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Bacterial Profile and Antimicrobial Susceptibility Patterns of *Staphylococcus aureus* Isolates from Blood Culture

DEEPAK KUMAR SHARMA[1], JASINA[1], RICHA PANWAR, MONIKA YADAV, SONIA GOEL* AND MOHINDER SINGH

Faculty of Agricultural Sciences, Shree Guru Gobind Singh Tricentenary University, Gurugram-122 505 (Haryana), India
**(e-mail : soniabansalsgt@gmail.com; Mobile : 9711817426)*

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ABSTRACT

A total of 30 positive blood culture samples from paediatrics wards, general medicine and general surgery in the Department of SGT Medical and Research Institute, Gurugram were analyzed for bacterial profile and antimicrobial susceptibility patterns of *Staphylococcus aureus*. The samples were collected following standard microbiological techniques as part of the routine clinical management of the patient. Antibiotic susceptibility testing was done on pure culture isolates employing disc-diffusion method for the commonly used antibiotics. Most of the patients (60%) were found positive from the paediatrics wards due to the immaturity of the immunity system in children. Sensitivity test showed that *S. aureus* from diverse blood cultures was found sensitive to different antibiotics as co-trimoxazole (23.3%), ciprofloxacin (16.6%), gentamycin (50%), vancomycin (100%), linezolid (96.6%), tetracycline (76.6%), clindamycin (43.3%), doxycycline (16.6%), cefoxitin (36.6%), minocycline (76.6%), penicillin-G (10%), erythromycin (33.3%) and azithromycin (3.3%). The study can be a potential tool in diagnosing and treating effectively the impact of *S. aureus*.

Key words : *Staphylococcus aureus*, antibiotic resistance, automated blood culture system, Vitek2 compact system

INTRODUCTION

Staphylococcus aureus is a gram positive bacterium which causes skin, bone, soft tissue infections, urinary tract infections, pneumonia, health care associated bacterium in community and health settings and other invasive infections (Gitau *et al.,* 2018). It is a part of the normal flora of human body and commonly carried on the skin or in the nose of healthy individuals, which makes it easy to be transmitted by air or fomites from patient or carriers (Salim *et al.,* 2015). *S. aureus* produces enzyme catalase that makes bacteria resistant to intra and extra cellular death by hydrogen peroxide. The mechanism of resistance includes inactivation of antibiotics by the enzymes, decreases affinity for the antibiotics caused by alteration of the target, efflux pumps and trapping of the antibiotics. Only few bacteria or fungi are present in blood, therefore, to improve the yield of these pathogens, the volume of blood to be cultured should be quite significant (John *et al.,* 2014). Emergence and spread of *S. aureus* strains which are resistant to methicillin, referred to as methicillin-resistant *S. aureus* (MRSA) results in high morbidity, high mortality and increased treatment costs (Treesirichod *et al.,* 2014). The present study focused on the determination of their antimicrobial susceptibility pattern of *S. aureus* isolates from blood culture.

MATERIALS AND METHODS

Positive blood cultures were collected from paediatrics department, general medicine and general surgery department from the Department of Microbiology, SGT Medical College and Hospital from March 2020-September 2020. A total of 30 positive blood cultures were included in the study. Blood culture bottle inoculated with the sample were

[1]Faculty of Allied Health Sciences, Shree Guru Gobind Singh Tricentenary University, Gurugram-122 505 (Haryana), India.

incubated at BacT/ALERT 3D (bioMerieux) system till they flash a positive signal or to a maximum five days (Pankaj *et al.,* 2020). Positive samples were sub-cultured on blood agar and MacConkey agar and plates incubated at 37°C for 18-24 h, organisms were identified and antibiotics sensitivity tests were performed. After culturing antimicrobial susceptibility, testing was done by Kirby- Bauer disc diffusion method with Mueller- Hinton Agar (MHA) as recommended by Clinical and Laboratory Standards Institutes (CLSI) 2020 guidelines (Melvin Weinstein *et al.,* 2020). Positive sample were progressed with automatic (Vitek 2) or manual method. A sterile swab or applicator stick was used to transfer a sufficient number of colonies of a pure culture and was suspended in 3.0 ml of sterile saline (aqueous 0.45 to 0.50% NaCl, pH 4.5 to 7.0) in a 12 x 75 mm clear plastic (polystyrene) test tube and the turbidity was adjusted in between 0.5 to 0.6 McFarland Standard Antimicrobial Susceptibility Test (AST) cards. The filled cassette (special racks) was placed manually into a vacuum chamber station. The card was automatically filled by the vacuum device and automatically sealed. It was manually inserted in the Vitek 2 reader-incubator module (incubation temperature 35.5°C). Every card was automatically subjected to a kinetic fluorescence measurement in every 15 min. The patient information was entered into the system. After appropriate incubation time, the turbidity and the coloured products of the substrate metabolism were interpreted by the software and compared to the database. *S. aureus* ATCC 25923, *Pseudomonas aeruginosa* ATCC 27853, *Escherichia coli* ATCC 25922 and *Klebsiella pneumonia* ATCC 700603 were included as quality control strains. Antimicrobial susceptibility was determined using an Antimicrobial Susceptibility Test (AST) card ATCC 414531, which tested the MIC of antibiotics, Vitek 2 GN ATCC 21341 and Vitek 2 GP 21342.

