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Original Article

Bacteriological Profile and Antimicrobial Susceptibility pattern of Blood culture positive isolates from Septicemia patients in a tertiary care Centre

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ABSTRACT

Background: Septicemia is a leading cause of morbidity and mortality with complex pathogenesis depending on Virulence and pathogen load, as well as host factors. In addition to antimicrobial therapy it is essential to identify any possible source of sepsis as failure of source control is an important reason for treatment failure and disease progression.
Objectives:
1. To Isolate Bacterial pathogens from Blood cultures.
2. To Determine Antimicrobial Susceptibility pattern of Blood culture positive isolates.
3. To Generate Syndromic Antibiogram to support evidence based empirical therapy for Sepsis.
Methods: A Prospective Cross-sectional study was done over a period of 1 year with Predefined Inclusion, Exclusion criteria and sample size of 380. Blood samples collected under strict aseptic precautions processed by automated BACTEC system as per manufacturer's protocols. Antibiotic susceptibility testing was done on Mueller Hinton agar using Modified Kirby Bauer Disc Diffusion method. Statistical data analyzed using SPSS software, Chi-square test and odds ratio with 95% Confidence intervals.
Results: Out of the 380 samples, 107 (28%) were positive for Bacterial growth, while 184 (48%) samples showed no growth and 89 (23%) showed mixed growth. Gram positive isolates were (63.5%) predominant over Gram negative isolates (36.4%) and Neonates, Pediatric group predominance over adult group. CONS, S.aureus, Klebsiella pneumonia followed by Pseudomonas, E.coli are predominant isolates.
Conclusion: Early Diagnosis and commencement of antimicrobial therapy and appropriate empirical treatment play a vital role in reducing mortality and morbidity. Blood culture, a Gold standard technique in Diagnosis of Sepsis.

Keywords: *Sepsis, Blood culture, Bacteriological profile, antimicrobial susceptibility, Syndromic Antibiogram.*

INTRODUCTION

Septicemia is defined as a condition in which bacteria circulate and actively multiply in the bloodstream and produce their products like toxins that cause harm to the host, that may or may not be associated with Bloodstream Infections (BSI).Septicemia is a leading cause of morbidity and mortality among developing and developed nations with complex pathogenesis depending on Virulence and pathogen load, as well as host factors and neonates particularly vulnerable to septicemia because of their weak immune system 1, 2. Septicemia may be mono or polymicrobial in nature and present with nonspecific signs and symptoms like severe febrile episodes of fever, chills, malaise, tachycardia, mental confusion, hyperventilation, hypotension or shock. Infections causing sepsis could be community acquired or hospital acquired, Pneumonia accounts for 50% of causes of sepsis followed by intraabdominal and genitourinary infections. In Hospital

settings gram negative infections predominant with most common organisms being Escherichia coli, Klebsiella pneumoniae, and Pseudomonas aeruginosa 1. Aim of the study includes To Diagnose and Treat Sepsis ,a medical emergency in order to minimize severity and degree of organ failure as patients with septic shock have a mortality of >40% in contrast to 10% for sepsis cases. In addition to antimicrobial therapy it is essential to identify any possible source of sepsis such as removal of central line, abscess drainage etc. as failure of source control is an important reason for treatment failure and disease progression.

OBJECTIVES

1. To Isolate Bacterial pathogens from Blood cultures.
2. To Determine Antimicrobial Susceptibility pattern of Blood culture positive isolates.
3. To Generate Syndromic Antibiogram to support evidence based empirical therapy for Sepsis.

MATERIALS & METHODS

- **Study Design and Settings :**

This Prospective Cross-sectional study was done over a period of 1 year from July 2025 to June 2026 in the Department of Microbiology, Navodaya Medical College, and Raichur.

- **Sample Size :**

Sample size of this study is calculated with reference to article 5 by using formulae n = Z2p q/d2
Z=1.96 (95% Confidence level), p=42%=0.42, q=1-p=0.58.
n=3.8416×0.2436/0.0025=374.37. So sample size of this study 380.

- **Inclusion Criteria:**
  1. Subjects with symptoms and signs of septicemia like fever, chills, malaise, tachycardia, hyperventilation, toxicity.
  2. All Gram positive and Gram negative bacteria isolated from blood samples.

