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Removal of the Peritoneal Dialysis Catheter Because of Gastrointestinal Disease in Patients on Continuous Ambulatory Peritoneal Dialysis: A Single-Center Case Series

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Catheter removal, gastrointestinal disease, encapsulating peritoneal sclerosis, contrast-enhanced computed tomography

Introduction
Catheter removal is one of the major factors in the technical failure of peritoneal dialysis (PD), even when adequate dialysis is performed. Previously, our group reported that the main cause of PD catheter removal is PD peritonitis (1), and electron microscopy revealed biofilm formation on catheters removed because of antibiotic-resistant infection (2). In our center, another major cause of catheter removal is urgent or elective surgery for disease of the gastrointestinal tract, including neoplasm and perforation. Identification of a gastrointestinal disease requiring laparotomy often means conversion to hemodialysis and (long-term) cessation of PD, because the PD catheter is removed. The idea behind this strategy is that foreign bodies should always be removed from infected areas except under exceptional circumstances (3).

After surgery, patients in these cases generally face two unusual problems specifically related to PD: complications associated with PD, and development of encapsulating peritoneal sclerosis (EPS) over a period of years.

One concern associated with PD is the possibility of infection after a surgical procedure. To the best of our knowledge, only one report has presented a case series of PD patients who underwent a surgical procedure for gastrointestinal disease. That report summarized the data for 15 PD patients who underwent laparotomy for...
viscous perforation (4). The report noted that multiple organisms were found in PD fluid cultures from 12 of the 15 patients with perforation.

Bioincompatible glucose-containing dialysis fluid may also negatively affect the environment of the peritoneal cavity. It is not known whether PD, performed until surgery, influences the postoperative course. However, it seems highly unlikely that PD could have a positive impact on an infection that occurs after a surgical procedure.

In regard to EPS, even if there is no evidential benefit in screening for a “pre-EPS” state using clinical indicators or computed tomography (CT) imaging (5), we nevertheless usually evaluate changes in peritoneal membrane transport characteristics or other factors, and we sometimes ask patients, especially long-term PD patients, to wash the peritoneal cavity for a certain period to prevent EPS. Even after PD is discontinued, EPS may progress, particularly in patients whose CT findings demonstrate abdominal signs or some of the features of EPS. In cases of antibiotic-resistant infection, catheter removal is probably the best method to prevent EPS progression. By contrast, it is uncertain whether accidental cessation of PD will subsequently lead to an undesirable clinical course.

In the present study, we summarize data from 13 patients who simultaneously underwent laparotomy and PD catheter removal, not for antibiotic-resistant peritonitis, but for gastrointestinal disease, including neoplasm.

**Methods**

From January 2004 to September 2010, all patients undergoing continuous ambulatory PD (CAPD) at our kidney center whose PD catheters were removed because of gastrointestinal disease were eligible for the study. All patients received outpatient treatment at least once monthly at our outpatient clinic throughout the period during which they were on PD. The PD dose (fluid volume and exchange frequency) was adjusted to maintain a weekly creatinine clearance of approximately 60 L. If the weekly creatinine clearance fell below 45 L despite a full dose of PD, once-weekly hemodialysis was introduced (6), and those patients were excluded from the study. Daily dietary protein intake was approximately 1 g per kilogram body weight, and daily energy intake was more than 30 kcal to 35 kcal per kilogram body weight. Daily salt intake was restricted to between 7 g and 9 g (6).

All operations were performed in the Department of Surgery at our hospital. Preoperative abdominal CT imaging with or without contrast was routinely performed for all patients. No surgical deaths occurred during the study period, and all patients recovered in the intensive care unit after surgery. For patients showing hypotension (systolic arterial pressure < 100 mmHg), marked tachycardia (120 bpm, including atrial fibrillation), severe acidemia (pH < 7.100 in arterial blood gas analysis), hyperkalemia (>7.0 mEq/L), and hypoxemia with excess fluid with or without pulmonary edema, we usually used a temporary vascular catheter to introduce continuous hemodialysis immediately after the operation. Otherwise, patients underwent intermittent hemodialysis within 2 days after surgery, also using a temporary vascular catheter. When patients were able to take nourishment by mouth, they were admitted to the kidney center for conversion to hemodialysis using an arteriovenous fistula. We collected data on prognosis at 1 October 2010. Informed consent was obtained from each patient. The mean period of observation was 3.7 ± 2.3 years (range: 7.1 – 0.5 years).

