The American Journal of Surgery (2009) 198, 135-141

The American Journal of Surgery®

Minimally Invasive Surgery

Effective use of laparoscopy for long-term peritoneal dialysis access

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KEYWORDS:
Catheter complications;
Catheter survival;
Laparoscopic catheter placement;
Laparoscopy;
Omentopexy;
Rectus sheath tunneling

Abstract

BACKGROUND Laparoscopy is an underused modality for peritoneal dialysis access procedures. The strengths of laparoscopy are that it can both prevent and resolve the common mechanical problems that adversely effect dialysis catheter outcomes.

METHOD Laparoscopically enabled catheter implantation and rescue procedures included rectus sheath catheter tunneling, omentopexy, adhesiolysis, resection of epiploic appendices, colopexy, salpingectomy, and appendectomy. Using these techniques, the outcomes of 428 laparoscopically implanted catheters were studied.

RESULTS During a mean follow-up of 21.6 months, mechanical obstruction complicated 3.7% of implantation procedures. The incidence of pericatheter leak was 2.6%. There were no occurrences of pericatheter hernia or subcutaneous cuff extrusion. Laparoscopic salvage procedures limited losses from mechanical catheter problems to .9%. Cumulative revision-free and assisted catheter survival probabilities for loss from mechanical complications at 5 years were .96 and .99, respectively.

COMMENTS Because it is enabled by techniques not available to other catheter-placement methods, laparoscopy produces superior outcomes.

Peritoneal dialysis offers patients the option of an effective home modality of renal replacement therapy for end-stage renal disease (ESRD), encourages self-autonomy, and supports optimal quality of life.[1–6] The success of peritoneal dialysis depends on the presence of functional and durable long-term catheter access to the peritoneal cavity. Next to infectious complications, mechanical catheter problems have been identified as the greatest impediment to the success of peritoneal dialysis, especially during the first year of therapy.[7] The necessity for further unexpected interventions to remedy catheter problems may discourage patients from continuing peritoneal dialysis and result in early switch to hemodialysis. Common catheter problems include flow dysfunction, pericatheter leaks and hernias, and subcutaneous cuff extrusion.

In recent years, there has been considerable interest in the use of laparoscopy for the creation of peritoneal access. As with any new application of a modality, laparoscopy for peritoneal access is still undergoing procedure-specific adaptation. It has become apparent that simply using the laparoscope to verify catheter location does not significantly improve outcomes more than conventional open catheter placement.[8–11] Continued use of laparoscopy in this manner is blatant underuse of this modality. The strength of laparoscopy is that it allows an opportunity to proactively address problems that adversely effect catheter outcome, specifically, catheter tip migration, omental entrapment, and

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Manuscript received June 13, 2008; revised manuscript October 30, 2008

0002-9610/$ - see front matter
doi:10.1016/j.amjsurg.2008.10.019

peritoneal adhesions. Preemptively identifying and attending to these problems at the time of the implantation procedure are the advantages of surgical laparoscopy over other catheter insertion techniques.

We previously reported a comparative case series analysis of 3 catheter-implantation groups that were accrued in the order of conventional open catheter insertion, laparoscopy to observe catheter placement without additional interventions, and laparoscopy with proactive adjunctive procedures to prevent mechanical flow dysfunction.[11] Using the laparoscope to merely view catheter placement did not significantly diminish the incidence of catheter flow obstruction compared with conventional open procedures. Employing advanced laparoscopic procedures, eg, rectus sheath tunneling, omentopexy, and adhesiolysis, significantly decreased the occurrence of mechanical catheter complications compared with the other 2 groups.

The current study reports the long-term experience in >400 patients, representing more than double our previous number of advanced laparoscopic catheter-implantation procedures. This larger case series allowed more exact characterization of problems requiring intervention and discovery of less common conditions and complications. The present experience added colopexy and epiploectomy to the list of adjunctive laparoscopic procedures. The success described in our original report led to the referral of more challenging patients from the standpoint of prevalence of previous surgery, obesity, and the necessity for additional simultaneous procedures; therefore, it offered an opportunity to test the veracity of our methodology.

