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Original Research Article

An institutional experience in insertion of hemodialysis catheter and peritoneal dialysis catheter for children with end stage renal disease

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ABSTRACT

Background: Chronic kidney disease (CKD) and end-stage renal disease (ESRD) are major health care problems worldwide even in Pediatric population. The etiology of CKD in children with ESRD is varied. Most of them are started on peritoneal dialysis or hemodialysis before being considered for renal transplantation.
The aims and objective of this study was to analyzed the patient group, methodology, results and outcomes of hemodialysis catheter insertion and continuous ambulatory peritoneal dialysis (CAPD) catheter insertion for children with ESRD. The etiology of ESRD in children with CKD is also reviewed.
Methods: All children with ESRD who underwent CAPD catheter and haemodialysis catheter insertion over a period of 5 years were included in the study. CAPD catheters were inserted by open and laparoscopic assisted methods. The procedures were done without image guidance due to logistical constraints in a limited resource scenario. Analysis of all relevant case records, operative notes and postoperative events were done.
Results: A total of 40 patients who underwent CAPD and hemodialysis catheter insertions were analysed. The primary cases (no previous insertion of dialysis catheter) included 29 and secondary cases (history of previous insertion of dialysis catheter) were 7. Re-insertions (of the same type of dialysis catheter) were 2 in each group. No significant complications occurred in either group.
Conclusions: Dialysis catheters for ESRD in Paediatric population can be inserted safely even without image guidance and with very few complications.

Keywords: Catheter insertion, Chronic kidney disease, Continuous ambulatory peritoneal dialysis, End-stage renal disease, Haemodialysis catheter, Primary cases, Secondary cases

INTRODUCTION

Chronic kidney disease (CKD) and end-stage renal disease (ESRD) are major health care problems worldwide even in Paediatric population.[1] The number of children with CKD and ESRD requiring dialysis have been steadily increasing over time. The etiology of CKD in children with ESRD is varied. Until few decades ago, children with ESRD had a bleak outlook. There have been major advancements in the care of children with CKD and ESRD. Presently these children have the option of being treated with dialysis or renal transplantation.[2] Most of them are started on dialysis and later receive renal transplant. However, the consequences of these renal diseases not only influence the child's health but also have long- term impact on their life as adults too.[3]

The aims and objective of this study was to analyses the patient group, methodology, results and outcomes of hemodialysis and CAPD catheter insertion for children with ESRD. The complications and the reasons for the same in these cases are analysed. The etiology of ESRD in these children is also reviewed.

METHODS

This was a retrospective analytical study. The duration of the study was for 5 years from January 2014 to December 2018.

The study was done in the Departments of Pediatric Surgery and Pediatric Nephrology of a tertiary teaching hospital.

The Study population was 40 children with ESRD who underwent either hemodialysis or CAPD catheter insertions were included in the study. The procedure for each patient was selected by the Pediatric Nephrologist and carried out by the Pediatric Surgeon.

Techniques

Technique of CAPD catheter insertion[4]

CAPD catheters were inserted under general anaesthesia either by an open method or by laparoscopy.

- Open method of CAPD catheter insertion

Insertion is done through the rectus sheath and muscle to reduce leakage and risk of herniation. A 3-4cm transverse incision is made through the skin and subcutaneous tissue at the level of the umbilicus. Most of them are done on the left side, considering that these children are candidates for renal transplantation in the future. The anterior rectus sheath is incised, the rectus muscle is split, and a purse string suture is taken incorporating the posterior rectus sheath, transversalis fascia and the peritoneum.

A 5-6mm incision is made over it and the greater omentum is excised to the extent feasible, to prevent catheter blockade. The catheter is soaked in sterile saline and inserted directed to the pelvis by sweeping through the anterior abdominal wall. The inflow and outflow are confirmed before the purse string suture is tied. The distal end of the catheter is brought out through another incision made on the anterior rectus sheath and the catheter is positioned in a subcutaneous tunnel and the tip brought out.

The catheter has two cuffs, one placed in the preperitoneal space and the second placed in the subcutaneous space.

