BACTERIAL PROFILE AND THEIR ANTIMICROBIAL SUSCEPTIBILITY PATTERN IN PEDIATRIC SEPTICEMIA FROM TERTIARY CARE HOSPITAL.

Farhan Rasheed, Iqra Jamil, Tahira Tehseen, Abeera Sikandar Saba Anwar, Sajjad Rafique

Abstract

Background and Objectives: Blood stream infection is a life-threatening infection, leading to increased morbidity and mortality in pediatric population. Antimicrobial drug resistance is a major therapeutic challenge and may result in treatment failure. Therefore, the present study was designed to assess the bacterial profile causing septicemia along with their antimicrobial resistance pattern in pediatric population.

Methods: This retrospective study was conducted in pathology department of Hameed Latif Hospital, Lahore, over a period of two years, from 1st January 2021 to 31 December 2022. Blood samples were aseptically collected and were transferred into Bact/Alert blood culture bottle. After the detection of microbial growth by Bact/Alert 3D system, bacterial isolates were identified by standard microbiological procedures. Antimicrobial sensitivity pattern was determined by Modified Kirby-Bauer disc diffusion method on Mueller Hinton agar. Data was entered and analyzed by using Microsoft Excel 2010.

Results: In our study, out of 1306 blood culture samples, 217(16.6%) were positive for bacterial growth. Among positive cases, Gram negative organisms were predominant isolates 181(83.4%), while Gram positive organisms were isolated in 36(16.6%) samples. Most common bacterial isolates were S. typhi (24%), A.baumanii (19%), P.aeruginosa (9%), while S.aureus and MRSA were 8% each. Highly resistant class of drugs for Gram-positive bacteria were found to be Aminopenicillin (69.1%) and Macrolides (68.6%), while Gram-negative organisms showed maximum resistance against Tetracycline (72.9%), Fluoroquinolones (62.1%) and Cephalosporins (61%).

Conclusion: Bacterial isolates clinically suspected cases of septicemia were high. Majority of bacterial isolates showed maximum drug resistance against different classes of antibiotics. To prevent antibiotic resistance, strict guidelines of antibiotic utilization and infection control programs should be implemented.

How to cite: *Rasheed F, Jamil I,Tehseen T, Sikandar A, Anwar S, Rafique S. Bacterial Profile and their Antimicrobial Susceptibility Pattern in Pediatric Septicemia from Tertiary Care Hospital. 2023 JAIMC; 21(2): 86-91*

Septicemia is a life-threatening bloodstream infection that is a serious public health concern worldwide and is deadly if not treated with appropriate antimicrobial agents.[1] Sepsis refers to the bacterial toxins production or release in bloodstream.[2,3] Signs of systemic infection and positive blood culture are best characterized the septicemia.[4] In pediatric patients, septicemia is still a major reason of illness and mortality in spite of improvement in antimicrobial regimes and supportive treatment.[5] Different factors such as unexplained fever, major injury, length of hospital stay or previous hospitalization, chronic antimicrobial therapy and invasive procedures considered to be important in increasing the incidence rate of septicemia.[6-8] According to the recent scientific publications, it is estimated that in 2017, about 48.9 million new septicemia cases were registered altogether, while 11.0 million mortalities

1. *Department of Pathology, Allama Iqbal Medical College, Lahore*
2. *Department of Microbiology, University of Central Punjab, Lahore*
3-5. *Department of Pathology, Wah Medical College, Wah Cantt*
6. *Paediatrician and Neonatologist, Hameed Ltif hospital Lahore*

Correspondence:
Iqra Jamil, *Ph.D Microbiology Scholar, Lecturer, Department of Microbiology, University of Central Punjab, Lahore*

