SCIENTIFIC ARTICLE

Laparoscopic continuous ambulatory peritoneal dialysis (CAPD) catheter insertion: a modified technique in low resource settings and early outcome

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Abstract

Chronic kidney disease [CKD] has become a major health issue worldwide. In Sri Lanka, the prevalence of CKD has increased rapidly in the recent past. The definite treatment is kidney transplantation. However, due to a variety of reasons, transplantation is either delayed or not possible. Dialysis is the management modality for those patients. Peritoneal dialysis is traditionally done via temporary lines for in-ward patients in Sri Lankan hospitals. There is an increasing trend to use CAPD catheters in major renal centres. CAPD lines are inserted by several techniques. In most centres in Sri Lanka CAPD is inserted by open surgery. Laparoscopic insertion is relatively new to local patients. In this article, a novel modified technique is described, and the early outcome is analyzed.

Introduction

Renal replacement therapy is needed to maintain homeostasis in patients with stage 4 chronic kidney disease[1]. They need either haemodialysis or peritoneal dialysis. Each of these modalities has its advantages and disadvantages. Haemo-dialysis is hospital-based while peritoneal dialysis could be performed in the community. CAPD has gained popularity worldwide[2]. The catheter insertion is mostly done laparoscopically in most other countries. In Sri Lanka, CAPD is being utilized increasingly[3,4]. CAPD has gained more popularity among patients, caregivers and healthcare personnel with appropriate counselling and training[3].

Peritoneal dialysis is the preferred mode for motivated patients and patients with significant co-morbidities such as severe cardiac illness, widespread peripheral and central venous disease, and peripheral arterial disease[5]. For community peritoneal dialysis, it is important to provide them with safe, reliable, and trouble-free permanent access to the peritoneum. Modern CAPD catheters are capable of providing the above requirements.

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A variety of CAPD catheters are available in different sizes in modern healthcare facilities. The size and the shape of the catheter to be inserted depend on the physique of the patient's abdomen. The largest possible size should be used as it provides better inflow and outflow of the dialysate as well as better long term patency.

Insertion of CAPD catheter is performed by open, blind or laparoscopic methods.

At our institute, the CAPD programme was started recently within the paediatric and adult nephrology units. We use laparoscopy for the implantation of the CAPD catheter. Although it is performed under general anaesthesia unlike the blind technique, it has several advantages. Being a minimally invasive procedure, post-operative pain is minimal. Loops of the small bowel and large bowel can be moved away from the pelvis and space for the tip of the catheter can be created. The catheter is placed in the pelvis under direct vision. Since all the steps are done with direct vision, bleeding, bowel and bladder injuries could be minimized[7]. This study is aimed to analyze the initial outcome and safety of the technique.

Methodology

All the patients referred to the surgical unit for CAPD catheter insertion were included in this study. This series describes the catheter implants done from July 2020 to February 2021. First, the patient and guardian/caregiver were counselled. Informed written consent was taken from the patient or the guardian after excluding contraindications [Table 1]. One patient was excluded as he had extensive adhesions due to multiple laparotomies. Home visits were done to make sure that there is adequate infrastructure and advice was given for further modifications.

We commonly use standard, double cuff Tenckhoff catheters with either straight or coiled tips [Figure 1]. The catheter has four parts: extra-abdominal, subcutaneous, transmural, and intra-abdominal.

A micro-enema was inserted a few hours before the operation. This manoeuvre helps to get rid of excess solid faeces in the large bowel and thereby enhances the handling ease of the large intestine during insertion [5].

The exit site was marked in the anterior abdominal wall above or below the belt line depending on the patient's stature. In addition, the subcutaneous tract and entry point were also surface marked [Figure 2].

In the technique described in the literature, once the pneumoperitoneum is created a laparoscopic port sufficiently large enough [7mm] to pass the CAPD catheter is tunnelled into the peritoneum from the exit site or in between. There are no suitable ports available at our institution for this purpose; it is impossible to pass the catheter through a 5 mm port and the 10 mm port is too large to be used as described in the standard technique. Hense the modified technique had to be adapted for laparoscopic implantation of CAPD.

The patient was placed supine on the table with hands-on on either side. The pneumoperitoneum was created using either an open technique or using Veress needle. Two 5mm laparoscopic ports were placed right side of the midline. These ports were placed within 5cm of the level of the umbilicus. Care was taken to avoid the proposed incision if a future transplant was planned. A 30-degree telescope was used for the visualization. Either port could be used as the camera port or instrument port.

