ORIGINAL RESEARCH

To study Microbiological profile of hospital vs community acquired blood stream infections in patients admitted in ICU

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ABSTRACT
Bloodstream infections (BSI) are an important cause of morbidity and mortality in hospitalized patients. BSI have been divided into community and nosocomial episodes. Rapid diagnosis, identification of the causative bacteria and appropriate treatment are necessary in mitigating the morbidity and mortality associated with BSIs.To study Microbiological profile of hospital vs community acquired BSI in patients admitted in ICU.This was a prospective study conducted in the department of Microbiology from 1st January 2020 to 31st December 2020. All the patients admitted in medical ICU were included and monitored for BSI. The blood samples received were cultured and antimicrobial susceptibility pattern was determined. 1039 patients were admitted in medical ICU and infections were present in 79(8 %) patients and a total of 80 isolates were obtained. In community acquired (CA) BSI, most common isolate *was E coli* (31 %) while in hospital acquired (HA) BSI, *Klebsiella* and *Acinetobacter*(17 %)were the most common. In HABSI, gram negative isolates showed higher resistance to amikacin (43.4 %), gentamicin (34.7 %) and imipenem(21.7 %) as compared to CA BSI. In CA BSI, MRSA were higher (58.3 %) as compared to HA BSI. Knowledge of antimicrobial resistance pattern provides guidance for the treatment thus improving the outcome.

Keywords: BSI, medical intensive care unit, antimicrobial susceptibility testing.

INTRODUCTION

Bloodstream infections (BSIs) cause considerable morbidity and mortality.[1,2]. Estimates suggest that 10 - 13% of community-onset BSIs are fatal [3,4] and 23% of nosocomial BSIs resulted in death in one study in the USA[4].Rapid diagnosis, identification of the causative bacteria and appropriate treatment are necessary in mitigating the morbidity and mortality associated with BSIs.

The epidemiology of bacterial infections differs in community and hospital settings. The predominant bacteria causing community-acquired infections are Gram-positive organisms, while hospital-acquired infections are more commonly caused by Gram-negative bacteria[4].This distinction has relevance to empirical treatment of suspected bacterial infection.

Blood culture is the most importantfor the diagnosis of Blood Stream Infections (BSIs). It is done to isolate the causative organism and to know about the sensitivity pattern of the isolates. It remains the mainstay of definitive diagnosis and the management of BSIs [5]. Respiratory, genitourinary tract and intra-abdominal foci are usually the identifiable sources of the bloodstream infections [6]. Blood cultures also provide essential information for the diagnosis of a variety of diseases like endocarditis, pneumonia, and pyrexia of unknown origin and particularly, in patients with suspected sepsis. The microorganisms which are present in circulating blood, whether continuously or intermittently, are threat to the host [7].

Gram negative bacteremia cause septic shock and the mortality is even greater with high-grade bacteremia and polymicrobial infections. Gram positive bacteremia is also on the rise, especially among neonates and children [8]. The bacteremia which is caused by the *Enterobacteriaceae*family is associated with an increased mortality as compared to the BSIs caused by Gram-positive bacteria [9].

Increasing antibiotic resistance complicates treatment of infections, in some cases diminishing the options for effective therapy,[10] and is often associated with worse outcomes.[11]. Regular surveillance and reporting of BSIs and antibiotic susceptibility, including differentiation of community and hospital acquired infections, can help in managing infections appropriately and in adapting local antibiotic stewardship policies.[12,13]

MATERIALS AND METHODS

The study was prospective study conducted in the department of Microbiology for a period of one year (January to December 2020). All the patients admitted in medical ICU with evidence of blood stream infections (BSI) were included in the study. This study was approved by Institutional Ethics committee.

