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Comparative Study of Laparoscopic and Open Insertion of Peritoneal Dialysis Catheter

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Abstract

Background : Laparoscopic insertion of Tenckhoff catheters has gained wider acceptance and is performed in many centres. This paper compares the immediate as well as the long-term results of catheters inserted by open and laparoscopic technique.

Methods : The operative techniques were described. Retrospective case notes audit of all patients who had peritoneal dialysis catheter inserted at The Queen Elizabeth Hospital during the last 10 years was performed to compare the operative morbidity and long term complications.

Results : Eight-two Tenckhoff catheters were placed in 77 patients. Forty-one catheters were inserted in 37 patients with open technique and 41 catheters in 40 patients with laparoscopic technique. Mean follow up period was 536 days in laparoscopic group and 777 days in open group. The patients in laparoscopic group had shorter operative time (38 min vs. 48 min), less postoperative narcotic requirement (2.6 mg. vs. 17 mg. of morphine or equivalent), earlier resumption of regular diet (1 day vs. 2.8 days) and shorter post operative hospital stay (3.6 days vs. 8.2 days). With laparoscopic technique, there was 10 per cent incidence of obstruction and 7.5 per cent incidence of leakage (5.2% and 2.6% respectively in open group). In the long-term follow up, the catheter survival was comparable in both groups.

Conclusion : Laparoscopic technique provides advantages over open technique in reducing post operative pain, hastening post operative recovery and shortening the hospital stay. The benefits of laparoscopic technique are in the immediate postoperative period.

Key words : Continuous ambulatory peritoneal dialysis (CAPD), Laparoscopy, Renal failure, Tenckhoff catheter.

Chronic ambulatory peritoneal dialysis has become possible since the introduction of the Tenckhoff catheter.[1] Several techniques have been used for the placement of the catheter into the peritoneal cavity. Many have favored open laparotomy with or without excision of the greater omentum. Minimally invasive surgical techniques are being used frequently to reduce the postoperative morbidity and hospital stay. Laparoscopy was used initially to reposition malfunctioning peritoneal catheters[2,3] and now many centres are inserting these catheters using laparoscopy.[4-5] There were only two reports[4,7] comparing the immediate postoperative complications and outcome of catheters inserted by open and laparoscopic technique. The aim of this paper is to analyse the immediate as well as the long-term results of catheters inserted by open and laparoscopic method in our centre.

Subjects and Methods

A retrospective case note audit of all patients who had the Tenckhoff catheter inserted with open and laparoscopic technique and commenced Continuous Ambulatory Peritoneal Dialysis (CAPD) at The Queen Elizabeth Hospital, Woodville between July 1990 and July 1999 was performed. Laparoscopic technique was introduced at our centre since 1993. Patient characteristics, immediate postoperative course, long term complications, peritonitis, exit site infections, inflow and outflow problems, catheter survival and the reasons for their removal were studied. Statistical methods used for analysis of operative time, day of resuming diet, narcotic dosage and the length of hospital stay were Wilcoxon rank, while Kaplan-Meier method was used for the analysis of catheter survival. Chi square analysis was used for the comparison of patient characteristics and a p-value of less than 0.05 was deemed statistically significant.

Double cuffed straight catheters (Quinton®) were used both in open and laparoscopic groups. The Dacron cuffs were immersed in saline and all the trapped air was expelled prior to its use. Catheter's tip was not anchored to peritoneum and the catheter was not sutured to the skin at the exit site.

Open technique: Under general anaesthesia a lower infra-umbilical left para-median incision (8-10 cm) was made. The anterior rectus sheath, rectus muscle and the posterior rectus sheath including the peritoneum were incised in the line of skin incision. Abdominal viscera were inspected and if the greater omentum was found to extend below the level of the umbilicus, it was exised. The catheter tip was placed behind the bladder or uterus. The peritoneum was sutured with continuous 2-0 catgut leaving the distal cuff in the rectus sheath and the cuff was sutured to the rectus muscle. An arcuate tunnel was created using a curved metal trocar of the same diameter as the catheter; starting from underneath the anterior rectus sheath and exiting through the skin at a position previously marked, based on the way patient wears the clothes. The arcuate tunnel allows the exit site to face towards the inguinal region. The proximal cuff lies in the tunnel about 0.5-1.0 cm from the exit site. One litre of peritoneal dialysis fluid was left in the peritoneal cavity. Post operatively, the peritoneal cavity was lavaged periodically until the effluent was clear. During the peri-operative period the patients received analgesia and their diet was modulated based on the bowel function. Peritoneal dialysis was commenced after 2-3 weeks following the insertion of the catheter.

