ISSN- O: 2458 - 868X, ISSN–P: 2458 – 8687
Index Copernicus Value: 49. 23

International Journal of Medical Science and Innovative Research (IJMSIR)
IJMSIR : A Medical Publication Hub
Available Online at: www.ijmsir.com
Volume – 3, Issue –4, July - 2018, Page No. : 226 - 233

Bacteriological profile and antimicrobial resistance patterns of bloodstream infections in a tertiary care hospital Bikaner, Northern western Rajasthan

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

BSIs infection is most serious complication and significant cause of morbidity and mortality at worldwide. Different etiological agents like Staphylococcus aureus, , Escherichia coli, and Klebsiella pneumonia are major cause of BSIs. Due to geographical variation and different antimicrobial agent may change prevalence and antimicrobial susceptibility of microorganisms. The present study was aimed to analyze the various microorganisms causing BSIs and their antimicrobial resistance profile in a major tertiary care hospital, Bikaner, Northern Western Rajasthan to to guide the clinicians to choose an appropriate antimicrobial therapy for treatment of BSIs. Blood samples in brain heart infusion (BHI) broth submitted to the microbiology laboratory for culture and sensitivity during a period of 1 year were included in the study. Samples were processed as per standard protocol of laboratory for isolation and identification. The antimicrobial susceptibility profile of bacterial isolates was determined by the disc diffusion method as per Clinical and Laboratory Standards Institute (CLSI) guidelines. Out of 200 samples 48 samples are culture positive in which Gram positive cocci are most significant microorganism isolated. Most of the Gram-positive cocci (GPC) were susceptible to vancomycin and linezolid. Most of the Gram-negative bacilli (GNB) showed sensitivity to imipenem.

Keywords: Bloodstream infections, coagulase negative staphylococci,Klebsiella pneumoniae sub spp. pneumoniae, imipenem

Introduction

At present time in hospitalized patients Bloodstream infections (BSIs) are most common and significant cause of morbidity and mortality and it has high mortality rate of 20%–50%.[1]These infection most common caused by bacteria.

Bloodstream infections disease are short and self-limiting or may result in death or serious morbidity including admission to intensive care or prolonged hospital stay.[2]

In blood stream continuous or transient presence of microorganism is known as Bacteraemia and these microorganism may be disseminated throughout body with evidence of systemic responses towards microorganism with variable severity is Septicemia. BSIs are often complicated with syndromes associated with septic shock.[3]

In BSIs many factors may be also cause of infection and they may lead to BSIs include increased use of indwelling intravenous catheters, overstay in intensive care units, increased use of steroids and immunomodulators, improved treatment of human immunodeficiency virus (HIV) infections, and changing pattern of antimicrobial usage.[4,5]

At present time increasing resistance to antimicrobial agents due to excessive and irrational use of antibiotics that worsened the condition of proper treatment outcome. Due to multi drug resistance to most commonly used antimicrobials results in a reduction in therapeutic options. In worldwide and India many studies have been reported that increased antimicrobial resistance among bacterial isolates causing BSIs.[6,7,8]Prevalence and antimicrobial susceptibility of microorganism vary depending upon the geography and the use of antibiotics.

Different etiological agents have been isolated in BSIs which include Acinetobacter spp., Pseudomonas aeruginosa, Escherichia coli, and Klebsiella pneumoniae among Gram-negative bacteria and coagulase-negative staphylococci (CoNS), Staphylococcus aureus, enterococci, and alpha-hemolytic streptococci among Gram-positive bacteria. The presence of different micro organisms in various center are also reported and their different antimicrobial resistance profile have been also reported .[6,7,9]

BSIs caused by multidrug -resistant organisms are commonly associated with prolonged hospital stay, increased mortality and thus requires treatment with more expensive antimicrobials. For this early antimicrobial therapy is initiated empirically before the results of blood culture are available. For effective antimicrobial therapy clinicians should be analyzed and monitor the antimicrobial resistance pattern in most commonly isolated pathogens. For improve treatment outcome and better results of treatment of BSIs, it is must need for clinicians to review its epidemiology and antimicrobial resistance pattern to determine the appropriate empirical antimicrobial therapy for the region. Once the organisms are isolated specific antimicrobial treatment plan can be started.

