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Original Research Article

Microbiological Profile and Antibiogram of Blood Stream Isolatesata Referral Hospital in North Delhi: A One Year Study

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Abstract

Introduction: Blood culture is the gold standard for diagnosis of bacteremia. It identifies the pathogen and allows susceptibility testing.

Objective: To identify Blood stream infections (BSI) which are critical and may prove fatal if not treated promptly.

Material and Methods: This was a retrospective study done at our institution to identify the prevalent microbial agents causing infections in hospitalized patients. A total of 1521 blood cultures were processed. Antimicrobial susceptibility was performed for clinically significant isolates.

Results: Of total cultures, 16.1% were positive for bacterial growth and 3.1%for fungal growth.

Conclusion: Local microbiological profile with antibiogram of frequently isolated organisms should be known to limit the severity of disease and initiate empiric treatment for blood stream infections.

Keywords: Bacteremia, infection, antibiotic susceptibility, resistance

1.Introduction

Bloodstream infections (BSIs) occur due to the failure of our immune system to restrict infection at a focal site; leading to widespread disease. It is a major cause of morbidity and mortality. The occurrence of these infections, their epidemiology, and the invading pathogens have altered in parallel with the evolution in medical care, particularly with emergence of increasingly ill and immunocompromised population of hospitalized patients who are often heavily reliant on medical support and indwelling devices.[1] The responsible bacteria are usually human pathogens. In contrast, many cases of severe sepsis that occur currently are associated with bacterial or fungal microbes that are members of the patient's own microbial flora. [2] These commensal microbes include Coagulase negative *Staphylococci* (CoNS), enteric gram-negative bacilli, *Enterococcus*, *Candida* species, and other pathogens infrequently cause disease in humans who have normal innate immune defenses. Individuals who develop serious disease due to commensal bacteria generally have a significant immune defect, most often breach in the epithelium barrier or immunosuppression. [2]Prompt diagnosis of BSI and antibiotic susceptibility results helps the clinician for further management. [3] This aids in reducing complications and hospital stay, resulting in major financial saving for the institution as well as improved care of the patient. [4] Current study reports about the prevalence and antimicrobial susceptibility profile of blood culture isolates over a span of one year.

2. Material & Methods

This was a retrospective study conducted for a period of one year (January 2014 to December 2014) in a 530-bed tertiary care centre in North Delhi. A total of 1521 blood culture samples were analyzed.All non- duplicate blood culture isolates were processed by conventional blood culture method (brain heart infusion broth with 0.05% sodium polyanethole sulphonate). Kirby Bauer disc diffusion method was

used for sensitivity testing as per CLSI guidelines [5]. For Coagulase negative *Staphylococcus* (CoNS) &*S. aureus*; vancomycin (30 µg), clindamycin (2 µg), gentamicin (10 µg), erythromycin (15 µg), cefoxitin (30µg) and ampicillin (10 µg) discs were used. For *Enterococcus* spp., vancomycin (30 µg), ampicillin (10 µg), ciprofloxacin (5 µg), ofloxacin (5 µg) and gentamicin (120 µg) discs were used. For *Acinetobacter* and *Klebsiella* spp., amikacin (30 µg), cefoperazone-sulbactum (75µg/30µg), ciprofloxacin (5 µg), gentamicin (10 µg) and meropenem (10 µg); and for *Salmonella* Typhi, ceftriaxone (30 µg), ampicillin (10 µg), ciprofloxacin (5 µg), nalidixic acid (30µg), cotrimoxazole (25 µg) and chloramphenicol (30 µg) discs were used.

3. Results

A total of 343isolates were recovered out of 1521 blood culture received in our laboratory over a period of one year, culture positivity 22.5%.Out of these 247clinically significant blood stream infections were identified, showing a positivity of 16.2%during the study period. Out of these, 56.6% were from admitted patients and 43.3% from Intensive Care Units. Overall frequencies of isolation was 137(39%) gram positive cocci, 109(31%) gram negative bacilli and 8(3.1%)*Candida* spp.