Submission Date: 12-04-23
1st Revision Date: 15-05-23
Acceptance Date: 23-06-23

associated with septicemia were reported, accounting 20% of all mortalities across the world.[9] In 2020, World Health Organization (WHO) estimated that 41% cases of septicemia cases were reported from Asian and Sub-Saharan countries, while most affected age group was under 5 years of age in children accounting for 30-70% cases. In intensive care patients, it accounts for about 42% mortality rate.[10,11] Additionally, among all hospital-related infections, 15% linked to BSI's.[12,13] In pediatric population, blood stream infections due to bacteria and increasing resistance against antimicrobials frequently result in prolonged infections and treatment failure.[14-16] Diagnosis of septicemia is usually done on the basis of clinical signs and symptoms and laboratory parameters of patients, but for the confirmation of septicemia, positive culture from blood I mandatory. Common symptoms of septicemia in pediatric population includes fever, hypothermia, lethargy, diarrhea and vomiting, abdominal distension, and respiratory distress.[17] Bacterial spectrums causing septicemia are different from place to place. Various Gram positive and Gram-negative bacteria can cause septicemia.[18-20] Antimicrobial treatment is started through empirical observation earlier than the blood culture results in almost all septicemia cases[(21)]. Improperly treated septicemia cases may have a 100% death rate.[22] In countries with limited resources, increase in antimicrobial resistance among all types of pathogenic bacteria has gotten worsen.[22-24] Thus, the present study was designed to assess the frequency of bacterial isolates and their antimicrobial susceptibility pattern amongst septicemia patients in Lahore.

METHODS

This reterospective study was conducted in pathology department of Hameed Latif Hospital, Lahore, over a period of two years, from 1st January 2021 to 31 December 2022. Samples from Age group of 0 to 12 years of both genders were included in the study. Repetitive samples from the same patient were excluded. Blood samples (4 mL for children and 10 mL for adults) were collected from every patient before any antibiotic use by experienced staff nurses. Samples were collected from patients who had fever while diagnosis was done.[25] Bact/Alert blood culture bottles were used to collect the blood samples and were transported to the microbiology laboratory. Blood culturing was done through automation in BACT/ALERT 3D culture system (bioMerieux, Durham, NC, USA).[26] After the detection of microbial growth by Bact/ Alert 3D system, gram staining was performed from the positive samples. Samples were sub cultured on blood agar, chocolate agar, and MacConkey agar. After sub-culturing, the inoculated culture plates were incubated for 18-24 hours at 37˚C aerobically, after overnight incubation, different microbiological procedures were used to identify bacterial isolates.[27] For identification of Gram-negative bacteria, different biochemical tests like indole test, citrate utilization, urease test, triple sugar iron, lysine decarboxylase test, motility tests and API 20E were used. While for the identification of Gram-positive bacteria, Gram reaction, their pattern of hemolysis, catalase and coagulase tests were used.[27] VITEK 2 Compact Automated ID/AST instrument (bioMerieux) were used for the antimicrobial sensitivity and interpretation was done according to the guidelines of the Clinical & Laboratory Standards Institute guidelines 2022.[28]

RESULTS

1306 blood cultures from suspected cases of bacterial sepsis were analyzed over the period of 2 years from 1st January 2021 to 31 December 2022. Among these, 217(16.6%) were positive for bacterial growth. Among positive cases, Gram negative organisms were predominant isolates 181(83.4%), while Gram positive organisms were isolated in 36(16.6%) samples. Among gram negative organisms, predominant organism was Salmonella typhi 52(28.7%), followed by Acinetobacter baumanni 41(22.6%), Klebsiella pneumoniae 20(), Salmonella paratyphi A and Burkholderia cepacia, 18(9.9%) each. Among Gram positive, predominant bacteria isolate was Methicillin resistant Staphylococcus aureus 13(36.1%), followed by Streptococcus pneumoniae 12(36%). (Figure 1)

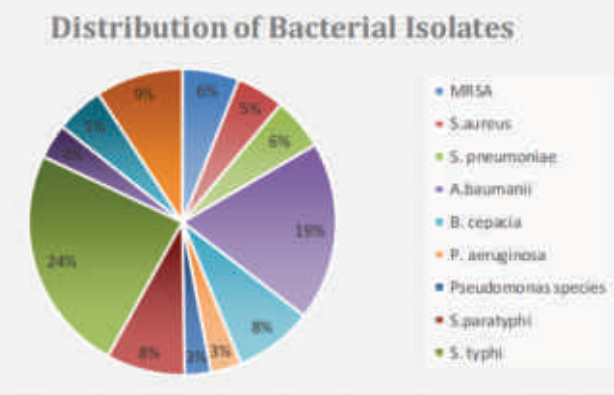

Figure 1: *Type And Frequency Of Culture Positive Organisms (n=217)*

Antimicrobial sensitivity testing was performed for both Gram negative and gram-positive organisms. Among Gram negative organisms, maximum resistance (72.9%) was observed against Tetracycline, followed by Fluoroquinolones (62.1%), Cephalosporins (61%), while Carbapenems showed minimum resistance against Gram negative organisms which was 34.9%. (Figure 2)

