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Percutaneous replacement of a right jugular dialysis catheter via a stenosed superior vena cava

經過狹窄的上腔靜脈經皮更換右頸透析導管的手術

A female patient with end-stage renal failure, who was maintained on haemodialysis via multiple central dialysis catheters, developed chronic occlusion of the left brachiocephalic vein. Subsequently, the right jugular dual lumen PermCath became dysfunctional because of marked superior vena cava stenosis. Angioplasty of the superior vena cava stenosis was performed but failed to restore adequate catheter function. The patient was referred for possible salvage of her central venous access and re-insertion of a new PermCath. During surgery, the right jugular PermCath was removed, the superior vena cava was stented to establish venous patency, and a new PermCath was re-inserted via the existing right jugular puncture site. The technique helps reduce cost and time, and avoids another jugular puncture. In addition, this procedure saves a central venous access which is important in patients on long-term haemodialysis.

一名須用多條中央透析導管維持血液透析的末期腎衰竭女病人，左頭臂靜脈出現慢性閉塞，稍後更因上腔靜脈明顯收窄而導致右頸的PermCath雙腔導管出現障礙，雖嘗試以血管成形術治療上腔靜脈收窄，但仍無法回復足夠的導管功能。後來醫護人員嘗試挽救病人的中央靜脈導管和更換上一副新的PermCath導管。手術成功取出原來的右頸PermCath導管，安置支架保持靜脈開張，並且經原來的右頸穿孔位置植入新的PermCath導管。這項技術節省成本和時間，無須再在病人頸上穿刺。此外，這技術還可保留病人的中央靜脈導管，這對須長期作血液透析的病人十分重要。

Case report

A 66-year-old Chinese woman with end-stage renal failure developed chronic occlusion of the left brachiocephalic vein (BCV) following multiple catheterizations of her central veins for haemodialysis access in December 2000. For 4 years, haemodialysis had been via a right jugular PermCath (Quinton, Seattle, US). Intermittent dysfunction of the dialysis catheter was managed by repeated stripping of the fibrin sheath and thrombolysis. Superior vena cava (SVC) stenosis was identified 3 years after catheter insertion. Percutaneous angioplasty of the SVC stenosis was attempted with temporary improvement, but failed to allow a satisfactory flow rate. She was subsequently referred for re-insertion of a new dialysis catheter. There were no clinical signs or symptoms of acute SVC syndrome or catheter-related infection.

A superior vena cavogram was performed to determine the status of the central veins using digital subtraction angiography: 40 mL diluted non-ionic water soluble contrast medium, 1:1 dilution, 20 mL Omnipaque 300 (Nycomed Ireland Ltd, Cork, Ireland) mixed with 20 mL normal saline were injected at a rate of 8 mL/sec via a Y-adapter with 20-gauge angiocatheters at both elbows, and at a film rate of 1 frame/sec. The venogram demonstrated the indwelling right jugular PermCath, occluded left BCV and marked SVC stenosis, and grossly dilated azygous vein and mediastinal collaterals (Fig 1a). Ultrasound examination of both internal jugular veins revealed patency with no intraluminal thrombus.

