Haemodialysis access by inferior vena cava catheterisation

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To the Editor: Progress in haemodialysis (HD) has made it increasingly accessible to patients, who often are able to perform their own dialysis at home.[1] We report our experience with 7 patients who were dialysed via inferior vena cava (IVC) catheters inserted after failure to obtain a functioning arteriovenous (AV) fistula or a femoral, subclavian or jugular catheterisation. IVC catheterisation is useful to gain vascular access for haemodialysis when conventional routes are impossible, and helped to prolong the life of 7 end-stage renal disease (ESRD) patients, with minimal side-effects.

Background

Dialysis membranes are becoming more biocompatible, and dialysis machines safer and easier to operate,[2] while also contributing to improved care of patients with non-renal disease, including end-stage liver disease and cardiac surgery bridging.[3] But vascular access can limit haemodialysis, especially in patients with poor veins, and may cause death in patients with ESRD. AV fistulas may thrombose and lose their patency. Subclavian, jugular or femoral catheters may be used but are often associated with thrombosis or stenosis.

Patients with ESRD can be kept alive for decades by dialysis or kidney transplantation. However, the use of catheters exposes patients to complications such as venous thrombosis, which affects blood flow and the adequacy of dialysis. Haemodialysis via IVC catheters has not been widely practised.[4-6] Vascular access remains a cause of morbidity and mortality in patients with ESRD,[7] and expertise in its use may be lacking. IVC access for haemodialysis may not need to be continued indefinitely as other means of access may become available through collaterals developing or resolution of occlusion. Other venous accesses such as the common femoral vein are prone to infection.[6]

Methods

Using the Seldinger technique, a double-lumen IVC catheter set was inserted.[8] The IVC was punctured via a translumbar approach with an 18-gauge Cheeba needle (Fig. 1); a 14 French dual-lumen tunnel dialysis catheter primed with heparin was introduced co-axially over the guide wire. Haemodialysis was performed 24 hours later and continued regularly 3 times a week. All patients who underwent the procedure were included in this retrospective study. The indication for this method was occlusion of all conventional haemodialysis vascular accesses. Outcomes and complications related to IVC catheters were recorded.

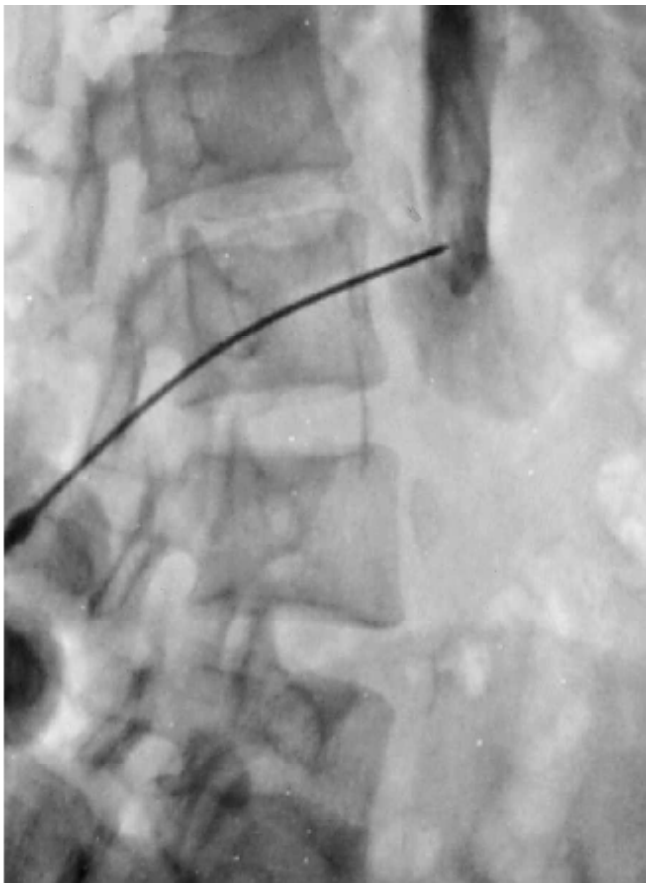

Fig. 1. Fluoroscopy showing puncture of inferior vena cava.

Results

Of 78 patients haemodialysed at Addington Hospital's haemodialysis unit from 2002 to 2007, 7 patients had a total of 9 IVC catheters following failure to obtain a functioning AV fistula or a femoral, subclavian or jugular catheterisation. The patients were 4 males and 3 females, ages 20 - 41 years, with a mean of 33 years (Table I). Two patients had torn catheters replaced. Infection of the catheters occurred in 4 patients. *Staphylococcus aureus* was cultured in 2 and *Pseudomonas aeruginosa* from another. Three patients died; 1 after 16 months from a cerebral bleed probably related to autosomal dominant

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polycystic kidney disease (ADPKD), 1 from catheter-related sepsis after 14 months, and 1 from further catheter occlusion after 9 months. All 3 patients were continuously dialysed through IVC catheters during the period reported (9, 14 and 16 months). The average lifespan of IVC catheters was 11.1±1.5 months (range 2 - 19 months). Selected cases highlight the course of patients following catheter insertion.