Materials and Methods

Preoperative assessment, catheter selection, and preparation of the patient for the implantation procedure have been previously described in detail.[11] A variety of catheters were used in the present report to fit the specific needs of the patient and included the following: (1) coiled tip, 2-cuff Tenckhoff catheters with a straight section or preformed bend in the intercuff segment and (2) 2-piece catheters that provided a subcutaneous extension segment to produce remote exit-site locations to the upper abdomen and chest.[12] Regardless of catheter configuration, insertion of the abdominal portion was performed using the same technique.

The laparoscopic procedure employed was a 2-port technique: The catheter was implanted through 1 port under the direction of a laparoscope at a second port location. The key aspect of the laparoscopic approach was to guide the implantation of the catheter in a long rectus sheath tunnel for its passage into the peritoneal cavity. Craniocaudal immobilization of the catheter within the rectus muscle and sheath promotes pelvic orientation of the catheter, decreases the risk of pericatheter leakage, and eliminates pericatheter hernias. A bladeless trocar port system was employed to perform rectus sheath tunneling (7mm-8mm Auto Suture Mini Step; Covidien AG, Norwalk, Connecticut) (Fig. 1). The system uses a radially expandable plastic sleeve that fits snugly over a Veress-type needle. After the needle–sleeve assembly has been advanced through the abdominal wall, the needle is removed, permitting dilatation of the expandable sleeve with insertion of a dilator–port–cannula assembly. A radially expanded tissue track causes less trauma and leaves a smaller hole than that produced by the cutting blades of a standard trocar port device.[13]

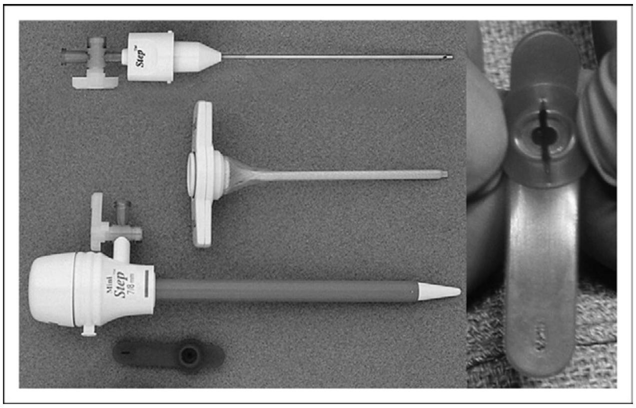

Figure 1 Laparoscopic bladeless trocar port system includes (from top to bottom) Veress-type pneumoperitoneum needle, radially expandable plastic sleeve, 7/8-mm dilator-cannula assembly, and 5-mm reducer cap for the 7/8-mm cannula. The reducer cap is modified (inset) to permit passage of the cuff of the dialysis catheter (reprinted with permission from Crabtree JH. Selected best demonstrated practices in peritoneal dialysis access. Kidney Int 2006;70(suppl):S27–S37).

The port site for the 5-mm laparoscope also served as the point for initial introduction of the Veress needle. Closed insertion of the Veress needle was achieved at the lateral border of the rectus sheath below the costal margin in either of the upper abdominal quadrants but preferably in the left upper quadrant at Palmer's point.[14] When the procedure was performed with the patient under local anesthesia and able to protrude and tense the abdominal wall to create a rigid platform, closed insertion of the Veress needle was performed through an incision just lateral to the rectus sheath on the side opposite of the planned catheter insertion. In the event of midline scars or multiple previous abdominal surgeries, the initial port was placed through an incision just inside the lateral border of the rectus sheath in the upper quadrant. The anterior fascia was incised, the muscle reflected medially or split, and the posterior sheath and peritoneum opened under direct vision. A purse-string suture maintained an airtight seal around the port and was later tied when the port was removed to close the opening. If the patient had an umbilical hernia or other midline defect to be repaired during the procedure, the hernia defect was often used to insert the initial port for insufflation and exploratory laparoscopy. Under laparoscopic control, a second port was then placed in the lateral abdomen to provide a more optimal field of vision for rectus sheath tunneling and catheter insertion.

