

Original Research Article

Bacteriological profile and antibiotic sensitivity pattern of blood culture isolates from tertiary care level teaching hospital of Vijayapura district

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ABSTRACT

Background: Blood stream infections, ranging from self-limiting bacteraemia to life threatening septicaemia, remain one of the most important cause of morbidity and mortality worldwide. Sepsis is a systemic illness caused by microbial invasion of normally sterile parts of the body. Bacteria isolated from blood stream infections are numerous and diseases related to them need urgent treatment with antimicrobial drugs. Aim was to study the bacteriological profile of positive blood cultures and to find their antibiotic sensitivity pattern

Methods: A retrospective analysis of positive blood culture reports was done in the microbiology laboratory of present tertiary care teaching hospital (Al-Ameen Medical College, Vijayapura) for the consecutive year 2017, 2018 and 2019.

Results: Total 21% samples found positive on blood culture shows *Staphylococcus aureus* as most common organism followed by *Klebsiella* and *E.Coli* antibiotic sensitivity pattern shows maximum sensitive to gentamicin (92%) and vancomycin (92%) as maximum resistance to penicillin (55%). Gram-positive organisms show more resistance to penicillin and least to vancomycin whereas gram-negative organisms show more resistance to cephalosporin group of antibiotics and least resistance to ciprofloxacin/gentamicin.

Conclusions: Resistance pattern of organisms to some commonly used drugs has given warning signal to clinicians to search for alternate effective antibiotics and hospital authorities to formulate antibiotic policy for rationale use of antibiotics to prevent drug resistance.

Keywords: Blood culture, Bacteriological profile, Antibiotic sensitivity

INTRODUCTION

Sepsis is a systemic illness caused by microbial invasion of normally sterile parts of the body.¹ Blood stream infections, ranging from self-limiting bacteraemia to life threatening septicaemia, remain one of the most important cause of morbidity and mortality worldwide. Bacteria isolated from blood stream infections are numerous and diseases related to them need urgent treatment with antimicrobial drugs.^{2,3}

Antibiotic resistance is a serious problem that has the potential to drag the world into pre-antibiotic era. The most probable reason is the widespread use of antibiotics and often choosing an inappropriate drug. The misuse of antibiotics stems primarily from the inherent inclination of doctors toward prescribing the potent antibiotics.⁴

Increasing antimicrobial resistance is a worldwide concern. The prevalence of resistance of blood borne isolates is increasing and it also varies in accordance with geographical and regional location. The infection caused

by multidrug-resistant (MDR) organisms is more likely to prolong the hospital stay, increase the risk of death, and require treatment with more expensive antibiotics.⁵

Regular surveillance of blood culture isolates and their antibiogram in the hospital seems essential for determining empiric antibiotic therapy and also for alerting clinicians to emerging pathogens that may pose a threat to the community.²

The present study was aimed to find the various forms of organism present in blood and its sensitivity pattern to antibiotics.

METHODS

A retrospective analysis of blood culture reports of Microbiology laboratory of present tertiary care teaching hospital (Al-Ameen Medical College, Vijayapura) for the year 2017, 2018 and 2019 was done in the month of July & August 2020.

Total 2252 blood culture reports of three consecutive years were analysed after taking permission from the Institutional Ethics Committee and head of the department. Blood samples were collected from peripheral vein by following aseptic precautions and before start of antibiotic treatment as per the guidelines of the hospital. The data collected were entered in excel sheet and was analysed by using SPSS software version-20.

Procedure of blood culture: about 5 ml (children) or 20 ml (adult) blood was collected from patients and then injected into the bottles of Brain Heart Infusion separately for aerobic and anaerobic organisms. Shake the bottle after injecting the blood and put it in the incubator (37°C). Result will be read daily by noticing any turbidity in the bottle. Aerobic organism turbid the upper layer of the culture while anaerobic organisms turbid the lower layer of the culture. if no growth is noticed after five days, the culture is negative.