The present study was aimed to analyze the various microorganisms causing BSIs and their antimicrobial resistance profile in a major tertiary care hospital, Bikaner, Northern Western Rajasthan to to guide the clinicians to choose an appropriate antimicrobial therapy for treatment of BSIs.

Materials and Methods

The present study was conducted in the Department of Microbiology & Immunology, PBM hospital, Bikaner, during the time frame of July 2017to December, 2017. A total of 200 non-repetitive blood samples collected from patients suspected of having bloodstream infections attending and admitted in P.B.M. Hospital Bikaner. Details like hospital identity, registration number, laboratory number, age and sex of the patients, and type and place of collection of specimen were recorded in a formatted proforma. Patients of all age groups with fever (both high and low grade) due to infective causes were included. Written and informed consent was taken from all who fulfilled the criteria. Patients having both leukocytosis and leucopenia were included in the study. Those who refused consent were excluded along with patients having autoimmune or chronic diseases like tuberculosis or sarcoidosis. Patients on steroids, having heat stroke, or having a suspected viral or parasitic infection were also excluded.

Blood was collected with all aseptic precautions from the bedside of the patients suspected of having bloodstream infection using a sterile syringe. Approximately 5–10 mL of blood was collected from adult patients, while 1–5 mL blood was collected from pediatric patients, and 1–2 mL from neonates for blood culture. Samples were incubated

aerobically at 37˚C in an incubator for 16-18 h. After incubation, primary subculture from the BHI broth was done on 5% blood agar and MacConkey agar and repeated daily till 7 days. The culture was reported negative if all subcultures showed no growth by the end of 1 week. Growth obtained during any of the subculture done on 5% blood agar or MacConkey agar was included in the study. Isolates were further processed as per standard routine protocol of the laboratory for its complete identification (Ananthanarayan and Paniker, 2013; Collee et al. 1996; Forbes et al. 2014; Winm et al. 2006)[10,11,12,13]. The organism grown on any of the culture media was included in the study if respective BHI broth was turbid and the smear prepared from broth and culture media showed the same organism; otherwise it was not included in the study.

Gram-negative bacilli. The colony character on culture media was observed, and Gram staining, motility, and biochemical tests – indole, methyl red, Voges–Proskauer, citrate utilization, urease test, phenyl pyruvic acid test, triple sugar iron agar, oxidase, amino acids decarboxylase test, and sugar fermentation reaction – were conducted.

Gram-positive cocci. On the basis of colony character, Gram stain, catalase test, and coagulase test.

Antibiotic susceptibility testing(AST) were done by Modified Kirby-Bauer's disc diffusion method for a pre determined panel of antibiotics for all isolates and the zone diameter was interpreted in accordance to Clinical and Laboratory Standards Institute (CLSI) guidelines 2014.[14] Culture media and antibiotic discs used in the study were obtained from HiMedia Labs Pvt Ltd, India.

Data were entered in excel sheet to prepare a master chart. Quantitative data were shown as mean ± standard deviation (SD), and qualitative data as numbers and percentages.

Results and Discussion

Table 1: Age-wise distribution of culture-positive patients

Age	culture-positive
<1 year	05
1-10 year	03
11-20 year	06
21-30 year	08
31-40 year	14
41-50 year	02
51-60 year	08
>60 year	03

Table 2: Distribution of Gram-positive cocci isolated

Gram-positive cocci	Culture positive
Coagulase Negative Staphylococcus	08
Methicillin Sensitive Staphylococcus Aureus(MSSA)	09
Methicillin Resistance Staphylococcus Aureus(MRSA)	06
Enterococcus species	03

Table 3: Distribution of Gram-negative bacilli isolated

Gram-negative Bacilli	Culture positive
Escherichia coli	11
Klebsiella pneumonia	05
Pseudomonas aeruginosa	03
Citrobacter species	02
Acinetobacter species	02