One to two cm above the apex of the subcutaneous loop, a transverse incision was made to accommodate a 10 mm port. Then subcutaneous tissue was dissected up to the apex of the loop. Using a sharp trochar a 10 mm port was advanced along the medial half of the loop to the entry point in the midline. The linea alba was pierced by rotational movements of trochar both clockwise and anticlockwise. However, care was taken not to pass the whole trochar through the abdominal wall. An instrument via the other port was used to support the abdominal wall. The entry of trochar to the peritoneum was visualized through the laparoscope. Once the tip of the port traverses the parietal peritoneum, the trochar was withdrawn while keeping the port pushed against the abdominal wall so that tip of the port remains inside the peritoneum.

In the meantime, the catheter was prepared by soaking both the cuffs in normal saline. The tip of the catheter was grasped by a Marylands forceps and advanced through a 10 mm port. Once the catheter entered the peritoneal cavity, it was grasped by another instrument and the Marylands forceps was withdrawn. The catheter was pulled further into the peritoneal cavity by the second instrument. This was done until the deep cuff was partially seen through the peritoneum. At this point, the 10 mm port was withdrawn.

This phase can be carried out using a 7 mm port which allows the free passage of the catheter with its cuff. We use this modified technique since we do not have a suitable 7 mm port]

The head end of the patient table was lowered, and the bowel is allowed to fall into the upper abdomen. This was facilitated by bowel grasping forceps via the second port. Then the tip of the catheter or the curled part was grasped and placed in a recto-vesical or recto-vaginal pouch in the pelvis.

A 5 mm trocar was inserted from the entry site of the 10 mm port. It was advanced infero-laterally following the lateral half of the marked loop. A tiny incision was made at the exit site and the tip of the trochar was taken out. A 5mm port was advanced retrogradely over the trochar, and trochar was withdrawn. The distal end of the catheter was fed into the 5 mm port as much as possible. The port was then withdrawn. The superficial cuff should be placed 2 cm away from the exit site [Figure 4].

After ensuring that the catheter tip was properly placed in the pelvis and the deep cuff was just external to the peritoneum, pneumoperitoneum was reversed, and ports are withdrawn under direct vision. The catheter was anchored to the skin in selected cases to prevent it from being pulled out during the early postoperative period. The incisions were closed subcuticular, and local anaesthetic infiltrated. Finally, a low volume dialysis cycle was carried out on the operating table. The position of the catheter was confirmed later by an abdominal X-ray[6] [Figure 5].

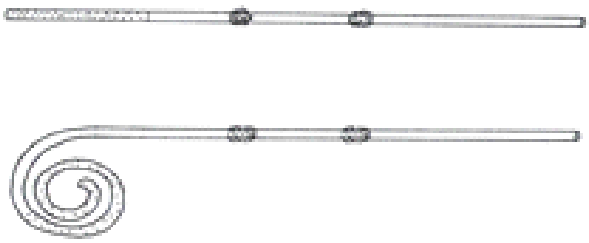

Figure 1. Common configurations of CAPD catheters

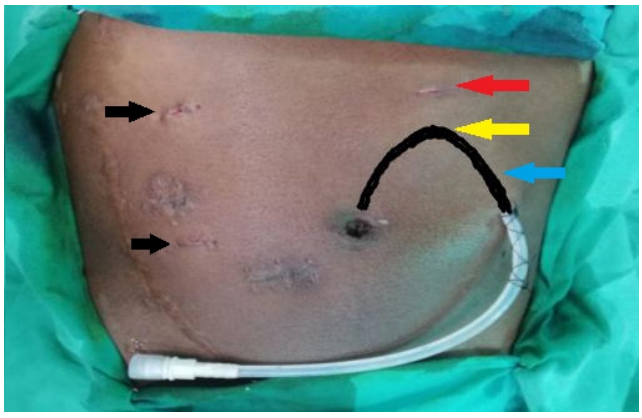

Figure 2. Port sites and subcutaneous loop is marked

Red Arrow : 10 mm port

Yellow Arrow: Subcutaneous loop

Blue Arrow : Superficial cuff

Black Arrows: 5 mm ports

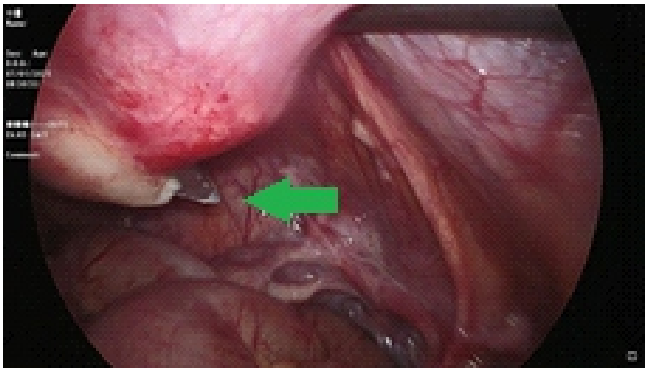

Figure 3. Only tip of 10mm trochar was inserted

Figure 4. End of catheter was retrogradely inserted in to a 5 mm port

Figure 5. X-ray confirming the position of the catheter

Results

A total number of 13 catheters were inserted in 8 patients, the details of whom are summarised in Table 2. The youngest age at insertion was 2 years while the oldest was 61 years. The mean age was 16 years. The majority of patients were females [n=10]. We used 4 different sizes of catheters depending on the body habitus of patients. All the procedures were done under general anaesthesia. Postoperative pain was minimal and was managed with simple oral analgesics. The majority of patients [n=11] had a trouble-free procedure. Two patients developed complications, namely cuff extrusion and catheter displacement.

