ORIGINAL RESEARCH

To evaluate the bacteriological profile and antibiotic sensitivity pattern of isolates from blood culture

Dr. Pratibha Sharma[1],Dr. Ranganath T Ganga[2]

[1]MD Microbiology, Assistant professor, Sri Balaji Institute of Medical Sciences, Mowa, Raipur
[2]MD, FAPSR, Associate Professor, Dept. of Pulmonary Medicine AIIMS Raipur

Corresponding author: Dr. Ranganath T Ganga,MD FAPSR

ABSTRACT

Aims: To evaluate the bacteriological profile and antibiotic sensitivity pattern of isolates from blood culture.

Methods: In all, 610 patients with a suspected blood stream infection were recruited for this research from the different OPDs, IPDs, and ICUs located within the hospital. Standard microbiological procedures, including colony character, gram staining, motility testing, and standard biochemical tests, were used throughout the process of isolating and identifying the organisms. Antimicrobial susceptibility test Kirby Bauer's disc diffusion technique was used on Mueller Hinton agar (MHA) in accordance with the recommendations provided by the CLSI to test antimicrobial sensitivity.

Results: During the course of this investigation, a total of 610 blood samples were obtained for the purpose of blood culture; of them, 120 (19.67 percent) were culture positive. From a total of 120 positive cultures, 49 were gram-positive bacteria (40.83 percent), 64 were gram-negative bacteria (53.33 percent), and 7 were *Candida spp*. *Klebsiella species*, which accounted for 36.37 percent of the total 120 isolates, was the most prevalent organism, followed by *Staphylococcus aureus*, which accounted for 18.33 percent, and *Escherichia coli*, which accounted for 2.5 percent of the total. Vancomycin (90.91 percent) and linezolid (90.91 percent) exhibited the greatest activity when compared to the other antibiotics that were utilised for susceptibility testing for gram-positive isolates.

Conclusion:*Klebsiella species* was the most prevalent organism, followed by *Staphylococcusaureus* as the second most prevalent organism. Imipenem was the medicine that was shown to be the most effective against gram-negative bacteria, while Vancomycin and Linezolid were found to be the most effective against gram-positive bacteria.

Keywords: blood stream infections, bacterial profile, antimicrobial susceptibility

Introduction

The presence of bacteria or their toxins in the bloodstream is what medical professionals refer to as septicemia.[1]Bacteremia describes the condition in which there is bacteria present in the bloodstream; this condition might be temporary, constant, or intermittent. [2] Sepsis is a body’s extreme response to an infection ,sepsis happens when an infection you already have triggers a chain reaction throughout your bodyand it is the greatest cause of death and illness across all age groups in India. Because of their immature immune systems, newborn infants are at an increased risk of contracting an infection (septicemia).[3]Septicemia may manifest itself with signs and symptoms that are not unique to the condition. These can include severe febrile episodes characterised by fever, chills, malaise, tachycardia, mental disorientation, hyperventilation, hypotension, or shock. [4] The presence of bacteria in the bloodstream can be caused by a number of different conditions, such as the manipulation of infected tissues, the instrumentation of contaminated mucosal surfaces, bacterial endocarditis, typhoid fever, undrained abscesses, meningitis, pneumonia, and other conditions. These conditions can lead to significant septicemia.[5]It is possible for septicemia to be caused by a single species of organism or it may be caused by many different species of bacteria. According to the most recent research in this field, the prevalence of polymicrobialbacteremia seems to be rising. When it comes to diagnosing septicemia, blood culture is still considered the gold standard. [6, 7]the vascular compartment is often uncontaminated and unaltered in appearance. Microbes may enter the body via breaks in blood vessels that are close to the skin or mucous membranes, or they can be carried in by phagocytic cells that enter the body through the capillaries or lymphatic system. Gram-negative lipids, also known as endotoxins, or Gram-positive toxins may set off a chain reaction that leads to hypotension. This chain reaction involves cytokines, interleukin-2, vascular mediators, and platelets. Due to the fact that this process is irreversible and results in the failure of all of the main organs, sepsis is a life-threatening emergency that requires prompt diagnosis and treatment. The high prevalence of antibiotic resistance in bacteria that causes disease has made the situation much worse. The infection known as septicemia may be brought on by a single kind of microorganism or by a combination of several bacterial species because the antibiotics to which they are susceptible is essential for the diagnosis of sepsis in order to initiate the appropriate antibiotic treatment therapy, which reduces the adverse effects of antibiotic treatment on patient prognosis, we conducted a study to determine which organisms are the most common in our hospital and how their sensitivity patterns differ. This study was conducted to identify the bacteriological profile and their antibiotic susceptibility patterns from blood culture in a tertiary care hospital in order to guide clinicians to initiate empiric antibiotic therapy and to formulate antibiotic policy. The study was carried out in order to identify the bacteriological profile and their antibiotic susceptibility patterns.