The gram positive cocci were *Staphylococcus aureus*20 (7.87%), *Enterococcus* spp. 8 (3.1%), *Streptococcus* spp. 3 (1.1%), *Streptococcus pneumoniae* 2 (0.7%) and a single isolate of *Rhodococcus* spp. Also 103 (40.5%) isolates of Coagulase negative *Staphylococcus* (*Staphylococcus epidermidis, S. hemolyticus*) were considered clinically significant. This was based on clinical correlation, repeated isolation of same isolate from blood culture and intravenous catheters, host factors like immunosuppression, extremes of age, prolonged use of indwelling devices. Of total blood cultures, 89 (5.85%) isolates were considered as contaminants. These included CoNS (47), diphtheroids (4), micrococcus (14) and*Bacillus* spp. (24). Among Gram negative bacilli, the most common isolate was*Acinetobacter* spp. 36(14.1%) followed by *Klebsiella* spp.-21(8.2%), *Escherichia coli* - 15(5.9%), *Salmonella* Typhi-19(7.4%), *Pseudomonas aeruginosa*-10(3.9%), *Morganellamorgani*-2(0.7%) anda single isolate of *Proteus mirabilis*. Five gram negative oxidase negative non-fermenters could not be identified.Out of 8 Candida spp., four were identified as *Candida krusei* during an outbreak in neonatal intensive care unit. The source of infection was traced to a suction bottle [6].Antifungal susceptibility testing of *Candida* spp. isolates was not done. For coagulase negative *Staphylococcus* and *Staphylococcus aureus* isolates (Figure 1); ampicillin and erythromycin were resistant in 82% of isolates, while all isolates were susceptible to vancomycin. Methicillinresistance was higher (25%) in CoNS in contrast with *S. aureus* (20%). This was tested using cefoxitin disc. Among the *Enterococcus* spp. (Figure 2), ampicillin, gentamicin and ciprofloxacin displayed resistance in more than 62% isolates.

Relatively high proportion of *Acinetobacter* spp. and *Klebsiella* spp. (Figure 3) displayed resistance to ciprofloxacin (61%, 55%) and amikacin (71%, 42%) respectively. Imipenem resistance was observed in 33% and 38% isolates of *Acinetobacter* spp. and *Klebsiella* spp. respectively. All *Salmonella Typhi* isolates were sensitive to ceftriaxone (Figure 4). Nalidixic acid resistance was observed in 89% isolates and a single isolate was also resistant to ampicillin, chloramphenicol and cotrimoxazole (ACCo).

Figure 1: Resistance pattern of antibiotics tested against Coagulase negative Staphylococci and *Staphylococcus aureus*

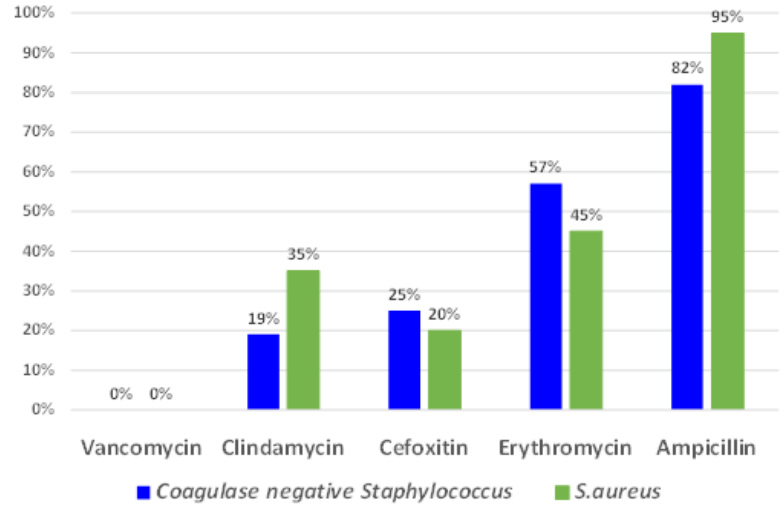


Figure 2: Resistance pattern of antibiotics tested against *Enterococcus* spp.

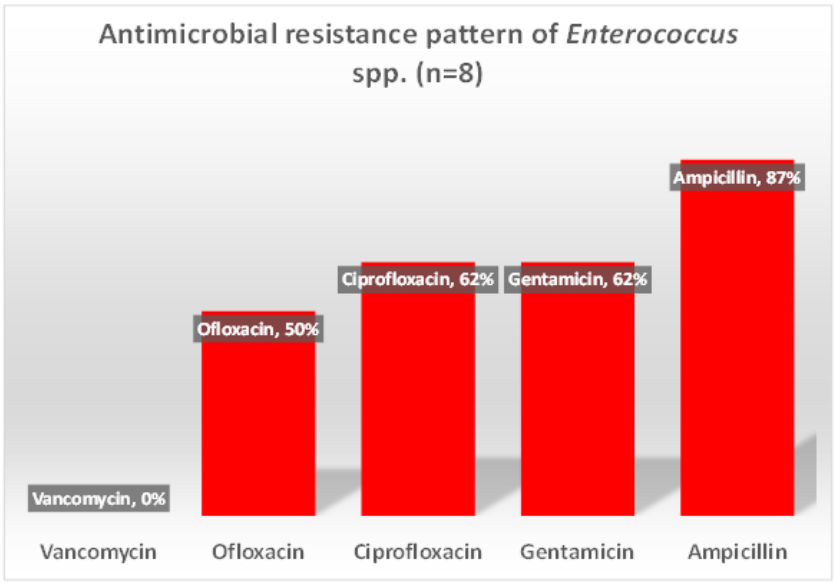


Figure 3: Resistance pattern of antibiotics tested against *Acinetobacter* spp. and *Klebsiella*spp.

