


# Nontunneled central venous catheter bloodstream infections in pediatric surgery

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*To the Editor*—In most cases, pediatric patients that have undergone invasive surgery need a central venous line to allow nutritional and therapeutic support before, during, and/or after the procedure. Central-line-associated bloodstream infections (CLABSIs) are one of the most dangerous complications of central venous catheter (CVC) placement; they contribute significantly to morbidity and mortality, and they are risk factors for increased hospital costs and length of stay.<sup>1</sup> Even so, only a few studies in the literature have addressed the incidence and risk factors for CLABSIs in pediatric surgical patients.

## Methods

We conducted an 18-month prospective observational study at Regina Margherita Children's Hospital (Turin, Italy), a pediatric-referral teaching hospital including medical and surgical wards and transplant divisions. Data from all temporary CVCs (both nontunneled catheters and peripherally inserted CVCs (PICCs) that were placed in children that had undergone major surgery were collected.

A CLABSI was defined using the US Center for Disease Control and Prevention definitions,<sup>2</sup> but given the characteristics of the population, a clinical CLABSI category was also recorded. This category included all patients (1) with clinical and laboratory signs and/or symptoms of sepsis,<sup>3</sup> without an infection at another body site, in which microbiological tests on blood yielded negative results, (2) with fever or signs/symptoms of sepsis after a infusion or a manipulation procedure of the central line, and (3) with clinical improvement after initiation of empiric antibiotic therapy and/or central-line removal.

## Results

We enrolled 290 patients (163 male and 127 female) undergoing major surgery, representing a total of 3,576 CVC days. Of those patients, 66 had PICCs and 224 had nontunneled CVCs, for sub-totals of 1,174 and 2,402 CVC days, respectively. Most patients had undergone neurosurgery ( $n = 143$ , 49%) or major abdominal surgery ( $n = 119$ , 41%), and almost all of these patients ( $n = 282$ , 97%) received antibiotic treatment (and 22 with glycopeptides). In 32 cases, fever was observed when performing the CVC insertion. Most CVCs were placed in the internal jugular vein ( $n = 170$ ,

58.6%) or femoral vein ( $n = 49$ , 16.9%); PICCs were mostly placed in the basilic and saphenous veins (combined  $n = 24$ , 8.3%).

Based on the aforementioned definitions, 6 patients were diagnosed with clinical bloodstream infection, CVC-related. The overall CLABSI rate was 0.02% (6 of 290), or 1.68 CLABSIs per 1,000 catheter days. Moreover, 2 infections were PICC related, with an incidence of 1.70 per 1,000 catheter days, and 4 infections were diagnosed in the presence of nontunneled central lines, with an incidence of 1.66 infections per 1,000 catheter days.

CLABSIs were statistically related to preschool age ( $P = .023$ ), fever when performing CVC insertion ( $P = .019$ ), and emergency surgery ( $P = .045$ ). Duration of CVC insertion, type of surgery, site of insertion, and type of CVC (PICC vs nontunneled CVC) were not associated with augmented risk of central-line infection.

## Discussion

The incidence of CLABSIs in pediatric populations has been described in depth in oncology wards, neonatal or pediatric intensive care units (ICUs), and also in National Healthcare Safety Network reports. CLABSIs from temporary CVCs were reported only in pediatric oncology patients, and no data were available for in pediatric surgical patients.<sup>4</sup>

To our knowledge, this study is the first to focus only on surgical pediatric patients outside of PICUs with temporary central lines, allowing the estimation of CLABSI incidence in this well-defined population. Previously, our rates could only be benchmarked against those obtained in the adult population.

In a similar study involving an adult population, Wu *et al*<sup>5</sup> found 5.6 catheter-related bloodstream infections per 1,000 catheter days, a significantly higher rate than in our study, probably due to the high proportion of oncology or chronic patients.

We identified 3 factors associated with CLABSI in our patient population: preschool age, fever during the insertion, and emergency surgery. Correlation with preschool age may be related to the difficulties in maintaining hygiene in this age group of patients when frequent manipulation and medications by nursing staff are required that could increase central-line infection risk.<sup>6</sup> Fever at the moment of insertion is probably due to a transient bacteremia during CVC placement that can lead to catheter colonization by the pathogen. Emergency surgery, already described in the adult population, can be associated with an increased risk of CLABSI, likely caused by rapid but incompletely sterile CVC insertion.<sup>5</sup>


The study has several limitations. It was performed in a single center, and only clinical CLABSIs were observed. This is probably due to the well-known limitations of blood-culture sampling in pediatric populations: small amounts of blood obtained from children and the high percentage (97%) of concomitant antibiotic therapy can reduce the chance of bacteria isolation.

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Despite the limits encountered, this report is the first to describe the incidence and risk factors of temporary central-line infections (nontunneled CVC and PICC) in pediatric patients that have undergone invasive surgery. CLABSIs in this well-defined population are infrequent compared to oncology patients<sup>7</sup> or premature newborn patients.<sup>8</sup> However, these events may complicate the postoperative course, with increased hospital costs and lengths of stay, and this complication should be considered in the management of pediatric surgical patients.

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## References

1. Ares G, Hunter CJ. Central venous access in children: indications, devices, and risks. *Curr Opin Pediatr* 2017;29:340–346.
2. Horan TC, Andrus M, Dudeck MA. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. *Am J Infect Control* 2008;36:309–332.
3. Goldstein B, Giroir B, Randolph A; International Consensus Conference on Pediatric Sepsis. International pediatric sepsis consensus conference: definitions for sepsis and organ dysfunction in pediatrics. *Pediatr Crit Care Med* 2005;6:2–8.
4. Dudeck MA, Weiner LM, Allen-Bridson K, *et al.* National Healthcare Safety Network (NHSN) report, data summary for 2012, device-associated module. *Am J Infect Control* 2013;41:1148–1166.
5. Wu S, Ren S, Zhao H, *et al.* Risk factors for central venous catheter-related bloodstream infections after gastrointestinal surgery. *Am J Infect Control* 2017;45:549–550.
6. Moon HM, Kim S, Yun KW, *et al.* Clinical characteristics and risk factors of long-term central venous catheter-associated bloodstream infections in children. *Pediatr Infect Dis J* 2018;37:401–406.
7. Hord JD, Lawlor J, Werner E, *et al.* Central-line-associated bloodstream infections in pediatric hematology/oncology patients with different types of central lines. *Pediatr Blood Cancer* 2016;63:1603–1607.
8. Dahan M, O'Donnell S, Hebert J, *et al.* CLABSI risk factors in the NICU: potential for prevention: a PICNIC study. *Infect Control Hosp Epidemiol* 2016;37: 1446–1452.