EXPERIENCE OF PERITONEAL DIALYSIS IN RENAL FAILURE IN CHILDREN

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ABSTRACT

Objective: To determine the course and efficacy of peritoneal dialysis in children presenting with renal failure.
Study Design: Quasi experimental study.
Place and Duration of Study: The study was conducted at the Nephrology department of Children's Hospital and Institute of Child Health Lahore from Feb 2007 to Feb 2008.
Material and Methods: Forty children diagnosed with renal failure at the Nephrology department of Children's Hospital and Institute of Child Health, Lahore were evaluated for the efficacy of PD, duration of PD and the associated complications.
Results: There were 55% cases of acute renal failure and 45% cases of chronic renal failure. The mean duration of PD was 3.8 days. About 75% of all the patients improved with PD. The mortality rate was 22.5%. Leading complications were Catheter-related (leakage/blockade) and peritonitis.
Conclusion: We concluded that peritoneal dialysis is lifesaving procedure which improves the acute metabolic derangements of renal failure in children. It is associated with certain complications but the benefits outweigh the complications.

Keywords: Peritoneal dialysis, Renal replacement therapy, Renal failure.

INTRODUCTION

Peritoneal dialysis is the preferred mode of dialysis for children around the globe but local experience, standard of care and clinical outcome vary markedly[1]. Peritoneal dialysis is considered to be a viable mode of dialysis which continues to evolve since its inception in the late 70's[2].

Conventional PD fluids consist of physiological solutions of electrolytes, bicarbonate precursor (usually lactate) and glucose as an osmotic agent[2]. PD has several advantages; it is less expensive than hemodialysis[3]. It is generally better tolerated by patients with cardiovascular compromise. It provides flexible schedules and it allows the opportunities to work, travel and participate in daytime activities of the patient. PD is needle-less and helps to preserve arteriovenus access sites. It minimizes the risk of blood-borne infections like hepatitis C[4,5]. It facilitates preservation of residual renal function[6-8] better than hemodialysis.

It can be associated with certain complications[9] like peritonitis, mechanical-like blockage of PD catheter and the displaced catheter. Bleeding and perforation of gut can also occur.

Pediatric renal failure is a common health issue and its prevalence has increased over the last ten years[9]. Both acute and chronic renal failure frequently needs supportive care as well as the renal replacement therapy. This renal replacement therapy can be done in the form of peritoneal dialysis, intermittent hemodialysis, continuous renal replacement therapy and hybrid therapies. PD however is more useful in pediatric age group and some other conditions like vascular access problems, hypothermia, hyperthermia and removal of toxins[10]. It is the most common used modality under 6 years of age[11]. In many Asian countries dialysis program is growing at a rate of 10% or more annually[12,13] and PD appears to be well suited to the Asian population.

Acute peritoneal dialysis not only improves the manifestations of renal compromise but

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also provides the time-bridge for the future management in chronic renal failure. This study was carried out to share our experience of acute peritoneal dialysis in children, analyzing the incidence of complications and clinical outcomes.

PATIENTS AND METHODS

This Quasi experimental was conducted at the Nephrology department of Children's Hospital and Institute of child health Lahore. The study was completed in 1 year from February 2007 to February 2008. Six months were utilised in collection of cases and next six months were used in compiling data, and its statistical analysis

gases, prothrombin time, activated partial thromboplastin time, urine complete examination and abdominal ultrasound of all the patients were done.Indications for peritoneal dialysis were noted.

Acute peritoneal dialysis was performed using per-cutaneous peritoneal dialysis catheter. Isotonic/hypertonic peritoneal dialysis solutions were used.

Patients were monitored for the duration of one week and all the complications were noted. Renal function tests and arterial blood gases were followed up for the duration of one week.

Table-I: Cases of renal failure.

	Frequency	Percentage (%)
Acute renal failure	22	55.0
Chronic renal failure	18	45.0
Total	40	100.0

Table-II: Complications of PD (frequency, percentage and cross tabulation).

		Frequency	Percentage (%)	Pathology	
				ARF	CRF
Valid	Peritonitis	6	15.0	2	4
	Bleeding	3	7.5	2	1
	Perforation	1	2.5	0	1
	wound infection	2	5.0	0	2
	catheter blockage	5	12.5	2	3
	catheter leakage	6	15.0	4	2
	Total	23	57.5	10	13
Missing System		17	42.5		
Total		40	100.0		

p=0.473

Forty Patients of acute or chronic renal failure in which PD was done, were included in the study in the Nephrology department during the study period.

