Figure 1 — Extended peritoneal dialysis catheter. (A) Subcutaneous extension segment. (B) Abdominal catheter segment. (C) Titanium connector. For patient 1, a Curl Cath catheter (abdominal segment) with a swan-neck presternal catheter (extension segment) was used (Covidien AG, Mansfield, MA, USA). For patient 2, an identical device provided as a presternal catheter (Medionics International, Markham, ON, Canada) was used.

Peritoneal Dialysis Catheters with Back Exit Sites

Renal failure patients with mental defects that include self-injurious behavior can represent a challenge when dialysis therapy is planned, whether peritoneal dialysis (PD) or hemodialysis. These patients usually cannot comprehend the consequences of pulling out catheters, tubing lines, or needles—behavior that not only interferes with therapy delivery, but that might result in life-threatening situations.

Here, we describe the use of an extended PD catheter to provide a safe skin exit site remote from the reach of the patient's hands.

METHODS

The extended peritoneal catheter is composed of a silicone coiled-tip one-cuff abdominal catheter segment joined with a titanium connector to a silicone two-cuff subcutaneous extension catheter possessing a preformed arc in the inter-cuff segment (Figure 1). The abdominal catheter segment is implanted into the peritoneal cavity. The attached subcutaneous extension portion allows for the catheter exit site to be located in a skin location remote from the abdominal region.

PATIENT 1

A 33-year-old man with Down syndrome and advanced chronic kidney disease from chronic glomerulonephritis had a history of self-injury and pulling out intravenous lines. The patient had an excellent support system under the care of his parents, who desired to pursue renal replacement therapy at home with PD. The patient was left-hand dominant and ambulatory by wheelchair. A skin exit site in the back region to right of midline above the backrest of the wheelchair was planned.

Because of the patient's large size, we elected to insert the abdominal catheter segment with the patient supine and then to reposition the patient in lateral decubitus to complete insertion of the extension tubing to the back. A single dose of cefazolin was administered preoperatively. The procedure was performed under general endotracheal anesthesia.

The abdominal catheter was implanted using a two-port laparoscopic approach as previously described (1). The peritoneal catheter was inserted at a paramedian site through a port conduit that was tunneled under laparoscopic control in a craniocaudal direction through the rectus muscle and sheath for a distance of 6 cm in its passage to the peritoneal cavity. The cuff was positioned in the rectus muscle just below the anterior rectus sheath. After a successful test of the catheter for flow function, the tubing was tunneled in a curvilinear path to an incision in the anterior axillary line [Figure 2(A)]. Through that incision, a Pean clamp and blunt finger dissection were used to further develop a subcutaneous path on the fascial surface toward the flank along the planned track to the back. The end of the catheter was inserted

Figure 2 — (A) Implanted abdominal catheter segment is seen exiting the skin incision (anterior view) at the tunnel track in the right anterior axillary line. A laparoscopic port is present in left upper abdomen. (B) Patient repositioned into left lateral decubitus. (C) Vascular tunneler inserted to implant joined abdominal and extension catheter segments. (D) Catheter exiting the back.

into that track so that it could be intercepted through a new incision after the patient had been turned and re-prepped and draped. All incisions were closed and dressed, and the patient was turned to left lateral decubitus [Figure 2(B)].

The end of the abdominal catheter was exteriorized through a new incision in the mid-axillary line. A right paravertebral incision was made at the predetermined site. A vascular tunneler (8-mm vascular tunneler, sheath, and tip: Scanlan International, St. Paul, MN, USA) was then inserted at the level of the fascia and advanced from the paravertebral incision to the mid-axillary incision [Figure 2(C)]. The two catheter segments were joined with a titanium connector and further secured with 0 polypropylene ties around the connector grooves. The extension catheter was pulled through the tunneler, and the tunneler was removed. The extension catheter was then tunneled to the planned skin exit site, leaving the most superficial cuff 3 cm from the exit wound [Figure 2(D)]. The surgical wounds were then closed and dressed.

At the time of writing, the patient had been successfully managed at home on PD for 6 months. The catheter is padded with sufficient gauze to prevent undue pressure of the tubing on the exit-site skin during recumbent

periods. The gauze covers enough area to avoid the sensation of a lump of dressing material in the middle of the back. A T-shirt is always in place to further deter tampering with the catheter and dressing. There have been no incidents of the patient attempting to disturb the catheter, and no occurrences of flow dysfunction, peritonitis, or exit-site infection [Figure 3(A)].

