

PERITONEAL DIALYSIS CATHETER PLACEMENT BY OPEN SURGICAL TECHNIQUE: NIKDU EXPERIENCE

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Abstract:

Objective: *To determine the outcome and complications of CAPD catheter implanted by open surgical technique for peritoneal dialysis.*

Methods: *In this prospective study peritoneal dialysis catheter (PDC) for continuous ambulatory peritoneal dialysis was inserted into the abdominal cavity using an open surgical approach. We described our experience of open surgical minimal invasive technique of CAPD catheterization from July 2012 to June 2015. Total 40 catheters were inserted successfully. Patients were followed up for a variable period of 3-36 months.*

Results: *In this study common indications of CAPD catheter insertion were CKD-5 due to diabetic nephropathy, chronic glomerulonephritis, and hypertensive nephrosclerosis. Common catheter related complications were peritonitis, hypokalaemia, exit site infection, catheter malfunction. Late peritonitis remains the major drawback of PD treatment, with the need of temporary or permanent changeover to the HD treatment in 10% of the patients.*

Conclusion: *Enrichment of the physician's interest and experience, along with a multidisciplinary approach to outline the optimal strategy of PD-catheter insertion and management of complications may improve technique and patients' survival and decrease the morbidity.*

Key words: *Peritoneal dialysis, Catheter, Complications, Peritonitis, Insertion techniques.*

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Introduction:

Richard Ruben was the first to use peritoneal dialysis (PD) successfully in 1959 in a patient with end-stage renal disease (ESRD) for 6 months[1]. In 1968, Henry Tenckhoff developed the indwelling peritoneal catheter, which was inserted following an open surgical technique. In 1970, he reported about 16 patients being treated with the self-PD for up to 4 years[2]. The PD was popularized by Popovich and Moncrief who developed continuous ambulatory peritoneal dialysis (CAPD)[3]. The introduction of the percutaneous[4] and later the laparoscopic technique[5] was a major step towards the implantation of PD catheters. In 2004, the National End-Stage Renal Disease program in the USA reported that 25,765 patients used CAPD, accounting for 8% of the prevalent dialysis population[6]. In Europe, the PD rates in the prevalent patients were higher, whereas in

the UK, 35% of the ESRD population was on PD[7]. In the Netherlands, during the last few years, the PD rate varied from 26% to 32% among all the dialysis patients[8]. Several advantages of PD over haemodialysis (HD) have been described, including the quality of life due to superior patient mobility and independence, its simplicity in use, along with the clinical advantages like the maintenance of residual renal function and lower mortality in the first years after the beginning of PD. A significant disadvantage is the poor blood pressure control due to fluid overload[9].

Several techniques and modifications have been described for the insertion of the catheter into the abdominal cavity. Though laparoscopy and percutaneous technique is gradually gaining popularity, open surgical technique is still a viable and valuable option for CAPD catheter insertion. Laparoscopy and Fluoroscopy is not available everywhere in our country. Peritoneal dialysis

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catheter can be safely inserted by open surgical technique with less technical support and modern facilities. In percutaneous implantation, there is risk of bowel perforation and laparoscopic implantation there is more chance of dialysate leakage. This can be minimized by open surgical technique. We describe our currently available catheter insertion technique with its early and late complications.

NIKDU is one of the tertiary care teaching hospitals for patients of kidney diseases. This 150 bedded govt. hospital provides all modalities of RRT at a subsidized rate. Acute and chronic HD are being done round the clock. At present one hundred ten (110) ESRD patients are in chronic HD program and in every month around 1000-1200 sessions of HD done for AKI and CKD patients. Here, CAPD started from 2005. PD utilization was sporadic upto 2011. Most of the patients were of paediatric age group. An organized PD-unit for adults started functioning from 2012 and up to June 2015 total 40 patients were enrolled in this program.

Materials and Methods:

This longitudinal prospective study was carried out in the Dept. of Urology of National Institute of Kidney diseases and Urology between July 2012 to June 2015. Patients with CKD stage 4 and 5 attending to Nephrology OPD were referred to RP for Renal replacement therapy counseling. If patient choose CAPD as RRT, they were referred to PD unit. If PD unit approves, they are admitted for catheter placement. Then training of patients and relatives started. Catheters were placed by surgical team of PD unit. Up to June 2015, total 48 patients were enrolled in the programme. Among them, CAPD catheter was inserted in 40 patients. Preoperative preparation for peritoneal catheter insertion is taken.

We ensured that patient requires peritoneal catheter and understands principles of catheter care.