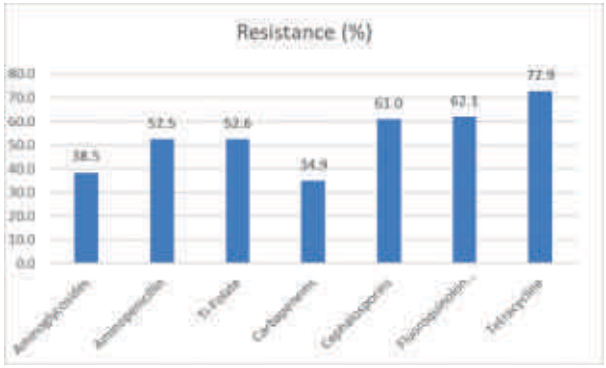

Figure 2: *Resistance Pattern Of Gram-negative Organism Against Different Antibiotics (n=181)*

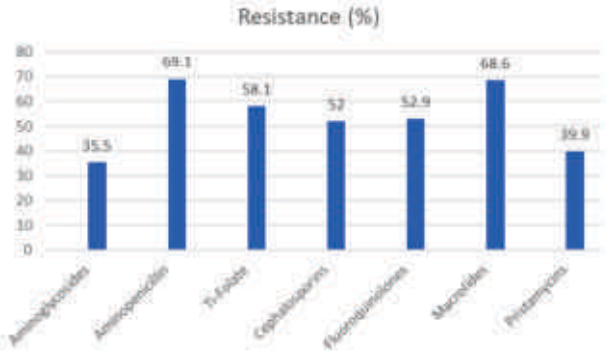

Figure 3: *Resistance Pattern Of Gram-positive Orga-nism Against Different Antibiotics (n=36)*

Gram positive organisms showed maximum resistance against Aminopenicillin which was 69.1%, followed by Macrolides (68.6%), Ti-Folate (58.1%), while minimum resistance was observed against Aminoglycosides which was 35.5%.(Figure 3)

DISCUSSION

In pediatric population, blood stream infections due to bacteria and increasing resistance against antimicrobials frequently result in prolonged infections and treatment failure. In the present study, prevalence of positive cases among clinical suspected cases of septicemia was found to be 16.6% which was in accordance with various studies conducted by (16.08–22.3%),[29] (16.08–22.3%),[30] (18.2%)[31] and (19.4%).[32] However, lower than a study conducted in Iran (38%),[33] Cameroon (28.3%) (22). On the other hand, current study showed high prevalence from the studies conducted in Kuwait (2.3%)[34] and Nepal (10.6%).[35] The possible reason for this variation might be due to epidemiological variations, execution of infection control and prevention, diagnostic system for blood culture identification and health care policies in different countries.

In the current study, Gram-negative bacteria were predominant than Gram-positive bacteria, with the prevalence of 83.4% and 16.6% respectively. Similar results were reported in Iran (55.4%)[36] and Nepal (52.3%).[37] However, studies conducted in India[38] and Gondar[39] reported higher prevalence of Gram positive bacteria. This variability may be due to differences in methodology and diagnostic methods.

Among Gram-positive bacteria, most common isolates were found to be S.aureus and Methicillin-resistant Staphylococcus aureus with the percentage of 36% each. Our results were similar with a study conducted in India (40), South Africa,[41] Addis Abeba, Ethiopia.[42] Resistance pattern of Gram-positive bacteria showed maximum resistance against Aminopenicillin and Macrolides which was 69.1% and 68.6% respectively, which was in accordance with the study conducted in different countries.[43-45] The high rate of resistance may be because of inappropriate or misuse

of antibacterial drugs.

