Incidence of Complications Associated with Long Term Use of Peripherally Inserted Central Catheters in Pediatric Cardiac Patients

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Introduction

- The use of centrally placed catheters is increasing for stable postoperative central access due to the increased number and complexity of neonatal and pediatric congenital heart disease, surgeries, and treatments.
- Central venous lines are particularly essential and useful for simultaneous continuous cardiac monitoring and intravascular central access for medications, inotropes, fluid administration, parenteral nutrition, and laboratory sampling.
- Existing literature studying PICC lines in pediatric cardiac patients is scant and have shown variable complication rates.

Research Question

The aim of this study is to determine the type and incidence of PICC line-related complications in pediatric cardiac patients at a large tertiary center.

Materials and Methods

- Retrospective study conducted in a tertiary, multidisciplinary pediatric cardiac intensive care unit (ICU) at Phoenix Children's Hospital.
- Measured endpoints: thrombus, failed removal bleeding, damage, infection, catheter migration.
- Study included patients aged 1 day to 18 years admitted to the CICU after their cardiac surgery between July 1, 2016 and June 30, 2018 that received PICC lines. Patients whose cardiac surgeries were performed at other institutions, who did not have percutaneously inserted central catheters, and who were admitted to the CICU for other reasons were excluded.
- Approval, with waivers of consent and HIPAA authorization, was obtained from the IRB prior to initiation of the study.
- Electronic medical records of all eligible, admitted patients were reviewed retrospectively.
- Demographic, clinical and PICC line data for the overall cohort of patients were described using medians and ranges for continuous variables and frequencies and percentages for categorical variables.

Results

The study included 351 cardiac patients with a median age of 4.5 months (range, 0 days to 18 years old). Amongst the total of 556 PICC lines inserted in this patient population, 151 patients (43%) had 2 lines, 37 (10.5%) had 3 lines, 10 (2.8%) had 4 lines, and 7 patients (1.9%) had 5 or more lines placed. The majority of PICC lines (81.4%) were placed during weekdays (Monday to Friday). Of the total 556 PICC lines, 537 (96.5%) were successfully placed. Thirty-nine of the 351 patients (11.1%) were safely discharged home with the PICC line in place to continue home therapy. The median duration of PICC line placement, defined as time from placement to removal or discharge home, was 17 days (range 0 to 202 days). Complications occurred in 168 of the 537 successfully placed PICC lines (31.3%). Sixty-nine of the 168 PICC lines with complications (41.1%) were removed from the patient when the complication was found.

Variable	% of Patients	Variable	% of Patients
Location of PICC line tip		**Patient location at time of insertion**	
Cavoatrial junction	41.9%	Radiology dept.	52.3%
Inferior vena cava	39.9%	Intensive care unit	40.8%
Superior vena cava	11.5%	Catheterization lab	3.6%
Right atrium	2.9%	Inpatient floor	0.5%
Other vessels	3.7%	Operating room	0.3%
		Other locations	2.3%
Catheter size		**No. PICC Lumens**	
2.6 Fr	29.3%	Single	7.8%
3 Fr	14.4%	Double	92.2%
4 Fr	52.3%		
5 Fr	3.9%		

Table 1: Data on location of PICC tip, patient location at time of insertion, catheter size, and lumens.

Complication	No. of Complications	Incidence Amongst Lines with Complications (%)	Incidence Amongst All Lines (%)
Dislodgement	94	55.9%	17.5%
Migration/ Malposition	32	19.0%	5.9%
Thrombus	16	9.5%	2.9%
Leaking	13	7.7%	2.4%
Suspected line infection	7	4.1%	1.3%
Catheter damage	6	3.5%	1.1%

Table 2: Total number and incidence of PICC lines with complications for each category of adverse event.

Complication	No. of Lines with Complication Removed	% Lines Removed for each Complication	% Lines Removed Amongst All Lines with Complications
Dislodgement	30	31.9%	17.8%
Migration/Malposition	15	46.9%	8.9%
Thrombus	9	56.3%	5.3%
Leaking	7	53.8%	4.1%
Suspected line infection	2	28.6%	1.1%
Catheter damage	6	100%	3.5%

Table 3: Total number and percentage of PICC lines removed amongst each individual category of complication and amongst all 168 lines with complications.

Conclusion

- Incidence of overall PICC line-associated complications in this cohort of pediatric cardiac patients (31.3%) is similar to the general population but high overall.
- Pediatric cardiac patients in this cohort had much lower thrombus and infection incidence rates than previously identified.
- Study findings cannot be extrapolated to general pediatric population. Risk factors were not evaluated due to limited patient sample and retrospective study design.
- Absence of standardized PICC care placement and maintenance may be important confounder.
- Critical to recognize the high incidence of complications with PICC line use especially amongst critically ill, pediatric cardiac patients.
- Need further study and vigilance to limit adverse events associated with long-term PICC line use

Summary

- Of the total 556 PICC lines inserted, 96.5% (n = 537) were successfully inserted with complications occurring in 31.3% (n = 168) of the successfully inserted lines.
- The type and incidence of complications identified in the study sample include catheter dislodgement (17.5%), migration/malposition (5.9%), thrombus (2.9%), leaking (2.4%), infection (1.3%), and damage (1.1%).
- Future studies should expand to include a larger cohort of cardiac patients and assess risk factors for each complication.

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