METHOD OF COLLECTION OF DATA

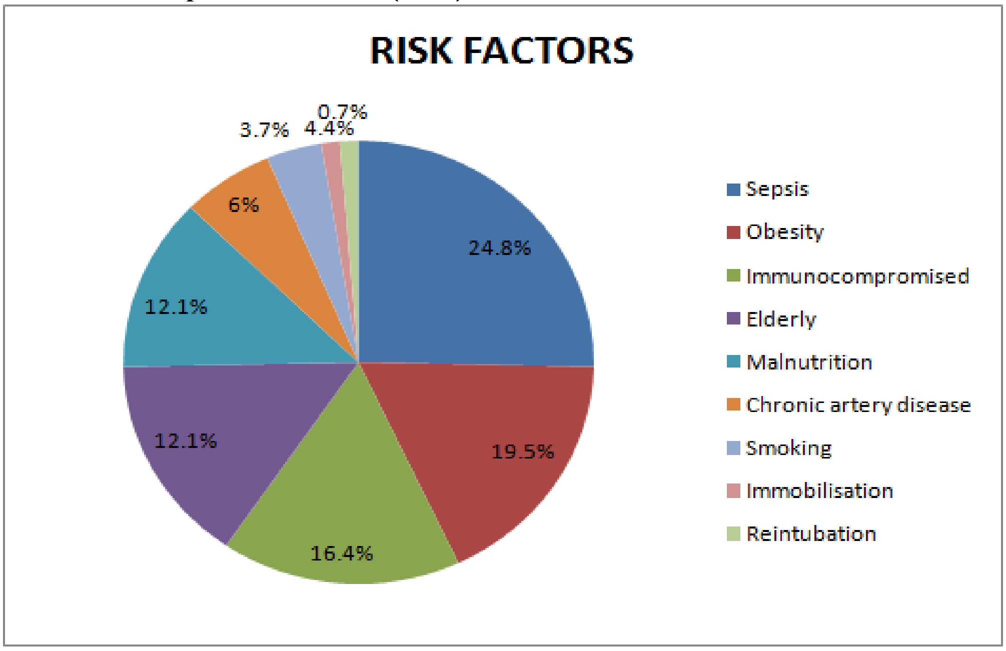
Patient details which include name, age, sex,MRD number, date of admission, risk factors, reason for ICU admission, sourceof admission, empirical antibiotics, general investigations, provisional diagnosisand outcome were recorded.

On clinical suspicion blood samples were collected under aseptic conditions and were processed as per standard protocol**.** Blood samples were processed in the BACTEC (BD BACTEC^{TM} FX BD) or Bac-T/Alert (Bac-T/Alert 3D Biomerieux) microbial detection system.Identification& antimicrobial susceptibility testing was done by Vitek2 (Vitek 2 Compact Biomerieux) system. Characterisation of isolates were done into MDR/XDR/PDR[14].For Gram negative isolates ESBL/Amp C/MBL and for Gram positive organisms MRSA/VRE characterization was done[15].Infections were categorized into hospital (HA) and community acquired (CA) BSI. Data obtained from the study was put to appropriate statistical analysis. P value <0.05 was considered significant.

RESULTS

A total of 1039 patients were admitted in medical ICU and infections were present in 79 patients with an infection rate of 8 %. Comorbid illness was observed in 59.4 % and most common was diabetes mellitus (28 %). Most common risk factors were sepsis (24.8 %), obesity(19.5 %) and immunocompromisedstatus(16.4 %) (Figure 1).

Figure 1: Risk factors of patients with BSI (n=79)



The most common clinical presentation was shock followed by acute febrile illness.

A total of 80 isolates were obtained(Monomicrobial growth was present in 78 patients & in one patient polymicrobial growth was obtained).Gram negative organisms were predominant 57 (71.2 %) than Gram positive 23 (28.7 %). Most common isolate was *E.coli* (21 %) followed by *Klebsiella spp.* (20 %).Gram negative organisms were predominant than Gram positive in both CA and HA BSI. In CA BSI, most common isolate *was E coli* (31 %) while in HA BSI, *Klebsiella* and *Acinetobacter*(17 %) were most common isolates(Table 1& Figure 2)

