

# Catheter related infections in children on continuous ambulatory peritoneal dialysis at tertiary care hospital in Mumbai

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## Abstract

**Context:** Continuous ambulatory peritoneal dialysis (CAPD) is a bridge between ESRD and renal transplant. One of the factors hindering the widespread use of CAPD in children is the high risk of infections and subsequent need for catheter removal. The current study was undertaken to assess the prevalence, microbiology, treatment and outcome of catheter related infections in a tertiary care hospital in Mumbai, Maharashtra, India. **Methods:** It was retrospectively analyzed data of 27 patients with end stage renal disease on CAPD who were on regular follow up at Pediatric Nephrology division of Bai Jerbai Wadia Hospital for children, Mumbai. Details of their catheter related infections (CRI) including spontaneous bacterial peritonitis (SBP), tunnel infections (TI), and exit site infections (ESI) were recorded. Results of microbiology, treatment and outcome of these infections were also analyzed. **Results:** Out of 27 patients, (15 male) with mean age of 7 years (range 11 months - 16 years), were followed up for a total of 657 CAPD months. A total of 39 episodes of CRI occurred in 16 patients. Out of these, 25(64%) were spontaneous bacterial peritonitis, 8(20.5%) were exit site infections and 6(15.3%) were tunnel infections. Among SBP, 6/25(24%) and among ESI 5/8(62.5%) were culture positive. Gram negative organisms (54%) were the most commonly isolates followed by gram positives (27%) and fungus (18%) as causes of SBP. Catheter related infections necessitated catheter removal in 8 patients (6 SBP, 1 ESI, and 1 TI). None of the ESIs or TIs progressed to SBP. SBP rate was 1 episode per 33.3 patient months. Monsoon season had maximum episodes (43%) of CRI. None out of 7 deaths was directly attributable to CRIs. **Conclusion:** Continuous ambulatory peritoneal dialysis is a safe modality of renal replacement therapy in children. If ESI or tunnel infections are managed aggressively, progression to SBP can be prevented. Prompt treatment of CRI may help to salvage catheters in these patients.

**Key Words:** Catheter related Infections, Children, Continuous Ambulatory Peritoneal Dialysis, Tertiary Hospital.

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Received Date: 02/07/2018 Revised Date: 10/08/2018 Accepted Date: 21/09/2018

DOI: <https://doi.org/10.26611/1014735>

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	Accessed Date: 24 September 2018

## INTRODUCTION

Continuous ambulatory peritoneal dialysis is a bridge between end stage renal disease (ESRD) and transplant. This treatment option is particularly attractive for children

because of its simplicity, comfort of performance at home, thereby allowing regular school attendance and facilitating normal childhood activities. Peritoneal dialysis obviates the challenges associated with vascular access, which can be particularly problematic in small children. As a result it is a popular form of renal replacement therapy in the developed nations.<sup>1</sup> However despite being available in India for over 2 decades, it is not been widely used by Indian population.<sup>2</sup> Though India has witnessed some increase in the number of patients initiated on CAPD over the last few years, the number of early dropouts remains high. The main hindrance in its wide use is the high risk of infections necessitating catheter removal and forcing discontinuation/interruption of this form of renal replacement therapy. Although there are a few studies on the microbiology and treatment of

SBP in Indian children, these are small sized, do not cover the entire spectrum of catheter related infections and do not detail the catheter outcome in these patients.<sup>3,4</sup> Hence the present study was undertaken to elucidate the outcome of catheter related infections in children on Continuous ambulatory peritoneal dialysis (CAPD) in tertiary care hospital in Mumbai.

### AIMS AND OBJECTIVE

To study the prevalence, microbiology, treatment and outcome of catheter related infections and calculate catheter salvage rate following CRIs at a tertiary care hospital in Mumbai, Maharashtra.

