

## To determine the bacterial agents responsible for hospital acquired septicemia and to determine the antibiotic sensitivity profile of the bacterial isolates

Ritu<sup>1</sup>, Shiv Shankar Prasad<sup>2\*</sup>, Hira Lal Mahto<sup>3</sup>

<sup>1</sup>Tutor, Department of Microbiology, Nalanda Medical College and Hospital, Patna, Bihar, India

<sup>2</sup>Assistant Professor, Department of Geriatric, PMCH, Patna, Bihar, India

<sup>3</sup>Professor and HOD, Department of Microbiology, Nalanda Medical College and Hospital, Patna, Bihar, India

Received: 09-10-2020 / Revised: 23-11-2020 / Accepted: 13-12-2020

### Abstract

**Aim:** To determine the bacterial agents responsible for hospital acquired septicemia and to determine the antibiotic sensitivity profile of the bacterial isolates. **Material and Methods:** This was a prospective observational study conducted in the Department of Microbiology Nalanda Medical College and Hospital, Patna, Bihar, India from Sept 2019 to March 2020. A total of 500 patients with suspected blood stream infection were included for this study. The sample collected was inoculated immediately into culture bottle containing 70 ml to Brain Heart infusion (BHI) broth. The culture bottle was incubated at 35-37°C aerobically. After 24h incubation, the sample was sub cultured on to Blood agar, MacConkey agar, Chocolate agar and special media which were suitable for isolation and identification of the species. Antimicrobial susceptibility test Antimicrobial sensitivity was determined by Kirby Bauer's disc diffusion method on Mueller Hinton agar (MHA). **Results:** A total of 500 blood samples were collected for blood culture in present study among that 90(18%) were culture positive. Out of 90 positive cultures 60(66.67%) were male while 30(33.33%) were female. The positive samples belonged to maximum from infants 46(51.11%) followed by adults 44 (48.89%). Out of 90 positive cultures, 44 (48.89%) were gram-positive, 41 (45.55%) were gram-negative and 5 (5.56%) were Candida spp. Among the 90 isolates, the most predominant organism was *Klebsiella species* 26(28.88%), followed by *Staphylococcus aureus* 16(17.78%) and the least was *Escherichia Coli* 2(2.22%). Among Gram positive sepsis, *Staphylococcus aureus* was found to be most sensitive to vancomycin (93.75%) & linezolid (93.75%) followed by amoxycylav (68.75%), amoxicillin (68.75%), tetracycline (56.25%), ciprofloxacin (56.25%) & netilmycin (50%). Low sensitivity to clindamycin (37.5%), cotrimoxazole (37.5%), gentamycin (43.75%) & least sensitive to erythromycin (12.5%), ampicillin (12.5%) and penicillin. *Klebsiella* spp. showed 88.46% sensitivity for imipenem followed by amikacin (61.54%), tetracycline (46.15%), aztreonam (42.30%), gentamycin (38.46%), netilmicin (38.46%) and ciprofloxacin (38.46%). Among the antibiotics used for susceptibility testing for gram positive isolates, vancomycin (95.24%) & linezolid (97.67%) showed highest activity. **Conclusion:** The most predominant organism was *Klebsiella species* followed by *Staphylococcus aureus*. Imipenem was the most effective drug for gram negative isolates while Vancomycin & Linezolid were most effective against gram positive isolates.

**Keywords:** blood stream infections, bacterial profile, antimicrobial susceptibility.

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

### Introduction

Blood stream infections (BSIs) are an important cause of morbidity and mortality worldwide. The condition

can be life threatening in critically ill patients in intensive care units (ICUs) of the hospitals. The case fatality rate associated with BSIs in ICU patients is between 35% - 50%. [1]

\*Correspondence

Dr. Shiv shankar Prasad,

Assistant Professor,

Department of Geriatric, PMCH, Patna, Bihar, India.

E-Mail: [drsspd123@gmail.com](mailto:drsspd123@gmail.com)

Risk factors contributing to these infections are many but leading causes are intravascular catheters (IVCs), debilitating condition of the patients due to some underlying disease/infection or invasive diagnostic or therapeutic procedures. [2,3]

Bacteremia indicates the presence of bacteria in the circulating blood; it may be transient, continuous or

intermittent.[4] Septicemia is a leading cause of morbidity and mortality in India.