Most common Gram-negative organism is our study was found to be S.typhi and A. baumanii which the prevalence of 28.1% and 22.6% respectively, which was in accordance with the study done in India in 2019.[46] Gram negative bacteria showed maximum resistance to Tetracyclines (72.9%), Fluoroquinilones (62.1%) and Cephalosporins (61%). Similar results were reported in India which showed 69% resistance against Tetracyclines.[46] Our results were also consistant with the studies conducted in Cameroon and Ethiopia, which reported 45-90% resistance to gentamycin, ciprofloxacin, and ceftriaxone.

The limitation of this study was that the samples were collected from a single hospital, and bacterial isolates were only identified phenotypically.

CONCLUSION

Blood stream infections remains an important health problem in pediatric population. It is vital to analyze the blood culture reports and its antimicrobial sensitivity pattern. Formulation of local antibiotic usage guidelines to improve clinical outcomes is equally important. Gram negative bacteria were more prevalent agents for septicemia in our study population. S.typhi, A.baumanii and S.aureus were the predominant causative agents for septicemia. High resistance rate of organisms against commonly used antibiotics calls for re-evaluation of protocols and policies of antibiotic empirical therapy.

REFERENCES

1. Kumalo A, Kassa T, Daka D, Tadesse AH. Bacterial profile of adult sepsis and their antimicrobial susceptibility pattern at Jimma University specialized hospital, south West Ethiopia. Health Sci J. 2016;10(2):0-.
2. Ameya G, Weldemedhin T, Tsalla T, Gebremeskel F. Antimicrobial susceptibility pattern and associated factors of pediatric septicemia in Southern Ethiopia. Infect Drug Resist. 2020;13:3895.
3. Negussie A, Mulugeta G, Bedru A, Ali I, Shimeles D, Lema T, Aseffa A. Bacteriological profile and antimicrobial susceptibility pattern of blood culture isolates among septicemia suspected children in selected hospitals Addis Ababa, Ethiopia. IJBMR. 2015; 6(1): 4709.
4. Alam MS, Mia SH, Uddin MB. Bacteriological Profile of Suspected Neonatal Septicaemia and Its Relationship with Selected Risk Factors. Med. Today. 2022; 34(1):17-21.
5. Tessin I, Trollfors B, Thiringer KJ. Incidence and etiology of neonatal septicaemia and meningitis in western Sweden 1975-1986. Acta Pædiatrica. 1990; 79(11): 1023-30.
6. Fentie A, Wondimeneh Y, Balcha A, Amsalu A, Adankie BT. Bacterial profile, antibiotic resistance pattern and associated factors among cancer patients at University of Gondar Hospital, Northwest Ethiopia. Infect. Drug Resist. 2018;11:2169.
7. Aliyu S, Cohen B, Liu J, Larson E. Prevalence and risk factors for bloodstream infection present on hospital admission. J Infect Prev. 2018;19(1):37-42.
8. Hailu M, Mulugeta G, Asrat DJ. Prevalence and antimicrobial resistance pattern of bacterial isolates among children suspected for septicemia and urinary tract infections at Tikur Anbessa specialized hospital, Addis Ababa, Ethiopia. Int j sci eng res. 2016;7(10):1431-44.
9. Rudd KE, Kissoon N, Limmathurotsakul D, Bory S, Mutahunga B, Seymour CW, et al. The global burden of sepsis: barriers and potential solutions. Crit Care. 2018;22(1):1-11.
10. Organization WH. Global report on the epidemiology and burden of sepsis: current evidence, identifying gaps and future directions. 2020.
11. Jagdish L, Naik TB, Gupta RK, Jais MJ. Etiology of blood culture from septicemia cases and their antibiotic susceptibility pattern at a tertiary care hospital. Indian J Microbiol Res 2016;3(4):435-39.
12. Singh R, Jain S, Chabbra R, Naithani R, Upadhyay A, Walia MJ. Characterization and anti-microbial susceptibility of bacterial isolates: Experience from a tertiary care cancer center in Delhi. IJCER. 2014;51(4):477.
13. Bhabhor H, Bhabhor U, Shingala H, Sinha MJ. Bacteriological study of blood stream infection (BSI) in ICU patients. Indian J. Microbiol. 2018;5(3):368-73.
14. Al-Mulla NA, Taj-Aldeen SJ, El Shafie S, Janahi M, Al-Nasser AA, Chandra PJI, et al. Bacterial bloodstream infections and antimicrobial susceptibility pattern in pediatric hematology/oncology patients after anticancer chemotherapy. Infect Drug Resist. 2014; 7: 289.
15. Butt T, Afzal RK, Ahmad RN, Salman M, Mahmood A, Anwar MJ. Bloodstream infections in febrile neutropenic patients: bacterial spectrum and antimicrobial susceptibility pattern. J Ayub Med Coll Abbottabad. 2004;16(1):18-22.
16. Kara Ö, Zarakolu P, Aşçioğlu S, Etgül S, Uz B, Büyükaşik Y, et al. Epidemiology and emerging resistance in bacterial bloodstream infections in patients with