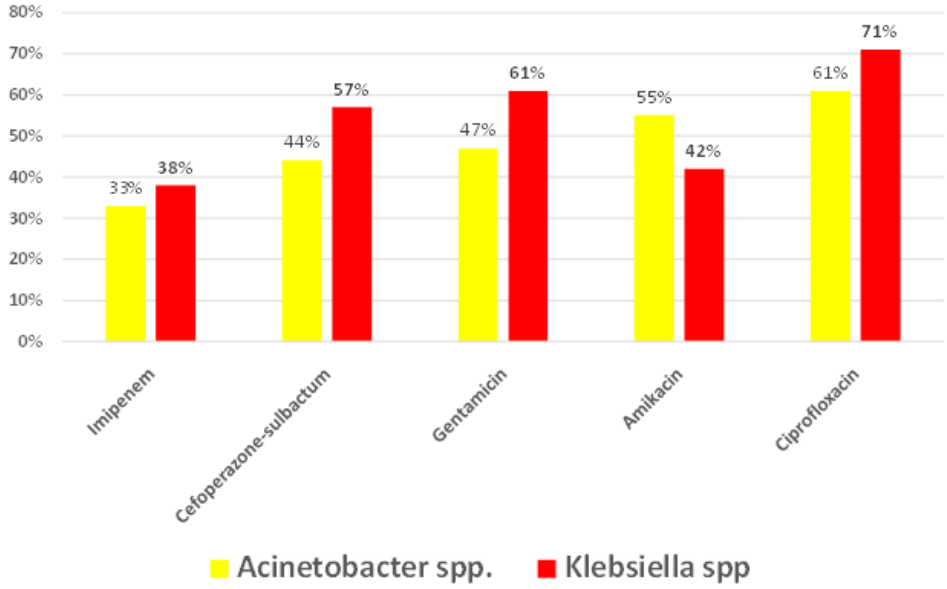
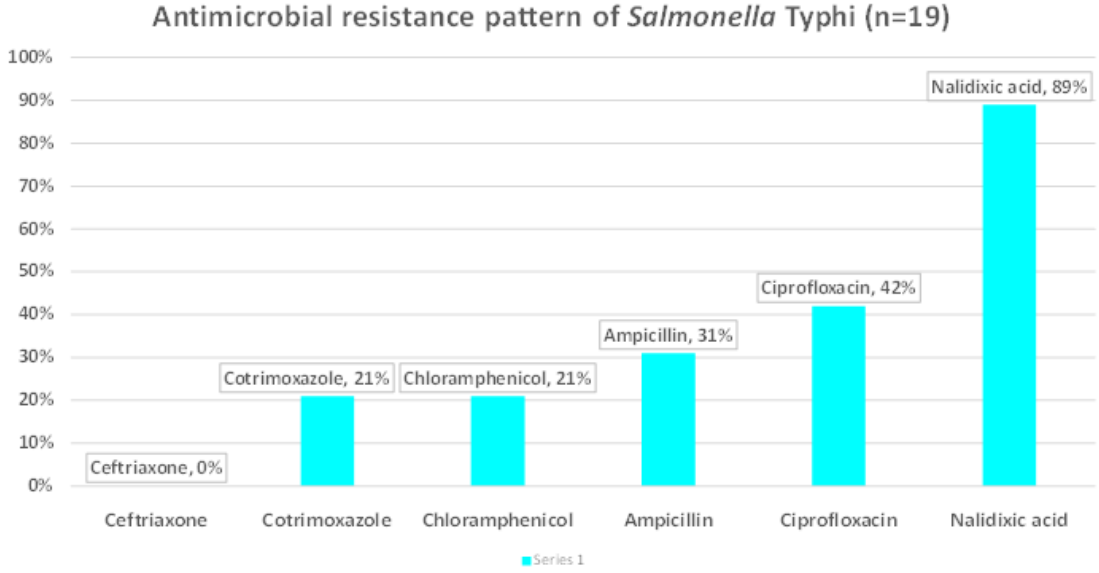


Figure 4: Resistance pattern of antibiotics tested against *Salmonella Typhi*



4. Discussion

Blood culture results provide useful information about the incriminating bacteria and their susceptibility patterns. Besides helping in treatment of the patient, profile of the isolated organisms provides useful adjuncts to choice of empiric therapy in a given set up. Comparison of the etiological profile of our blood cultures with various studies has been done in Table 1[1,7-20].

