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Original Research Article

# A study on the bacterial isolates from blood cultures of a tertiary care hospital

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ABSTRACT

**Introduction & Objectives:** Blood stream infections are the most important and common cause of morbidity and mortality in tertiary care hospitals. Since the results are usually not available promptly a knowledge of epidemiologic and antimicrobial susceptibility pattern of blood pathogens is life saving and very useful for early treatment and recovery of patients. The aim of this study is to describe the epidemiological, bacterial profile and antimicrobial resistance pattern of bloodstream infections in a tertiary care centre.

**Materials and Methods:** A prospective cross-sectional study was done on seven hundred and eight blood samples collected over a period of six months in the Microbiology laboratory. Blood samples collected under aseptic conditions were cultured by aerobic culture method. Identification of bacterial isolates were done using standard bacteriologic and biochemical testing methods and antibiotic sensitivity testing done by Kirby - Bauer disc diffusion method.

**Result:** Bacteria was isolated in 201 (28.3%) samples with highest rates among newborns 84(41.8%). The most frequent isolates were *Coagulase negative staphylococci* 111 (55.2%) followed by *Klebsiella pneumoniae* 49 (24.4%). Results showed high susceptibilities of CoNS 111 (100%) to Vancomycin, Linezolid and *Klebsiella* 51 (98%) to Meropenem. This study highlights the common prevalent bacteriological agents in bacteremia, their antibiotic susceptibility & resistance patterns.

**Conclusion:** *Coagulase negative staphylococci* and multi drug resistant *Klebsiella* were the leading causes of septicaemia in our hospital with Vancomycin, Linezolid and Carbapenems the effective antibiotics against these pathogens respectively.



## 1. Introduction

Blood stream infections (BSI) are the most important and common cause of morbidity and mortality in tertiary care hospitals. [1,2]

Clinical signs and symptoms, though useful in diagnosing possible cases of bacteremia have only limited specificity. Definitive diagnosis is only by performing a bacteriologic culture and antimicrobial susceptibility testing of the blood samples to identify the pathogens. Since the results are usually not available promptly a knowledge of epidemiologic and antimicrobial susceptibility pattern of blood pathogens is life saving and very useful for early treatment of critically ill patients with blood stream infections. [3–5]

Antibiotic resistance is a major limiting factor in the selection of antibiotics in the treatment of blood stream infections. [6,7] Both gram positive and gram negative bacteria are associated with bacteremia but, most of the Gram-negative bacteria were found to be multi drug resistant with a very high resistance to beta-lactam antibiotics. [3]

This is the first study conducted in our Department of Microbiology to describe the epidemiological, bacterial

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profile and antimicrobial resistance pattern of pathogens in bloodstream infections.

## 2. Materials and Methods

Our study is a prospective cross-sectional study carried out in the Department of Microbiology, Govt. Thiruvarur Medical College Hospital, Tamil Nadu. This study was conducted over a period of six months from December 2020 to May 2021. Blood samples were collected under aseptic conditions and cultured by aerobic culture method. Identification of bacterial isolates were done using standard bacteriologic and biochemical testing methods and antibiotic sensitivity detection done by Kirby- Bauer disc diffusion method and results were interpreted by following Central Laboratory Standards Institute (CLSI) guidelines, using Hi-Media discs, Mumbai.[8]

## 3. Results

Seven hundred and eight blood samples from febrile patients from various wards in the hospital were collected. Positive bacterial growth was observed in 201 isolates showing a blood culture positivity of 28.3%.

### *3.1. Patient characteristics*

Sex wise distribution shows 94(46.7%) samples were from males and 107(53.3%) samples were from females and age wise distribution showed 84(41.8%) samples from neonates, 24(11.9%) samples from less than 5 yrs, 11(5.5%) samples from 5-15 yrs and 82(40.8%) samples from above 15 yrs of age out of the 201 positive blood cultures. [Table 1]. The majority of cases were from NICU 88(43.7%) followed by labour ward 19(9.4%) {Figure 1}.

### *3.2. Etiologic agents of BSI*

Of the 201 positive bacterial growth, 115(57.2%) were gram positive cocci predominated by *Coagulase negative staphylococci* 111(55.2%) followed by *Staphylococcus aureus* 4(1.9%) and 86(42.8%) were gram negative bacilli predominated by *Klebsiella pneumoniae* 49(24.4%) followed by *Proteus mirabilis* 16(8%), *Escherichia coli* 8 (4%), Proteus vulgaris 5(2.5%), *Klebsiella* oxytoca 4(2%) and *Pseudomonas aeruginosa* 4(2%) [Figure 2 &Table 2].

