Percutaneous fibrin sleeve stripping of failing haemodialysis catheters

Robert D. Johnstone², Graham A. Stewart¹, Jacob A. Akoh¹, Mustafa Fleet², Murat Akyol¹ and Jon G. Moss²

¹Renal Unit and ²Department of Radiology, West Glasgow Hospitals University NHS Trust, Gartnavel General Hospital, Glasgow, UK

Abstract

Background. One of the most frequent reasons for failure of haemodialysis lines is catheter blockage caused by fibrin sheath formation. We report our experience of percutaneous fibrin sheath stripping in treating this problem.

Methods. A consecutive series of failing haemodialysis catheters underwent percutaneous fibrin sheath stripping in an attempt to retrieve and prolong the life of the catheter. Immediate technical success, clinical success, and primary and secondary patency were measured based on clinical follow-up.

Results. Sixteen non-functional permanent haemodialysis lines in 15 patients underwent percutaneous fibrin sheath stripping on 21 occasions. Technical success rate was 100%. Catheter flow rates sufficient for initial dialysis were achieved in 12 (75%) lines. Successful percutaneous fibrin sheath stripping produced a mean catheter patency of 126 days (range 6–299 days).

Conclusions. Percutaneous fibrin sheath stripping is a simple, repeatable procedure that can usefully extend the life of a failing dialysis line. However, a randomized trial will be needed to evaluate its role compared with catheter replacement.

Key words: catheter; fibrin; haemodialysis; sheath; stripping

Introduction

The role of permanent dual-lumen catheters (PDLC) in providing long-term access for haemodialysis in selected patients is well established. Blockage, the commonest reason for loss of catheter function, is thought to be due to encasement of the catheter shaft by a fibrin sleeve [1,2]. This can sometimes be managed by reversal of arterial and venous lines, urokinase lock for catheter clearance, or urokinase infusions [3]. If the above measures fail, the catheter is traditionally removed and replaced. Following reports of successful prolongation of catheter function by percutaneous fibrin sheath stripping [4], we have evaluated this technique and report on our initial experience.

Subjects and methods

Patients with failing dual-lumen permanent haemodialysis catheters (PermCath, Quinton Instrument Co., Seattle, Washington, and VasCath, VasCath Inc, Mississauga, Ontario) were initially assessed clinically. Functional catheter failure was defined as inability to achieve blood flow rates (BFR) of 150 ml/min or greater to allow for satisfactory completion of dialysis using a catheter that was confirmed to lie in a satisfactory position with demonstrable one-way obstruction (withdrawal BFR of less than 150 ml/min).

The catheter was reassessed fluoroscopically to confirm position of its tip and exclude mechanical problems such as kinking. Venography was performed through both lumina of the catheter using non-ionic contrast medium (Figure 1). A 6 F vascular sheath was introduced into the common femoral vein and a 25-mm Amplatz goose-neck snare (Microvena Corporation, USA) advanced through it into the superior vena cava. The snare was then advanced over the dialysis catheter as far as possible. Multiple stripping passes (usually 3) were made by closing the snare around the catheter and gently pulling the closed snare down the catheter shaft whilst applying gentle counter traction to the other end of the catheter (Figure 2 a,b). This was repeated until good flow was obtained through both lumina using a 20-cc syringe. If it proved difficult to snare the catheter then a glide wire (Radiofocus, Terumo, Japan) was inserted through one of the lumina and the end of this initially snared in the inferior vena cava. A single intravenous prophylactic dose of cefuroxime, 750 mg, was given at the beginning of the procedure in the last nine patients. Most of the procedures were performed on a day-case basis with puncture site observation for 1 h. Patient details, initial BFR, post-stripping BFR, and outcome were recorded for analysis. The initial venogram did not always detect a fibrin sheath but the lines were stripped nonetheless.

Technical success was defined as the ability to strip the catheter and obtain satisfactory flow ‘on the angiographic table’ through both lumina with a 20-cc syringe. Immediate clinical success was defined as providing adequate flow sufficient to permit haemodialysis (usually >250 ml/min). Catheter primary patency was defined as functional patency.
Percutaneous fibrin sleeve stripping

Fig. 1. Venogram showing typical fibrin sheath (arrow) around the catheter tip, with contrast spilling out around this.

from the time of percutaneous fibrin sheath stripping to catheter failure without any further intervention. Secondary patency rate included a further episode or episodes of percutaneous fibrin sheath stripping on the same catheter. Functional patency curves were generated by means of Kaplan–Meier life table methods.