Discussion with patient was done where he would like the exit site placed. Enema was given at night. Prophylactic antibiotic was given approximately 1 hour before catheter insertion. Patient must empty their bladder immediately before procedure. Left or right paramedian incision was made. Skin and subcutaneous tissue was cut. Anterior layer of rectus sheath was cut along the line of incision. Rectus muscle was split. Posterior layer of rectus sheath was elevated and purse sting suture was applied. Then a small niche was made in peritoneum. Omentectomy was done if needed.

Catheter tip was placed in pelvic cavity. Purse sting suture was tightened. A subcutaneous tunnel was created up to opposite site of incision. Other end of catheter was taken out through that wound. Rectus muscle was apposed. Anterior rectus and skin was closed in layers. The functioning of the catheter was tested by filling the abdomen with 100 cc saline and the entrance site is checked for leakage. The saline is allowed to drain and is inspected for evidence of haemoperitoneum and faecal contamination. PD was started 3 weeks following the implantation of catheter. Around 70% patients do 3 exchange/day with 2 litre fluid-bag (Bextar). In 2/3rd of the patients exchange procedure done with the help of close relatives/caregivers. Patients were followed up every month for one year and three monthly thereafter. Records were kept about catheter related complication and vital parameters.



Fig.-1: Curled Tenckhoff PD catheter



Fig.-2: Steps of catheter insertion



Fig.-3: Steps of catheter insertion



Fig.-4: Steps of catheter insertion

Results:

Total 40 patients underwent CAPD catheter placement. Mean age was 60.1 ± 15.7 . Numbers of male patient were 25 (62.5%) and female patient were 15 (37.5%). Aetiology of ESRD of those patients is summarized in table I.

Table-I
Aetiology of ESRD (n=40)

Aetiology	No	%
Diabetic Nephropathy	22	55%
Chronic glomerulonephritis	10	25%
Hypertensive Nephrosclerosis	4	10%
Obstructive uropathy	2	5%
Others	2	5%

CKD due to Diabetic Nephropathy was the commonest indication of CAPD catheter insertion. Table II showed catheter insertion related and other complications. Most

common complication was peritonitis followed by hypokalaemia and hypoalbuminaemia. The common complications of catheter placement were exit site infection, dialysate leakage, catheter tip migration, infections, omental wrapping, and catheter drainage failure. Bleeding and hematoma occurred in a few cases. There was no bowel or bladder perforation. Table III shows Outcome of Peritoneal dialysis. Catheter survival was 90% and 72% at one and two years respectively

Table -II
Complications catheter insertion (n=40)

Complication	No	%
Peritonitis	20	50%
Hypokalaemia	16	40%
Hypoalbuminemia	16	40%
Exit Site infection	4	10%
Catheter malfunction	3	7.5%
Catheter tip migration	3	7.5%
Omental wrapping	2	5%
Ultrafiltration failure	2	5%
Leakage	2	5%
Haemoperitoneum	1	2.5%
Cuff extrusion	1	2.5%

Table -III
Outcome of Peritoneal dialysis (after 3 months)

Variables	Pre-CAPD	Post- CAPD	P-Value
Haemoglobin (gm/dl)	8.9	10.1	.041
S.Creatinine (mg/dl)	12.1	6.2	.038
Serum Sodium (mmol/L)	138	135	.692
Serum Potassium (mmol/L)	5.7	3.6	.043
Serum bicarbonate	16	22	.039
Serum albumin	2.8	3.0	.512

Discussion:

CAPD is a form of renal replacement therapy for patients with end stage kidney disease. It is specially suitable for bed ridden patients and patients of remote area. Endeavors to replace some of the functions of the kidney

such as, removing waste products, removing excess fluid, correcting acid/base imbalances, correcting electrolyte imbalances. It is a high maintenance form of therapy requiring meticulous compliance and effort on part of patient. Continuous Ambulatory Peritoneal Dialysis (CAPD) has gained popularity in the recent years due to overall improvement in the patients well being, technical improvement, better hemodynamic stability, absence of the need to vascular access and decline in peritonitis[10]. Causes of underutilization of PD are reduced enrollment of chronic kidney disease patients to PD due to inadequate physician education, lack of enthusiasm, inadequate patient education before end-stage renal disease, lack of infrastructure to sustain PD program, financial disincentive. Other factors are increased loss/technique failure are due to PD-related infections, ultra filtration/membrane failure, mechanical complications of catheter, inadequate dialysis, small centre size, psychosocial reasons, lack of family support, patient burn-out, relocation, difficulty in transportation[11]. Strategies to improve the growth of a PD program are Pre-ESRD education program for patients and families by physician education and training, improved patient training, psychosocial counselling for patients, dietary counselling for patients. Strategies to preserve residual renal functions are avoiding nephrotoxins & use of ACEIs or ARBs[12]. In our study aetiology of ESRD was Diabetic Nephropathy, Chronic glomerulonephritis, Hypertensive Nephrosclerosis, Obstructive uropathy which is consistent with other studies[11]. In our study, common catheter related complications are peritonitis, exit site infection, catheter malfunction, catheter tip migration, omental wrapping, leakage, haemoperitoneum, which is consistent with others[9,12].

