arteriovenous (AV) fistula, an arteriovenous bridge graft by native and/or prosthetic graft is the next best alternative. However, harvesting a native vein, such as the saphenous vein (SV), is invasive and requires a large incision. We report an endoscopic saphenous vein harvesting (ESVH) technique combined with forearm bridge grafting as a new approach for vascular access (VA).

Methods: **We used the Clearglide, Endoscopic Vessel Harvesting System (Eticon, Inc.) for a less invasive SV harvesting technique. Five patients had a SV graft implant and 10 patients had a polytetrafluoroethylene (PTFE) graft implant in the forearm.**

Results: **The SV was harvested easily in all patients in 46 ± 2 min. There were no wound complications. All SV and PTFE grafts provided satisfactory access within 1 month; however, two declotting procedures in the SV group and five in the PTFE group were required. The PTFE group had two graft infections.**

Conclusions: **It is possible that a combination of ESVH and SV forearm grafting will be one of the new approaches for hemodialysis (HD) access. (The Journal of Vascular Access 2003; 4: 98-101)**

KEY WORDS: *Endoscopic harvest, Vascular access, Hemodialysis, Saphenous*

INTRODUCTION

The first fistula should be placed in the arm as distally as possible. A native arteriovenous (AV) fistula is the best option for patients requiring maintenance hemodialysis (HD), but when this is not possible, an AV bridge graft is usually the next best alternative (1). A native vein and a prosthetic graft have been previously considered as AV bridge grafts. Using grafts in HD is well established; however, technology has yet to provide the perfect dialysis access graft, which will not stenose, thrombose or be prone to infection. We used a polytetrafluoroethylene (PTFE) graft and a saphenous vein (SV) graft for an AV bridge graft. However, these grafts have been occasionally problematic. Bonnaud et al reported a 12% serious infection rate with PTFE grafts compared to a 2% rate with SV grafts (2). Bosman et al reported that the patency rates between PTFE and native vein grafts were no different (1-yr primary; 40 vs 30%, secondary; 63 vs 63%) (3). Native vein grafts, such as SV grafts, were then considered a reasonable alternative. Traditionally, the SV is harvested from the lower leg, thigh or through a long continuous incision or interrupted longitudinal incisions over its course. Wound complications such as hematoma, dehiscence, drainage, cellulitis, skin necrosis, neuralgia and infection led

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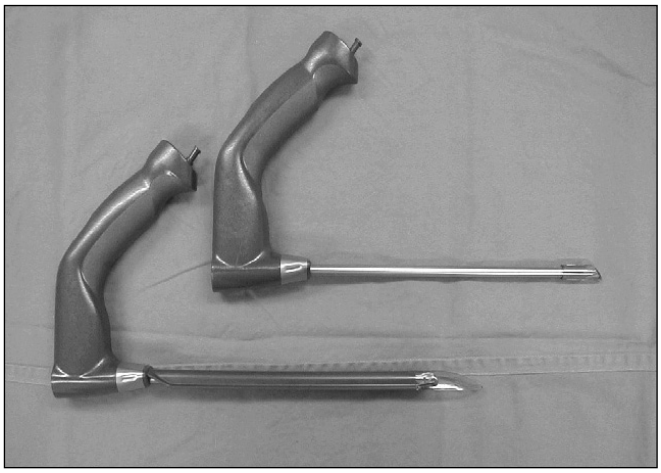

Fig. 1 - *Clearglide, Endoscopic Vessel Harvesting System. Optical vessel dissector (upper), and ultra-retractor (lower).*

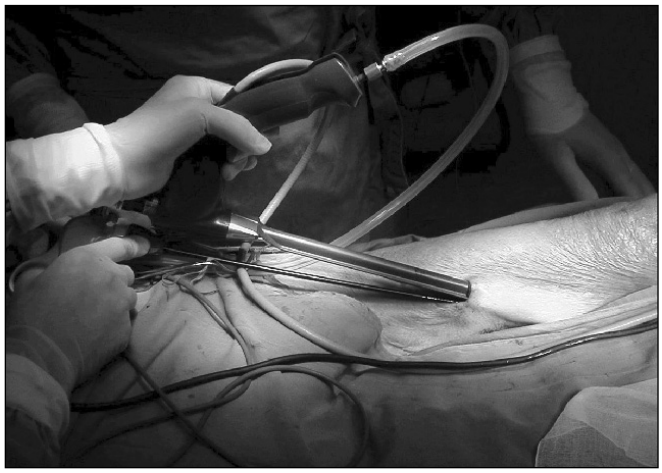

Fig. 2 - *Insertion of the ultra retractor into the subcutaneous space and subcutaneous space maintenance.*

to an increased morbidity and primary complaints of patients after HD access surgery. There are several recently reported clinical trials using an endoscopic saphenous vein harvesting (ESVH) technique in cardiovascular surgery (4). This approach reduced the complication rate and post-operative pain and provided better cosmetic results for patients (5). We put this method to practical use as a new approach of AV bridge grafts for HD access and evaluated its feasibility.