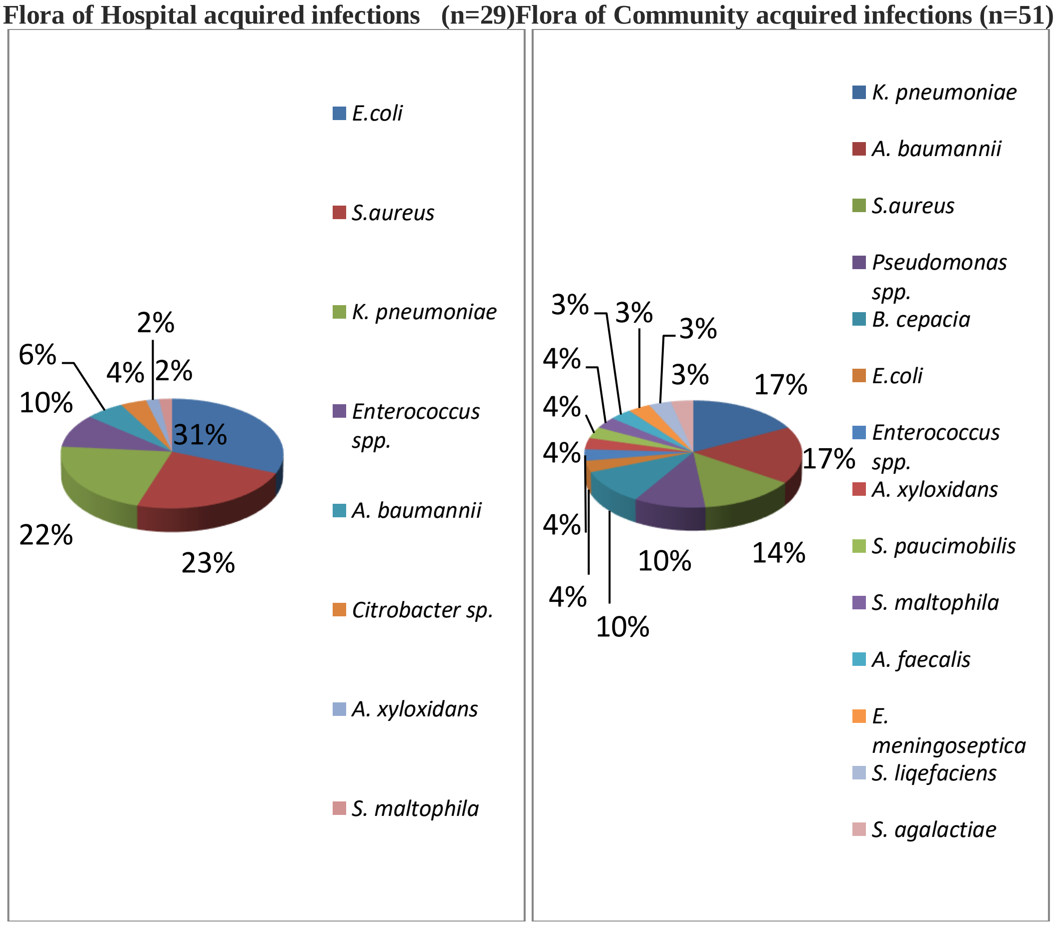
Table 1: Distribution of flora in hospital vs community acquired BSI (n=80)

Gram negative	HAI (n=23)	CAI (n=34)
Klebsiella spp.	5	11

E. coli	1	16
A. baumannii	5	3
Pseudomonas spp.	3	0
Enterobacter spp.	0	0
B. cepacia	3	0
Citrobacter spp.	0	2
A. xyloxidans	1	1
Myroides spp.	0	0
Proteus spp.	0	0
S.paucimobilis	1	0
S. maltophilia	1	1
A.faecalis	1	0
E.meningoseptica	1	0
Pantoea spp.	0	0
P.rettgeri	0	0
S.liquefaciens	1	0
Gram positive isolates	**n=6**	**n=17**
Enterococcus	1	5
S. aureus	4	12
S.pneumoniae	0	0
S. agalactiae	1	0
Total	29	51

Figure 2: Distribution of flora in hospital vs community acquired BSI (n=80)

Flora of Hospital acquired infections (n=29)Flora of Community acquired infections (n=51)



In CA BSI, Gram negative isolates showed lower sensitivity to ceftazidime (5.8 %), ampicillin, ciprofloxacin and amoxyclav (8.8 %).In HA BSI, Gram negative isolates showed lower sensitivity to ampicillin (17.3 %), ciprofloxacin, ceftriaxone and imipenem (21.7 %). *Staphylococcus aureus* showed good susceptibility to vancomycin, teicoplanin and linezolid in both CA and HA BSI (100 %).(Figure 3, 4).

Figure 3: Antimicrobial sensitivity profile of gram negative blood isolatesin community acquired and hospital acquired BSI