Neonates are particularly vulnerable to infection (septicemia) because of their weak immune system.[5] Septicemia may present with nonspecific signs and symptoms – severe febrile episodes with fever, chills, malaise, tachycardia, mental confusion, hyperventilation, hypotension or shock.[6] Various conditions in which bacteria are present in the blood stream include manipulation of infected tissues, instrumentation of contaminated mucosal surfaces, bacterial endocarditis, typhoid fever, undrained abscesses, meningitis, pneumonia etc. causing significant septicemia.[7] Septicemia is caused either by a single type of organism or it may be caused by multiple species of bacteria. Recent literature suggests that the incidence of polymicrobial bacteremia is increasing. Blood culture remains the gold standard for the diagnosis of septicemia.[8,9] The vascular compartment is sterile and usually intact. Microbes gain entry from breakages of blood vessels adjacent to skin or mucous surfaces or by phagocytic cells carrying organisms into capillaries or the lymphatic system. Gram-negative lipids (endotoxins) or Gram-positive toxins initiate a cascade of events involving cytokines, interleukin 2, vascular mediators and platelets leading to hypotension. This process becomes irreversible and produces failure of all major organs so sepsis is life threatening emergency that demands urgent diagnosis and treatment. High rate of antibiotic resistance against bacterial pathogen has worsened the situation. Detection of causative organisms and their antibiotic susceptibility is crucial for diagnosis of sepsis in order to initiate the appropriate antibiotic treatment therapy which reduces the adverse effects of antibiotic treatment on patient prognosis; hence we had done study to identify most common organisms and its sensitivity pattern in our hospital. This study was conducted to identify the bacteriological profile and their antibiotic susceptibility patterns from blood culture in a tertiary care hospital to guide clinicians to initiate empiric antibiotic therapy and to formulate antibiotic policy.

### Material and methods

This was a prospective observational study conducted in the Department of Microbiology Nalanda Medical College and Hospital, Patna, Bihar, India from Sept 2019 to March 2020. after taking the approval of the protocol review committee and institutional ethics committee.

### Methodology

A total of 500 patients with suspected blood stream infection from various OPDs, IPDs and ICUs in the hospital regardless to their age, sex, occupation, were included for this study. 10-20 ml of blood was drawn in case of adult and 2 to 5ml in children in aseptic condition. The sample collected was inoculated immediately into culture bottle containing 70 ml to Brain Heart infusion (BHI) broth with 0.05% Sodium Polyanethol Sulfonate (SPS) as anticoagulant in adult and 20 ml of BHI broth with 0.05% SPS in children with utmost precaution and aseptic procedure. The culture bottle was incubated at 35-37°C aerobically. After 24h incubation, the sample was sub cultured on to Blood agar, MacConkey agar, Chocolate agar and special media which were suitable for isolation and identification of the species. The plates incubated for 18-24 hours at 35-37°C in the incubator. If no growth observed on plate by next day subculture were repeated on day 3, day4 and finally on day 7. Isolation and identification of organisms was done by using standard microbial procedure by colony character, gram staining, motility testing and standard biochemical test. Antimicrobial susceptibility test was determined by Kirby Bauer's disc diffusion method on Mueller Hinton agar (MHA) as per CLSI guidelines.[10] Antibiotic discs used for sensitivity testing were amikacin, ampicillin, Amoxicillin + Clavulanic acid, Aztreonam, Cefepime, Cefoperazone, Cefotaxime, Cefoxitin, Ceftazidime, Ceftriaxone, Chloramphenicol, Ciprofloxacin, Cotrimoxazole, Erythromycin, Gentamicin, Imipenem, Linezolid, Netilmicin, Ofloxacin, Penicillin-G, Piperacillin, Tetracycline, Vancomycin.

### Results

A total of 500 blood samples were collected for blood culture in present study among that 90(18%) were culture positive. Out of 90 positive cultures 60(66.67%) were male while 30(33.33%) were female. The positive samples belonged to maximum from infants 46(51.11%) followed by adults 44 (48.89%). Out of 90 positive cultures, 44 (48.89%) were gram-positive, 41 (45.55%) were gram-negative and 5 (5.56%) were *Candida* spp. Among the 90 isolates, the most predominant organism was *Klebsiella species*26(28.88%), followed by *Staphylococcus aureus*16(17.78%) and the least was *Escherichia Coli*2(2.22%) (Table 1)

