Technical Note

Alternative puncture site for implantable permanent haemodialysis catheters

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Abstract

Background. Vascular access represents a major problem in long-term haemodialysis patients. In patients without patent internal arteriovenous fistula, the implantation of cuffed catheters to provide a temporary or permanent central venous access is often necessary. Catheterization of the subclavian vein should be avoided because of the high risk of stenosis or thrombosis. The puncture of the internal jugular vein can be impossible in cases with stenosis or thrombosis due to previous catheterization. To overcome these limitations we evaluated an alternative puncture site for implantation of permanent central venous catheters.

Methods. The very low, most central jugular approach, first described by Rao et al., with the site of puncture just above the medial notch of the clavicle, was used to introduce Dacron cuffed dialysis catheters into the innominate vein in four chronic dialysis patients with impeded conventional vascular access.

Results. In all four patients puncture of the internal jugular vein using Rao’s technique was successful at the first attempt. All four catheters were introduced without any problems. Even in a case with thrombosis of the internal jugular vein and the ipsilateral subclavian vein, this technique was successfully applied. No complications such as haematoma, pneumothorax, or catheter-associated infection were observed. The catheters remained in situ for 2–12 months with excellent blood flow and without clinical evidence of venous stenosis or thrombosis.

Conclusions. In case of failure to cannulate the internal jugular vein by a conventional approach, the technique of Rao et al. can be used before sacrificing the subclavian vein or changing to exotic techniques such as translumbar, transfemoral or transhepatic methods.

Key words: haemodialysis; permanent central venous catheter

Introduction

Internal arteriovenous fistulae and grafts represent the preferred vascular access in long-term haemodialysis patients. For many reasons (e.g. thrombosis or maturation of the fistula) temporary or permanent central venous access with a cuffed catheter may be required for dialysis treatment [1–4]. Because of the high incidence of stenosis and/or thrombosis after cannulation of the subclavian vein, which can compromise the patency of an ipsilateral endogenous fistula or graft, the internal jugular vein is considered as the site of first choice for implantation of a central venous access in haemodialysis patients [5–11]. Several studies concerning puncture sites of the internal jugular vein have been published using either the central, the anterior, or the posterior approach (for review see [12]). However, puncture of the internal jugular vein may not be feasible because of stenosis or total thrombosis due to previous cannulation or haematoma after arterial puncture. Another problem associated with the conventional jugular access can be low blood flow because of kinking of the catheter.

In contrast to the above-mentioned classical puncture sites of the internal jugular vein, Rao et al. [13] described the most central approach to this vessel at its confluence with the subclavian vein. This technique has several advantages compared to the conventional jugular puncture. The landmark of this approach is the notch located just above the medial end of the clavicle. This notch can be easily identified, even in obese patients, and the vessel is punctured at the site of the largest diameter. The success rate is reported to be about 99% [13]. The catheter enters the vessel in a smooth curve so that kinking is almost impossible (Figure 1). The complication rate reported by Rao et al. is low compared to the conventional jugular and subclavian access, which is probably due to the ease and reliability of identifying the constant bony landmark. Furthermore, this technique can be successfully applied even in patients with thrombosis or stenosis of the proximal internal jugular vein.

In four patients with a complicated conventional...
Fig. 1. Chest X-ray showing a permanent dialysis catheter introduced according to Rao’s technique.

vascular access, permanent Dacron cuffed haemodialysis catheters were introduced using the method described above after previous attempts of insertion at conventional sites had failed.

Subjects and methods

Puncture technique

After turning the patient’s head away from the site of puncture (the right side in all four patients), the notch just above the medial end of the clavicle was identified by the left thumb. Local anaesthesia was induced by injecting 2-5 ml Xylocaine 2%. The needle was introduced into the notch just above the clavicle 0.5 cm lateral from the sternal end of the sternocleidomastoid muscle. Under aspiration the canula was advanced caudally parallel to the sagittal plane and at an angle of 30-40° with the coronal plane. Black crosses show the conventional (anterior, medial, posterior) puncture sites of the internal jugular vein.

In one patient a silastic double-lumen Kimal IDL 26 with a 16 G introducer set, in two patients a silastic double-lumen Quinton 36 cm with a 12 G oval introducer set, and in one patient a polyurethane double-lumen Vascath 19 cm with a 13 G introducer set was used. Correct position of the catheter tip in the upper third of the right atrium was confirmed by chest X-ray.