Procedure of drug sensitivity test

The disk diffusion test or agar diffusion test, which uses antibiotic discs to test the extent to which bacteria are affected by those antibiotics. In this test wafers containing antibiotics are placed on an agar plate where bacteria have been placed, and the plate is left to incubate. If an antibiotic stops the bacteria from growing or kills the bacteria, there will be an area around the wafer where the bacteria have not grown enough to be visible. This is called zone of inhibition.

RESULTS

Total 473 positive blood culture reports (21% of total samples tested i.e. 2252) of three consecutive years were analysed, which yielded following observations, about 50% positive blood culture belongs to the year 2019 whereas nearly one fourth each were from previous two years (Figure 1).

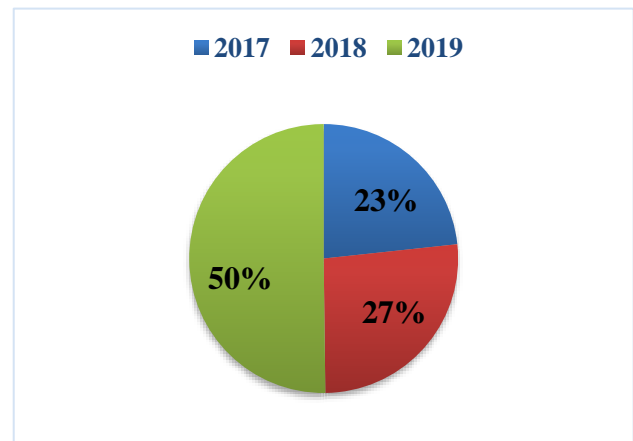


Figure 1: Year wise distribution of positive blood culture samples.

According to (Table 1) the most common organism isolated from blood culture was *Staphylococcus aureus* in all three years followed by *Klebsiella species* and *Escherichia coli* whereas least common isolates was *Salmonella paratyphi* & *Streptococcus species*.

Table 1: Year wise distribution of bacteriologic profile of blood culture isolates.

Year	2017		2018		2019		TOTAL
Species	Number	%	Number	%	Number	%	No.
<i>Staphylococcus aureus</i>	44	40	51	40	101	43	196
<i>Enterococcus spp.</i>	04	04	04	03	12	05	20
<i>Streptococcus spp.</i>	02	02	01	01	07	03	10
<i>Pseudomonas spp.</i>	06	05	09	07	14	06	29
<i>Salmonella typhi</i>	10	09	14	10	28	12	52
<i>Salmonella paratyphi</i>	02	02	01	01	05	02	08
<i>Escherichia coli</i>	14	13	19	15	24	10	57
<i>Klebsiella spp.</i>	15	14	19	15	28	12	62
<i>Enterobacter spp.</i>	09	08	06	05	12	05	27
Total	109	100	128	100	236	100	473

