

Case report

Four Cases of Adhered Permanent Double Lumen Hemodialysis Catheters (Permcath)

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Abstract

Between September 2010 and January 2012, four patients in our hospital were observed to have permanent dialysis catheters that adhered to either the SVC or right atrium. The first patient underwent intraoperative fluoroscopy and was scheduled for cardiac surgery. Unfortunately due to metabolic disturbances, the patient's condition deteriorated and she died before surgery. The second patient underwent cardio-thoracic surgery with mid-sternotomy and cardio-pulmonary bypass. The catheter was removed and another access route for hemodialysis was established. The third case was scheduled for interventional venocavagaphic exploration of the adhered Permcath. An endovascular snare was passed through the guide wire, which separated the catheter from the SVC. Finally, the fourth patient was a known case of Von Willebrand disease who was scheduled for interventional angiographic Permcath removal. Unfortunately, a few hours following the attempt at surgical removal of the Permcath, her condition deteriorated and she died.

Several methods have been used to manage an adherent Permcath. It is assumed that the longer the catheter is in place, the probability of adhesion to the central veins increases. Histological changes have been demonstrated in the venous wall adjacent to the catheter.

Interventional venacavagaphic exploration of the catheter and snaring the adherent site of the catheter seems to be a valuable option.

Keywords: Cardiac Surgical Procedures, Central Venous Catheters, Kidney Failure - Chronic, Renal Dialysis, Endovascular Procedures

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Introduction

Maintenance hemodialysis is the mainstay of treatment in chronic renal failure (CRF) patients who await renal transplantation. The majority of these patients will require an optimal venous access for possible long term dialysis. As documented in various guidelines of hemodialysis, arteriovenous fistulas (AVF) are practically and clinically superior to any route of vascular access.¹ Despite professional efforts to increase AVF in CRF patients, there are a high number of patients who undergo vascular surgery to install tunneled catheters for hemodialysis. This elevation in patient numbers may be due to the following reasons: 1) patients who with an AVF, but awaiting its maturation time out while undergoing dialysis via a catheter during this specific period of time (average: 6 to 8 weeks); 2) patients who have poor venous vasculature for AVF construction; and 3) those who refuse an AVF.

The placement of a tunneled catheter in a CRF patient may be the cause of some well-known complications such as catheter infection and thrombosis, perforation, fragmentation and emboli into the main central vessels and the rare complication of a catheter adhering to the superior vena cava (SVC) and right atrium.

Between September 2010 and January 2012, there were four patients in our hospital who had permanent dialysis catheters which

adhered to either their SVC or right atrium. Each patient had a permanent double lumen tunneled dialysis catheter (Permcath) installed via a percutaneous anterior pectoral tunnel into the internal jugular vein.

The first patient was a 25-year-old woman who was scheduled for semi-urgent catheter removal because of septicemia and failure to respond to widespread antibiotics. The second patient was a 52-year-old man who underwent the same surgery due to right atrial thrombosis (RAT) and a concomitant infection. In the third patient, a 48-year-old man was not septic but had bacteremia, thus antibiotics were administered via the Permcath. After resolution of the bacteremia and due to long-term catheter existence, elective catheter removal was planned. The fourth patient was a 26-year-old woman, a known case of Von Willebrand disease who had chronic renal failure that necessitated hemodialysis via the Permcath. Due to catheter malfunction and suspected catheter infection, she was scheduled for its removal. All four patients had Permcaths that were inserted via the right internal jugular vein. The chief complaint in all four patients was chills and fever during hemodialysis, with a probable diagnosis of a Permcath infection.

Internal jugular vein Permcath removal technique

Considering catheter insertion site in right anterior pectoral site and its subcutaneous tunnel through cephalic direction to lateral aspect of clavicular head of Sternocleidomastoid muscle, catheter is brought out of the cervical incision exactly on the site of venous cannulation and then is curved to enter internal jugular vein.

Catheter removal is accomplished by reopening the cervical incision, unsheathing the fibrous tissue over the catheter and removing it from the jugular vein, while the venous insertion site is packed. Then, the proximal end of the catheter is released from subcutaneous tissue and removed.

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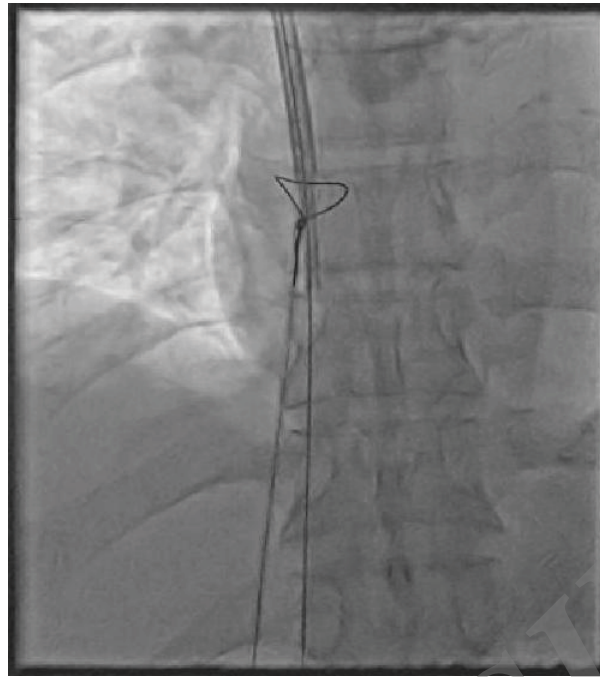


Figure 1. Adhered Permucath encircled by a snaring wire.

