

**Original Article**

**CAPD in Saudi Arabian Children:  
Ten Years Experience From a Single Center**

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**ABSTRACT,** In this paper we describe our experience with chronic ambulatory peritoneal dialysis (CAPD) in children. Between 1984 and 1993, a total of 51 patients were treated by CAPD at King Khalid University Hospital. Eight patients were excluded from the study because of incomplete data. There were 25 boys and 18 girls aged three months to 16 years; 12 patients (27.9%) were below two years, 15 patients (34.9%) were between 2-6 years, and 16 patients (37.2%) were above six years of age. Reflux nephropathy secondary to obstructive uropathy was the main cause of ESRD in the study patients (27.9%). The total period of CAPD was 579 patient-months (48.25 years). The overall incidence of peritonitis was high, one episode per 4.7 patient months; one episode per 3.2 patient months in the first five years of the study and one episode per 6.2 patient-months in the 2nd five years of the study period. The cause of peritonitis was gram positive organisms in 38.7% and gram negative organisms in 24.9%. Seventeen (39.5%) of catheters were changed because of infection or mechanical obstruction. In 90.7% of patients, the mother was the person who was performing dialysis. At the end of the study, seven patients (16.2%) were still on CAPD, 10 patients (23.3%) shifted to haemodialysis, 16 patients (37.2%) were transplanted, six patients (14.0%) died and four patients (9.3%) recovered. We conclude that CAPD may be a suitable renal replacement therapy for children in a country with a wide geographical area and low population density as Saudi Arabia.

**Key words:** Continuous ambulatory peritoneal dialysis, Peritonitis, Children, Developing countries.

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**Introduction**

Continuous ambulatory peritoneal dialysis (CAPD) has gained progressive acceptance as the renal replacement therapy of choice for end-stage renal disease (ESRD) in pediatric

patients over the last two decades. It is the treatment of choice in Europe (1,2) and North America (3-5). In North America, young infants with ESRD are generally treated more frequently with dialysis than transplantation (5). There are major problems in providing care for children with ESRD in underdeveloped and developing countries including financial constraints, education level, hygiene condition, moral, social and psychological support for the patients and their families (6-9). Since health service, in some of the developing countries including the Arab countries, have limited resources and competing priorities, there have been isolated experiences with dialysis programs developed through either personal efforts or private funding (6-9). Our CAPD program was started on 1984 as the first CAPD program for children in Saudi Arabia and it was supported by the government. Here we analyze our data in the first ten years of the program and discuss the outcome and lessons learnt from this experience.

### Patients and Methods

We reviewed all charts of children with ESRD treated by continuous ambulatory peritoneal dialysis (CAPD) in our institute between 1984-1993. A total of 51 patients were treated by CAPD during this period. Eight patients were excluded from the study because of incomplete data or loss of follow-up. All patients were dialyzed using the standard pediatric Tenckhoff catheter, with single cuff for children less than two years of age and double cuff for children older than two years. The catheters were usually inserted in the para-midline and tunneled subcutaneously. The dialysis technique involved running 25-50 ml per kg of dialysis fluid into the peritoneal cavity

Table 1, Causes of ESRD in the study patients (n = 43).

Diagnosis	No.	%
Reflux nephropathy	12	28.0%
Rapidly Progressive GN	6	14.0%
HUS	4	9.3%
Polycystic Kidney	3	7.0%
Vasculitis	2	4.6%
FSGS	2	4.6%
Congenital Nephrosis	2	4.6%
Cortical Necrosis	2	4.6%
Acute Tubular Necrosis	1	2.3%
Renal	2	4.6%
Unknown	7	16.3%

HUS = Hemolytic uremic syndrome, FSGS = Focal segmental glomerulosclerosis.

via a closed delivery system where it remained for six hours then drained. The fluid bag changes were performed four times daily. The decision to start CAPD was based on the understanding and agreement of the parents to continue CAPD at home. Discharging patients to start CAPD at home was a team-decision after ensuring that the care-giver could perform dialysis alone with safety and confidence, by non-touch clean technique, and the ability to recognize the signs of peritonitis.

The data reviewed included age and sex of the patient, family structure, etiology of ESRD, duration of dialysis, episodes of peritonitis, catheter problems and outcome of dialysis.