- **Exclusion Criteria:**
  1. Subjects without symptoms and signs of septicemia
  2. All no growth and contaminated Clinical samples are excluded.
  3. All mixed samples will be excluded.

METHODOLOGY:

- **Sample collection and Processing :**

Blood samples collected according to standard operational procedures under strict aseptic precautions by proper skin decontamination, 2 sets of adults and pediatric BACTEC bottles per patient and processed by automated BACTEC system as per manufacturer's protocols.

- Blood culture by automated blood culture system: For the automated blood culture system, 8-10ml each of blood for adults and 1-3ml of blood for pediatric age will be inoculated into Aerobic and Anaerobic BACTEC PLUS bottles and will be loaded into the machine. As soon as an audible or visible alert given by the BACTEC FX40, it will be treated as a positive blood culture and sub cultures will be done into appropriate liquid media. Preliminary tests like Gram's stain, hanging drop, catalase, and oxidase test will be done and appropriate biochemical reactions like Slide Coagulase, Tube Coagulase, Bile Aesculin Agar, Optochin Sensitivity, and Bacitracin Sensitivity will be put for Gram Positive Cocci and Indole Test, Citrate and Urease Reaction, Triple Sugar Iron Agar for Gram Negative Bacilli. If there was no alert, audible or visible, the bottles will be incubated for 7 days before undergoing a terminal subculture, to report as negative.

- Antibiotic susceptibility testing: Antibiotic susceptibility testing will be carried out on Mueller Hinton agar using modified Kirby Bauer Disc Diffusion method by using the Hi Media Antibiotic Discs and Syndromic cumulative antibiogram will be generated. 1, 3, 4.

- **Statistical analysis:**

Data were analyzed using SPSS software. Chi-square test was applied and odds ratio with 95% Confidence intervals were calculated. A p value of < 0.05 was considered statistically significant.

- **Ethical clearance: Approval was obtained from the ethical committee of the institute for this study**

RESULT

During the study period from July 2025 to January 2026, a total of 380 samples with clinical suspicion of septicemia were investigated. Blood samples were collected under strict aseptic precautions and processed for culture. Out of the 380 samples analyzed, 107 (28%) were positive for bacterial growth, while 184 (48%) samples showed no growth and 89 (23%) showed mixed growth and among Culture positive distribution, Gram positive isolates were (63.5%) predominant over Gram negative isolates (36.4%) and age wise Distribution of isolates shows Neonates , Pediatric group predominance over

adult group as shown in Tables 1-5 and Figure 1-5.Antimicrobial Susceptibility testing of Gram positive and Gram negative isolates shown in Table 6-7.

Table 1- sample distribution

Culture	Number	Percentage (%)
Culture Positive	107	28 %
Culture Negative	184	48 %
Mixed culture	89	23 %
Total	380	100 %

Table 2: Age-wise distribution of culture positive cases

Gender	Number	Percentage (%)
Adult	24	22 %
Pediatrics including Neonates	83	78 %
Total	107	100 %