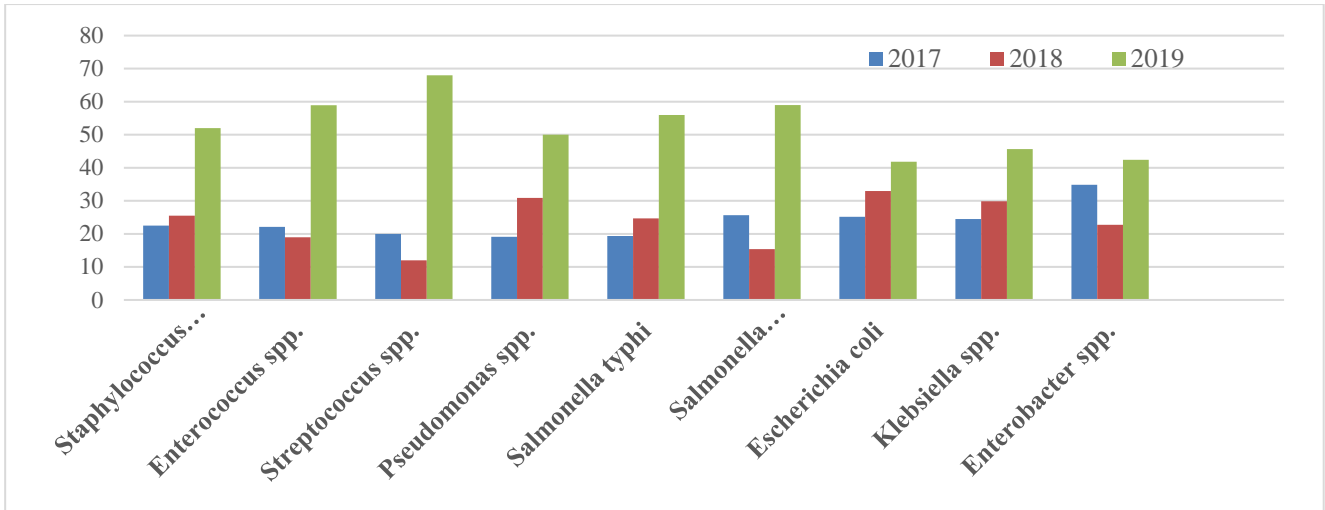


Figure 1: Bacteriologic profile of blood culture isolates of three years.

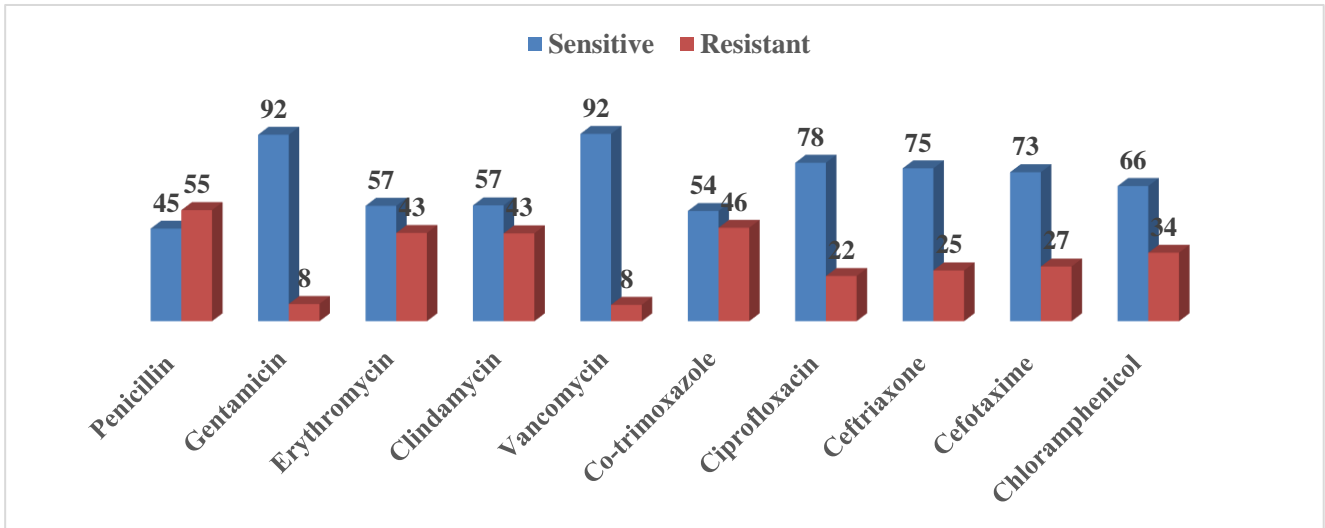


Figure 2: distribution of Antibiotic resistance pattern of blood culture isolates (n=473).

Here (Figure 2) shows proportions of organisms divided across the three year, which indicates the maximum proportion of organisms were isolated in the year 2019 compared to other two years.

Figure 3 shows distribution of antibiotic resistance pattern to various isolates of blood culture, according to which gentamicin (92%) and vancomycin (92%) were found more sensitive antibiotics whereas penicillin (55%) was showing more resistance against the organisms.

Table 2 gives detail percentage of antibiotic sensitivity and resistance pattern against blood culture isolate.

Table 3 shows drug sensitivity pattern against some important common blood culture isolates according to which gram-positive organisms shows resistance more to penicillin and least to Vancomycin whereas gram-negative organisms shows more resistance to cephalosporin group of antibiotics and least resistance to ciprofloxacin/gentamicin.

Table 2: Year wise distribution of drug sensitivity pattern of blood culture isolates.

