



Bacterial Spectrum and Antibiotic Sensitivity Patterns of Isolates from Blood Culture

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Abstract

Context: Blood cultures remain the gold-standard not only for the diagnosis of blood stream infection, but also for the identification of the responsible pathogens, and for the testing of their susceptibility to anti-infective agents.

Aims: To study bacterial profile of consecutive blood cultures isolates.

Objective: To perform antimicrobial susceptibility of bacterial isolates against antibiotics as per Clinical Standards Institute and Laboratory (CLSI) guidelines.

Settings and design: An observational study was conducted by department of microbiology, SGT medical college and Hospital from march2020-september 2020.

Methods and material: A total of 50 positive blood cultures were studied. Blood culture bottles inoculated with the sample were incubated at BacT/ALERT 3D (bioMerieux) system till they were flash a positive signal or to a maximum of 5 days. Smears from the signal positive blood culture bottles will be examined microscopically after Gram's stain. Simultaneously the bottles will be sub-cultured on blood agar and Mac Conkey agar and the plates will be incubated at 37° C for 18 -24 hours. Organisms were identified and antibiotic sensitivity term performed by Vitek2 Compact system.

Results: We received majority of positive blood cultures from paediatrics ward (72%). Most common age group affected was children less than one year of age. In this study, Gram positive bacteria (78%) were found to be predominant over Gram negative bacteria (22%). All the *Staphylococcus aureus* isolates were susceptible to vancomycin and linezolid, whereas 80% isolates were *Methicillin Resistant Staphylococcus Aureus* (MRSA). On the other hand, MRCoNS were observed to be 52.4%. All the *Salmonella Typhi* isolates were susceptible to piperacillin (100%) while, 66.7% were susceptible to ceftriaxone. None of the *S. Typhi* isolates

Received: Nov 28, 2020

Accepted: Dec 17, 2020

Published Online: Dec 21, 2020

Journal: Journal of Community Medicine

Publisher: MedDocs Publishers LLC

Online edition: <http://meddocsonline.org/>

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Keywords: Staphyococcus aureus; Antibiotic resistance; Automated blood culture system; Vitek2 Compact system.

Key message: Blood cultures are among the most important laboratory tests performed in the diagnosis of serious infections. The rampant, unchecked use of antibiotics has led to spread of antibiotic resistant organism. It is there for pertinent to analyse spectrum of bacterial isolates as well as their antibiotic sensitivity profile from blood culture.

Cite this article: Tanisha B, Pankaj P, Tanisha B, Manisha K, Surinder K. Bacterial Spectrum and Antibiotic Sensitivity Patterns Isolates from Blood Culture. J Community Med. 2020; 3(1): 1026.



were susceptible to ciprofloxacin. Two isolates of *Burkholderia cepacia* complex were obtained from blood culture of new-borns.

Conclusions: Our study highlights the rising problem of antibiotic resistance among blood culture isolates from rural Haryana.

Introduction

Blood stream infections range from self-limiting infections to life threatening sepsis that requires rapid and aggressive antimicrobial treatment [1].

Rapid detection and identification of clinically relevant microorganisms in blood cultures is very essential. Determination of antimicrobial susceptibility pattern for rapid administration of antimicrobial therapy has been shown to reduce the morbidity and mortality associated with blood stream infections [2]. Awareness of the baseline antimicrobial resistance specific to a hospital prevents irrational use of antibiotics and thus, spread of antibiotic resistance [3].

This study was conducted to investigate bacteriological and antibiotic susceptibility patterns of bacterial culture in Shree Guru Gobind Singh Tercentenary (SGT) Medical College, Hospital and Research Institute, Budhera, Gurugram.

Materials and methods

An observational study was conducted by department of microbiology, SGT medical college and Hospital from march 2020-september 2020. A total of 50 positive blood cultures were included in the study. Samples received were from the inpatient wards of the hospital. Blood samples were collected from the patients before the administration of any antibiotic. Relevant details of the patients were recorded in a pre-designed proforma. Blood culture bottles inoculated with the sample were incubated at BacT/ALERT 3D (bioMerieux) system till they were flash a positive signal or to a maximum of 5 days [4]. Smears from the signal positive blood culture bottles were examined microscopically by Gram's stain. Simultaneously the bottles were sub-cultured on blood agar and MacConkey agar and the plates were incubated at 37° C for 18 -24 hours. Organisms were identified and antibiotic sensitivity term performed by as per Clinical Standards Institute and Laboratory (CLSI) guidelines. Vitek2 Compact system perform VITEK2 GN 21341, VITEK2 GP 21342 Antimicrobial Susceptibility Test (AST) cards were used for identification of antibiotic sensitivity test. *Staphylococcus aureus* ATCC 25923, *Pseudomonas aeruginosa* ATCC 27853, *Escherichia coli* ATCC 25922, *Klebsiella pneumonia* ATCC 700603 were included as quality control strains.

