The great saphenous vein for central venous access and haemodialysis

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Abstract

Background. Utilising an open surgical technique the Great Saphenous vein in the proximal thigh can be used for the insertion of central venous catheters for haemodialysis. This approach is safe and efficacious, and may be performed under local or general anaesthesia. This technique is of particular importance in patients requiring vascular access for haemodialysis in whom the upper central veins are stenosed and the femoral vessels are not amenable to percutaneous cannulation.

Methods. The Great saphenous vein is exposed via a surgical incision in the thigh. The central venous catheter is then inserted and advanced until in the desired position, as confirmed on fluoroscopy.

Results. Seven Great saphenous catheters were placed over a period of six months. All catheters insertions were technical successes with completion of at least one dialysis session. Primary patency rates were 57%, 49%, 23% at 30, 60 and 90 days respectively.

Conclusion. The great saphenous vein offers an additional site for the insertion of central venous catheters. These data demonstrate equivalence in patency between this novel technique and percutaneous femoral vein cannulation.

Keywords: central venous cannulation; great saphenous vein; haemodialysis

Background

The prevalence and the lifespan of patients with end-stage renal disease (ESRD) are increasing. Achieving adequate vascular access is the main limiting factor for the longevity of haemodialysis. The usual sites for central venous cannulation (CVC) are the internal jugular veins and the subclavian veins although increasingly the femoral veins are being utilized. Although CVC is an efficient means of allowing haemodialysis, it is associated with significant sequelae, such as infection, thrombosis, fibrin sheath formation and central venous stenosis (CVS). Catheter-associated infection accounts for over 30% of CVC loss [1–3]. CVS and fibrin sheath formation also threaten longevity of haemodialysis [4–6]. CVS may occur in up to 42% of patients with CVCs and is demonstratable in up to 27% of patients with dysfunctional arterio-venous fistulae [7]. CVS may preclude repeat usage of a vein for catheter placement [8]. Fibrin sheath formation has been shown to be present in up to 76% of CVCs on radiological studies, and can promote catheter thrombosis or dysfunction necessitating catheter exchange or placement at a different site [3].

It is evident that as the prevalence of ESRD increases, and the mortality of patients with ESRD decreases, the sequelae of CVC will have an increasing impact on morbidity and hospital admission rates. As patients dependent on haemodialysis lose venous access due to the sequelae of CVCs, the use of the lower limb vessels must be considered.

We present a novel technique for the placement of CVCs for haemodialysis utilizing the great saphenous vein (GSV).

Report

Technique

Cannulation of the GSV may be performed under local or general anaesthesia. The patient is placed in a supine position with the thigh positioned in a partially externally rotated position. The GSV is exposed in the thigh ∼5 cm from the classical anatomical position of the sapheno-femoral junction, a point ∼2 cm below and lateral to the pubic tubercle. The course of the GSV may be mapped using ultrasound examination. The GSV is controlled with 3/0 polygalactin ties. The CVC of choice is tunnelled through the anterior thigh into the wound. Catheter choice is dependent upon surgeon preference, length of catheter required and GSV calibre. A longitudinal venotomy is made in the GSV and the GSV advanced such that the tip lies in the common iliac vein or IVC. Tip position is confirmed with fluoroscopy. Patency is confirmed by instillation of heparinized saline, and aspiration of blood from both lumens of the catheter. The vein distal to the CVC may be ligated with the distal tie to assure haemostasis, whilst the proximal tie is used to secure the vein around the catheter. The cuff of the catheter...
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Table 1. Summary of catheter length and patency

<table>
<thead>
<tr>
<th>Catheter no.</th>
<th>Catheter length (cm)</th>
<th>Side (L/R)</th>
<th>Surgical success</th>
<th>Dialysis success</th>
<th>Duration of patency (days)</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>55</td>
<td>R</td>
<td>Y</td>
<td>Y</td>
<td>111</td>
<td>Ongoing patency awaiting graft insertion</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>R</td>
<td>Y</td>
<td>Y</td>
<td>25a</td>
<td>Died of unrelated cause</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
<td>L</td>
<td>Y</td>
<td>Y</td>
<td>64</td>
<td>Successful bridge to dialysis via fistula</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>R</td>
<td>Y</td>
<td>Y</td>
<td>163</td>
<td>Catheter failed at 163 days. Surgical exchange for R iliac catheter</td>
</tr>
<tr>
<td>5</td>
<td>40</td>
<td>R</td>
<td>Y</td>
<td>Y</td>
<td>112</td>
<td>Catheter exchanged Day 25. Successful bridge to dialysis via graft at 112 days</td>
</tr>
<tr>
<td>6</td>
<td>55</td>
<td>R</td>
<td>Y</td>
<td>Y</td>
<td>55</td>
<td>Successful bridge to successful PD</td>
</tr>
<tr>
<td>7</td>
<td>55</td>
<td>R</td>
<td>Y</td>
<td>N</td>
<td>3</td>
<td>Died of unrelated cause</td>
</tr>
</tbody>
</table>

