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"Spectrum of Bacterial Pathogens Causing Blood Stream Infections in ICU Settings (Surgical And Medical ICU) In A Tertiary Care Hospital In Western India"

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Abstract
Background: *Blood stream infections (BSIs) are amongst the leading hospital acquired infections in intensive care unit (ICU) patients. BSIs may be primary (the only identifiable infectious process) or secondary (spread of bacteria from another localized infection) Emergence of resistant bacteria in the ICUs and their spread to other patients in the hospital settings is a challenge for the clinician dealing with seriously ill patients.*
Aim and objective: *To study the profile of bacterial pathogens causing blood stream infections (BSI) in Medical (MICU) and Surgical ICU (SICU) and to study the antimicrobial susceptibility patterns of these isolates in a tertiary care hospital in Western India.*
Materials and methods: *The study was conducted over a period of 12 months (between January to December 2021) where 129 patients admitted in SICU and MICU for over 48 hours with laboratory confirmed blood stream infections were evaluated at a tertiary care hospital in Western India. The culture and sensitivity patterns of all of these isolates were evaluated and compared.*
Results: *The overall blood stream infection rate in ICUs was found to be 4.8/1000 patient days. Staphylococcus spp were the commonest Gram positive organisms causing BSI in ICUs (MICU and SICU) settings. Acinetobacter baumanii & Klebsiella pneumoniae were the commonest Gram negative organisms causing BSI in these ICU settings.*
Conclusion: *Routine and early lab testing of Paired clinical site blood cultures should be performed for better understanding and clinical co-relation of health-care associated bloodstream infections in suspected patients. Implementation and monitoring of hand hygiene practices and catheter associated blood stream infection prevention bundles are important to control BSI in ICU settings.*
Key words: *Blood stream infections, MICU, SICU*

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I. Introduction

➢ Nosocomial infections are infections that become clinically evident after 48 hours of hospitalization and do not originate from the patient's original admitting medical conditions [1]. Infections acquired in the hospitals, especially in the intensive care unit (ICU) settings, ranging between 15% and 20%, may further lead to complications in >40% of critically ill patients [2]. SICU and MICU share similar profile of main bloodstream pathogens even though the disease spectrum might be different between SICU and MICU [3].There is an increased mortality rate that is independently associated with hospital originated laboratory-confirmed bloodstream infections, pneumonia, and clinical sepsis [4-5]. Treatment of bloodstream infections is based on the knowledge of prevalent microorganisms and their antimicrobial sensitivity patterns. This information also forms the basis for making recommendations for initial empirical therapy to be started when a bloodstream infection is suspected [6]. Approximately one in five BSIs diagnosed at ICU admissions may be classified as health care-associated BSIs. Risk factors for BSIs include - greater severity of illness, disruption of anatomical barriers, and impaired immune response. Prior and prolonged antibiotic exposure and prolonged hospitalization are risk factors for BSIs due to resistant microorganisms

Considering higher rates of mortality with blood stream infections in patients admitted in MICU or SICU, it is prudent to know the prevalent strain of microorganism responsible and its antimicrobial sensitivity pattern. This would help in starting the ideal empiric therapy and would prevent further spread of infections and complications apart from antimicrobial resistance. With this intention, the current study was conducted to evaluate the prevalent microbial strains in MICU and SICU patients having a blood stream infection and also

to identify the resistance and sensitivity patterns of these organisms in a tertiary care hospital in Western India.This study was conducted with a view to help clinicians decide timely interventions like change over to appropriate susceptible antimicrobials or checking of care bundles so as to stop the spread of resistant organisms to other areas of the hospital.

II. Materials And Methods:

This is a data-based anonymous, cross-sectional study conducted between January to December 2021 where 129 patients samples from SICU and MICU settings with confirmed blood stream infections were evaluated. The samples of patients with ICU stay of more than 48 hours were analyzed. Consecutive paired blood samples from study population,with samples collected during an acute febrile episode were taken. Only those with positive lab confirmed reports were included. The organisms were isolated by standard microbiological techniques and were subjected to culture and sensitivity as per updated CLSI guidelines. The samples included 105 isolates from MICU and 24 from SICU.