Figure 1: Distribution of Isolates

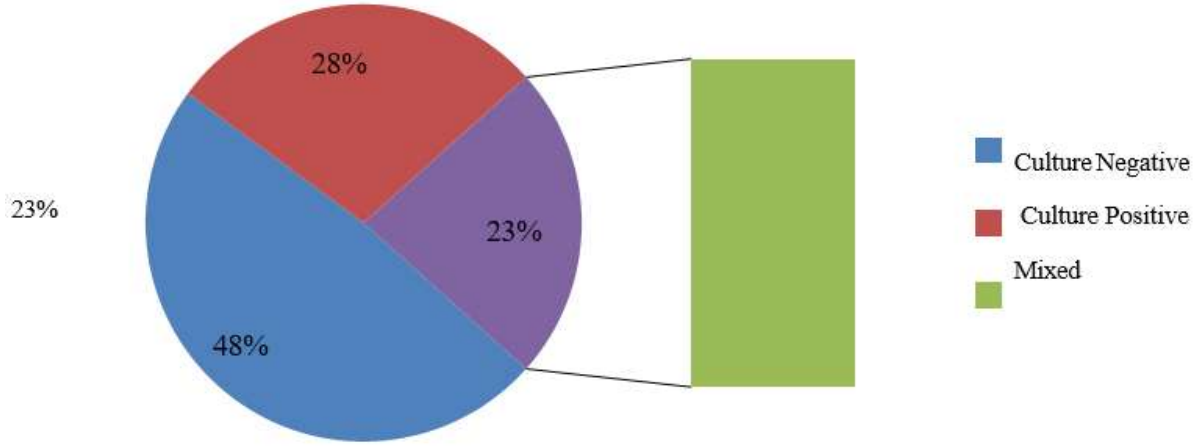

Figure 2: Age wise distribution

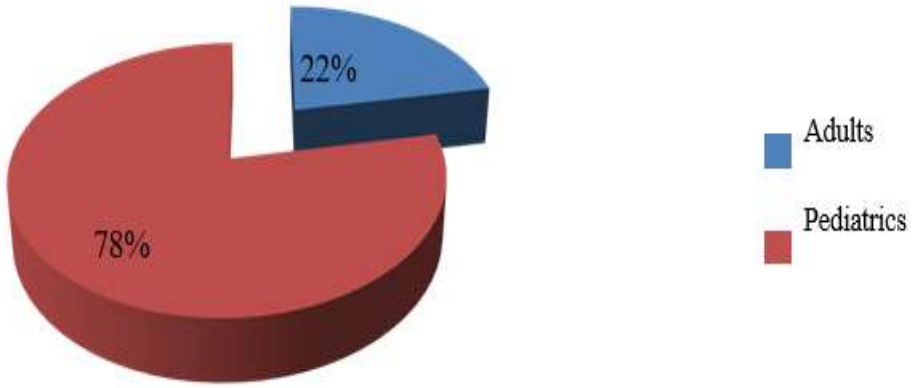

Table 3: Distribution of Isolates

Isolate	Number of isolates	Percentage (%)
Gram positive isolates	68	63.5%
Gram Negative isolates	39	36.4%
Total	107	100 %

Figure 3: Percentage %

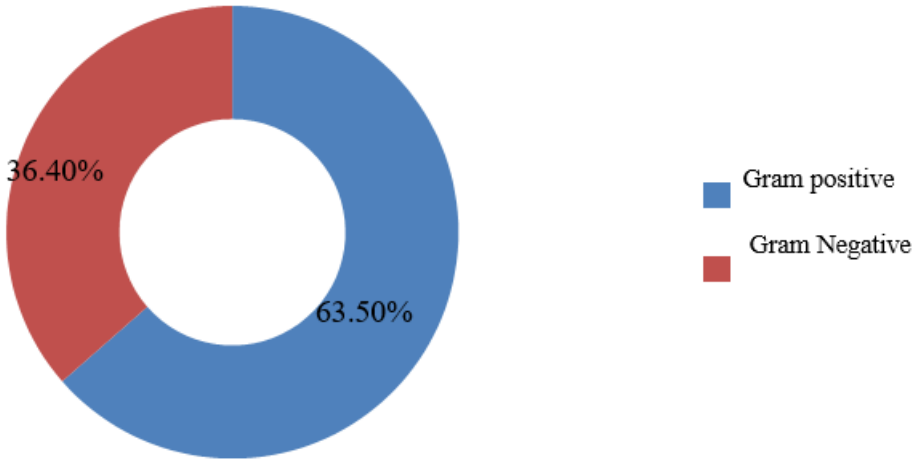

Table 4: Distribution of Gram positive isolates

S.no	Gram Positive Isolate	No of Isolates	Percentage (%)
1.	CONS	33	49 %
2.	S.aureus	32	47 %
3.	Enterococcus	03	04%
	Total	68	100 %

Figure 4 : Distribution of Gram positive isolates (n= 68)

