Original Articles

PROLONGED PERITONEAL DIALYSIS IN ACUTE RENAL FAILURE USING TENCKHOFF CATHETER

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ABSTRACT

The changing spectrum of acute renal failure (ARF), in children has necessitated the support by peritoneal dialysis (PD) for a longer duration. Use of permanent catheters like Tenckhoff catheter can overcome many of the problems associated with the prolonged use of temporary catheters. Thirty one infants and children with mean (SD) age of 49.3(39.4) months were subjected to PD using surgically placed Tenckhoff catheter. Catheters were put under general anesthesia in 28 patients and under local anesthesia in 3 patients. The technique of catheter insertion has been described in detail. All the catheters, except one, functioned immediately after the insertion. There was no intraperitoneal hemorrhage, dialysate leak or poor catheter drainage. The mean (SD) duration of catheter placement for PD was 11.3 (16.1) days (range 2-90 days). There were 6 episodes of infections (19.2%), peritonitis in 4 (12.8%) and exit site infection in 2 (6.4%). In 2 patients, infection episodes did not respond to antibiotics and the catheter had to be removed. There was no mortality due to complications of PD procedure and catheter insertion. Acute intermittent PD using surgically placed Tenckoff catheter was done safely for prolonged duration and also had additional advantages of good catheter drainage and no intraperitoneal hemorrhage.

Key words: *Peritoneal dialysis catheter, Peritonitis, Intraperitoneal hemorrhage.*

Dialytic support for acute renal failure (ARF) patient is needed till the kidneys recover, the duration of which can not be predicted and may be prolonged. Peritoneal dialysis (PD) is a convenient, simple and safe mode of dialysis. It is also sufficient to control uremia in most cases and is a popular mode of dialysis in children(1,2). Most of the centres in India use temporary catheters for PD(3,4). The incidence of peritonitis increases with the use of temporary catheter for longer periods, however this can be decreased by putting a fresh catheter through a new site every 48 hours(2,5). Nevertheless it is quite troublesome and traumatic for the child. Inraperitoneal hemorrhage and perforation of viscus by the trocar have also been reported(5). Poor catheter drainage is another irritant, requiring frequent manipulations. The above problems can be overcome with the use of permanent catheter placed in peritoneum under direct vision. We describe our experience with the perito-

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neal dialysis using surgically placed Tenckhoff catheter in children with ARF.

Material and Methods

Thirty one infants and children with ARF seen between January 1989 to June 1992 were subjected to PD using surgically placed Tenckhoff catheter. The indications of dialysis in addition to uremia (all cases) were fluid overload (7 cases), hyperkalemia (4 cases) acidosis (3 cases) and uremic encephalopathy (2 cases).

Technique of Catheter Insertion

Children were kept fasting for 4 hours prior to the procedure. Catheter was put under general anesthesia using inravenous ketamine. The patient was given a single dose of Gentamycin 1-2 mg/kg intravenously an hour before insertion of the catheter. In 3 cases, the procedure was performed under local anesthesia using local skin infiltration with 1% xylocaine and inramuscular pentazocin and phenergan. A midline vertical incision of 3-4 cm was given and the peritoneum opened protecting the underlying bowel. A subcutaneous tunnel of 5 cm was made by the side of incision in a horizontal direction. The Tenckhoff catheter was inserted from the skin traversing the tunnel and inserted in the peritoneal cavity with its tip directed towards pelvis (*Fig. 1a*). The catheter was so placed that one of the dacron cuff lies at the peritoneal end and the other just beneath its exit from the subcutaneous tunnel (*Fig. 1b*). Care was taken to reposit the bowels inside before closing the peritoneum by a purse string suture around the catheter, so as to make it water tight. About 20 ml of saline was injected through the catheter and attempt made to suck out the same so as to check the water tightness as well as the patency of the catheter before closing the wound in two layers.

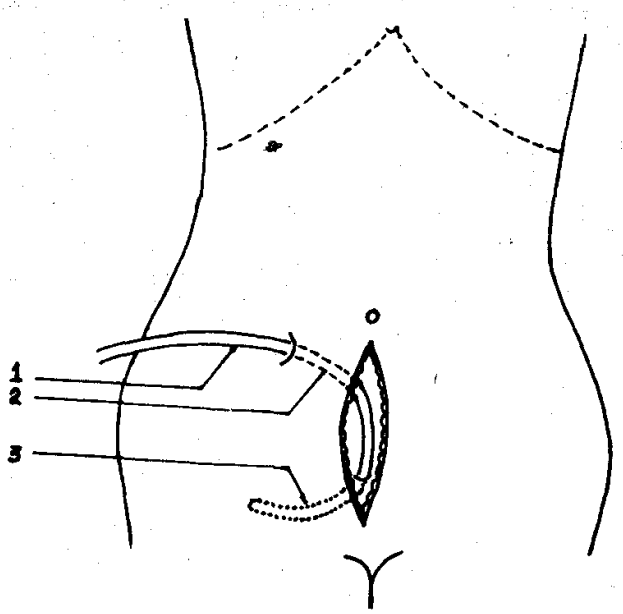

Fig. 1a. Site of the incision prior to insertion of the catheter.