Material and procedures

After receiving permission from the department's protocol review committee as well as the institution's ethics committee, this investigation was a prospective observational research that was carried out at the department in question. In all, there were 120 anaemic individuals that participated in the trial.In all, 610 patients with a suspected blood stream infection were recruited for this research from the different OPDs, IPDs, and ICUs located within the hospital. Patients were recruited for this study regardless of their age, sex, or employment. Under aseptic conditions, 10 to 20 ml of blood was collected from adults, but only 2 to 5 ml was taken from children. The sample that was collected was immediately inoculated into a culture bottle containing 70 ml of Brain Heart infusion (BHI) broth containing 0.05 percent Sodium PolyanetholSulfonate (SPS) as an anticoagulant in adult patients, and 20 ml of BHI broth containing 0.05 percent SPS in paediatric patients, using the utmost caution and an aseptic procedure. The vial containing the culture was aerobically incubated between 35 and 37 degrees Celsius. Following an incubation period of 24hr or 48 hr depending upon when the media became turbid the sample was subcultured on Blood agar, MacConkey agar, Chocolate agar, and other specialised media that were appropriate for the isolating and identifying of the species. In the incubator, the plates were kept at a temperature of 35-37 degrees Fahrenheit for 18-24 hours. If there was no sign of development on the plate by the next day, the subculture was carried out once again on days 3, 4, and ultimately day 7. Standard microbiological procedures, including colony characteristics, gram staining, motility testing, and standard biochemical tests, were used throughout the process of isolating and identifying the organisms. Antimicrobial susceptibility test Kirby Bauer's disc diffusion technique was used on Mueller Hinton agar (MHA) in accordance with the recommendations provided by the CLSI to test antimicrobial sensitivity. The following 10 antibiotic discs were used for sensitivity testing: amikacin, ampicillin, amoxycillin with clavulanic acid, aztreonam, cefepime, cefoperazone, cefotaxime, cefoxitin, ceftazidime, ceftriaxone, chloramphenicol, ciprofloxacin, cotrimoxazole, erythromycin, gentamicin, imipenem.

Results

During the course of this investigation, a total of 610 blood samples were obtained for the purpose of blood culture; of them, 120 (19.67 percent) were culture positive. There were a total of 120 positive cultures. The highest proportion of positive samples came from children less than one year old (52 percent), followed by adults (48 percent). 75 (62.5%)were male while 45 (37.5%) were female patient.From a total of 120 positive cultures, 49 were gram-positive bacteria (40.83 percent), 64 were gram-negative bacteria (53.33 percent), and 7 were *Candida spp*. *Klebsiella species*, which accounted for 36.37 percent of the total 120 isolates, was the most prevalent organism, followed by *Staphylococcus aureus*, which accounted for 18.33 percent, and *Escherichia coli*, which accounted for 2.5 percent of the total (Table 1)