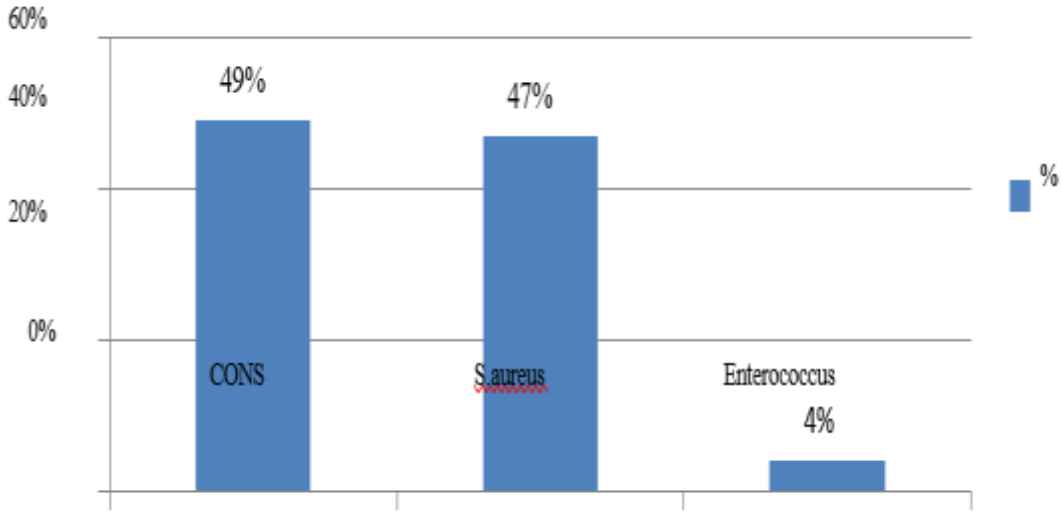

Table 5: Distribution of Gram negative isolates

S.no	Gram Negative Isolate	No of Isolates	Percentage (%)
1	Klebsiella	21	54%
2	Pseudomonas	9	23.07%
3	E.coli	3	7.7%
4	Acinetobacter	2	5.12%
5	Citrobacter	2	5.12%
6	Proteus	1	2.5%
7	Non fermenter	1	2.5%
	Total	39	100%

Figure 5: Distribution of Gram Negative isolates (n= 39)

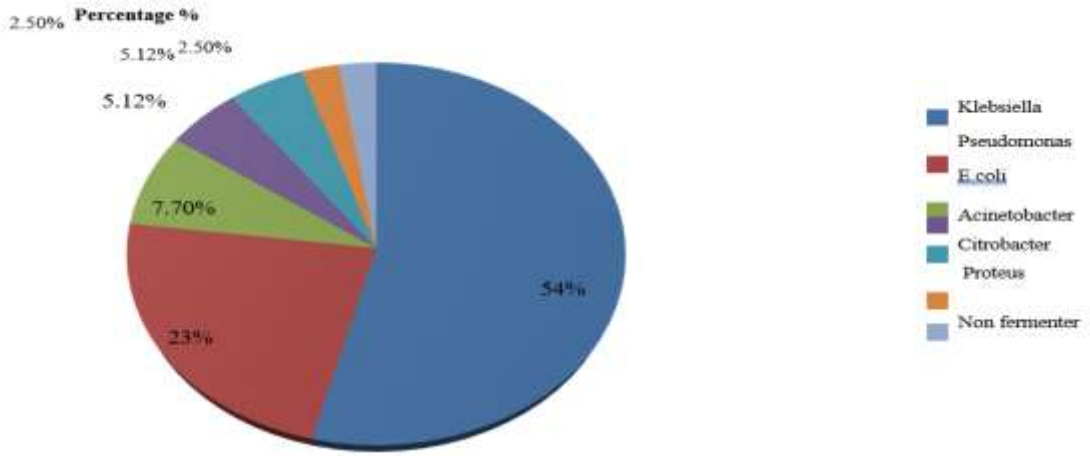

Table 6: Antimicrobial Susceptibility Testing of Gram negative isolates (n= 39)

Isolate (39)	AK	CIP	COT	DOX	AMC	CFS	PTZ	MRP	CTX
Klebsiella lla (21)	6 (28.6%)	8 (38%)	14 (66.6%)	8 (38.09 %)	19 (90.5%)	10 (48%)	11 (52.3%)	10 (48%)	12 (57.1%)
Pseudo monas (9)	3 (33.3%)	6 (66.7%)	1 (11%)	1 (11%)	1 (11%)	5 (55.5%)	4 (44.4%)	5 (55.5%)	4 (44.4%)
E.coli (3)	1 (33.3%)	1 (33.3%)	2 (66.6%)	2 (66.6%)	3 (100%)	1 (33.3%)	1 (33.3%)	1 (33.3%)	2 (66.6%)
Acinet obacter (2)	1 (50%)	1 (50%)	1 (50%)	1 (50%)	1 (50%)	0	1 (50%)	1 (50%)	0
Citroba cter (2)	1 (50%)	0	1 (50%)	1 (50%)	0	1 (50%)	0	1 (50%)	0
Proteus (1)	1 (100%)	1 (100%)	0	0	1 (100%)	1 (100%)	0	0	1 (100%)
Non fermenter (1)	1 (100%)	11 (100%)	0	1 (100%)	1 (100%)	1 (100%)	1 (100%)	0	0

