Original article

Antibiotic sensitivity and resistance pattern in blood and urine culture reports obtained from paediatric patients in a tertiary care hospital, Pondicherry

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Abstract:

Introduction: Blood streamand urinary tract infections remain one of the most important causes of morbidity and mortality in paediatric age group. Due to inappropriate use of antibiotics, antibiotic resistance is increasing and treatment of UTIs and blood stream infections becomes more difficult by time. Thus, it is necessary to inform the clinicians and other health care professionals about the bacterial profile of a particular area and their antimicrobial susceptibility patterns to design an empirical treatment policy for the patients.The present study was undertaken to assess the commonest bacteriological profile in urine and blood culture specimens and their antibiotic sensitivity, resistance patterns in our hospital.

Materials and methods: This retrospective observational study was conducted in our teaching hospital. Blood and urine culture reports of paediatric patient records maintained in the department of Microbiology were collected during the period from May-2012 to April- 2014. The data were analysed and expressed in descriptive statistics.

Results: A total of 156 culture reports (Blood-88 and Urine-68) were analysed. In urinary isolates the predominant organisms were E.coli (48%) and Klebsiella (34%). Sensitivity rates were high for Imipenem (94%) and Nitrofurantoin (87%). Highly resistant antibiotics for urinary isolates include Penicillin G (76%), Ciprofloxacin (62%) and Amoxicillin+Clavulanic acid (52%). In blood culture reports, most common organisms isolated were coagulase negative Staphylococci (CONS- 49%) and Salmonella typhi (22%) with high sensitivity towards Amikacin (92%) and Vancomycin (90%). Highly resistant antibiotics for blood culture organisms include Penicillin G (68%) and Erythromycin (64%).

Conclusion: High proportion of drugs were found to be resistant to commonly prescribed drugs. E.coli was the most common isolated organism in UTI and CONS in blood culture. The urinary isolates were highly sensitive to Imipenem, Nitrofurantoin and in blood culture isolates were highly sensitive to Amikacin and Vancomycin. This study showed that it is important to monitor antibiotic sensitivity and resistance trends in infection control measures to prevent emergence and spread of multi-resistant bacteria.

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Key words: UTI, Blood stream infection, Antibiotic Sensitivity, Antibiotic Resistance, Urine culture and Blood culture.

Introduction:

Urine in the human bladder is normally sterile. Bacteriuria is the presence of bacteria in urine[1,2]. It is usually asymptomatic or might show apparent symptoms of UTI [3].

Urinary tract infections are the most common serious bacterial infection in infants and children [5,6] .It is an infection of the lower/upper urinary tract or even includes both [7].Boys are more susceptible to urinary tract infections (UTI) in their first year of life and thereafter the incidence is substantially higher in girls [4].Its prevalence varies according to age, gender, seasons and living regions [9].

Blood stream infections also cause significant mortality and morbidity and range from self-limiting infections to life threatening sepsis that require prompt, rapid and aggressive anti microbial treatment [10]. A wide spectrum of microbial organisms were described for this kind of infections and they are also subject to geographical variation as similar to urinary tract infections.[11]

In under-developed and developing countries, inappropriate use of antibiotics has lead to increasing antibiotic resistance and the treatment of sepsis and urinary tract infections has become far difficult [8]. The prevalence of resistance is increasing in both out-patient and hospitalized patients with septicaemia and it varies accordingly with geographical regional location. As the mortality and morbidity of these infections are high, it is a common practice of initiating antibiotics empirically before the result of blood / urine culture is available [11]. Clinicians should be well knowledgeable about their regional antibiotic sensitivity and resistance patterns for determining the empirical therapy till they get the culture results or even if they have no culture report facilities in rural areas.

Hence, there exists a great need for antimicrobial resistance surveillance at local, national and international levels. [12]

The aim of the present study was to determine the antimicrobial resistance and sensitivity patterns of pathogens in urine and blood culture reports at Sri Manakula Vinayagar Medical College and Hospital, a teaching and referral hospital in the west of Puducherry.

Materials and methods:

This was a retrospective study conducted in Department of Pharmacology, Sri Manakula Vinayagar Medical College and Hospital, Puducherry. The urine and blood culture positive reports of paediatric patients (age<13) were retrieved from the Department of Microbiology and analyzed. Data obtained between May 2012 to April2014 from both outpatients and inpatients were included in our study. All the significant isolates were identified and studied by standard procedures and their antibiotic susceptibility patterns was tested and interpreted according to Clinical and Laboratory Standards Institute (CLSI) recommendations. With the automatic identification system against to amikacin, amoxicillin/clavulanate, ampicillin, ampicillin/sulbactam, aztreonam, cefoxitin, ceftazidime, ceftriaxone, cefuroxime sodium, cefazolin, cefepime, cefotaxime, ciprofloxacin, gentamicin, imipenem, levofloxacin, piperacillin, piperacillin/tazobactam, tetracycline, meropenem, nitrofurantoin, norfloxacin, tobramycin, trimethoprim and sulfamethoxazole.