Laparoscopic technique: Under general anesthesia, a small incision was made in the right upper quadrant halfway between the costal margin and the umbilicus. Peritoneotomy was performed as per Hasson technique. A 10-mm port was introduced for the camera. Sutures were placed on the peritoneum and the abdominal muscles to facilitate the closure of the port entry site at the end of the procedure. The peritoneal cavity and the abdominal viscera were inspected. Under laparoscopic visualisation a second 10-mm port was inserted obliquely downwards through the rectus muscle halfway between the pubis and the umbilicus. A third 5-mm port was inserted in the right iliac fossa. Placement of the ports in this fashion makes it easier to work without the clashing of instruments. The Tenchkoff catheter was introduced through the second port and its tip was placed behind the bladder with a grasper introduced through the 5-mm port. An arcuate tunnel was created with a curved metal trocar starting behind the anterior rectus sheath and exiting through the skin as in open technique. The gap in the peritoneum above the catheter was closed with the Endoclose™ to maintain the downward direction of the catheter. Normal saline 50-100 ml was infused through the catheter to confirm free flow. By using 3

ports it was possible to divide peritoneal adhesions if warranted, but the omentum was not exsed. Peritoneal cavity was lavaged at weekly intervals until the commencement of CAPD. During the early part of this study peritoneal dialysis was commenced 4 weeks after the catheter placement, this period was shortened to 2 weeks in the later cases.

Results

Eighty-two catheters were placed in 77 patients. Open technique was used in 37 patients to place 41 catheters and laparoscopic method was used in 40 patients to place 41 catheters. The general characteristics of patients were not statistically different (Chi square=9.87, DF=10, p=0.45, Table 1). Omentectomy was performed on 23 patients in the open group. One laparoscopic procedure was converted to open, to control bleeding from the inferior epigastric artery caused by the trocar. This patient was included in the open group leaving 40 catheters for analysis. Out of 41 catheters in the open group, one catheter never functioned (sclerosing peritonitis) and 2 patients had incomplete follow-up, leaving 38 catheters for long term analysis.

Mean operative time was 48 minutes in the open group. In the laparoscopic group it was 53 minutes during the early phase of using this technique and recently the time was reduced to 38 minutes. Twenty four hours narcotic use in the post operative period was 2.6 mg of morphine or its equivalent in the laparoscopic group compared to 17 mg in the open group ($p<0.05$). Commencement of liquid and regular diet was earlier in the laparoscopic group with a mean value of 0.5 day for liquid diet and 1 day for regular diet, compared to 1.7 days and 2.8 days respectively in the open group ($p<0.05$). Post operative hospital stay was shorter in the laparoscopic group with a mean of 3.6 days while it was 8.2 days in the open group ($p<0.05$). Complications were summarised in Table 2. Four patients (7.5%) in the laparoscopic group developed flow problems soon after the commencement of dialysis. Laparoscopic exploration was performed in these patients. The cause of obstruction was found to be omentum wrapping around the catheter. The peritoneal cavity was explored through an incision away from the cuffs and the offending omentum was excised. Dialysis was resumed without any delay.

The mean follow up period was 536 days in laparoscopic group and 777 days in open group. The catheter complications and the reasons for its removal were summarized in Tables 2 and 3. Fifteen catheters out of 40 in the laparoscopic group had 27 episodes of peritonitis (0.013 peritonitis episodes per catheter per year), while 25 catheters out of 38 in the open group had 62 episodes of peritonitis (0.021 peritonitis episodes per catheter per year). There was statistical difference between the two groups (Chi square=6.24, DF=10, p=0.0125). To exclude the bias of shorter follow up period of some in laparoscopic group, the peritonitis

Table 1 Patient characteristics

	Laparoscopic	Open
Male/Female	11/29	21/16
Age	58.2 (29-77)	58 (18-78)
Weight (kg)	63.8 (31-90)	66.5 (42-91)
Previous abdominal operations	15	17
Causes of renal failure		
Analgesic nephropathy	6	8
Diabetic nephropathy	10	5
Ig A nephropathy	3	6
Renovascular	3	5
Reflux nephropathy	2	0
Obstructive uropathy	0	2
Others	8	8
Unknown	8	3