aCatheter patent at the time of death.

**Definitions**

Primary catheter patency, or primary device service interval, is defined as the number of days from catheter placement to removal at the completion of therapy, patient death, removal, catheter exchange or the need for further surgical/radiological intervention to maintain/restore patency [9]. Secondary patency is defined as the sum of all device service intervals at a single access site. Secondary patency therefore includes catheters replaced or manipulated surgically/radiologically to maintain patency [9].

**Results**

This technique was performed in seven patients over a period of 6 months. All attempts at insertion of CVC were successful with fluoroscopy confirming tip position in the common iliac vein or IVC. All patients had successful completion of at least one haemodialysis session at a flow rate of >300 ml/min.

No patient suffered an immediate complication as a result of surgery. The mean duration of patency was 76 days, with a median duration of 64 days. Primary patency rates were 57%, 43% and 29% at 30, 60 and 90 days respectively. Secondary patency rates, defined as the sum of all device intervals at a single site, were 71%, 57% and 29% respectively. Results are summarized in Table 1.

Kaplan–Meier analysis was performed to create life tables of primary and secondary catheter survival (Figures 2 and 3).

**Discussion**

Percutaneous cannulation of the femoral vein and surgical cannulation of the deep circumflex iliac vein for haemodialysis are well-established techniques [10,11]. Both of these techniques have drawbacks that may limit their usage. Percutaneous CVC requires the femoral vein to be of suitable calibre for catheter placement and requires
censoring of patients who died with a functioning catheter explained by different definitions for catheter patency, and the secondary patency [10,12,13]. This variation is in part explained by the formation [4].

of direct trauma to the femoral vein may reduce the risk of venous thrombosis [4]. Utilization of the deep circumflex iliac vein for catheter insertion is performed under direct vision allowing small GSVs to be dilated sufficiently to pass a CVC. Unlike percutaneous femoral vein catheterization, puncture of the femoral vein itself is not required; thus a virgin femoral vein may be preserved for future CVC placement or renal transplantation. Equally, previous placement of a renal transplant may preclude the utilization of the deep-circumflex iliac vein for catheter insertion.

Utilization of this novel technique confers benefits making it superior to the aforementioned methods. Insertion is performed under direct vision allowing small GSVs to be dilated sufficiently to pass a CVC. Unlike percutaneous femoral vein catheterization, puncture of the femoral vein itself is not required; thus a virgin femoral vein may be preserved for future CVC insertion. Furthermore, the absence of direct trauma to the femoral vein may reduce the risk of CVS formation [4].

A review of the published literature demonstrates that percutaneous insertion of femoral vein CVC is associated with highly variable published rates of primary and secondary patency [10,12,13]. This variation is in part explained by different definitions for catheter patency, and the censoring of patients who died with a functioning catheter or who had removal of a functioning catheter. Our definition of patency was derived from the only published guidelines on reporting catheter patency [9]. This definition is also used in the largest published study assessing percutaneously placed femoral catheters [10]. This study, analysing 86 catheters, demonstrated primary patency rates of 44%, 29% and 20% at 30, 60 and 90 days respectively and secondary patency rates of 85%, 60%, 45% and 25% at 30, 60, 90 and 180 days respectively. The mean patency duration was 51 days, and median duration 25.5 days.

These data demonstrate equivalence between this technique and percutaneous femoral vein cannulation. It is important to appreciate that our data represent a group of patients in whom the GSV was utilized as a final, in extremis attempt to obtain vascular access. This fact explains the mortality rate of 29%, which in this small cohort of patients adversely skews the patency rates. It is the opinion of the authors that the GSV is an important site for placement of a CVC when other sites are unavailable.

Conflict of interest statement. None declared.

References