

Renal Data from the Arab World

Peritoneal Dialysis in Children

Jameela A. Kari

Pediatrics Department, King Abdul Aziz University Hospital, Jeddah, Saudi Arabia

ABSTRACT. This is a retrospective study of the course of children who received peritoneal dialysis (PD) at King Abdul Aziz Hospital, Jeddah, Saudi Arabia, from June 2000 to June 2004. A total of 15 children (9 boys and 6 girls) with end-stage renal failure (ESRF) received PD for a mean duration of 9 ± 8.6 months; 11 children received continuous ambulatory dialysis (CAPD) and four received automated PD. The mean age of the children at the start of PD was 7.3 ± 4.3 years. All the children had low socio-economic status. The most common complication was peritonitis (53%) followed by exit site infection (26.6%). The over all rate of peritonitis was one episode per 5.9 patients treatment months. Five children had recurrent peritonitis. Gram negative bacteria were the cause of peritonitis in 43.5% of the cases, gram positive in 30.4%, fungi in 8.9% and unknown in 17.4%. PD catheters were removed in five children; four because of infection and one because of obstruction. Three children were shifted to hemodialysis permanently, two children received renal transplantation from living donors and five children died. There was no difference in the age, duration of therapy or number of siblings, between the eight children who had peritonitis and the seven children who did not have peritonitis. However, illiteracy was higher and a separate room was less available in the peritonitis group compared to the peritonitis free group (37.5% vs 14.3% and 50% vs 100%, respectively). In conclusion; PD may still be a suitable modality of renal replacement therapy for children living in low socioeconomic conditions despite the challenging problems in them.

Key Words: Peritoneal dialysis, Children and peritonitis, ESRF, Renal.

Reprint request and correspondence to:

Jameela A. Kari
Associate professor
Pediatrics Department
King Abdul Aziz University Hospital
P O Box 80215, Jeddah 21589
Kingdom of Saudi Arabia

Introduction

Peritoneal dialysis (PD) is a more common method of dialysis for end-stage renal failure (ESRF) in the developed countries than the developing ones.¹⁻⁴ In the Kingdom of Saudi Arabia (KSA), the first peritoneal dialysis

(PD) in a child was performed in June 1982.⁵ Since then, rapid expansion has occurred in the facilities of dialysis in the kingdom. However, hemodialysis (HD) remained the main modality of RRT for adults and children. The 2002 data of the Saudi Center for Organ Transplantation (SCOT) showed that 145 children were receiving HD compared to 85 receiving PD with a ratio of HD: PD of 1.7:1.⁶ This ratio is still much less than the adults where the ratio of HD: PD is 18:1 because of social and educational reasons. A number of PD programs for children have been established in the Riyadh, the capital.^{5,7-8} Recently, similar programs have become available in the western province of KSA; our PD program for children started in 2001 as the first program in this area.

This is a report of the experience of the PD program at King Abdul Aziz University Hospital (KAUH) in terms of the efficacy of this method of RRT and its adverse effects of morbidity and mortality.

Patients and Methods

All chronic renal failure (CRF) children who received PD at KAUH from June 2001 to June 2004 were included in the study. The unit policy was to recommend PD as a modality of RRT except if it was not possible for medical or social reasons. The unit was funded by the government and a charitable society.

Patients' records were reviewed for age at starting PD, sex, etiology of CRF, duration of the PD, complications such as peritonitis or catheter problems, medical and social history including family structure. Age and growth data at first presentation to the clinician and pediatric nephrologist were obtained.

Statistical Analysis

Results were expressed as mean \pm standard deviation (SD) or median (range). T- test

assuming equal variance was used to compare groups.

Results

A total of 15 children with ESRF (9 boys and 6 girls; male to female ratio 1.5:1) received PD for a mean duration of 9 ± 8.6 months. Eleven children received continuous ambulatory PD (CAPD) and 4 children had automated PD (APD).

The mean age of the patients at the start of PD was 7.3 ± 4.3 years. Eight children (53%) were Saudi and the rest were from different nationalities (1 Pakistani, 1 Filipino, 1 Bangladeshi, 1 Palestinian, 1 Sudanese and 1 Yemeni). Eight (53%) children belonged to poor families with poor income (monthly income ≤ 2000 Saudi Riyals or ≤ 500 US dollars).