Table 4: Antibiotic sensitivity pattern of GPC

Antibiotic	Staphylococcus			Enterococcus
	MSSA(n=9)	MRSA(n=6)	CONS(n=8)	(N=3)
Cefoxitin	100%	0	100%	100%
Amikacin	8(88.88%)	2(33.33%)	7(87.5%)	0
Ciprofloxacin	7(77.77%)	1(16.66%)	6(75%)	0
Clindamycin	7(77.77%)	4(66.66%)	7(87.5%)	1(33.33%)
Erythromycin	-	-	-	2(66.66%)
Vancomycin	9(100%)	6(100%)	8(100%)	3(100%)
Linezolid	9(100%)	6(100%)	8(100%)	3(100%)

Table 5: Antibiotic sensitivity pattern of GNB

Antibiotic	E.coli (n=11)	Klebsiella (n=5)	Citrobacter (n=2)	Acinetobacter (n=2)
Gentamycin	3(27.27%)	3(60%)	0	0
Ceftriaxone	3(27.27%)	2(40%)	2(100%)	2(100%)
Pipercillin+Tazobactum	10(90.90%)	4(80%)	2(100%)	2(100%)
Cefaparazone+Sulbactum	10(90.90%)	5(100%)	2(100%)	2(100%)
Ciprofloxacin	4(36.36%)	2(40%)	1(50%)	1(50%)
Cefepime	8(72.72%)	1(20%)	1(50%)	2(100%)
Imipenem	11(100%)	5(100%)	2(100%)	2(100%)

Table 6: Antibiotic sensitivity patterns for Pseudomonas aeruginosa.

Antibiotics	P. aeruginosa (n = 3)
Amikacin	2(66.66%)
Aztreonam	2(66.66%)
Ceftazidime	2(66.66%)
Ciprofloxacin	1(33.33%)
Colistin	3(100%)
Pipercillin+Tazobactum	3(100%)
Tobramycin	2(66.66%)
Imipenem	3(100%)
Polymyxin-B	2(66.66%)

During last few decade, BSI have been challenge to clinicians due to resistance against commonly used antimicrobials. The pattern of resistance in antibiotics continuous change due to indiscriminate use of antibiotics. In worldwidw BSIs presently is a major cause of morbidity and mortality. So early detection of causative organism and determination of its antimicrobial resistance profile is necessary to decrease the mortality associated with BSIs.

Therefore this present study was undertaken to detect the prevalence of microorganisms isolated from blood and study their antimicrobial resistant patterns in a tertiary care hospital Bikaner for a geographical location helps clinicians to decide appropriate empirical therapy, which ultimately decreases the emergence of resistance.

The present study was conducted in the Department of Microbiology & Immunology, PBM hospital, Bikaner, during the time frame of July 2017 to December, 2017. A total of 200 non-repetitive blood samples collected from patients suspected of having bloodstream infections attending and admitted in P.B.M. Hospital Bikaner. Culture positivity was seen in 48 (24%) samples out of 200 samples and 152 (76%) samples were sterile as no pathogenic microorganism grown on culture.

In our study maximum number of positive blood culture was from age group of 31 to 40 years, and the minimum from age group 41 to 50 years (Table- 1)

Out of 200 samples 48 samples are culture-positive and in positive samples Gram-positive cocci (GPC) were the most common organism isolated, with S. aureus being the most common of them (table-2), and E. coli was the most commonly isolated Gram-negative bacilli (GNB)(table-3).

The antibiotic sensitivity patterns of GPC are shown in Table 4 and those of GNB are shown

Some other antibiotic sensitivity patterns were also noted for P. aeruginosa, which are listed in Table 6.

In our study most number of positive cases was found in the third decade of life followed by second and sixth decade of life. Our finding were consistent with studies by Prashanth et al. (2011)[15] and Nikita Vasudeva et al (2016)[16] who also reported that maximum number of positive cases in age group of 31–45 years.

From the total culture positive samples, Gram positive cocci were predominat isolated. In GPC most commonly isolated S. aureus 15 samples followed by coagulase-negative Staphylococcus spp.08 and Enterococcus spp. 03, whereas the maximum number of GNB which were isolated were E. coli 11 followed by Klebsiella spp.05, P. aeruginosa 03, Acinetobacter 02 and Citrobacter spp.02.Our results is in agreement with study done by Nikita Vasudeva et al (2016)[16], Fayyaz et al. (2013)[17] and Karlowsky et al. (2004)[18] who also reported maximum number of E. coli in GNB in their studies. Our finding were also consistent with studies by by Karunakaran et al. (2007)[19] and Aiken et al.(2011) [20]for GNB.

