SHORT REPORTS

Management of Peritoneal Dialysis Catheters That Erode Into Bowel: Two Pediatric Case Reports and a Review of the Literature

Erosion of peritoneal dialysis (PD) catheters into the intestine is a rare complication of PD. Herein, we convey the first reports of 2 pediatric patients undergoing PD who were found to have the catheter eroding into their intestines. They were treated minimally with catheter removal and antibiotics. Definitive repair of the intestinal injury was not performed. These are the first pediatric patients reported with PD catheter erosion. Perforating injuries may be self-limiting, and therefore a more minimal approach may be considered in certain patient populations who do not express overt signs of peritonitis or illness.

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KEY WORDS: Peritoneal dialysis; catheter; erosion; minimal therapy; pediatric.

CASE REPORT

Case 1

The patient, DR, is a 1.9-kilogram neonate who was born with bilateral renal cortical necrosis and underwent placement of a non-curved neonatal peritoneal dialysis (PD) catheter on the fifth day of life. Postoperatively, the catheter worked well, but by postoperative day 10 he was found to be passing large amounts of fluid into his diapers. A voiding cystourethrogram and abdominal radiographs determined that the catheter had eroded through the rectum (Figure 1) (1). Contrast injected through the PD catheter opacified the rectum and descending colon. The patient was afebrile, asymptomatic, and a small amount of dialysate from the catheter had no debris or cells within it.

The patient was taken to the operating room where the small catheter incision site was reopened. There was no evidence of contamination in the pelvis. The PD catheter was removed. A perforation was not seen and the bowel was not definitively explored or repaired. Thirteen days later, his renal function continued to deteriorate and he was taken back to the operating room for successful placement of a subsequent curled-tip PD catheter.

Case 2

The patient, LM, is a 6-year-old male who was born with imperforate anus, a solitary dysplastic kidney, and a neurogenic bladder. In the newborn period, his fecal and urinary

streams were diverted with a colostomy and vesicostomy. He later underwent posterior sagittal anorectoplasty and ligation of his rectal-vesicular fistula. He was lost to follow-up but returned at 6 years of age. He still had his colostomy and was now on PD. He was preparing for transplant, and the nephrologist suggested that his ostomy be closed prior to this event. We therefore restored fecal continuity, but elected to leave his PD catheter (39-cm curled catheter placed 13 months prior to this operation) in place for future dialysis. He was undergoing hemodialysis during this interim period.

Eight weeks postoperatively he expressed no complaints. Dialysis nurses were able to hand flush a small amount of dialysate and allow it to gravity drain, but were not able to get the dialysis machine to cycle the dialysate automatically. Routine

Figure 1 — Abdominal radiograph showing peritoneal dialysis catheter eroding through the rectum. Contrast is seen in the bladder from a voiding cystourethrogram, and injection of contrast through the catheter opacifies the rectum both proximally and distally to the catheter.

X ray demonstrated that the catheter was not in its ideal and intended location in the pelvis, but rather, was lying in the right lower quadrant over the iliac crest. Nurses continued to hand flush his PD catheter weekly. The patient reported no pain with catheter flushes, and dialysis nurses did not notice cloudy or particulate effluent at this time. Twelve weeks postoperatively he was noted to have cloudy, brown fluid in his PD catheter. The fluid yielded an amylase level of 6,700 units/L and grew *Klebsiella*, *Enterobacter*, and *Enterococcus*. He exhibited no symptoms or abdominal pain. A computerized tomography (CT) scan with contrast through the catheter demonstrated opacification of the entire small bowel, indicating erosion of the catheter into the bowel lumen (Figure 2).

Given that he was asymptomatic, he was taken to the operating room electively the next morning, where the small 2-cm incision that was used to place the catheter was reopened. The catheter was released from the fascia and removed. A small amount of purulence was noted on the catheter tip but no frank stool was appreciated. A formal laparotomy was not performed and the bowel was not inspected or repaired. He remained asymptomatic and his diet was advanced on

postoperative day 6. Postoperative abdominal radiographs demonstrated contrast within the distal colon and no leak into the peritoneal cavity.

DISCUSSION

Reports of PD catheters eroding through the bowel are sparse. To our knowledge, these are the first reports of pediatric patients with this problem. The overwhelming majority of adult patients with catheter erosion underwent surgical laparotomy with definitive repair of the intestinal injury. However, more involved surgical procedures, such as laparotomy and bowel resection, may not always be necessary, particularly in patients without decompensation or symptoms of peritonitis.

