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Research Article

Laparoscopic Peritoneal Dialysis Catheter Insertion

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Abstract

Objective: To assess laparoscopic peritoneal dialysis (PD) catheter placement techniques and complications among End Stage Renal Disease (ESRD) patients at Prince Sultan Military Medical City (PSMMC), Riyadh, Kingdom of Saudi Arabia.

Methods: Retrospective review was performed on patients who underwent laparoscopic PD catheter placement with tunneling +/- adhesionlysis and omentopexy or omentectomy, between July 2008 and June 2018, by a single surgeon at Prince Sultan Military Medical City (PSMMC), Riyadh, Kingdom of Saudi Arabia.

Result: Two hundred and twenty-two patients underwent laparoscopic PD catheter insertion during the study period. Late complications encountered include: tuberculosis (TB) peritonitis in 9 patients (4%), catheter dysfunction in 13 patients (6%), adhesions in 2 patients (1%), bacterial peritonitis in 25 patients (11%), leakage in 15 patients (7%), and 16 patients (7%) developed an umbilical hernia. There is a superficial fungal infection around the catheter exit in one patient (0.45%), and exit-site bacterial infection in 7 patients (3%). Catheter remained active for the first insertion in 33 patients (15%) and was reinserted in 7 patients (3%). Fifty-one patients (23%) underwent renal transplantation, and 82 (37%) patients were switched to hemodialysis. Eleven patients (5%) were lost to follow up, and 45 patients (20%) died due to their chronic illness. Seven (28%) of the 25 patients with bacterial peritonitis were cured with conservative management in the form of antibiotics and other conservative measures. There was no procedure-related mortality or bleeding.

Conclusion: Laparoscopic PD catheter insertion is safe and effective. Utilization of this technique provides a low rate of PD catheter complications. However, we encountered a noticeable rate of peritoneal tuberculosis in our patients.

Keywords: Peritoneal Dialysis Catheter; Laparoscopic Surgery; Complications of Peritoneal Catheter Insertion

Introduction

Tenckhof and Schechter described a percutaneous nonvisualized method of peritoneal dialysis catheter (PDC) placement in 1968 [1]; however, this was associated with a risk of bowel and vessel injury, as well as a high incidence of malpositioned PDCs resulting in failure rates of up to 65% at two years. Subsequently, the procedure was modified to open placement of the PDC tip into the pelvis under direct surgical vision via minilaparotomy [2]. A peritoneoscopic technique was later used in 1981 by Ash., *et al.* [3] to improve catheter function and decrease complications. Over the last decade, several reports have described laparoscopic placement of PDCs, [4-11] facilitating direct visualization of the peritoneal cavity and exact placement of the catheter tip deep into the cul-de-sac. Currently, 4% of patients requiring peritoneal dialysis (PD) in Saudi Arabia are served at Prince Sultan Military Medical City (PSMMC). We have 54 patients on peritoneal dialysis out of the 1372 registers in Saudi Center of Organ Transplant (SCOT) as reported in 2016. Peritoneal dialysis is gaining popularity among our end-stage renal disease (ESRD) patients at PSMMC, and over the last few years, based on our hospital nephrology registry; this has grown to approximately 16% of the total number of patients who are on dialysis. This modality of treatment is in demand globally, reaching overall of 9% of patients on dialysis in the Kingdom, based on SCOT data published in 2016. The advantages of PD over hemodialysis include the preservation of vascular access sites, reduced risk of transmission of blood-borne infection, and possibly better preservation of residual renal function [13]. Other advantages are lower cost, increased patient mobility, better control of hypertension, maintenance of blood chemistries, no requirement for anticoagulants, and no routine blood loss [4]. However, the disadvantages and associated complications include peritonitis, pericatheter infection, catheter malfunction, dialysate leaks, sclerosing peritonitis, and hernias [14]. In this study, we assessed the laparoscopic PDC placement techniques and complications among ESRD patients at PSMMC over ten years duration.

Methods

We performed a retrospective review of 222 patients who underwent a laparoscopic PDC placement procedure over a 10-year period from July 2008 to June 2018 at PSMMC, Riyadh, Saudi Arabia. All patients were managed by a single surgical team and followed regularly by one clinical nurse specialist (RN).