In our study it was observed that GPC were 100% sensitive to vancomycin and linezolid. Nikita Vasudeva et al (2016)[16],Fayyaz et al. (2013)[17]and Marshall et al.(1998)[21] were also reported 100% sensitivity in their study to vancomycin and linezolid. Another study done by by Kaur and Singh (2014)[22]reported low sensitivity to vancomycin(57.14%).

In our study amikacin show high sensitivity (88.88%) to methicillin-sensitive S.aureus, 33.33% for methicillin-resistant S. aureus, 87.5% for coagulase-negative Staphylococcus spp. and 0% for Enterococcus spp.. These finding are consistent for methicillin-sensitive S. aureus and coagulase-negative Staphylococcus spp. with the study by Fayyaz et al. (2013)[17]who reported 93.33% sensitivity to amikacin.

The sensitivity of clindamycin in our study is 77.77% for methicillin-sensitive S. aureus, 66.66% for methicillin-resistant S. aureus, and 87.5% for coagulase -negative Staphylococcus spp., these finding were consistent with the study by Marshall et al. (1998).[21]

In our study sensitivity rate of ciprofloxacin for coagulase-negative Staphylococcus spp. is 75%, for methicillin-sensitive S. aureus is 77.77%,for methicillin-resistant S. aureus is 16.66% and 0% for Enterococcus spp., these finding correlate with the study of Marshall et al. (1998)[21]and Nikita Vasudeva et al (2016).[16]

In this Cefoxitin was 100% sensitive for coagulase-negative Staphylococcus spp., methicillin-sensitive S. aureus, and Enterococcus spp.and 100% resistant for methicillin-resistant S. aureus.

In present study Imipenem showed 100% sensitivity to E. coli, Klebsiella spp., Citrobacter spp. and Acinetobacter. These findings correlate with the study of Nikita Vasudeva et al (2016)[16]and Saghir et al.(2009)[23]who reported 100% sensitivity of imipenem for Enterobacteriacae family but was not compatible with E. coli and Citrobacter spp. A study done by Jyothi et al. (2013)[24]who reported 93% sensitivity to E. coli and Klebsiella spp. were consistent our findings.

In our study, ceftriaxone showed 27.27% sensitivity to E. coli, 40% to Klebsiella spp., and 100% sensitivity to Citrobacter spp. and Acinetobacter spp.. Our findings were consistent with study by Saghir et al. (2009)[23]and Fayyaz et al. (2013)[17] who reported 28% and 22.44%, sensitivity for Enterobacteriacae family. Another study done by Zenebe et al. (2011)[25]and Nikita Vasudeva et al (2016)[16] who reported 100% sensitivity to ceftriaxone for Citrobacter spp. and Acinetobacter spp. consistent with the our study.

In our study sensitivity of E. coli, Klebsiella spp., Citrobacter spp. and Acinetobacter spp. for piperacillin/tazobactam are 90.90%,80%,100 and 100% respectively. These findings were consistent other study by Nikita Vasudeva et al (2016)[16] and Karlowsky et al.(2002)[18].

In our study E. coli and Klebsiella spp. showed sensitivity rate 27.27% and 60% to gentamycin, and Acinetobacter spp. Citrobacter spp. both were 100% resistance to gentamycin. Sensitivity rate to ciprofloxacin was 36.36% and 40% respectively for E. coli and Klebsiella spp. and 50% for Acinetobacter spp. Citrobacter spp..These

findings are consistant with other study by Fayyaz et al. (2013)[17]and Nikita Vasudeva et al (2016)[16].

In our study E. coli, Klebsiella spp., Acinetobacter spp. and Citrobacter spp. showed 72.72%, 20%, 100% and 100% sensitivity rate respectively to cefepime. Similar findings were reported for cefepime by Nikita Vasudeva et al (2016). Another study done by Saghir et al. (2009)[23]for Klebsiella spp. who reported 20% sensitivity of for Enterobacteriacae family to Cefepime, but other findings were not consistent for E. coli and Citrobacter spp.