Result

In our study, majority of blood cultures were received from male patients (62%), while only 38% were from female patients. Majority of blood cultures were from infants (58%) Figure 1. We received positive blood cultures from General Medicine ward, Paediatrics ward, and Casualty. Majority of specimens received were from Paediatrics ward (72%), followed by General Medi-

cine (26%) and casualty (2%). Gram positive bacteria (78%) were found to be predominant over Gram negative bacteria (22%). *Staphylococcus aureus* was the most common Gram positive bacteria observed in our study (30%). Among the 21 Coagulase Negative *Staphylococcus* (CoNS), 12%, 6%, 6% and 2% were identified as *Staphylococcus epidermidis*, *Staphylococcus Hominis*, *Staphylococcus capitis* and *Staphylococcus hemolyticus* respectively. Speciation for 8 CoNS could not be done. *Salmonella Typhi* was the predominant Gram negative bacilli isolated (6%) as shown in Figure 2. Among the *Staphylococcus aureus* isolates, all the isolates were susceptible to vancomycin and linezolid, whereas 80% isolates were *Methicillin resistant Staphylococcus aureus* (MRSA) as shown in Table 1. On the other hand, among the total CoNS isolated, MRCoNS were observed to be 52.4%. All the *Salmonella Typhi* isolates were susceptible to piperacillin (100%) while, 66.7% were susceptible to ceftriaxone. None of the *S. Typhi* isolates were susceptible to ciprofloxacin Table 2. Over this six month period, two *Burkholderia cepacia* were isolated. Both the isolates were obtained from newborns. The institute reported an outbreak of *Burkholderia cepacia* complex septicemia from the neonatal intensive care unit early last year [5]. Thus, the hospital infection control team was alerted about a possible outbreak situation. However, no further cases were observed.

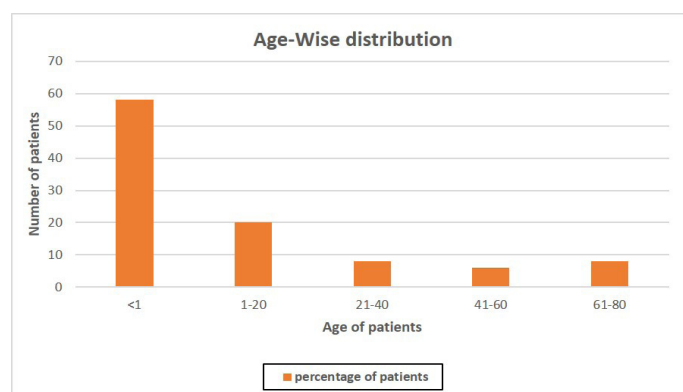


Figure 1: Bar graph showing age wise distribution of positive blood cultures.

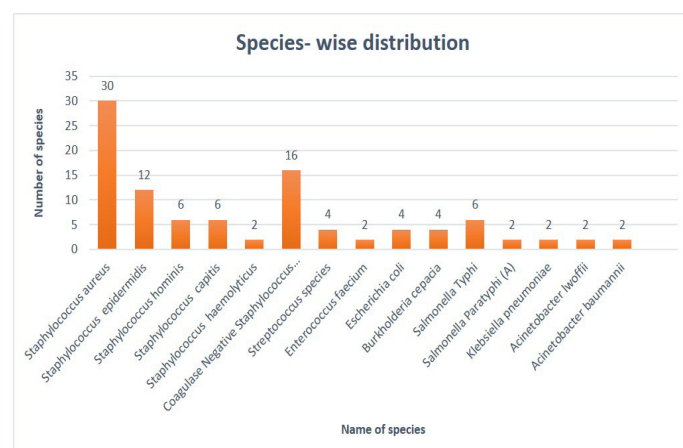


Figure 2: Bar graph showing species wise distribution of positive blood cultures.

Table 1: Antibiotic susceptibility profile of Gram positive cocci isolated from positive blood cultures.

Name of species	#CIP (%)	#GEN (%)	#VA (%)	#LZ (%)	#TCA (%)	#CL (%)	#CF (%)	#E (%)	#Cot (%)	#AZ (%)	#LX (%)	#MI (%)	#PiG (%)	#TEI(%)
<i>S. aureus</i>	*NT	*NT	100	100	60	33.3	20	6.7	*NT	*NT	00	73.3	6.7	6.7
<i>S. epidermidis</i>	00	50	100	100	83.4	50	83.4	33.4	83.4	50	*NT	*NT	*NT	*NT
<i>S. hominis</i>	33.4	33.4	100	100	33.4	33.4	00	00	00	00	*NT	*NT	*NT	*NT
<i>S. capitis</i>	100	66.7	100	100	100	66.7	33.4	66.7	100	66.7	*NT	*NT	*NT	*NT
<i>S. haemolyticus</i>	00	00	100	100	100	00	00	00	00	00	*NT	*NT	*NT	*NT
CoNS (speciation could not be done)	37.5	62.5	87.5	100	62.5	50	00	25	00	*NT	*NT	*NT	*NT	*NT
St Species	*NT	*NT	100	100	100	00	00	100	*NT	*NT	50	00	100	50
<i>E. faecium</i>	*NT	*NT	00	00	00	00	00	00	*NT	*NT	00	00	00	100

*NT: Not tested; #CIP: Ciprofloxacin; #GEN: Gentamicin; #VA: Vancomycin; #LZ: Linezolid; #TCA: Tetracycline; #CL: Clindamycin; #CEF: Cefoxitin; #E: Erythromycin; #Co-t: Co-trimoxazole; #AZ: Azithromycin; #LX: Levofloxacin; #MI: Minocycline; #Pi-G: Penicillin-G; #TEI: Teicoplanin.