### MATERIAL AND METHODS

This retrospective observational study was carried out amongst 27 patients (2 on automated and 25 on manual CAPD who were on regular follow-up) during the period of June 2008 to May 2018 at Pediatric Nephrology division of Bai Jerbai Wadia hospital for children, Mumbai, Maharashtra which is a tertiary care hospital. Nephrology case record forms, indoor forms of all patients on CAPD over last 10 years (June 2008 to May 2018) were reviewed. In all patients, a double cuff Tenckhoff straight or swan neck peritoneal catheter was placed in the abdomen surgically in the operation theater. Prophylactic antibiotic intravenous cephazolin was administered 1 hour before and six hours after the insertion. Pediatric size peritoneal catheter was used in children less than 15 kg. In older children, adult size catheter was used. Peritoneal dialysis was initiated after a break in of 14 days. The dose of dialysis was increased to desired prescription over the next 2 weeks. Simultaneously rigorous training of at least two caregivers of the patient was carried out detailing the steps of procedure, aseptic precautions, trouble shooting in accordance with our unit protocol. Training of caregivers was carried out the by nephrology residents and clinical coordinators using audiovisual aids and hands on training. The patients were discharged to carry on home CAPD when desired dialysis prescription had been reached and the caregivers were fully trained. For the purpose of present study, a proforma was made recording the age, gender, primary diagnosis, age at commencement of CAPD, number of episodes of catheter related infections that is spontaneous bacterial peritonitis (SBP), tunnel infections (TI) and exit site infections (ESI). Details of results on microbiology, antibiograms, management and outcome of catheters and outcome of the patients were recorded. Diagnosis of peritonitis was based on the presence of two out of the following three criteria:<sup>5</sup>

1. Cloudy peritoneal fluid and abdominal pain;

2. Peritoneal fluid containing more than 100 white blood cells/cu mm with at least 50% polymorphonuclear cells; and
3. Micro-organisms in peritoneal fluid. Purulent discharge from exit site was considered as ESI and erythema, tenderness or swelling over the peritoneal dialysis subcutaneous tunnel pathway was taken as tunnel infection.

All patients with SBP were treated with intraperitoneal antibiotics. First choice of empiric antibiotics were - Intraperitoneal (IP) cephazolin plus ceftazidime till the year 2015. Later the unit adopted policy of empiric IP ceftazidime plus vancomycin as cephazolin was withdrawn from the market. The choice of antibiotics and duration of therapy were modified in accordance with the antibiograms. Patients with culture negative peritonitis were continued on first line if there was clinical response or upgraded to second line or third line according to fluid cytology and clinical response. If child failed to clear infection in 7 days or fungus was isolated on culture-catheter was removed, therapy was continued with intravenous drugs and patient was shifted to hemodialysis as a mode of renal replacement. The mean duration of antibiotics for culture negative and responsive case was 14 days. The outcomes were recorded- in terms of outcome of infections-complete clearance of infection, persistent infection needing catheter removal and shift to hemodialysis, infection causing death. Final outcome of patients was assessed in terms of numbers who got transplanted, continued on CAPD or shifted to HD or died.

**Statistical Analysis:** The data was entered in Microsoft Office Excel Sheet. Results were evaluated using frequencies and percentages for categorical variables and mean with standard deviation or median with ranges for continuous variables. Data were analysed by t-test, chi-square test, Fisher's exact test, Mann Whitney U test using SPSS software for windows. A p-value of less than or equal to 0.05 was considered statistically significant.

### RESULTS

A total 27 patients younger than 18 years of age were studied. 25 patients were on manual CAPD and two patients were on cyclor. There were 15 males and 12 females. The mean age of the patients was 7 years with the range of 11 months to 16 years. The cumulative treatment time of this cohort was 657 CAPD months. Out of 27 patients, 12 were having primary diagnosis of bilateral small size kidneys, 3 were having C3 glomerulopathy, 3 were having Focal segmental glomerulosclerosis, two each were having posterior urethral valve and immune complex mediated glomerulonephritis. Atypical hemolytic uremic syndrome,

bilateral grade five vesicoureteral re flux, solitary small size kidney, Neuropathic bladder with myelomeningocele and nephronphthisis were contributing to one patient of each.

