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Prevalence of multidrug resistant uropathogenic bacteria in pediatric patients of a tertiary care hospital in eastern India

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Summary Today, because systemic infections such as urinary tract infection (UTI) affect even pediatric patients, antibiotic resistant bacteria have become a constant clinical challenge. In the present study, a total of 1054 urine samples were collected from pediatric patients over 18 months. From these samples, 510 isolates of pathogenic bacteria were collected using HiCrome UTI agar. Antibiotic sensitivity tests of isolates were performed using the Kirby—Bauer method. Two Gram-positive bacteria (*Enterococcus faecalis* and *Staphylococcus aureus*) and 7 Gram-negative bacteria (*Citrobacter freundii*, *Enterobacter aerogenes*, *Escherichia coli*, *Klebsiella oxytoca*, *K. pneumoniae*, *Proteus vulgaris* and *Pseudomonas aeruginosa*) were isolated. Antibiograms of isolated bacteria were ascertained using antibiotics of 4 classes: aminoglycosides, β-lactams, fluoroquinolones and 2 stand-alones (co-trimoxazole and nitrofurantoin). Based on percent values of antibiotic resistance, isolated bacteria were (in decreasing order of number of isolated isolates): *E. coli* (109) > *S. aureus* (65) > *E. faecalis* (82) > *E. aerogenes* (64) > *C. freundii* (41) > *P. aeruginosa* (32) > *K. pneumoniae* (45) > *K. oxytoca* (50) > *P. vulgaris* (22). Surveillance results show that MDR isolates of 9 pathogenic bacteria were prevalent in

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the environment around the hospital. Thus, revisions to the antimicrobial stewardship program in this area of the country are required to increase clinician confidence in empiric therapy, which is often used for UTI cases.

Introduction

Urinary tract infection (UTI) is defined by the presence of a threshold number of pathogenic bacteria (10^5 CFU/mL) in urine. Invasive/progressive infections of the tract with a higher bacterial population cause cystitis, urethritis and pyelonephritis. Symptoms of UTI in children include hematuria, dysuria, cloudy urine and nocturnal enuresis, sometimes associated with nausea and vomiting along with fever [1,2]. Febrile young female children without proper toilet training, infants with vesicoureteral reflux and tight phimosis are at risk for UTI. The resultant blood stream infection can lead to fatal bacteremia, with symptoms ranging from skin reactions, subcutaneous nodules, metastatic abscesses, and meningitis, etc., which may lead to terminal illness [3—5]. UTI is often associated with other ailments such as acute respiratory infection and acute diarrhea. Due to the vague clinical manifestation in children and infants, basic first level diagnostic tests of urine are not advised regularly in developing countries, thus, UTI is not reported as a cause of childhood morbidity.

Antibiotics are frequently prescribed everywhere in both empiric and regular therapy for UTI [6]. At the hospital in the present study, UTIs were of serious clinical concern for adult patients due to causative multidrug resistant (MDR) bacteria, which are resistant to routinely used antibiotics [7]. This hospital reported that in an 18 month period, 2 Gram-positives (GPs) (*Enterococcus faecalis* and *Staphylococcus aureus*) and 9 Gram-negatives (GNs) (*Acinetobacter baumannii*, *Citrobacter freundii*, *Enterobacter aerogenes*, *Escherichia coli*, *Klebsiella oxytoca*, *K. pneumoniae*, *Proteus mirabilis*, *P. vulgaris* and *Pseudomonas aeruginosa*) were isolated as uropathogens from hospitalized and community adult patients attending the hospital [7]. Device and fomite associated nosocomial infections in hospitals are important factors related to pathogenic spread.

As an extension of previous research on adults conducted in 2011—2012 [7], this study was undertaken in 2013—2014 with pediatric UTI patients who were visiting the outpatient department (OPD) and who were admitted to wards, cabins and neonatal intensive care unit designated as inpatient departments (IPD) over a period of 18 months. This study was undertaken to explore possibilities for a revision of the antimicrobial stewardship program because the rising concern caused by frequent UTI reports in adults and children could be addressed with a newer prophylaxis module. A revised antimicrobial stewardship program would reduce nosocomial spread of certain isolates of bacteria reported earlier from this hospital [8—10] as well as morbidity and hospitalization costs. Obviously, empiric therapy is usually formulated on epidemiological data based on regional surveillance reports; however, the spread of drug resistant bacteria may undermine empiric therapy. The present study should help inform empiric therapy for preventing child mortality from UTI and enteric infections in India [11].

Methods

Isolation and identification of pathogenic bacteria

Over a span of 18 months (January 2013 to June 2014) 510 isolates of pathogenic bacteria belonging to 9 genera (2 GP and 7 GN bacteria) were isolated by culturing 1054 urine samples of OPD and IPD pediatric patients attending/admitted to the Institute of Medical Sciences and Sum Hospital with complaints of fever and foul urine. Strains were identified using media, HiCrome UTI agar (HiMedia, Mumbai) and standard biochemical tests [7] and were maintained as pure cultures in nutrient agar (HiMedia). Corresponding Microbial Type Culture Collection (MTCC) strains were used as reference controls during biochemical identification of isolated bacteria. Two GPs and 7 GNs were isolated from culturing urine samples and were used in this study (Table 1).

Antibiotic susceptibility test

All bacterial isolates including the standard isolates from MTCC of each bacterium were subjected to