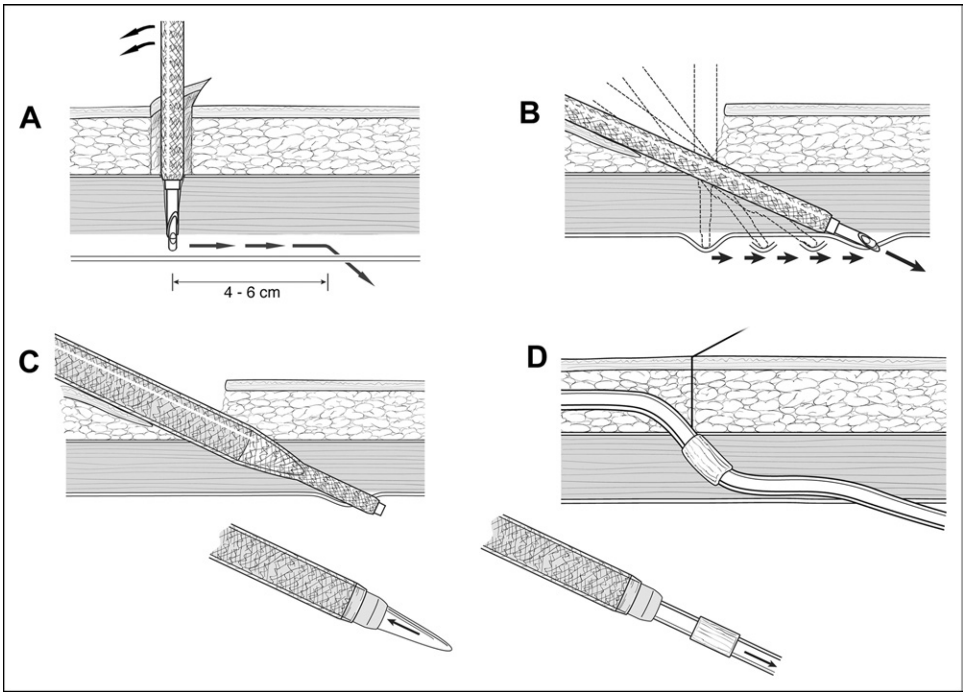

Figure 2 Steps of rectus sheath tunneling of dialysis catheter. (**A**) Veress needle-expandable sleeve assembly is inserted through the skin incision and the anterior rectus sheath. (**B**) The needle-sleeve assembly is angled toward the pelvis, advanced down the rectus sheath, and pushed through into the peritoneal cavity at the indicated site. (**C**) The needle is removed, and the expandable sleeve serves as a conduit for insertion of the dilator-cannula. (**D**) The dialysis catheter over a stylet is advanced into the peritoneal cavity until the deep cuff is visible. The cannula and stylet are withdrawn, and the catheter is retracted until the deep cuff is just below the anterior rectus sheath (reprinted with permission from Crabtree JH. Selected best demonstrated practices in peritoneal dialysis access. Kidney Int 2006;70(suppl):S27–S37).