Removal of the indwelling right jugular PermCath, SVC stenting, and

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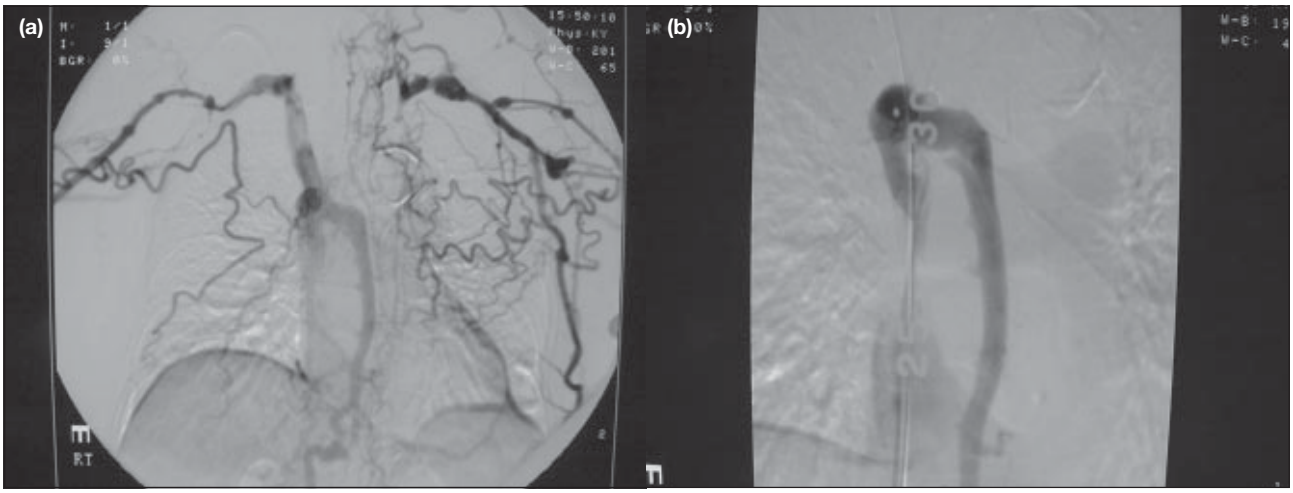

Fig 1. (a) Superior vena cavogram via upper limb veins showing the right jugular PermCath in situ, occluded left brachiocephalic vein and superior vena cava, huge azygous vein and extensive mediastinal collaterals, more on the left side. (b) Superior vena cavogram via 5-French H1 catheter, showing the faintly opacified right atrium and huge azygous vein. One of the safety guidewires was positioned in the inferior vena cava. The other guidewire was at the junction of the right internal jugular vein and the right brachiocephalic vein (not included in this figure)

insertion of a new right jugular PermCath via the existing puncture site were performed under local anaesthesia and fluoroscopic guidance. Adalat 10 mg (Bayer Healthcare Ltd, Leverkusen, Germany) was administered sublingually to prevent venous spasm. Prophylactic antibiotics were not given. Two 0.035-angled Terumo guidewires (Terumo, Tokyo, Japan) were inserted into the two lumina of the indwelling right jugular PermCath as safety guidewires. One guidewire was positioned in the inferior vena cava (IVC) and one was placed in the right BCV. The patient preferred a femoral approach to a jugular approach for SVC stenting. A 10-French (F) vascular sheath was inserted via the right femoral puncture. A 5-F H1 catheter (Cook; Bloomington, IL, US) was positioned in the IVC then the right atrium to measure pressures, in order to document haemodynamic improvement after stenting. At this point, 3000 IU heparin was administered intravenously via the side-arm of the vascular sheath to prevent acute venous thrombosis during manipulation of the guidewire and catheter through the markedly stenosed SVC. If manipulating the femoral guidewire through the marked SVC stenosis was technically unsuccessful, the guidewire in the IVC could be snared using a femoral approach. The old PermCath was then withdrawn to the right BCV, leaving the guidewires in situ. The SVC stenosis was successfully traversed using a 0.035 straight Terumo guidewire (Terumo) and via the H1 catheter. The pressure at the right BCV was recorded. A superior vena cavogram via the H1 catheter was then performed (Fig 1b). A cavogram is useful to identify intraluminal thrombus and venous dissection, and to allow adjustment of the length of the stent. The IVC guidewire through one of the lumina of the indwelling PermCath was then withdrawn to the right BCV. The tip of the H1 catheter was placed at the junction of the right internal jugular vein and the right BCV. The length of the stent was measured using the 'guidewire withdrawal' technique and the diameter of the stent obtained from previous computed tomography. The SVC stenosis was pre-dilated using a 10-mm balloon. A 14 mm x 49 mm Unistep Plus Wallstent (Boston Scientific; Minneapolis, US) was then deployed across the SVC and the stent was further dilated using a 14-mm balloon (Fig 2a) with good angiographic and pressure results. The pressure gradient across the SVC stenosis dropped from 25 to 1 mm Hg.

