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Bacteriological profile of Blood Stream Infection in Tertiary care Hospital, Kolhapur

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Abstract

Background: *Blood stream infection (BSI) is the most devastating infection in hospital settings especially in critical care units. They can be caused by Bacteria, Virus as well as fungi. BSI with MDR (Multidrug Resistance) pathogens is more common so, the treatment of the patient with MDR is challenging only.*

Aim: *The objective of this study is to evaluate the spectrum of bacterial blood stream infection by using inflammation and antimicrobial resistance patterns.*

Methodology: *This retrospective study was conducted in the Department of Microbiology, at D.Y Patil Medical College and Hospital, Kolhapur. Patients of all ages (0 to 70 Years) and both genders who were admitted to medical general wards and ICUs were included during the period of Jan 2016 to Jan 2018*

Results: *In this study, a total of 500 patients were included. Of these, 161 showed positive. Out of 161 isolates 95 gram positive bacteria (59.01%) and 65 gram negative bacteria were isolated (40.99%). Of these, resistance to ESBL 23.07%, Carbapenem resistance (MBL) 20%, Methicillin Resistance Staphylococcus (MRS) 28.42%, MDR (Multidrug Resistance) 9.23% were observed*

Conclusion: *MDR continues to increase at a rapid rate so proper disease management and detection of inflammation markers could be help to differentiate infection from noninfectious fever and helps to optimize the usage of antibiotics in general patients, minimize the emergence of developing the antibiotic resistance.*

Key words: *Blood stream infection, MDR, ESBL, MRS, MBL*

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I. Introduction

Blood stream infections (BSI) are common and associated with morbidity and mortality especially in intensive care unit patients[1]. Multiple factors involving the influence of the blood stream infection such as increase in the length of hospital stay, use of multiple indwelling medical devices etc. It's improper management could establish the infection. Apart from this, the respiratory tract, gastrointestinal, urinary tract, wound infections also contribute to establishing the bloodstream infection[2]. Traditionally, blood stream infection can be classified as Hospital acquired or Community acquired, based on the exposure to the infection[3]. *Staphylococcus aureus, CONS, Enterobacteriaceae* are the more common etiological agents for causing BSI. In addition, antimicrobial resistance is increasing and emerging nowadays. It has become problematic in saving the life of the patient and is a major threat to the public health system[4]. Infection control plays an important role in monitoring the pathogens with MDR and determines whether the patients were already colonized or got infection after arrival in ICUs[5]. The objective of this study is to evaluate the spectrum of bacterial pathogens and degree of blood stream infections by using inflammation markers and their antimicrobial patterns.

II. Material And Methods

Methods:

This retrospective study was conducted in the Department of Microbiology, at D.Y Patil Medical College and Hospital, Kolhapur. Patients of all ages (0 to 70 Years) and both genders who were admitted to medical general wards and ICUs were included during the period of Jan 2016 to Jan 2018.

Definition:

The following are the **Clinical criteria** for Systemic Inflammatory Response Syndrome and sepsis[13]:

1. Temperature of > 38 °C,
2. Systolic blood pressure of < 90 mmHg,
3. Diastolic blood pressure of < 60 mmHg,
4. Heart rate of > 90 beats/minute,

5. Respiratory rate of > 20 breaths/minute, and
6. White blood cell count of > 12,000/mm^3 or < 4,000/ mm^3.

BSI was confirmed by using microbiological blood culture and inflammation markers.

During the study period blood specimen were collected aseptically (2-5mL from infants, 10-20mL from adult patients) and inoculated into 2 sets of blood culture bottle system and loaded to Bactec automated system (Matrix Render) and incubated for 7 days at 37°C. Based on the patient's clinical condition, blood samples were obtained at different sites by vein puncture (Left brachial, right brachial vein etc.)[16,14]

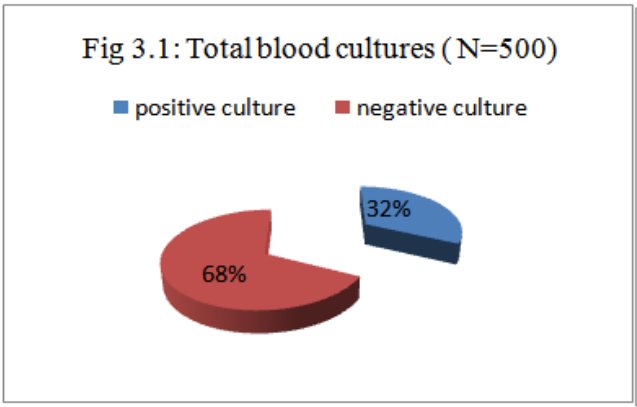
The obtained positive blood culture bottles were gram stained and immediately reported to respective wards (Critical alerts). The finding was further confirmed by growth on Blood agar and MacConkey agar. Identification and Antibiotic susceptibility tests were performed according to standard guidelines[14].

