Outcome of Peritoneal Dialysis in Children: Experience in a Tertiary Level Hospital in Chittagong, Bangladesh

Abstract

Objective: The objective of the study is to see the outcome of peritoneal dialysis in child age group ranging from 6 months to 15 years admitted in Chattagram Maa-Shishu-O-General Hospital ICU setup. Methods: Patients were selected randomly who admitted with the indication of renal replacement therapy. Intermittent peritoneal dialysis was done in 10 patients from February 2012 to January 2013. Results: Out of ten patients eight survived and two died due to complication. The success rate is 80%. Among the survivors four made complete recovery with no complication and another four were sent to paediatric surgery for treatment of obstructive uropathy, the primary cause of the renal failure. Conclusion: The data presented indicate that peritoneal dialysis is an effective type of dialysis, that it is safe, that it can be accomplished with a minimum of equipment and that a trained team is essential for its efficient use. It is the preferable practical procedure currently available by which dialysis of an anuric infant or small child can be accomplished.

Key words: Peritoneal dialysis; Children; PD catheter; Hypernatremia; Obstructive uropathy; Hemolytic uremic syndrome; Septicemia; Renal failure.

INTRODUCTION

Worldwide, peritoneal dialysis (PD) has long been recognized as the dialysis modality of choice for pediatric renal failure patients. Not only is the treatment regimen flexible to a variety of family lifestyles and environments; placement of a PD access is usually possible throughout early developmental stages of the lifespan. With infants, hemodialysis (HD), although technically possible, is difficult. Maintenance of a functional and complication-free vascular access can be problematic. The decision to select PD as a dialysis modality for the pediatric patient requires considering several factors including patient size, medical co-morbidities, and overall family support. We lost many patients before, due to lack of peritoneal dialysis facilities in Chittagong. Now we were able to establish a full-fledged Paediatric-Nephrology & Peritoneal Dialysis unit in Chattagram Maa-Shishu-O-General Hospital.

MATERIALS AND METHODS

The study period was from February 2012 to January 2013. In this period IPD (Intermittent Peritoneal Dialysis) done in 10 patients for different indications such as Acute watery diarrhea with hypernatremic dehydration with acute renal failure, Hemolytic uremic syndrome and CRF due to obstructive uropathy. Peritoneal dialysis was done by a trained team in Chattagram Maa-Shishu-O-General Hospital Paediatric ICU setup.

In this study we used disposable Medical Tenckhoff PD catheter. Site for insertion of catheter in all cases was two-third of the distance from the umbilicus to the left last rib just lateral to the border of rectus abdominis muscle. The bladder was emptied before catheter insertion. The procedure was done under aseptic technique. Then, the set of PD lines was prepared and the patency of fluid channel was checked. The area was cleaned with povidone iodine and the patient was draped. Then, the area was infiltrated with lignocaine for local anaesthesia.
For young children additional I/V sedation were needed. For very small infants and patients with very scaphoid abdomen, one may need to infiltrate the abdominal cavity using a canula size 20G or larger with 10 – 15ml/kg PD fluids before catheter insertion to prevent traumatic puncture of underlying vissus. A small skin incision, slightly smaller than the diameter of the catheter is made using a sharp pointed blade. The muscle layer is not cut. The catheter was checked carefully by withdrawing the stilette from the catheter for any breaks before insertion. The catheter with the stilette was introduced perpendicular to the abdominal wall while controlling the length with the dominant hand until the peritoneum is pierced. The stilette was then withdrawn and the catheter gently pushed in directing towards either iliac fossa. The catheter then connected to the PD lines. Skin sutures were not necessary where a retaining knob was present. Bleeding from the insertion site was stopped by a purse-string suture. Dressing was done with dry gauze or gauze impregnated with povidone iodine for the older children.

We started at 20 ml/kg and observed for discomfort, cardiorespiratory changes or leakage at the catheter site. We started at 20 ml/kg and observed for discomfort, cardiorespiratory changes or leakage at the catheter site. The volume was increased by 5 ml/kg/run up to a maximum of 40ml/kg in infants. First 6 cycles were rapid cycles i.e. no dwell time. Subsequent cycles usually lasted an hour 5-10 minutes to instill (depending on exchange volume), 40 minutes dwell, 10-15 minutes to drain (depending on exchange volume). As homeostasis improves, longer dwelling was instituted. The cycles were done manually.