METHODS

Fifteen patients having no suitable native veins to create a native AV fistula received an AV bridge graft as a first access choice in their forearms. An SV graft was implanted in five patients and a PTFE graft implanted in 10 patients. The size and number of SV tributaries are highly variable and bifid or varicose SV are unsuitable for SV forearm grafting. Therefore, the anatomical location and the quality of the SV were examined by echography prior to the operation. The equipment was a Clearglide, Endoscopic Vessel Harvesting System (Ethicon Inc, Sommerville, NJ, USA), which consisted of an optical vessel dissector and an ultra-retractor, which has an application for use in the creation and maintenance of an operative cavity in the subcutaneous area (Fig. 1). Under spinal anesthesia, the initial incision was made in the femoral region and was a long wrinkled line, 25-27 mm. After dissection in the visible periadventitial plane, the rigid endoscope, covered by the optical vessel dissector, was inserted and the anterior surface of the SV dissected under endoscopic guidance to the middle of the thigh (Fig. 2). A second incision, 25-26 mm, was made at the distal end of the dissected space, and the endoscope, covered by the optical vessel dissector, was then inserted for further distal dissection in the popliteal region above the knee. To complete circumferential dissection, the ultra-retractor was inserted to maintain the operative cavity, and then bipolar scissors and vessel clips were used to divide the collateral branches (Fig. 3). A small incision, 10 mm, under endoscopic vision, was then made above the knee joint to ligate and directly transect the distal SV. Once the vein was dissected, it was ligated and transected at the saphenofemoral junction and removed. The vein segment was cannulated and gently distended with a normal saline (250 ml) and heparin (2500 U) solution, and stored at room temperature. After hemostasis the leg was closed up with an interrupted 3.0 silk suture. The SV grafts were implanted as vascular access (VA) in the non-dominant forearm of the HD patient. The end of the SV graft was anastomosed to the side of the radial artery as an inflow, and through the subcutaneous tunnel, the opposite end was anastomosed to the side of the deep forearm veins as an outflow. The PTFE graft was implanted using the above method in the remaining 10 patients. The follow-up period was 12 months.

Measurements are reported as mean ± standard deviation of the mean. The statistical significance was calculated using the Student's t-test for group comparison (SV vs PTFE group). A value $p = 0.05$ was considered statistically significant.

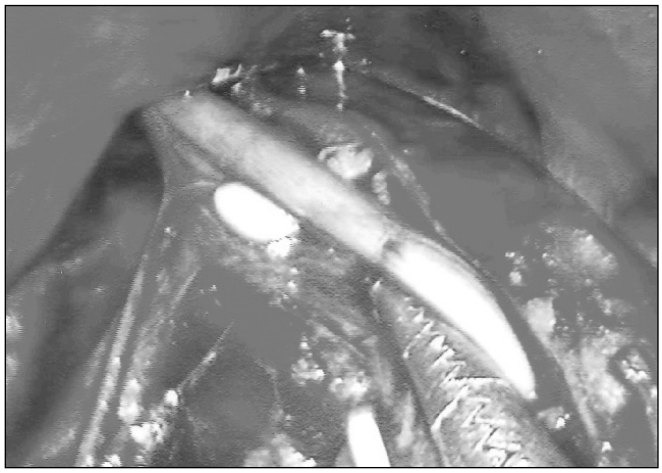

Fig. 3 - ***Dissection of the surrounding tissue and side branches of SV with scissors and clipping devices.***

