Original Research Article

Bacteriological Profile of Urinary Tract Infection in Infants

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A B S T R A C T

Urinary tract infection (UTI) is an important cause of morbidity in infants. The incidence of UTI is more common among boys. Inappropriately treated cases of UTI can further lead to major acute complications such as cystitis, pyelonephritis, bacteremia. Timely diagnosis and treatment is of paramount importance to prevent rare but serious complications. The objective of this study is to isolate and identify the organisms causing UTI in infants and to study antibiotic susceptibility pattern of the isolated organisms. In this cross-sectional prospective study, 480 infants with suspected of urinary tract infection, were evaluated at Smth Kashibai Navale medical college and general hospital between October 2016 to September 2017. Urine was collected by clean catch mid-stream technique or suprapubic aspiration and sent for culture sensitivity. After identifying bacteria, antimicrobial susceptibility testing was performed by the Kirby-Bauer disc diffusion method. The results were interpreted according to the Clinical and Laboratory Standards Institute (CLSI) guidelines 2013. Most common symptom was fever with suspected UTI. Of 480 UTI suspected cases 192(40%) was culture positive. In present study there was male preponderance. Majority of the isolates were gram negative bacilli followed by gram positive cocci. The most common organism was *E. coli, Enterococcus Klebsiella* species. Majority of gram negative organisms were sensitive to amikacin, nitrofurantoin, gentamicin and imipenem while gram positive cocci were sensitive to nitrofurantoin, vancomycin, and teicoplanin. Overall susceptibility test showed the highest resistance to ampicillin and cotrimaxazole (TMP-SMX). Urinary tract infection is common in infants and it varies with age and gender. Appropriate evaluation of infants with history, physical examination, urine analysis and microbiological testing of urine should be mandatory. This study highlights the better efficacy of nitrofurantoin and aminoglycosides, imipenam and can be included as empirical therapy.

Introduction

Urinary tract infection (UTI) is an important cause of morbidity in infants. It is mainly due to the ascending infection from urethra (Jitendranath *et al.,* 2015) Principal risk factors include immature immunity, congenital anatomical anomalies in genitourinary tract, status of circumcision, constipation, improper hygiene (Chang *et al.,* 200 6). The incidence of UTI is more common among boys until the age of 12 months; also more in uncircumcised boys than circumcised (Shaikh *et al.,* 2008; Chang *et al.,* 2006).

Inappropriately treated cases of UTI can further lead to major acute complications such as cystitis, pyelonephritis, bacteremia (Vernon *et al.,* 1997). Timely diagnosis and treatment is of paramount importance to prevent rare but serious complications such as renal scarring, impaired renal growth, recurrent pyelonephritis, impaired glomerular filtration, hypertension, end stage renal disease (Butler *et al.,* 2015). If not diagnosed and managed properly recurrence is common (15-20%), especially in the first year after an initial occurrence and the risk increases with the number of prior occurrences (Foxman, 2014). However establishing a diagnosis in infants is challenging; as they are pre-verbal and also collecting uncontaminated urine is difficult. (Mori *et al.,* 2007)

The classic signs of UTI such as frequency, urgency, dysuria, flank, and supra-pubic pain in older children are not present in infants. Fever is most common symptom (Winberg *et al.,* 1974). So to establish diagnosis and for proper treatment microbiological evaluation of urine and antibiotic sensitivity is mandatory while planning treatment. The objective of this study is to isolate and identify the organisms causing UTI in infants and to study antibiotic susceptibility pattern of the isolated organisms.

Materials and Methods

In this cross-sectional prospective study, 480 infants with suspect of urinary tract infection, were evaluated in Smth Kashibai Navale medical college and general hospital between October 2016 to September 2017. Patients who were referred to hospital pediatric emergency room and those presenting to paediatric outpatient department (OPD) were considered outpatients, and patients who were admitted to the ward or intensive care unit (ICU) and developed UTI at or after 3 days of admission, were considered inpatients with

nosocomial infections. Infants presenting with symptoms of UTI or only fever with suspected UTI were included. Patients who have received antibiotics before urine culture, those who have treated empirically before presenting to us, samples that grew more than 1 type of micro-organism and fungal infection were excluded from the study.

Urine was collected by clean catch mid-stream technique or suprapubic aspiration and sent for culture sensitivity. Samples were cultured on blood agar and MacConkey agar by using semiquantitative method of culture. Diagnosis of UTI was made by means of positive urine culture (colony count > or = 100000CFU/ml of urine (Ismaili *et al.,* 2011). Organisms were identified by morphology and biochemical reactions.