hematologic malignancies. Int J Infect Dis. 2015; 47 (10): 686-93.

17. Alam MS, Mia SH, Uddin MB. Bacteriological Profile of Suspected Neonatal Septicaemia and Its Relationship with Selected Risk Factors. 2022;34(1):17-21.
18. Wasihun AG, Wlekidan LN, Gebremariam SA, Dejene TA, Welderufael AL, Haile TD, et al. Bacteriological profile and antimicrobial susceptibility patterns of blood culture isolates among febrile patients in Mekelle Hospital, Northern Ethiopia. Springerplus 2015; 4(1): 1-7.
19. Gupta S, Kashyap BJ. Bacteriological profile and antibiogram of blood culture isolates from a tertiary care hospital of North India. Trop. J. Med. Res. 2016; 19(2):94-.
20. Ansari S, Nepal HP, Gautam R, Shrestha S, Neopane P, Rimal B, et al. Childhood septicemia in Nepal: documenting the bacterial etiology and its susceptibility to antibiotics. Int. J. Microbiol. 2014;2014.
21. Pal N, Sujatha RJ. Antimicrobial resistant pattern of blood culture isolates, among septicaemia suspected patients. Natl J Lab Med 2016;5(1):17-21.
22. Kamga H, Njunda A, Nde P, Assob J, Nsagha D, Weledji PJ, et al. Prevalence of septicaemia and antibiotic sensitivity pattern of bacterial isolates at the University Teaching Hospital, Yaoundé, Cameroon. African J. Clin. Exp. Microbiol. 2011;12(1).
23. Obeng-Nkrumah N, Labi A-K, Addison NO, Labi JEM, Awuah-Mensah GJAocm, antimicrobials. Trends in paediatric and adult bloodstream infections at a Ghanaian referral hospital: a retrospective study. Ann. Clin. Microbiol. Antimicrob. 2016;15(1):1-10.
24. Dandoy CE, Haslam D, Lane A, Jodele S, Demmel K, El-Bietar J, et al. Healthcare burden, risk factors, and outcomes of mucosal barrier injury laboratory-confirmed bloodstream infections after stem cell transplantation. Biology of Blood and Marrow Transplantation. 2016;22(9):1671-7.
25. Arega B, Woldeamanuel Y, Adane K, Sherif AA, Asrat D. Microbial spectrum and drug-resistance profile of isolates causing bloodstream infections in febrile cancer patients at a referral hospital in Addis Ababa, Ethiopia. Infect. Drug Resist. 2018;11:1511.
26. Chaurasia S, Sankar M, Agarwal R, Yadav C, Arya S. Investigators of the Delhi Neonatal Infection Study (DeNIS) collaboration. Characterization and antimicrobial resistance of sepsis pathogens in neonates born in tertiary care centres in Delhi, India: a cohort study. PLoS One. 2016;4(10):e752-e60.
27. Tigabu A, Tiruneh M, Mekonnen F. Nasal carriage rate, antimicrobial susceptibility pattern, and associated factors of Staphylococcus aureus with special emphasis on MRSA among urban and rural elementary school children in Gondar, Northwest Ethiopia: A comparative cross-sectional study. Prev. Med. 2018;2018.
28. Mohakud NK, Mishra JP, Nayak MK, Mishra J, Pradhan L, Panda SS, et al. Bacteriological Profile and Outcome of Culture-Positive Neonatal Sepsis in a Special Newborn Care Unit Setting, Odisha. Cureus. 2022; 14(5).
29. Kotgire SA, Hatkar SJAoP, Medicine L. Aerobic bacteriological profile and its antimicrobial sensitivity pattern from blood culture specimens in a tertiary care hospital. APALM. 2017;4(01).
30. Folgori L, Bielicki JJ. Future challenges in pediatric and neonatal sepsis: emerging pathogens and antimicrobial resistance. J. Pediatr. Intensive Care. 2019; 8(01): 017-24.
31. Fentie A, Wondimeneh Y, Balcha A, Amsalu A, Adankie B. Bacterial profile, antibiotic resistance pattern and associated factors among cancer patients at University of Gondar Hospital, Northwest Ethiopia. Infect Drug Resist. 2018;11:2169.
32. Weinstein MP. Performance standards for antimicrobial susceptibility testing: Clinical and Laboratory Standards Institute; 2019.
33. Panahi Y, Mojtahedzadeh M, Beiraghdar F, Pazooki M, Moharamzad Y. Prevalence of microorganisms causing septicemia and determination of antimicrobial resistance in intensive care unit. IJPR. 2008; 7(4): 305-9.
34. Mokaddas EM, Shetty SA, Abdullah AA, Rotimi V. A 4-year prospective study of septicemia in pediatric surgical patients at a tertiary care teaching hospital in Kuwait. J. Pediatr. Surg. 2011;46(4):679-84.
35. Ansari S, Nepal HP, Gautam R, Shrestha S, Neopane P, Rimal B, et al. Childhood septicemia in Nepal: documenting the bacterial etiology and its susceptibility to antibiotics. 2014;2014.
36. Rubio M, Palau L, Vivas JR, Del Potro E, Diaz-Mediavilla J, Alvarez A, et al. Predominance of gram-positive microorganisms as a cause of septicemia in patients with hematological malignancies. Infect. Control Hosp. Epidemiol. 1994;15(2):101-4.
37. Ansari S, Nepal HP, Gautam R, Shrestha S, Neopane P, Rimal B, et al. Childhood septicemia in Nepal: documenting the bacterial etiology and its susceptibility to antibiotics. Int. J. Microbiol.. 2014;2014.
38. Kabi A, Mohanty A, Kumar SK, Singh V, Jha MK, Gupta PJ, et al. Clinical spectrum and risk factors for hospital-acquired septicemia in a tertiary care centre of North-East India. Fam. Med. Prim. Care Rev. 2020; 9(8):3949.
39. Dagnew M, Yismaw G, Gizachew M, Gadisa A, Abebe