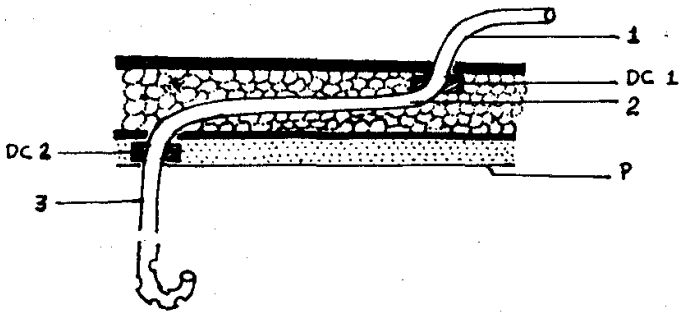

Fig. 1b. Placement of the Tenckhoff catheter (1) extra abdominal part of catheter, (2) catheter segment in sub-cutaneous tunnel (3) intraperitaal part of catheter, (P) peritoneum, (DC_1) dacron cuff beneath the exist from subcutaneous tunnel, (DC_2) Dacron cuff just above the peritoneum.

PD was started immediately after the catheter insertion and was continued for 24 hours. The initial volume used was 10 ml/kg per exchange with a dwell time of 15 minutes. The CAPD catheter was capped after this and thereafter daily intermittent perito-

neal dialysis was carried out for 10 exchanges using a volume of 20-30 ml/kg. The CAPD catheter was capped every day after completion of the peritoneal dialysis. Heparin in the dose of 1000 units per litre was added to the fluid during intermittent peritoneal dialysis and before capping the catheter 10,000 units of undiluted heparin (2 ml of 1 : 5000 units) was instilled in the catheter. During episodes of peritonitis the dose of heparin was increased to 2000 units per litre. The dialysate used contained acetate and had standard dextrose concentration of 1.7%. A cell count was performed in the dialysate every 48-72 h and also whenever fever, abdominal pain, tenderness or turbid dialysate was present. Peritonitis was defined when 2 of following 3 were present: abdominal tenderness, dialysate with more than 100 cells/cu mm with 50% or more of the cells being polymorphonuclear leukocytes and a positive effluent culture. The diagnosis of exit site infection was based on pericatheter redness or exudate with or without positive culture. If the patient was diagnosed to have peritonitis after sending the effluent for cell count, Gram's stain and culture, parenteral cloxacillin (250-500 mg 6 hourly) and intraperitoneal gentamicin (8 mg/litre) was started pending the results following which the antibiotics were changed according to the sensitivity pattern. Antibiotics were continued for a minimum of 2 weeks. Exit site infections were treated initially with cloxacillin and later according to the results of the exit site swab culture.

When PD was no longer required, the catheter was removed under general anesthesia.

Results

The mean (SD) age of infants and children was 49.3 (39.4) months ranging from 1.5 months to 144 months. Of 31 children, 24 were males and 7 females. The underlying cause of ARF was hemolytic uremic syndrome (HUS) (11 cases), glomerulonephritis (7 cases), gastroenteritis (5 cases), obstructive uropathy (3 cases) and post-operative renal failure (5 cases). Twenty six of 31 children (85.9%) were oliguric (urine output less than 1.0 ml/kg/h). The mean (SD) predialysis level of serum creatinine was 5.8 (1.8) mg/dl (range 3.4-7.2 mg/dl).

The Tenckhoff catheter was kept for 11.3 (16.1) days ranging from 2 to 90 days. All the catheters except one functioned immediately after the insertion. A total of 33 catheters were put in; in 2 patients fresh catheters had to be introduced as there was malfunction because of technical problem in one and blockade of the catheter due to peritonitis in the other. None of the children had intraperitoneal hemorrhage and dialysate leak. There were 6 episodes of infection (19.2%), peritonitis in 4 (12.8%) and exit site infection in 2 (6.4%). The incidence of peritonitis and exit site infection per patient day was 0.011 and 0.0057, respectively. The organisms isolated from dialysate were *E. coli, Klebsiella pneumoniae* and *Pseudomonas aeuroginosa*, one each in 3 episodes and the rest 3 episodes were sterile on culture. The peritonitis were managed by intraperitoneal and systemic antibiotics only. In one case of peritonitis, the catheter had to be removed. Of the 2 cases of exit site infection, in one, catheter had to be removed and the other one responded to systemic antibiotics.