Surgical technique

The exit-site was chosen preoperatively by marking the abdomen wall on the side opposite to the dominant hand, and the patients were placed on the operating room table on a supine position. All procedures were carried out under general anesthesia. One dose of prophylactic antibiotics (Ciprofloxacin) was administered preoperatively, and 2 doses postoperatively. Iodine povidone was applied 3 times to the abdomen, followed by draping of the area. A supraumbilical open technique (modified Hasson technique) was used to establish a pneumoperitoneum of 14 mm Hg. We used a 5 mm trocar and zero-degree laparoscope. After visualization of the abdominal cavity, a 10 mm trocar was inserted in the right upper abdomen at the mid- clavicular line, 5-6 cm below the costal margin, and the patient was re positioned with head down and table tilted to the left side. Once the pelvis was free from adhesions and adhesiolysis was completed, if needed, the entrance and exit-sites were marked. We found it helpful to lay the catheter on the abdomen to estimate the entrance site based on the length of the patient's torso. The tip should easily reach the cul-de-sac, and the top of the curl should be at the pubic symphysis. We preferred an entrance site within the linea alba, 2 cm below the umbilicus. The PDC or Tenckhoff set is composed of a catheter, introducer needle, 10 cc syringe, guidewire, #11 scalpel, 16-French sheath, dilator, tunneling stylet, 6 gauze sponges, clamp, and cap (Figure 1 and Figure 2). The dissection (tunneling extend caudally extraperitoneal to a point just above the dome of the urinary bladder. Tunneling is carried out with Lahey forceps for a length of 7-10 cm along the midline without breaching the peritoneum under direct visualization. The peritoneum is then opened at this point. The catheter is inserted from the 10 mm port and then pulled out using the Lahey forceps leaving the coil fenestrated catheter end within the pouch of Douglas. The caudal cuff was held to the peri peritoneum (extra-peritoneal), and the outer cuff tunneled to an exit-site 30-40 degrees from a horizontal imaginary line at the level of the umbilicus, in the subcutaneous tissue. Omentopexy is done if needed and the abdomen is then deflated, and the trocars removed. The fascia of the 10 mm trocar was closed with non-absorbable sutures and skin closed with skin clip. The catheter was tested on table for any dysfunction or leakage with 1-2 liters of dialysate solution and then evacuated. Five thousand units of heparin diluted in 50 ml saline and injected into the catheter. The catheter was used after 2 to 3 weeks later. All patients are followed up in the PD catheter outpatient's clinic.

Figure 1: Coiled Peritoneal Dialysis catheter.

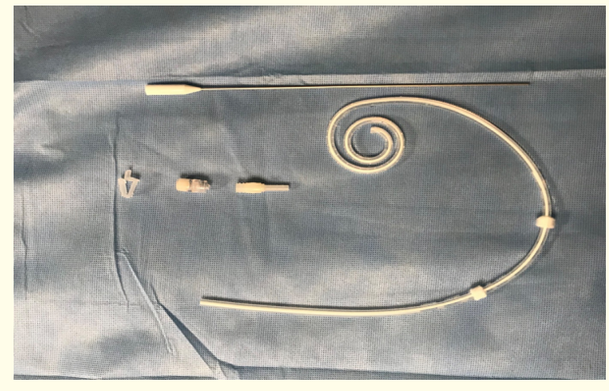

Figure 2: Coiled Peritoneal Dialysis Catheter

Results

Two hundred and twenty-two patients underwent laparoscopic PDC insertion under general anesthesia between July 2008 and June 2018. All patients were discharged on the first or second postoperative day. Combined diabetes and hypertension were the cause of renal failure in a large percentage (47%) of our study population (Table 1). Hypertension was documented in 47 patients (21%), diabetes in 42 patients (19%), glomerulonephritis in 13 patients (6%), renal artery stenosis in 7 patients (3%), polycystic kidney disease in 5 patients (2%), and systemic lupus erythematosus in 4 patients (2%). No visceral or vascular injuries occurred. Twenty-five patients had peritonitis (Table 2); 7 were cured with medical treatment and intravenous antibiotics (PD catheter was

not removed) and 4 patients died (3 sepsis, and one myocardial infarction). 14 patients out of the 25 patients have been shifted to hemodialysis and their PD catheter was removed. A total of eighty-two patients was switched to hemodialysis (Table 3). Nine patients had peritoneal tuberculosis, of which 8 shifted to hemodialysis, and 3 patients died; 2 because of the hepato-renal syndrome, and one because of a stroke. One patient with peritoneal tuberculosis still had an active PD catheter after completion of TB treatment course. Fifteen patients had early leakage and underwent a second operation for the closure of the peritoneal opening. Thirteen patients had late catheter malfunctions, of which, 7, required re-insertion. Two patients had adhesions, both requiring adhesiolysis and re-insertion. Fungal infection occurred in one patient, which was cured by antifungal treatment. Sixteen patients had an umbilical hernia requiring open umbilical repair. 13 patients have been shifted to hemodialysis up on their requests (11 patients of the lost follow up with us). At the end of the study period, 33 (15%) patients had active PDCs, 51(23%) patients had been transplanted, and 82(37%) patients were switched to hemodialysis (Table 4).