III. Results:

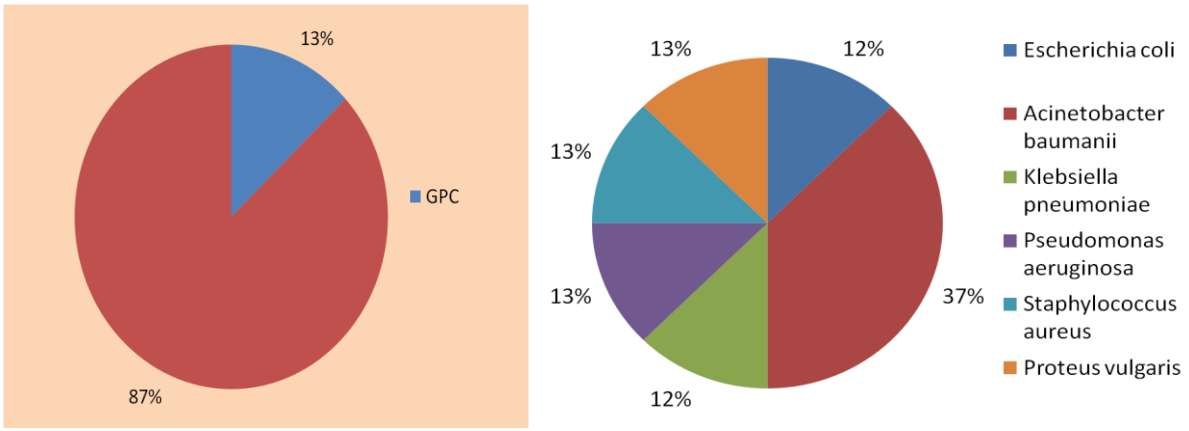

Figure 1 Isolates from SICU:

13% of the isolates were gram positive cocci and 87% were gram negative bacilli. The commonly isolated organisms were Acinetobacter baumanii, Pseudomonas aeruginosa, Staphylococcus aureus, Proteus vulgaris, Escherichia coli and Klebsiella pneumonia

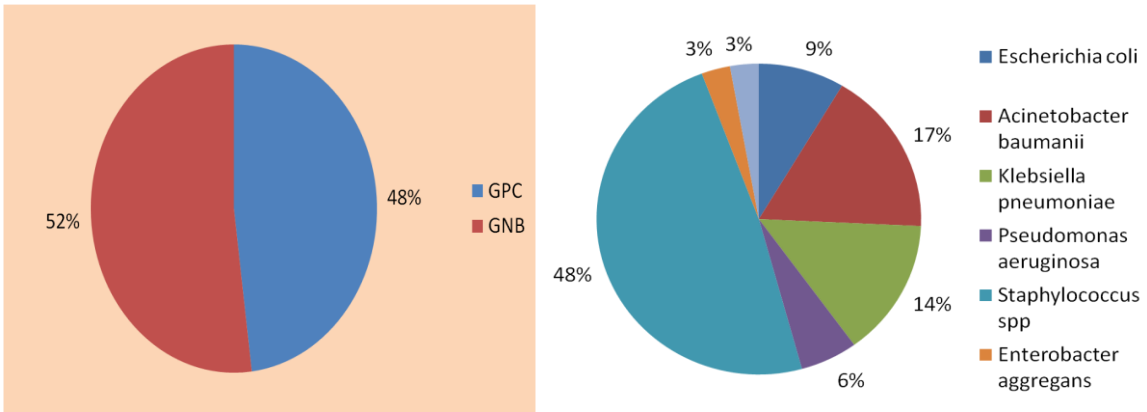

Figure 2 Isolates from MICU:

52% of the organisms isolated were gram negative bacilli whereas 48% were gram positive cocci. The common organisms isolated in order included Staphylococcus spp, Acinetobacter baumanii, Klebsiella pneumoniae, Escherichia coli, Pseudomonas aeruginosa, Enterobacter aggregans and Salmonella typhi.