### Table 1: Patient particulars and outcomes

<table>
<thead>
<tr>
<th>Case no</th>
<th>Age</th>
<th>Initial parameters</th>
<th>Diagnosis</th>
<th>Duration of PD</th>
<th>Complication</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case-1</td>
<td>18 months</td>
<td>S.Na+ 194.6mmol/l, pH 7.24, S.creatinine 1.2mg/dl</td>
<td>AWD with hypernatrenc dehydration with ARF</td>
<td>72 hours</td>
<td>None</td>
<td>Survived</td>
</tr>
<tr>
<td>Case-2</td>
<td>11 months</td>
<td>S.Na+ 198mmol/l, pH &lt;6.9, S.cr 2.6mg/dl</td>
<td>AWD with hypernatrenc dehydration with ARF with M etabolic acidosis</td>
<td>6 hours</td>
<td>Died during PD due to severe metabolic acidosis</td>
<td></td>
</tr>
<tr>
<td>Case-3</td>
<td>15 years</td>
<td>S.cr 8.6mg/dl, pH 7.15</td>
<td>CRF due to Obstructive uropathy</td>
<td>72 hours</td>
<td>None</td>
<td>Improved</td>
</tr>
<tr>
<td>Case-4</td>
<td>8 years</td>
<td>S.cr 6 mg/dl, pH 7.2</td>
<td>CRF with bilateral gross hydronephrosis with bladder diverticula with metabolic acidosis</td>
<td>72 hours</td>
<td>None</td>
<td>Improved</td>
</tr>
<tr>
<td>Case-5</td>
<td>8 years</td>
<td>S.cr 5.6mg/dl, pH 7.25</td>
<td>CRF with obstructive uropathy</td>
<td>72 hours</td>
<td>None</td>
<td>Improved</td>
</tr>
<tr>
<td>Case-6</td>
<td>18 months</td>
<td>S.Na+ 187mmol/l, pH 7.35, S.cr 1.8mg/dl</td>
<td>AWD with hypernatrenc dehydration with ARF</td>
<td>72 hours</td>
<td>Peritonitis developed, E.coli growth in PD fluid</td>
<td>Survived, normal</td>
</tr>
<tr>
<td>Case-7</td>
<td>15 months</td>
<td>Hb 5.9g/dl, Platelate -80,000/cmm, RBC In urine, S.cr 8mg/dl, PBF-haemolytic anemia with fragmented RBC</td>
<td>HUS (haemolytic uremic syndrome)</td>
<td>72 hours</td>
<td>Peritonitis developed, pseudomonas growth in PD fluid</td>
<td>Survived, normal</td>
</tr>
<tr>
<td>Case-8</td>
<td>7 yrs</td>
<td>S.cr 5.8mg/dl, pH 7.15</td>
<td>CRF with Metabolic acidosis</td>
<td>72 hours</td>
<td>None</td>
<td>Improved</td>
</tr>
<tr>
<td>Case-9</td>
<td>8 months</td>
<td>S.Na+ 176mmol/l, S.cr 1.2mg/dl, pH 7.2, HCO3- 14 mmol/l</td>
<td>AWD with hypernatrenc with ARF with M etabolic acidosis</td>
<td>72 hours</td>
<td>Peritonitis developed, K.lebsiella growth in PD fluid</td>
<td>Survived, normal</td>
</tr>
<tr>
<td>Case-10</td>
<td>12 months</td>
<td>S.Na+ 173mmol/l, S.cr 2.6mg/dl, pH &lt;6.90, HCO3- 6.0mmol/l</td>
<td>AWD with hypernatrenc with ARF with M etabolic acidosis</td>
<td>72 hours</td>
<td>Peritonitis developed, E.Coli growth in PD fluid</td>
<td>Died 2 days after IPD stopped due to Septicemia</td>
</tr>
</tbody>
</table>

In our cases commercially available dialysis fluid 1.5%dextrose were used. PD was usually initiated with 1.5% and watched for hyperglycaemia. As no hyperglycemia occurs, so we didn’t go for higher concentration of dialysis fluid. We added 3 ml of potassium chloride [1 g (13 mmol) in 10 mls] in every litre of dialysate if serum K+ was found < 4 mmol/l. The addition of heparin (500 units/litre dialysate) was used for the first 3 days and subsequently if blood or fibrin was present in the effluent. We didn’t use bicarbonate as lactic acidosis was not a problem in our cases.