Causes	Number of patients	%
Diabetes Meletus and Hypertension	104	(47)
Hypertension	47	(21)
Diabetes Meletus	42	(19)
Glomerulonephritis	13	(6)
Renal Artery Stenosis	7	(3)
Polycystic Kidney	5	(2)
Systemic Lupus	4	(2)

Table 1: Causes of renal failure in 222 patients underwent Laparoscopic Peritoneal dialysis Catheter Insertion.

Complications	Numbers of patients	%
Peritoneal Tuberculosis	9	(4)
Dialysate leakage	15	(7)
Catheter malfunction	13	(6)
Late adhesions	2	(1)
Fungal infection	1	(0.45)
Hernia	16	(7)
Peritonitis	25	(11)

Table 2: Complications encountered.

Reasons	Numbers of patients	%
Leakage	15	(18)
Catheter malfunction	13	(16)
T.B Peritonitis	8	(10)
Late adhesions	2	(2)
Fungal infections	1	(1)
Hernia	16	(20)
Bacterial infections	14	(17)
On patients request	13	(16)

Table 3: Reasons to shift to Hemodialysis (82 patients).

Catheter disposition	Numbers of patients	%
Active	33	(15)
Transplanted	51	(23)
Shifted to Hemodialysis	82	(37)
Lost follow up	11	(5)
Died	45	(20)

Table 4: Catheter disposition in 222 patients.

Discussion

Laparoscopic insertion of PDCs is an innovative use of minimally invasive surgery. Our technique was successful as there was no need to convert to the open method for insertion or re-insertion of the PDC's. The designation of the exit-site of the catheter was comfortable for the patient because of the cultural type of dress worn.

A meta-analysis by Strippoli., *et al.* [15] identified 17 eligible trials with 1098 patients. The trials included 8 straight versus coiled catheters, one of single versus double cuff catheters, and one of immobilizer devices. There were no significant differences with laparoscopy compared to laparotomy for peritonitis, exit site/tunnel infection, or catheter removal/replacement. Standard insertion with no subcutaneous burying of the catheter versus implantation and subcutaneous burying was not associated with a significant reduction in peritonitis rate, exit-site/tunnel infection rates, or overall mortality. Midline compared to lateral insertion showed no significant difference in the risk of peritonitis or exit-site/tunnel infection. There was no significant difference in the risk of peritonitis, or its rate, exit-site/tunnel infection, or its rate, or catheter removal/replacement between straight versus coiled catheters. One trial compared single versus double cuffed catheters and showed no significant difference in the risk of peritonitis, exit-site/tunnel infection, or catheter removal/replacement. One trial compared immobilization versus no immobilization of PDC and showed no significant difference in the risk of peritonitis and exit-site/tunnel infection.

Abdominal wall hernia is a known complication in patients undergoing peritoneal dialysis, occurring in up to 12%. Peritoneal tuberculosis is another known complication of PCD [16-18]. However, we found a surprisingly high rate among our patients. Most probably because this area is endemic for tuberculosis, in addition to the low cellular type of immunity in renal failure patients [19,20]. The prevalence and incidence of ESRD and the requirement for Renal Replacement Therapy (RRT) are increasing in Saudi Arabia (SCOT report 2016). With the scarcity of available organ for transplant, patients must choose between hemodialysis (HD) and peritoneal dialysis (PD). Currently, most of our patients are on HD and only 16% are in PD. With the advantages of laparoscopic

surgery, this may encourage the patients to choose the option of peritoneal dialysis.

In conclusion, laparoscopic PDC insertion is safe and effective. The utilization of this technique provides a low rate of PDC complications. However, we did encounter a noticeable rate of peritoneal tuberculosis in our study group.

Conclusion

Laparoscopic PD catheter insertion is safe and effective. The utilization of this technique provides a low rate of PD catheter complications. However, we encountered a noticeable rate of peritoneal tuberculosis in our patients.

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