Through a small paramedian incision over the medial 3rd of the rectus sheath at the catheter insertion site, the anterior fascia was exposed by blunt spreading dissection with a combination of hemostat clamps and narrow ribbon retractors. A small pinpoint hole was made in the anterior rectus sheath with the cautery device. The Veress needle with overlying expandable sheath of the 7mm-8mm Mini Step device was advanced gently through the pinpoint fascial hole and rectus muscle in perpendicular fashion (Fig. 2A). A perpendicular passage was the shortest distance through the muscle to decrease the risk of trauma to the intramuscular vasculature. The blunt tip of the guarded needle was easily seen through the laparoscope as it tented down the posterior rectus sheath. The needle was then angled toward the pelvis and advanced with the blunt end observed laparoscopically as it easily slid down the posterior rectus sheath (Fig. 2B). Unlike the firm attachments of the rectus muscle to the anterior rectus sheath at its tendinous intersections, there are no such attachments of the muscle to the posterior rectus sheath. The course of the inferior epigastric vessels and tributaries could be readily identified and avoided during advancement of the needle. The length of the rectus sheath tunnel was limited by the tendency for the unsupported plastic radial sheath to kink in the tissue track of obese patients when the Veress needle was withdrawn. A 4-cm rectus sheath tunnel could be safely achieved in obese patients and a tunnel as long as 6 cm could be obtained in thinner individuals. Determination of tunnel length was made with the use of a locator needle passed through the abdominal wall a measured distance caudal to the paramedian incision. The Veress needle was pushed through the peritoneal membrane into the abdominal cavity at the indicated distance. The Veress needle was removed, and several milliliters of saline were squirted into the expandable sleeve as lubrication before introduction of the dilator-cannula. The dilator-cannula was advanced through the sleeve to complete the catheter port–insertion procedure (Fig. 2C).

Under laparoscopic control, the peritoneal dialysis catheter, straightened over a stylet, was advanced through the catheter port deep into the pelvis behind the bladder. The stylet was partially withdrawn as the catheter was inserted. To assure that the deep cuff was passed through the anterior rectus sheath, the catheter was advanced until the cuff was visible within the peritoneal cavity (Fig. 2D). The port was then withdrawn from the abdominal wall up onto the shaft of the catheter–stylet assembly. Under laparoscopic control, the catheter–stylet assembly was withdrawn so the deep cuff just disappeared above the peritoneum. The stylet was then removed from the catheter. Guided by the known distance between the deep and superficial catheter cuffs, the catheter was further withdrawn by gentle traction until the deep cuff was just below the anterior rectus sheath (Fig. 2D). A 0-polyglycolic purse-string suture was placed around the catheter at the level of the anterior rectus sheath to decrease the risk of pericannular leakage.

The catheter was passed subcutaneously to the exit site with a tunneling guide that did not exceed the diameter of the tubing and that could be passed in the direction from the paramedian incision to the exit site (Faller tunneling stylet; Covidien AG, Mansfield, Massachusetts). The stylet was advanced through the exit-site skin without making a previous incision. The superficial cuff of the catheter was positioned 3 to 4 cm from the exit wound depending on the catheter type.[12] The catheter adapter and a dialysis transfer set were attached. With the patient in reverse Trendelenburg position, trial irrigation of the catheter to observe for unimpeded inflow and outflow was performed using a 1-L bag of normal saline for intravenous administration with heparin (1000 U/L). A residual of 250 to 300 mL of the irrigant was left in the abdomen toward the end of the drainage process to decrease the likelihood of intraperitoneal structures siphoning up against the catheter. At the conclusion of successful irrigation, the entire system was flushed with 20 mL heparin (100 U/mL). While catheter flow function was being tested, the paramedian incision was closed, and the catheter was secured to the skin adjacent to the exit wound with medical adhesive tincture and sterile adhesive strips. No catheter anchoring stitches were used. The catheter was further immobilized by a covering dressing. Catheter irrigation was repeated within 72 hours of the procedure and then weekly until the patient began dialysis. Dressings were changed weekly for the first 2 weeks after which the patient began a routine of daily exit-site care. When possible, the patient was allowed a 2-week healing period before beginning dialysis.