The etiology of CRF was congenital abnormalities of the renal system in four patients; one had renal dysplasia, two had posterior urethral valve and one had primary vesico-ureteral reflux. Three other patients had inherited diseases; one had congenital nephrotic syndromes; one had cystinosis and one had familial hypomagnesaemia hypercalciuric nephrocalcinosis syndrome (FHHNC). Six other children had acquired causes of CRF; three had steroid resistant nephrotic syndrome, two had rapidly progressive glomerulonephritis (RPGN) and one had cortical necrosis following cardiomyopathy caused by using adriamycin for neuroblastoma. The rest of the cases included one child who had neurogenic bladder associated with spina bifida and another in whom the cause of CRF was unknown.

There was a considerable delay in referring patients to the pediatric nephrologist with a mean of 4.2 ± 3.8 years to the first presentation. Furthermore, the patients were severely growth retarded with the mean Ht SDS (Z score) of -3.3 ± 2.1 and mean body mass index (BMI) of 15.9 ± 1.9 .

Table 1. Complications of PD.

Complication	Number of children	Percentage
Peritonitis	8 children (23 episodes)	53%
Exit site infection	4 children (12 episodes)	26.6%
Bilateral hernia	1	6.6%
Catheter obstruction	1	6.6%
External Leak	1	6.6%

Double cuffed PD catheters were used in all children but the direction of the catheter at the exit site was not recorded in most of the children. The regular use of mupirocin ointment at the exit site was not practiced in any of the studied patients. All the CAPD patients used the twin bag system.

Peritoneal dialysis at home was performed in all the cases by mothers except in two patients; one had the father's help and one had a maid's help. The dialysis providers for five (33.3%) children were educated (finished high school), for five (33.3%) they had minimal education and for the remaining five (33.3%), the dialysis providers were illiterate

Five patients lived in other cities and had to travel long distance to reach the dialysis center in Jeddah. Eleven (73%) children had the dialysis performed in a separate room spared for this purpose and the remaining four had it done in the living room of the family because of inadequate residence space.

Table 1 shows that the most common complication of PD was peritonitis, which occurred in 8 (53%) children. Exit site infection (ESI) occurred 12 times in four (26.6%) children. All the children with ESI developed peritonitis. The overall incidence of peritonitis was one episode per 5.9 patients treatment months. Five children had recurrent peritonitis.

Table 2 shows the types of microorganisms that caused peritonitis. Gram negative bacteria were the cause of peritonitis in 43.5% of the cases, gram positive bacteria in 30.4%, fungal in 8.9% and unknown in 17.4%.

Table 2. Etiology of peritonitis.

Organisms	Number	%
Gram positive (<i>Staphylococcus aureus</i>)	7	30.4
Gram negative	10	43.5
<i>Pseudomonas aeruginosa</i>	7	
<i>Klebsiella</i>	1	
<i>Enterobacter</i>	1	
Diphtheroid species	1	
Fungal infection	2	8.7
No growth	4	17.4

Catheter was replaced in five children: four because of infection and one because of obstruction.

Three children were shifted to HD permanently; two because of peritoneal failure and one for social reasons. Two children required a period of HD while giving the peritoneum time to recover from peritonitis. Two children received renal transplantation from living donors; one from his father at King Faisal Specialist hospital in Riyadh, and another child had transplantation from non-relative donor abroad. Five (33%) children died; three because of sepsis, one because of chickenpox pneumonitis and one following cerebro-vascular accident.

When we compared between the eight children who had peritonitis with the seven who did not have peritonitis, there were no differences in the age, duration of therapy or number of siblings Table 3. However, illiteracy rate was higher and a dedicated room was less available in the peritonitis group compared to the peritonitis free group (37.5% vs 14.3% and 50% vs 100%, respectively).

Discussion

This is a report of a referral center's experience with peritoneal dialysis in children living in sub-optimal social conditions. Similar to previous studies, we found that peritonitis and ESI were the main complications in children on PD. We have observed higher rate of peritonitis

Table 3. Comparison between children with peritonitis and peritonitis free children.

