



# Urinary tract infection in children after cardiac surgery: Incidence, causes, risk factors and outcomes in a single-center study



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Received 15 September 2015; received in revised form 10 December 2015; accepted 19 December 2015

## KEYWORDS

Urinary tract infection;  
Cardiac surgery;  
Nosocomial

**Summary** Nosocomial urinary tract infection (UTI) increases hospitalization, cost and morbidity. In this cohort study, we aimed to determine the incidence, risk factors, etiology and outcomes of UTIs in post-operative cardiac children. To this end, we studied all post-operative patients admitted to the Pediatric Cardiac Intensive Care Unit (PCICU) in 2012, and we divided the patients into two groups: the UTI (UTI group) and the non-UTI (control group). We compared both groups for multiple peri-operative risk factors. We included 413 children in this study. Of these, 29 (7%) had UTIs after cardiac surgery (UTI group), and 384 (93%) were free from UTIs (control group). All UTI cases were catheter-associated UTIs (CAUTIs). A total of 1578 urinary catheter days were assessed in this study, with a CAUTI density rate of 18 per 1000 catheter days. Multivariate logistic regression analysis demonstrated the

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following risk factors for CAUTI development: duration of urinary catheter placement ( $p < 0.001$ ), presence of congenital abnormalities of kidney and urinary tract (CAKUT) ( $p < 0.0041$ ) and the presence of certain syndromes (Down, William, and Noonan) ( $p < 0.02$ ). Gram-negative bacteria accounted for 63% of the CAUTI. The main causes of CAUTI were *Klebsiella* (27%), *Candida* (24%) and *Escherichia coli* (21%). Resistant organisms caused 34% of CAUTI. Two patients (7%) died in the UTI group compared with the one patient (0.3%) who died in the control group ( $p < 0.05$ ). Based on these findings, we concluded that an increased duration of the urinary catheter, the presence of CAKUT, and the presence of syndromes comprised the main risk factors for CAUTI. Gram-negative organisms were the main causes for CAUTI, and one-third of them found to be resistant in this single-center study.

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## Introduction

Nosocomial infections after pediatric cardiac surgery are common, occurring in 16–31% of cases [1–4]. Blood stream infection (BSI), ventilator associated-pneumonia (VAP), urinary tract infection (UTI) and surgical site infection (SSI) are the main causes for nosocomial infections [2]. The development of nosocomial infections increases the treatment cost and leads to morbidity and mortality in the affected patients [5].

The information available about nosocomial UTIs in children undergoing cardiac surgery is limited. The majority of the published data address nosocomial UTIs in general ICUs, and there is a striking paucity of data about UTI and CAUTI development in specialized Pediatric Cardiac ICUs (PCICUs). Recently, many authors have advocated establishing specialized dedicated pediatric cardiac ICUs to improve outcomes [7]. The characteristic features of these specialized units in terms of their infection rate, type of infection, causes and outcomes therefore require evaluation. Furthermore, many hospitals have recently started reporting the emergence of resistant organisms in their ICUs [6]. The magnitude and impact of this problem in PCICU patients requires further study and analysis.

The objectives of this study are to determine the incidence, etiology, main risk factors, and outcome of UTIs in post-operative cardiac children admitted to the PCICU.

## Methods

We conducted this retrospective cohort study on prospectively collected data in the PCICU at King Abdulaziz Cardiac Center, Riyadh, Saudi Arabia. Our PCICU consists of 12 beds. The average annual number of medical–surgical admissions is

approximately 550 patients; approximately 80% of these patients are admitted following cardiac surgery. The majority of cardiac surgeries performed are open-heart surgery (80%).

We included all post-operative patients less than 14 years of age admitted to our PCICU between January 1st 2012 and December 31st 2012. Patients admitted for other reasons were excluded. Patients were followed and evaluated for the development of UTIs. Patients were divided into two groups: the patients who had UTIs (UTI group) and the patients who did not have UTIs (control group). Data were collected using a standardized data collection form. Demographic, clinical and microbiologic data were collected from the patients' medical records and from the microbiology laboratory records. Our Institutional Review Board (IRB) approved the study. We compared the two groups in terms of their age, weight, intra-operative variables, urinary catheter duration, presence of syndrome, presence of congenital abnormalities of kidney and urinary tract (CAKUT), use of total parenteral nutrition (TPN), association with other nosocomial infections, the presence of an open or closed chest postoperatively, mechanical ventilation duration, the number and duration of inotropes and the length of the PCICU and hospital stay.

To define patients' surgical risk, we used the RACHS-1 score to divide patients into six surgical risk categories [8,9]. We evaluated the duration of the urinary catheter and the incidence of UTIs in each of the RACHS-1 categories.

All patients undergoing cardiac surgery had a urinary catheter inserted at the time of the surgery. A nurse or an anesthetist inserted these catheters using aseptic techniques in the operation room. After surgery, the primary nurses in PCICU checked the urinary catheters routinely during each shift. Routine changes in the urinary catheter have not been adapted as a policy in our unit unless there

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