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The data were entered and analyzed using SPSS software version 21.0 and results were expressed in percentages.

Results:

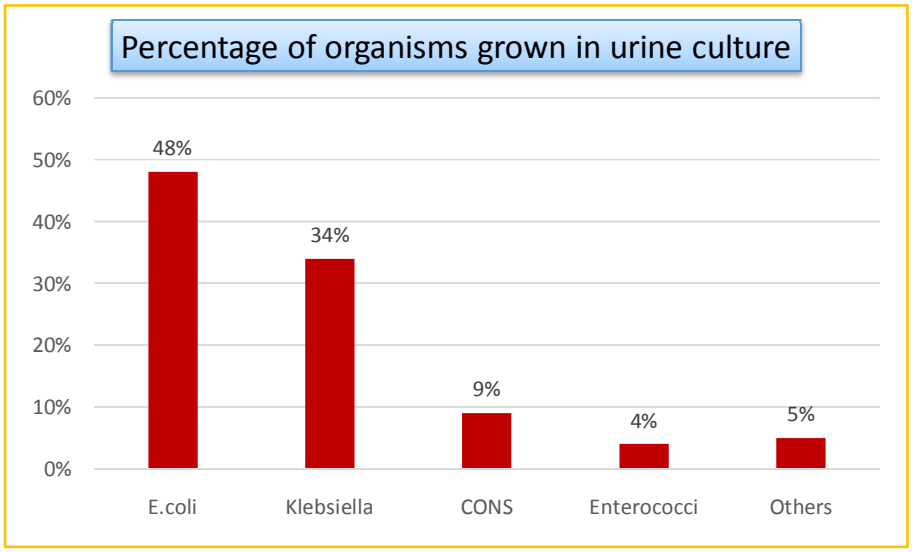
During the two years study period, 156 cultures were analyzed for isolation and identification of bacterial isolates. Among them 88 were blood culture repots and the remaining (68) were urine culture reports.

ANALYSIS OF URINE CULTURE REPORTS:

a. Distribution of organisms grown in urine culture positive specimens:

- Among the organisms grown, E.coli was the most common isolated organism which accounted for about 48% in our study and the remaining were Klebsiella (34%), Coagulase negative staphylococcus aureus (9%), Enterococci (4%) and other micro-organisms were Citrobacter, Proteus mirabilis (5%) as depicted in the figure 1.

Figure 1: Percentage of organisms grown in urine culture.



b. Sensitivity and resistance pattern of organisms isolated from urine culture specimens:

- The organisms grown in urine culture specimens were shown to have a high sensitivity for Imipenem (94%) and Nitrofurantoin (87%). Highly resistant antibiotics to the common isolated organisms were Penicillin-G (76%), Ciprofloxacin (62%) and Amoxicillin + Clavulanic acid (52%) as shown in the figure 2 and table 1.

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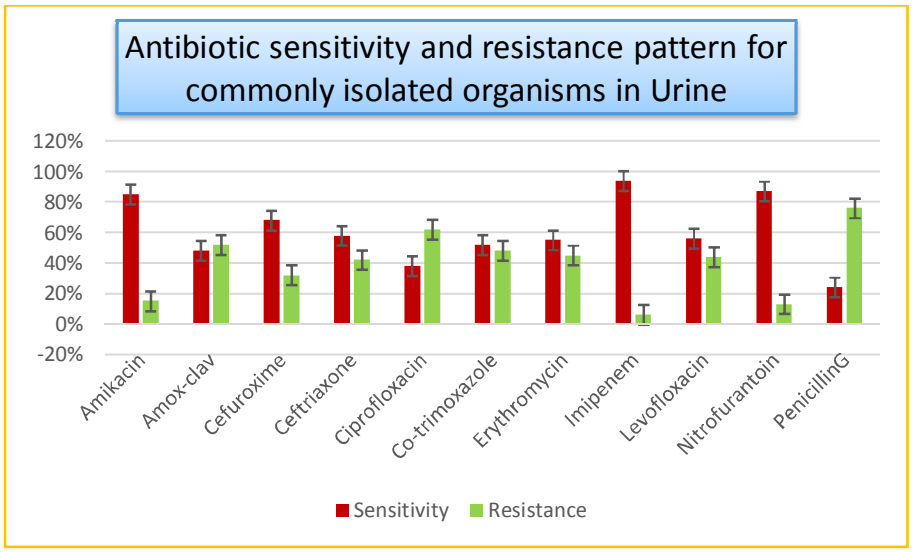
Table 1: Antibiotic sensitivity and resistance pattern for common Urine isolates.

