Successful Laparoscopic Bariatric Surgery in Peritoneal Dialysis Patients Without Interruption of Their CKD6 Treatment Modality

During the past several decades, the conventional management of peritoneal dialysis (PD) patients undergoing elective abdominal surgery required a transition to hemodialysis on a temporary basis. In recent years, that protocol has been challenged by various authors who successfully repaired hernias in such subjects without interruption of their PD modality. However, that new approach was reserved for abdominal wall procedures and was not used for intra-abdominal surgery.

The rapid evolution of laparoscopic surgery and the development and refinement of minimally invasive surgical techniques have revolutionized the field of surgery by providing superior outcomes for an ever-increasing list of indications including morbid obesity. The present study, the first of its kind involving elective intra-abdominal surgery, sought to determine the safety of uninterrupted PD therapy in morbidly obese patients with stage 6 chronic kidney disease undergoing laparoscopic bariatric surgery as a precursor to transplantation.

Key words
Laparoscopy, bariatric surgery

Introduction
Abdominal surgery in the peritoneal dialysis (PD) population has invariably led to a transition to hemodialysis (HD) in the perioperative period. Complex, urgent, or complicated interventions may result in a permanent switch to HD, but after most cases of elective and uneventful intra-abdominal surgery, re-institution of PD is the norm.

Even in the stable, uncomplicated preoperative patient, concerns surround the potential for intra- or trans-abdominal leaks, peritoneal contamination, interference with wound healing, aggravation or perpetuation of ileus, and impairment of respiratory mechanics, among other issues (1,2). Additionally, the efficiency and efficacy of dialysis may be in question because of changes in splanchnic macro- and micro-circulatory hemodynamics, effective peritoneal surface exchange area, membrane transport properties, delayed bowel function, and patient tolerance of dialysate dwells (3–6).

The extent and complexity of the operation and the not-so-subtle effects of the size and location of the abdominal incision or incisions affecting postoperative recovery in cases of conventional surgery appear to be the main culprits. However, since the early 1990s, a handful of studies on PD patients undergoing elective conventional abdominal wall hernia repair have established that reparative surgery can be successfully performed without temporary conversion to HD. Indeed, in the largest study of its kind, all subjects were managed with a protocol of modified PD prescription without significant complications (7).

Other authors have also shown that, in cases of limited abdominal wall breakdown and intraperitoneal invasion (such as the straightforward surgical insertion of a tunneled PD catheter), there is no need to delay the initiation of PD. Compared with a standard group in whom initiation of PD exchanges took place 2 weeks

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after catheter placement surgery, a group undergoing short break-in periods immediately after surgery did not experience an increase in complications (8).

Nonetheless, no standardized approach has been developed to date for the PD patient undergoing elective intra-abdominal surgery—a more challenging problem, because it encompasses a wide variety of very different surgical interventions. Conventional management calls for temporary conversion to HD in the postoperative period. The emergence, since the early 1990s, of laparoscopic surgery as the preeminent option for a wide variety of indications (9) may change that approach. Increasingly sophisticated and minimally invasive, laparoscopic surgery has rapidly gained acceptance because of its advantages in shortening length of stay and postoperative pain, allowing for faster recovery, enhanced cosmetic results, increased patient satisfaction and a lesser incidence of incisional hernia (10).

The challenging field of morbid obesity is no exception to this trend and has benefited from the introduction, development, and subsequent evolution of the laparoscopic technique as the “gold standard” approach to the surgical treatment of this serious condition (10–12). Simultaneously, the convergence of two modern epidemics (13–16), obesity and chronic kidney disease (CKD), has given rise to a growing high-risk population of morbidly obese (MO) patients with CKD stage 6 who have a critical need for effective weight management interventions to qualify for kidney transplantation. Absent a protocol for successful weight rehabilitation and the option of organ transplantation, these subjects are left with a very limited outlook with respect to health and quality of life (17–22).

In an area in which medical management—combinations of diet, exercise, and psychological interventions—has met with very limited success and increasing recidivism, bariatric surgery has been established as the most successful treatment modality for severely obese individuals who meet specific criteria from the American Society for Metabolic and Bariatric Surgery and the National Institutes of Health (11,23).