### Results

There were 43 patients records available for the study. Twenty five (58.1%) were males and 18 were females (41.9%) with an age range of three months to 16 years. Twelve patients (27.9%) were below two years of age, 15 patients (34.9%) were between 2-6 years of age, and 16 patients (37.2%) were above six years of age. The etiology of ESRD in all 43 patients is shown in Table 1. Obstructive uropathy was

the main cause of ESRD in these patients (28.0%). Performing dialysis at home was the responsibility of the mother in 39 patients (90.7%); of whom 31 (79.5%) were illiterate or could barely read and write. One patient (16 years old) performed dialysis by herself, and two patients had nurses at home to perform the procedure. The study patients came from various size families with a varying number of siblings 1-9 (mean 5.6 siblings) in each family.

Table 2. Causative organisms of 124 episodes of peritonitis.

Organisms	No.	%
Gram-positive	48	38.7
Staphylococcus aureus	19	15.3
Coagulase-negative	19	15.3
Enterococcus	5	4.0
Streptococcus viridans	3	2.4
Diphtheroid	2	1.6
Gram-negative	31	24.9
Pseudomonas Sp	15	12.1
Enterobacter Sp	13	10.4
Acinobacter Sp	3	2.4
Fungi	3	2.3
No Growth	42	33.8
Sp = Species		

The total of patient months on CAPD was 579 with a mean of 13.5 patient months, (range 2-60). The most common complication was peritonitis with an over all incidence of one episode per 4.7 patient months. In the patients below two years of age, the incidence was one episode per 5.9 patient months, while in those aged between 2-6 years the incidence was one episode per 5.4 patient months, and it was one episode per 2.9 patient months for those above age of six years.

The incidence of peritonitis in the first five years of the CAPD program was one episode per 3.2 patient months and in the second five years of the CAPD program it was one episode per 6.2 patient months. The organisms responsible for those episodes of peritonitis are as described in

Table 2. Exit site infection occurred in association with 10 episodes of peritonitis (Table 3). Seventeen catheters (39.5%) were changed, 12 because of infection and five because of mechanical obstruction or accidental trauma. At the end of the study there were seven patients (16.3%) still on CAPD. Ten patients (23%) shifted to hemodialysis; three due to peritoneal fibrosis, two because of recurrent peritonitis, four due to parental request after 6-24 months of dialysis, and one upon his request. Sixteen patients (37.2%) had renal transplantation; five locally, and 11 abroad. There were six deaths (14%); four in our hospital secondary to septicemia, and two died abroad while waiting for renal transplantation. Four patients (9.3%) recovered spontaneously.

Table 3. Causative organisms of exit-site infections (n = 10).

Organizations	No	%
Staphylococcus aureus	3	30
Coagulase staphylococcus	2	20
Pseudomonas	1	10
Candida	1	10
No Growth	3	30

## Discussion

This study is the experience over 10 years of the first center to start CAPD program in Saudi Arabia, and to the best of our knowledge, in the Arab World (1). The first attempt to apply chronic peritoneal dialysis to a child in Saudi Arabia was done in June 1982 by Prof. El-Idressy from the same center (10).

The patients enrolled in our program were young, (62.7% of our patients were below six years of age) compared to 29% in North America (5) and 32% in Europe (1). This indicates the predominance of young age group in our patients.

The main cause of ESRD in our patients was reflux nephropathy (28%), mainly secondary

to obstruction; this is almost double of what is seen in North America (5). These patients have potentially preventable causes of CRF, and early diagnosis and management could improve prognosis (11). Renal hypoplasia or aplasia is the leading cause of ESRD in North America (16.5%) (5), while it was only in 4.5% of our patients.

Dialysis was performed mainly by mothers (90.7%), while the contribution of the fathers was limited due to the nature of the Saudi Arabian Society, where mothers are mostly housewives and fathers work. Despite their illiteracy, these mothers were able to give full attention to training and performing dialysis.

Peritonitis was the main cause of morbidity and mortality. The overall incidence of peritonitis was one episode per 4.7 patient months. No doubt this is a high incidence compared to North America Registry (one episode per 8.2 patient months) (5), or some parts of Europe (one episode per 11.6 patient months) (2). However, it is better than results reported from Mexico where it is one episode per 1.8 patient months (6).

