CLINICAL STUDY

Venous Ports in Infants

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ABSTRACT

Purpose: To evaluate technical success and the incidences of, and risk factors for, mechanical and infectious complications of venous port placement in infants.

Materials and Methods: This was a retrospective single-institution cohort study of port placement in infants (age < 1 y) from January 2006 through June 2016 (mean age, 7.5 mo ± 3.3; mean weight, 8.1 kg ± 1.9). Age, weight, sex, side of placement, tip position, and indication for placement (chemotherapy vs other) were recorded. Total catheter-days (CDs), mechanical complications, and central catheter–associated bloodstream infections (CCABSIs) were identified.

Results: During the study years, 64 ports were placed in 64 infants, with a technical success rate of 100%. The mean catheter life was 321 days (total range, 4–1,917 d; interquartile range [IQR], 107–421 d). There were 13 CCABSI events (0.63 per 1,000 CDs); of these, 8 (12.5% among 64 patients) required port removal for infection. There was an increase in CCABSIs in patients with left-sided port placement (relative risk [RR], 3.22; 95% confidence interval [CI], 1.02–10.14; $P = .05$). There were 8 mechanical complications of the port reservoir or catheter (0.39 per 1,000 CDs). Of these, 2 (3.1%) required removal. Patients in the lowest weight quartile were at an increased risk of mechanical complications (RR, 4.37; 95% CI, 1.09–17.48; $P = .04$).

Conclusions: Venous ports can be placed with a high rate of technical success in infants. Left-sided ports and low weight are associated with increased infectious and mechanical complications, respectively.

ABBREVIATIONS

CCABSI = central catheter–associated bloodstream infection, CD = catheter-day, CI = confidence interval, EMR = electronic medical record, IQR = interquartile range, RR = relative risk, TPA = tissue plasminogen activator

Subcutaneously implanted venous access devices, also known as ports, are used for long-term venous access indications, including the administration of medications, chemotherapy, plasmapheresis, and nutrition. Ports offer quality-of-life advantages over other venous access devices that are specific to children, such as a reduction in the stigma associated with an externally visible catheter, positive perception by parents, and no risk of accidental dislodgment (1). Although access requires strict aseptic technique and the use of topical anesthesia cream, ports can be accessed with minimal pain. Ports may also decrease the need for peripheral venipuncture and the associated discomfort.

The use of ports in children has been previously described, including technical success rates, utility of placement, and device-related complications (2–6). However, there is significant heterogeneity in the pediatric literature. A recent large meta-analysis, for example, comparing external catheters and ports placed in pediatric oncology patients (7) found significant variation between studies regarding ages and indications. Infants—children younger than 1 year of age—are particularly underrepresented, likely because of the limited number of indications for port placement in this population. There are also unique technical considerations for the placement of ports in infants compared with older children, such as limited chest wall space and lack of subcutaneous fat. For example, Janik et al (8) demonstrated a higher rate of technical complications when a 6-F catheter, surgical port, or tunneled catheter was placed in a child 6–12 months of age or weighing less than 10 kg compared with older, larger children.

Infants are also undergoing a phase of rapid longitudinal growth, and, as with other mechanical devices such as

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ventriculoperitoneal shunts, it is possible that catheter tip migration/displacement may occur during the implantation period (9). For example, the 50th percentile for length at birth is 49.9 cm and increases to 87.9 cm at 24 months for boys, a 57% growth over a period of 2 years (10). Such concerns about patient growth and its impact on port complications has the potential to impact willingness to consider port placement in infants.

The primary aim of the present study is to report the technical success of port placement in infants and the rates of, and risk factors for, mechanical and infectious complications in this population.

MATERIALS AND METHODS

This was an institutional review board–approved retrospective study of all ports placed in children younger than 1 year of age from January 1, 2006, through June 30, 2016, at a single institution. Cases were abstracted from the local radiology search engine (Softek Illuminate, Overland Park, Kansas). Demographic and procedural information were recorded from the electronic medical record (EMR; EPIC Systems, Verona Wisconsin; Table 1). Age and weight were treated as categorical variables, with < 5 months defining the youngest quartile and < 7 kg defining the lowest weight quartile.

Table 1. Demographic and Procedural Details (N = 64)

Characteristic	Value
Mae sex	39 (62.5)
Age (y)	
Mean ± SD	7.5 ± 3.3
IQR	5.0–11.0
Range	0–12
Weight (kg)	
Mean ± SD	8.1 ± 1.9
IQR	7.0–9.0
Range	3.7–12.5
Sedation	
General anesthesia	33 (51.6)
Moderate sedation	31 (48.4)
Single-lumen port	64 (100)
Internal jugular vein	
Right	48 (75.0)
Left	16 (25.0)
Catheter size (F)	
5	23 (35.9)
5.5	25 (39.1)
6	2 (3.1)
6.5	14 (21.9)
Tip location	
Cavoatrial junction	34 (53.1)
Right atrium	30 (46.9)

Note–Values in parentheses are percentages.
IQR = interquartile range.

A total of 64 ports were placed in 64 patients during the study period. The majority of ports were placed for the administration of chemotherapy (89.1%; Table 2). Among the nonchemotherapy indications, 4 ports were placed in patients with hemophilia needing frequent factor VIII replacement, 2 were placed in patients with metabolic disorders (propionic acidemia and ornithine transcarbamylase deficiency) requiring enzyme replacement therapy, and 1 was placed for parenteral nutrition in a patient with necrotizing pancreatitis.

All ports were placed by a specialty-trained pediatric interventional radiology attending physician or by a directly supervised pediatric interventional radiology fellow. Ports were inserted in the interventional radiology suite or operating room by the interventional radiologist via standard technique with real-time ultrasound and fluoroscopy as previously described (4). Hematologic inclusion criteria were a platelet level greater than 50,000/μL and an International Normalized Ratio less than 1.5 with or without correction.

Technical success was defined as an absence of procedural complications and the placement of a functioning port with the catheter tip at the desired position. Tip position and port reservoir location were ascertained by reviewing images from the time of placement, with the cavoatrial junction defined as 2 vertebral body units below the carina (11). At the preference of the attending physician, catheters were positioned at the cavoatrial junction or in the right atrium (Fig). One port reservoir was placed over the sternum. All other ports were placed over the second rib on the anterior chest wall and were secured in position with nonabsorbable sutures. All chest incisions were approximated with deep interrupted and running subcuticular absorbable sutures. All catheters were instilled with dilute heparin (10 U/mL or 100 U/mL) when not in use.

Patients with ports were not followed on a scheduled basis in the interventional radiology clinic, but it was standard practice during the study years to notify interventional radiology personnel regarding concerns for complications related to ports placed via interventional radiologic means.

Table 2. Diagnoses of Patients with Ports for Chemotherapy (n = 57)

Diagnosis	No. of Pts.
Central nervous system neoplasm	21
Severe combined immunodeficiency	8
Leukemia	6
Langerhans cell histiocytosis	4
Neuroblastoma	4
Retinoblastoma	4
Fibrosarcoma	3
Hepatoblastoma	3
Renal neoplasm	2
Kaposiform hemangioendothelioma	1
Rhabdomyosarcoma	1