Additional laparoscopic procedures supportive of improved catheter outcomes were performed based on intraoperative findings. Redundant omentum was prophylactically tacked up to the upper abdomen if it was found to be filling the pelvis. The tacking needle (Endo Close Suturing Device; Covidien AG, Norwalk, Connecticut), with an attached 0-polyglycolic suture, was used to skewer multiple folds of redundant omentum and to secure it to the upper abdominal wall using a "U"-stitch configuration.[12] Intraperitoneal adhesions that interfered with catheter placement or produced compartmentalization that would impede dialyzate drainage were treated with laparoscopic adhesiolysis; however, it was neither necessary nor desirable to mobilize every adhesion. Omental adhesions to the abdominal wall above the level of the pelvis that did not interfere with drainage of fluid from the upper abdomen were thought to protect against omental entrapment of the catheter. Amputation of excessively long epiploic appendices of the colon (epiploectomy) or tacking up of redundant sigmoid colon along the left lateral abdominal wall (colopexy) was usually performed if an irrigation test demonstrated impaired flow or low volume return. An additional 5-mm port and a separate incision for the Endo Close needle were necessary for omentopexy, and 2 extra 5-mm ports were usually required for adhesiolysis, resection of epiploic appendices, or colopexy.

All patient data in this report were recorded prospectively in an Institutional Review Board–approved database. Probability distributions for catheter survival were estimated using the method of Kaplan and Meier. All causes for loss except mechanical complications were censored. Analyses were performed with GraphPad Prism version 4.03 for Windows (GraphPad Software, San Diego, California).

Results

From January 2000 through December 2007, 506 consecutive procedures were undertaken to implant 494 catheters in 468 patients. Eight patients (1.6%) with extensive adhesions from previous abdominal surgery or dialysis-related peritonitis could not be implanted. Four procedures (.8%) were excluded because of other intraoperative events that aborted catheter placement. One of these cases was terminated on discovery of a large ovarian neoplasm. Four months after hysterectomy and bilateral salpingo-oophorectomy, the patient underwent successful laparoscopic catheter placement. Another patient, slated to undergo simultaneous catheter replacement for a nonfunctioning catheter inserted at an outside institution by a fluoroscopically guided percutaneous approach, was found to have the tip of the previous catheter within the small-bowel lumen. The catheter was removed and the small bowel repaired. After 6 months, the patient returned for successful laparoscopic catheter implantation. One patient, awake under local anesthesia, sustained gas embolism caused by injection of the hepatic veins through a Veress needle penetrating the right lobe of an enlarged liver in the right mid-abdominal region. The mishap was immediately recognized by a sudden change in the level of consciousness, the presence of a mill-wheel murmur, and a decrease in systemic blood pressure. The patient completely recovered in minutes after being placed in the left lateral decubitus and Trendelenburg position. The patient returned 1 month later for successful laparoscopic catheter placement. One patient sustained an acute myocardial infarction on induction of general anesthesia, and the procedure was abandoned.

Sixty-six patients, who underwent implantation of buried catheters in advance of anticipated need with the strategy of delayed exteriorization of the subcutaneously embedded external tubing when the necessity for dialysis became imminent, will be the subject of a separate report. Described herein are the results of the remaining 428 catheters in 402 patients who underwent placement for immediate use.

Demographics and clinical details of the catheter placement procedures and outcomes are listed in Table 1. The 2 most commonly performed procedures in addition to catheter placement were omentopexy and adhesiolysis. The need for these additional interventions was apparent on introduction of the laparoscope and exploration of the peritoneal cavity. The necessity for other procedures, eg, epiploectomy and colopexy, was performed because of failed

Table 1 Demographics and clinical details of laparoscopically implanted peritoneal dialysis catheters

