Perioperative Management of Peritoneal Dialysis Patients: Review of Abdominal Surgery

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Introduction
Peritoneal dialysis (PD) is an established alternative renal replacement therapy for patients with stage 5 chronic kidney disease. Complications arising from PD may require surgical intervention. These surgical procedures may result in interruption of PD and temporary hemodialysis (HD) (1). However, with the increased use of laparoscopy, many procedures may be performed with no need for HD and minimal interruption of PD (2).

Case report
The index patient, a 23-year-old male, had been on PD for 6 years secondary to hypertension. Initially, HD had been his renal replacement therapy for 2 years. He was converted to PD secondary to recurrent HD access complications. His PD course was complicated by recurrent episodes of exit-site infection and peritonitis, including interruption of PD (with temporary return to HD) secondary to peritonitis.

This patient developed periodic episodes of urinary tract infection associated with nephrolithiasis. As a result of an earlier evaluation for nephrolithiasis, bilateral simple renal cysts had been identified by ultrasound examination. When macroscopic hematuria developed, another ultrasound examination revealed development of a complex cystic mass that warranted further evaluation. An earlier computed tomography scan had confirmed multiple renal cysts bilaterally. Annual surveillance of the bilateral multiple renal cysts by magnetic resonance imaging revealed a complex cystic mass that warranted urologic investigation. Following that investigation, laparoscopic nephrectomy was planned. In preparation for the surgical procedure, a cardiovascular risk assessment was made, and additional PD by the continuous cycling method (CCPD) was planned for the 3 preoperative...
days. A right-sided laparoscopic nephrectomy was performed.

On the third postoperative day, low-volume CCPD with 1000 mL low-calcium dialysate was performed while the patient remained in the supine position. During physical therapy and other scheduled tests, a 250 mL residual was left at disconnection. On postoperative day 7, the dialysate volume was increased to 2000 mL. The patient tolerated the increased volume without complications. Two weeks postoperatively, the patient resumed his usual preoperative PD prescription of 2800 mL CCPD, with a daily 2500 mL continuous ambulatory peritoneal dialysis (CAPD) exchange.

The remainder of the patient’s postoperative course was unremarkable. He required introduction of erythropoietin to maintain hemoglobin at 12 g/dL. (His maintenance dose of erythropoietin had been discontinued approximately 4 years before surgery.) Pathology examination of the kidney demonstrated renal cell carcinoma confined to the kidney. Perinephric lymph nodes were negative for metastatic disease. The patient was staged as T1M0N0.

Discussion
Complications of PD include the infectious, the anatomic, and structural complications related to the PD catheter. Anatomic complications include hernias arising from earlier surgical incisions and inguinal and umbilical hernias. Abdominal wall and inguinal hernias are frequent complications of PD, requiring surgical intervention for repair. Before the introduction of laparoscopic techniques, surgical intervention often required interruption of PD, temporary HD, surgical repair, and postoperative recovery before PD could be resumed.

The risk of catheter-related complications and the reluctance that many PD patients have regarding HD are significant concerns. Many examples exist in the literature where temporary interruption of PD occurs in association with laparoscopic procedures, followed by resumption of PD 1 – 3 days following the surgery (1,3–6). In patients at risk for abdominal hernias, automated PD with low daytime fill volumes should be considered (7). Additionally, in obese patients and older patients, the complication of peritoneal leak may require correction and result in interruption of PD (7). Laparoscopic management may be considered for these patients as well.

Malfunctions of the PD catheter may result from migration, kinking, or omental wrapping. Management of these complications may require surgical intervention. However, with newer interventional radiology techniques, catheters may be repositioned using a guide wire. In these instances, PD may be resumed immediately following confirmation of position (8). In instances that require surgical manipulation of the catheter, PD may be interrupted. However, with the increased use of laparoscopy, many malpositioned catheters may be manipulated into the correct position. In these circumstances, PD may be resumed immediately or interrupted for no more than 1 day (9,10).

If patients develop peritonitis and require catheter replacement, Postuma et al. have provided an example of removal and replacement of an infected catheter during the same surgical procedure without interruption of PD (4). Patients undergo removal of the infected catheter laparoscopically and replacement on the opposite side of the abdominal wall. Following the surgery, PD is resumed within 48 – 72 hours with low volumes. Over the next few weeks, patients may resume their preoperative dialysis prescription.

During a literature review before creating the perioperative plan for the patient discussed here, no clear perioperative recommendations were found. The literature does provide many case reports and case series for PD patients undergoing abdominal surgical procedures (Table I). Many examples exist for the management of PD patients who develop umbilical and inguinal hernias and who undergo surgical repair without interrupting PD for prolonged periods of time or without conversion to HD (3,4). In these examples, surgical repair has been followed by resumption of PD with low volumes for 1 – 7 days, followed by return to the preoperative PD prescription within 2 – 4 weeks of the surgical repair (4). In more invasive laparoscopic abdominal surgical procedures such as cholecystectomy or gynecologic surgery, PD using low volumes has been resumed 24 – 72 hours after the procedure (11–13). In these cases, patients resumed their preoperative dialysis prescription within 2 – 3 weeks of the surgical procedure.

Laparoscopic nephrectomy has been performed for living related-donor transplant harvest and the removal of renal masses in otherwise healthy patients. Schwartz and Vestal described bilateral laparoscopic nephrectomy for renal masses in a case report in a dialysis patient (14). The resulting operative
In the perioperative management of PD patients (Table II), evaluation of cardiovascular risk, as well as surgical risk, needs to occur. Most dialysis patients have significant cardiovascular risk factors that may delay surgical procedures or result in modification of their perioperative management.