T, Tadesse T, et al. Bacterial profile and antimicrobial susceptibility pattern in septicemia suspected patients attending Gondar University Hospital, Northwest Ethiopia. BMC research notes. 2013;6:1-7.

40. Prabhash K, Medhekar A, Ghadyalpatil N, Noronha V, Biswas S, Kurkure P, et al. Blood stream infections in cancer patients: A single center experience of isolates and sensitivity pattern. IJCER 2010;47(2):184.
41. Mvalo T, Eley B, Bamford C, Stanley C, Chagomerana M, Hendricks M, et al. Bloodstream infections in oncology patients at red cross war memorial Children's hospital, Cape Town, from 2012 to 2014. IJID. 2018; 77:40-7.
42. Feld RJ. Bloodstream infections in cancer patients with febrile neutropenia. Int. J. Antimicrob. Agents. 2008; 32:S30-S3.
43. Kotgire SA, Hatkar SJAoP, Medicine L. Aerobic bacteriological profile and its antimicrobial sensitivity pattern from blood culture specimens in a tertiary care hospital. Health Sci. J. 2017;4(01).
44. Patel R, Jain MR. Bacteriological profile and antibiotic sensitivity pattern of isolates from blood culture in suspected septicemic patients attending tertiary care hospital. 2019.
45. Kitila K, Taddese B, Hailu T, Sori L, Geleto S. Assessment of Bacterial Profile and Antimicrobial Resistance Pattern. 2018.
46. Nazir A. Multidrug-resistant Acinetobacter septicemia in neonates: A study from a teaching hospital of Northern India. J. Lab. Physicians. 2019;11(01):023-8.