

Original Research Article

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Antimicrobial Susceptibility Profile of *E. coli* Isolates Causing Urosepsis: Single Centre Experience

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ABSTRACT

Urosepsis is defined as presence of systemic inflammatory response syndrome secondary to a severe infection of the urinary tract, with the risk of multi-organ dysfunction and shock. This study was designed to analyze the antimicrobial susceptibility profile of *E. coli* isolates causing urosepsis and to compare it with the susceptibility profile of other isolates of *E. coli* from blood stream infection. And to study the various factors associated with *E. coli* urosepsis cases. A total of 689 isolates of *E. coli* were isolated from blood cultures in 2015. Of them 112 were identified to be associated with urosepsis. The mean age of the urosepsis patients was 46.26 years (SD 17.24) and 65.1% were females. The prevalence of Extended spectrum beta lactamase production (ESBL), as screened by disc diffusion testing using ceftazidime was almost similar in the two groups, 76% in the isolates from urosepsis, and 72% in the other group (p value>0.05). Carbapenem resistance was found in 3.1% of urosepsis isolates. On the other hand, about 13% of the non urosepsis *E. coli* isolates carbapenem resistance (p value<0.05). We here with report high prevalence of ESBL production in blood stream *E. coli* isolates. In *E. coli* isolates associated with urosepsis, higher susceptibility towards aminoglycosides and carbapenems was seen. Thus these two groups can serve as empiric antibiotics of choice in a female patient with known predisposing factors for developing a UTI, and presenting with signs and symptoms of urosepsis.

Keywords

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Introduction

Urosepsis accounts for approximately 25% of all sepsis cases and may develop from a community or nosocomial acquired urinary tract infection (UTI). Urosepsis refers to the presence of systemic inflammatory response syndrome secondary to a severe infection of

the urinary tract, with the risk of multi-organ dysfunction and shock (1). The underlying UTI is almost exclusively a complicated one with involvement of parenchymatous urogenital organs (e.g. kidneys, prostate) (2). The majority of the cases of urosepsis are attributable to gram-negative bacilli. *Escherichia coli* (*E. coli*) is the predominant

organism responsible for a large number of cases of community as well as hospital acquired UTI, across all age groups. *E. coli* has been reported to cause 50% to 75% of cases of urinary tract infection (UTI) with bacteremia, from (1,3). The other organisms implicated in causing urosepsis include *Proteus* spp., *Enterobacter* spp, *Klebsiella* spp. and *Pseudomonas* spp. Less frequently involved are Gram-positive organisms like *Enterococcus* spp, Methicillin resistant *Staphylococcus aureus* and *Staphylococcus epidermidis*. In this paper we reviewed the clinical and microbiological profile of urosepsis *E. coli* isolates for a year. The primary aim of the study was to analyze the antimicrobial susceptibility profile of *E. coli* isolates causing urosepsis and to compare it with the susceptibility profile of other isolates of *E. coli* from blood stream infection. Whereas the secondary aim was to study the various factors associated with *E. coli* urosepsis cases.

Materials and Methods

This cross sectional, observational study was carried out in a tertiary care centre in south India. All non-duplicated consecutive isolates of *E. coli* causing blood stream infection for a year were included in the study. Blood culture was performed on the samples with the BacTAlert automated system (bioMérieux). The growth positive specimens were Gram stained and subcultured onto Blood agar and MacConkey agar. The gram negative bacilli were identified based on the cultural characteristics and biochemical reactions using preliminary screening media- mannitol motility medium, triple sugar iron agar, indole production and citrate utilization. Antimicrobial susceptibility by Kirby Bauer disk diffusion was performed, as per Clinical and Laboratory Standards Institute (CLSI 2014) guidelines. The *E. coli* isolates were classified into two groups, first group

comprising of isolates causing urosepsis and the other including isolates from sepsis without a concomitant or preceding UTI. An isolate was considered as an urosepsis isolate only if the same organism grew in blood culture along with or subsequent to a growth in urine culture, with the two showing the same antimicrobial susceptibility pattern. The susceptibility patterns and multidrug resistance rates of the urosepsis *E. coli* isolates were studied and compared with the non-urosepsis isolates. Relevant demographic and clinical details of the urosepsis patients were obtained from the medical records, and the associated factors were studied.