Patient demographics (n = 428)	
Age (mean ± SD) (y)	54.8 ± 14.1
Male (%)	215 (50.2)
Body mass index (mean ± SD) (kg/m^2)	29.5 ± 6.6
Previous intra-abdominal surgery (%)	244 (57.0)
Postsurgical follow-up (mean ± SD) (mo)	21.6 ± 18.8
Procedures (%)	
Outpatient procedure	400 (93.5)
Local anesthesia	138 (32.2)
Rectus sheath tunneling of catheter	428 (100)
Selective prophylactic omentopexy	107 (25.0)
Selective adhesiolysis	78 (18.2)
Resection of epiploic appendices	8 (1.9)
Colopexy	3 (.7)
Simultaneous abdominal wall hernia repair	47 (11.0)
Simultaneous catheter replacement	25 (5.8)
Simultaneous cholecystectomy	8 (1.9)
Noninfectious mechanical complications (%)	
Catheter flow obstruction	16 (3.7)
Pericatheter leak	11 (2.6)
Resurgery for hemorrhage	0 (0)
Hollow viscus perforation	0 (0)
Pericatheter hernia	0 (0)
Superficial cuff extrusion	0 (0)
Catheters removed for mechanical complications (%)	
Catheter flow obstruction	3 (.7)
Pericatheter leak	1 (.2)

catheter irrigation tests demonstrating impaired flow or low volume return.

Simultaneous insertion of a new catheter and removal of an old catheter was performed for 7 cases of recurrent peritonitis (executed during culture negative periods with concurrently low peritoneal leukocyte counts), 6 cases of tunnel track infection, 7 cases of faulty catheter placement referred from outside institutions, 4 cases of irreparably damaged catheter tubing, and 1 case of persistent pericatheter leak.

There was a low incidence of catheter flow obstruction, which occurred after only 3.7% of catheter implantations. Catheter blockage developed at a mean of 3.4 months (range .5 to 11.9) after implantation. Causes of obstruction were identified and remedied by laparoscopic intervention in 13 of 16 cases. The etiology of the catheter blockages included 4 cases of attached uterine tubes (with 1 case of bilateral tube involvement), 4 cases of adherent epiploic appendices (including 1 case also involving the vermiform appendix), 4 cases of adhesions between the small bowel and parietal peritoneum, and 1 case of omental entrapment. Successful laparoscopic rescue of the catheter was achieved in each instance by salpingectomy, resection of epiploic appendices (and vermiform appendix in 1 case), adhesiolysis and/or pulling the catheter free of the intestinal adhesions, and omentolysis with omentopexy, respectively. Three cases of nondisplaced catheter obstruction underwent catheter removal because 1 patient was already in the process of elective transfer to hemodialysis because of incapacity for self-care, and the remaining 2 declined further interventions to save the catheter. One of the latter patients later requested and subsequently underwent successful reimplantation of a dialysis catheter.

Pericatheter leak occurred after 2.6% of catheter-implantation procedures. Ten of the 11 occurrences resolved spontaneously with an additional period of catheter rest. One patient with persistent leak underwent simultaneous catheter replacement as previously described. At the time of catheter replacement, the site of pericatheter leakage could not be identified and there was no visible damage to the catheter tubing. Moreover, the replacement catheter suffered a period of pericatheter leakage as well.

The probability of 60-month catheter survival free of revisions for mechanical complications and assisted catheter survival employing laparoscopic rescue procedures is shown in Fig. 3. Revision-free and assisted catheter survival probabilities were .96 and .99, respectively, by the end of the 5-year period. The proportional contributions of causes for permanent transfer of 54 of the 402 patients to in-center hemodialysis during the first year of initiating peritoneal dialysis were 3.7% from mechanical catheter problems, 29.6% from dialysis-related infections, and 66.7% collectively from inadequate dialysis, psychosocial reasons, and other medical problems. There were no occurrences of mechanical flow obstruction or pericatheter leaks after the first year on therapy in this group of 402 patients.

