Laparoscopic Left Hemicolectomy for Colon Cancer in Peritoneal Dialysis Patients: A Valid and Safe Surgical Technique to Ensure Peritoneal Dialysis Survival

A laparoscopic approach represents an effective alternative to open surgery in patients undergoing peritoneal dialysis (PD). In these patients, conventional thinking provides for removal of the peritoneal catheter during left colon resections because of higher risk of patient contamination and peritonitis. The present paper describes 3 cases of laparoscopic left hemicolectomy for colon cancer performed in PD patients without complications and without peritoneal catheter removal, leading to subsequent early PD resumption.

Three normotype PD patients affected by early-stage sigmoid colon adenocarcinoma (T1-T2, M0, N0) underwent integrated surgical and nephrological management to reduce peritoneum stress, infective risk and postoperative complications. The day before surgery, patients were shifted to isovolumetric hemodialysis through tunneled central venous catheter. All patients underwent laparoscopic left hemicolectomy without Tenckhoff catheter removal. The postoperative period was uneventful, with concomitant antibiotic prophylaxis until the fifth day after surgery. Flushing of the PD catheter was performed twice a week postoperatively. Peritoneal dialysis was recovered 4 weeks after surgery in 2 cases with a well-maintained dialytic adequacy. One patient did not proceed to PD due to improvement of renal function after surgery.

In selected PD patients, a minimally invasive surgical approach combined with careful nephrological management may represent a valid and safe strategy to treat early-stage colon cancer, avoiding PD drop-out.

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In the past, laparotomy was thought to be the standard treatment recommended for peritoneal dialysis (PD) patients who were candidates for intra-abdominal surgery (1).

For the past 2 decades, the laparoscopic approach has been recognized for its value in retaining patients on PD (2,3). Various reports have demonstrated that the use of laparoscopy in PD patients for different pathologies (4–7) is feasible, safe, and successful. Data on laparoscopic surgery for colon cancer in PD patients are rarely described (8,9) and limited to right and transverse colon resections. Conventional perspective suggests removing the peritoneal catheter during left colon resections in PD patients because of a higher risk of patient contamination and peritonitis. Furthermore, data on PD management for patients undergoing abdominal surgery are less consistent (10). The present paper describes 3 cases of laparoscopic left hemicolectomy for early-stage colon cancer performed in PD patients without peritoneal catheter removal. Moreover, we propose a clinical strategy for PD management leading to subsequent early PD resumption.

MATERIALS AND METHODS

CASE REPORTS

In 2014, 3 PD patients were referred to our hospital for rectal bleeding. Colonoscopy revealed a sigmoid colon adenocarcinoma in 2 cases and an endoscopically non-removable 3-cm sigmoid-rectal junction polyp in the latter one. Patients' clinical and demographic characteristics are summarized in Table 1. They received integrated surgical and nephrological management. No distant metastasis or peritoneal carcinomatosis were observed at computed tomography examination. Planned surgery was laparoscopic left hemicolectomy for all. Informed consent was obtained from all patients. Antibiotic prophylaxis with cefazolin and metronidazole was started perioperatively and maintained for 5 days after surgery. The day before surgery, all patients were shifted to hemodialysis, after proper placement of a central venous catheter in the internal jugular vein.

SURGICAL TECHNIQUE AND POSTOPERATIVE CARE

Procedures were carried out with the commonly used 4-trocar technique (11). Trocar placement is described in Figure 1. The 10-mm trocar, usually placed in the right iliac fossa, is placed more medially to avoid the Tenckhoff catheter. At peritoneal examination, the peritoneal catheter was still correctly placed in the lower pelvis. The dissection maneuvers are carried out by harmonic scalpel (Ultracision; Ethicon Endosurgery, Cincinnati, OH, USA). Colonic section was done below the sacral promontory in all patients just below the colorectal junction by Echelon 60 mm (Ethicon Endosurgery, Cincinnati, OH, USA) linear stapler with green cartridge. A 7-cm mini-laparotomy in the left iliac fossa was performed.