After identifying bacteria, antimicrobial susceptibility testing was performed by the Kirby-Bauer disc diffusion method. The results were interpreted according to the Clinical and Laboratory Standards Institute (CLSI) guidelines 2013 (Budd *et al.,* 2013). Susceptibility of gram-negative bacteria was tested against disks of nitrofurantoin, nalidixic acid, ampicillin, colistin, cefotaxime, imipenem, piperacillin, ciprofloxacin, chloramphenicol, gentamicin, amikacin, ampicillin- sulbactam, cotrimoxazol, tetracycline, tobramycin. Disks used for gram-positive bacteria included: nitrofurantoin, nalidixic acid, ampicillin, cefotaxime, imipenem, ciprofloxacin, chloramphenicol, gentamicin, trimethoprim/sulfamethoxazole (TMP-SMX), tetracycline, vancomycin, linezolid, cefoxitin, cloxacillin, penicillin.

Results were recorded includes patient's demographic profile, hospitalization status, previous treatment, microbiology laboratory data which includes type of organism and its antibiotic sensitivity.

Ethical consideration

All these samples were a part of routine diagnosis, so ethical consideration was not necessary.

Results and Discussion

Most common symptom was fever with suspected UTI followed by suprapubic pain, frequency and dysuria (crying while micturation). Of 480 UTI suspected cases 192(40%) was culture positive. Among these culture positive subjects 111(58.3%) were boys and 81 (42.6) % were girls. Majority of the isolates were gram negative bacilli 119(62%) followed by gram positive cocci 73(38%). The most common organism was E. coli 77(40%) followed by *Enterococcus* 52 (27%), *Klebsiella* species 25(13%), *Staphylococcus* species 21(11%) *Pseudomonas* species 11(6%), and *Proteus* species 6(3%) (Figure 1).

Antibiotic sensitivity: Majority of gram negative organisms were sensitive to amikacin, nitrofurantoin, gentamicin and imipenem while gram positive cocci were sensitive to nitrofurantoin, vancomycin, and teicoplanin. Overall susceptibility test showed the highest resistance to ampicillin (82.3%) and cotrimaxazole (TMP-SMX) (77.3%).

Antibiotic susceptibility pattern of most common pathogen i.e. *E. coli* shows that it was 100% sensitive to aminoglycosides (amikacin, gentamicin), nitrofurantoin and imipenam. It also had good sensitivity 94% to cefotaxim; while it was less susceptible to ampicillin and cotrimaxazole. Antibiotic susceptibility pattern of *Klesialla* was also similar to *E. coli*. It was 100% sensitive to aminogycosides and imipenam and less to ampicillin and cotrimaxzole (Table 1). Enterococci were 100% susceptible to vancomycin, ticoplanin and nitrofurantoin and

to lesser degree to erythromycin (74%), doxycyclin (60%).

UTI, one of the most frequently occurring bacterial infections in infants and is a serious global health problem affecting millions of infants every year (Spencer *et al.,* 2010). Majority of infants present with febrile illness with no other obvious symptom of UTI (Downs S., 1999). In the present study also most common presentation of UTI was febrile illness. This is mainly due to pre-verbal phase of infants leading to communication barrier. Prevalence of UTI varies with age and sex with some studies showing female preponderance (Elder J., 2007) while in some it is male preponderance (Winberg *et al.,* 1974) while few has shown UTI occurs equally in boys and girls in infancy (Yilmaz *et al.,* 2016). In the present study boys were more commonly affected than girls.

Majority of UTIs are caused by Gram negative organisms. Worldwide most common organism isolated is *E. coli* (Winberg *et al.,* 1974; Elder, 2007). Similar to this our study also shows *E. coli* being the most common uropathogen representing 40% of all culture positive cases. In this present study second most common pathogen was *Enterococcus* (27%) followed by *Klebsiella* (25%). Literature varies with respect to other pathogens such as *Klebsiella*, *Enterococci*; few shows *Klebsiella* being second common pathogen leading to UTI in infants (Rai *et al.,* 2008). Gram positive cocci such as enterococci are also one of the common organism leading to UTI in infants, Gupta *et al.,* confirms similar finding with our study (Gupta *et al.,* 2015).

Antibiotic susceptibility testing is the backbone for managing UTI in infants. Empirical therapy, over the counter antibiotic prescriptions has shown to increase drug resistant pathogens.