Year	2017 (n=109)		2018 (n=128)		2019 (n=236)	
Drugs	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant
Penicillin	53 (49%)	56(51%)	58(45%)	70(55%)	104(44%)	132(56%)
Gentamicin	102(94%)	07(06%)	119(92%)	09(07%)	212(90%)	24(10%)
Erythromycin	65(60%)	44(40%)	76(59%)	52(41%)	127(54%)	109(46%)
Clindamycin	62(57%)	47(43%)	77(60%)	51(40%)	130(55%)	106(45%)
Vancomycin	104(95%)	05(05%)	119(93%)	09(07%)	212(90%)	24(10%)

Continued.

Co-trimoxazole	68(62%)	41(38%)	70(55%)	58(45%)	118(50%)	118(50%)
Ciprofloxacin	88(80%)	21(20%)	101(79%)	27(21%)	179(76%)	57(24%)
Ceftriaxone	88(80%)	21(20%)	97(76%)	31(24%)	170(72%)	66(28%)
Cefotaxime	85(78%)	24(22%)	96(75%)	32(25%)	165(70%)	71(30%)
Chloramphenicol	76(70%)	33(30%)	87(68%)	41(32%)	151(64%)	85(36%)

Table 3: Distribution of drug sensitivity pattern of some common blood culture isolates.

Organisms	<i>Staphylococcus aureus</i> (n=196)		<i>Enterococcus spp.</i> (n=20)		<i>Streptococcus spp.</i> (n=10)		<i>Salmonella typhi</i> (n=52)		<i>Escherichia coli</i> (n=57)		<i>Klebsiella spp.</i> (n=62)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Penicillin	157	80	20	100	08	82	-	-	-	-	-	-
Erythromycin	59	30	18	90	02	21	-	-	-	-	-	-
Vancomycin	37	19	07	36	01	09	-	-	-	-	-	-
Gentamicin	49	25	08	40	02	20	34	65	23	41	25	40
Co-trimoxazole	102	52	10	48	04	40	26	50	46	80	40	65
Ciprofloxacin	55	28	17	85	02	18	00	00	46	80	25	41
Ceftriaxone	-	-	-	-	-	-	48	92	51	90	56	90
Cefotaxim	-	-	-	-	-	-	30	55	48	85	56	90
Chloramphenicol	-	-	-	-	-	-	47	90	30	52	24	39

DISCUSSION

Present study found *Staphylococcus aureus* as most common isolate among blood culture followed by *Klebsiella species* and *E. coli* whereas *Salmonella paratyphi* and *Streptococcus species* as least common. Antibiotic resistance pattern to various isolates of blood culture shows gentamicin (92%) and vancomycin (92%) as more sensitive whereas penicillin (55%) as more resistance antibiotic against the organisms. Gram-positive organisms show more resistance to penicillin and least to vancomycin whereas gram-negative organisms show more resistance to cephalosporin group of antibiotics and least resistance to ciprofloxacin/gentamicin.

Khanal et al studied 3,324 blood samples collected for culture and sensitivity, only 345 (10.3%) showed bacterial growth. Among bacterial causes of blood culture positive cases, *Staphylococcus aureus* was most common (26.3%) followed by *Acinetobacter spp.* (18.9%), *Salmonella Typhi* (15.7%), *Salmonella Paratyphi* (4.6%), coagulase negative *Staphylococci* (10.8%), *Escherichia coli* (8.7%), *Klebsiella spp.* (7.9%) and other various organisms such as *Enterococcus spp.* (0.02%), *Streptococcus pneumoniae* (0.002%), *Citrobacter spp.* (0.02%), *Enterobacter spp.* (0.008%), *Pseudomonas spp.* (0.005%), and *Proteus spp.* (0.002%).²

Sonawane et al studied 308 positive cultures out of 2994 samples, bacterial isolates were obtained in 286/ 308 (92.86%) and 22/308 (7.14%) were *Candida spp.* of 286 bacterial isolates, gram-negative bacteria accounted for 238 (83.22%) cases and gram-positive were 48 (16.78%) with predominance of *Klebsiella spp.* (22.38%) followed

by *Pseudomonas spp.* (20.98%), *Acinetobacter spp.* (17.48%) and *E. coli* 32(11.19%).⁶