**Results**

During the study period, catheters were removed from a total of 13 patients (4 men, 9 women) because of gastrointestinal disease. Table I shows the clinical characteristics of these patients. The mean age at disease onset was 64.5 ± 9.6 years. The underlying cause of end-stage renal disease was nephrosclerosis in 7 patients. Mean duration of PD was 6.2 ± 4.7 years. The gastrointestinal diseases were gastric cancer (n = 3), colon cancer (n = 3), perforation of the lower gastrointestinal tract (n = 3), and others (n = 4). In patient 7, peritoneal calcification and very mild, but not incon siderable, adhesion of the intestine was revealed by the preoperative contrast-enhanced CT imaging, and thus EPS was diagnosed. In all cases, excised specimens underwent pathology examination. Various degrees of subserous fibrosis accompanied by chronic inflammatory changes and occasionally fibrin deposition were observed in peritoneum in 6 patients, including patient 7.

During the study period, 2 of the 13 patients died. Patient 1, a 63-year-old woman, died from severe acute necrotizing pancreatitis not associated with PD. Patient 2, an 80-year-old woman, already had advanced cancer when PD was initiated because
### Table 1: Clinical characteristics of the patients

<table>
<thead>
<tr>
<th>Pt ID</th>
<th>Age (^a) (years)</th>
<th>Sex</th>
<th>Renal diagnosis</th>
<th>PD duration (^a) (years)</th>
<th>Diagnosis</th>
<th>Type of surgery</th>
<th>Pathology findings of peritoneum</th>
<th>Outcome (^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>63</td>
<td>Female</td>
<td>Diabetic nephropathy</td>
<td>4</td>
<td>Necrotizing pancreatitis</td>
<td>Cholecystectomy</td>
<td>Almost normal</td>
<td>Death</td>
</tr>
<tr>
<td>2</td>
<td>80</td>
<td>Female</td>
<td>Nephrosclerosis</td>
<td>0.5</td>
<td>Gastric cancer</td>
<td>Distal gastrectomy</td>
<td>Almost normal</td>
<td>Death</td>
</tr>
<tr>
<td>3</td>
<td>59</td>
<td>Female</td>
<td>Lupus nephritis</td>
<td>4.5</td>
<td>Rectal perforation</td>
<td>Hartmann procedure</td>
<td>Subserous fibrosis</td>
<td>Alive (^b)</td>
</tr>
<tr>
<td>4</td>
<td>62</td>
<td>Female</td>
<td>IgA nephropathy</td>
<td>4</td>
<td>Intra-abdominal abscess</td>
<td>Abscess drainage</td>
<td>Almost normal</td>
<td>Alive (^b)</td>
</tr>
<tr>
<td>5</td>
<td>78</td>
<td>Female</td>
<td>Nephrosclerosis</td>
<td>6</td>
<td>Sigmoid colon cancer</td>
<td>Laparoscopic sigmoidectomy</td>
<td>Almost normal</td>
<td>Alive (^b)</td>
</tr>
<tr>
<td>6</td>
<td>67</td>
<td>Male</td>
<td>Nephrosclerosis</td>
<td>5</td>
<td>Rectal cancer</td>
<td>Low anterior resection</td>
<td>Almost normal</td>
<td>Alive (^b)</td>
</tr>
<tr>
<td>7</td>
<td>61</td>
<td>Female</td>
<td>Nephrosclerosis</td>
<td>12</td>
<td>Renal pelvic cancer</td>
<td>Total nephroureterectomy</td>
<td>Subserous fibrosis, fibrin deposition</td>
<td>Alive (^b)</td>
</tr>
<tr>
<td>8</td>
<td>72</td>
<td>Male</td>
<td>Diabetic nephropathy</td>
<td>6.5</td>
<td>Rectal cancer</td>
<td>Low anterior resection</td>
<td>Subserous fibrosis</td>
<td>Alive (^b)</td>
</tr>
<tr>
<td>9</td>
<td>62</td>
<td>Male</td>
<td>Polycystic kidney disease</td>
<td>4.5</td>
<td>Inguinal hernia</td>
<td>Hernioplasty</td>
<td>Almost normal</td>
<td>Alive (^b)</td>
</tr>
<tr>
<td>10</td>
<td>66</td>
<td>Female</td>
<td>Nephrosclerosis</td>
<td>19</td>
<td>Sigmoid diverticulum perforation</td>
<td>Sigmoidectomy</td>
<td>Subserous fibrosis</td>
<td>Alive (^b)</td>
</tr>
<tr>
<td>11</td>
<td>56</td>
<td>Male</td>
<td>Nephrosclerosis</td>
<td>5.5</td>
<td>Gastric cancer</td>
<td>Distal gastrectomy</td>
<td>Subserous fibrosis</td>
<td>Alive (^b)</td>
</tr>
<tr>
<td>12</td>
<td>69</td>
<td>Female</td>
<td>Nephrosclerosis</td>
<td>2</td>
<td>Gastric cancer</td>
<td>Distal gastrectomy, cholecystectomy</td>
<td>Subserous fibrosis</td>
<td>Alive (^b)</td>
</tr>
<tr>
<td>13</td>
<td>43</td>
<td>Female</td>
<td>Lupus nephritis</td>
<td>7.5</td>
<td>Rectal perforation</td>
<td>Segmental rectal resection with colostomy</td>
<td>Almost normal</td>
<td>Alive (^b)</td>
</tr>
</tbody>
</table>

