An Initial Experience of Continuous Peritoneal Dialysis in Children in the Armed Forces

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Abstract

Background: Continuous peritoneal dialysis (CPD) is a modality of renal replacement therapy in children with renal failure. A retrospective study analysis of CPD data over four years at our center was carried out.

Methods: Ten children with renal failure on CPD were included. Depending on the supply, peritoneal dialysis (PD) fluids of two different brands were used in the same patients over time. The patient months of CPD were divided into two groups based on the brand of PD fluid used. The rates of complications with the two different fluid brands were compared.

Results: The mean age of our patients was 8.8 ± 2.51 years (range 4 – 13), with a total of 141 patient months of CPD. The mean follow up period was 13.6 months (range 1– 48). The commonest underlying renal pathology was focal segmental glomerulosclerosis in 30%, followed by crescentic glomerulonephritis in 20%. Peritonitis rate was 0.48 episodes per patient year. Patients in Group I had one episode of peritonitis per 53.5 patient months and Group II had one episode per 7.25 patient months ($p= 0.021$, relative risk of 7.3). Patients in Group I had one episode of hypertensive encephalopathy per 107 patient months and Group II had one episode per 4.8 patient months ($p= 0.001$, relative risk of 21.9). On analyzing the outcome, four patients were eventually transplanted, three continued on CPD awaiting a renal transplant, two died and one recovered spontaneously.

Conclusion: CPD is an effective bridge to renal transplant in children with end stage renal disease. The risk of developing peritonitis and hypertensive encephalopathy varied with the brand of fluid used over time in the same set of patients.

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Introduction

The improvement in paediatric health care in the country has seen a change in spectrum of diseases in children, with a shift from infectious diseases to chronic systemic ailments over the last decade. Among these, a significant increase in the number of children with chronic kidney diseases and their enhanced survival has been noted [1]. Children progressing to end stage renal disease (ESRD) or chronic kidney disease (CKD) stage V require renal replacement therapy (RRT) which consists of continuous peritoneal dialysis (CPD), haemodialysis (HD) or a preemptive transplant. CPD is the most commonly used modality of RRT in children with end-stage renal disease (ESRD). The therapy is not available to most children in developing countries due to constraints of availability of trained personnel and cost. There is a paucity of data regarding CPD in children from India and none exists from the Armed Forces. This study is a retrospective analysis of outcome of children treated with CPD over four years at paediatric nephrology unit.

Material and Methods

We retrospectively analyzed the data of 10 children, nine with ESRD and one with class four lupus nephritis who were on CPD at our center over past four years. Peritoneal dialysis (PD) consisted of continuous ambulatory peritoneal dialysis (CAPD) and automated peritoneal dialysis (APD) using Home Choice Cycler (Baxter Healthcare Corporation, USA). During the study period depending upon the supply, PD fluids from two different companies were used for CAPD. The same dialysis prescription was used with either of the two brands of fluids.

All the children were on antihypertensive medications with a target blood pressure below 90th centile for age, height and gender. They also received weekly erythropoietin, vitamin supplements and calcium containing phosphate binders. They were followed up regularly. Adequacy of dialysis was determined by appetite, weight, blood pressure and average ultrafiltrate assessment. Residual renal function contributed less than 10% of the glomerular filtration rate (GFR) in two cases and it was negligible in the remaining since the children were anuric. Monthly blood tests were done to assess the nutritional status and efficacy of dialysis.

The total patient months for children on CPD was divided

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into two groups, based on the brand of PD fluid used in the same set of patients. Complications and the outcome of the patients was studied.

The diagnosis of peritonitis was based on any two of the following criteria; symptoms of peritoneal inflammation; cloudy fluid with a total leukocyte count of more than 100 cells / ? L with more than 50% neutrophils or the presence of organism on gram staining or culture of CPD fluid [2]. Hypertensive encephalopathy was diagnosed in children with stage II hypertension with altered sensorium with or without seizures [3]. The total episodes of adverse outcomes i.e. peritonitis and hypertensive encephalopathy occurring in Group I and II were compared and the relative risk of fluid II vs fluid I was statistically calculated using EPI 6 software.

Results

The average age of patients was 8.8 ± 2.51 years (range 4 – 13), comprising of four girls and six boys. The commonest cause for ESRD was focal segmental glomerulosclerosis(FSGS) as shown in Table 1.

Peritoneal access was obtained using a straight double cuffed Tenckhoff catheter. The average break in period was 5.5 days for the initiation of dialysis following insertion of the catheter and period of hospitalization for training and adjusting the dialysis prescription was around four weeks. The average dwell volume was 40 mL/kg body weight. 1.5% and 2.5% dextrose containing dialysate of concentration was used to obtain satisfactory ultrafiltrates. Children on CAPD were given an average of six exchanges per day of one litre PD fluid by using an alternate short (two hour) and long dwell times (four to six hour) to permit ambulation and avoid wastage of fluid. Additional twice a week APD was given for two children to improve weekly clearance and ultrafiltrate. These children received CPD for a period of 141 patient months. The average duration for CPD was 13.6 months (range 1- 48).