Before creating a new subcutaneous tunnel, a small incision was made at the right side of the neck at the site of the original jugular vein puncture. The indwelling PermCath was then withdrawn and discarded. Manual compression was applied at the existing jugular puncture site to prevent bleeding and air embolism. Air embolism was also prevented by tilting the angio-table in the head-down position. One of the two guidewires was withdrawn via the original subcutaneous tunnel while maintaining original jugular access. The dilator peel-away sheath assembly (Cook; Bloomington, IL, US) was inserted into the original right jugular puncture site through the withdrawn guidewire. The other guidewire was then removed.

A new subcutaneous tunnel was created because of slight redness over the chest entry point of the original subcutaneous tract. A new double-lumen PermCath (Sherwood Medical Company; St Louis, Missouri, US) was inserted through the new subcutaneous tunnel and through the dilator peel-away sheath assembly at the original jugular puncture. The final position of the new PermCath was checked by fluoroscopy (Fig 2b). The jugular puncture and the chest wall entry sites were then sutured. The lumina of the new PermCath were flushed with heparin to maintain patency. Manual compression of the femoral puncture site

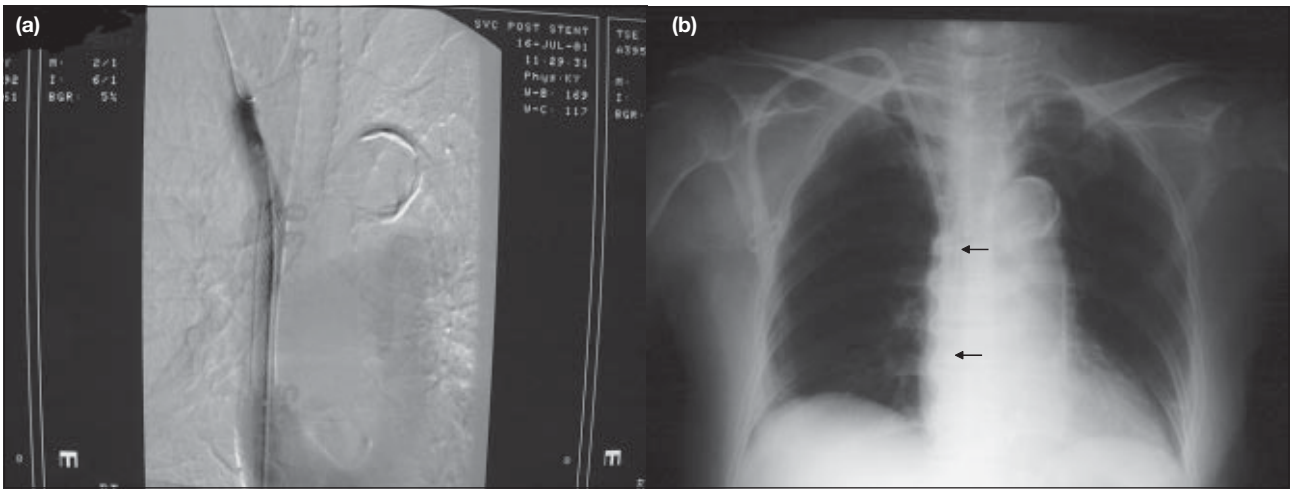

Fig 2. (a) Superior vena cavogram via 5-French H1 catheter after superior vena cava (SVC) stenting. The safety guidewire has been pulled to the right brachiocephalic vein before stenting. (b) Chest radiograph after SVC stenting and insertion of PermCath. The tip of the PermCath is at the junction of the SVC and the right atrium; SVC stent is noted in place (arrows)

was performed to ensure haemostasis. Postoperatively the patient was advised to remain on bed-rest for 6 hours with the head propped up at 30 degrees, and to keep the right leg straight. The new PermCath functioned well during haemodialysis (flow rate, 250 mL/min). The procedure was well tolerated by the patient with no periprocedural morbidity. No catheter-related infection was present at follow-up. Post-stenting anticoagulation with clopidogrel (Plavix; Sanofi, Paris, France) 75 mg orally was prescribed for 8 weeks to allow endothelisation of the stent.