Table 1: Comparison of etiological data of the present study with other studies

Organisms	Present Study	Similar Studies	Other Studies
Coagulase negative *Staphylococcus*	40.5%	41.2%[7], 42%[8]	24.7%[9], 22%[10], 31%[11,12], 54.3%[13]
Acinetobacter spp.	14.1%	12.6%[14]	24%[15], 21.5%[16], 9.18[17]
Klebsiella spp.	8.2%	7.3%[14]	4.8%[12], 18%[16], 3.6%[8], 6.4%[15]
Staphylococcus aureus	7.8%	9%[18]	28.96%[15], 14.5%[16], 16.5%[8]
Salmonella Typhi	7.4%	8.4% [15]	9.2%[20], 3.7%[19]
Enterococcus spp.	3.1%	3.7%[1,14]	7.31%[15], 9%[16], 9.4%[12]

We observed in our study, maximum number of isolates was Coagulase negative *Staphylococcus* (40.5%).Similar findings have been reported by other authors -41.2% by Lu *et al* [7], 42% by Karlosky *et al* [8]and 54.3% by Bharmare *et al* [13]. CoNS have been considered the most common blood culture contaminant but multiple positive cultures from the same patient are considered significant [21]. According to Souvenir *et al*, clinical significance of CoNS was defined as at least two blood cultures positive for CoNS within 5 days or one positive blood culture plus clinical evidence of infection, which includes abnormal leucocyte count and temperature or blood pressure [9]. Incidence of nosocomial bacteremia due to CoNS is increasing due to frequent use of vascular access devices.Coagulase negative *Staphylococcus*is the third most common cause of BSI [22] and the most common cause of nosocomial BSI [23]. Methicillin resistance rate was higher in CoNS as compared with *S. aureus*, which is similar to study by Mathur *et al* [16], Mir *et al*[24]. The methicillin resistance for CoNSwas less in our study (25%) in comparison to study by Mathur *et al*[16]and Mir *et al* [23].CoNS *and Staphylococcus aureus* isolates displayed maximum resistance to ampicillin, similar to study by Mathur *et al* [16] while all isolates were sensitive to vancomycin. Among gram negative bacteria, imipenem was the most effective agent against *Acinetobacter* spp. and *Klebsiella* spp. Maximum resistance was demonstrated by these bacteria to ciprofloxacin. The number of isolates of *Salmonella Typhi* in our study is in concordance with Duggal *et al* [15]. *SalmonellaTyphi* displayed zero resistance to ceftriaxone,similar to study by Madhulika *et al* [25], but highest resistance was observed for nalidixic acid (89%) followed by ciprofloxacin (42%). Multidrug resistance (MDR, ACCo resistance) was seen only in a single isolate of S. Typhi which is different from study by Jain *et al* [26]. According to WHO, the percentage of MDR(ACCo) resistance in India was 7% and nalidixic acid resistance was 57%. [27]The details of antimicrobial susceptibility of isolates are shown in figures 1-4.

The overall contamination rate in our blood cultures was 5.8%, which is higher than the published benchmark standards [28]. Contamination rate reported by other authors was 12.6%by Chraiti *et al* [29] and 18% by Malik *et al* [30]. In our study, contamination rate of blood cultures was higher than the permitted level (≤3%). We intend to take measures for reducing contamination. A method known as ISDT (Initial specimen diversion technique) can be implemented for the reduction of blood culture contamination as described by Binkhamis *et al* [21].

Even though a small number of patients receive care in intensive care units, majority of the nosocomial BSIs are reported from these units.An active infection prevention team can help in reducing nosocomial blood stream infections. The tracking and reporting of blood stream infection rates are both important activities that rely heavily on the accurate differentiation of contamination from true bacteremia. [28]

5. Conclusion

Blood culture remains the gold standard for the detection of bacteremia despite the limitations. The correct interpretation of blood culture including the clinical scenario will go a long way in the implementation of active control measures.Patterns of species distribution and drug susceptibilities in local patient populations, can guide empirical therapy of BSIs.

Declaration

The manuscript is original and is not published or communicated for publication elsewhere either in part or full.

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