Parameters	Children with peritonitis (8 children)	Children without peritonitis (7 children)	P value
Age at the start of PD	7.5	6.8	0.75
Duration (months)	11.7	6.7	0.21
Availability of spare room for dialysis	50%	100%	
Number of siblings	4	2.8	0.44
Illiterate mother	37.5%	14.3%	

(1:5.9 patient's months) than those reported in the western countries.⁹⁻¹¹ The North American Pediatric Renal And Transplant Study (NAPRTCS) reported a lower incidence of one episode per 13.2 patients months.⁹ Similarly, a study from Vienna dialysis department reported the rate of one per 14.2 patient months¹⁰ and a much lower incidence (1:30 patient months) was reported by the Japanese National Registry.¹¹ Our results are almost similar to that reported from the King Saud University Hospital in Riyadh (1:4.7 patient months) and to that reported from other Arab countries such as Tunisia (1.8 episodes/patient/year).^{12,13} However it is better than the results reported from other developing countries such as Nigeria (70%) and Mexico (1: 1.8 patients month or 5. 6 episodes per patients year).^{14,15} This high rate of peritonitis in the developing countries could be explained by the low socio-economic status of the patients besides the inadequately equipped dialysis facilities. Better result was reported by Mirza et al (1: 9 patient months) from the Riyadh medical complex and King Fahd National Guard hospital, where the resources are comparable to the west.⁷

Earlier studies from the western countries showed a higher rate of peritonitis: 1: 4.6 patient months reported by the Southwest Pediatric Nephrology Study Group in the eighties and 1:3.5 patients months from Scotland.^{16,17} NAPRTCS reported the rate of 1: 7.1 patients month in 1993, which improved recently to 1:13.2 patients months.¹⁸ Similar improvement was found by Al-Salloum et al as the rate improved from 1: 3.2 patients months in the

first five years of their program to 1:6.2 patients months in the last five years.¹² We hope that we will attain this improvement as we continue our program. Furthermore, most of our patients were referred at advanced stage of the renal disease as reflected by their poor growth parameters at the start of PD.

Our results of the gram negative organisms being the main cause of peritonitis is similar to those reported by Mirza et al.⁷ However, most of the previous studies reported gram positive organisms as the main cause.^{9,12,19} The increased prevalence of gram positive organisms particularly *Staphylococci species* (coagulase negative) could be explained by contamination during handling. In our study, *Pseudomonas aeruginosa* was the commonest gram negative peritonitis and resulted in catheter removal, similar to other experiences.²⁰

Both of the two children who had fungal peritonitis (FP) were treated with antifungal medication besides dialysis catheter removal.²¹ One of them had to be shifted to HD permanently because of damaged peritoneum. The NAPRTCS reported that the outcome of FP in children appeared to be more favorable than in the adult dialysis population.²⁰

The NAPRTCS study demonstrated that black race, single-cuffed catheters, and upward pointing exit sites were independent risk factors for peritonitis.⁹ All our patients had double cuffed catheter, however the data of the direction of the catheter at the exit site were not available. ESI was associated with peritonitis in our cohort and in previous reports.^{7,9,12} There was no difference in the age between

the peritonitis group and the peritonitis free group in our study but it was shown by others that the frequency of infection was the greatest in the youngest patients.²²

Mother's illiteracy and the lack of dedicated room were more common in the peritonitis group. However, the number of the patients in our study was rather small to draw conclusions about the risk of peritonitis presented by these factors.

We could not compare the rate of peritonitis between the CAPD and APD patients as we had only four patients in the latter group. However, previous studies demonstrated that APD was associated with a lower incidence of peritonitis and ESI than CAPD.^{23,24}

We have very high mortality rate of 33% compared with other studies. Mirza et al reported it to be 4.6%, Al-Sallom et al 14% and NAPRTCS 4.6%. This could be explained by many factors including our limited resources, the late presentation of the patients and the low socio-economic status of the patients.

In conclusion; PD may still be a suitable modality of renal replacement therapy for children living in low socioeconomic conditions despite the challenging problems in them.