TABLE 1
Demographic Characteristics and Operative Data

	Patient 1	Patient 2	Patient 3
Age (years)	78	86	78
Gender	M	M	F
Time on PD (months)	0	19	6
ESRD cause	Nephrolithiasis	Suspected glomerulonephritis	Suspected glomerulonephritis
Clinical history	Myocardial infarction, hypertension	Hypertension, previous bilateral inguinal hernioplasty	Diverticular disease
BMI (kg/m ²)/ASA score	26/2	24/2	19/2
Cancer staging	pT1pN1aM0	pT2N0M0	T0N0M0
PD modality (before and after surgery)	None	APD; total volume 10 L; ILV 2,000 mL; TV 70%; time APD 8 h and 30 min	APD; total volume 10 L; ILV 1,900 mL; TV 60%; time APD 9h

M = male; F = female; PD = peritoneal dialysis; ESRD = end-stage renal disease; BMI = body mass index; ASA = American Society of Anesthesiology score; APD = automated peritoneal dialysis; ILV = initial load volume; TV = tidal volume.

Figure 1 — Trocar placement in laparoscopic left hemicolectomy in peritoneal dialysis patients. Black spots: operative trocars. One 10- to 12-mm trocar on the middle line 5 cm above the umbilicus; one 10- to 12-mm trocar in the right side on the transverse umbilical line; one 10- to 12-mm trocar (usually in the right iliac fossa) is moved medially in the right para-rectal line 4 cm below the umbilicus; one 5 mm trocar in the left iliac fossa. Red spot: Tenckhoff catheter.

A polyethylene drape protected the incision from malignant seeding and protected the abdomen from fecal contamination while the colorectal specimen was extracted.

In patients 1 and 3, the colorectal anastomosis was constructed with an intraluminal stapling device that was introduced into the rectum through the anus (Ethicon Endo-Surgery ILS, 29 mm, Cincinnati, OH, USA). A stapler anvil, one of the two separate pieces composing the circular stapler, is inserted into the colon stump through the mini-laparotomy and then connected to the instrument's rectal end. The anvil is closed down onto the stapler and fired, creating a circular anastomosis with a double row of staples. In patient 2, the concern for intraperitoneal contamination and anatomical feasibility led to extracorporeal anastomosis. Both a colonic and a rectal stump were extracted from the mini-laparotomy in the left iliac fossa and a side-to-side mechanic anastomosis with Endopath 45 mm (Ethicon Endosurgery, Cincinnati, OH, USA) linear stapler with green cartridge was performed. The stapler insertion break point was closed using a double-layer re-absorbable hand suture. The omentum was carefully placed between the anastomosis and the PD catheter (Supplemental

Figure 1). Beyond preoperative bowel preparation with 1 dose of Sennosides (X-Prep 250 mL) 48 hours before surgery, all patients received an intraoperative enema at the beginning of the procedure to widely clean the rectal ampulla.

Postoperative care was uneventful. Patients underwent isovolumetric hemodialysis while awaiting PD resumption. Starting from the second day after surgery, flushing (50 mL) of the peritoneal catheter was performed by experienced nurses twice a week. No episodes of bloody or fibrin peritoneal effluent were observed. Patients were discharged on day 7. In a month, patients 2 and 3 resumed automated PD (APD) without functional complications. Ninety days after surgery, patients 2 and 3 presented no ultrafiltration failure, reaching PD adequacy targets as recommended by current guidelines (12). Peritoneal dialysis resumption was delayed in patient 1 due to partial renal function recovery 28 days after surgery. The patient was thereafter lost to follow-up due to being transferred to a different dialysis center. After another 5 months, renal function recovery was confirmed and the Tenckhoff catheter was removed.

DISCUSSION

In surgery, when the outcome of a surgical intervention is equal or better, a minimally invasive surgical approach is privileged over open abdominal surgery.

In the literature, there are large case series showing no differences in catheter or technique survival in PD patients with and without prior intra-abdominal open surgery (3). However, laparoscopy is well accepted as a more conservative procedure compared with open surgery (13), with lower peritoneal membrane stress and better preservation of peritoneum integrity (14). We demonstrate that laparoscopic left hemicolectomy can be performed safely, providing the patient the benefits of a minimally invasive approach and retaining them on PD.