Cases were diagnosed on the basis of clinical presentation and laboratory investigations. Informed consent was taken for peritoneal dialysis and using the patient's information in the study. Name, age, sex, social status and record numbers were recorded. Detailed history was taken and patients were examined for the signs of renal failure. Complete blood counts, serum electrolytes, renal function tests, arterial blood

The collected data was entered into the SPSS version 11.0 and analyzed through this statistical program. Socio-demographic data like sex and socio-economy and variables of interest including dyspnea, body swelling, decreased urine output, altered conscious, vomiting, improvement in the clinical signs, renal function tests, arterial blood gases, indications for dialysis, number of days of dialysis and complications were described statistically by finding proportions and percentages.

The efficacy was assessed by improvement in the clinical signs, renal function tests and

arterial blood gases. The course was observed through indications for dialysis, number of days of dialysis and complications associated with PD. For the numerical data like age, weight, blood pH level, renal function tests and number of days of dialysis, mean and standard deviation was taken.

Categorical data including dyspnea, body swelling, decreased urine output, altered conscious, vomiting, indications for dialysis, improvement in the clinical signs and investigations (renal function tests/arterial blood gases) and complications were analysed statistically chi-square test of significance and the numerical data including age, weight, blood PH level, renal function tests and number of days of dialysis were analyzed statistically by t-test of significance. The *p*-value of less than 0.05 was considered significant.

RESULTS

Forty cases of renal failure were enrolled in this study

The mean age was 59.62 months and median age was 54.00 months with standard deviation of 46.74 months. The mean age of males was 59.46 months and of females was 59.92 months.

Of the 40 cases 26 were males and 14 females (65% were males and 35% were females). The mean weight was 13.2 kg; median was 12.50 kg and standard deviation of 8.37 kg and the 95% confidence interval of 10.54-15.89.

Table-III: Complications (acute vs. chronic renal failure).

Type			Frequency	Percentage (%)
Acute renal failure	Valid	Peritonitis	2	9.1
		Bleeding	2	9.1
		Catheter blockage	2	9.1
		Catheter leakage	4	18.2
		Total	10	45.5
	Missing system		12	54.5
		Total	22	100.0
Chronic renal failure	Valid	Peritonitis	4	22.2
		Bleeding	1	5.6
		Perforation	1	5.6
		Wound infection	2	11.1
		Catheter blockage	3	16.7
		Catheter leakage	2	11.1
		Total	13	72.2
	Missing system		5	27.8
		Total	18	100.0

Table-IV: Outcome of Peritoneal Dialysis.

		Patients		Total
		Acute renal failure	Chronic renal failure	
Outcome	Adequate response	13	17	30
	Inadequate PD response	0	1	1
	Death	9	0	9
Total		22	18	40

p-value=0.002

Majority of the cases were of ARF as shown in table-I.

Majority of ARF cases were having hemolytic uremic syndrome and majority of cases of CRF were having Posterior uretheral valves.

The most common sign of ARF was acidotic breathing and of CRF was pallor and fluid over load. Dyspnea was most common symptom of ARF cases and in CRF cases, it was the decreased urine output.

As an indication for PD metabolic acidosis was the most common and was present in 87% of cases. The second most commonly present indication was uremic enceplopathy 35%.

Acidosis was present in 95.5% of ARF and in 77.8% of CRF. Volume overload was present in 40.9% of ARF and 17.6% of CRF. Hyperkalemia was present in 45.5% of ARF cases and 5.6% of CRF. Uremic encephalopathy was present in 40.9% of ARF and 27.8% of CRF.

The mean duration of PD was 3.85 days, median was 4.0 days, and standard deviation was 0.94 and 95% confidence interval of 3.54-4.15. The mean duration of PD in cases of ARF was 3.72 days, median 4.0 and standard deviation was 1.07 in CRF mean duration of PD was 4.0, mode, 4.0 and standard deviation was 0.76. The difference between the durations of PD in ARF and CRF was not significant and *p*-value was 0.566.

Table-V: Cross tabulation of outcomes.

Outcome	**Acidosis**		**Total**
	Yes	**No**	
Adequate response	26	4	30
Inadequate response	1	0	1
Death	8	1	9
Total	35	5	40
p-value=0.92			
Outcome	**Hyperkalemia**		**Total**
	Yes	**No**	
Adequate response	5	25	30
Inadequate response	0	1	1
Death	6	3	9
Total	11	29	40
p-value=0.011			
Outcome	**Uremic Encephalopathy**		**Total**
	Yes	**No**	
Adequate response	8	22	30
Inadequate response	1	0	1
Death	5	4	9
Total	14	26	40
p-value=0.108			
Outcome	**Overload**		**Total**
	Yes	**No**	
Adequate response	6	23	29
Inadequate response	0	1	1
Death	6	3	9
Total	12	27	39
p-value=0.026			

Mean stay of patients at hospital was 11.40 days. Mean stay of patients at hospital was 11.40 days, median was 11.50 days, standard deviation was 3.54 and 95% confidence interval was 10.26-12.53.