### *3.3. Antimicrobial susceptibility profiles*

The antibiotic susceptibility patterns of Gram positive cocci, Enterobacteriaceae and Pseudomonas aeruginosa have been shown in the tables [Tables 2, 3 and 4] respectively.

## 4. Discussion

Blood stream infections are one of the leading causes of mortality in tertiary care hospitals. A continuous surveillance of the bacteriological profile and antibiotic susceptibility pattern of the blood culture isolates are a best guide to the clinicians for timely and effective management of BSI. Early administration of antibiotics in patient with septicemia drastically increases recovery and decreases mortality rate.[9] This study shows the bacteriological profile and antimicrobial susceptibility pattern of the blood culture isolates, aiding the immediate and proper management of septicemic cases. Blood culture positivity of 28.3% was observed in our study which is similar to blood culture positivity rate observed in other studies.[10] Sex wise distribution shows and 107(53.3%) samples were from females and 94(46.7%) samples were from males similar to study of Manmeet Kaur et al [2016][3]and age wise distribution showed 84(41.8%) samples were from neonates a scenario found in developing countries like North Ethiopia.[10]

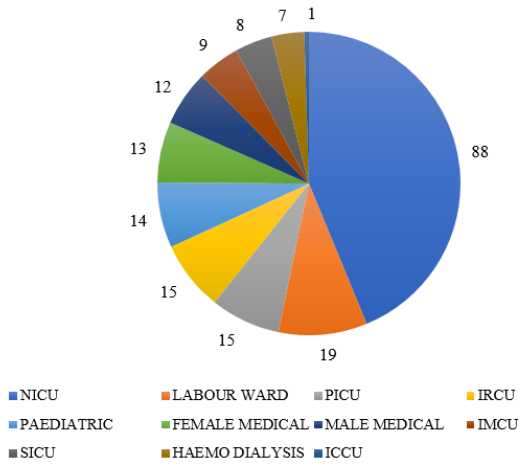


**Fig. 1:** Ward wise distribution of positive blood cultures

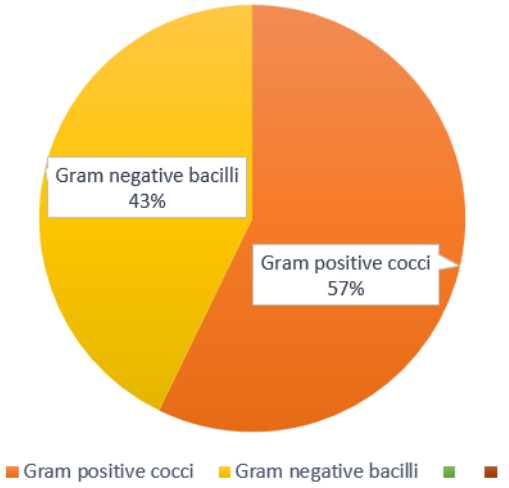


**Fig. 2:** Bacterial distribution of positive blood cultures

**Table 1:** Showing age wise frequency of bacterial isolates recovered from patients with BSI

| Age of the patient | CoNS | *Staph. Aureus* | *Klebsiella pneumoniae* | *Klebsiella* oxytoca | *Proteus mirabilis* | *Proteus vulgaris* | *Esch erichia coli* | *Pseudomonas aeruginosa* |
|---|---|---|---|---|---|---|---|---|
| <28 days | 42 | 1 | 23 | 1 | 7 | 2 | 7 | 1 |
| <5 yrs | 15 | 1 | 6 | 0 | 1 | 0 | 0 | 1 |
| 5-15yrs | 7 | 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| >15yrs | 47 | 2 | 19 | 2 | 7 | 3 | 0 | 2 |
| Total | 111 | 4 | 49 | 4 | 16 | 5 | 8 | 4 |

**Table 2:** Antimicrobial susceptibility pattern of gram positive bacterial isolates from blood culture.

| Antibiotic | CoNS sensitive | CoNS resistant | Staph.aureus sensitive | Staph.aureus resistant |
|---|---|---|---|---|
| Ampicillin | 32 (28.8%) | 79 (71.2%) | 1 (25%) | 3 (75%) |
| Clindamycin | 101(91%) | 10 (9%) | 4 (100%) | 0 (0%) |
| Cefoxitin | 32(28.8%) | 79(71.2%) | 1 (25%) | 3 (75%) |
| Erythromycin | 30 (27%) | 81 (73%) | 3 (75%) | 1 (25%) |
| Ciprofloxacin | 97 (88.2%) | 14 (12%) | 3 (75%) | 1 (25%) |
| Gentamicin | 95 (85.5%) | 16 (14.5%) | 4 (100%) | 0 (0%) |
| Cotrimoxazole | 88 (79) | 23 (21) | 3 (75%) | 1 (25%) |
| Vancomycin | 111(100%) | 0 (0%) | 3 (75%) | 1 (25%) |
| Linezolid | 111(100%) | 0 (0%) | 4 (100%) | 0 (0%) |

