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# Increased complication rates associated with Port-a-Cath placement in pediatric patients: Location matters

**Sara C. Fallon, Emily L. Larimer, Natalie R. Gwilliam, Jed G. Nuchtern, J. Ruben Rodriguez, Timothy C. Lee, Monica E. Lopez, Eugene S. Kim***

*Texas Children's Hospital, Division of Pediatric Surgery, Michael E. DeBakey Department of Surgery, Baylor College of Medicine, Houston, TX 77030, USA*

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**Abstract**

**Introduction:** Port-a-Caths (PACs) are commonly placed below the clavicle or below the inframammary line for cosmesis. We hypothesized that inframammary placement is associated with increased catheter-related complications due to redundant catheter length.

**Methods:** A review of pediatric patients with PAC placement from 2007 to 2009 was performed. Port placement was identified as subclavicular (SC) or inframammary by x-ray (below the fifth-intercostal space). Inframammary ports were stratified by the midclavicular line: medial inframammary (MIM) and lateral inframammary (LIM). Early complications (<30 days) and late complications were analyzed.

**Results:** We identified 167 SC, 46 MIM, and 166 LIM patients. LIM placement was independently associated with increased total complication rate ($p < 0.001$), migration rate ($p < 0.001$), and operative exchange ($p = 0.017$) compared to the SC group. The catheter survival time was decreased in the LIM vs. SC group (1021 ± 55 vs. 1396 ± 48 days, $p = 0.005$). Additionally, LIM placement was independently associated with increased odds of catheter removal ($p = 0.006$). MIM patients demonstrated fewer complications compared to the LIM group (17.4% vs. 44.6%, $p = 0.001$) and were similar to the SC group (17.4% vs. 20.4%, $p = 0.835$).

**Conclusions:** Lateral inframammary chest wall placement of PACs is independently associated with increased total complication rates, migration rates, and need for operative exchange. We recommend subclavicular or medial inframammary PAC placement in children.


Subcutaneous implantable vascular access devices, or Port-a-Caths (PAC), are commonly used in children who require long-term central venous access for medications or nutrition. Common pediatric conditions that necessitate PAC placement include childhood lymphomas, solid organ tumors, cystic fibrosis, sickle cell disease, and short gut syndrome. The benefits of these ports, as opposed to tunneled central lines (TCL) or percutaneously inserted central catheters (PICC), include ease of medication administration, decreased infectious risks, and improved patient quality of life [1]. Children are able to continue with normal activities, including swimming, without compromising their venous access.

* Corresponding author. Tel.: +1 832 822 3135, +1 832 825 3141.
*E-mail address:* eskim@bcm.edu (E.S. Kim).

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However, the insertion of these PACs is not without complication [2,3]. Reported overall rates of complication range from 5% to 31%, and may include catheter embolization into the heart, medication extravasation, and infection [2,4]. PACs may be particularly prone to medication leakage and extravasation from the insertion site of the catheter onto the reservoir. Additionally, PACs are typically left in situ for a longer period of time than either TCL or PICC lines. As the child grows, these catheters are particularly prone to proximal migration and subsequent dysfunction, often requiring operative exchange.

At our institution, PACs are commonly placed below the inframammary line on the lateral chest wall, as opposed to directly beneath the clavicle, for the cosmetic appeal of a less visible incision and reservoir. This technique has been particularly popular in female patients. We empirically noted a high rate of PAC revision, presumably secondary to an increased migration rate caused by the redundancy of catheter length as it travels over the active pectoralis and serratus muscle groups. While this complication does not usually pose a direct threat to the patient's health, many of these children have poor immune function and are high-risk operative candidates with often difficult venous access. Therefore, the purpose of this study was to evaluate the effect of the location of PAC placement on overall complication, migration, and operative exchange rates.

## 1. Methods

### 1.1. Patient population

After IRB approval (H-29956), patients (ages 1–18) who had their initial PAC placed at our institution from 2007 to 2009 were identified through our surgical database. Patients who had the catheter removed at another institution were excluded from the study. Patients less than a year of age were excluded due to a markedly different PAC indication profile, the rapid growth in this population, and the decreased frequency of port placement compared to TCL.

### 1.2. Operative technique

All ports were placed under physician-controlled fluoroscopic guidance. The catheter brand used in all cases was Vortex Port (AngioDynamics, Manchester, GA). The vein (usually subclavian) is then accessed, and a wire is introduced with confirmation of correct positioning by fluoroscopy. A subcutaneous pocket is created to accommodate the low-profile reservoir. The catheter is cut to the approximate length of the cavo-atrial junction, and is inserted using standard Seldinger technique. Final positioning is fluoroscopically confirmed, the reservoir is secured in place with non-absorbable sutures to the chest wall fascia, and the skin is closed over the port. The subcutaneous pocket is created directly below the clavicle on the anterior chest wall (SC), on the lateral chest wall in the inframammary location (LIM), or next to the distal sternum just proximal to the xiphoid process (MIM). All patients had immediate post-placement radiographs.

### 1.3. Study design

Port placement was identified as being subclavicular (SC) or below the inframammary line by the immediate postoperative chest radiograph; the fifth intercostal space was used to differentiate SC and inframammary groups. Inframammary ports were stratified into two groups based on the midclavicular line: medial inframammary (MIM) next to the sternum, and lateral inframammary (LIM) along the lateral chest wall, usually along the anterior axillary line (Fig. 1).

Outcomes of interest included rates of total complications, migrations, and operative exchanges for both cohorts. Early complications were defined as those occurring within 30 days and included pneumothorax, line infection, operative malpositioning, and wound problems. Late complications included catheter infection, migration, occlusion requiring removal, leakage, or reservoir flipping. Operative exchange was not needed for all complications, since some patients did not have an indication for continued central access at the time of malfunction. Occlusions which were treated with TPA were not included due to inconsistencies with documentation.

Patients were compared based on their preoperative characteristics and their postoperative complication profiles, operative exchange rates, and length of catheter life. Chi-square and Student's *t*-tests were used for normally distributed categorical and continuous data, respectively. Predictors of adverse outcomes were analyzed using a logistic regression model. The survival of the individual catheter was analyzed using both a Kaplan–Meier survival curve with a log-rank test and a Cox proportional hazard ratio. Catheter survival time was defined as the time to insertion until the time to operative exchange, if necessary. Statistical analyses were performed using SPSS (Version 19, Chicago, IL). A $p$-value $< 0.05$ was considered statistically significant.

## 2. Results

From 2007 to 2009, 379 patients had their initial PAC placed at our institution. 167 (44.1%) were placed in the subclavicular position (SC), 166 (43.8%) were in the lateral inframammary position (LIM), and 46 (12.1%) were in the medial inframammary position (MIM). The preoperative demographics are presented in Table 1. Males were more likely to have a subclavicular placement. The groups were similar with respect to age, BMI, and indication for