Patient number 5 pulled her catheter out accidentally, resulting in superficial cuff extrusion. She developed exit site infection. Ultimately the catheter was removed after a month.

Patient number 3 experienced difficult dialysis after 3 months. An abdominal X-ray showed that the catheter was displaced to the upper abdomen. This is the commonest complication associated with CAPD lines [7]. She underwent a laparoscopy. It revealed that the omentum was wrapped around the catheter causing an obstruction. The omentum was freed, and the catheter was repositioned in the pelvis. She did not have further complications.

Discussion

CAPD is well established among renal patients who are being dialyzed. The principal advantages of PD are that it is home-based treatment, vascular access is not required, there is less cardiovascular stress in patients with poor cardiac function and quality of life may be better for many older patients [5]. The catheters are placed in the peritoneum under strict aseptic conditions by one of three techniques, open, blind or laparoscopic.

The efficacy and safety of laparoscopic and open insertion of PD catheters have been studied in both randomized and non-randomized studies. Although earlier studies showed that there is no significant difference, recent studies are in favour of the laparoscopic technique. The laparoscopic technique is associated with higher one-year catheter survival and less migration, which would be clinically relevant [9]. Further refining of the laparoscopic method and wider incorporation of the technique will help in improving patient outcomes [10].

Being minimally invasive, the laparoscopic procedure is associated with minimum peri-operative pain. This is an added advantage when managing children with ESRF. The catheter can be placed in the pelvis after moving the bowel away from the pelvic cavity. However, it has to be done under general anaesthesia.

Table 1. Exclusion criteria [contraindications] for CAPD catheter insertion

Absolute contraindications	• Extensive intra-abdominal adhesions that limit dialysate flow
	• Sepsis of the anterior abdominal wall
	• Encapsulating peritoneal sclerosis
	• Surgically uncorrectable mechanical defects
Relative contraindications	• Fresh intra-abdominal foreign bodies [4-month wait after abdominal vascular prosthesis, recent ventricular-peritoneal shunts]
	• Peritoneal leaks
	• Inflammatory, ischaemic bowel disease or frequent episodes of diverticulitis
	• Large polycystic kidneys
	• Stomas

Table 2. Details of patients who underwent laparoscopic CAPD insertion at Teaching Hospital, Peradeniya. [GA = General Anaesthesia]

Patient ID	Age	Gender	Anaesthesia	Catheter size	Entry site	Complications
1	8y	F	GA	37	Infra-umbilical	Nil
2	14y	F	GA	37	Infra-umbilical	Nil
3	15y	F	GA	62	Infra-umbilical	Obstruction, displacement
4	31y	F	GA	62	Infra-umbilical	Nil
5	2y	F	GA	32	Supra-umbilical	Cuff extrusion
6	61y	F	GA	65	Infra-umbilical	Nil
7	16y	F	GA	37	Infra-umbilical	Nil
8	9y	M	GA	62	Supra-umbilical	Nil
9	2y 3m	F	GA	32	Supra-umbilical	Nil
10	8y	F	GA	37	Infra-umbilical	Nil
11	17y	M	GA	65	Infra-umbilical	Nil
12	11y	F	GA	62	Infra-umbilical	Nil
13	15y	M	GA	65	Infra-umbilical	Nil

In Sri Lanka, CAPD is done only in tertiary hospitals where there are renal units. All these centres have laparoscopic facilities. Even though equipment availability is limited, this article highlights that the standard technique can be modified to resource-poor settings with success. All the patients tolerated the procedure well. Only oral simple analgesics were required for pain relief.

Early complications of CAPD insertion include haemorrhage, perforated viscus, wound infection, catheter obstruction and displacement, and dialysate leakage. Late complications are exit-site and tunnel infections, subcutaneous cuff extrusion, obstruction, peri-catheter leaks and hernia, and encapsulated peritoneal sclerosis. In this series, external cuff extrusion and migration were the complications encountered so far. After that, we anchored the catheter to the skin temporarily in children until the superficial cuff is fibrosed although it is not advocated in the literature.

Conclusion

Laparoscopy is a safe, reliable mode of CAPD catheter implantation. It is feasible to achieve good results even in low resource settings with technical modifications. However, it should be further evaluated with larger studies although early results are encouraging.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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