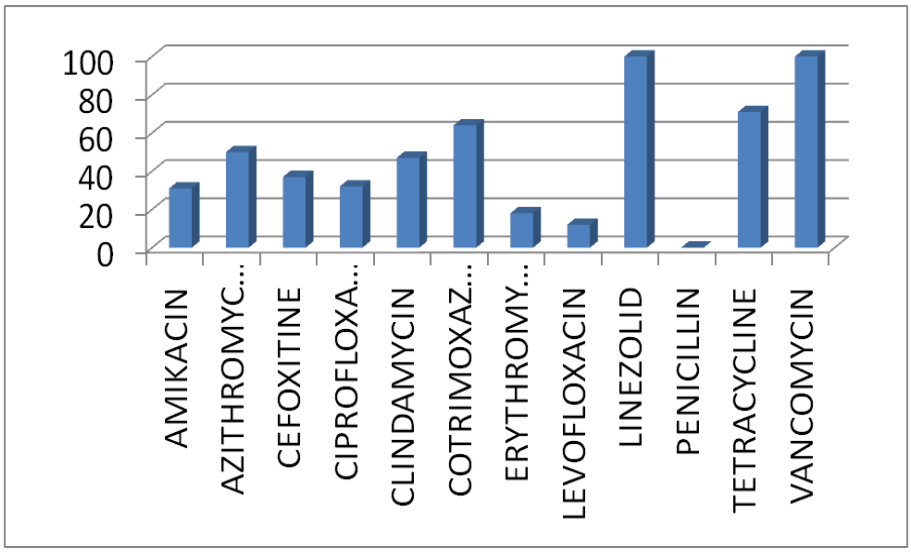

Figure 3: Antimicrobial susceptibility pattern of Gram positive isolates: Most of the Gram positive organisms were susceptible to Linezolid and Vancomycin with a considerable number showing susceptibility to Tetracycline.

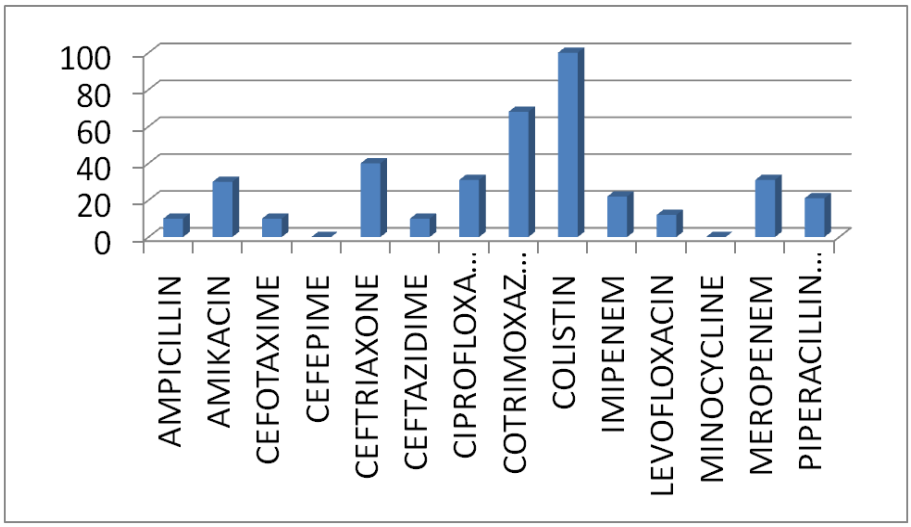

Figure 4: Antimicrobial susceptibility pattern of Gram negative isolates: Most of the Gram negative isolates were highly susceptible to Colistin whereas considerable number of isolates were susceptible to Cotrimoxazole.