Among Gram positive sepsis, *Staphylococcus aureus* was found to be most sensitive to vancomycin (93.75%) & linezolid (93.75%) followed by amoxycylav (68.75%), Amoxacillin (68.75%), tetracycline

(56.25%), ciprofloxacin (56.25%) & netilmicin (50%). Low sensitivity to clindamycin (37.5%), cotrimoxazole (37.5%), gentamycin (43.75%) & least sensitive to erythromycin (12.5%), ampicillin (12.5%) and penicillin. (Table 2). *Klebsiella* spp. showed 88.46% sensitivity for imipenem followed by amikacin (61.54%), tetracycline (46.15%), aztreonam (42.30%), gentamycin (38.46%), netilmicin (38.46%) and

ciprofloxacin (38.46%).table.3 Imipenem showed 87.5% efficacy against the *Pseudomonas aeruginosa*. Among the antibiotics used for susceptibility testing for gram positive isolates, vancomycin (95.24%) & linezolid (97.67%) showed highest activity. The antibiotic sensitivity patterns of GPC are shown in Table 2 and those of GNB are shown in Table 3.

**Table 1: Distribution of Isolates**

Organism	Number	Percentage
<i>Klebsiella species</i>	26	28.88
<i>Staphylococcus aureus</i>	16	17.78
CoNS	13	14.44
<i>Enterococcus species</i>	13	14.44
<i>Pseudomonas aeruginosa</i>	8	8.88
<i>Citrobacterfreundii</i>	5	5.55
<i>Candida species</i>	5	5.55
<i>Streptococcus viridians</i>	2	2.22
<i>Escherichia Coli</i>	2	2.22
Total	90	100%

**Table 2: Antibiotic sensitively pattern of Gram positive organism**

Organism		AMP	P	AMC	CIP	TE	GEN	NET	E	LZ	OX	VA	COT	CX	CD
<i>Staphylococcus aureus</i> (n=16)	No	2	0	11	9	9	7	8	2	15	11	15	6	10	6
	%	12.5	0	68.75	56.25	56.25	43.75	50	12.5	93.75	68.75	93.75	37.5	64.28	37.5
CoNS (n=13)	No	2	0	10	8	10	9	9	6	13	10	13	4	9	6
	%	15.38	0	76.92	61.54	76.92	69.23	69.23	46.15	100	76.92	100	30.77	69.23	46.15
<i>Enterococcus species</i> (n=13)	No	3	0	8	3	6	6	7	4	13	5	12	4	5	4
	%	23.08	0	61.54	23.08	46.15	46.15	53.85	30.77	100	38.46	92.30	30.77	35.46	30.77

**Table 3: Antibiotic sensitive pattern of Gram negative organisms**

Organism	No	AMP	P	AMC	CIP	CTX	CAZ	CFM	CTR	CPZ	CPM	AT	IMP	TE	GEN	NET	AK	PI
<i>Klebsiella spices</i> (n=26)	No	0	8	10	7	5	7	7	5	0	9	11	23	12	10	10	16	Na
	%	0	30.77	38.46	26.92	19.23	26.92	19.23	0	34.61	42.30	88.46	46.15	38.46	38.46	61.54	-	-
<i>Pseudomonas aeruginosa</i> (n=8)	No	2	2	6	3	4	Na	2	Na	3	4	7	2	4	Na	5	6	Na
	%	25	25	75	37.5	50	-	25	-	37.5	50	87.5	25	50	-	62.5	75	-
<i>Citrobacterfreundii</i> (n=5)	No	0	3	4	2	2	2	2	0	3	3	5	5	4	5	5	5	Na
	%	0	60	80	40	40	40	40	0	60	60	100	100	80	100	100	100	-
<i>E. coli</i> (n=2)	No	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	Na
	%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	-

Septicemia is a leading cause of morbidity and mortality in India. Sepsis remains the most important cause of multi-organ dysfunction syndrome (MODS) all over the world. Septicemia remains a major and challenging clinical problem throughout the world. Blood stream infections range from transient bacteremia to septic shock. Blood culture is a gold standard for accurate detection of etiological agents of infectious diseases and can assist in choice of appropriate antimicrobial therapy. Furthermore, early

detection of bloodstream infections could prevent implantation of microorganisms into vital organs such as brain, heart or kidneys. In this study the isolation rate of blood culture positive cases was 18% which is similar to studies conducted by Mehta MP et al.[11] Qureshi M et al.[12] and A. Vijaya Devi et al.[13] who reported a culture positive rate of 16.4% and 16.6% and 16.8% respectively. The low rate of isolation may be explained by the fact that many of the patients probably received antibiotic therapy before they came to the