Case Reports

In this series of cases, interestingly all four patients complained of chest pain during the catheter removal procedure. Permucath removal was not successful. Because we did not have previous experience regarding an adhered Permucath, thus the first patient underwent intraoperative fluoroscopy. Water-soluble contrast media was injected via the Permucath and we attempted simultaneous removal of the catheter. The right superior mediastinal movement in each catheter removal attempt was visualized under fluoroscopy. Further attempts at catheter removal were not performed. The catheter was fixed to the subcutaneous tissue of the neck and following a cardiosurgery consultation, a thoracotomy for cardiectomy with cardio-pulmonary bypass and catheter removal was scheduled. Unfortunately due to metabolic disturbances, the patient's condition deteriorated and she died prior to cardiac surgery.

The second patient had the same scenario as the first patient. This patient underwent cardio-thoracic surgery with midsternotomy and cardio-pulmonary bypass. The catheter was removed and another access route for hemodialysis was established. Sternomyelitis occurred three weeks after surgery but was resolved with debridement and broad-spectrum antibiotics. Until now, this patient has had no further complications.

The third case underwent a new technique for catheter removal. He was scheduled for interventional venocavagram exploration of the adhered Permucath. A Terumo guidewire was passed through the Permucath to the Inferior Vena Cava (IVC) and the wire was snared from the right femoral vein in the inguinal region. In next step a 12–20 mm endovascular snare (Angiotech, EN Snare System, Medical Device Technologies, Inc., USA) was passed through the guidewire and the catheter was separated from the SVC (Figure 1). The Permucath was removed from the cervical incision and a temporary double lumen catheter was placed in the right internal jugular vein. The final SVC and right ventricle injection were normal without any extravasations. After angiographic intervention, a chest X-ray was obtained that revealed no compli-

cations. Four days following removal of the Permucath, a second Permucath was placed in the right internal jugular vein. To date, this patient is without complications.

As previously mentioned, the fourth patient was a known case of Von Willebrand disease. She had evidence of bacteremia and a catheter malfunction for which removal of the Permucath was indicated. Due to this adhesion she was scheduled to undergo an interventional angiographic procedure for removal of the Permucath. Unfortunately a few hours after surgical intervention for Permucath removal, her condition deteriorated which was possibly the result of refractory hyperkalemia and she died.

Discussion

Permanent double lumen tunneled catheters are used in a significant number of renal failure patients who undergo hemodialysis. This is of importance because catheter-related complications may occasionally occur. Such complications could lead to deterioration and death. Of these complications, much attention is focused on catheter adhesions to the SVC or right atrium.

The four cases reported here had a Permucath for an extended period of time, an average of 14 months. It has been assumed that the longer the catheter is in place, adhesion to the central veins would be more probable.¹ It is presumed that catheter complications are more common in females due to their smaller venous caliber,² but in this case series there was no gender priority. Hypercoagulopathy was not detected in these patients.

Forauer et al.³ have shown histological changes to the venous wall that were catheter related. Short-term evidence included were focal areas of endothelial injury in the vein wall that were adjacent to the catheter. Long-term catheters showed wall thickening and bridges between the venous wall and the catheter.

Management of catheters that adhere is not well described in the medical literature. The first method for catheter removal from the central vein was traction which might lead to serious vascular, atrial and tricuspid valve damage. Thein et al. have reported

the case of a patient with a stuck internal jugular catheter which resulted in catheter tearing and catheter remnants on attempted removal, leading to the patient's death.⁴

Cut-down at the venous insertion site of the catheter has been an acceptable method for removing catheters⁵ but complications such as catheter break down have been reported.^{4,6,7}

Thoracotomy may be the last option. Ideally thoracotomy with cardiopulmonary bypass should be avoided for removal of adherent catheters because it consists of severe morbidity, particularly in immune-compromised renal failure patients. Sequeira et al. have reported one case of catheter adhesion that underwent thoracotomy and cardiopulmonary bypass with successful removal of the catheter.¹ In our series of cases mentioned in this paper, the second patient underwent a thoracotomy and suffered from sternomyelitis following surgery.

Hassan et al. left the distal half of the catheter under subcutaneous tissue following suture ligation of its double lumens in six patients, with no obvious complications.²

Carrillo et al. introduced a novel method that was based on a technique used in pacemaker removal by extraction of the catheter with a laser sheath. No complications were observed in three patients with tethered catheters that were successfully removed with this technique.⁸

Vesely reported a method for retrieval of embedded catheters that was based on interventional radiology literature using snares and a venacavogram.⁹ The method applied to extract the catheter in the third patient of our case reports was similar to this technique.

The presence of chest pain during an attempted removal of the Permcath should raise the suspicion of catheter adhesion (either right atrium or SVC) which is a primary risk factor in long standing catheters (greater than 1 year). By taking into consideration

demographics and established data of complications that arise from adherent Permcath catheter removal that could be lethal, we suggest that elective Permcath replacement should be performed less than one year following its installation.

Among various techniques introduced to remove an adherent catheter, interventional venocavagram exploration of the catheter and snaring the adherent catheter site seems to be a valuable option because complications from this method may be less than other procedures.

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