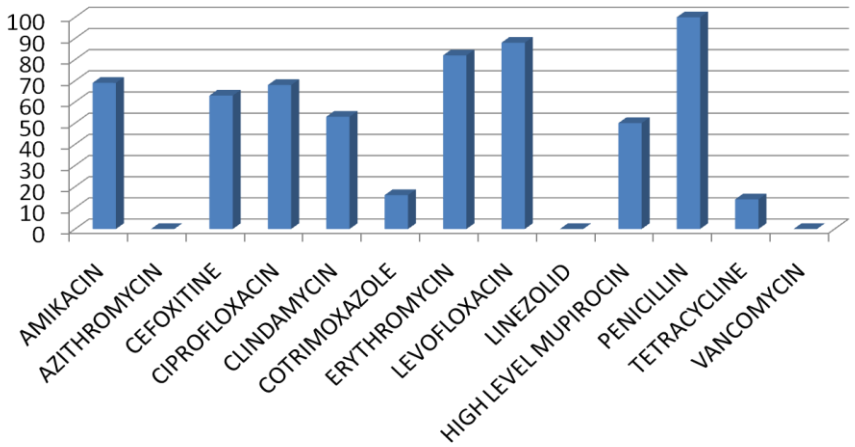

Figure 5: Antimicrobial resistance pattern of Gram positive isolates: Gram positive isolates were noted to be highly resistant to Penicillin, Levofloxacin and Erythromycin.

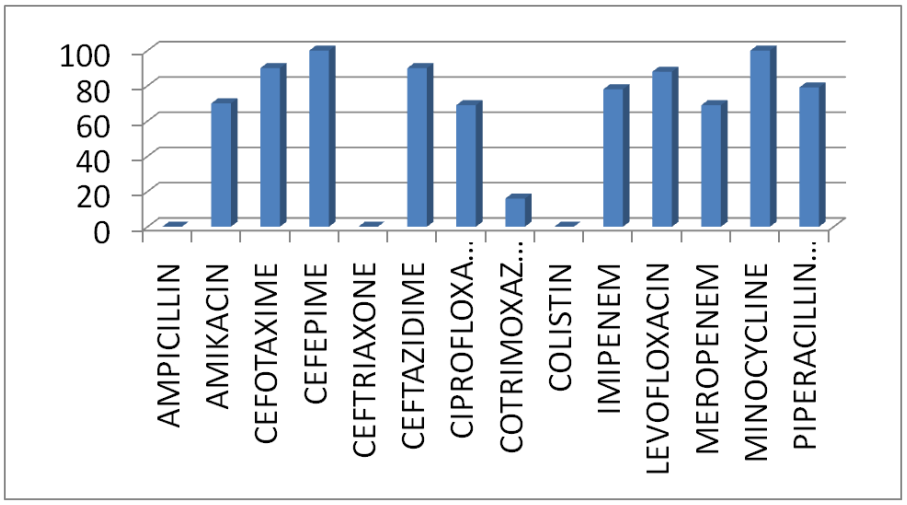

Figure 6: Antimicrobial resistance pattern of Gram negative isolates: Gram negative isolates were noted to have considerable resistance against commonly used drugs in ICUs such as Cefepime, Meropenem, Minocycline, Pipercillin, Imipenem, Levofloxacin.

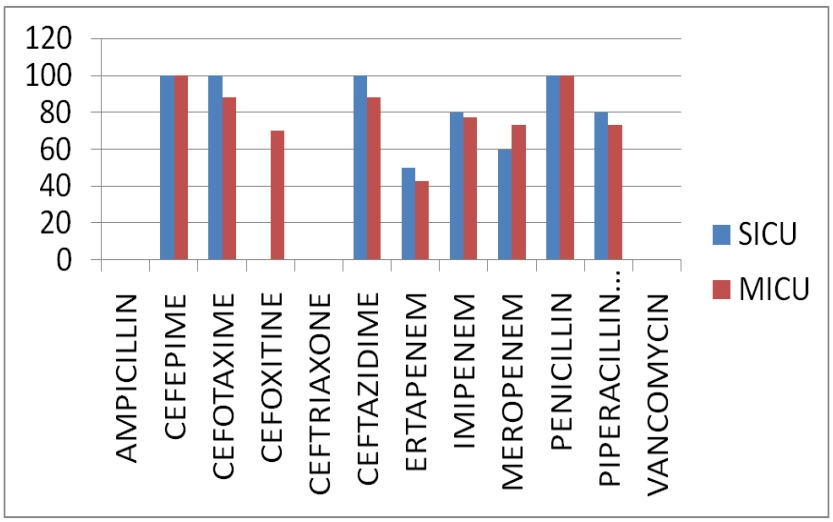

Figure 7: Antimicrobial resistance pattern comparison of isolates in MICU & SICU: On comparison it was noted that similar resistance profile was noted from the isolates from MICU and SICU. They showed a similar profile in resistance against Imipenem,,Pipercillin-Tazobactam, Cefepime, Cefotaxime, Ertapenem.