PATIENT 2

A 30-year-old woman with advanced chronic kidney disease was known to be uncooperative and combative with medical interventions. She had severe Down syndrome with a very low level of function. Moreover, she was born with tetralogy of Fallot, with moderate pulmonary regurgitation and an aberrant right subclavian artery, which was subsequently treated with total surgical correction at the Hospital for Sick Children in Toronto, Ontario, Canada.

The patient remained reasonably physically active until 2000, when her overall function declined dramatically. She developed extraordinary anxiety with respect to health care providers and became severely combative and uncooperative to all health care interventions. At that point she refused to lie down or to cooperate with any

medical investigations or procedures. Echocardiograms were performed in the sitting position only after administration of high doses of sedative medication.

This patient's renal disease was related to abnormal development of her kidneys (both were small and atrophic). Because of a pressing need to initiate dialysis, multiple attempts were made to insert subclavian and femoral hemodialysis lines; however, the woman was able to pull out each line. Because of the inability to establish a stable hemoaccess line, consideration was given to using PD, with a plan to tunnel the catheter to the left interscapular region. An exit site in that area would not allow the patient to reach the catheter or pull at it.

A single dose of cefazolin was administered preoperatively. The procedure was performed under general endotracheal anesthesia. The patient was positioned in right lateral decubitus so that the procedure could be completed without a need for repositioning. The incision sites, exit site, and tunnel track were mapped on the skin. Laparoscopic access to the obese abdomen was obtained using a Veress needle in left upper quadrant, which permitted insufflation and placement of a laparoscopic port and camera. A left transverse paramedian incision was made over the rectus sheath just above the level of the umbilicus, and the abdominal catheter segment was inserted by rectus sheath tunneling under laparoscopic guidance using a previously described technique (1).

The entire length of the extension catheter segment was used. A transverse counter incision was made in the mid-axillary line. A titanium connector was used to attach the abdominal and extension components, the junction being further secured with 2-0 polypropylene ties. A vascular tunneler (Scanlan International) was used to create a subcutaneous tunnel from the abdominal to the mid-axillary incision. The extension catheter was threaded through the vascular tunnel. Another transverse incision was made between the left scapula and the spine. The vascular tunneler was used again to pass the extension catheter from the mid-axillary incision to the interscapular wound. Finally, a Faller stylet (Faller tunneling stylet: Covidien AG, Mansfield, MA, USA) was used to direct the catheter in a downward direction from the interscapular incision to the predetermined exit site. The surgical wounds were then closed and dressed.

At the time of writing, the woman's mother had successfully maintained this patient on home PD for more than 3 years. Initially, when the patient refused to enter the hospital for training, the dedicated nursing team performed the training sessions in a car parked on the hospital parking lot. Because the patient sleeps prone,

Figure 3 — (A) Peritoneal catheter exiting from the mid-back above the backrest of the wheelchair (patient 1). (B) Interscapular exit-site location of the peritoneal catheter in patient 2.

no special dressing has been required to prevent pressure over the catheter exit site. There has been no incidence of catheter malfunction [Figure 3(B)].

DISCUSSION

An extended PD catheter was introduced in 1992 to provide a skin exit site in the upper anterior chest when the abdomen region was unsuitable (2). This two-piece catheter is ideal for patients with obesity, floppy abdominal skin folds, urinary or fecal incontinence, chronic yeast intertrigo, or intestinal stomas, and for those who desire to take deep tub baths. When used for such reasons, extended catheters increase the pool of patients that otherwise might not be considered candidates for PD. Compared with the usual abdominal exit-site locations, these remote exit sites located in the upper chest significantly delay the probability of first exit-site infection (3) and tend to lower peritonitis and exit-site infection rates (3–6). Although multiple studies have not demonstrated statistically significant differences in infection rates between standard abdominal and extended catheters, patients who are typical candidates for extended catheters are at such high risk for infection that any tendency to an equal or lower rate is considered clinically important.

The present report broadens the indications for extended catheters to include patients with behavioral disturbances who are prone to pull or snatch at lines. Being able to offer renal replacement therapy at home through the use of PD provides the additional advantage of eliminating the problems of transporting disruptive patients to in-center hemodialysis. An peritoneal catheter extended to the patient's back provides a successful and safe dialysis access option.

DISCLOSURES

In the past year, TP has received honoraria and consultancy fees from Baxter Healthcare and Covidien. JHC has received speaking honoraria and consultancy fees from Baxter Healthcare; Fresenius Medical Care; MediGroup, Inc.; Covidien; and Medcomp.

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