\(^a\) At the time of surgery. In all patients, the catheter was removed at the time of surgery for the primary gastrointestinal disease.

\(^b\) At the time of writing.

PD = peritoneal dialysis; IgA = immunoglobulin A.
of symptoms of chronic uremia. Six months later, she was rushed to hospital for massive melena, and emergency surgery was required. She eventually died from pneumonia with malnutrition.

To date, no new EPS has developed after removal of the PD catheter. No patient has required further PD, and all patients continue to receive hemodialysis at our kidney center or other outpatient clinics.

Discussion
From January 2004 to September 2010, the period of this study, 216 patients were newly introduced to PD at our kidney center, and about 250 patients regularly attended our outpatient clinic. Surgeons at our hospital are familiar with PD patients, and we maintain close coordination between the Department of Surgery and the kidney center. It should be noted that, in our experience, PD seems to have no negative impact on the postoperative course. When patients undergo laparoscopic surgery at our hospital, the PD catheter is removed, without exception, in consideration of the potential for infection after a surgical procedure. To our knowledge, only 1 case report has described laparoscopic therapy in a CAPD patient with perforated appendicitis in which the peritoneal catheter was not removed (3). It is significant, however, to consider the actual situation with respect to PD, because the modality is usually eschewed as a renal replacement therapy if the subject has a history of laparotomy. On that basis, our decision to remove the PD catheter is thought to be reasonable.

The present study also demonstrates that subserous fibrosis with chronic inflammation with or without fibrin deposition is not necessarily an indication of the future progression of EPS in PD patients. Many reports have discussed peritoneal morphology changes during PD, demonstrating that mesothelial cells have an active role in the structural and functional alterations to the peritoneum during PD (7). Significant structural changes have been shown to become worse with CAPD treatment, and alterations have also been observed in the peritoneal membrane of uremic patients (8). The average peritoneal thickness (resulting from subserous fibrosis with chronic inflammation and fibrin deposition) is greater in uremic patients and progressively thickens with increase in the duration of PD (9). Thus, PD treatment itself is thought to have a very strong impact on the progression of peritoneal sclerosis. Encapsulating peritoneal sclerosis is associated with high morbidity related to bowel obstruction and malnutrition. The reported mortality is around 50%, usually within 12 months of diagnosis, although not all deaths are attributable to EPS itself (10–12). Microscopically, EPS is characterized by chronic inflammation and fibrosis of the peritoneum. Thus, there is nothing surprising in the notion that the presence of both inflammation (for example, peritonitis) and long-term PD markedly enhances the odds of subsequent EPS development.

By contrast, it should be emphasized that all current data indicate that most patients receiving long-term PD do not develop EPS (5). Most PD patients have some degree of peritoneal sclerosing inflammation, and our study showed that obvious peritoneal alterations were present in approximately half the study patients. As expected, such microscopic peritoneal alterations do not indicate EPS progression, and similarly, the presence of gastrointestinal disease does not affect the incidence of EPS.

Conclusions
We present data for 13 patients who experienced catheter removal because of gastrointestinal disease requiring surgical intervention. Our results suggest that a history of PD presents no disadvantages in the postoperative clinical course. Moreover, as reported previously, many PD patients show peritoneal alterations characterized by subserous fibrosis and fibrin deposition without any increased risk of EPS.

The age of new dialysis patients is rapidly increasing, with one third of patients in Japan being 75 years of age or older. Increased age has been associated with an increased incidence of malignant gastrointestinal tumors and viscus perforation, which would imply that aging is associated with an increased need for surgery. However, there is no evidence to support the withholding of PD as a treatment option through fear of the risk of postoperative complications.

We conclude that PD does not, in itself, complicate the postoperative course and prognosis for survival. In addition, with the exception of 1 patient in whom contrast-enhanced CT had already revealed EPS, none of 5 other patients showing changes related to subserous fibrosis and chronic inflammation in excised specimens have developed sclerogenic peritonitis to date. Therefore, the foregoing pathology findings do not always indicate future progression of EPS in PD patients.
Disclosures
The authors have no competing interests to declare.

References

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