- Laparoscopic method of CAPD catheter insertion[5]

In Laparoscopy, a 5mm umbilical port is used as the camera port. Through the left flank another port is inserted which is used for omentectomy and as the catheter exit site.

Technique of hemodialysis catheter insertion[6]

Hemodialysis catheters are inserted under general anaesthesia either on right or left internal jugular vein.

Patient is placed supine with neck extended and turned to opposite side. A 1-2 cm incision is made above the clavicle between the two heads of sternocleidomastoid. The platysma and cervical fascia are incised. On separating the heads of sternomastoid, the internal jugular vein is identified. The vein is held in vessel loops. A subcutaneous tunnel is created. The hemodialysis catheter is brought in through the tunnel. After adequate exposure of vein, with tenotomy scissors the vein is opened and the catheter is inserted. The length up to the atriocaval junction is measured.

On right side it's up to the right nipple level and on left side it's just below the right nipple line. The catheter is inserted, and the inflow and outflow are confirmed in both the arterial and venous ends of the catheter and heparinised saline is injected. The catheter is fixed to the skin. Position of the catheter is confirmed postoperatively by chest X ray.

Successful insertion of hemodialysis catheter is defined by- Obtaining good flow, maintenance of catheter for hemodialysis for a minimum period of 4 months and no major complications related to the procedure.[7]

A successfully inserted hemodialysis catheter is used for hemodialysis from the next day onwards.

Successful insertion of CAPD catheter is described as -a catheter which allows 800 ml/sq.m of inflow in children < 2years and 1200- 1400 ml/sq.m in children > 2years; has no outflow obstruction, which is confirmed by complete recovery of the instilled dialysate and could be maintained for the requisite period of peritoneal dialysis. [8]

A successfully inserted CAPD catheter is used for peritoneal dialysis 2 weeks after the insertion.[9] Analysis of all relevant case records, operative notes and postoperative events were done.

RESULTS

Number of cases

The total number of cases were 40, of which 21 underwent hemodialysis and 19 CAPD catheter insertion.

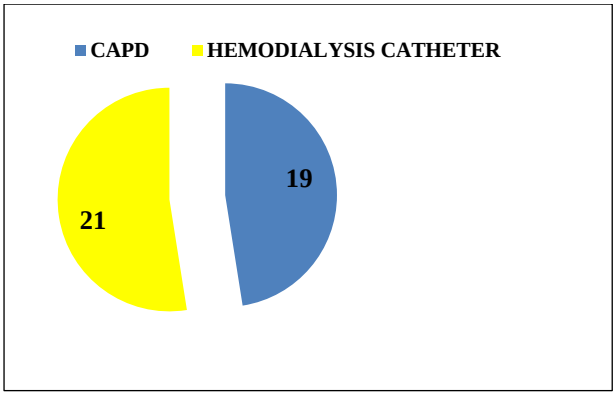

Figure 1: Number of cases.

Sequence of use of the procedures

The total number of primary cases (no previous insertion of dialysis catheter) were 29, of which 16 (55%) were CAPD and 13 (45%) were hemodialysis catheter insertions.

Out of the 7 secondary cases (history of previous insertion of dialysis catheter) one was CAPD catheter insertion patient who had previously underwent hemodialysis catheter insertion; and 6 patients had hemodialysis catheter insertions.

The 2 patients in each group had reinsertions. So, the reinsertion was 10% (4 out of 40 patients). Three patients of CAPD catheter insertion group underwent this under laparoscopic guidance.

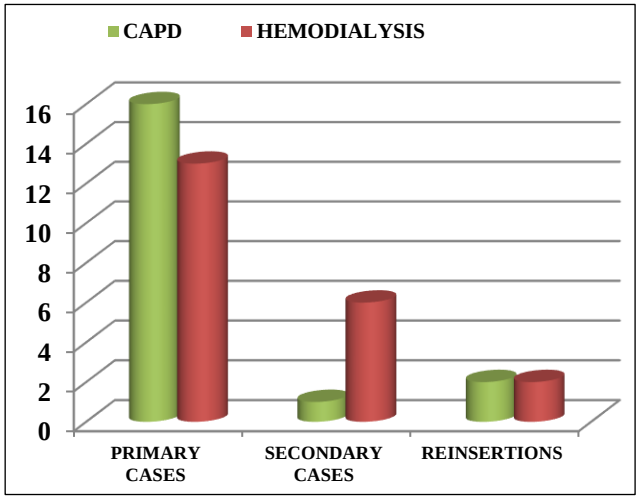

Figure 2: Bar chart of sequence of procedures.