tertiary care hospital. However Khanal et al.[14] and Sharma P Petal.[15] reported high frequency of positive blood cultures accounting for 44%, 33.9% and 20.2% respectively whereas studies by Anbumani et al.[16] and Arora U et al.[17] reported lower frequency of positive blood cultures accounting for 7.89% and 9.94%, respectively. In this study, men had high culture positivity as compared with women i.e 60(66.67% male and 30 (33.33) % were female) The result was consistent with the study done by Vanitha Rani et al.[18] who reported high culture positivity 60.2% in male & 36.7% in female. A similar study was done by Kaur and Singh[19] who reported high culture positivity in 65.22% men. However, Zenebe et al.[20] reported more high culture positivity in women, 59.2% than men, 40.8%, in their study. The reason for this difference is because of gender bias. Secondly, it may be due to more male newborns being admitted in NICU as they are more prone to neonatal septicemia as compared to female newborns.[21] In this study we found that most of the blood culture positive cases were from infant 46 (51.11%) than other age groups were 44 (48.89%). This is in accordance with study conducted by Ayobola et al.[22] & Bichitranda S et al.[23] who reported culture positivity in infants up to 58.3% and 50% respectively. The high rate of isolation from infants may be due to their weak immune system as compared to adults & most infants take medication by means of intravascular devices that may easily introduce bacteria into their blood stream. In this study we found that the rate of isolation of Gram positive bacteria was higher (48.89%) than Gram negative bacteria (45.55%) which are consistent with the studies conducted by various authors.[24-27] We found that most common organism isolated in our study was *Klebsiella species* (28.88%). It is predominant in all age groups being highest in infants. This observation is in concordance with other studies conducted by Rathod SD et al.[28], Mustafa et al.[29] and Oza SS et al.[30] The second most common isolate overall and most common Gram Positive Cocci was *Staphylococcus aureus* (17.78%), again similar results were reported from studies done by Kumar G Detal. (24%) [31], Mehta et al.(13.86%)[11], Mustafa et al. (24%)[29] and S. Oza Sweta et al.[30]

In our study, *Coagulase Negative Staphylo cocci* (CoNS) were recovered at a frequency of 14.44%. This is in agreement with studies conducted by Pavani G et al. [32] (23%), Sharma R et al. (13.3%)[33], Oza SS et al. (20.2%).[30] However Kante M et al.[34] had reported very low occurrence of CoNS 7.1% & 5.6% respectively. This variation in occurrence of CoNS as blood pathogen is due to fact that they are considered

as most common skin commensal and their presence in blood may be result of contamination due to non follow of proper aseptic technique of blood collection. However, there are many studies suggesting that there is increase in occurrence of CoNS as true blood pathogen due to increase use of intravascular devices.<sup>35,36</sup> Antibiotic sensitivity pattern of micro-organisms is always changing. Earlier it was observed gentamycin sensitivity in 80% cases of *Klebsiella sepsis* but today it is no cases due to development of resistance to gentamycin. In past, penicillin was effective for gram positive organisms but now days they are usually not effective for such micro organisms. In this study, among the antibiotics used for susceptibility testing for gram positive isolates, vancomycin (95.24%) & linezolid (97.67%) showed highest activity. This correlates with other studies conducted by Mehta M. et al[11] Sharma M et al[37] ,Atul G et al[38], Mustafa M et al[29]. Among Gram positive sepsis, *Staphylococcus aureus* was found to be most sensitive to vancomycin (93.75%) & linezolid (93.75%) followed by amoxyclav (68.75%), oxacillin (68.75%), tetracycline(56.25%), ciprofloxacin (56.25%) & netilmycin (50%).

Low sensitivity to clindamycin(37.5%), cotrimoxazole (37.5%), gentamycin (43.75%) & least sensitive to erythromycin (12.5%), ampicillin (12.5%) and penicillin. This high level of resistance to commonly used antibiotics is comparable with Sharma R et al [33]. Rani V et al[18], Rathod S et al[28]. In this study we found that among the Gram negative isolates imipenem showed the highest sensitivity (85.36%) which is consistent with the studies conducted by Rathod SD et al[28] and Mustafa M et al[29] who also showed imipenem as most effective drug for Gram negative *bacilli*.