Review of case reports in the literature

A review of the literature depicts 13 adult patients who sustained enteric injuries associated with PD catheters (Table 1) (2–8). All but 2 patients underwent laparotomy and repair of bowel injury at the time of diagnosis. One patient with a PD

Figure 2 — Abdominal CT scan with contrast instilled through the PD catheter (A–D). Contrast fills the small bowel, indicating an erosion of the catheter into the bowel lumen. The catheter is identified by a white arrow. CT = computerized tomography; PD = peritoneal dialysis.

TABLE 1
Literature Review of Patients with Peritoneal Catheter Erosion into Bowel

Author	Age/sex	Renal disease	Catheter type	Peritonitis on physical exam	Dialysate cultures	Outcome	Site injured	Bowel repaired?	Ostomy created?
Watson	71M	Chronic glomerulonephritis	N/A	Yes	<i>E. coli</i> / <i>Pseudomonas</i>	Death	Sigmoid	Yes	Yes
Jamison	46M	Polycystic kidney disease	N/A	No	<i>Bacteroides</i> / <i>E. coli</i>	Recovered	Rectum	No	No
Rotellar	22M	Poststrep glomerulonephritis	Straight	no	gram- rods/ <i>Bacteroides</i>	Recovered	Sigmoid	Yes	N/A
	69F	Polycystic kidney disease	Straight	No	<i>Proteus</i> / <i>Enterococci</i> / <i>Klebsiella</i>	Delayed Surgery	Sigmoid	No	No
	36M	Hypertensive nephrosclerosis IgA Glomerulonephritis	Straight	Yes	<i>S. epidermidis</i> / <i>S. aureus</i> / <i>Bacteroides</i> / <i>E. coli</i>	Recovered	Rt. Colon	Yes	N/A
	80M	Hypertensive nephrosclerosis	Straight	No	gram- cocci/ gram+ cocci/ <i>Bacteroides</i> / <i>Clostridium</i>	Recovered	Sigmoid	Yes	N/A
	54M	Hypertensive nephrosclerosis renal tuberculosis	Straight	Yes	Anaerobes	Recovered	Sigmoid	Yes	N/A
	54F	Hypertensive nephrosclerosis Type 2 Diabetes	Curl	No	<i>Klebsiella</i> / <i>Enterococci</i> / <i>Pseudomonas</i>	Recovered	Cecum	Yes	N/A
	53F	Interstitial nephritis	Curl	No	<i>Enterococci</i> / <i>S. aureus</i> / <i>Candida</i>	Recovered	Sigmoid	Yes	N/A
Balaji	46M	Chronic glomerulonephritis	Curl	No	N/A	Recovered	Cecum	Yes	No
Finkle	73M	Hypertensive nephrosclerosis amyloidosis	Curl	No	N/A	Recovered	Rectum	Yes	Yes
Saweirs	18M	Membranous glomerulonephritis	Curl	No	N/A	Recovered	Rectum	Yes	No
Ramanarayanan	44M	Chronic glomerulonephritis	Straight	No	CNS	Recovered	Jejunum	Yes	No

N/A = not applicable; CNS = coagulase-negative *Staphylococcus*.

catheter who did not undergo definitive bowel repair was a 46-year-old male who was asymptomatic with the exception of a persistent wound sinus at the site of catheter entry. A sinogram was performed, which showed a communication between the catheter and the rectum. The catheter was simply removed and the patient recovered without further incident (3). The other patient also had the catheter removed without

definitive bowel repair. She did well in the initial postoperative period. Unfortunately, she developed persistent and chronic abdominal pain that was initially attributed to polycystic kidney disease. At the time of planned nephrectomy, chronic inflammation of the left colon and sigmoid colon were found with erosion into the bladder (4). Hemicolectomy and partial bladder resection were performed.

In the remaining 11 cases, definitive bowel repair was performed. In 3 of the 11 patients, peritonitis was diagnosed by physical exam findings of pain, rebound tenderness, and guarding. In 8 of the 11 patients, bacterial or fungal elements were cultured from the dialysate or the catheter exit site. Three cases did not report bacterial culture data. Six of the operative cases involved injuries to the colon, 2 sustained injuries to the rectum, 2 to the cecum, and 1 to the small bowel. One patient died, and the remaining were able to be discharged. There appeared to be an equivalent number of straight and curled-tip PD catheters in this population.