Comments

No prospective randomized studies have compared the advanced laparoscopic methodology discussed in this article with either laparoscopic approaches not using such methodology or with other conventional catheter-insertion methods. As will be pointed out in the comments later, large case series studies with ample follow-up consistently demon-

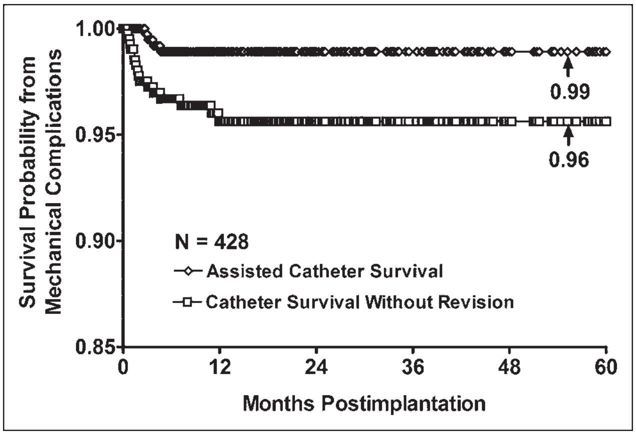

Figure 3 Cumulative revision-free and assisted catheter survival probabilities for loss from mechanical complications. Censored subjects appear as data point symbols on the flat part of the curves.

strate improved outcomes when ≥1 of the advanced laparoscopic techniques are employed compared with other catheter-insertion methods. Moreover, there is synergism in combining the laparoscopic practices of immobilization of the catheter toward the pelvis (rectus sheath tunneling) and omental treatment (omentopexy) that produces a better outcome than when the procedures are performed individually. Because the effective use of advanced laparoscopic techniques clearly produces superior results, it may be ethically difficult to justify performing a randomized controlled study.

The results of comparative literature analyses of major catheter-implantation approaches and their incidences of associated mechanical complications can be extremely variable because there is a plethora of studies with few numbers of subjects and short-term follow-up. More consistent data can be obtained by limiting the literature survey to contemporary experiences published since 2000 and comprised of ≥50 catheters with an average follow-up >12 months. Using these parameters, a literature review showed that the incidence of catheter-flow dysfunction was 10.5% to 11.2% for percutaneous needle-guidewire techniques,[15,16] 10.4% to 17.1% for open surgical placement,[16–19] and 6% to 6.9% for laparoscopic implantation.[17,20,21] Although the previously cited contemporary laparoscopic experiences performed rectus sheath tunneling of the catheter and selective adhesiolysis, none addressed the potential for omental entrapment by using either omentopexy or omentectomy. In a small case series study of 31 laparoscopic catheter insertions by Haggerty et al,[22] both omentopexy and omentectomy, but not rectus sheath tunneling, were selectively employed. During a mean follow-up of 14 months, he observed an equally low 6.5% incidence of flow obstruction.

None of the previously mentioned laparoscopic studies appreciated the synergistic effects of combining catheter immobilization and omental treatment. Ogunc,[23] in a study of 44 subjects with a 20.5% prevalence rate of previous abdominal surgery, performed rectus sheath tunneling and omentopexy for all implantation procedures and adhesiolysis as needed. During a median follow-up of 17.4 months, he observed no occurrences of omental entrapment or other catheter blockage. In our study of 428 catheters with a 57% prevalence rate of previous surgery and followed-up for a mean of 21.6 months, rectus sheath tunneling in all subjects and selective use of omentopexy and adhesiolysis was associated with only a 3.7% incidence of flow dysfunction, which included 1 instance of omental blockage (.2%).

As pointed out previously, Ogunc performed omentopexy during all laparoscopic catheter-placement procedures except when omental adhesions from previous abdominal surgery had already produced omental fixation.[23] To decrease the performance of unnecessary procedures and minimize cost, we followed selective criteria for omentopexy, employing it for cases in which the omentum was observed to extend to the vicinity of the catheter tip in the pelvis. Our previously published 14.5% performance rate for prophylactic omentopexy has increased to 25% in the present report. This increase can be attributed to demographic changes in our study population to include a greater number of female subjects with a higher prevalence of previous reproductive tract surgery and pelvic omental adhesions.[24] If pelvic omental adhesions were lysed, it seemed prudent to definitively eliminate the juxtaposition of the freed omentum from the pelvis and catheter tip to prevent subsequent catheter failure. In the current series, 53 of 78 adhesiolysis procedures (68%) were accompanied by omentopexy. The soundness of this strategy is supported by the fact that our incidence of omental obstruction in the present study was only .2%, a low occurrence rate unsurpassed by any other large case series with long-term follow-up and equivalent prevalence rate of previous abdominal surgery.

