

## Prevalence of nosocomial urinary tract infection in PICU of referral children hospital in Iran

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### ABSTRACT

**Objectives:** To determine the prevalence of the occurrence, risk factors and microbiology for acquiring UTIs in the PICU of one of the main referral children hospital in Iran.

**Methodology:** A surveillance study was conducted among all children admitted to PICU in the Mofid children hospital in Tehran between July 2007 and July 2008.

**Results:** During the one year, 428 patients were admitted to PICU for 48 hours or more and a total of 31(7.2%) acquired UTIs, yielding an overall incidence density, of 11 per 1000 PICU days. One bacteremic (4.3%) ICU-acquired UTIs occurred. Mean hospital staying in UTI patients was 22 days comparing with 7 days in other patients (P value<0.001) but mortality rate difference was not significant (P value=0.2). The most common organisms isolated were *Escherichia coli* (30.4%), *Kelebsiellapneumoniae*(30.4%) and *Candida albicans*(21.7%).

**Conclusions:** Monitoring of a PICU-acquired UTI is important in critically ill patients. The results of this study offer a reliable measure of the prevalence of nosocomial UTIs at hospitals in Iran and provide a baseline for future studies.

**KEY WORDS:** Nosocomial infection, Urinary tract infection, Pediatric intensive care unit (PICU).

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### INTRODUCTION

Nosocomial infections are associated with an increase in morbidity, mortality, length of hospital stay, and healthcare costs that would normally not be associated with the underlying disease.<sup>1,2</sup> Infection of the urinary tract (UTI) is the most common hospital acquired infection and is among the most frequent nosocomial infections especially in critically ill patients.<sup>3,4</sup> The majority of UTIs were associated with urinary catheters.<sup>5,6</sup> Therefore, nosocomial UTIs usually account catheter related nosocomial infections. Surveillance of health care-associated infections, especially in high-risk hospital settings, such as the intensive care unit (ICU), has become an integral feature of infection control and quality assurance in all hospitals. Surveillance of health care-associated infection has been standardized by the CDC's National Nosocomial Infection Surveillance (NNIS) System by providing simple unambiguous definitions, especially for device-associated infections.<sup>7</sup>

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Pediatric intensive care units (PICUs) differ from adult intensive care units (ICUs) apart from the age of their patients. Fewer children than adults in ICUs have chronic or degenerative organ system disorders and probably the majority of children in PICUs will, if successfully treated, return to a normal productive life. Therefore, nosocomial infections represent an important cause of morbidity and mortality in this population.<sup>8</sup>

This report describes the epidemiology of nosocomial UTI infections in children within PICUs in the Mofid children hospital that use the standard surveillance protocols and nosocomial infection site definitions from the NNIS system. If a patient was determined to have acquired a health care-associated infection, the date of onset, type of infection and infecting microorganisms were also recorded. These results can be compared with nosocomial UTIs of PICU in other country.

## METHODOLOGY

Data were collected on patients in PICU in the NNIS system between July 2007 and July 2008. All patients in the PICU that were between one month and 15 years old were monitored for nosocomial infection by the nurse of hospital's control infection according to the study protocol. The nurse responsible for surveillance in PICU ward had at least three years of infection control experience. Nosocomial UTI infections were considered PICU-associated, if they were identified on PICU after the first 2 days (48 hours) or within 48 hours of discharge from the unit, unless the clinical evidence strongly suggested otherwise.

An infection control team, comprising a physician (sub specialist of pediatric infectious disease) and an infection control practitioner (experienced nurse), and a microbiology laboratory (pediatric infectious research center) that can isolate and identify aerobic pathogens from clinical cultures and perform in vitro susceptibility testing by using standardized methods. All patients in the PICU were monitored for nosocomial UTI symptoms & signs and for abnormal urine analysis & culture by experienced nurse every day. Then, suspicious cases were documented by our experienced physician.

Data were collected by detailed uniform questionnaires for each patient with nosocomial UTI. For each patient, information was collected concerning demographics (age and sex), underlying disease, predisposing conditions for UTIs, presence of fever, severity of illness according to the sepsis score and isolated micro-organisms from urine and blood cultures.

In patients with a urinary catheter, the type of catheter and length of catheter used was requested.