Gohel et al study found, positive blood cultures in 9.2% of cases of which Gram-positive bacteria accounted for 58.3% of cases with staph aureus predominance; gram negative bacteria accounted for 40.2% with enterobacteriaceae predominance; and 1.5% were fungal isolates. The most sensitive drugs for Gram-positive isolates were vancomycin, teicoplanin, daptomycin, linezolid, and tigecycline and for Gram-negative were carbapenems, colistin, aminoglycosides, and tigecycline. The prevalence of MRSA and vancomycin resistance was 70.6% and 21.6%, respectively.⁵

Kumar et al found the positivity of blood culture was 42% (770/1,828). Most (93.2%) bacteraemic episodes were caused by a single organism, while polymicrobial aetiology was observed in 52 (6.8%) cases. Gram-negative organisms were isolated in 493 (60%) of 823 cases, with *Klebsiella* (33.8%), *Enterobacter* (7.5%), *Alcaligenes faecalis* (4.9%), and *Escherichia coli* (4.6%) being the common microbes. *Staphylococcus aureus* (24.4%), followed by coagulase-negative staphylococci (7.9%), were the major Gram-positive isolates. Most (80%) gram-positive isolates were sensitive to vancomycin, and 50-75% of the gram-negative isolates were sensitive to ciprofloxacin and amikacin.⁸

Tiwari et al analysed 6918 sample reports, among them half (46%) of them were positive. The most commonly bacteria isolated in 35% of positive blood and pus samples was vancomycin-sensitive *Staphylococcus aureus*.⁴

Negussie et al tested 201 blood samples, blood cultures were positive in 56 (27.9%). Gram negative and Gram-positive bacteria constituted 29 (51.8%) and 26 (46.4%), respectively. The most frequent pathogen found was *Staphylococcus aureus* 13 (23.2%), followed by *Serratia marcescens* 12 (21.4%), CoNS 11 (19.6%), *Klebsiella spp* 9 (16%) and *Salmonella spp* 3 (5.4%). Majority of bacterial isolates showed high resistance to ampicillin, penicillin, co-trimoxazole, gentamicin and tetracycline.¹

Savanur SS et al studied 167 cases out of which 127 patients were culture positive and 40 cases were culture negative. Isolated bacteria were mostly gram-negative bacilli, of which *Escherichia-coli* was (18.6%), *Acinetobacter* (14.5%), *Klebsiella* (11.6%), *Pseudomonas* (9.8%) and *Proteus* (1.74%). Among the gram-positive organisms, coagulase negative staphylococcus (CoNS) (15.6%) was most commonly isolated followed by *Streptococcus* (2.32%).⁹

Wasihun AG et al observed out of the total 514 febrile patients, 144 (28%) culture positive were isolated. *Staphylococcus aureus* 54 (37.5%), Coagulase-negative staphylococci 44 (30.6%), *Escherichia coli* 16 (3.1%), *Citrobacter spp.* 9 (1.7%) and *Salmonella typhi* 8 (1.6%) were the most dominant isolates, collectively accounting for >90% of the isolates. Antimicrobial resistance pattern for gram positive and gram-negative bacteria was 0-83.3% and 0-100%, respectively. High resistance was seen to trimethoprim-sulphamethoxazole 101 (70.1%), oxacillin 65 (62.5%), ceftriaxone 79 (58.9%) and doxycycline 71 (49.3%). Fifty-nine percent of the isolated bacteria in this study were multi drug resistant. Most bacterial isolates were sensitive to gentamicin, ciprofloxacin and amoxicillin clavulanic acid. All gram-positive isolates in this current study were sensitive to vancomycin.¹⁰

CONCLUSION

Resistance pattern of organisms to some commonly used drugs has given warning signal to clinicians to search for alternate effective antibiotics and hospital authorities to formulate antibiotic policy for rationale use of antibiotics to prevent drug resistance. There should be a regular surveillance on the practice of prescribing antibiotics, quality of antibiotics used and blood culture reports.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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