References

- Schaefer F, Klaus G, Muller-Wiefel DE, Mehls O. Current practice of peritoneal dialysis in children: results of a longitudinal survey. Mid European Pediatric Peritoneal Dialysis Study Group (MEPPS). *Perit Dial Int* 1999;19 Suppl 2:S445-9.
- Lewy JE. Treatment of children in the U.S. with end-stage renal disease (ESRD). *Med Arh* 2001;55(4):201-2.
- Fischbach M, Desprez P, Mengus L, Geisert J. Role of peritoneal dialysis for the treatment of terminal renal insufficiency in the child. *Nephrologie* 1995;16(1):101-4.
- Barsoum RS. Overview: end-stage renal disease in the developing world. *Artif Organs* 2002;26(9):737-46.
- Elidrissy AT, Abdurrahman MB, Abu-Aisha H, Alsudairy R, Blyth M. CAPD in children in Saudi Arabia. *Ann Saudi Med* 1989;9(1):23-6.
- SCOT data. Dialysis in the Kingdom of Saudi Arabia. *Saudi J Kidney Dis Transplant* 2003;14(3):406-15.
- Mirza K, Elzouki AY. Peritonitis in continuous ambulatory peritoneal dialysis in children living in Saudi Arabia. *Pediatr Nephrol* 1997;11(3):325-7.
- Mahmoud AM, Hassab MM, El.Sibai MA, Mattoo TK. Six years experience with continuous ambulatory peritoneal dialysis and chronic hemodialysis in Saudi children. *Ann Saudi Med* 1993;13(6):516-9.
- Furth SL, Donaldson LA, Sullivan EK, et al. Peritoneal dialysis catheter infections and peritonitis in children: a report of the North American Pediatric Renal Transplant Cooperative Study. *Pediatr Nephrol* 2000; 15(3-4):179-82.
- Arbeiter K, Vecsei A, Mueller T, Sanz C, Balzar E, Aufricht C. Chronic peritoneal dialysis in children. Results of the Vienna Pediatric Dialysis Department. *Wien Klin Wochenschr* 2003;115(17-18):660-4.
- Honda M. The 1997 Report of the Japanese National Registry data on pediatric peritoneal dialysis patients. *Perit Dial Int* 1999;19 Suppl 2:S473-8.
- Al-Salloum AA, Al Mugeiren M, Al Rasheed S, Al Mazrou A, Al Zamil F. CAPD in Saudi Arabian children: ten years experience from a single center. *Saudi J Kidney Dis Transplant* 1997;8(3):302-9.
- El Matri A, Ben Abdallah T, Kechrid C, Ben Maiz H, Ben Ayed H. Continuous ambulatory peritoneal dialysis in Tunisia. *Nephrologie* 1990;11(3):153-6.
- Arije A, Akinlade KS, Kadiri S, Akinkugbe OO. The problems of peritoneal dialysis in the management of chronic uraemia in Nigeria. *Trop Geogr Med* 1995;47(2):74-7.
- 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.
16. Continuous ambulatory and continuous cycling peritoneal dialysis in children. A report of the Southwest Pediatric Nephrology Study Group. *Kidney Int* 1985;27(3):558-64.
 17. Mocan H, Murphy AV, Beattie TJ, McAllister TA. Peritonitis in children on continuous ambulatory peritoneal dialysis. *J Infect* 1988; 16(3):243-51.
 18. Alexander SR, Sullivan EK, Harmon WE, Stablein DM, Tejani A. Maintenance dialysis in North American children and adolescents: a preliminary report. North American Pediatric Renal Transplant Cooperative Study (NAPRTCS). *Kidney Int Suppl* 1993; 43:S104-9.
 19. Chiou YY, Chen WP, Yang LY, Lin CY. Peritonitis in children being treated with continuous ambulatory peritoneal dialysis. CAPD Team. *Chung Hua Min Kuo Hsiao Erh Ko I Xue Hsueh Ts Chih* 1995; 36(3):176-83.
 20. Szabo T, Siccione Z, Izatt S, Vas SI, Bargman J, Oreopoulos DG. Outcome of *Pseudomonas aeruginosa* exit-site and tunnel infections: a single center's experience. *Adv Perit Dial* 1999;15:209-12.
 21. Warady BA, Bashir M, Donaldson LA. Fungal peritonitis in children receiving peritoneal dialysis: a report of the NAPRTCS. *Kidney Int* 2000;58(1):384-9.
 22. Warady BA, Sullivan EK, Alexander SR. Lessons from the peritoneal dialysis patient database: a report of the North American Pediatric Renal Transplant Cooperative Study. *Kidney Int Suppl* 1996; 53:S68-71.
 23. Rodriguez-Carmona A, Perez Fontan M, Garcia Falcon T, Fernandez Rivera C, Valdes F. A comparative analysis on the incidence of peritonitis and exit-site infection in CAPD and automated peritoneal dialysis. *Perit Dial Int* 1999; 19(3):253-8.
 24. Holley JL, Bernardini J, Piraino B. Continuous cycling peritoneal dialysis is associated with lower rates of catheter infections than continuous ambulatory peritoneal dialysis. *Am J Kidney Dis* 1990; 16(2):133-6.