Table.1 Antibiotic susceptibility of *E. coli* and *Klebsiella*

Antibiotic	*E. coli*	*Klebsiella*
Amikacin	100%	100%
Nitrofurintoin	100%	100%
Gentamicin	100%	100%
Imepenam	100%	100%
Norfloxacin	70%	60%
Cefotaxim	94%	84%
Ampicillin	10%	8%
Cotrimaxazole	33%	28%

Fig.1 Distribution of organisms isolated
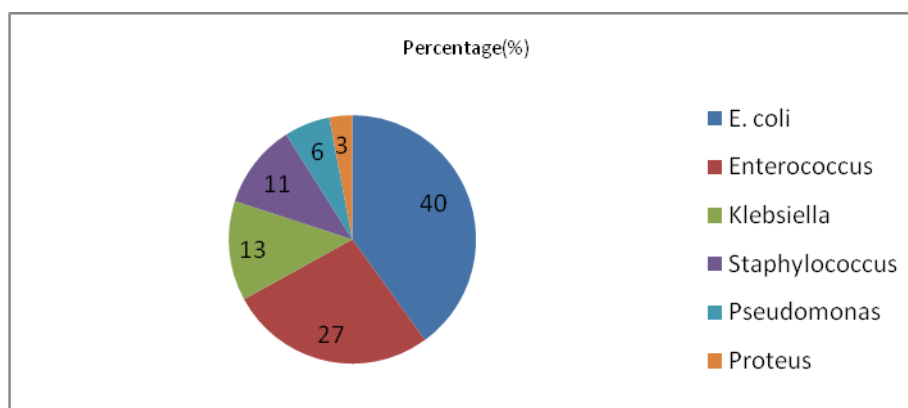
This is particularly true for developing countries like India where there are no specific guidelines and control over prescribing antibiotics (Patel *et al.,* 2014).

In the present study *E. coli* was the most common uropathogen. It was 100% sensitive to aminoglycosides such as amikacin, gentamicin. Sensitivity to Imepenam and Nitrofurontoin was also 100%. Literature also supports similar findings; majority studies shows that *E. coli* are most sensitive to aminoglycosides, nitrofurintoin and carbepenam group of drugs (i.e. imipenam) (Butler *et al.,* 2015; Downs S., 1999). In present study 70% of *E. coli* isolates were sensitive to fluroquinolones but various Studies from other part of India have shown variable pattern of sensitivity of *E. coli* to fluroqunolones like norfloxacin (Taneja *et al.,*

2004; Gould *et al.,* 2009). Cephalosporins are one of the common antibiotics used empirically in treatment of fever with suspected UTIs. Present study shows that *E. coli* has good sensitivity to cefotaxim (94%) but rest of the literature shows increasing trend of drug resistance to cephalosporins (Salles, 2013). Bryce *et al.,* in their systemic review have found nosocomial UTIs with *E. coli* are more resistant to cephalosporins (Bryce *et al.,* 2016).

In the present study maximum *E. coli* isolates were resistant to ampicillin (90%) followed by cotrimaxzole (77%). These findings are consistent with overall trend in India [Gupta *et al.,* 2015; Taneja *et al.,* 2004) as well as other part of world (Gould *et al.,* 2009) as its well-known fact that poor gram negative coverage with penicillin group of antibiotics.

Klebsiella was the second common gram negative organism in the present study. Its antibiotic sensitivity and resistance pattern is more or less similar to *E. coli* in present study. It was 100% sensitive to aminoglycoside, nitrofurointoin, imipenam. With minimal resistance to cephalosporin (cefotaxim) and maximum resistance to ampicillin and cotrimaxazole. Findings from other studies of Bryce *et al.,* (2016), Salles *et al.,* (2013) support above findings.

Enterococci species were the second most common uropathogens in the present study and most common gram positive organism. Enterococci were 100% susceptible to vancomycin, ticoplanin and nitrofurintoin and to lesser degree to erythromycin (74%), doxycyclin (60%). Similar sensitivity pattern is seen in literature (Shaikh *et al.,* 2008). However Gupta *et al.,* a study from north India has isolated vancomycin resistant enterococci which is a worrisome situation. Other less common pathogens found in present study were *Staphylococcus* species 21(11%) *Pseudomonas* species 11(6%), and Proteus species 6(3%). Their prevalence is variable in other studies as well (Foxman, 2014; Ismaili *et al.,* 2011).

Urinary tract infection is one of the commonest infection seen in infants worldwide (Bryce *et al.,* 2016). In infants with suspected UTI, the most common strategy is to treat empirically. In developing countries like India majority of patients present to primary care physicians or pediatric clinics where facilities of microbiological testing of urine are not available and empirical treatment is the choice. This has shown to increase drug resistance in uropathogens.

The study conducted by us and similar studies from other part of country will help to formulate antibiotic strategies.

Urinary tract infection is common in infants and it varies with age and gender. Appropriate evaluation of infants with history, physical examination, urine analysis and microbiological testing of urine should be mandatory. This study highlights the better efficacy of nitrofurantoin and aminoglycosides, imipenam and can be included as empirical therapy. However each institution should have bacteriological profile and list of sensitive antibiotics to avoid development of drug resistance.

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