Patients

Case 1

A 68-year-old female diabetic patient had been on chronic intermittent haemodialysis for 42 months. After a history of multiple central venous catheters, she had a stenosis of the right subclavian vein and a thrombosis of the cranial two-thirds of the right internal jugular vein. A fistula on the left side was planned. To bridge the time until the fistula was mature for puncture, we decided to place a tunneled Dacron cuffed catheter on the right side. Previous attempts to puncture the subclavian vein either from the infraclavicular or from the supraclavicular access had failed. Ultrasound-guided puncture according to the technique described by Rao et al. was successful at the first attempt. A cuffed catheter (Quinton 36 cm) was introduced without any problems. Adequate dialysis was achieved at a blood flow rate of 250 ml/min until the patient died 3 months later after haemodialysis treatment had been withdrawn because of irreversible dementia syndrome.

Case 2

In a 76-year-old female patient who had been on chronic ambulant peritoneal dialysis (CAPD) for 2 years, a permanent central venous access was required because the CAPD catheter had had to be removed due to fungal peritonitis.
Permanent haemodialysis catheters

Placement from the left jugular and subclavian vein failed because the guide wire could not be advanced into the superior vena cava despite fluoroscopic guidance. Two days later another attempt through the right subclavian vein (from the supravcavicular and infraclavicular approach) failed for the same reason. Failure was probably due to an abnormal intrathoracic course of the central vessels caused by pleural adhesions and severe kyphoskoliosis. Puncture at the site described by Rao et al. was successful at the first attempt. The guide wire and the cuffed catheter (Quinton 36 cm) could be advanced without difficulty. Dialysis was performed at a blood flow rate of 250 ml/min without complications until the catheter was removed 2 months later when CAPD was restarted.

Case 3

A 63-year-old male patient suffering from diabetic nephropathy and severe atherosclerosis required dialysis treatment. Previous attempts to create an internal fistula had failed. Implantation of a permanent dialysis catheter into the right jugular vein was scheduled. Following accidental puncture of the carotid artery, a haematoma developed and the puncture site was shifted to the very low jugular access. Puncture was at once successful. The catheter (Kimal IDL 26) was introduced following standard procedures. Uncomplicated dialysis has now been performed for 12 months at a blood flow rate of 280 ml/min.

Case 4

A 40-year-old female patient who had received a renal allograft 4 years ago had to restart dialysis treatment because of transplant failure. Since the creation of an internal fistula had been scheduled on the left side, the right side was chosen for insertion of a permanent dialysis catheter. At the right jugular and subclavian region, there were multiple scars from previous permanent catheters and the patient reported that placement of central venous catheters on this side had often failed. Puncture according to Rao et al. was successful and the catheter (Vascath 19 cm) was introduced without complication. Dialysis has now been performed for 2 months with a blood flow rate of 250 ml/min.

Discussion

Our data show that the most central jugular access as first described by Rao et al. [13] represents a promising technique for placement of tunnelled Dacron cuffed catheters in haemodialysis patients with compromised conventional vascular access. Even in patients with stenosis of the jugular vein and the ipsilateral subclavian vein (case 1), introduction of a permanent dialysis catheter was possible. Because of the straight line to the right atrium, the guide wire could be advanced easily, even in the presence of intrathoracic abnormalities (case 2). In case of thrombosis or haematoma (case 3) the very low jugular access is feasible and allows preservation of the subclavian vein for arteriovenous fistulae and grafts. In our small series of permanent haemodialysis catheters introduced according to the technique described by Rao et al., neither puncture-associated nor long-term complications were observed. The complication rate for insertion of infusion lines in the original paper of Rao et al. was very low. In a series of 376 paediatric and adult patients, one pneumothorax, three accidental arterial punctures, and two accidental punctures of the thoracic duct (from the left side), all without clinical relevance, have been described [13]. However, ultrasound-guided cannulation is recommended for less experienced physicians and the left side should be avoided because of the danger of chylothorax due to accidental puncture of the thoracic duct. We believe that this method is applicable for patients with difficult vascular anatomy and should be used prior to 'exotic' techniques such as transfemoral, trans hepatic, or translumbar access [15–18].

References

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