The duration of PD depends on the needs of the patient, we used 60 cycles of PD usually but at times more cycles were needed based on biochemical markers or clinical needs. Serial measurements of fluid balance, weight, vital signs and serum chemistries and dialysate effluent for daily cell count and culture were done. The study was duly permitted by the hospital authority and proper consent was taken from the parents.

### RESULTS

During last one year period we did peritoneal dialysis in 10 patients. Out of those, 5 patients were suffering from diarrhea with hyperneteremia (50%), 4 patients were CRF due to obstuctive uropathy (40%) and 1 was HUS (10%). Total two patients died (20%); one died 6 hours of IPD due to Severe metabolic acidosis and another patient died 2 days after IPD due to septicemia. Our success rate is 80%. Among recovery, four patients referred to pediatric-surgery for correction of obstructive uropathy. The results are mentioned in table-1.
DISCUSSION

Pediatric PD evolved on the heels of the therapy’s early investigative work within the adult ESRD population. Reports published by Bloxsum and Powell in 1948 and Swan and Gordon in 1949, describe PD as a treatment option for children with acute renal failure (ARF). Undeterred by embryonic PD technologies, Swan and Gordon employed available resources such as 60-watt light bulbs over the dialysate inflow path to regulate temperature of the dextrose solution. Novel investigative work continued and in 1961, Segar and colleagues reported the success of pediatric PD for treatment of ARF. Though successful, treatments were plagued with the repeated insertion and removal of metal catheters. In 1968, Tenckhoff and Schecter introduced a safe and permanent catheter which revived interest in PD. Shortly after this innovation, the development of an automated delivery system together with the availability of commercial dialysate revolutionized the ability to perform PD in the home setting. The novel concept of equilibration dialysis transformed PD into a popular, effective, and acceptable form of renal substitution therapy. Continuous ambulatory PD (CAPD) was born providing an appealing alternative to HD (Hemodialysis). Freedom from needle punctures, reduced dietary and fluid restrictions, and decreased risk of disequilibrium syndrome were recognized as potential benefits of choosing PD as one’s dialysis modality. The first reported use of CAPD in a child was in Toronto in 1978. In Bangladesh Peritoneal Dialysis in Pediatric age group started several years ago in Dhaka, specially in BSM MU, subsequently in National Institute of Kidney Disease and Dhaka Shishu Hospital. But in Chittagong we are pioneer in starting Peritoneal Dialysis from 1st February 2012 in ChattagramMaa-Shishu O General Hospital.

PD dialysis fluid is made up of a glucose solution, different concentrations of glucose are provided in order to help with the removal of excess fluid in the blood. The fluid in the blood is pulled across the peritoneal membrane to ‚dilute’ the glucose using the process called osmosis. In order to increase the amount of fluid removed a higher concentration of glucose would be used. Waste products are removed from the blood through the process called diffusion; this process means that molecules will pass from the stronger solution (blood) into the weaker solution (dialysate). Indications for PD are fluid overload as in Pulmonary edema, Congestive cardiac failure, Refractory hypertension, Hindrance to adequate nutrition, Oliguria following recent heart surgery, Oliguria during ECMO; Symptomatic electrolyte/acid-base imbalances as in Hyperkalaemia (K+ >7.0), Hypo- or hypernatraemia, Acidosis (pH<7.2; or <7.3 with hyperkalaemia), toxins such as Ureamia (puritus, pleuritis, pericarditis, CNS symptoms), Hyperuricemia, Exogenous toxins: lithium, salicylate, ethanol, methanol, bromide, ethylene glycol, aminoglycosides. Haemodiaysis (HD) is the therapy for choice for rapid treatment of dialyzable poisonings and Inborn errors of metabolism with encephalopathy and Hyperammononemia. In our series, 5 were hypernatremia, 4 were CRF due to obstructive uropathy and 1 was ARF due to Haemolytic-Uremic syndrome Contraindications of PD are abdominal wall defects of infection, bowel distension, perforation, adhesion or resection and Communication between the chest and abdominal cavities.

Common complications are Poor drainage (omentum obstruction, kinking), Peritonitis, Exit site infection, Leaking dialysate at exit site and leakage from tubing. One of our patient developed peritonitis and another septicemia. Both the patient died out of complications.

CONCLUSION

In experienced hands peritoneal dialysis is a convenient, effective, and reasonably safe way of treating acute renal failure; it is best performed in centers capable of handling complex metabolic problems and investigating and treating the underlying renal disease. In a developing country, the method can also be used to survive the patient with this simple technical maneuver.

Competing Interest : The authors have no competing interest.

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REFERENCES