### Conclusion

The most predominant organism was *Klebsiella species* followed by *Staphylococcus aureus*. Imipenem was the most effective drug for gram negative isolates while Vancomycin & Linezolid were most effective against gram positive isolates. As the resistant rate of an antibiotic for bloodstream pathogens is increasing, continuous monitoring of the susceptibility of the organism towards antibiotics has become mandatory, in order to avoid the inappropriate use of the antibiotics.

### References

1. Russotto V et al. Bloodstream infections in intensive care unit patients: distribution and antibiotic resistance of bacteria. Infection and Drug Resistance. 2015; vol 8; 287-96

2. Mathur P, Varghese P, Tak V. Epidemiology of Blood Stream Infections at a Level-1 Trauma Care Center of India. *J Lab Physicians*. 2014;6(1):22–27.
3. Passerini R, Ghezzi T, Sandri M, Radice D, Biffi R. Tenyear surveillance of nosocomial bloodstream infections: Trends of aetiology and antimicrobial resistance in comprehensive cancer centre. *E cancer medical science*. 2011;5:191.
4. Ntusi N, Aubin L, Oliver S, Whitelaw A, Mendelson M. Guideline for the optimal use of blood cultures. *S Afr Med J*. 2010;100(12):839–843.
5. Katiyar R, Bose S. Bacteriological Profile of Neonatal Septicemia in Pravara Rural Hospital. *Pravara Med Rev*. 2012;4(2).
6. Komolafe AO, Adegoke AA. Incidence of bacterial Septicaemia in Ile-Ife Metropolis Nigeria. *Malaysian J Microbiol*. 2008;4(2):51–61.
7. Forbes BA, Sahn DF, Weissfeld AS. Bloodstream infection. *Mosby Elsevier*; 2014,. p. 860–877.
8. B SRC. Infective syndromes. In: David Greenwood, Richard Slack John Pentheser. In: *Medical Microbiology- A guide to microbial infections*. Oxford: Churchill Livingstone; 2007,. p. 656–666.
9. Towne AR, Gay RM. Evaluation of the Efficacy of Reincubation and Subsequent Subculture of Initially Positive Blood Cultures in the Detection of Additional Clinically Significant Isolates. *J ClinMicrobiol*. 1985;20(2):155–157.
10. CLSI - Clinical and Laboratory Standards Institute 2015. Performance standards for antimicrobial susceptibility testing. Twenty-second informational supplement. Wayne, PA, USA. CLSI,2015.
11. Mehta M, Pyria D, Varsha G. Antimicrobial susceptibility pattern of blood isolates from a teaching Hospital in north India. *Japan J Infec Dis*. 2005;58:174-176.
12. Qureshi M, Aziz F. Prevalence of microbial isolates in blood culture and their antimicrobial susceptibility profile. *Biomedica*. 2011;27:136-39.
13. Vijaya Devi A, Sahoo B, Damrolien S, Praveen SH, Lungran P, Ksh Mamta Devi. A Study on the Bacterial Profile of Bloodstream Infections in Rims Hospital. (*IOSR-JDMS*). 2015;14(1):18-23.
14. Khanal B, Harish BN, Sethuraman KR, Srinivasan S. Infective endocarditis: Report of prospective study in an Indian Hospital. *Trop Doct* 2002;32:83-85.
15. Sharma PP, Halder D, Dutta AK. Bacteriological profile of neonatal septicemia. *Ind. Pediatr*. 1987;24:1011-1017.
16. Anbumani N, Kalyani J, Mallika M. Original research distribution and antimicrobial susceptibility of bacteria isolated from blood cultures of hospitalized patients in a tertiary care hospital. *Indian Journal for the practicing doctor* 2008; 5(2):98
17. Arora U, Devi P. Bacterial profile of blood stream infections and antibiotic resistance pattern of isolates. *J KSci*. 2007;9:186-190.
18. Vanitha Rani N, Kannan G, Venkata Narendra M, et al. A retrospective study on blood stream infections and antibiotic susceptibility patterns in a tertiary care teaching hospital. *Int. J Pharm Pharm Sci*. 2012;4:543-8.
19. Kaur A, Singh V. Bacterial isolates and their antibiotic sensitivity pattern in clinically suspected cases of fever of unknown origin. *JK Science*. 2014;16:105-109.
20. Zenebe T, Kannan S, Yilma D, Beyene G. Invasive bacterial pathogens and their antibiotic susceptibility patterns in Jimma University Specialized Hospital, Jimma, Southwest Ethiopia. *Ethiop J Health Sci*. 2011; 21:1-8.
21. Clinical and Laboratory Standards Institute. Performance Standard for Antimicrobial Susceptibility Testing, Twenty fifth informational supplement. M100-S25,2015.
22. Ayobola ED, Egbule OS, Omonigho O. Study of Prevalence and antimicrobial Susceptibility of Blood Culture Bacterial Isolates *Malaysian Journal of Microbiology*. 2011;7(2)78-82.
23. Bchitrnanda swain, Sarita Otta. Blood stream infection in teaching hospital, *annals of biological research*. 2012; 3(4):1923-1928
24. Usha Arora, Pushpa Devi. Bacterial Profile of Blood Stream Infections and Antibiotic Resistance Pattern of Isolates *JK Science*. 2007;9:4.
25. Mehdinejad M, Khosravi AD, Morvaridi A. Study of prevalence and antimicrobial susceptibility pattern of bacteria isolated from blood cultures. *Journal of Biological Sciences*. 2009;9(3):249-253.
26. Kamga HLF, Njunda AL, Nde PF. Prevalence of septicemia and antibiotic sensitivity pattern of bacterial isolates at the University Teaching Hospital, Yaoundae, Cameroon. *African Journal of Clinical and Experimental Microbiology*. 2011;12(1):2-8.
27. Araya GebreyesusWasihun. Bacteriological profile and antimicrobial susceptibility patterns of blood culture isolates among febrile patients in