Now a days laparoscopic and percutaneous catheter placement is becoming popular[13]. Catheter survival is comparable in both groups. The peritonitis rate was similar in both the groups[14]. According to some studies both the open surgical and laparoscopic techniques can be used in patients who receive a primary PD catheter and have no history of previous abdominal surgery, which could lead to PD catheter malfunction[15]. When abdominal surgery has been performed, a laparoscopic technique is to be preferred, with the advantage of additional adhesiolysis. Also, the cause of persistent PD catheter malfunctioning can be elucidated with a diagnostic laparoscopy, and if possible, solved under the same conditions. Percutaneous placement is particularly well suited for ailing patients, who cannot

tolerate general anaesthesia[16]. Complications after PD catheter placement are defined as those occurring early (<30 days) or late (>30 days), after surgery. Literally, Bowel perforation occurs rarely in 1% of the patients and is usually initiated during the entry into the abdominal cavity or when advancing the catheter with the stylet into the lower abdomen. Surgical exploration is mandatory with the repair of the perforation and removal of the catheter. Bleeding is rarely a significant problem after catheter implantation and usually occurs at the exit site. Blood may be present initially in the effluent drained, owing to the trauma of insertion, but the drainage should return to normal within a few days. Manual pressure or additional suturing can stop persistent bleeding. Wound infection is uncommon and usually antibiotics are sufficient to treat superficial wound infections. The outflow failure may be due to multiple causes, including clots or fibrin in the catheter, kink in the subcutaneous tunnel and placement of the catheter in the omentum, development of omental wrap or adhesions in the abdomen. Obstructed catheters may be forcefully irrigated by saline or urokinase. As an alternative, a stiff guide wire may be advanced into the catheter under direct fluoroscopic control[17].

Malpositioning of the catheter into the upper abdomen usually causes pain and sometimes outflow failure. A plain abdominal radiological examination, eventually with a fluoroscopic contrast study, can reveal this problem. Catheter repositioning with a stiff guide wire or forceps can be successful and causes little morbidity. In this technique, a device such as a malleable rod, guide wire, cannula or tip-deflecting wire, is inserted into the catheter and is used to redirect or reposition the catheter tip in a more favourable position for PD. Laparoscopic repositioning with catheter fixation into the lower abdomen may be the ultimate therapy to solve this problem. Prevention of catheter malposition remains the major goal and can be adjusted by a laparoscopic insertion technique and correct measurement of catheter length.

Early peritonitis with catheter placement may be a sign of a poor surgical technique. If the peritoneal fluid becomes cloudy, associated with pain, then the dialysate should be cultured and appropriate antibiotics must be administered. Eradication of nasal staphylococcus carriers by mupirocin and antibiotic prophylaxis with vancomycin may substantially decrease the rate of early peritonitis. Late complications (>30 days) include exit-site infection, tunnel infection,

cuff protrusion, outflow failure, and dialysate leaks or hernias. Irritation and even cuff protrusion can occur when the exit is placed directly beneath the belt line. Superficial cuffs placed close to the skin may be prone to extrusion and infection. An upward-directed site may collect fluid, leading to an increased incidence of infection. Catheter exchange is indicated in most instances and can be performed in one session with the emphasis on the fact to choose a different exit site through the skin for the new catheter.

Patients blood Haemoglobin, S.Creatinine, Serum Sodium, Serum Potassium, Serum bicarbonate, serum albumin were assessed before and after peritoneal dialysis. Statistically significant improvement of parameters were found, which is consistent with other studies[6,8,13].

Conclusion:

A successful peritoneal dialysis program is dependent on the proper placement of the permanent PD catheters. The advantage of the open surgical technique is based on its simplicity. Surgical residents who are familiar with opening the abdomen can perform the procedure. So, open surgical technique is still a viable and valuable option for CAPD catheter insertion. Patients must be well trained in self care and the medical and nursing staff must pay attention to the implantation technique, the construction of the tunnel and exit side and the care of catheter. In NIKDU, our peritoneal dialysis catheter implantation technique and outcome is satisfactory and comparable to other study. Open technique is simple, safe, cost effective, easily can be performed in any hospital with minimum facility in our country. Further study in large scale comparing with other methods of catheter implantation should be done in future.

Conflict of Interest: None declared

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Abbreviations:

CAPD : Continuous Ambulatory Peritoneal Dialysis

CKD : Chronic Kidney Disease

ESRD : End Stage Renal Disease