Results and Discussion

A total of 689 isolates of *E. coli* were isolated from blood cultures in 2015. Of them 112 were identified to be associated with urosepsis. The mean age of the urosepsis patients was 46.26 years (SD 17.24) and 65.1% were females. The various demographic and associated factors for the urosepsis cases are mentioned in table 1.

The antibiotic susceptibility rates of the urosepsis isolates were compared with the non-urosepsis isolates and are depicted in table 2.

Prevalence of multidrug resistance in the two groups

The prevalence of Extended spectrum beta lactamase production (ESBL), as screened by disc diffusion testing using ceftazidime was almost similar in the two groups, 76% in the isolates from urosepsis, and 72% in the other group (p value>0.05).

Carbapenem resistance was found in 3.1% of urosepsis isolates. On the other hand, about 13% of the non urosepsis *E. coli* isolates carbapenem resistance (p value<0.05).

Table.1 Demographic and clinical factors associated with urosepsis *E. coli* isolates

	Percentage
Gender	
Male	34.9%
Female	65.1%
Age	
0-16	5.6%
17-40	45.8%
41-60	26.3%
>60	22.3%
Diabetes	38.2%
Urinary tract abnormalities	14%
Post-operative	6.2%
Post-labour	7.2%
Pregnancy	3%
Chemotherapy	2.9%

Table.2 Percentage susceptibility of blood stream *E. coli* isolates (urosepsis vs. others) to various antibiotics

Antibiotic	Urosepsis causing <i>E.coli</i> (%)	Other isolates of <i>E.coli</i> (%)
Ceftazidime	32.7	32.9
Gentamicin	52.3	47.7
Amikacin	92.1	89.89
Netilmycin	93.6	83.2*
Ciprofloxacin	23.3	23.9
Amoxi-clav	40	NA
Cotrimoxazole	37.2	NA
Nitrofurantoin	83.3	NA
Piperacillin/tazobactam	60	61.1
Cefoperazone/sulbactam	85.2	72.9*
Meropenem	98.5	85.1*
Imipenem	96.5	82.9*
Tigecycline	99.8	98.9
Colistin	100	98.4

*P<0.05

Infections of the urinary tract are responsible for a large number of cases of secondary healthcare-associated bacteremia. Female gender, older age, urinary catheterization, diabetes mellitus, urinary tract obstruction and pregnancy are known risk factors for

developing a urinary tract infection (4,5). In this study, about 65% of the patients were females. About 46% of the infections occurred in the age group 17 to 40, followed by the elderly (26.3%). Diabetes mellitus was found to be the most common associated

factor, seen in 38.2% of the patients. High rates of resistance to ciprofloxacin (77%) and trimethoprim-sulfamethoxazole (65.4%) were noted. This is consistent with the reports of increasing resistance to these drugs seen in large population based studies(6,7). High rates of prevalence of extended spectrum beta-lactamase producers was seen, which has also been reported in other studies on *E. coli* bacteremia. ESBL rates between 41% to 76% have been reported from various parts of the country(8–10). Significantly higher susceptibility to amikacin and netilmycin ($p < 0.05$) was seen in urosepsis isolates, when compared to the non-urosepsis *E. coli* isolates. On the other hand, no significant difference in susceptibility to gentamicin was seen ($p > 0.05$).

Majority of the isolates were resistant to amoxicillin-clavulanic acid, followed by piperacillin-tazobactam, while only 15% were resistant to cefoperazone-sulbactam. The prevalence of carbapenem resistance was found to be significantly ($P < 0.05$) low in urosepsis isolates compared to the non-urosepsis isolates. These rates are comparable to the rates reported from other centres. While the multicentric SENTRY study(11) conducted across in 14 hospitals in various Indian cities in 2006-2007 showed an overall resistance of 2.7% in Enterobacteriaceae isolates, Dutta *et al.*, (12) in their analysis of ten year resistance profile of blood stream infections found 6% carbapenem resistance in *E. coli*.

The isolates were largely susceptible to nitrofurantoin. No resistance was seen to colistin and tigecycline.

In conclusion, we here with report high prevalence of ESBL production in blood stream *E. coli* isolates. In *E. coli* isolates associated with urosepsis, higher susceptibility towards aminoglycosides and

carbapenems was seen. Thus these two groups can serve as empiric antibiotics of choice in a female patient with known predisposing factors for developing a UTI, and presenting with signs and symptoms of urosepsis.

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