At first, a urine sample was obtained from each patient on first day PICU admission, and if patient has abnormal urine analysis or positive urine culture, he or she was excluded from the study. Then, urine sample routinely was aseptically aspirated from the sampling port of the urinary catheter in catheterized patients twice a week and with clean catch in uncatheterized patients once a week during PICU admission.

For the diagnosis of nosocomial UTI, the patient must meet at least one of each type criteria. The first type criteria are when a patient in PICU has one or more of the following symptoms with no other recognized cause: fever (temperature  $>38^{\circ}\text{C}$ ), dysuria, urgency, frequency and suprapubic tenderness. The second type criteria are: positive urine culture with  $>10^5$  Colony Forming Units (CFU)/ml in clean catch or  $>10^3$  (CFU)/ml in catheter catch with no more than 2 microorganisms isolated, urine positive nitrite test, pyuria ( $>5$  leukocytes in high power field), organisms seen on Gram stain in uncentrifuged urine (bacteriuria) and physician diagnosis of urinary tract infection or physician-initiated therapy for a urinary tract infection. In the case of yeast isolates (*Candida* spp.), we considered positive growth as equal or more than  $10^3$  CFU/ml.

A bacteremic /fungemic UTI was defined as a UTI with a concomitantly positive blood culture with the same organism within a 48 hour period.<sup>9</sup>

Chi-squared and Fisher's exact test were used for comparison of categorical data, and Student's t-test was used for comparison of continuous data in each group.

## RESULTS

During the one year of the study 428 patients were admitted to PICU of Mofid children hospital for 48 hours or more. A total of 31(7.2%) PICU-acquired UTIs occurred during surveillance. On the other hand, we observed an incidence density of PICU-acquired UTI of 11 per 1000 PICU days hospitalization. Twenty (64.5%) were male and eleven (35.5%) female. Median age was 13 month (rang from 2-156 month). Mean duration of hospitalization in our patients was  $22\pm 14$  days comparing with  $7\pm 5$  days in other PICU patients. (P value  $<0.001$ )

The majority of UTIs (90.4%) were associated with urinary catheters. The most common catheter type was urethral catheter (96.5%). The common indications for catheter usage were urine output measurement, urinary retention and urinary incontinence.

Mean duration of urinary catheterization was 15 days.

History of previous UTI were in 4.5% of patients. 45.5% of ICU-acquired UTIs had an underlying disease that 11 cases had malnutrition and three cases were immunocompromised. A total of 22 (71%) patients were receiving antimicrobials on the day of urine sampling and detection of nosocomial UTI. The mortality rate of ICU-acquired UTIs patients (29%) comparing to mortality rate of total ICU patients (23%) was not significant. (P value =0.2)

Overall, (74.2%) patients of UTIs were urine culture proven that 11 (47.8%) were unimicrobial and 12 (52.2%) were polymicrobial. The isolated microorganisms were shown at Table-I. *E. coli* and *Kelebsiella* were the most common seen agents. About seventy percent (69.4%) of reported isolates were Gram-negative bacilli. Nine (29%) patients have culture-proven bloodstream infection. This bloodstream infection was concordant with the UTI in one (4.3%) case (Urosepsis). Pyuria, bacteriuria and positive nitrite test were detected in 75.9%, 22.5% and 3.8% respectively.

### DISCUSSION

In our study, the patient nosocomial UTI infection rate was 7.2 infections per 100 patients and the infection rate per 1000 patient days was 11, that is comparable to that observed in other studies that evaluated nosocomial UTIs in ICUs.<sup>10-12</sup> In one multicenteric study with title of "Device-Associated Nosocomial Infections in 55 Intensive Care Units of 8 Developing Countries", catheter-associated urinary

tract infections were 8.9 cases (range 1.7 to 12.8 cases) per 1000 catheter days.<sup>13</sup>

In the present study, Asymptomatic Bacteriuria (ASB) was not considered. Therefore, to determine a case of symptomatic UTI according to CDC criteria in some patients who are sedated or on analgesics, the only criterion is fever that cannot be explained by other circumstances. The rate of symptomatic UTI in one study was 4.2%, in contrast, the rate of asymptomatic CAUTI that was much higher (14%).<sup>14</sup> The clinical significance of ABS for the individual patient, however, is debatable. As we know, patients with ASB usually do not need antimicrobial therapy, except in rare clinical situations. In our routine clinical approach alone, this category may be greatly underestimated.