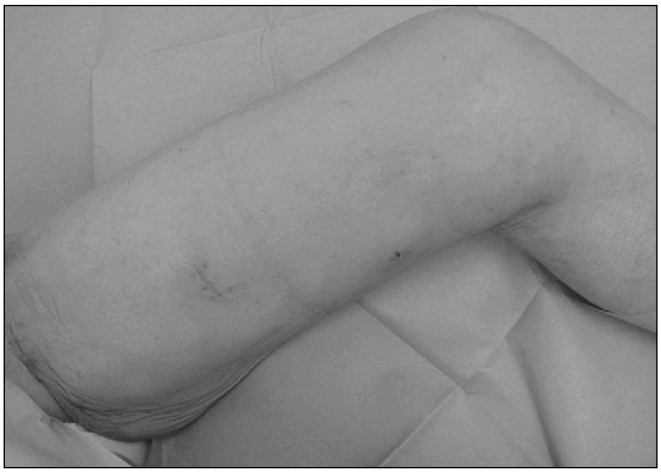

Fig. 4 - ***Wound scar on the thigh 2 weeks post-ESVH.***

RESULTS

The SV was harvested easily in all patients and harvesting time was 46 ± 2 min. There were three incisions with no additional incision required. The average incision length was 25 mm, 24 mm and 10 mm. The harvested SV length was 23.8 ± 0.3 cm. Small tributaries were divided an average of 3.4x per vein segment, requiring vascular clip placement. There were no wound complications, i.e. hematoma, dehiscence, drainage, cellulitis, skin necrosis, neuralgia and infection associated with ESVH. All patients were satisfied with the small incisions and the improved cosmetic appearance after the procedure. The implant time of the SV group and the PTFE group was similar (59.6 ± 2.4 vs 61.1 ± 3.1 min, NS). However, the total operating time of the SV group was significantly longer than that of the PTFE group (108.2 ± 7.3 vs 73.1 ± 3.1 min, $p < 0.0001$). The SV diameters before harvesting and 1 month post-operation were 2.9 ± 0.1 mm and 5.0 ± 0.2 mm. All grafts provided satisfactory access 1 month post-operation in both groups. During the follow-up, several complications were seen in both groups. One declotting procedure was required in one SV group patient and five declotting procedures for three PTFE group patients. To combat infection two PTFE group patients required systemic antibiotics.

DISCUSSION

The DOQI Guidelines suggested that a native AV fistula, like the Cimino Brescia fistula, was a preferred VA for patients requiring maintenance HD, but when the superficial arm veins are not suitable to create a native AV fistula an AV bridge graft was the next best alternative (1). We performed five SV forearm grafts and 10 PTFE forearm grafts. For harvesting SV, the conventional (open) procedure was used. This procedure was quick and provided optimal SV visualization during harvest. However, it was invasive and required a large incision and a long wound closure period, resulting in a large scar. The ESVH technique was developed to minimize the morbidity and to improve the clinical outcome in cardiac surgery. In all our patients, the SV was harvested easily and harvesting time was 46 ± 2 min. The implant time of the grafts was similar between the groups; however, the total operating time of the SV group was significantly longer than that of the PTFE group (108.2 ± 7.3 vs 73.1 ± 3.1 min, $p < 0.0001$). This was due to the additional operating time for harvesting required for the SV group. Although it was one of the disadvantages of ESVH, we considered the time taken as acceptable. There were three incisions with no additional incision required. The average lengths of the incisions were 25 mm, 24 mm and 10 mm. Therefore, all patients were satisfied with the small incisions and improved cosmetic appearance after the procedure (Fig. 4). Marty et al reported the major advantages of ESVH as being a significant reduction in post-operative pain and strikingly better cosmetic results than the open procedure (6). Griffith et al reported that endoscopically and conventionally harvested SV grafts were histologically similar (7). In our patients there were no wound complications associated with the ESVH method. Felisky et al reported that the ESVH group

had a marked reduction in the number of wound complications compared with the open procedure group (7.1 vs 26.1%, $p < 0.00001$) (8). SV grafts were implanted as VA in the forearm and interposed between the radial artery and the deep forearm vein. When there were no suitable veins for outflow, the use of the deep forearm vein, as an outflow system to construct an AV graft access was a reasonable alternative (9). The SV diameter before harvesting was 2.9 ± 0.1 mm and was considered enough, since the diameter of the cephalic vein for radial fistula construction needed to be greater than 1.6 mm (10).

Patency rates between SV grafts and PTFE grafts were no different; however, more infections were seen in PTFE grafts, and more PTFE grafts needed surgical revision or removal because of infection (2, 3). We experienced some graft complications in both groups with graft infections seen in only the PTFE group. To evaluate the significance, we need a larger patient number and a longer follow-up period.

The DOQI Guidelines suggested that a brachiocephalic/basilic AV fistula in the upper arm was the second choice for AV fistula creation (1). However, Koo et al reported that a larger vein was required for AVF creation in the upper arm than in the forearm (11). When there were no suitable veins in the arm to create a native AV fistula, an AV bridge graft in the forearm was considered the next best alternative.

In conclusion, ESVH is a clinically feasible minimal invasive surgical technique in HD patients requiring SV forearm grafting because of the lack of suitable arm veins. It is possible that a combination of ESVH and SV forearm grafting will be one of the new approaches to AV bridge grafting for HD access.

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