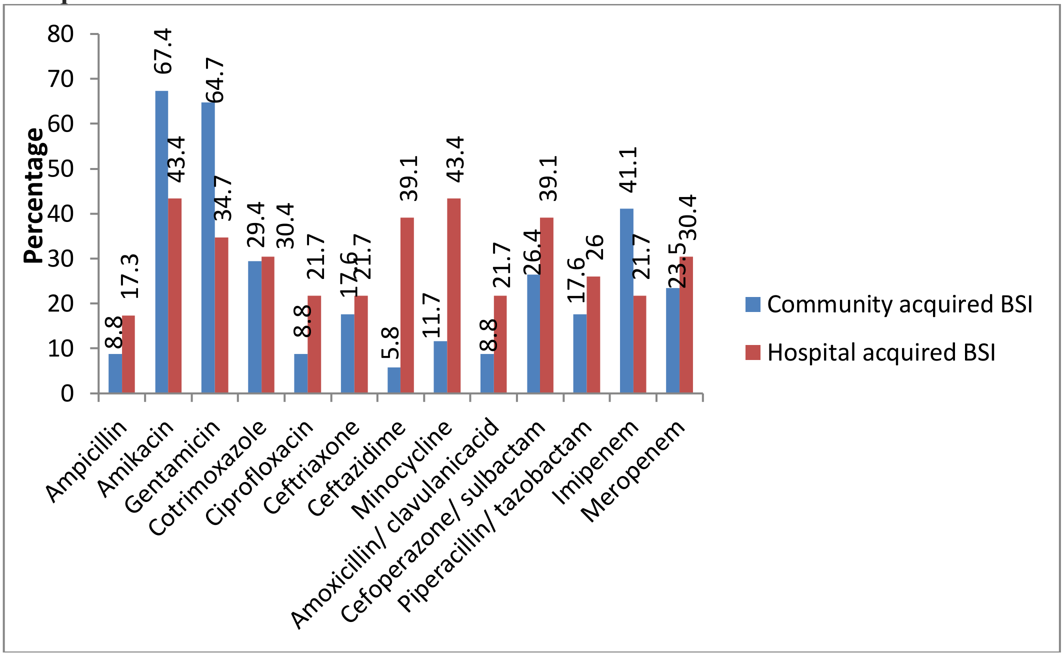
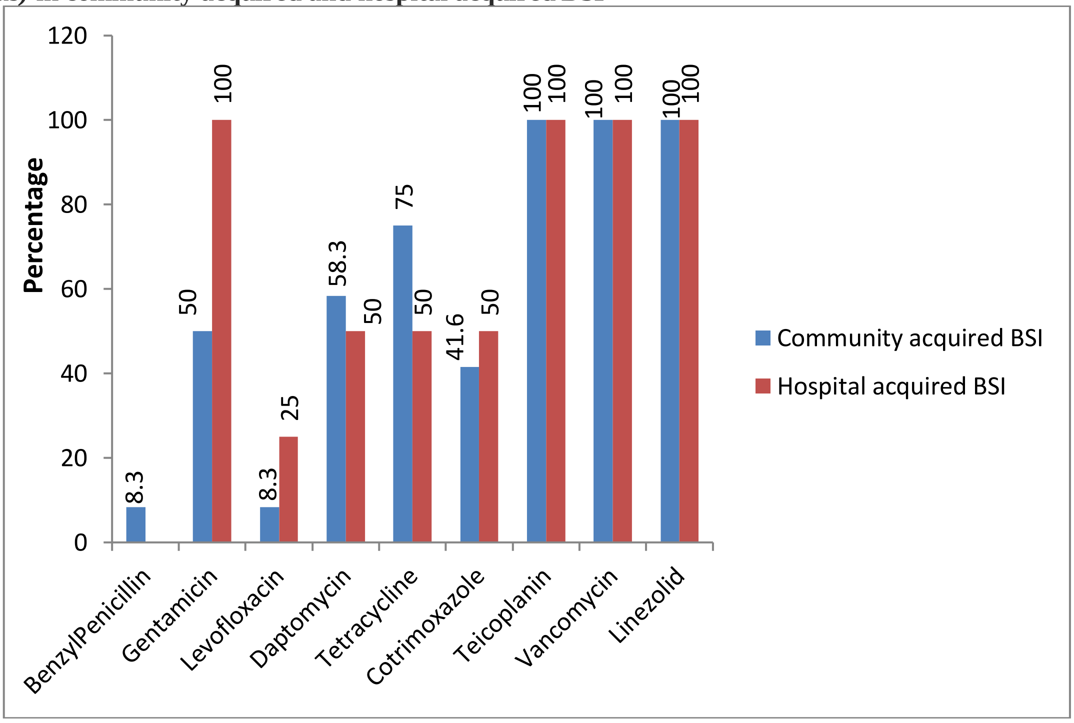


Figure 4: Antimicrobial sensitivity profile of predominant gram positive blood isolate *(staphylococcus aureus)* in community acquired and hospital acquired BSI