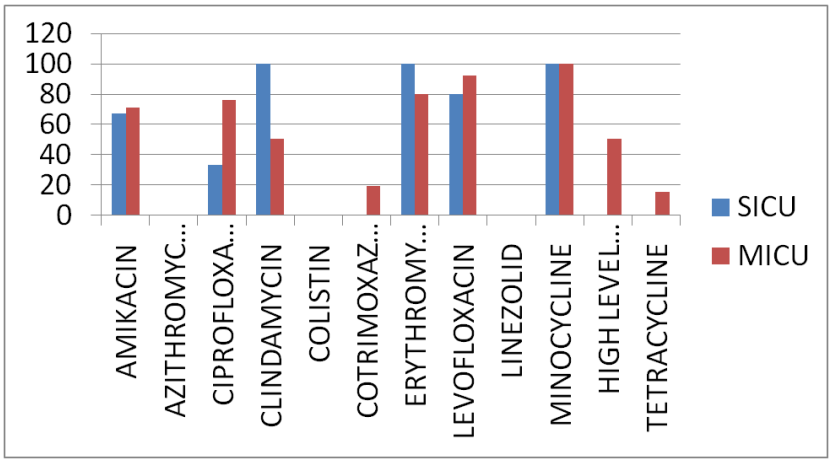

Figure 8: Antimicrobial resistance pattern comparison of isolates in MICU & SICU: Other commonly used antibiotics were additionally evaluated apart from those in figure 7. It was noted that strains from SICU showed higher level of resistance against Clindamycin and Erythromycin when strains from MICU were compared.

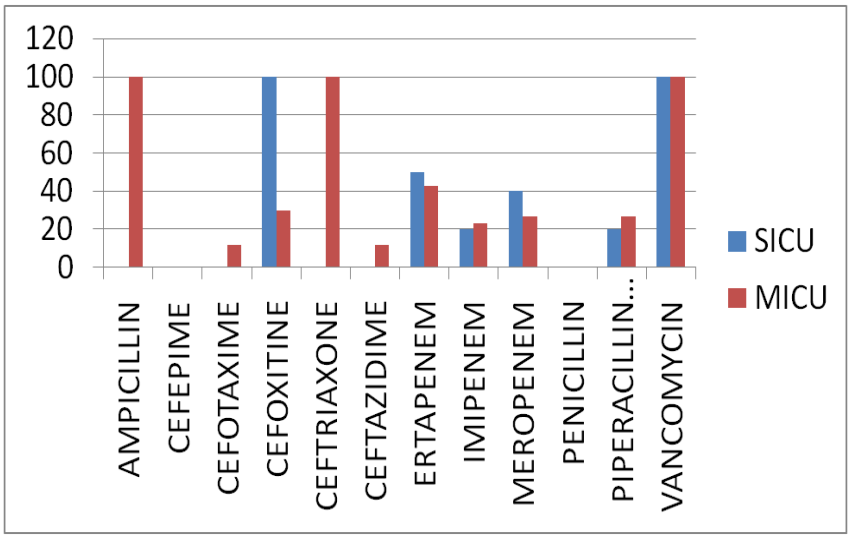

Figure 9: Antimicrobial susceptibility pattern comparison of isolates in MICU & SICU: Strains from MICU showed lower levels of susceptibility compared to SICU strains for Cefotaxime. Strains from both SICU and MICU were highly susceptible to Vancomycin. The profile of SICU strains with regard to Ceftriaxone was not available however those from MICU were highly susceptible.