Mujais and Story[25] reported outcomes in a contemporary group of 40,869 patients initiating peritoneal dialysis in the United States from 2000 to 2003. Of the 7,694 patients who transferred from peritoneal dialysis to in-center hemodialysis during the first year, 19.6% did so because of mechanical catheter problems, representing the second most common reason for transfer after infection at 23.7% (K. Story, personal communication, 6/12/2008). Moreover, the largest percentage of transfers for catheter complications (65.6%) occurred during the first year of therapy. Statistics were not available to categorize the type of catheter-insertion methods used or the percentage of patients having additional catheters with mechanical problems who may have undergone successful salvage procedures; however, the data do provide a snapshot of catheter outcomes in the United States that is contemporary to the experience described in this report. Although 4 of 428 catheters (.9%) in our study were removed for mechanical complications, only 2 of these patients were permanently transferred to in-center hemodialysis, comprising 3.7% of the 54 patients who underwent transfer to hemodialysis during the first year. The low incidence of our mechanical catheter complications and the effective use of laparoscopy to rescue malfunctioning catheters accounts for an incidence of transfer to hemodialysis for catheter problems that was >5-fold lower than the large United States cohort.

In our previous series, the use of helium gas insufflation enabled performance of laparoscopic catheter-implantation procedures with the patient under local anesthesia in >70% of cases.[11] Compared with the pain caused by carbon dioxide gas insufflation, helium produces no pain. Although we still use helium gas for insufflation, the incidence of cases performed under local anesthesia in the current report has decreased to 32.2%. General anesthesia was more frequently employed in the present experience for the following reasons: (1) greater use of extended 2-piece catheters, (2) larger number of obese patients, (3) increased additional simultaneous procedures, thus making local anesthesia unfeasible, or (4) the anticipated local anesthetic requirements exceeded the dose allowable to complete surgery.

Simultaneous laparoscopic cholecystectomy for asymptomatic cholelithiasis was successfully carried out in 8 patients without the occurrence of infectious complications. These procedures were performed in patients who were considered transplant candidates and the transplant centers required cholecystectomy for them to remain on the organ waiting list. All patients received a single preoperative dose of cefazolin and metronidazole. Catheter implantation was performed first. After closing all catheter-related incisions and covering the wounds, attention was directed to completing the cholecystectomy.

Peritoneal dialysis and hemodialysis are equally beneficial as renal replacement therapy and provide overall equivalent patient survival during the first 5 years after onset of ESRD.[26] Data consistently support improved survival benefit for peritoneal dialysis patients during the first 1 to 2 years through better preservation of residual renal function and improved blood volume and pressure control.[27,28] Peritoneal dialysis is less expensive than hemodialysis. In 2005, the average Medicare cost per person per year for ESRD care was $69,758 for hemodialysis and $50,847 for peritoneal dialysis, a cost difference of approximately $19,000/person/year.[26] The economic advantages of the lower cost of peritoneal dialysis are lost if the patient switches to hemodialysis during the first year.[29] The use of peritoneal dialysis beyond the first year produces Medicare cost savings even if the patient later makes a modality switch. Efforts to decrease preventable causes of early transfer of peritoneal dialysis patients to hemodialysis can significantly decrease health care expenditures. If the surgeon can help assure peritoneal dialysis technique survival beyond the first year of treatment, cost savings can be achieved. It seems, therefore, that our primary effort should be directed toward developing and using implantation techniques that assure the best prospect for long-standing success. Effective use of laparoscopy to create and maintain peritoneal access is an important step in achieving this aim.

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