On comparing community and hospital acquired BSI, predominant isolates (*E coli* and *Acinetobacterbaumannii*) was considered statistically significant (P value < 0.05). 70.5 % isolates were MDR and 52.9 % were XDR in CA BSI while in HA BSI 72.4 % isolates were MDR and 55.1 % were XDR.MRSA in CA BSI were 58.3 % while in HA BSI 50 % were MRSA and no VRE was reported.Mortalityin HABSI (25 %) was higher than CA BSI (12 %).(Table 2)

Table 2: Hospital vs community acquired blood stream infections

Parameters	Community acquired BSI (51)	Hospital acquired BSI (28)	P value
Age 1-20	1	1	0.106

21-40	13	1	
41-60	18	16	
61-80	18	10	
81-100	1	0	
Sex -			
Male	33	15	0.332
Female	18	13	
Comorbidity	n=51	n=28	
Yes	31(60.7 %)	16 (57.1%)	0.752
No	20 (39.2 %)	12 (42.8 %)	
	n=51	n=29	
Gram negative-	34(66.6%)	23 (79%)	0.229
Gram positive-	17(33.3%)	6(20.6%)	
Predominant isolates	n=51	n=29	0.003
E.coli	16(38%)	1(5.5%)	0.642
Klebsiella spp.	11(26.1%)	5(27.7%)	0.092
A.baumannii.	3(7.1%)	5(27.7%)	0.017
Pseudomonas spp.	0(0%)	3(16.6%)	0.328
S. aureus	12(28.5%)	4(22.2%)	
	n=51	n=29	0.862
MDR	36(70.5 %)	21 (72.4 %)	0.847
XDR	27 (52.9%)	16(55.1 %)	
	n= 34	n= 23	
ESBL	15 (44 %)	9(39.1 %)	0.708
Amp C	6(17.6 %	5(21.7 %)	0.701
MBL	5(14.7 %)	3(13 %)	0.859
MRSA	n=12	n=4	0.713
	58.3 %	50 %	
Outcome -	51	28	
Recovered	27(53 %)	13(46 %)	0.579
DAMA	18(35 %)	8(29%)	0.543
Expired	6(12 %)	7(25 %)	0.711

DISCUSSION

Over a period of one year 1039 patients were admitted in medical ICU and infections were present in 79 patients with an infection rate of 8 % and 80 isolates were obtained. Most common isolate was*E coli* (21 %) followed by *Klebsiella sp.*(20 %).

Gram negative organisms were predominant 57 (71.2 %) than Gram positive 23 (28.7 %).Our data is similar with the study made by Mehta et al [16] in which Gram negative organisms accounted for 71% and 80.96% of blood stream infections respectively. This was in contrast with study made by Hoste et al[17] (39.7%) which showed that in there study maximum blood stream infections were caused by Gram positive organisms(50%).

Most common isolate was *E.coli* (21 %) followed by *Klebsiella spp.* (20 %) which is similar to a study done by Zaveri et al.[18] who also reported *E. coli* as most common isolate obtained from blood .This differs from studies by Mehta et al [16] in which *A. baumannii* and *Pseudomonas aeruginosa*were the commonest Gram negative isolates respectively.

Overall the most prevalent organisms responsible for community-acquired were *E. coli*, *S. aureus* and *K. pneumoniae* and in hospital acquired BSI were *Acinetobacter* spp., *Klebsiella* spp., *S. aureus*, our study is consistent with other recent studies.[19,20]

Gram negative isolates showed higher resistance to majority of antimicrobial agents ciprofloxacin, cephalosporins, carbapenems in both community and hospital acquired infections, this is almost similar to various other studies done by R.B. Patwardhan et al, 17[21]and S sager Faiz et al. 21[22]

*Staphylococcus aureus*showed higher resistant to penicillin, quinolones and cotrimoxazole similar observations seen in previous multicentricstudies[23]

In community acquired BSI 70.5 % isolates were MDR while in hospital acquired BSI 72.4 % isolates were MDR this is similar to a study in which 73.9 % isolates were multidrug resistant.[24,25]

CONCLUSION

The distinction between community and hospital acquired infection is relevant and important to empirical treatment options of BSIs. The findings presented here suggest that hospital acquired bloodstream pathogens carry significant resistant phenotypes. This includes selection of an appropriate antibiotic, as well as prescribing the optimal dose and duration for all important bacterial infections.

CLINICAL SIGNIFICANCE

This study will provide knowledge about the flora of BSI and guide the intensivist in the treatment of infectionsthus improving the outcome.

CONFLICT OF INTEREST

None

SOURCES OF FUNDING

None

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