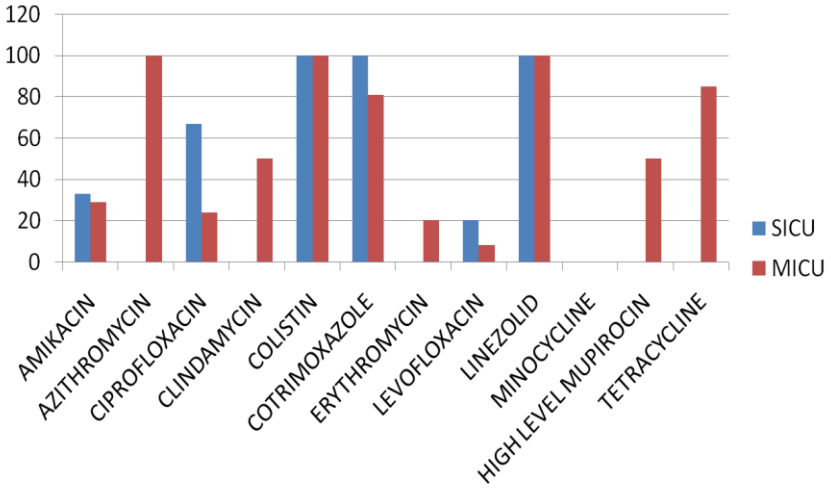

Figure 10: Antimicrobial susceptibility pattern comparison of isolates in MICU & SICU: In addition to figure 9, strains from both SICU and MICU showed significant susceptibility to Colistin and Linezolid. Profile for Azithromycin was available for strains from MICU which showed significant susceptibility. Interestingly strains from both SICU and MICU showed significant susceptibility to Cotrimoxazole.

IV. Discussion:

13% of the isolates were gram positive cocci and 87% were gram negative bacilli in SICU. The commonly isolated organisms were Acinetobacter baumanii (37%), Pseudomonas aeuginosa (13%), Staphylococcus aureus(13%), Proteus vulgaris(13%), E.coli (12%) and Klebsiella pneumoniae (12%). 52% of the organisms isolated were gram negative bacilli whereas 48% were gram positive cocci in MICU. The common organisms isolated in order include Staphylococcus spp (48%), Acinetobacter boumanii (17%), Klebsiella pneumonia (14%), E.coli (9%), Pseudomonas aeruginosa (6%), enterobacter (3%) and salmonella (3%). Gram positive isolates had high prevalence of resistance to Amikacin (70%), Cefoxitine (65%), Clindamycin (55%), Levofloxacin (90%), Mupirocin (50%). However higher susceptibility was noted for Azithromycin, Linezolid and vancomycin in most of the Gram positive isolates. Gram negative isolates showed high levels of resistance to Amikacin (70%), Ciprofloxacin (70%), Meropenem (70%), Pipercillin Tazobactam (80%). However these Gram negative strains were highly susceptible to Ampicillin, Ceftriaxone and Colistin. Also significant number of all the strains showed susceptibility to Co-trimoxazole (80%).

When patients in SICU and MICU are compared, there are higher instance of infections with Gram negative bacilli in SICU (87%) when compared to MICU (52%). The common organism was Acinetobacter

boumanii (37%) in SICU. All the Gram positive cocci infections in MICU were due to Satphyloccocal spp. Overall Carbapenem resistance in Acinetobacter baumanii was 62.5%.

Our study results were similar to other workers studies, who evaluated nosocomial infections and resistance patterns.

In a study by Yangzom T et al. [7] who evaluated BSIs in hospitalized patients, Gram-positive and gram-negative bacteria isolated were 518 (39.8%) and 783 (60.2%), respectively. Commonly isolated organisms were coagulase-negative Staphylococci (29.4%), Escherichia coli (19.8%), Klebsiella species (13.5%), Salmonella species (9.4%), and Staphylococcus aureus (7.5%). Schwab F et al. [8] evaluated 4,556,360 patients with 16,978,882 patient days from 937 ICUs were considered in the analysis PBSI with Enterococci, E.coli, C.albicans and Non-albicans Candida spp., S. maltophilia and P.aeruginosa were associated with higher ICU mortality rates compared to S.aureus, Coagulase negative Staphylococci were associated with significantly lower ICU mortality. Venkataraman R et al. [9] conducted a multi-centre study where they evaluated the microbiological isolates and resistance patterns of ICU-acquired infections. Of the 381 patients included in the study, 346 patients had 01 ICU acquired infection and 35 had more than one ICU acquired infection. Among patients with single infections, 223 had VAP with Acinetobacter being the most common isolate. CRBSI was seen in 81 patients and Klebsiella was the most common causative organism. Multidrug resistance was noted in 87.5% of Acinetobacter, 75.5% of Klebsiella, 61.9% of E.Coli and 58.9% of Pseudomonas isolates, respectively. Staphylococcus constituted only 2.4% of isolates. Mortality rates were 34.6% in catheter related blood stream infection.