Perioperative management in PD patients requiring surgery should also include optimizing anemia management for a target hemoglobin of 12 – 13 g/dL by using a combination of intravenous iron administration, erythropoietin, blood, and blood products as warranted. If patients may require blood transfusion, the transfusion should be done preoperatively, with additional dialysis to optimize volume status preoperatively. To improve intraoperative hemostasis, daily preventive aspirin should be discontinued 1 week before surgery in those patients on this regimen.

Uremia causes platelet dysfunction and may alter hemostasis in surgical patients. Additional preoperative dialysis may therefore be indicated for PD patients. Patients on CCPD may perform PD nearly continuously for 48 – 72 hours before surgery. Patients on CAPD may perform PD every 3 – 4 hours while awake for 48 – 72 hours before surgery.

In an effort to prevent postoperative infections, prophylactic antibiotics may be administered as appropriate to the surgical procedure (2). Intraoperatively, when possible, a laparoscopic approach should be used. This approach will shorten the postoperative recovery period and minimize the need to convert PD patients to HD. Additionally, intravenous fluid administration should be minimized to reduce the necessity of immediate postoperative dialysis for volume overload.

Postoperatively, PD may be resumed immediately if abdominal wall integrity is maintained (8–10). For many abdominal laparoscopic procedures, PD with low volumes may be resumed on postoperative days 1 – 3 with the patient in a supine position (3,5,6,9–13,15). Exchange volumes may be gradually increased over the next week if the patient tolerates the increase.

In most patients, the preoperative dialysis prescription may be resumed at 2 – 3 weeks postoperatively. Postoperative anemia management should also be optimized using intravenous iron, erythropoietin, and blood products as clinically indicated. Meticulous exit-site care and PD technique should be emphasized to minimize the risk of infectious PD complications. Surgical wound care should be just as meticulous to minimize the risk of wound infection.

Acquired cystic kidney disease (ACKD) is a known complication of dialysis patients and was first

### Table I: Summary of literature concerning surgical procedures in peritoneal dialysis (PD) patients

<table>
<thead>
<tr>
<th>Procedure</th>
<th>References</th>
<th>Anesthesia</th>
<th>PD interruption (days)</th>
<th>Laparoscopy</th>
<th>Complications</th>
<th>PD modality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catheter manipulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guide-wire</td>
<td>8–10</td>
<td>Local</td>
<td>0</td>
<td>No</td>
<td>None</td>
<td>CAPD, CCPD</td>
</tr>
<tr>
<td>Surgical</td>
<td>9,10</td>
<td>General or local</td>
<td>1–3</td>
<td>Yes</td>
<td>None</td>
<td>CAPD</td>
</tr>
<tr>
<td>Cholecystectomy</td>
<td>13</td>
<td>General</td>
<td>1–3</td>
<td>Yes</td>
<td>None</td>
<td>CAPD</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td>14 (HD)</td>
<td></td>
<td>4/10 Peritonitis</td>
<td></td>
</tr>
<tr>
<td>Hernia repair</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cicatricial</td>
<td>5</td>
<td>General</td>
<td>1–3</td>
<td>No</td>
<td>None</td>
<td>CAPD, CCPD</td>
</tr>
<tr>
<td>Incisional</td>
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<td></td>
<td></td>
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<td>CAPD</td>
</tr>
<tr>
<td>Inguinal or umbilical</td>
<td>3,5,6</td>
<td>General or local</td>
<td>0–1</td>
<td>No</td>
<td>None</td>
<td>CAPD, CCPD</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
<td>1–3</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Nephrectomy</td>
<td>Case report</td>
<td>General</td>
<td>3</td>
<td>Yes</td>
<td>None</td>
<td>CCPD</td>
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<tr>
<td>PD catheter replacement</td>
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<td>2–3</td>
<td>Yes</td>
<td>None</td>
<td>CAPD</td>
</tr>
<tr>
<td>Salpingectomy</td>
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<td>General</td>
<td>1</td>
<td>Yes</td>
<td>None</td>
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</tr>
</tbody>
</table>

CAPD = continuous ambulatory peritoneal dialysis; CCPD = continuous cycling peritoneal dialysis; HD = hemodialysis.
described more than a hundred years ago. When ACKD occurs in PD patients, patients may initially be asymptomatic. As cyst progression occurs, complications can range from none at all to combinations of flank pain, nephrolithiasis, infection, bleeding, hematuria, malignancy, erythrocytosis, and benign tumors (16). If tumors occur as a complication of ACKD, definitive treatment may require interruption of PD for resection.

The frequency of ACKD in low in PD patients (16–18). The present report emphasizes the fact that ACKD remains a potential complication of long-term dialysis in PD patients. In the presence of hematuria, further evaluation for ACKD is warranted. This review provides a management strategy (Table II) for PD patients who develop ACKD to continue PD with minimal interruption to perform a laparoscopic nephrectomy.

Conclusions
Using the management strategy outlined here, PD patients may undergo abdominal or retroperitoneal surgical procedures with minimal interruption to PD. Using the laparoscopic approach, the postoperative course may be significantly shorter. Monitoring chronic PD patients for the development of malignancy in ACKD should be considered. Early intervention by laparoscopic nephrectomy using the management strategy outlined here will maintain the PD treatment modality.

References


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