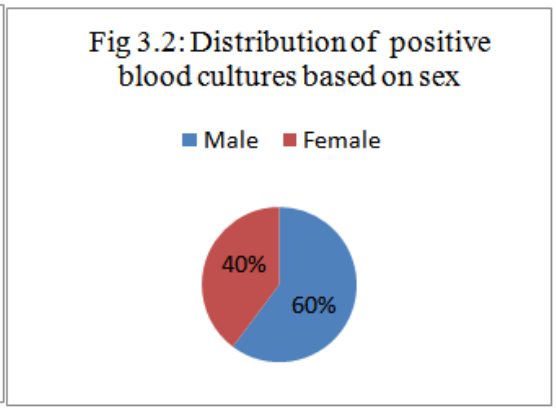
Serum Procalcitonin (PCT) was performed quantitatively by using minividas (Biomeriux) to detect the levels of blood stream infection as follows[15].

1. Normal-0.005ng/mL
2. Local infections- 0.5 ng/mL
3. Systemic infection (sepsis)-2 ng/mL
4. Severe sepsis – 10 ng/mL
5. Septic shock ->10 ng/mL

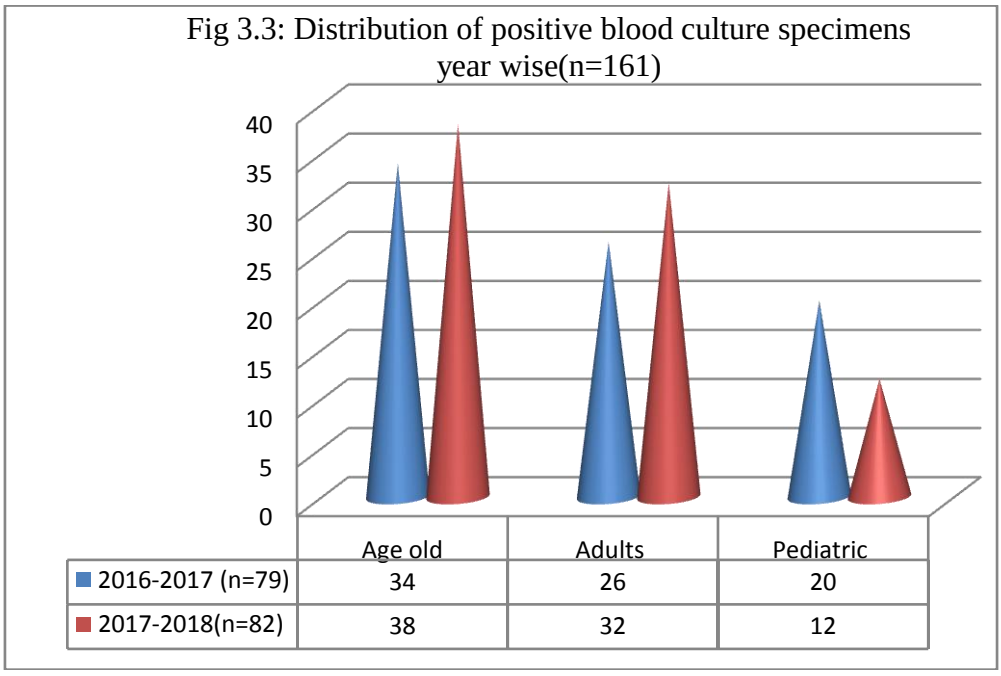
III. Result

Total of 500 blood culture specimen were assessed. Of these,161(32.2%) were positive (Fig 3.1) and it was correlated with PCT and the patient's clinical history.