DRUGS	SENSITIVITY	RESISTANCE
Amikacin	85%	15%
Amoxicillin + Clavulanic acid	48%	52%
Cefuroxime	68%	32%
Ceftriaxone	58%	42%
Ciprofloxacin	38%	62%
Co-trimoxazole	52%	48%
Erythromycin	55%	45%
Imipenem	94%	6%
Levofloxacin	56%	44%
Nitrofurantoin	87%	13%
Penicillin-G	24%	76%

Figure 2: Antibiotic sensitivity and resistance pattern for commonly isolated organisms in urine.



c. Sensitivity and resistance pattern of E. coli isolates with different antibiotics:

- The most commonly isolated organism from urine culture was E. coli showed high sensitivity to Imipenem (98%) followed by Nitrofurantoin (94%) and Amikacin (89%). E. coli was found to be highly resistant to drugs including Ciprofloxacin (82 %) and Amoxicillin + Clavulanic acid (77%).

ANALYSIS OF BLOOD CULTURE REPORTS:

a. Distribution of organisms grown in blood culture positive specimens:

- Out of 88 blood culture reports analyzed, the most common isolates were Coagulase negative staphylococcus aureus (49%), Salmonella typhii (22%), Staphylococcus aureus (15%), Pseudomonas (4%), E. coli (3%), others (7%) as depicted in figure 3.

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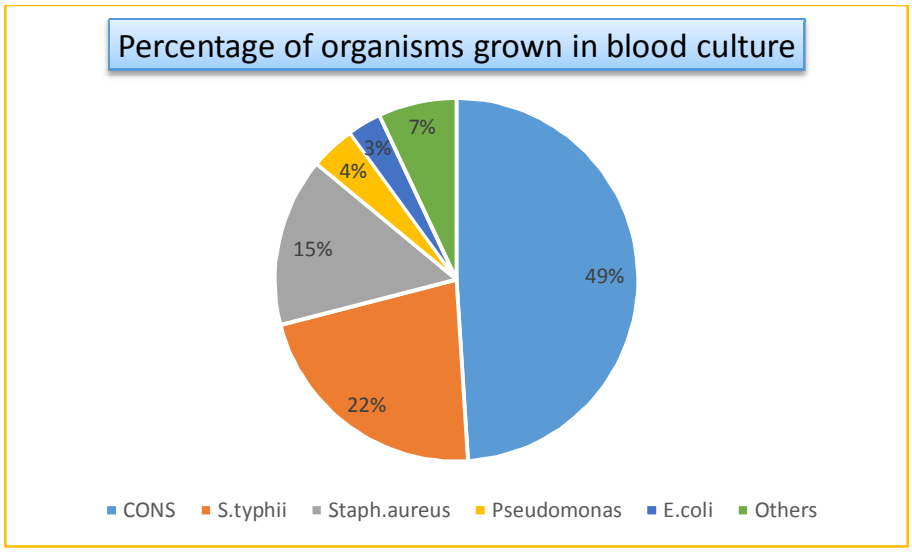
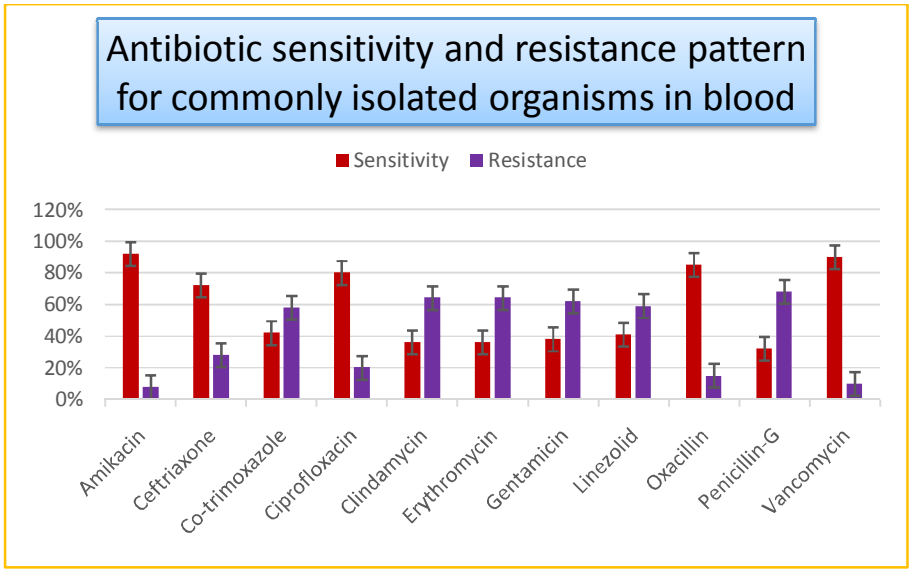
Figure 3: Percentage of organisms grown in blood culture.



b. Sensitivity and resistance patterns of organisms isolated from blood culture reports:

- As shown in figure 4, the most common organisms isolated from blood culture reports showed a very high sensitivity to Amikacin (92%), Vancomycin (90%) and Oxacillin (85%). These organisms were resistant to commonly used drugs like Penicillin – G (68%), Erythromycin (64%) and Clindamycin (64%).