In our study, P. aeruginosa showed 100% sensitivity to imipenem, pipercillin+tazobactum and colistin. These findings are consistent for imipenem with other study by Hafsa et al. (2011)[26] and Nikita Vasudeva et al (2016)[16].

In our study P. aeruginosa showed higher percentage of sensitivity 66.66% for aztreonam, amikacin, ceftazidime, tobramycin and polymyxin B. Low sensitivity rate 33.33% showed by ciprofloxacin. Our finding was correlate with the study by Hafsa et al.(2011)[26]for ciprofloxacin and amikacin, that is, 50% sensitivity to ciprofloxacin and 75% sensitivity to amikacin, and was also consistent with the study by Fayyaz et al. (2013)[17], that is, 37.5% sensitivity to aztreonam, 60% sensitivity to ciprofloxacin, and 72.5% sensitivity to amikacin.Our findings also are consistent with the study done by Fayyaz et al.(2013)[17], reporting a sensitivity of 60%, and by Rabirad et al. (2014)[27], reporting a sensitivity of 65.8% to ceftazidime.

It is concluded from present study that isolation of various aerobic microorganisms shows that different conditions of BSIs should be differentiated on microbiological grounds therefore continuous and periodic surveillance of microbiological pattern is desirable in all cases of BSIs. In the era of antibiotics the emergence of antibiotic resistance is becoming more common and human negligence is a factor responsible for the development of antibiotic resistance. Therefore continuous evaluation of antibiotic pattern of microbial isolates along with judicious use of antibiotics in local area is of paramount importance in prescribing empirical antibiotics for successful treatment of BSIs thus minimizing its complications and emergence of resistant strains.

References

1. Diekema DJ, Beekmann SE, Chapin KC, Morel KA, Munson E, Doern GV. Epidemiology and outcome of nosocomial and community-onset bloodstream infection. J Clin Microbiol 2003;41:3655-60.

2. Movahedian A, Moniri R, Mosayebi Z. Bacterial culture of neonatal sepsis. Iranian J Publ Health. 2006; 35:84-9.

3. Balk RA. Severe sepsis and septic shock. Definitions, epidemiology and clinical manifestations. Crit Care Clin 2000;16:179-92.

4. Fridkin, SK, Steward CD, Edwards JR, Pryor ER, McGowan JE Jr, Archibald LK, et al. Surveillance of antimicrobial use and antimicrobial resistance in Unites States hospitals: Project ICARE phase 2. Project Intensive Care Antimicrobial Resistance Epidemiology (ICARE) hospitals. Clin Infect Dis 1999;29:245-52.

5. Pien BC, Sundaram P, Raoof N, Costa SF, Mirrett S, Woods CW, et al. The clinical and prognostic importance of positive blood cultures in adults. Am J Med 2010;123:819 -28.

6. Mehta M, Dutta P, Gupta V. Antimicrobial susceptibility pattern of blood isolates from a teaching hospital in north India. Jpn J Infect Dis 2005;58:174-6.

7. Kaistha N, Mehta M, Singla N, Garg R, Chander J. Neonatal septicemia isolates and resistance patterns in a tertiary care hospital of North India. J Infect Dev Ctries 2009;4:557.

8. KatoMaeda M, BautistaAlavez A, RolónMontesdeOca AL, Ramos-Hinojosa A, PoncedeLeón A, Bobadilladel Valle M, et al. Increasing trend of antimicrobial drugresistance in organisms causing bacteremia at a

tertiary care hospital: 1995 to 2000. Rev Invest Clin 2003;55:600-5.

9. Alam MS, Pillai PK, Kapur P, Pillai KK. Resistant patterns of bacteria isolated from bloodstream infections at a university hospital in Delhi. J Pharm Bioallied Sci 2011;3:525-30.

10. Ananthanarayan, R. and Paniker, C. (2013) Ananthanarayan and Paniker's Textbook of Microbiology, 9th edn. Hyderabad, India: Universities Press, pp. 49–53, pp. 661–663.

11. Collee, J., Fraser, A., Marmion, B. and Simmons, A. (1996) Mackie and McCartney Practical Medical Microbiology, 14th edn. New York: Churchill Livingstone, pp. 131–144.