Of 31 patients, 17 recovered (54.9%) and 14 died (45.1%). Nine patients died while they were on treatment; this included 5 patients of HUS and 4 of post operative ARF. Three patients of HUS and 2 of crescentic glomerulonephritis, who were doing well on PD died when they had to discontinue PD due to financial constraints. The mean (SD) duration of catheter placement

in these 5 patients was 19.2 (34.4) days ranging from 5 to 90 days. None of the deaths were due to complications of PD procedure and catheter insertion.

On followup of the patients who recovered, abdominal wound site was normal.

Discussion

The spectrum of ARF has changed over the last two decades. Gastroenteritis was earlier the leading cause of ARF and the dialytic support required was also of shorter duration(4,6). Choudhry, *et al.*(3) in their experience of 58 children over 9 years had to do PD twice in 11 children and thrice in 3 children, in rest only one session of dialysis was required. However, at present, HUS, post operative and multiple organ system failure are the important causes of ARF in children(7,8). HUS comprised 34% cases of ARF in children, with majority of them having oligoanuria and patchy or diffuse cortical necrosis(7). Children under these circumstances have to be supported by PD for a longer duration. Day and White(5) used temporary catheter which was kept *in situ* and the infection rate was 42%. All patients who were dialysed for more than 11 days became infected. Leigh(9) experienced no infection before the 3rd day and infection rate of 26% after 1 week. Thus, the length of PD is a major factor for higher incidence of infection. The other way to decrease the infection rate with temporary catheters is repeated punctures, which is quite troublesome and traumatic for the child(2,5). Hence, the need of catheters which can be kept for prolonged period.

Palmer, *et al.*(10) used silastic, which is more biocompatible and less irritant to develop the first permanent catheter. Tenckhoff(11) modified the catheter and added dacron cuffs. These cuffs besides functioning as stabilizer also create a barrier against bacterial invasion of the peritoneal cavity. These permanent catheters can be kept for longer periods and are meant for chronic use. The Tenckhoff catheter can be placed in the peritoneum either by percutaneous method using trocar or by surgical method. Percutaneous placement is a quick and convenient procedure, but it has the disadvantages of bleeding, poor flow, dialysate leak and viscus perforation. Surgical technique allows direct visualisation of the peritoneum, good hemostasis and has the advantage of good immediate function(2). We found surgical placement of the Tenckhoff catheter quite satisfactory. All the catheters except one functioned immediately after insertion. We did not encounter any problems in the form of intraperitoneal hemorrhage or viscus perforation as observed by some of the workers using temporary catheter(5). Poor catheter drainage, with temporary catheter, either due to blockade or displacement of the catheter by the movements of the child is a common problem requiring manipulation. In a recent study, Reznik, *et al.*(8) noted this problem in 15 of 50 patients. We didn't encounter any such problem. Subcutaneous tunnel and dacron cuffs provide stabilization to the catheter and prevent the displacement.

Infection rate in the present study was 19.2% which is significantly less than that observed by Day and White(5). However, the infection episode per patient day is almost similar to that observed by Reznik *et al.*(8). We feel that this infection rate can be brought down further by using more stringent and strict aseptic measures during the PD.

With the Tenckhoff *in situ*, PD can be done with the either intermittent peritoneal dialysis regimen or continuous ambulatory peritoneal dialysis (CAPD) regimen if CAPD bags are available(2).

The advantages of Tenckhoff catheter including good catheter drainage, low infection rate, avoidance of repeated punctures, however, must be weighed in an individual patient against the risks and delays associated with the procedure which requires general anesthesia(2). For unstable infants surgical placement at the bedside using local anesthesia can be readily accomplished(12). We have also put the catheter under local anesthesia in 3 patients without any problems. However, in an emergency one can always put a temporary catheter and start the PD, and depending upon the requirement, a permanent catheter can be put in subsequently. The Tenckhoff catheter costs almost 5 times (Rs. 2000 *vs* Rs. 400) more than a single acute peritoneal dialysis catheter. However, maintaining an acute temporary catheter in long periods is difficult because of obstruction and specially when the dialysis is done intermittently. This necessitates several insertions of acute catheters over a short period which not only adds to the cost but also increases the incidence of peritonitis and chances of possible trauma to other intraperitoneal structures.

We conclude that surgically placed Tenckhoff catheter offers significant advantages in conducting intermittent peritoneal dialysis in the management of ARF in children.

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