- MekelleHospital, Northern Ethiopia. Springer Plus. 2015;4:314.
28. Sanjay D Rathod, Palak V Bhatia, Parimal H Patel, Jayshri D Pethani, Lata R Patel, Bimal Chauhan. Bacteriological analysis and resistance pattern among various culture isolates from neonatal septicemia at tertiary care hospital of Ahmedabad. National Journal of Medical Research. 2012; 2(4):466-469.
  29. Maimoona Mustafa, Syed Laeeq Ahmed. Bacteriological profile and antibiotic susceptibility patterns in neonatal septicemia in view of emerging drug resistance J Med Allied Sci. 2014;4(1):2-8.
  30. OzaSweta S, Mehta Sanjay J, KunjanKikani M, Oza Sunil G. Bacteriological profile and antibiogram of blood culture isolates from patients of rural tertiary care hospital. IJMM. 2016;4(3):1-7
  31. Ghanshyam D Kumhar, Ramachandran VG, Piyush Gupta. Bacteriological Analysis of Blood Culture Isolates from Neonates in a Tertiary Care Hospital in India J. Health Popul Nutr. 2002; 20(4):343-347.
  32. GandhamPavani, Dr. Vani MadhaviKommula, Dr. Jyothi Lakshmi, Mudaliar G. Bacteriological Profile and Multidrug Resistance Patterns of Blood Culture Isolates in a Teaching Hospital in South India NJIRM. 2012; 3(3):55-59.
  33. Sharma R, Sharma R, Gupta S. Bacteriological Analysis of Blood Culture Isolates with their Antibiogram from a Tertiary Care Hospital. Int J Pharm Sci. Res. 2015; 6(11): 4847-51. doi: 10.13040/IJPSR.0975-8232.6(11).4847-51.
  34. Kante M, Uma P, John MS, Naidu MP. Bacterial profile of blood stream infections and antibiotic susceptibility pattern of isolates. International Journal of Current Microbiology and Applied Sciences. 2014; 3(12):222- 233.
  35. Khatua SP, Das AK, Chaterjee BD, Ghose B, Saha A, Khatua S. Neonatal septicemia. Ind. J ped. 1986; 53:509- 514.
  36. Nataro JP, Corcoran L, Ziris S, et al. Prospective analysis of coagulase-negative staphylococcal infection in hospitalized infants. J Pediatr. 1994; 125:798-804.
  37. Sharma M, Goel N, Chaudhary U, Aggarwal R, Arora DR. Bacteraemia in children. Indian J Pediatr. 2002; 69(12):1029-32.
  38. Garg A, Anupurba S, Garg J, Goyal RK, Sen MR. Bacteriological profile and antimicrobial resistance of blood culture isolates from a university hospital. Journal Indian Academy of Clinical Medicine. 2007; 8(2):139-43.

**Conflict of Interest: Nil**

**Source of support:Nil**