Table 2: Antibiotic susceptibility profile in gram negative rods isolated from positive blood cultures.

Antibiotics	<i>S. Typhi</i> (%)	<i>E. coli</i> (%)	<i>B. cepacia</i> (%)	<i>K. pneumoniae</i> (%)	<i>A. lwoffii</i> (%)	<i>A. baumannii</i> (%)	<i>S. Paratyphi(A)</i> (%)
Amikacin	00	(100)	(100)	=00	(100)	00	00
Ciprofloxacin	00	(50)	(100)	(100)	00	00	00
Gentamicin	00	(50)	(100)	00	(100)	00	00
Ceftriaxone	(66.67)	00	00	00	(100)	00	(100)
Colistin	(66.67)	(50)	00	1 (100)	(100)	00	(100)
Imipenem	(66.67)	00	00	00	(100)	00	(100)
Co-trimoxazole	(66.67)	00	(50)	00	(100)	00	(100)
Piperacilin	(100)	(50)	(50)	00	(100)	00	(100)
Meropenem	(66.67)	(100)	(100)	00	(100)	00	(100)
Amoxyclav	(66.67)	(100)	(50)	00	00	00	(100)

Discussion

In our study, among the total positive blood culture studied 62% were from male while only 38% were from female. In a study done in Vellore, India 55.1% were male patients and 44.9% were female patients [6]. Another study done in Ethiopia showed 53.6% male patients and 46.4% female patients among the total positive blood culture. The result of both the studies is consistent with our study [7]. In our study, out of the total positive blood culture, majority were obtained from <1years old (58%). Highest rate of pediatric bacterial isolation can be attributed to the immaturity of the immunity system in children hence they are vulnerable to blood stream infection. Another study from Cameroon reflected similar findings [8]. In our study, majority of specimens were received from paediatrics ward. Our study was consistent with the study conducted by Junda et al. [8]. In our study, Gram positive bacteria were found to be predominant over Gram negative bacteria. Seventy eight percent blood culture isolates were Gram positive bacteria while 22% Gram negative bacteria. The findings were similar to studies conducted in Ethiopia and Nigeria where 46.4% and 30.7% isolates were Gram positive and 53.6% and 69.3% isolates were Gram negative respectively. However, Negussie et al find higher percentage of Gram negative blood culture 51.8% compared

to Gram positive blood culture (46.4%) [7,9]. Another study was consistent to our study which was done in Kathmandu, Nepal with (61%) gram positive bacteria and (39%) gram negative bacteria [10]. The predominant Gram-positive bacteria identified in our study was *Staphylococcus aureus* (30%). Similarly, in studies conducted by Junda et al and Negussie et al, highest number of bacteria identified were *Staphylococcus aureus* [7,8]. CoNS have been considered non-pathogenic and rarely reported to cause severe infections. However, as a result of increased use of intravascular devices and increased number of hospitalized immune compromised patients clinical significance of these Gram positive bacteria has increased. CoNS was the second most prevalent Gram positive bacteria (26%) isolated in our study. However, our current finding is different from previous finding in Addis Ababa, Ethiopia 19.6% [7]. Two other studies which were consistent with our study, one from Northern Ethiopia with 30.6% and other from Cameroon with (22.7%) Gram positive organisms [11,8]. Among Gram negative bacteria, *Salmonella Typhi* (6%) was predominant. In comparison to a study conducted from Northern India, *Salmonella Typhi* (1.5%) was isolated in much lower number [3]. Another study from Northern Ethiopia reported *Salmonella Typhi* in 5.6%. It is consistent

with our study [11]. Another study conducted in Cameroon reported a higher percentage of *Salmonella Typhi* (9.1%) [8]. Another objective of present study was finding the antibiotic sensitivity pattern among the blood culture. All the CoNS isolates were sensitive to vancomycin and linezolid, while 76.9%, 69.2%, and 46.2% were sensitive to tetracycline, co-trimoxazole and cefoxitin respectively. Our antibiotic sensitivity findings were similar to the study of Gupta et al. [3]. On the other hand 100% *Staphylococcus aureus* isolates were sensitive to vancomycin and linezolid and 61% isolates were sensitivity to minocycline. While another study conducted in 2019 from North India reported (100%) sensitivity among *Staphylococcus aureus* isolates towards vancomycin and linezolid [3]. All the Enterobacteriaceae isolates were sensitivity to piperacilin (100%). Among the *Salmonella Typhi* isolates 66.7% were sensitivity to ceftriaxone. Compared to our findings, Gupta et al reported 80% *Salmonella Typhi* isolates as sensitivity to ceftriaxone [3].

Conclusion

Thus our study highlights the common organisms isolated from blood cultures and their antimicrobial sensitivity.

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