In addition to increased morbidity and mortality, higher health care expenses are incurred by patients having acquired blood stream infections in the ICU leading to financial burden on the patient [10].

Limitations of the study:

1) A small sample size of 129 cannot be extrapolated to regional trends.
2) Underlying co-morbidities and risk for infections could not be evaluated.
3) Type of underlying surgical process and medical conditions that are commonly associated with blood stream infections were not evaluated.
4) Role of preventive measures for prophylaxis of BSIs was not discussed.
5) Antimicrobial utilization pattern was not discussed.
6) Cost effective analysis was not performed

V. Conclusion:

Knowledge of bacteriological profile, risk factors, resistance patterns, and outcomes of BSIs caused by resistant bacteria may have a major influence on the management of ICU patients**.** Lab testing of Paired clinical site blood cultures should be performed for better understanding and clinical co-relation of health-care associated bloodstream infections. Implementation and monitoring of hand hygiene practices and catheter associated blood stream infection prevention bundles are important to control BSI in ICU settings.

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Conflict of interest: Nil
Acknowledgements: Nil

References:

[1]. Nguyen QV. Hospital-Acquired Infections. J Hosp Infect. 2004;43:85–100.
[2]. Mukhopadhyay C. Infection control in intensive care units. Indian J Respir Care 2018;7:14-21
[3]. Gong S, Xinlan HU, Rongguo YU. Distribution and antimicrobial resistance of bloodstream pathogens in surgical and medical ICUs. Chinese Journal of Infection and Chemotherapy. 2018 Jan 1;18(1):68-75.
[4]. Eggimann P, Pittet D. Infection control in the ICU. Chest 2001;120:2059-93.
[5]. Vincent JL, Bihari DJ, Suter PM, Bruining HA, White J, Nicolas-Chanoin MH, et al. The prevalence of nosocomial infection in Intensive Care Units in Europe. Results of the European prevalence of infection in intensive care (EPIC) study. EPIC international advisory committee. JAMA 1995;274:639-44.
[6]. Vasudeva N, Nirwan PS, Shrivastava P. Bloodstream infections and antimicrobial sensitivity patterns in a tertiary care hospital of India. Therapeutic Advances in Infectious Disease. 2016 Oct;3(5):119-27.
[7]. Yangzom T, Tsering DC, Kar S, Kapil J. Antimicrobial Susceptibility Trends among Pathogens Isolated from Blood: A 6-Year Retrospective Study from a Tertiary Care Hospital in East Sikkim, India. J Lab Physicians. 2020.
[8]. Schwab F, Geffers C, Behnke M, Gastmeier P. ICU mortality following ICU-acquired primary bloodstream infections according to the type of pathogen: a prospective cohort study in 937 Germany ICUs (2006-2015). PloS one. 2018 Mar 8;13(3):e0194210.
[9]. Venkataraman R, Divatia JV, Ramakrishnan N, Chawla R, Amin P, Gopal P, et al. Multicenter observational study to evaluate epidemiology and resistance patterns of common intensive care unit-infections. Indian Journal of Critical Care Medicine: Peer-reviewed, Official Publication of Indian Society of Critical Care Medicine. 2018 Jan;22(1):20.
[10]. Ramasubramanian V, Iyer V, Sewlikar S, Desai A. Epidemiology of healthcare acquired infection–An Indian perspective on surgical site infection and catheter related blood stream infection. Indian J Basic Appl Med Res. 2014 Sep;3(4):46-63.