Staphylococcus aureus was shown to be sensitive to vancomycin in (90.91) and linezolid to (90.91) among Gram-positive sepsis, followed by amoxyclav (68.18 percent), Amoxacillin (68.18 percent), tetracycline (54.54 percent), ciprofloxacin (54.54 percent), and netilmycin) (50 percent). Very low sensitivity to erythromycin (13.64 percent), ampicillin (13.64 percent), and penicillin. Low sensitivity to clindamycin (36.36 percent), cotrimoxazole (36.36 percent), and gentamicin (45.45 percent).Imipenem was the antibiotic that exhibited the highest maximum level of sensitivity (86.36 percent) for *Klebsiella spp*., followed by amikacin (59.09 percent), tetracycline (40.91 percent), aztreonam (38.64 percent), gentamicin (34.09 percent), netilmicin (34.09 percent), and ciprofloxacin (34.09 percent). Table.3 The effectiveness of imipenem against *Pseudomonas aeruginosa* was shown to be 90 percent. Vancomycin (90.91 percent) and linezolid (90.91 percent) exhibited the greatest activity when compared to the other antibiotics that were utilised for susceptibility testing for gram-positive isolates. Table 2 presents the antibiotic sensitivity patterns of GPC, whereas Table 3 presents the same information for GNB.

Table 1: Distribution of Isolates

Organism	Number	Percentage
Klebsiella species	44	36.37
Staphylococcus aureus	22	18.33
CONS	12	10
Enterococcus species	10	8.33
Pseudomonas aeruginosa	10	8.33
Citrobacterfreundii	7	5.83
Candida species	7	5.83
Streptococcus viridians	5	4.17
Escherichia Coli	3	2.5
Total	120	100%

Table 2: Antibiotic sensitively pattern of Gram positiveorganism

Organism		AMP	P	AMC	CIP	TE	GEN	NET	E	LZ	OX	VA	COT	CX	CD
Staphylococcus aureus (n=22)	No	3	0	15	12	12	10	11	3	20	15	20	8	14	8
	%	13.64	0	68.18	54.54	54.55	45.45	50	13.64	90.91	68.18	90.91	36.36	63.64	36.36
CoNS (n=12)	No	3	0	9	7	9	8	8	6	12	9	12	4	8	6
	%	25	0	75	58.33	75	66.67	66.67	50	100	75	100	25	66.67	50
Enterococcus species (n=10)	No	3	0	6	3	5	5	6	3	10	4	9	3	4	3
	%	30	0	60	30	50	50	6	30	100	40	90	30	40	30

Table 3: Antibiotic sensitive pattern of Gram negativeorganisms

Organism	No	AMP	AMC	CIP	CTX	CAZ	CFM	CTR	CPZ	CPM	AT	IMP	TE	GEN	NET	AK	PI
Klebsiella spices (n=44)	No	0	13	15	11	9	11	9	0	14	17	38	18	15	15	26	Na
	%	0	29.55	34.09	25	20.45	25	20.45	0	31.82	38.64	86.36	40.91	34.09	34.09	59.09	-
Pseudomonas aeruginosa (n=10)	No	3	3	7	3	5	Na	3	Na	4	5	9	3	5	Na	6	8
	%	30	30	70	30	50	-	30	-	40	50	90	30	50	-	60	80
Citrobacterfreundii (n=7	No	0	4	5	3	3	3	3	0	4	4	7	7	5	7	7	Na
	%	0	57.14	71.43	42.86	42.86	42.86	42.86	0	57.14	57.14	100	100	71.43	100	100	-
E. coli (n=3	No	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	Na
	%	0	0	0	0	0	0	O	0	0	0	0	0	0	0	100	-