Many factors could have led to such high incidence of peritonitis in our patients; one of these, could be the duration of treatment which was relatively long. This was considered as a predisposing factor for peritonitis by others (12); as one of our patients was on treatment for 60 months. Other factors were low level of education of mothers and the low level of hygiene; some of these patients lived in small villages in the desert.

The main cause of peritonitis in our view, however, was the type of system used for CAPD. The peritonitis rate in the first five years of the program was one episode per 3.2 patient months. When we changed from the spike system to safe-lock system, the rate of peritonitis decreased in the following five years to one episode per 6.2 patient months. Most of the authors mentioned that

peritonitis rate was higher in younger age group (3,5,12). However, we achieved the best results in children below two years of age (one episode per 5.9 patient months), while the worst were in the age group of above six years (one episode per 2.9 patient months). This can be explained by the increased physical activities in the latter group. In our study, peritonitis was not the main cause of abandonment of CAPD, unlike EDTA Registry of the same period, where peritonitis accounted for 50% of causes of abandonment (1).

Exit site infection was not a major problem in our patients. Only 10 episodes of exit site infections, were encountered; staphylococcus aureus was the cause of catheter removal in 17% of the cases. This is similar to the experience of the UCLA pediatric dialysis program study, where 14% of their catheters were removed because of exit site or tunnel infections (12).

In conclusion we believe that CAPD is still a suitable renal replacement therapy for children with ESRD awaiting renal transplantation in the developing countries, especially countries with a wide geographical area and low population density as in Saudi Arabia. Building up experience in major centers would be a major factor to better results in the future.

## References

1. Rizzoni G, Broyer M, Ehrich JH, et al. The use of continuous peritoneal dialysis in Europe for the treatment of children with end-stage renal failure: Data from the EDTA Registry. *Nephrol Dial Transplant* 1990;5:985-90.
2. Barakat M, Savage JM, Burns A, Stewart M. Efficacy of CAPD as the primary treatment for end-stage renal failure in children. *Child Nephrol Urol* 1992;12:216-20.

3. Bunchman TE. Chronic dialysis in the infant less than 1 year of age. *Pediatr Nephrol* 1995;9:18-22.
4. Qamar IU, Balfe JW. Experience with chronic peritoneal dialysis in infants. *Child Nephrol Urol* 1991;11:159-64.
5. Avner ED, Chavers B, Sullivan EK, Tejani A. Renal transplantation and chronic dialysis in children and adolescents: the 1993 annual report of the North American Pediatric Renal Transplant Co-operative Study. *Pediatr Nephrol* 1995;9:61-73.
6. Munoz-Arizpe R, Salazar-Gutierrez ML, Gordillo-paniagua G. Adequacy of chronic peritoneal dialysis in low socioeconomic class uremic children. *Int J Pediatr Nephrol* 1986;7(2):81-4.
7. Mahmoud AM, Hassab MM, El-Sibai MA, Mattoo TK. Six years experience with continuous ambulatory peritoneal dialysis and chronic hemo-dialysis in Saudi children. *Ann Saudi Med* 1993;13(6):516-9.
8. Saieh-Andonie C. The management of end-stage renal disease in underdeveloped countries: a moral and an economic problem. *Pediatr Nephrol* 1990;4: 199-201.
9. Grunberg J, Leumaan E, Srivastava RN, Chantler C. Pediatric nephrology in countries with limited resources. *Pediatr Nephrol* 1994;8:522-4.
10. EHdrissy AT, Abdurrahman MB, Abu-Aisha H, Al Sudairy R, Blyth M. CAPD in children in Saudi Arabia. *Ann Saudi Med* 1989;9(1):23-6.
11. Abdurrahman MB, Al Mugeiren M, Al Rasheed SA. Chronic renal failure in children in Saudi Arabia. *J Nephrol* 1990;2:93-6.
12. Kuizon B, Melocoton TL, Holloway M, et al. Infectious and catheter-related complications in pediatric patients treated with peritoneal dialysis at a single institution. *Pediatric Nephrol* 1995;9:S12-7.