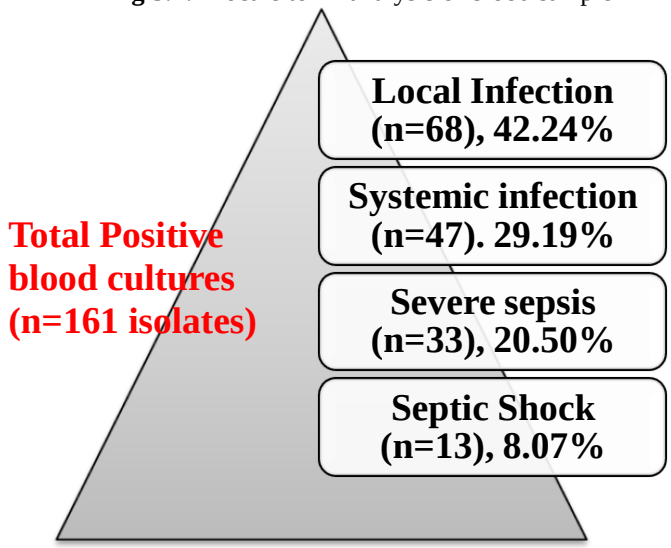


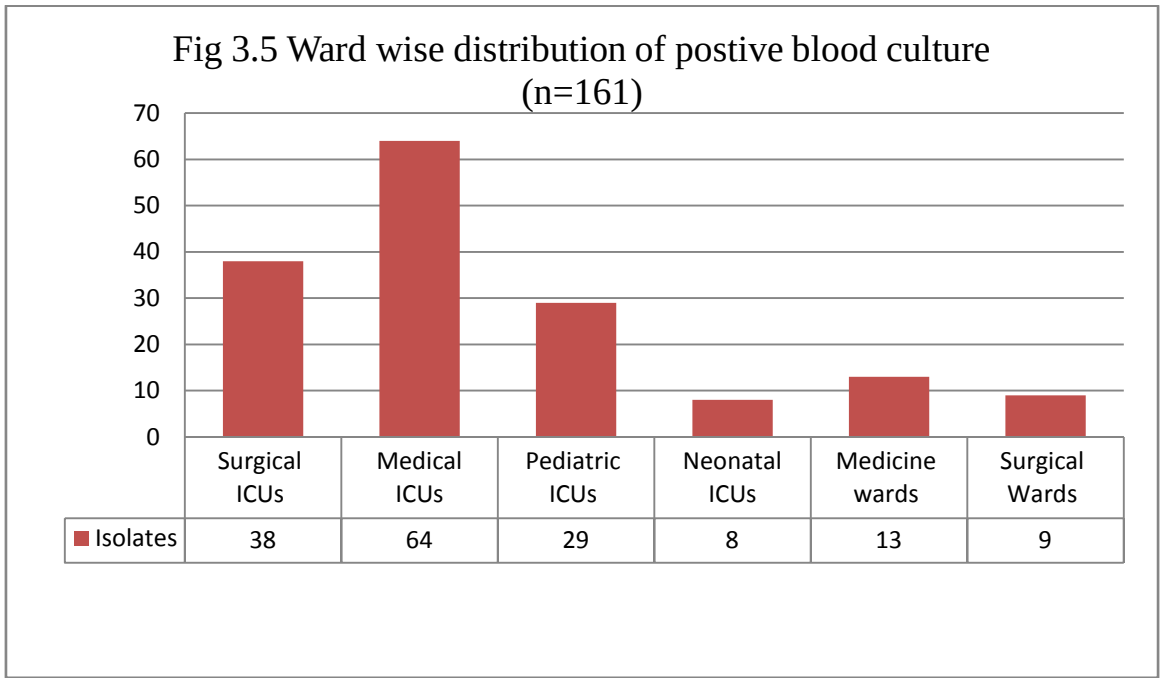
Frequency of positive blood culture was more in males when compared to females (Fig3.2)



Blood stream infections are more frequently observed from elderly (age old) patients followed by adults and paediatric patients (Fig3.3). Based on the procalcitonin level, degree of blood stream infection was further confirmed quantitatively. Of these, local infections (42.24%) were more, when compared to other infections; followed by systemic infections (29.19%), severe sepsis (20.50%) and septic shock (8.07%). (Fig 3.4)

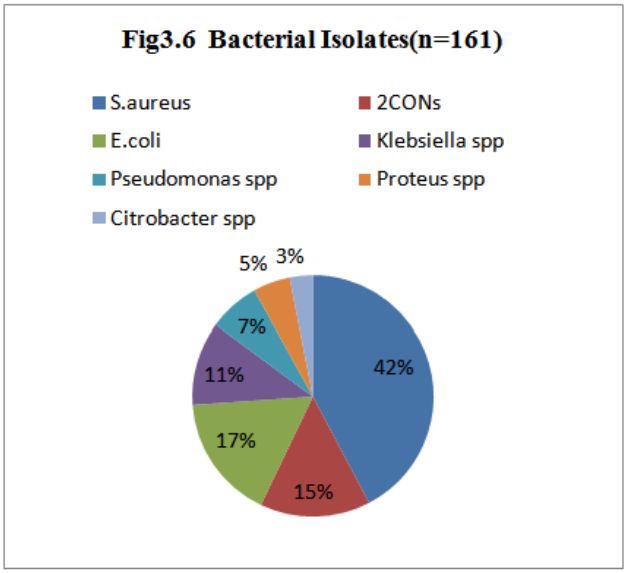
Fig 3.4: Procalcitonin analysis of blood sample





