

## PERIOPERATIVE MANAGEMENT OF PERITONEAL DIALYSIS PATIENTS UNDERGOING HERNIA SURGERY WITHOUT THE USE OF INTERIM HEMODIALYSIS

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◆◆**Objective:** To review the feasibility of undertaking elective hernia repair in peritoneal dialysis (PD) patients without converting them to hemodialysis.

◆◆**Design:** A 10-year retrospective review of prospectively collected data.

◆◆**Setting:** PD unit of a university-based hospital.

◆◆**Patients and Methods:** All patients received regular exchanges until the morning of the surgery and remained off dialysis for the first 48 hours postoperatively. After that, PD was gradually reintroduced. The patients on continuous ambulatory PD (CAPD) received intermittent PD (IPD) 3 times per week for 10 hours per day for 2 weeks, followed by 5 exchanges of low volume (1 – 1.5 L) CAPD for 2 weeks, returning to the pre-surgery prescription by 4 weeks. Patients on continuous cycling PD (CCPD) received 1 week of IPD followed by 4 weeks of nocturnal IPD and returned to the original dose in 5 weeks. Between 1 April 1995 and 31 March 2005, 50 consecutive patients were managed by this protocol. Average age was 65 years and 67.7% were males. The original disease was diabetes mellitus (19 patients), hypertension (6), chronic glomerulonephritis (13), polycystic kidney disease (6), and others (6). The types of abdominal hernias included umbilical (25 patients), inguinal (18), incisional (5), and epigastric (2). 42 patients were on CAPD and 8 on CCPD. Average duration of PD prior to development of hernia was 16.4 months.

◆◆**Results:** Average pre-surgery creatinine was 673  $\mu\text{mol/L}$ , increasing to 968  $\mu\text{mol/L}$  on IPD. Serum potassium increased from 3.4 to 4.7 mmol/L. No episodes of hyperkalemia were noted. The average total follow-up was 33.4 months. None of the patients had leakage or early hernia recurrence due to early resumption of PD; 13 patients had recurrence of the same hernia after a median 19.9 months; 4 patients had hernias at different sites after an average of 55 months.

◆◆**Conclusions:** Based on this experience, we recommend that PD patients undergoing elective abdominal hernia sur-

gery should continue PD according to the prescribed protocol. Interim hemodialytic support does not appear to be necessary in most patients.

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KEY WORDS: Hernia; hemodialysis; automated peritoneal dialysis.

Abdominal wall hernias are common mechanical complications of peritoneal dialysis (PD). The reported incidence ranges from 2% to 37% in adult patients (1,2). Increased intra-abdominal pressure from the peritoneal dialysate is a major risk factor for hernias, and the hernias tend to enlarge over time. Other complications of hernias include bowel strangulation and rupture of the hernia sac. The latter complication can lead to abdominal wall and genital edema. These complications have prompted strong recommendations for the repair of abdominal wall hernias at the start of PD or while on PD (3,4).

Management of dialysis after hernia surgery has not been standardized. In one survey, only 14/37 units had a policy with respect to management of patients on continuous ambulatory PD (CAPD) undergoing repair of inguinal hernia (5). That is the only study addressing this issue. In fact, that study recommended temporary hemodialysis (HD) for all patients. A review of the literature shows that the dialysis prescription after hernia surgery varies from continuation of PD (6,7), to switching to HD (1,5,7), or to a combination of the two (2,3,7–9). Few of the studies have treated their patients based on a protocol. The present study is the first with a prospectively prescribed protocol and a large number of patients with a prolonged follow-up.

Patients at our institute are managed using a PD-based protocol without interim HD. The aim of the present study is to present results for safety and feasibility of the prescribed protocol.

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**METHODS**

A protocol for the management of dialysis for PD patients undergoing elective surgery for abdominal hernias was established in January of 1994. All patients received regular exchanges until the morning of the surgery and were managed as per the prescribed protocol (Table 1). All patients were off dialysis for the first 48 hours after hernia repair. From the data available in the surgical record, 43 operative repairs were performed under general anesthetic and 5 under local anesthetic. Twenty hernia repairs used mesh and there was no mention of the use of mesh in the operative record of 28; it is assumed that the repair was done without mesh reinforcement.

Patients on CAPD received intermittent PD (IPD) 3 times per week for 10 hours per day. The prescription was 10 exchanges of 1-L fill volume for 10 hours. This continued for 2 weeks and was followed by 5 exchanges of low volume (1 – 1.5 L) CAPD for another 2 weeks. At that point, they returned to their pre-surgery prescription.

Patients on continuous cycling PD (CCPD) received 1 week of IPD using the same protocol, followed by 4 weeks of NIPD, and then returned to their original prescription in 5 weeks. The longer time of 5 weeks for the CCPD patients was simply because it was an easier protocol for these patients to adapt at home compared to the protocol for the CAPD patients.

All patients had laboratory tests prior to the surgery, during the period of protocol dialysis, and on return to their regular dialysis. Complications during this period were noted. The patients were followed up for recurrence of hernia.

**RESULTS**

Fifty patients underwent elective surgery for abdominal hernia in the decade 1 April 1995 to 31 March 2005. Demographic and clinical characteristics are shown in Table 2.

**TABLE 2**  
Patient Demographics

Age	65 years
Sex (male)	67.7%
Original disease	
Diabetes mellitus	19 (38%)
Chronic glomerulonephritis	13 (26%)
Hypertension	6 (12%)
Polycystic kidney disease	6 (12%)
Others	6 (12%)
CAPD/CCPD	42/8
Duration of PD (months)	16.4
Hernia	
Umbilical	25
Inguinal	18
Incisional	5
Epigastric	2

CAPD = continuous ambulatory peritoneal dialysis; CCPD = continuous cycling PD.