Age group

In this study, age group varied from 40 days to 17 years. The youngest child was a 40-day old baby who underwent CAPD catheter insertion for obstructive uropathy and the eldest in our series was 17-year-old. The most common age group who underwent CAPD catheter insertion was of 0-5-year group. The commonest group who underwent hemodialysis catheter insertion were between 6-15 years. The youngest child with hemodialysis catheter insertion was a 3-month-old infant for Denys Drash syndrome.

Figure 3: Postoperative picture of swan neck tenckhoff CAPD catheter in situ.

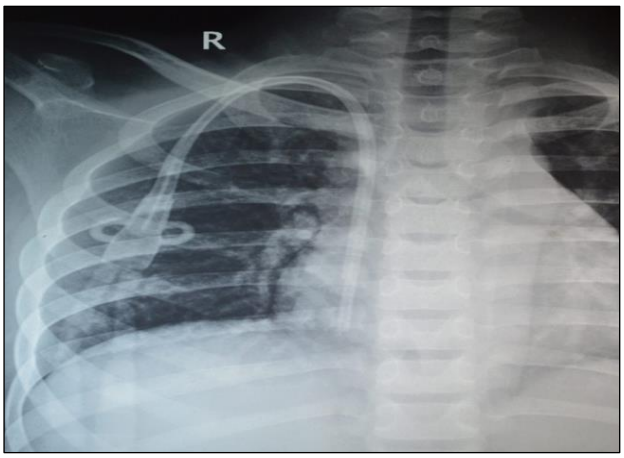

Figure 4: Hemodialysis catheter in right atrium.

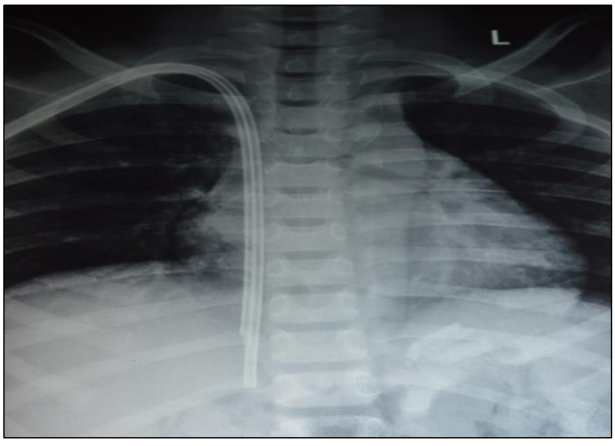

Figure 5: Abnormal position of hemodialysis catheter.

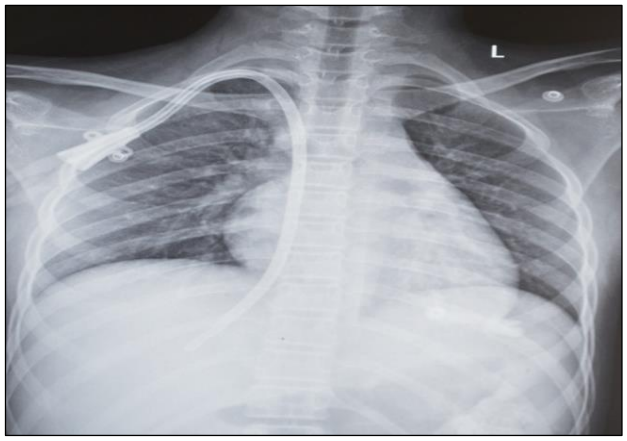

Figure 6: Hemodilaysis catheter in hepatic vein.