Between February 1996 and March 1997, 17 patients were referred for a percutaneous fibrin sheath stripping procedure. One patient’s line was found to lie in the right hepatic vein and was successfully manipulated and did not require percutaneous fibrin sheath stripping; another line was found to be in the subclavian vein and was replaced. The remaining 15 patients (5 males and 10 females) underwent 21 percutaneous fibrin sheath stripping procedures of 16 lines. In most cases percutaneous fibrin sheath stripping was performed once, but two patients underwent percutaneous fibrin sheath stripping twice and one patient four times (hence the total of 21 percutaneous fibrin sheath stripping procedures). The mean time from initial catheter placement to failure was 143 days (range 5–517 days).

Results

Patient outcome is represented in Figure 3. Technical success was 100%. Immediate clinical success was achieved in 12 (75%) of the 16 lines after the first percutaneous fibrin sheath stripping procedure. Long-term follow up of these initially successful cases revealed that adequate dialysis was maintained for a mean of 126 days (range 6–299 days).

At the end of the study period five (31%) lines were

Fig. 2. (a) Radiograph showing goose-neck snare in open position around catheter. (b) Radiograph showing goose-neck snare in closed position around catheter.
still functional after a mean of 202 days follow-up (range 163–299). A further three patients died with a functioning line (mean follow up 50 days, range 1–68 days). Cumulative primary and secondary catheter patency was 40 and 60% respectively at 6 months post-percutaneous fibrin sheath stripping (Figure 4). Three patients developed minor groin haematoma, but none required specific therapy. One line became infected 7 days following successful percutaneous fibrin sheath stripping and was removed and replaced.

Discussion

PDLC are indicated when primary and secondary vascular accesses have been exhausted in patients

![Graph showing catheter cumulative primary and secondary patency by Kaplan—Meier analysis. Primary patency solid line. Secondary patency dashed line.](image)

Fig. 4. Graphs showing catheter cumulative primary and secondary patency by Kaplan—Meier analysis. Primary patency solid line. Secondary patency dashed line.

![Diagram showing results of percutaneous fibrin sheath stripping.](image)

Fig. 3. The results of percutaneous fibrin sheath stripping, including multiple procedures. Individual catheter patency in days following percutaneous fibrin sheath stripping in parentheses. In cases of multiple PFSS the value given is the cumulative total.
Percutaneous fibrin sleeve stripping

Deemed to be unsuitable for chronic ambulatory peritoneal dialysis [6]. With the increasing proportion of elderly and long-term dialysis patients, PDLC are becoming popular in major dialysis centres. The major drawback is blockage, which often requires removal of the catheter [7]. We have previously presented our experience with PDLC to the Scottish Renal Association. The most frequent cause of catheter loss was blockage (28%). The median first catheter survival was 5.6 months [8]. Any technique or treatment that can salvage these catheters will lead to considerable cost savings, preservation of central veins (by avoiding repeat cannulation or surgery) and avoidance of general anaesthesia for catheter replacement or more complex access surgery.

Autopsy dissections and fluoroscopic injections have conclusively shown that totally circumferential fibrin sleeves consistently and extensively form on indwelling subclavian catheters within 5–7 days [1]. Venographic signs of fibrin sleeve formation are variable and include detection of a filling defect associated with either of the ports, and reflux of contrast material along the proximal shaft of the catheter with efflux from the defects in the sleeve. Excessive injection of contrast material from the side-holes of the proximal port and lack of contrast material jet flowing from the proximal port distally into the right atrium are other features.

It should be remembered that there are other causes of catheter malfunction and these should be excluded prior to attempted percutaneous fibrin sheath stripping. During the study, two other patients with catheters exhibiting inadequate BFR were excluded when fluoroscopy showed one catheter to be in the hepatic vein and the other to be in the subclavian vein.

Others have reported similar experience with upto 23% of lines referred for percutaneous fibrin sheath stripping being either kinked or malpositioned [9].

There is a theoretical risk associated with the inevitable embolization of fibrin sleeve fragments to the lungs. To date no adverse clinical sequelae have been reported following percutaneous fibrin sheath stripping. It should be remembered that catheter removal will also necessarily strip off the fibrin sheath with consequent pulmonary embolization. A known right-to-left cardiac shunt should be a contraindication to percutaneous fibrin sheath stripping.

One catheter became infected and had to be removed following percutaneous fibrin sheath stripping, emphasizing the need for a strict aseptic technique, and we think it prudent to administer a single peroperative dose of intravenous antibiotic.

No predictors of success have been identified in the literature, although one centre excluded patients where venography failed to demonstrate a fibrin sheath [4]. Others have stripped the line irrespective of the venographic findings and found satisfactory results in both groups [9].

Percutaneous fibrin sheath stripping is a simple effective procedure with a low complication rate that extends the longevity of haemodialysis catheters. It can be performed as a day case and provides a useful alternative to catheter replacement although a randomized controlled trial together with a cost benefit analysis will be required before a fair comparison can be made.

References

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