Average age was 65 years and 68% were males. The original disease was diabetes mellitus (19 patients), chronic glomerulonephritis (13), hypertension (6), polycystic kidney disease (6), and others (6). Types of abdominal hernias included umbilical (25 patients), inguinal (18), incisional (5), and epigastric (2). Average duration on PD prior to developing the hernia was 16.4 months; 42 patients were on CAPD and 8 were on CCPD.

Average pre-surgery creatinine was 673 μmol/L, increasing to 968 μmol/L on IPD. Serum potassium increased from 3.4 to 4.7 mmol/L. Importantly, no episodes of hyperkalemia were noted. Data were available in 49 patients for the 24-hour urine collection closest to the time of the surgery. Nine patients were anuric and, in the remaining 40, median urine volume was 615 mL (range 117 – 2893 mL). Median creatinine clearance in the patients with urine output was 4.5 mL/minute (range 0.6 – 23.4 mL/minute).

**TABLE 1**  
Protocol for Peritoneal Dialysis (PD) Before and After Hernia Surgery

<ul style="list-style-type: none"> <li>• Continue on standard PD therapy until the morning of surgery</li> <li>• Drain the PD fluid prior to the surgery</li> <li>• No dialysis for the first 48 hours</li> <li>• Laboratory investigation at start of IPD and weekly</li> <li>• IPD 3 times per week (1-L exchange ×10 for 10 hours) for 2 weeks for CAPD patients and for 1 week for CCPD patients</li> <li>• CAPD patients resume low volume (1–1.5 L × 5 exchanges for 2 weeks)</li> <li>• CCPD patients to continue on NIPD for 4 more weeks</li> <li>• All patients resume preoperative PD prescription after 4–5 weeks</li> </ul>
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IPD = intermittent PD; CAPD = continuous ambulatory PD; CCPD = continuous cycling PD; NIPD = nocturnal intermittent PD.

Average total follow-up was 33.4 months. None of the patients had leakage, surgical dehiscence, or immediate recurrence of hernia due to early resumption of PD. Thirteen patients had recurrence of the same hernia after 19.9 months, including umbilical (7), inguinal (2), incisional (3), and epigastric (1) hernias. Their average age was 64 years. In addition, 4 patients had hernias at different sites after an average of 55 months.

## DISCUSSION

Fifty patients underwent elective surgery for abdominal hernia in the decade from 1 April 1995 to 31 March 2005. All these patients were managed perioperatively based on a protocol. That protocol is shown in Table 1.

It is important to note that, during this 4 – 5 week protocol, no patient developed electrolyte abnormalities or symptomatic underdialysis. Furthermore, upon resumption of PD during the postoperative period, the integrity of the operative repair was not threatened. No patient developed leakage of dialysate from the operative site, nor was there repeat immediate re-herniation through the operative site. There was a large number of late recurrent hernias in this population, but recurrence has been well-documented in PD patients and cannot necessarily be ascribed to early resumption of PD under conditions of low intra-abdominal pressure.

Management of dialysis after hernia surgery has not been well studied. Various centers have reported their retrospective experience. These studies have advocated continuation of PD (7), switching to HD (1,5,7), or a combination of both (2,3,7–9). The present study is the first with a prospectively prescribed protocol.

Morris–Stiff *et al.* noted the lack of guidelines in the management of perioperative dialysis for patients undergoing hernia surgery (5). He conducted a survey with the aim to study the practice in the UK and to formulate a protocol. Only 14 (44%) centers had a perioperative management protocol, 34% changed the pre-op CAPD prescription, an additional 19% converted their patients to HD prior to the surgery, and 69% of the centers managed their patients with HD during the postoperative period. Thus, based on this information, it was recommended that CAPD should be continued until the day of surgery, a HD line should be inserted intra-operatively, and patients must be kept on HD for 4 weeks post hernia surgery. For patients switched to HD, return to PD varied from 12 days (1) to 1 – 21 days (8) in different studies. In our opinion, this conversion to HD is not necessary. Furthermore, insertion and maintenance of an indwelling HD catheter is, itself, associated with risk.

Imvrios *et al.* started their patients on PD within a few hours of surgery, with reduced volume and increased frequency based on a protocol (7). They carried out hourly exchanges with 300 mL for days 1 – 3, followed by 500 mL 2-hourly for days 4 – 7, which was then gradually increased to 4 – 5 exchanges of 1500 mL in 3 – 4 weeks. In our opinion, this protocol results in a prolonged admission and needs more monitoring. Furthermore, the number of patients in this study was small.

Mettang *et al.* (6) and Crabtree (10) managed their patients with a protocol similar to ours. They also reported no leaks or recurrence. However, one study included only 9 patients (6). Our study has confirmed these findings in a large number of patients.

Our study is the first with a prospective protocol including a large number of patients followed over a long period of time. Our patients were operated on as day surgery, thus avoiding prolonged admission. This single-center experience needs to be confirmed at other centers. The protocol is limited to elective surgeries. Patients with bowel strangulation were not part of this protocol and were often changed temporarily to HD when bowel ischemia was suspected.

## CONCLUSION

Based on our experience, we recommend PD be continued as per the prescribed protocol in PD patients undergoing elective abdominal hernia surgery. Interim HD does not appear to be necessary in most patients.

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