Figure 4: Antibiotic sensitivity and resistance patterns for commonly isolated organisms in blood culture.



c. Sensitivity and resistance pattern for CONS in blood culture reports:

- As explained before, the most common organisms isolated from blood culture reports were CONS. These organisms were found to be highly sensitive to Amikacin (96%) and Vancomycin (95%) followed by ciprofloxacin (83%).

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Discussion:

Urinary tract infection and septicaemia are the most common types of infections encountered in medical practice. In community and hospital settings the etiology of UTIs and septicaemia and the antimicrobial susceptibility have been changing over years as the regional patterns differ.

Of all the reports obtained isolated from paediatric patients, E. coli was the most common organism isolated from urine culture and it showed high sensitivity to Imipenem and Nitrofurantoin. CONS was the most common organism isolated from blood culture and it showed high sensitivity to Amikacin and Vancomycin.

One study done by Mohammed et al [4], showed that E. coli were the most common organism isolated from urine (71.4%). Our study also showed the similar results but in a lesser frequency (E. coli – 48%). The E. coli isolated by Mohammed et al [4], study were highly sensitive to Imipenem (94%) and Amikacin (93%). In our study, E. coli showed high sensitivity to Imipenem (98%) followed by Nitrofurantoin (94%) and Amikacin (89%). Though the organisms were highly resistant to Co-trimoxazole as pertained to Mohammed et al, in our study showed that high degree of resistance was observed with Ciprofloxacin and Amoxicillin – Clavulanic acid (82% & 77% respectively) [4].

This could be because of the most widespread usage of quinolones and amoxicillin as empirical treatment of urinary tract infection that has led to the imminent threat of increase in resistance patterns of the organisms. According to Mirsoleymani et al [13], high resistance was observed to third generation Cephalosporins, but our study showed that these drugs have better action in the treatment of UTIs.

Study done by Uwaezuole et al [14],in Nigeria showed that Nitofurantoin and Gentamicin were highly sensitive to causative organisms of UTI (80%) as compared to our study where Nitrofurantoin has better sensitivity (87%). This implies that this drug can be used as an empirical therapy for E. coli infection in emergency conditions.

Atul garg et al[11] showed that CONS was the common organism isolated which was on a par with our study reports, showing 49% of isolates was CONS followed by salmonella typhii (22%) and staph aureus (15%). The second common organism isolated by Atul garg et al [11] was pseudomonas (16%), but our study reports showed that the pseudomonas isolates were comparatively less (4%).

The resistance and sensitivity patterns of common organisms showed a better sensitivity to Amikacin and Vancomycin. Even in Turkey, as per the study conducted by koksal et al[15], the most common organism causing blood borne infections was Coagulase negative staphylococcus aureus similar to our study results.

CONS have become a major concern to the medical community due to the fact that they have extraordinary ability to adapt rapidly to antibiotic stress [16], As there was widespread usage of penicillin in the early 1960's, a high resistance pattern was noticed in the treatment of UTI and septicaemia. This organism (CONS) may adhere to medical devices and surfaces that causes multi resistant CONS to colonize within hospital environment. Thus, they may serve as a reservoir of anti-microbial resistant determinants in hospital [15].So, a detailed analysis of sensitivity and resistance pattern is essential and appropriate use of antimicrobial drugs to prevent further resistance development.

Conclusion:

It is a universal truth that the choice of drugs for empirical treatment of UTI and septicaemia is narrowed down due to rapid development of

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resistant organisms. High proportion of drugs were found to be resistant to commonly prescribed drugs. In paediatric age group, E. coli was the most common isolated organism in UTI and CONS in blood culture as per our study. The commonly prescribed antibiotics (Penicillin- G and co-trimoxazole) were less susceptible to these organisms. The urinary isolates were highly sensitive to Imipenem and Nitrofurantoin. These drugs can be considered as drug of choice for empirical treatment of urinary tract infections. In blood culture, isolates were highly sensitive to Amikacin and Vancomycin. This study showed that it is important to monitor antibiotic prescription and resistance trends in infection control measures to prevent emergence and spread of multi-resistant bacteria.

Abbreviation's used:

CLSI	:	Clinical and laboratory standards institute
CONS	:	Coagulase negative staphylococci
E.coli	:	Escherichia coli
UTI	:	Urinary tract infection

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