**Table 1:** Age wise distribution of CRI

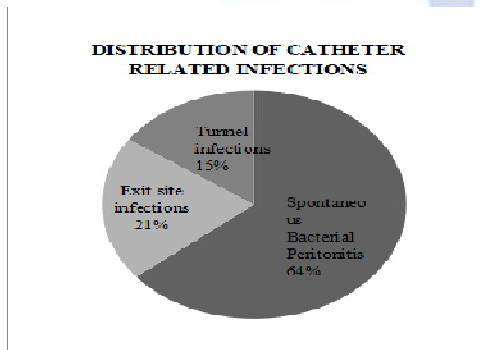
Age Group	No. of Patients
0-5 Years	06
6-10 Years	08
11-18 Years	02

It was seen from Table 1 that patients were categorized according to age into groups - 0-5 years, 6-10 years, 11-16 years. The lowest incidence of peritonitis was observed in 11-16 years age group.

**Table 2:** Onset of peritonitis after PD commencement

Onset of Peritonitis after PD Commencement	
Onset of peritonitis	Number of patients (%)
First six months	06 (37.5%)
6-12 months	04 (25%)
> 12 months onwards	06 (37.5%)

It was observed from Table 2 that a total 39 episodes of CRIs occurred in 16 patients while 11 remain free of any kind of catheter related infections. CRIs were seen within the first six months of PD initiation in 6 patients (37.5%), between 6 and 12 months in 4 patients (25%) and after more than 12 months in 6 patients (37.5%). Maximum episodes of CRI occurred in monsoon season followed by winter and summer seasons. Six (37.0%) patients experienced one episode of catheter related infections during the study period and 10(62.5%) experienced more than two episodes of catheter related infections.



**Figure 1:** Distribution of Catheter related Infections

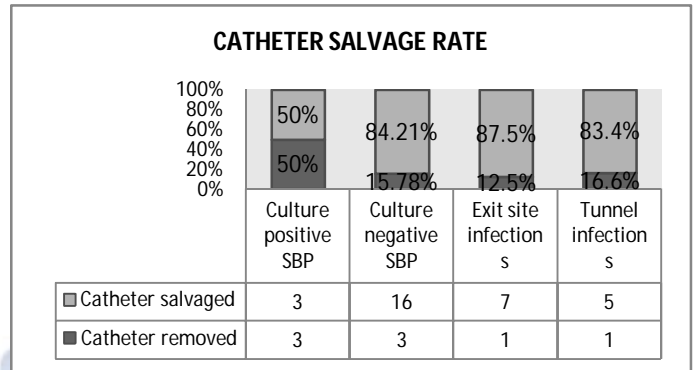
As seen in Figure 1 that a total 25 episodes of peritonitis occurred during the study period translating to 1 episode per 33.3 patient months. Out of 39 episodes of CRI, most common infection was spontaneous bacterial peritonitis (SBP) seen in 25 (64%) patients. This was followed by exit site infections (ESI) seen in 8 (20.5%) patients and least common catheter infection were tunnel infections seen in 6 (15.3%).

**Table 3:** Prevalence of culture positivity in CRI

Type of CRI	Culture	Culture	Total
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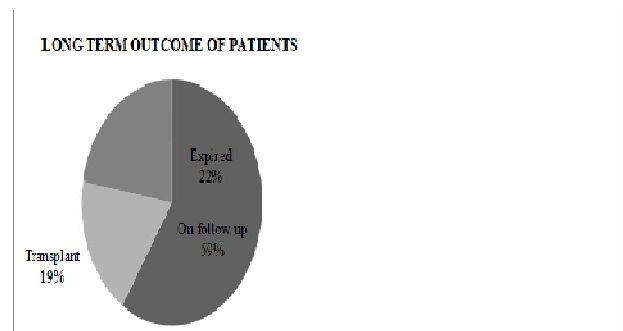
	Positive	Negative	
Spontaneous bacterial peritonitis	06	19	25
Exit site infections	03	05	08
Tunnel infections	00	06	06
<b>Total</b>	<b>09</b>	<b>30</b>	<b>39</b>

It was seen from Table 3 that among SBP, 6/25(24%) and among ESI 5/8(62.5%) were culture positive Gram negative organisms were the most common isolates 6/11 (54%), followed by gram positive 3/11(27%).