Our novel approach to the postoperative care of the bariatric PD patient is based on two leading considerations:

- The very essence of the laparoscopic “minimally invasive” method offers controlled, limited disruption of the intra-abdominal organs and abdominal wall, affording better preservation of the physiologic integrity of the peritoneum and of peritoneal cavity compliance.
- The strength of a center-of-excellence, certified bariatric surgery program within which all operations are performed by an experienced surgeon with an extremely low incidence of complications.

In addition, patient selection based on dynamic criteria such as compliance with scheduled clinic visits, pharmacotherapy, preoperative dietary prescription, achievement of educational goals, and commitment to the transplant program was of paramount importance.

The present study was designed to determine the safety of laparoscopic bariatric surgery (LBS) without interruption of continuous cycling PD (CCPD) in MO PD patients desirous of kidney transplantation, but unable to reach their qualifying weight goal.

**Methods**

Between November 2010 and December 2011, 5 MO patients [2 men, 3 women; 3 black, 1 white, 1 Hispanic; average age: 41 years (range: 35 – 56 years); average body mass index: 43.3 kg/m²] with CKD6 who were enrolled in our home dialysis program underwent LBS. All subjects were established on CCPD (duration of therapy: 6 – 36 months) and had tried a variety of weight loss programs for several years. All had received conditional approval for inclusion in regional kidney transplant programs, contingent on achieving a center-specified target weight goal. The main causes of CKD in these patients were diabetes mellitus, hypertension, and chronic glomerulonephritis (Table I).

Presurgical management included up to 3 weeks of a hypocaloric liquid diet, which produced significant weight loss. (For a more detailed description, see the Discussion section.)

Leading up to the procedure, patients had no oral intake after midnight, and regular nocturnal exchanges were continued until the morning of surgery. At the end of the last CCPD session, the peritoneal cavity was drained completely. Preoperative antibiotic prophylaxis consisted of a single intravenous dose of amoxicillin (2 g) or clindamycin (600 mg). Anesthesia was administered following standard protocols.
Laparoscopic Bariatric Surgery in PD Patients

Laparoscopic procedures included gastric banding (1 patient) and Roux-en-Y gastric bypass (4 patients). One of the latter patients also underwent tandem inguinal hernia repair. A standard surgical laparoscopic approach was used, except that the surgeon explicitly inserted the lowest port as cephalad as possible to avoid interference with or disruption of the peritoneal catheter position. Limited upper abdominal lavage was routinely performed. The reported estimated blood loss was less than 60 mL. In all patients undergoing gastric bypass, a Jackson–Pratt drain was kept in the left subphrenic space until the following morning.

After completion of their bariatric surgery, 2 patients resumed CCPD without delay; the other 3 remained off dialysis for the first 24 postoperative hours. Heparin (1000 U/L) was added routinely to the dialysate for the first week after surgery. Upon resumption of their CCPD at home, all patients used the following volume titration protocol: The dwell volume was initially set at 25% – 50% of the original prescription for the first 3 – 5 days. It was then increased by 25% every 3 – 5 days until the preoperative prescription was restored (Figure 1). The main determinants for the selection of starting volume and the progression of volume titration were patient height and development of abdominal discomfort. The dialysate dextrose concentration was maintained at 1.5% and adjusted to meet ultrafiltration needs as clinically indicated, paralleling the patient’s ability to gradually resume a modified bariatric diet.

**Results**

After 2 – 3 weeks of a strict low-calorie diet and a lead-in average weight loss of 6.8 kg (range: 4.5 – 11.3 kg), all patients underwent successful bariatric surgery without complications. Overall need for analgesics or other symptomatic therapy was remarkably minimal. The patient who received a gastric band was discharged home within 12 hours; the 4 patients undergoing gastric bypass were discharged the day after surgery. Two patients who started in-hospital CCPD reported volume-related abdominal discomfort. The adoption of our volume titration protocol resulted in excellent patient tolerance. All but 1 patient started home CCPD on postoperative day 1. The patient who had the additional hernia repair delayed re-institution of CCPD and reported lower abdominal “soreness and bloating,” but experienced rapid resolution of those symptoms during the first dialysis session on postoperative day 3.

None of the patients experienced fluid leakage attributable to early resumption of PD. A hemorrhagic effluent was universally noted from the first exchange after surgery and gradually disappeared within 7 – 10 days. An incremental bariatric diet of clear to full liquids, protein shakes, and soft foods was very well tolerated. Dumping syndrome a few days after surgery occurred in 1 patient because of dietary indiscretion; but otherwise, all patients had loose, but not frequent, stools for up to 2 weeks.