Inspired by the protocol already suggested by Attard *et al.* (9) for laparoscopic right hemicolectomy in PD patients, we planned a 10-point strategy to reduce peritoneum stress, infective risk, and postoperative nephrological and surgical complications.

- 1) Safety and success of laparoscopic approach may be hampered by overweight, locally advanced cancer, and high anesthetic risk. In order to favor the laparoscopic surgery and avoid PD drop-out, our experience was thus limited to low-risk PD patients with body mass index (BMI) < 30 kg/m², American Society for Anesthesiology (ASA) score < 2, and cancer staging T1-T2, N0-N1, M0 (Table 1).
- 2) Proper timing (pre- and postoperative hemodialysis) and fluid balance management (isovolumetric hemodialysis and maximal diuretic therapy, furosemide 1 g/die) was performed to preserve residual renal function and to ensure PD recovery (15).
- 3) Patients undergoing active PD should require an extracorporeal anastomosis, whenever possible (patient 2), in order to reduce the risk of intra-abdominal contamination. On the other hand, intracorporeal anastomosis could be safely addressed in patients with a placed Tenckhoff catheter not

yet functioning or for those patients where the extracorporeal extraction of the rectal stump is not anatomically possible (patients 1 and 3).

- 4) An intra-operative enema can assure a clean ampulla in order not to contaminate the peritoneal cavity while performing the anastomosis. Some surgical literature (16) has not borne out the benefit of colon bowel preparations from the standpoint of reduced anastomotic leaks, infection, or mortality. However, these studies were not faced with the prospect of a remaining intraperitoneal foreign body such as a peritoneal catheter. It is well known that colonic manipulation, irritation, and constipation can produce translocation of bacteria across the bowel wall. In the presence of a peritoneal catheter, this could be associated with an increased risk of peritonitis.
- 5) An adequate antibiotic prophylaxis (proper timing of somministration and correct empiric choice of antibiotic drugs) can reduce the risk mentioned previously. Unfortunately, the value of colon bowel preparation when there is an existing intraperitoneal foreign device cannot be resolved with this small case series.
- 6) Moving the 10-mm trocar medially away from the catheter did not impair the surgical procedure (Figure 1).
- 7) Sharp and atraumatic dissection together with a careful hemostasis check should be done throughout the whole procedure in order to reduce the risk of remnant postoperative intra-abdominal fluids.
- 8) Placing the omentum between the anastomosis and the catheter, although not providing adequate protection against contamination in the case of a leak, can be protective against early contamination from the stapled anastomotic lines and from the decubitus of the catheter on the colonic wall in all the other circumstances. Stitching epiploic appendices over the anastomotic line could be another solution, but it was not done because stitching near and through the anastomosis could increase the risk of anastomotic bleeding and therefore of anastomotic fistula. Moreover intracorporeal stitching could prolong the operative time, increasing the risk of Tenckhoff contamination.
- 9) Avoiding placing tubes could also reduce intraperitoneal contamination.
- 10) Periodic flushing of the PD catheter was performed to check its correct functionality.

Although the clinical results of the present case series is valuable, several limitation should be considered. The generalizability of our results is weakened by the limits intrinsic to single case reports. Furthermore, the first out of the 3 patients herein described, although having undergone peritoneal catheter placement, was never treated with PD, thus impairing conclusions on the effect of laparoscopic hemicolectomy on peritoneal membrane performance and PD preservation.

CONCLUSIONS

In PD patients, laparoscopic left hemicolectomy may represent a valid and safe surgical intervention to treat colon

cancer at an early stage, avoiding PD drop-out and favoring the chance of long-lasting PD survival. At the moment, this approach seems to require a reasonable restriction in favor of low-risk PD patients, under the strict guidance of surgeons who are experts on colorectal laparoscopic surgery and nephrologists who are experts on PD management.

DISCLOSURE

The authors have no financial conflicts of interest to declare.

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