**Figure 2:** Catherter Salvage Rate

As seen from Figure 2 that two episodes had fungal etiology was (18%). Among the gram negative organisms, the most common isolate was Pseudomonas aeruginosa. Catheter was removed in 8 patients. 3 with culture positive SBP, 3 with culture negative SBP, 1 with recurrent tunnel infection and 1 with recurrent culture negative exit site infections. In rest of 8 or 16 patients with CRI (50%), peritoneal catheter could be salvaged. Out of 6 cultures positive SBP, two growing fungus and one growing Pseudomonas aeruginosa underwent catheter removal. In three other culture positive SBP cases, infections could be eradicated completely and catheters could be salvaged.



**Figure 3:** Summarizes the long term outcome of patients

As seen from Figure 3 that none out of seven deaths was directly attributable to CRIs. Out of seven deaths, three were due to severe protein energy malnutrition related

complications, one was due to severe anemia, one of was due to sequelae of post transplant lymphoproliferative disorder and two were due to complications related to hemodialysis catheter.

## DISCUSSION

Continuous ambulatory peritoneal dialysis is the preferred modality of renal replacement in children due to its simplicity, non dependence on a vascular access, relatively better preservation of residual renal functions and ease of doing from home and continuing school.<sup>6-8</sup> However the major limiting factor in its widespread use in developing nations is the high risk of catheter related infections necessitating catheter removal and a shift to alternate form of renal replacement - Hemodialysis. Catheter related infections can be in the form of spontaneous bacterial peritonitis (SBP), tunnel infections (TI) and /or exit site infections (ESI). In our study, we were able to successfully carry out CAPD in 27 patients for a total of 657 patient months with 39 episodes of CRIs. The most common infection encountered in our study was SBP which occurred with the frequency of 1 episode in 33 patient months. This rate was comparable to another study conducted at Iran.<sup>9</sup> Our study demonstrated higher rate of culture negative peritonitis (76%) than is recommended by ISPD but such has been the trend in several studies using conventional techniques for microbiological cultures showing only 20-70% culture positivity rates.<sup>10,11</sup> Lack of automation, use of substandard media or substandard techniques for inoculation can possibly account for such poor culture positive rates but our study was not adequately powered to draw such conclusions. Unlike western literature, it was found increased prevalence of gram negative organisms.<sup>4</sup> Similar findings was reported by a large multicentric study done at India.<sup>11</sup> Hospitalization was needed in 52% of total peritonitis episodes and in 43% of total catheter related infections in the current study.<sup>12</sup> In a similar study by Abraham G. *et al*, rates of hospitalization were almost 71% in patients of peritonitis.<sup>11</sup> If not treated on priority basis, exit site infections and tunnel infections are known to progress to peritonitis necessitating catheter removal.<sup>13,14</sup> but none of our patients with ESI or TI showed progression into full blown into peritonitis. We were able to salvage catheter in 50% of CRI and in 76% patients with Spontaneous bacterial peritonitis which indicates that early detection and aggressive management, can salvage catheters even in patients with culture positive CRI. Needless to say catheter infection prevention remains the best option.

## CONCLUSION

Continuous ambulatory peritoneal dialysis (CAPD) is a safe modality of renal replacement therapy. If exit site infections or tunnel infections are managed promptly, spontaneous bacterial peritonitis can be prevented. Aggressive treatment of catheter related infections may help to salvage catheter in this patients and allow continuation of CAPD in these patients.

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Source of Support: None Declared  
Conflict of Interest: None Declared