No significant episodes of volume or metabolic derangements were noted within the extended postoperative period. All subjects achieved their target

<table>
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CGN = chronic glomerulonephritis; FSGS = focal segmental glomerulosclerosis; HTN = hypertension; SLE = systemic lupus erythematosus; DM1 = type 1 diabetes mellitus; OSA = obstructive sleep apnea; DL = dyslipidemia.
weight within 8 weeks after surgery and were approved for transplantation. One patient received a living donor organ a year later.

In every instance, weight loss continued beyond the pre-transplant goal in a gradual, safe, and persistent manner, leading to substantial improvement in the control of hyperglycemia, dyslipidemia, hypertension, and sleep apnea.

Discussion
The increasing prevalence of MO patients with CKD6 has created a cohort of high-risk individuals with a serious prognosis and the inability to qualify for renal transplantation. Most are affected by comorbidities such as diabetes and hypertension, which portend increased cardiovascular morbidity and mortality (17,24,25). Furthermore, surgical risks and outcomes after renal transplantation are both negatively affected by an elevated body mass index (20,26).

During the past few years, our home dialysis population has included a growing number of MO individuals, a well-defined group of mostly younger CKD6 patients who have unsuccessfully battled crippling obesity, failed multiple attempts at medical management, and embraced the opportunity of a proven surgical treatment option (11,20,22,23). Furthermore, circumventing the temporary switch to HD was a very strong stimulus in encouraging them to pursue this course of therapy.

Our CKD program emphasizes ongoing patient education (CKD4 and beyond), early referral to a transplant center, and a multidisciplinary approach to their associated illnesses and psychosocial issues though specialty care coordination and counseling. All study subjects were employed and productive, had developed a keen interest in their health, had gained substantial and above-average knowledge of the metabolic aspects of their disease process, and had become highly motivated about qualifying for kidney transplantation.

Perioperative management encompassed major dietary interventions and behavioral changes. A coordinated multispecialty and multidisciplinary approach and regular follow-up were crucial to the success of this therapeutic approach. In preparation for the surgery, patients were asked to follow a low-calorie liquid diet for 2–3 weeks. The main purpose of this preliminary intervention is to decrease visceral fat and reduce liver size (steatohepatitis), both of which help to improve the surgeon’s ability to visualize and manage the operative field (27–31). The secondary endpoint was to evaluate patient’s overall compliance and commitment.

This dietary protocol led to a considerable average preoperative weight loss of 6.8 kg (range: 4.5–11.3 kg). Surgery was uneventful and successful in all the study patients, without significant modification of the standard bariatric technique. A painless hemorrhagic effluent was present for up to a week. Given their remarkably benign postoperative course, it is conceivable that removal of intraperitoneal blood, cellular debris, and other proinflammatory byproducts of tissue injury was instrumental in facilitating the faster restoration of normal peritoneal and splanchnic homeostasis. In theory, this unintended “peritoneal lavage” effect could also have helped to mitigate the development of adhesions (32,33).

Re-initiation of PD in the early postoperative period with a modified volume prescription proved safe and effective. However, hemodynamically and metabolically stable patients may safely delay the return to PD for few days. Such was the case in our patient in whom a hernia repair was also accomplished. A delay of this kind might also be applicable to individuals who undergo more extensive, complex, or prolonged laparoscopic procedures and in whom the compliance...
of the abdominal cavity and the membrane transport dynamics of the peritoneum may be significantly compromised immediately after surgery.

By virtue of tailored perioperative nutrition management, the metabolic demands of the CKD6 bariatric patient may not require the immediate restoration of PD, particularly in patients whose residual renal function and urine volume are substantial, making the transition back to PD less time-sensitive and more clinically driven.

In PD patients, laparoscopic surgery allows for maximal preservation of abdominal wall integrity and of peritoneal cavity compliance—which are the two most important, sine qua non factors for the sound delivery of this modality of renal replacement therapy.

Conclusions
Based on our initial experience, we recommend that CCPD patients undergoing LBS continue their renal replacement modality using the described volume titration protocol. This recommendation is likely also to be applicable to CAPD patients. In this CKD6 population, LBS can be safely and successfully performed without requiring either interruption of the PD modality or temporary conversion to HD.

Disclosures
The authors have no financial conflicts of interest to declare.

References


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