Tab 3.1 : Bacterial isolates

Sr.No	Bacteria	Total number of isolates
1	Staphylococcus aureus	68(42.23%)
2	E.coli	27(16.77%)
3.	Coagulase Negative Staphylococcus	24(14.90%)
4.	Klebsiella spp	18(11.20%)
5.	Pseudomonas spp.	11(6.83%)
6.	Proteus Spp.	8(4.97%)
7.	Citrobacter spp	5(3.10%)
	Total	**n=161**



Blood specimen from patients in intensive care units were more frequently being sent to microbiological laboratory as compared to the other general wards for analyzing the bacterial blood stream infections (Fig 3.5)

S.aureus is the commonest blood stream infection followed *by E.coli and CONS*. *CONS* established infection was confirmed by repeated blood cultures, patient's clinical history and PCT analysis (Fig 3.6).

Table 3.3: Antibiotic resistance pattern of isolated bacteria's

	S. aureus	***CONS***	***E.coli***	***Pseudomonas spp***	***Citrobacter spp***	***Klebsiella spp***	***Proteus spp***	**Total**
ESBL	-	-	03(11.11%)	04(14.81%)	--	06(33.33%)	02(25%)	15(23.07%)
MRS	19(27.94%)	08(33.33%)	-	-	-	-	-	27(28.42%)
MDR	1(1.47%)	1(4.166%)	1(3.70%)	1(9.09%)	-	02(11.11%)	-	06(9.23%)
MBL	-	-	03(11.12%)	04(14.81%)	-	05(27.77%)	01(12.5)	13(20%)

IV. Discussion and conclusion

Blood stream infection is the most devastating but preventable infection in hospital settings especially in critical care units. Exact rate of blood stream infection differs from country to country. Early detection and treatment of BSI is very important for improved clinical outcome of the patient. Isolation of the etiological agent is the gold standard method of diagnosis[6]. In this study 32.2% sample showed culture positive. Of these, gram positive bacteria (59.01%) were found to be more common than gram negative bacteria (40.99%). 67.8% blood samples showed no organisms until 1 week of incubation at 37 °C. Results were compared to clinically suspected cases and inflammation markers.

Isolation rates of bacteria from other Indian studies performed by routine microbiological blood culture showed a wide variation. Meenakshi Kante et al, 2014 reported 17% rate[8], Pragnya Paramita Jena et al, 2015 documented a rate of 22.5%[7] and Vijay Prakash et al, 2017 showed 30.83%[6]. In India, isolation rate of BSI pathogens differs due to the inappropriate administration of broad-spectrum antibiotics to patients before coming to tertiary care hospitals. In the present study, isolation rate is 32.2%. Of these, *S.aureus* were (42.23%) followed by *E.coli* (16.77%), CONS (14.90%), *Klebsiella spp* (11.20%), *Pseudomonas* (6.83%), *Proteus spp* (4.97%) and *Citrobacter spp* (3.10%).

Clinical significance of CONS was confirmed by at least two blood cultures positive within 5 days or one positive blood culture plus clinical diagnosis of infection, abnormal leucocyte count and temperature or blood pressure[9]. Frequent use of foreign indwelling devices is a source of increasing the CONS associated BSI and it is the third most common cause of BSI [10]

Rate of methicillin resistance in our study was found to be higher in CONS (33.33%) compared to *S.aureus* (27.94%) which was same as reported by Mathur et al [11], Mir et al [12]. ESBL producing *Enterobacteriaceae* plays an important role for the ineffectiveness of antimicrobial therapy, thus leading to increase in mortality and length of stay in hospitals. With wide use of carbapenem drugs for the first line therapy of ESBL bacteria, now carbapenem resistance is becoming widespread. In our study resistance to ESBL was

23.07%, carbapenems 20%.Of these Klebsiella spp showed more ESBL resistance 33.33% and carbapenem showed 27.77% compared to others isolates.

Recently emerging multidrug resistance (MDR) bacteria are becoming problematic in patients. In our study, MDR showed 6 isolates. Results from the present study and previous observation from the other studies have shown BSI to have emerged as a serious problem due to increasing emergence of MDR pathogens. Proper disease management, alternative diagnostic procedures like detection of inflammatory markers, could be helpful for clinicians to differentiate an infection from noninfectious fever and it helps to optimize the limited use of antibiotics among general patients to prevent the development and emergence of resistance

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