The complication rate of peritonitis and catheter leakage was 26.09 each, in the 40 cases (table-II). The most common complication in ARF was catheter leakage, (40.0%), while in CRF it was peritonitis that was the most common, (30.8%) (table-III). The difference between the complications in ARF and CRF was not significant and *p*-value was 0.611

All of the renal functions improved with the PD .

ARF patients had poor outcome and CRF had good outcome with PD. There was a significant difference between the response and *p*-value was 0.006. (table-IV outcome of PD).

Outcome with volume overload and hyperkalemia was significantly poor with *p*-values of 0.026 and 0.011 respectively. Outcome with metabolic acidosis and uremic encephalopathy was good and *p*-value was >0.05 in both of them (table-V).

DISCUSSION

Renal failure has a serious impact on child health. Whether, ARF or CRF the management has always been challenging and required important steps to be taken, in time. Of many interventions PD has its place for both the ARF & CRF.

In our study of 40 cases males outnumbered the female which is supported by already done studies of our region[14,15].

The mean age of presentation in our study was almost 4.96 years while it was 9.48 years in a study done by Ali et al[14] but this study included adult patients also. The mean age of presentations was 4.5 years in a study of ARF patients by Jamal et al[15].

In our study 55% of the patients were of ARF and rest of them were of CRF (table-I) while in a similar study[16] on PD by there were 74% of ARF cases and 26% of CRF. This difference may be due to increased awareness towards PD in ARF and selection of hemodialysis for most of the patients of CRF presently in our centre.

In our study most of the patients of renal failure presented with vomiting, altered conscious state, acidotic breathing and pallor. Common presentations in another study[14], were fever, fluid overload, vomiting and oliguria. A study in children with CRF showed that common presentations were growth failure, metabolic acidosis and hypertension[17].

In our study the most common cause of ARF patients was haemolytic uremic syndrome that is also found in many other studies[15,16] as well. Septicaemia was the second most common cause of ARF followed by acute glomerulonephritis and prerenal causes contributed less in our study. A study[18] in Thailand showed sepsis as the major cause of ARF followed by hypovolemia. Another study[19] in newborns with ARF documented the surgery as the major predisposing factor.

In our study the most common cause of CRF was posterior urethral valves which is supported by the two earlier studies at our hospital[16,17]. The second most common contributing cause of CRF was nephrolethiasis in our study as well as by Hafez et al[17]. A study of general population showed Diabetes Mellitus and hypertension as the leading causes of CRF[20].

The mean duration of PD in our study was 3.85 days while the mean duration of PD was 4.12 days in another local study[14].

Complications occurred in 57.5% of cases in this study in which catheter related and peritonitis were the leading ones (table-II & III). Peritonitis is the universal complication of PD documented as the most prevalent complication in local[9,14,16] as well as other areas of the world[21,22]. Catheter related complications were the most common complications in our study which included blockage and leakages. This was the second most common complication in study by Jamal et al[9]. This increased prevalence of catheter related complications is also

supported by an earlier study[16]. The reported incidence of mechanical complications[23] ranges from 12%-73%. Rate of peritonitis is relatively low in our study as compared to other[2] local[9,16] studies which may be due to technique related and maintenance of asepsis. Catheter related problems might not be given much importance in these studies[9,16]. Bleeding and gut perforation remained little higher in our study as compared to study by Jamal et al[9] which may be due to personal expertise related or small sample size of my study. The certain uncommon complications like abdominal hernias, chyloperitoneum, hydro-thorax, non occlusive mesenteric ischemia, encapsulating peritoneal sclerosis and sudden death were not found in our study as their incidence increases in long term PD in elderly patients and with certain other predisposing factors.

In our study it was the metabolic acidosis that in most of the patients required the PD where as Saeed et al[16] showed equal percentage of metabolic acidosis and fluid overload as an indication of PD.

The efficacy of PD is supported by many studies[9,14,16] however; the underlying pathology and type of renal failure do matter a lot. The overall adequate response in our study was 75% and it is supported by another study[16].

The overall mortality in our study was 22.5% (table-IV) while it was 12% in a previous study at our centre and it was 24% in another study[16]. Mortality rate in study of Jamal et al[9] was 17%. The high mortality rate in our study is likely due to inclusion of more patients of ARF who universally have poor outcome. A local study[9] showed that the high mortality rate in ARF was due to septicaemia and HUS.

Some studies[24,25], have compared the outcome of PD and HD and found PD with increased mortality but we did not compare the two modalities as only the PD was used as a first line dialysis modality.

Some studies[9,14] have documented increased rate of peritonitis with increasing days of PD and this was also observed in our study where peritonitis rates were higher in patient of CRF as they required more days of PD. In a study by Jamal et al[9] 50% cases were left with the persistent renal impairment in the immediate period after doing PD which is contrary to our results.

CONCLUSION

We concluded that peritoneal dialysis is lifesaving procedure which improves the acute metabolic derangements of renal failure in children. It is associated with certain complications but the benefits outweigh the complications.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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