RESULTS AND DISCUSSION

Majority of blood cultures were received from male patients (57%), while only 43% were female patients [Fig. 1 (1)]. In age-wise distribution, maximum samples were of infants (60%) and minimum samples were of

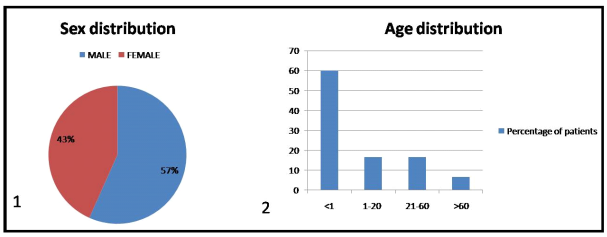

Fig. 1. Pie graph showing sex-wise distribution (1) and Bar graph showing age-wise distribution of positive blood culture for *S. aureus* (2).

senior citizens (7%) as shown in Fig. 1 (2). Majority of samples received from Pediatrics ward (76.66%) then from general medicine (20%) and general surgery (3.33%) and were found positive for *S. aureus* (Table 1). The blood cultures were analyzed for sensitivity test of different antibiotics and sensitivity was observed as in Table 2.

Table 1. Ward-wise distribution of positive blood culture

Name of wards	No. of patients	Percentage of patients
Paediatrics	23	76.66
General medicine	6	20.00
General surgery	1	3.33
Total	30	100

Table 2. Antibiotic susceptibility profile for *S. aureus*

S. No.	Antibiotic	*S. aureus* (%)
1.	Co-Trimoxazole	23.3
2.	Ciprofloxacin	16.6
3.	Gentamycin	50.0
4.	Vancomycin	100.0
5.	Linezolid	96.6
6.	Tetracycline	76.6
7.	Clindamycin	43.3
8.	Doxycycline	16.6
9.	Cefoxitin	36.6
10.	Minocycline	76.6
11.	Penicillin-G	10.0
12.	Erythromycin	13.3
13.	Azithromycin	3.3

The present study concluded that the males (57%) were more than females (43%) in case of positive culture The similar observations were done in earlier studies in Jorden and Ehiopia (Kahsay *et al.,* 2014). Another study of Jorden (57% male and 43% female) was in consistent with our study (Salim *et al.,* 2015). Non-significant difference was observed between males and females in the overall blood culture growth positivity rate (Negussie *et al.,* 2015). In the present study, out of total positive blood cultures, majority were obtained

from age group <1 year old which were 60%. Highest rate of pediatric bacterial isolation can be attributed to the immaturity of the immunity system in children as they can be highly vulnerable to *S. aureus* infection. Here majority of specimens were received from Paediatrics Ward. In the present study, isolates derived from 1-20 (17%) and 21-60 (17%) age group patients were similar to each other and showed minimum growth of *S. aureus*. Another study from Nepal showed that patients between 0-10 age group showed the maximum positive growth for *S. aureus* (24%) followed by age group 51-60 (19%). Age group 0-10 tends to have higher colonization rates, probably because of their frequent contact with respiratory.

It was found that the patients having age over 60 or very young were found most susceptible to these infections and very less in number (7%). It was also observed that Gram positive bacteria was predominant over Gram negative bacteria, and were found gram positive cocci among the *S. aureus* isolates. Ward-wise, it was found in majority of paediatrics ward (76.66%), general medicine (20%) and general surgery (3.33%). Another study, from Ethopia observed that majority of the patients were from surgical ward (31.3%), gynaecology and obstetrical wards (44.4%). They found maximum patients from gynaecology and obstetrical wards and very least from surgical wards, also developed MRSA infection (Kahsay *et al.,* 2014). Antibiotic sensitivity pattern among the blood culture showed diverse pattern of sensitivity. All isolates were found sensitive to vancomycin and linezolid, while 76.6, 50 and 43.3% were sensitive to cefoxitin, co-trimoxazole and ciprofloxacin, respectively. Similar results were reported by Gupta and Kashyap (2016) and Salim *et al.* (2015). In this study, vancomycin (100%), linezolid (96.6%), tetracycline (76.6%), minocycline (76.6%), gentamycin (50%) and clindamycin (43.3%) were most sensitive agents against isolated *S. aureus* strains, while cefoxitin (36.6%), co-trimoxazole (23.3%), ciprofloxacin (16.6%), erythromycin (13.3%), penicillin-G (10%) and azithromycin (3.3%) were least sensitive antimicrobial agents.

CONCLUSION

The present study concluded the susceptibility pattern of *S. aureus* towards diverse antibiotics.

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