12. Forbes, B., Sahm, D. and Weissfeld, A. (2014) Bailey & Scott's Diagnostic Microbiology, 13th edn. St. Louis, MO: Mosby, Inc, pp. 201–229, pp. 860–876.

13. Winm, W, Jr., Allen, S., Janda, W., Koneman, E., Schreckenberger, P., Procop, G. et al. (2006) Koneman's Colour Atlas and Text Book of Diagnostic Microbiology, 6th edn. Philadelphia, PA: Lippincott Williams & Wilkins Company, pp. 97–105.

14. Clinical and Laboratory Standards Institute (CLSI). Performance standards for antimicrobial disk susceptibility tests; approved standard–eleventh edition. Wayne, PA: CLSI; 2012. CLSI document M02-A11.

15. Prashanth, H., Dominic Saldanha, R., Shenoy, S. and Baliga, S. (2011) Predictors of mortality in adult sepsis. Int J Biol Med Res 2: 856–861.

16. Vasudeva N, Nirwan P S, Shrivastava P, Bloodstream infections and antimicrobial sensitivity patterns in a tertiary care hospital of India, Ther Adv Infectious Dis ;2016, Vol. 3(5) 119 –127.

17. Fayyaz, M., Mirza, I., Ikram, A., Hussain, A., Ghafoor, T. and Shujat, U. (2013) Pathogens causing blood stream infections and their drug susceptibility profile in immunocompromised patients. J Coll Physicians Surg Pak 23: 848–851.

18. Karlowsky, J., Jones, M., Draghi, D., Thornsberry, C., Sahm, D. and Volturo, D. (2004) Prevalence and antimicrobial susceptibilities of bacteria isolated from blood cultures of hospitalized patients in the United States in 2002. Ann Clin Microbiol Antimicrob 3: 7.

19. Karunakaran, R., Raja, N., Ng, K. and Navaratnam, P. (2007) Etiology of blood culture isolates among patients in a multidisciplinary teaching hospital in Kuala Lumpur. J Microbiol Immunol Infect 40: 432–437.

20. Aiken, A., Mturi, N., Njuguna, P., Mohammed, S., Berkley, J., Mwangi, I. et al. (2011) Risk and causes of paediatric hospital-acquired bacteraemia in Kilifi District Hospital, Kenya: a prospective cohort study. Lancet 378: 2021–2027.

21. Marshall, S., Wilke, W., Pfaller, M. and Jones, R. (1998) Staphylococcus aureus and coagulasenegative staphylococci from blood stream infections: frequency of occurrence, antimicrobial susceptibility, and molecular (mecA) characterization of oxacillin resistance in the SCOPE program. Diagn Microbiol Infect Dis 30: 205–214.

22. Kaur, A. and Singh, V. (2014) Bacterial isolates and their antibiotic sensitivity pattern in clinically suspected cases of fever of unknown origin. JK Science 16: 105–109.

23. Saghir, S., Faiz, M., Saleem, M., Younus, A. and Aziz, H. (2009) Characterization and anti-microbial susceptibility of gram-negative bacteria isolated from bloodstream infections of cancer patients on chemotherapy in Pakistan. Indian J Med Microbiol 27: 341–347.

24. Jyothi, P., Basavaraj, M. and Basavaraj, P. (2013) Bacteriological profile of neonatal septicemia and antibiotic susceptibility pattern of the isolates. J Nat Sci Biol Med 4: 306–309.

25. Zenebe, T., Kannan, S., Yilma, D. and Beyene, G. (2011) Invasive bacterial pathogens and their antibiotic susceptibility patterns in Jimma University Specialized Hospital, Jimma, Southwest Ethiopia. Ethiop J Health Sci 21: 1–8.

26. Hafsa, A., Fakruddin, M., Hakim, M. and Sharma, J. (2011) Neonatal bacteremia in a neonatal intensive care unit: analysis of causative organisms and antimicrobial susceptibility. Bangladesh J Med Sci 10: 187–192.

27. Rabirad, N., Mohammadpoor, M., Lari, A., Shojaie, A., Bayat, R. and Alebouyeh, M. (2014) Antimicrobial susceptibility patterns of the gram-negative bacteria isolated from septicemia in Children's Medical Center, Tehran, Iran. J Prev Med Hyg 55: 23–26.