Table 2 Complications

Complication	Laparoscopic (n=40)	Open (n=38)
Immediate conversion	1 (2.4%) Trocar injury to inferior epigastic artery (n = 41)	None
Catheter obstruction	4 (10%), Omentectomy (early)	2 (5.2%), Division of adhesions (late)
Wound infection	2 (5%), Conservative management	2 (5.2%) Conservative management in one, another required secondary suture
Leakage	3 (7.5%), one managed conservatively, the others required surgery	1 (2.6%), surgical repaired
Others	2 ventral hernia	1 incisional hernia, 1 diaphragmatic leakage 1 inguinal hernia

Table 3 Catheter outcome

	Laparoscopic (n=41)	Open (n=41)
Catheters still in use	18	2
Removed		
Transplantation	5	7
Recurrent peritonitis	4	12
Other reasons	2	6
Death		
Uncontrolled peritonitis	3	4
Unrelated	8	8
Incomplete follow-up	0	2
Converted to open	1	-

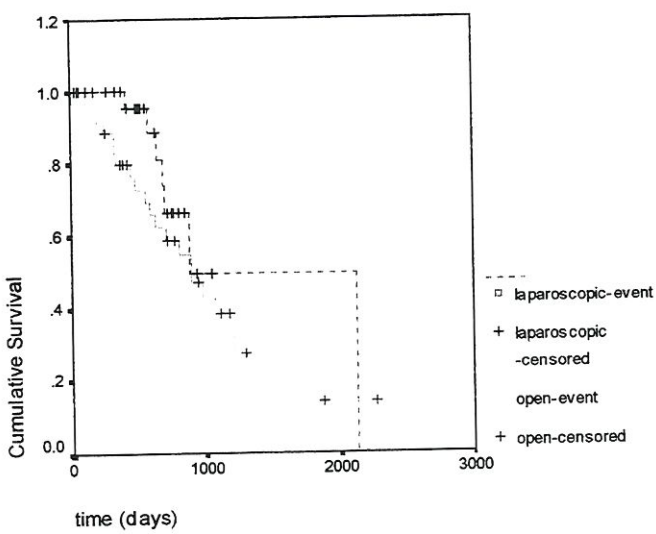

Fig. 1 Kaplan-Meier plot of catheter survival

incidence was reanalysed in all patients with more than 6 months follow up period. Thirteen catheters out of 27 in the laparospcic group has 25 episodes of peritonitis (0.019 peritonitis episodes per catheter per year), while 22 catheters out of 33 in the open group had 55 episodes of peritonitis (0.022 peritonitis episode per catheter per year). There was no statistical difference (Chi square = 2.1, DF = 10, p=0.147). Analysis of catheter survival time revealed no difference (p>0.05) between the two groups, with a median survival time of 900 days in laparoscopic group and 886 days in open group (Figure 1).

Discussion

Many techniques have been used for the placement of Tenckhoff catheters. These include percutaneous insertion with Seldinger technique, limited peritoneal entry with peritoneoscope under local anesthesia,[8-10] laparotomy and laparoscopic method.[4-6] Percutaneous technqiue carries the inherent risks of visceral dam-age.[11,12] Limited entry under vision (peritoneoscopy), into the peritoneal cavity reduces the risk of visceral damage. However, Gadallah et al have reported visceral damage incidence of 1.3 per cent with this technique.[13] The field of vision provided by the peritoneoscope is inadequate for proper inspection of the peritoneal cavity and any surgical interventions, if indicated. Often visceral injuries may result in abandoning CAPD. There were no visceral injuries in either group in this study. Formal

open techniques provide adequate visualisation of the peritoneal cavity and enable the surgeon to perform omentectomy to prevent catheter blockage. This prolongs the post-operative recovery and hospital stay. Minimally invasive surgical technique (laparoscopic method) has gained the acceptance because of the reduced postoperative morbidity and shorter hospital stay. This technique has the advantages of open method without the same level of postoperative morbidity.