Management

Intestinal erosion presents a challenging problem to PD patients. Continuous lavage of the peritoneum and intraperitoneal use of antibiotics may mask the acute symptoms often seen in early peritonitis (4). Additionally, the risk of delayed perforation may be increased due to peritoneal friability and an empty peritoneal cavity if the catheter is not being actively used. The peritoneum and bowel can therefore rub directly on the catheter, which may cause pressure necrosis and eventual perforation (4,9). Therefore, routine flushes of the catheter should be undertaken, even if the catheter is not in use, so as to avoid a "dry rubbing" of the catheter on the bowel wall.

Optimal positioning of the PD catheter deep within the pelvis should also be undertaken during PD catheter placement (10). Despite appropriate placement, though, visceral perforations can still occur, as seen by several rectal injuries in the aforementioned cases, as well as case reports involving erosions into the bladder and uterus (11,12). Utilization of curled catheters, as well as techniques that suture the tip of the catheter to the pelvic peritoneum, remove the omentum, and perform ovariopexy when indicated, have all been shown to decrease catheter migration and increase catheter lifespan (13–15). Unfortunately, there is no solid evidence to suggest that these maneuvers work to prevent catheter erosion.

Although practice patterns of PD catheter insertion differ among institutions (16), and injuries associated with peritoneal catheter insertion have been well documented (17), strategies to manage patients with an enteric erosion from a PD catheter are less well defined. Certainly, in situations with overt sepsis, peritonitis, and notable free air on abdominal radiographs, patients should be urgently taken to the operating room for abdominal exploration and bowel repair.

However, several reports entail non-operative management of bowel perforations involving other smaller diameter peritoneal catheters such as ventriculo-peritoneal (VP) shunts (18–20). In many of these patients, the VP shunts are simply removed without definitive abdominal exploration or intestinal repair. Peritoneal dialysis catheters, however, are larger diameter catheters, and as such, can leave larger holes in the bowel. Despite this, perforating injuries of the bowel with PD catheters may be self-limiting, and therefore, a more minimalistic approach that only involves catheter removal and antibiotics, and not laparotomy with bowel repair, could be considered in certain patient populations.

Three of 4 patients initially treated with minimal therapy (1 adult and 2 children mentioned herein) have now been successfully treated without ever repairing the bowel injury. The ability to remove the catheter without definitive bowel repair likely stems from a localized inflammatory response which effectively walls off the injury, thereby avoiding generalized peritonitis and the need for abdominal exploration and bowel repair. In those patients with a large amount of free abdominal air or generalized peritonitis on physical exam, this localized containment process did not occur, and therefore, patients should be operatively explored to contain the injury.

DISCLAIMER

This report suggests an alternative, and more minimalistic, approach to treating certain patients with bowel injury from PD catheter erosion. The approach presented in this article should only be considered in patients without peritonitis on physical exam or other signs of illness, and should only be undertaken at a center with significant PD and surgical services. The article is not meant to suggest that every patient with a catheter erosion is a candidate for this therapy. Certainly, the gold standard, and most efficacious therapy, is operative intervention with definitive bowel repair.

When discussing all available treatment options with patients who have sustained a catheter erosion into the bowel, minimal therapy should be considered with those who are appropriate candidates. This type of therapy may be beneficial for patients who have had multiple surgeries, those who just had surgery and whose abdomen may be considered "hostile" secondary to adhesions, and those patients who may not be good candidates at the time for surgical intervention due to other comorbidities. Risks of this more minimalistic management style could involve the need to undergo urgent surgical intervention, peritonitis with peritoneal injury and the inability to perform PD in the future, and acute decompensation.

CONCLUSION

Peritoneal dialysis catheter erosion into the intestine is a rare phenomenon. Although catheter erosion is more common in adults, it can occur in children. Patients with catheter erosions into bowel may be managed by antibiotics and catheter removal alone only if they show no overt signs of sepsis or peritonitis. Careful monitoring at an experienced center is warranted with this management strategy, and if patients decompensate they should be taken urgently to surgery for abdominal exploration and bowel repair.

DISCLOSURES

The authors have no financial conflicts of interest to declare. Figure 1 was previously published in the *Journal of Pediatric Surgery* in 1990 (1). Permission was obtained from Elsevier (License number: 3795940296678) to use this figure in this work.

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