Journal of Pediatric Surgery 49 (2014) 1300–1303

Contents lists available at ScienceDirect

Journal of Pediatric Surgery

journal homepage: www.elsevier.com/locate/jpedsurg

Outcome of tunnelled central venous catheters used for haemodialysis in children weighing less than 15 kg

Pedro-Jose Lopez [a,c], Bernardita Troncoso [a,*], Jean Grandy [b], Francisco Reed [a], Alejandra Ovalle [a], Soledad Celis [a], Danielle Reyes [a], Nelly Letelier [a,c], Ricardo Zubieta [a,c]

[a] Pediatric Urology, Exequiel González Cortes Hospital, Santiago, Chile
[b] Nephrology Services, Exequiel González Cortes Hospital, Santiago, Chile
[c] Department of Pediatrics and Pediatric Surgery, School of Medicine, University of Chile, Santiago, Chile

ARTICLE INFO

Article history:
Received 28 September 2013
Received in revised form 28 January 2014
Accepted 10 February 2014

Key words:
End stage renal disease
Haemodialysis
Central venous
Catheters
Infants, body weight

ABSTRACT

Purpose: Central venous catheters (CVC) are frequently used for haemodialysis (HD) in children. However, there is paucity of information on the outcomes of CVCs when used for HD in very young patients. Our objective is to report the success, safety and complication rates of CVCs used for HD in children weighing less than 15 kg.

Materials and methods: This is a single-center retrospective study of all patients with end-stage renal disease (ESRD) weighing <15kg, who underwent a tunneled CVC placement for HD, between July 2006 and June 2012 at our institution. Analysed data included clinical background, age and weight at initiation of HD, outcome of HD, CVC vein insertion site, reason for removal, and catheter survival (in days).

Results: Thirty-one CVC were placed in 11 patients weighing <15 kg, 8 males and 3 females. The main causes of ESRD were renal dysplasia and congenital nephrotic syndrome. At the beginning of HD, mean age was 27.5 (range 5–60) months and mean weight was 10.4 kg (4.5–13 kg). The preferred insertion site was the right internal jugular vein (90%). Mean duration of HD was 312 days. Mechanical factors were the main reason for catheter removal (39%). Mean catheter survival was 110 days/catheter.

Conclusions: We believe our study provides relevant information and encouraging data to support the use of CVC for HD in this cohort of infants; however, further improvement in prevention of catheter thrombosis and management of infections needs to be achieved.

Over the past two decades, technological advances have made dialysis a viable long-term option for pediatric patients with end-stage renal disease (ESRD), but it still carries a significant morbidity and mortality risk [1–3]. Successful kidney transplant remains the treatment of choice for ESRD; however, the majority of pediatric patients require chronic dialysis while they wait for a transplant, for periods that can last several years [2,4–6].

In children with ESRD, the first option for renal replacement therapy is peritoneal dialysis (PD) and it constitutes 91%–97% of dialysis care in children <1 year of age [4,7]. Haemodialysis (HD) is reserved only for cases in which PD has failed or is impossible owing to anatomical or social reasons [1,2,5–7]; however, it may become necessary to complement PD, when infections or other PD-related complications are being treated. In North America and Europe, only 31% of children receive haemodialysis [7–9] and HD rates are similar in our country [10,11].

In pediatric patients undergoing HD, the vascular access is of vital importance. The use of CVC has become more common in children with ESRD [12,13] and it is currently the first choice for pediatric haemodialysis, especially in patients weighing less than 15 kg [1,2,14]. However, there is considerable morbidity associated with these catheters, mainly related to the patient's disease and the small size of their vessels, and their maintenance requires a lot of manipulation by the surgeons and much care by the nursing staff and parents [13,15–17]. Arteriovenous fistulas (AVF) are associated with a lower failure rate and fewer complications, but they are used only in patients weighing more than 20 kg in most centres [6,12–14,18], mainly because of technical difficulties involved in creating and maintaining the fistula.

There are little data on life expectancy and long-term complications of CVC in children, and there are even fewer reports in children weighing <15 kg [2,14,15,18]. Considering that the difficulties associated with using a CVC for pediatric HD are related mainly to patient weight rather than chronological age [1,2], we studied the use of CVC for haemodialysis in children weighing less than 15 kg. We assessed demographic factors, life expectancy and complications, in order to determine whether the technique is safe in this pediatric population subgroup.

* Corresponding author at: Pediatric Surgery and Urology Service, Exequiel Gonzalez Cortes Hospital for Children, Barros Luco 3301, San Miguel, Santiago, Chile. Tel.: +56 225 765 824.
E-mail address: 1301bts@gmail.com (B. Troncoso).

http://dx.doi.org/10.1016/j.jpedsurg.2014.02.043
0022-3468/

1. Patients and methods

We conducted a retrospective review of the medical records of all patients with ESRD who had HD for at least 1 month, between July 2006 and June 2012 at the Nephrology and Urology Service of the Exequiel González Cortés Pediatric Hospital. Information about demographics, underlying cause of renal disease, age at initiation of HD, site and form of vascular access, number of catheters per patient, reason for removal, complications and catheter survival, duration of HD and outcome was recorded and analysed. For children who remained on HD, data were calculated until December 2012.