**Table 3:** Antimicrobial susceptibility pattern of Enterobacteriaceae from blood culture.

| Antibiotic | *Klebsiella* sensitive | *Klebsiella* resistant | *E.coli* sensitive | *E.coli* resistant | *Proteus* sensitive | Proteus resistant |
|---|---|---|---|---|---|---|
| Amoxycillin-Clavulanic acid | 34 (65.3%) | 18 (34.7%) | 4 (50%) | 4 (50%) | 23 (74%) | 8 (26%) |
| Ciprofloxacin | 48 (92.3%) | 4 (7.7%) | 8 (100%) | 0 (0%) | 30 (97%) | 1 (3%) |
| Gentamicin | 49 (94.2%) | 3 (5.8%) | 7 (87.5%) | 1 (12.5%) | 30 (97%) | 1 (3%) |
| Cotrimoxazole | 41 (79%) | 11 (21%) | 5 (62.5%) | 3 (37.5%) | 22 (71%) | 9 (29%) |
| Ceftazidime | 21 (40.3%) | 31 (59.7%) | 2 (25%) | 6 (75%) | 20 (64.5%) | 11 (35.5%) |
| Ceftriaxone | 20 (38.4%) | 32 (61.6%) | 2 (25%) | 6 (75%) | 18 (58%) | 13 (42%) |
| Cefotaxime | 13 (25%) | 39 (75%) | 2 (25%) | 6 (75%) | 19 (61%) | 12 (39%) |
| Meropenem | 51 (98%) | 1 (2%) | 8 (100%) | 0 (0%) | 31 (100%) | 0 (0%) |

**Table 4:** Antimicrobial susceptibility pattern of Non-fermenter from blood culture.

| Antibiotic | *Pseudomonas sensitive* | *Pseudomonas* resistant |
|---|---|---|
| Ceftazidime | 0 (0%) | 4 (100%) |
| Amikacin | 2 (50%) | 2 (50%) |
| Ciprofloxacin | 4 (100%) | 0 (0%) |
| Piperacillin-Tazobactum | 0 (0%) | 4 (100%) |
| Meropenem | 4 (100%) | 0 (0%) |
| Tobramycin | 4 (100%) | 0 (0%) |

Gram negative bacteria were found to be the majority over Gram positive bacteria in most of the studies. *Coagulase negative staphylococci* 111(55.2%) were the predominant bacteria in our study which is in similarity to study by Prakash KP et al [2011].[11] *Coagulase negative staphylococci*, which is the usual skin commensal is being commonly reported as an important bloodstream pathogen for the past 2 decades. Improper blood collection procedure, increased usage of prosthetic heart valves and persistance of long standing i.v. devices are found to be the possible modes of transmission of blood stream infection by *Coagulase negative staphylococci*.[12,13] Adequate skin antisepsis before collection of blood cultures by peripheral venipuncture reduces blood culture contamination rates and favours correct interpretation of results by the clinician. Tincture of iodine, chlorine peroxide and chlorhexidine gluconate are more efficient than povidine iodine preparations for skin antisepsis.[14] Multi drug resistant *Klebsiella* were the second most pathogen causing BSI in our study.

Antibiotic sensitivity testing showed Vancomycin and Linezolid to be the most effective antibiotic for Gram positive isolates and resistance to Erythromycin and Ampicillin comparable to the findings of Druba Hari et al.[2020].[15] In our study 100% of the Staphylococcus aureus isolates and 92.9% of Coliforms were sensitive to Gentamicin similar to a Nigerian study[16] on blood cultures of septicaemic children. Meropenem, Gentamicin and Ciprofloxacin were found to be effective for Enterobacteriaceae group of bacteria in accordance to the study by Tomar et al, [2019].[17] Non-fermenter Pseudomonas was highly sensitive to Meropenem, Ciprofloxacin and Tobramycin similar to findings Tomar et al, [2019].[17]

## 5. Conclusion

This study has shown that *Coagulase negative staphylococci* and multidrug resistant *Klebsiella* are the leading causes of blood stream infections in Tiruvarur. Antibiotic resistance pattern of these agents to common antibiotics alerts us to implement rational use of antibiotics. Continuous epidemiological research such as the current one is always vital to guide clinical practice, prevent antimicrobial resistance and to make policies on rational use of anti-microbial agents.

## 6. Author's Contributions

All the authors were actively involved in the laboratory testing and preparation of the final manuscript.

## 7. Acknowledgements

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## 8. Conflict of Interest

The authors declare that there are no conflicts of interest in this paper.

## 9. Source of Funding

None

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