Discussion

Infections in the blood stream may vary from temporary bacteremia to life-threatening septic shock. Blood culture is the gold standard for precise identification of etiological agents of infectious illnesses and may help in the choice of antimicrobial treatment that is suitable. In addition, early diagnosis of bloodstream infections has the potential to avoid the implantation of bacteria into important organs including the brain, heart, or kidneys. This study reported an isolation rate of blood culture positive cases that was 18.18 percent, which is comparable to studies that were carried out by Mehta MP et al.[11], Qureshi M et al.[12], and A. Vijaya Devi et al.[13], who each reported a culture positive rate of 16.4 percent, 16.6 percent, and 16.8 percent respectively. It's possible that the low percentage of patients being placed in isolation might be attributed to the fact that many of the patients had already been treated with antibiotics before coming to the tertiary care hospital. However, studies conducted by Khanal et al.[14] and Sharma PP et al.[15] reported a high frequency of positive blood cultures, accounting for 44 percent, 33.9 percent, and 20.2 percent respectively. Studies conducted by Anbumani et al.[16] and Arora U et al.[17] reported a lower frequency of positive blood cultures, accounting for 7.89 percent and 9.94 percent respectively. According to the findings of this research, males exhibited a higher level of cultural positively than women did, which (65 percent male and 35 percent were female) This conclusion was in line with the findings of a research carried out by Vanitha Rani and her colleagues18, who found a high level of cultural positive among male participants (60.2%), but only 36.7 % among female participants. Kaur and Singh[19] conducted a research that was quite similar to this one, and they found that 65.22 percent of males had a high cultural positivity. In contrast, Zenebeet al.[20] found that women had a higher level of high cultural positive than males (40.8 percentvs 59.2 percent) in their research. The discrimination against females is the root cause of this discrepancy. The second possible explanation is that more male babies, who are more likely to have neonatal septicemia than female newborns, are being hospitalised to the neonatal intensive care unit (NICU). [21] The majority of the blood culture positive cases, which comprised 54.17 percent of the total, were discovered to originate from infants aged 65, as opposed to other age groups who were 55. (45.83 percent). This is in line with the findings of a research that was carried out by Ayobolaet al.[22] and another that was carried out by Bichitrananda S et al.[23], both of which found culture positive in babies at up to 58.3 percent and 50 percent, respectively. The high rate of isolation from infants may be because their immune systems are not as strong as those of adults, and the majority of infants take their medication by means of intravascular devices, which can easily introduce bacteria into their blood stream. This may also contribute to the high rate of isolation from infants.

The results of this investigation showed that the rate of isolating Gram-negative bacteria was much greater (53.33 percent) than the rate of isolating Gram-positive bacteria (40.83 percent). These findings are in line with the research carried out by a variety of authors.

[24-27], we observed that the most often isolated bacterium in our investigation was a member of the *Klebsiella* genus 44. (36.37 percent). It is prevalent across the board, with the greatest prevalence seen in babies. This finding is consistent with the findings of earlier investigations carried out by Sanjay D. Rathod[28], Mustafa et al.[29], and S. OzaSweta et al.[30]. *Staphylococcusaureus* was the most frequent Gram-positive cocci and the second most common isolate overall. Again, comparable findings were observed from investigations carried out by Ghanshyam D. Kumar et al. (24 percent)[31] and Mehta et al (13.86 percent)11, Mustafa et al. (24 percent)[29] and S. OzaSweta et al.[30]

Coagulase Negative Staphylococci(CoNS) were found to be present at a frequency of 10% over the course of our research. Studies carried out by GandhamPavani et al. [32] (23 percent), R. Sharma et al. (13.3 percent)[33], and S. Ozasweta et al. are in accord with this finding (20.2 percent). [30]MeenakshiKanteet al.[34], on the other hand, observed an exceptionally low incidence of *CoNS*, with just 7.1 percent and 5.6 percent, respectively. This variation in the occurrence of *CoNS* as a blood pathogen is due to the fact that they are considered to be the most common skin commensal, and their presence in blood may be the result of contamination due to the non-following of proper aseptic technique when blood is collected. This variation in the occurrence of *CoNS* as a blood pathogen is due to the fact that they are considered to be the However, a large number of research point to the increased usage of intravascular devices as the likely cause of the rise in the incidence of *CONS* as a real blood pathogen. [35,36]The pattern of antibiotic sensitivity shown by microorganisms is constantly shifting. In the past, gentamicin sensitivity was reported in 80 percent of cases of *Klebsiellasepsis*; however, owing to the development of resistance to gentamicin, this no longer occurs in any