The urinary tract is one of the most common sites of nosocomial infections. Most of these infections follow instrumentation of urinary tract, mainly urinary catheterization. The majority of our PICU-UTI acquired infections occurred after the first week, and had an indwelling urinary catheter during their stay in the ICU and greater than ninety percent of patients had urinary folly catheter. Therefore, catheter care according to evidence-based medicine must be implemented in each ICU.

The most clinically important finding of this study was that ICU-acquired UTIs do not independently increase the risk for death among patients admitted to ICUs but may be associated with increased stay of their hospitalization. On the other hand, health care-acquired infections have been associated with substantial morbidity and attributable mortality, as well as greatly increased health care costs.<sup>15,16</sup> Our

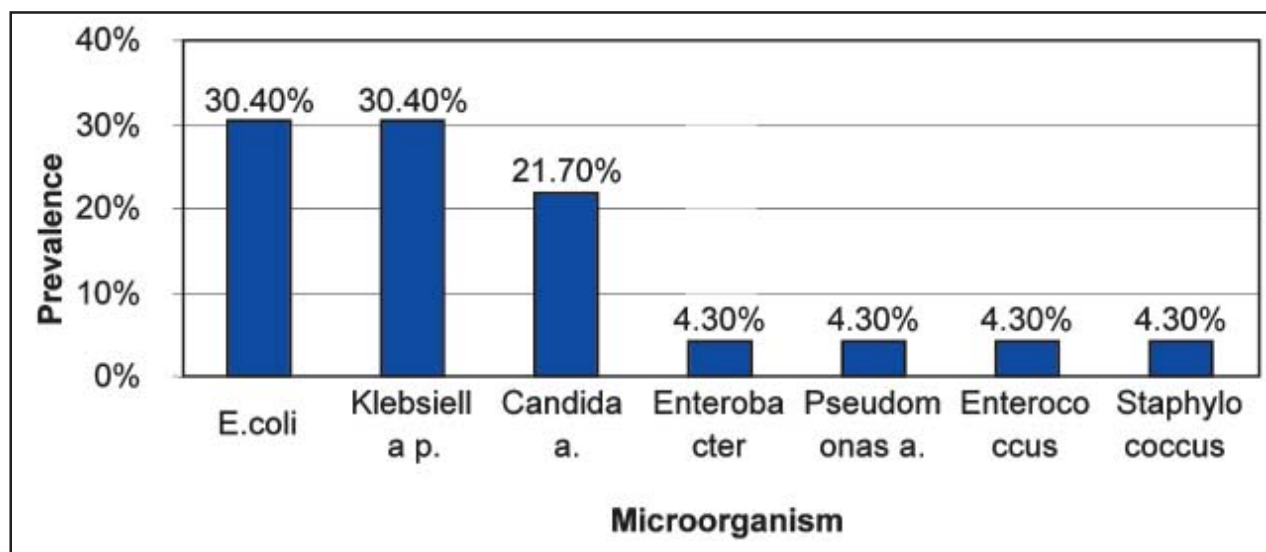


Fig-1: Prevalence of micro-organisms as etiology of nosocomial UTI in Mofid PICU.

current observation of a low rate of uroseptic type ICU-acquired UTI (4.3%) and lack of attributable mortality suggests that ICU-acquired UTIs usually have a benign clinical course but judgment-based approach to treatment may be reasonable.

*E. coli* and other Gram-negative *Enterobacteriaceae* were the most predominant pathogens as community UTI etiology. However after *E. coli* and *Kelebsiella*, in this analysis we noted the increased reporting of fungi (*Candida spp*) associated with UTIs especially in patients with urinary catheters. *Candida* species are among the most important causes of ICU-acquired UTI in other studies and a reduced rate of ICU-acquired UTI is expected if these organisms are not routinely cultured.<sup>17,18</sup> Therefore, in a patient with symptomatic nosocomial infection not respondent to antimicrobial agents, UTI with fungi especially *Candida spp* should be considered.

The results of this NNIS System based study offers a reliable measure of the prevalence of nosocomial UTIs at one referral children hospital in Iran and provides a baseline for future studies which will enable the monitoring of trends overtime.

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## Author Contribution:

Tabatabaei S. A, Fahimzad A: Main Authors of paper.

Shirvani F: Analysis of Data.

Naderi M, Talebian M: Data collectors.