Discussion

Central vein stenosis, and pericatheter and central vein thrombosis are common following central catheter placement, especially when the procedure has been performed on multiple occasions.[1,2] Traditional teaching mandates catheter removal from a thrombosed vein and replacement of a new catheter at a different site. Nonetheless placement of a long-term haemodialysis catheter in patients with restricted venous access is challenging for both the access surgeon and interventional radiologist. Techniques to salvage a dysfunctional Hickman catheter,[3] placement of long-term haemodialysis catheters in occluded jugular veins through external jugular and collateral veins,[4] through thyrocervical collateral veins,[5] directly into occluded central vein segments,[6] angioplasty of the occluded veins,[7] and correction of central venous stenoses using angioplasty and Wallstents[5,8] have all been described. Alternative approaches include translumbar puncture of the IVC,[9] and transhepatic cannulation of the hepatic[10] or femoral vein.[11] To the best of our knowledge, percutaneous insertion of a new haemodialysis catheter via an existing jugular puncture site after removal of a haemodialysis catheter and SVC stenting has not been reported.

The technique consists of three stages: (1) loosening and removal of the indwelling dialysis catheter, (2) angioplasty and stenting of the markedly stenosed central vein, and (3) insertion of a new dialysis catheter. Contrary to Ferral et al's technique,[7] which consisted of recanalisation of occluded central veins, our technique involves re-opening the SVC by stenting. Recanalisation of markedly stenosed central veins via a femoral approach after immediate removal of the indwelling large-bore dialysis catheter is technically much easier. If recanalisation fails, the safety guidewire can be snared at the IVC via the femoral approach. The first stage of our procedure can be performed outside the angio-room before the patient is transferred to the angio-table. This saves time spent in the angio-suite. As a precaution, the loosened catheter should be securely taped to the anterior chest wall to facilitate the procedure.

The technique used in our unit has several advantages. First, recanalisation of the markedly stenosed central vein immediately following removal of the indwelling large-bore dialysis catheter is undoubtedly much easier. According to Ferral et al,[7] the most time-consuming step is the recanalisation process. We believe that use of a snare catheter[5,7] is not necessary, thus procedural cost is reduced. Second, the procedure was well tolerated by the patient, in line with the findings of other studies.[5,7] Third, angioplasty and stenting across the SVC allows insertion of a large-bore long-term dialysis catheter to facilitate adequate flow. Fourth, if salvage of limited central venous access fails in patients on chronic dialysis, alternate venous access sites have not been excluded.

Scintigraphic evidence of pulmonary embolism has been reported in 7% to 33% of patients, depending on the type of central vein catheter.[12] The existing haemodialysis

catheter should therefore be gently removed under fluoroscopic guidance and contrast study if necessary. In our case, we encountered no difficulty when withdrawing the dialysis catheter, since the SVC stenosis was chronic and a marked collateral circulation had developed.

Superior vena cava stenting could have been performed via the original jugular puncture. However, the patient found a femoral approach more acceptable since she had difficulty turning her head towards the left side. Compared with most other approaches, our case did not require an additional puncture at the internal jugular vein. In addition, the original subcutaneous tract could have been used, in the absence of redness at the chest entry point, using the technique described by Brown et al.[3]

In conclusion, percutaneous replacement of a haemodialysis catheter following angioplasty and stenting of a markedly stenosed SVC is a precise and simple procedure in patients with a dysfunctional catheter in a stenosed central vein. The technique offers several advantages, including reduced cost and time, and avoidance of further jugular puncture. In addition, the procedure is well-tolerated and does not preclude other methods of central venous access. We believe that this is a preferable means of managing other patients in similar situations.

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