instances. In the past, penicillin was efficient against gram-positive organisms. These days, however, antibiotics like penicillin are often ineffective against such microorganisms.
Vancomycin (90.91 percent) and linezolid (90.91 percent) demonstrated the greatest activity among the antibiotics that were employed in this investigation to examine the sensitivity of gram-positive isolates to various antibiotics.
This is consistent with the findings of earlier research projects carried out by Mehta M. et al.[11], Sharma M. et al.[37], Atul G. et al.[38], and Mustafa M. et al.[29]. *Staphylococcus aureus* was shown to be the most responsive to vancomycin (90.91) and linezolid (90.91) among Gram-positive sepsis, followed by amoxyclav (68.18 percent), Amoxacillin (68.18 percent), tetracycline (54.54 percent), ciprofloxacin (54.54 percent), and netilmycin (54.54 percent) (50 percent). Very low sensitivity to erythromycin (13.64 percent), ampicillin (13.64 percent), and penicillin.Low sensitivity to clindamycin (36.36 percent), cotrimoxazole (36.36 percent), and gentamycin (45.45 percent) (0 percent). This high degree of resistance to antibiotics that are often prescribed is on par with that seen in studies conducted by R. Sharma et al.,[33]Vanitha Rani et al.[18], and S. Rathod et al.[28]. In this study, we discovered that among the Gram-negative isolates, imipenem showed the highest sensitivity (84.37 percent), which is consistent with the findings of the studies carried out by Sanjay D Rathodet al.[28] and Mustafa M et al.[29], both of which showed imipenem to be the most effective drug for Gram-negative bacilli.

Conclusion

Klebsiella species was the most prevalent organism, followed by *Staphylococcus aureus* as the second most prevalent organism. Imipenem was the medicine that was shown to be the most effective against gram-negative bacteria, while Vancomycin and Linezolid were found to be the most effective against gram-positive bacteria. Continuous monitoring of an organism's susceptibility to antibiotics has become mandatory in order to avoid the inappropriate use of antibiotics as the rate of antibiotic resistance for bloodstream pathogens continues to rise.

References

1. Munford RS. Severe Sepsis and Septic shock. In: Fauci, Braunwald, Kasper, Hauser, Longo, et al., editors. Harrison'sPrinciples of Internal Medicine ; 2015,. p. 1751–1759. Severe Sepsis and Septic shock. 19th edition.
2. 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.
3. Katiyar R, Bose S. Bacteriological Profile of Neonatal Septicemia in Pravara Rural Hospital. *Pravara Med Rev*. 2012;4(2).
4. Komolafe AO, Adegoke AA. Incidence of bacterial Septicaemia in Ile-Ife Metropolis Nigeria. *Malaysian J Microbiol*. 2008;4(2):51–61.
5. Forbes BA, Sahm DF, Weissfeld AS. Bloodstream infection. Mosby Elsevier ; 2014,. p. 860–877.
6. 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.
7. 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.
8. Mathur P, Varghese P, Tak V. Epidemiology of Blood Stream Infections at a Level-1 Trauma Care Center of India. J Lab Physicians. 2014 Jan-Jun;6(1):22–27.
9. 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.
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, KshMamta 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).
17. Arora U, Devi P. Bacterial profile of blood stream infections and antibiotic resistance pattern of isolates. J K Sci. 2007;9:186-190.
18. Vanitha Rani N, Kannan G, VenkataNarendra 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 ntimicrobial Susceptibility of Blood Culture Bacterial Isolates Malaysian Journal of Microbiology. 2011;7(2)78-82.
23. Bchitrananda swain, SaritaOtta. Blood stream infection in teaching hospital, annals of biological research. 2012; 3(4):1923-1928
24. UshaArora, 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, BimalChauhan. 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 PopulNutr. 2002;20(4):343-347.
32. GandhamPavani, Dr.VaniMadhaviKommula, 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.