Comparison between the various techniques used and the results they produced are difficult because there is no standard definition of the terms - laparotomy and laparoscopy. Laparotomy could be a small incision just enough to pass the catheter introducer into the pelvic cavity[7] or a more extensive exposure as we have used. Similarly with the term laparoscopy, some have included peritoneoscopy. Wright et al have used laparoscopy with a single camera port combined with short midline incision for the introduction of a disposable trocar and peel apart plastic sheath for the introduction of the catheter.[7] They have used mini laparotomy (4-6 cm). In a randomised prospective comparison of these methods, they concluded that there was no difference in postoperative discomfort or complication rate. The other comparative study was by Draganic et al[4] using a lower abdominal transverse incision, which allowed additional procedures like omentectomy and salpingectomy. They have used only two ports for the laparoscopy. In their retrospective study they found laparoscopic technique to be safe and less painful compared to the open technique.

In this study, omentectomy was performed where indicated in the open group. Some surgeons suture the tip of catheter to the peritoneum or the posterior wall of urinary bladder to prevent its migration.[5] We believe that it is unnecessary as the catheter drainage depends on the size of the sump and the siphon action. In addition it is possible for the small bowel loops to twist around the catheter while its tip is anchored to the pelvic wall resulting in an intestinal obstruction. With laparoscopic technique, omentum can be dealt with in several ways. It can be fixed to the back of the anterior abdominal wall above level of the umbilicus (omentopexy), partially excised with electro cauterization, resected using Endo-GIA® stapler (Auto Suture Com.)[2,3,15] or left to be dealt with later if it causes catheter obstruction. Use of open Hasson technique reduces the risk of visceral or blood vessel injuries reported with the use of Veress needle.[14] Using a metal trocar as described creates a tunnel without empty spaces around the catheter that could be filled with blood clots. Downward direction of the exit provides drainage and speedy resolution of the exit site infections. With adequate closure of the catheter entry site and the ports, dialysis could be commenced early but we prefer to wait for a couple of weeks to allow tissue ingrowth into the catheter's cuffs. Therre were no operative complications in this series except for one trocar injury to the inferior epigastric artery.

The incidence of peritonitis in CAPD varies widely depending on the technical perfection achieved by an individual patient, in the care of the catheter and the bag exchanges; and it may not be related to the surgical technique of catheter insertion. In this study, the incidence of peritonitis in laparoscopic group is less than in open group due to a shorter follow up period and this difference was not evident when all catheters with adequate follow-up period were considered. The reported incidence of catheter obstruction varied between 3.3 to 11 per cent in laparoscopy group[4,5,14] and 3 to 7.9 per cent in the peritoneoscopic group.[10,13] We have noticed a higher incidence of obstruction that required operative intervention (10%) in our laparoscopic group, which may be a result of not excising the omentum. Most catheter obstructions were noticed at the commencement of CAPD in the early group with 4-5 weeks waiting period. Later, this period was shortened and peritoneal cavity was lavaged periodically. This has reduced its incidence. Initially all catheter obstructions were managed conservatively and the measures included overfilling the peritoneal cavity, changing the position of the patient while the catheter is draining and enemas to empty the bowels. Those that did not respond were subject to surgical intervention. Laparoscopy was performed and if there was no omental wrapping, the catheter was flushed and repositioned and any minor peritoneal adhesions were lysed.[2,3,5,15] Omentum was excised where indicated through a small incision without disturbing the cuffs. Watertight closure of peritoneum will allow continuation of CAPD immediately. In the long-term, the incidence of catheter obstruction was lesser in laparoscopic group compared to the open group. This may be related to the lesser frequency of adhesion formation with laparoscopic surgery.

The incidence of dialysate leakage in laparoscopic series was reported to be 3.3-10.5 per cent.[4,5] The leak could occur at trocar sites or catheter exit site and it could be external or internal into the abdominal wall. The internal leakage manifests as a swelling around offending trocar site or fluid accumulation in the dependent parts as scrotal or labial edema. Initially, both types of leakage could be managed conservatively[5] with peritoneal rest for 2 weeks and then the dialysis could be resumed with gradually increasing volumes. Persistent leaks required operative intervention. In this series, leakage into the subcutaneous tissue occurred in 2 patients, one patient responded to conservative management while the other required surgery. Dialysate leakage could be prevented by meticulous watertight closure of trocar hole, either with Endoclose or suturing under direct vision. In this study there was one case of external leakage in the open group, while 12.9-17 per cent incidence was reported.[16,17]

Conclusion

The benefits of using laparoscopic technique for the insertion of Tenckhoff catheter are during the immediate postoperative period. The morbidity was less and the hospital stay was shorter.

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