Table 1: Age group distribution.

Age group	CAPD	Hemodialysis catheter
0-5 years	8	2
6 -10 years	7	9
11-15 years	4	9
>15 years	0	1
Total	19	21

Sex distribution

In these series, males dominated and the male to female ratio was 1.85:1.

Table 2: Sex distribution.

Technique	Male	Female
CAPD	12	7
Haemodialysis catheter	14	7
Total	26	14

Table 3: Etiological disease distribution in children with ESRD.

Aetiology of CKD with ESRD	n = 40
Obstructive uropathy	10
Steroid resistant nephrotic syndrome	6
Chronic glomerulonephritis	6
Focal segmental glomerulosclerosis	4
Polycystic kidney disease	4
Reflux nephropathy	3
Hypoplastic kidneys	2
Hemolytic uraemia syndrome	2
Denys drash syndrome	1
Medullary nephrocalcinosis	1
Acute lymphocytic leukemia	1

Disease distribution

The commonest etiology for ESRD requiring dialysis was obstructive uropathy, of which the most common cause being Posterior urethral valve. As the age increases, the etiology also becomes more varied. Older children with ESRD were mainly due to chronic glomerulonephritis and focal segmental glomerulosclerosis.

DISCUSSION

In this study the number of hemodialysis patients (52.5%) exceeded that of peritoneal dialysis (47.5%), which was comparable to the study by Chand et al, in which the hemodialysis patients were 59% compared to 41 % of peritoneal dialysis patients.[6]

The number of laparoscopic assisted CAPD catheter insertions in our study was 3. The study Laparoscopic-Assisted peritoneal dialysis catheter implantation in pediatric patients by Mattioli et al has compared the results of Peritoneal dialysis catheter insertion by Laparoscopic- assisted methods in 15 children with open method.[5]

The complications of CAPD catheterare: Outflow failure due to kinks or clots in catheter, kinks in subcutaneous tunnel, leakage of dialysate, omental block; early and late peritonitis.[4,10,11]

In the study by Borzych-Duzalka D et al, the incidence of peritoneal dialysis catheter reinsertion was 13 %, and the most common cause being mechanical obstruction (60%). [12] In this series, the incidence of reinsertion of CAPD catheter was 10.5 % and the reason being mechanical obstruction by omental blockade. This complication was overcome by routine omentectomy during both open and laparoscopic assisted CAPD catheter insertions.

The complications of hemodialysis catheter are: Failure to establish adequate flow, migration of catheter tip, thrombosis, infection, early and late bleeding, hematoma formation and faulty position.[6,13,14]

In this study, most common complication encountered after hemodialysis catheter insertion was bleeding in immediate postoperative period which was managed by head end elevation and compression bandage. The number of hemodialysis catheter reinsertions were 2. Reasons were catheter blockade by thrombus formation in one; and faulty positioning (due to anomalous venous anatomy -Absent superior vena cava) in the other patient.

In this series the average duration of a single CAPD catheter use was 3 years. In the study by Borzych -Duzalka et al, the average duration of peritoneal dialysis catheter was 2 years.[12] The mean duration of a single hemodialysis catheter use was 2 years in our study.

The most common cause of CKD with ESRD requiring dialysis in our series was obstructive uropathy in younger children and chronic glomerulonephritis in older children, which was in accordance with the study by Becherucci et al.[1]

In this study, it was found that, CAPD/ hemodialysis catheter insertions done in children with ESRD requiring dialysis were with good outcome. There were no major complications. The procedure was done without image guidance, though it is ideally done with image guidance.

The catheters could be maintained in these patients for requisite time periods of hemodialysis and peritoneal dialysis. Some of these children underwent the procedure on semiemergency basis as lifesaving procedure. Limitations of study the total number of cases were low.

CONCLUSION

The insertion of Peritoneal dialysis catheter/ Haemodialysis catheter in children with ESRD requiring dialysis is an essential procedure in the armamentarium of a Paediatric Surgeon. In this study, we have analysed the outcome of performing these procedures without image guidance, in a limited resource scenario, and found minimal complications and good outcome.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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