The complications are shown in Table 2. Out of 10 patients, four had six episodes of peritonitis and three had seven episodes of hypertensive encephalopathy. The peritonitis rate was 0.48 episodes per patient year. On comparing the adverse outcomes, group I had one episode of peritonitis per 53.5 patient months while group II had an episode per 7.25 patient months ($p = 0.021$, relative risk of 7.3). Group I had one episode of hypertensive encephalopathy per 107 patient months and group II had one episode per 4.8 patient months ($p = 0.001$, relative risk of 21.9).

Table 1

Renal disease in children on CPD

Aetiology	Patients (%)
Focal segmental glomerulosclerosis	3 (30)
Crescentic glomerulonephritis	2 (20)
Alport's syndrome	1 (10)
Bartter's syndrome	1 (10)
Obstructive uropathy	1 (10)
Lupus nephritis	1 (10)
Haemolytic uremic syndrome	1 (10)

On analyzing the outcome, four children were transplanted successfully and three are continuing on CPD programme awaiting renal transplant (Table 3).

Discussion

CPD is a common modality of managing adult patients with ESRD [4]. CPD is preferred over haemodialysis (HD) in children to avoid the problems of vascular access, anticoagulation and haemodynamic imbalance [5]. In addition, CPD is associated with better control of hypertension and correction of acid-base and fluid imbalances [6]. Despite advances in peritoneal dialysis (PD) systems, peritonitis is a significant clinical problem [7]. The risk factors for peritonitis are often identifiable and one of them is the quality of the PD fluid used. Poor quality fluids are not only 'peritonitogenic' but also ineffective, often resulting in poor control of hypertension. Ideally a "Peritoneal Equilibrium Tests" (PET) and "Dialysis Adequacy Tests" need to be performed regularly in patients on CPD and the dialysis prescription tailored accordingly. Connecting techniques, asepsis and training of patients are the other factors in CPD associated peritonitis.

The complications associated with CPD may be procedure related i.e. infections (peritonitis, tunnel infections, exit site infections) and mechanical problems (catheter occlusions, dislodgement, cuff extrusion, abdominal wall hernias) [8]. The other set of complications are related to the inadequacy of ultrafiltrates and the fluid overload resulting in worsening of preexisting hypertension. In our study the major complications encountered were peritonitis and hypertensive encephalopathy. The peritonitis rate seen was 0.48 episodes per patient year. The North American

Table 2

Complications on continuous peritoneal dialysis

Complication	Number of episodes		p
	Group I*	Group II#	
Peritonitis	2	4	$p = 0.021$
Hypertensive encephalopathy	1	6	$p = 0.001$
Others	1	1	

* Group I: CAPD bags from Baxter

Group II: CAPD bags from J Mitra / Claris

Table 3

Outcome at four years for children on continuous peritoneal dialysis (n=10)

Outcome	Number of children (%)
Transplanted	4 (40)
Died	2 (20)
Off dialysis*	1 (10)
Awaiting transplant (continuing CPD)	3 (30)

* Child with lupus nephritis recovered spontaneously

Pediatric Renal Transplant Cooperative Study (NAPRTCS) database reveals a peritonitis rate of 0.9 episodes per patient year [9]. The only other Indian study reported a rate of 0.58 episodes per patient year [4]. The low incidence of peritonitis in our patients was probably due to pretreatment of patients and their parents with intranasal mupirocin three days prior to catheter insertion, flush before fill technique of PD, use of titanium adaptors between catheter and transfer set, mupirocin application at exit site and intense training of parents on catheter handling.

We could compare the rate of complications between two brands of PD fluids because the supplies of PD fluids were different in the same patients over time. In group II patients the relative risk of developing peritonitis by using fluid II was 7.3 times. One reason could be number of product defects with fluid II bags in the form of leakages and gross contamination. However, the PD fluid bags used by the patients were scrutinized carefully and only those with no apparent defects were used. A bacteriological study of the fluid from sealed bags used in group II patients did not reveal contamination. A possible reason which could have contributed to the increased incidence of infections was incompatibility of the transfer set with the CAPD bags. The other adverse outcome was a higher incidence of hypertensive encephalopathy in group II patients (relative risk 21.9). This may be due to poorer ultrafiltrates with the fluid used in Group II despite the same dialysis prescription. This was supported by signs of weight gain and oedema in children during hospitalization for the hypertensive encephalopathy. However this needs to be studied more objectively with "Dialysis Adequacy Tests". In a similar study by Wong et al, on comparing PD fluids of two different manufacturers, a cause and effect relationship between the occurrence of product defect and peritonitis was suggested [10].

Temporary catheter occlusion seen in two patients was attributable to fecal impaction. Enema relieved the constipation and the blockage. Other complications like peritoneal leak, incisional hernia and haemorrhagic outflow were not seen despite the young age of our patients. This was probably due to gradual increase in dwell volume and a tidal cycling dialysis for the first week after catheter insertion. The virtual absence of mechanical problems are probably related to paramedian insertion of catheter, using double cuffed catheters, performing partial omentectomy in all cases and post operative flushes to prevent occlusion [8].

A cause and effect relationship between the many variables in CPD and the outcome is difficult to establish.

Continuous quality initiative efforts can significantly reduce peritonitis rates. Measures like retraining current patients and all new patients six months after initiation and then annually, changing from plastic to titanium adaptors between the catheter and the transfer set and using equipment from a single reliable PD manufacturer for all patients can reduce the rates of peritonitis considerably [11].

Conflicts of Interest

None identified

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