Table 7: Antimicrobial Susceptibility Testing of Gram positive isolates (n= 68)

Isolate (68)	AMP	A ZM	CIP	COT	DOX	E	CD	G	LE	CX	VA	LZ
CON S (33)	16 (48.5 %)	6 (18.2 %)	20 (60.6 %)	16 (48.5%)	1 (3%)	1 (3%)	3 (9%)	3 (9%)	17 (51. 5%)	19 (57.6 %)	2 (6%)	1 (3%)
S.aure us (32)	18 (15.6 %)	5 (15.6 %)	12 (36.3 %)	18 (15.6%)	2 (6%)	1 (3%)	1 (3%)	1 (3%)	16 (50 %)	17 (53.1 %)	1 (3%)	1 (3%)
Entero coccus (3)	3 (100 %)	1 (33.3 %)	1 (33.3 %)	3 (100%)	0	0	0	0	2(66 .7%)	1 (33.3 %)	0	0

DISCUSSION

- Bloodstream infections (BSI) are major contributors of sepsis and rapid identification of the causative organism and antimicrobial treatment can reduce morbidity and mortality. This study attempted to analyze bacterial profiles and assess their antimicrobial susceptibility trends to formulate an antibiogram and effective empirical treatment of bloodstream infections.
- In the Present study, Blood culture positivity rate is 28% that aligns with study of Akshatha Peddinti, et al which has 27, 27% and is lower than the study Of Arun T L et al which has 42.4% of culture confirmed BSI and of Datta,

et al. which has 32%. Such variability across studies may be influenced by several factors, including prior empirical antibiotic therapy, undetected viral or fungal infections, differences in patient demographics, and variability in laboratory practices and infection control measures among institutions 6.

- In the present study, study population included patients across all age groups and positive culture shows predominance of neonates and pediatric patients about 78%. Adults and elderly individuals constituted a comparatively smaller proportion of cases of about 22% that correlates with studies by Arun T L et al, which highlights neonate's predominance, particularly vulnerable to septicemia and in contrast to study by Datta et al, highest incidence of positive cultures (37%) was observed in patients aged 60–75 yrs.
- In Present study Distribution of isolates, Gram positive isolates (63.5%) shows predominance over Gram negative isolates (36.4%). In Gram positive distribution of isolates, CONS followed by S.aureus that aligns with studies by Wajid & Naaz , Kaur C, Sharma S et.al that shows predominance of Gram positive over Gram negative and in Gram negative distribution of isolates , Klebsiella pneumonia followed by Pseudomonas, E.coli and other isolates correlates to study done by Akshatha Peddinti, et al, Arun T L et al which shows predominance of Klebsiella , Pseudomonas , Acinetobacter spp .
- Antimicrobial susceptiblity profile of Gram positive isolates shows highest sensitivity for Cefoxitin (CX),Ciprofloxacin (CIP), Levofloxacin (LE),Ampicillin (AMP), cotrimaxozole (COT) and highest resistance shown to Erthromycin (E),Clindamycin (CD),Gentamicin (G). Overall Methicillin sensitive Staphylococcus aureus and CONS are more than Methicillin Resistant comparable to findings from Wajid & Naaz .
- Antimicrobial susceptiblity profile of Gram negative isolates shows highest sensitivity to amoxicillin-clavulinate (AMC), piperacillin-Tazobactum (PIT) ,Cotrimaxozole (COT), Cefperazone-sulbactum (CFS), 3rd Generation Cephalosporin (CTX), Meropenem (MRP) and highest resistance to amikacin (AK),ciprofloxacin(CIP) comparable to findings from Akshatha Peddinti, et al, Arun T L et al.

CONCLUSION

Early Diagnosis and commencement of antimicrobial therapy can play a vital role in reducing mortality and morbidity and appropriate empirical treatment is based on continuous knowledge of causative agents and their resistance patterns. Our study has provided information about likely pathogens in bloodstream Infections and their resistance patterns in the rural setup and Importance of Blood culture as a Gold standard in Diagnosis which help in Diagnosis, formulating Antibiotic policy and avoid indiscriminate antibiotic use.

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