Patient 1

A 41-year-old woman with ESRD secondary to ADPKD was treated by dialysis for 10 years, including continuous ambulatory peritoneal dialysis (CAPD) for 1 year, followed by haemodialysis. Two attempts to fashion an AV fistula were unsuccessful, and she was haemodialysed via subclavian and femoral catheters respectively. Due to occlusion of the subclavian, jugular and femoral veins, she was haemodialysed via an IVC catheter. After 2 months, the catheter cracked at the external tip and was successfully replaced by another that performed very well for 14 months, until she died suddenly following a massive cerebral bleed.

Patient 2

A 28-year-old man with ESRD of unknown origin had been treated by chronic dialysis for 3 years. He was treated by CAPD for 6 months that was stopped due to recurrent peritonitis and a frozen abdomen. An attempt to fashion an arteriovenous fistula failed. Renal transplant surgery was abandoned because of extensive fibrosis which rendered any dissection hazardous. Subsequent haemodialysis was via catheters placed consecutively in subclavian, jugular and femoral veins. Owing to their occlusion, haemodialysis was continued via an IVC permanent catheter that functioned very well for 8 months, when it tore at the exit site. It was successfully replaced and is functioning well with a venous Doppler revealing good venous flow. A subsequent radio-radial AV fistula is functioning well for haemodialysis.

Patient 3

A 40-year-old man with ESRD of unknown aetiology was treated by haemodialysis for 6 years after failure of CAPD. Well-controlled hypertension and diabetes mellitus had been diagnosed 5 years earlier. On ultrasound, the left kidney was not clearly visualised while the right kidney measured 7.2 cm and was echogenic. An AV fistula worked for 6 months but then stopped because of thrombosis, and femoral catheterisation was unsuccessful owing to occlusion. A poorly effective peritoneal dialysis was commenced because of vascular access and pending IVC catheterisation. A permanent IVC catheter was inserted and haemodialysis commenced. A *S. aureus* infection of the IVC catheter was successfully treated with vancomycin (Table I).

Discussion

IVC catheterisation helped to prolong the lives of our 7 ESRD patients. As in previous studies, IVC catheterisation was offered when all other HD accesses failed.[9,10] The technique requires expertise to be developed to improve success and reduce the risk of injury,[11] as well as an experienced radiologist and a vascular suite. If these are not available, a surgical approach can be used.[4]

The state of patients' veins should be regularly reviewed to assess the development of adequate collaterals that may allow use of peripheral vein accesses. Recanalisation of an occluded vein should be considered if no other conventional vascular access is possible.[12-14]

An IVC catheter can be replaced safely.[15] IVC catheter-related thrombosis may be treated using a wallstent or thrombolitic agents.[12,16,17] Despite its usefulness for haemodialysis, IVC thromboses may also occur and other options may need to be considered.[18] Our patient 2 underwent a successful AV fistula after >8 months of IVC catheter use. IVC catheters are used for indications other than haemodialysis, such as in peripheral

Table I. Profile of patients haemodialysed via IVC catheter

Patient	Age/sex	Nephropathy	Indication	Durat. IVC cath.	Complication	Outcome
1	41/F	ADPKD	Occlusive veins	2; 14 months	Torn; nil	Functioning cath. Death (cerebral bleed)
2	28/M	Unk	Vein thrombosis	8; 10 months	Torn; nil	Resolved, AV fistula
3	40/M	Unk	Occlusive vein	19 months	Infection	Functioning cath.
4	20/M	CGN	Vein thrombosis	9 months	Occlusion	Replaced by cath. in collateral femoral vein
5	30/M	CGN	Vein thrombosis	11 months	Recurrent	Functioning infection
6	27/F	CIN	Vein occlusion	13 months	Infection	Functioning
7	32/F	Unk	Vein occlusion	14 months	Infection	Death

ADPKD = autosomal dominant polycystic kidney disease; Unk = unknown; CGN = chronic glomerulonephritis; CIN = chronic interstitial nephritis; cath. = catheter

stem cell apheresis and transplantation.[19] Complications of IVC catheters and other long-term haemodialysis catheters include infection and thrombosis.[20,21] In our series, infection occurred in 4 and thrombosis in 1 out of 7 patients. No significant difference has been found between brands of IVC catheter and the prevalence of stenosis and thrombosis.[18]

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