

# Vascular access in patients affected by short bowel syndrome

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**ABSTRACT:** The aim of this study was to evaluate the problems induced by the use of a central venous catheter (CVC) in a series of patients with short bowel syndrome observed at the university of Padua (Italy) between January 1981 and June 1997. During this period, 14 patients required central venous access for parenteral nutrition (PN); 55 catheters were inserted, 6 with percutaneous and 49 with surgical techniques. We divided the patients into two groups according to PN duration. The first group includes 11 children with short/medium-term PN (8 are now eating, and 3 died from respiratory failure) while the second group includes 3 patients on home long-term PN.

Thirteen catheters were placed in the first group, and the mean PN duration was 173 days; the three patients on home PN required 42 catheters. It is our experience that the use of catheters in patients requiring short/medium-term PN is a safe procedure with few complications; patients on home long-term PN present an increasing number of complications, and the vascular access could become a serious problem as the number of PN-dependent increases.

**KEY WORDS:** Central venous catheter, Short bowel syndrome, Parenteral nutrition

## INTRODUCTION

Short bowel syndrome (SBS) is defined as malabsorption following resection of part of the small bowel. This is a functional definition, because the amount of intestine that must be resected to produce malabsorption varies (1, 3). Patients with SBS require parenteral nutrition (PN) for at least 3 months to achieve adequate growth and development, but in many cases they need home long-term PN. The duration of dependence on PN is not easily predicted. Central venous access is essential for the administration of nutrients, and its preservation in these cases is mandatory. We report here our experience with central venous access problems and management.

## MATERIALS AND METHODS

From January 1981 to June 1997, 14 patients with neonatal SBS were treated at the Department of

Pediatrics of the University of Padua (Italy). We reviewed all charts and records of these patients. The causes of SBS included jejunoileal atresia (9 cases, 65%), midgut volvulus (2 cases, 14%), necrotising enterocolitis (2 cases, 14%), and gastroschisis (1 case, 7%). The mean small bowel length was 48 cm (range 5-80 cm); 8 out of 14 patients retained the ileocecal valve (ICV). Fifty-five cuffed silicon central venous catheters (CVC) were inserted, 6 with percutaneous and 49 with surgical techniques. All the CVCs were tunneled and the position of the tip into the right atrium or inferior vena cava (IVC) just above the diaphragm was always checked by X-ray. Most of the catheters were placed in the tributary veins of the superior vena cava (SVC); the external and internal jugular, cephalic, basilic, axillary or subclavian veins were used in 65.4% of the cases whereas IVC tributary veins, such as the saphenous, femoral or epigastric vessels were used in 34.6% of the cases.

We divided the patients into two groups; the first group includes 11 patients with short/medium PN

duration (less than 24 months); the second group includes 3 patients with home long-term PN (more than 2 years). An important difference emerged between the two groups regarding the number of catheters, and the number of complications. Statistical analysis was performed using Student's *t* test.

## RESULTS

Presently, 8 patients in the first group (57.1%) have been successfully weaned off PN, and 3 died (21.4%) from respiratory failure; the mean PN duration was 173 days. All 3 patients in the second group are PN-dependent (21.4%). Out of 55 CVCs, 13 were placed in the first group (mean duration 3.82 months, range 1-15 months); 42 CVCs were placed in the second group (mean duration 6.79 months, range 2-686 days). 41 CVCs (74.5%) were removed because of complications. In the first group, only 2 catheters were removed due to dislocation; in the second group, the complications that required replacement included breakage (n=14, 35.9%), displacement (n=10, 25.6%), thrombosis resistant to fibrinolytic drugs (n=5, 12.8%), clotting unsolved with urokinase (n=6, 15.4%), tunnel infection (n=2, 5.1%) and sepsis unsolved with medical management (n=2, 5.1%). There is no good correlation between PN duration and the presence of the CVC ( $p < 0.10$ ).

## DISCUSSION

SBS treatment is a multistage process where the goal of management is to reduce the duration of total PN. However, PN is the first step in management, patients are subsequently and gradually weaned to enteral, and finally oral feeding (2, 6, 8). A cuffed silicon tunnelled CVC is placed to administer PN. The CVCs are inserted by surgical or percutaneous techniques into the SVC or the IVC using some of their collateral vessels; traditional sites include the subclavian, cephalic, basilic, jugular, saphenous and femoral veins. (5) CVC position must always be carefully monitored by X-rays, an improperly positioned catheter may induce thrombosis of the vein and lead to SVC syndrome.

Catheter-related complications, such as tunnel infections, sepsis, clotting, displacement, breakage and thrombosis, occur in almost all total PN-dependent patients with SBS; infants and young children are more susceptible. The major problem is sepsis, and it is usually the result of poor catheter care (the making of a fibrin sleeve increases the in-

cidence of infections), or seeding of bacteria from the small intestine into the blood stream (8, 9); these two problems are extensively discussed in the literature. In 1994 Moukarzel et al. reported that experience is an important factor in extending the life span of the second catheter, as well as the higher incidence of catheter-related complications in the first years of home PN versus later years. Patient age is another factor in decreasing the incidence of CVC complications and thus in increasing CVC longevity (5, 7). It has also been suggested that patients receiving PN have an altered local immunity secondary to the shorter gut (1). Another speculation is that children with SBS have a high frequency of bowel movements; consequently, there is a greater probability of contaminating the patient bed area and the catheter with intestinal flora (2, 4).

In our series of patients, the most frequent complication that necessitated catheter removal was breakage (14 pts, 35.9%). While sepsis is surely the most frequently reported complication, only 2 of our patients required catheter removal for this reason; in all the other cases, the associated use of antibiotics and fibrinolytics prolonged the life of the catheter. Thrombous formation in patients requiring lifetime PN, if it is not treated at the right moment, causes a progressive reduction in vascular accesses because it becomes resistant to fibrinolytic treatment; therefore, in this restricted group of subjects, it is mandatory to trace out a detailed map of the vascular tree with colour doppler ultrasonography and/or phlebography, and to immediately treat this complication.

When these patients no longer have central veins, thoracotomy is necessary to position the CVC in the right atrium or azygos vein; in our second group of patients, only one patient had complete thrombosis of the SVC and IVC up to the renal veins.

We subdivided our patients into two groups because of a sharp difference between patients with short/medium term PN and those with long-term home PN. This small group of patients often needs PN during their entire life, and surgical techniques to lengthen the bowel are attempted in all these subjects. Our less favourable results compared well with those of Vargas et al (9) and Moukarzel et al (5) who reported a longer catheter duration in patients with home long-term PN; this difference is probably due to the accuracy of domestic management, the attention in evaluating the vascular tree map and the error in the nursing procedure at the hospital.

To guarantee a long life for the catheters we believe that it is mandatory to have a dedicated hospital staff and the correct training of the family.

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