All children who weighed less than 15 kg and underwent a tunnelled CVC placement for HD during that period were included in our study. CVC were placed by Paediatric Surgeons using Seldinger's Technique and all procedures were performed in the operation theatre, under general anaesthesia. All of our patients received prophylactic antibiotics immediately before surgery.

A uniform percutaneous needle vein puncture was performed in all patients under strict aseptic precautions. Blind puncture based in anatomic landmarks was used because Doppler ultrasound guidance was not available. After venous access was obtained, confirmed by blood backflow, the guide wire was introduced into the needle and advanced. The needle was then removed, leaving the wire in place, and a dilator was advanced over the guide. Once the tract was dilated, the dilator was removed and the catheter threaded over the wire into the vessel. The catheter was tunneled subcutaneously to the venipuncture site and inserted into the vein with the tip near the level of the third rib. The guide wire was removed, blood return was confirmed and the catheter was flushed with 1 ml of heparinised saline (5000 U/5 ml normal saline) to fill the lumen. All CVC were covered with sterile dressings at the end of the procedure. Intraoperative fluoroscopy was used to confirm guide wire placement and final position of the catheter tip, and further assessment of the position of catheter with a postoperative chest x-ray was routinely performed.

All patients underwent catheter heparin locks between haemodialysis sessions to ensure maintenance of patency. This involves instillation of heparin into the catheters lumens in a volume sufficient to fill to the lumen tip (1000 UI).

Only descriptive statistics were calculated owing to the small number of patients.

2. Results

Over a period of approximately 6 years, 31 CVC were placed in 11 patients weighing less than 15 kg. There were 3 girls and 8 boys. Group characteristics are shown in Table 1. At initiation of HD, mean age was 27.5 (range 5–60) months and weight 10.4 (4.5–13 kg), with 4 patients weighing less than 10 kg. The main causes of ESRD were renal dysplasia, with or without associated urological malformation (n = 4), and congenital nephrotic syndrome, secondary to diffuse mesangial sclerosis (n = 2), focal and segmentary glomerulosclerosis (n = 1), and Dennys-Drash Syndrome (n = 1). The main reasons for haemodialysis initiation were: failed PD owing to recurrent peritonitis (n = 8); social reasons (n = 3) and impossibility of using peritoneal dialysis because of prior abdominal surgeries (n = 1). The mean duration of HD was 312 days (range 26–840).

2.1. Vascular access

A Pediatric Split Cath® LT or Hemo-Cath® LT haemodialysis catheter (Medcomp®, Harleysville, PA, USA) was used for long-term vascular access in all patients. Because of the low weight and small size vessels of our patients, most catheters used were 8Fr/18 cm (25 catheters in 9 patients) and 10Fr/18 cm (5 catheters in 2 patients). Only one patient required a bigger catheter, a 10Fr/24 cm, owing to occlusion of the ones used before.

The most common CVC insertion site was the internal jugular vein (n = 28; 90%), with the right jugular vein used more frequently than the left (Table 2). Only 3 patients underwent CVC placement at another site (subclavian vein, n = 2, and femoral vein, n = 1), in all cases owing to thrombosis of both jugular veins. The mean number of catheters placed per patient was 2.5 (range 1–5). Mean catheter survival was 110 days/catheter (range 26–586).

The main reason for removing the catheters was mechanical factors (39%) such as occlusion, owing to thrombosis and kinking, displacement and fracture (Fig. 1), followed by infections (13%), which occurred in 4 catheters. CVC occlusion was suspected when inadequate blood flow was observed. Before catheter removal, a trial with local infusion of streptokinase was made. Five catheter thromboses were proven in 4 patients. After fibrinolytic treatment, there was partial response in 2 cases, with only transitory increase in catheter permeability, and no response in the remaining 3. All CVCs had to be replaced.

Table 1
Characteristics of pediatric patients undergoing chronic haemodialysis.

Patient	Renal disease	Gender	Age at initiation of HD (mo)	Weight at initiation of HD (kg)	Duration of HD (d)	No. of AV	Outcome of HD
1	CNS[a] FSGS[b]	M	28	11.8	162	5	Successful transplant
2	Nephropathy owing to VUR[c]	M	0.4	6.3	312	5	Successful transplant
3	PKD[d]	F	51	12.4	186	2	Successful transplant
4	Renal dysplasia	M	60	13	216	4	Moved to AVF
5	CNS[a] DMS[e]	M	20	10.5	30	1	Moved to PD[f]
6	CNS[a] DMS[e]	M	42	11.7	586	1	Successful transplant
7	Renal dysplasia	M	5	5.5	840	3	Successful transplant
8	Prune belly syndrome	M	9	7	216	2	Expired
9	Renal dysplasia	F	30	13	420	5	Moved to PD[f]
10	CNS[a] Denys-Drash syndrome	M	6	4.5	243	1	In HD
11	Renal dysplasia	M	34	11.1	216	2	In HD

[a] CNS: Congenital nephrotic syndrome.
[b] FSGS: focal segmental glomerulosclerosis.
[c] VUR: Vesicoureteral reflux.
[d] PKD: polycystic kidney disease.
[e] DMS: diffuse mesangial sclerosis.
[f] PD: peritoneal dialysis.