PIONEER
MEDICAL JOURNAL

Vol.5 No.1 Jan. - Jun., 2025

www.pioneermedicaljournal.com

ISSN: 2354 - 1954

ERRATUM:
This article was inadvertently republished under Volume 5, No. 1 (January–June 2025)
following a redesign and restructuring of the journal website.
The correct bibliographic designation for this article is Volume 14, No. 3 (January–June 2026),
under which it was originally published.
This correction affects only the volume, issue, and publication-period metadata.
The article content, DOI, authorship, pagination, and publication date remain unchanged.

Official Publication of The Medical and Dental Consultants' Association of Nigeria ***(MDCAN)***
FMC, Umuahia Chapter.

Editor In-Chief
DR. CHIMEZIE GODSWILL OKWUONU

PIONEER MEDICAL JOURNAL

OFFICIAL SCIENTIFIC PUBLICATION OF MEDICAL AND DENTAL CONSULTANTS ASSOCIATION OF NIGERIA (MDCAN)

FEDERAL MEDICAL CENTRE UMUAHIA ABIA STATE NIGERIA

ORIGINAL ARTICLE

Neonatal Septicemia at a Tertiary Hospital in Southeast Nigeria: Bacteriological Profile and Antibiotic Sensitivity Pattern

Gilbert Nwadiakanma Adimora[1,2], Oluchi Mildred Izuka[3], Herbert Obu[1,2], kenechukwu Kosisochukwu Iloh[1,2]

[1]Department of Paediatrics, University of Nigeria Teaching Hospital Ituku-ozalla Nigeria,
[2]Department of Paediatrics, College of Medicine University of Nigeria, Enugu, Nigeria,
[3]Department of Paediatrics, Federal Medical Centre Umuahia, Abia State, Nigeria,

Corresponding author
Dr. Oluchi Mildred Izuka
Department of Paediatrics
Federal Medical Centre Umuahia
Abia State, Nigeria,
mildredizuka@gmail.com

ABSTRACT

Background: Infectious diseases such as septicemia account for a substantial proportion of neonatal deaths in Nigeria. Regular bacteriological surveillance in neonatal units is therefore essential to guide empirical antibiotic therapy.

Objective: To determine the prevailing bacterial pathogens causing neonatal sepsis in the Special Care Baby Unit (SCBU) of the University of Nigeria Teaching Hospital (UNTH), Enugu, and to assess their antibiotic susceptibility patterns.

Methodology: A prospective study was conducted over an 18-month period involving 112 neonates with clinical features suggestive of sepsis. Blood samples were obtained for bacteriological culture and antibiotic susceptibility testing using standard microbiological methods.

Results: Bacterial isolates were recovered from 28 (25.0%) neonates. Of these, 50.0% were Gram-positive organisms and 50.0% were Gram-negative, with no mixed growths identified. *Staphylococcus aureus* was the most frequently isolated pathogen (42.9%), followed by coliform bacilli (32.1%) and *Escherichia coli* (14.3%). Other isolates included *Streptococcus pyogenes* (7.1%) and *Klebsiella* species (3.6%). Overall susceptibility to at least one penicillin

was observed in 39.3% of isolates, while only 14.3% were susceptible to a combination of penicillin and gentamicin. In contrast, susceptibility to at least one third-generation cephalosporin and quinolone was 78.6% and 100.0%, respectively. Ceftriaxone and ciprofloxacin demonstrated effectiveness against 64.3% and 82.1% of isolates, respectively.

Conclusion: This study demonstrates a shift in the predominant Gram-negative bacterial pathogens compared with previous reports from our unit, alongside a concerning decline in susceptibility to commonly used first-line antibiotics. Continuous surveillance and periodic review of empirical antibiotic protocols are recommended.

Keywords: Neonatal sepsis; Septicemia; Newborn; Antibiotic susceptibility; Nigeria

INTRODUCTION

Neonatal septicemia remains a major public health challenge in sub-Saharan Africa and is a significant contributor to neonatal morbidity and mortality. In Nigeria and other parts of Africa, neonatal infections account for approximately 18–35% of deaths occurring within the first month of life.[1] Despite advances in neonatal care globally, the burden of neonatal sepsis in low- and middle-income countries remains unacceptably high.

In high-income countries, Group B Streptococcus (GBS) is the leading cause of neonatal sepsis, particularly in early-onset disease, followed by Gram-negative organisms such as *Escherichia coli*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*.[2-4] In contrast, reports from several developing countries indicate that GBS is an uncommon cause of neonatal sepsis.[5-9] Instead, Gram-negative bacteria predominate, with *Staphylococcus aureus* emerging as the most frequently isolated Gram-positive pathogen.[10-12] These variations highlight the influence of geographical location and local clinical practices on the etiological profile of neonatal sepsis.

Recent reports from the West African sub-region have raised concern over the increasing prevalence of multidrug-resistant bacterial pathogens in neonatal units.[13] The widespread and often indiscriminate use of antibiotics has been identified as a major driver of this trend. Empirical treatment in many neonatal units commonly involves a combination of a penicillin—such as benzylpenicillin, ampicillin, or cloxacillin—and an aminoglycoside, most frequently gentamicin. However, resistance to ampicillin and cloxacillin is now widespread among Gram-negative organisms, and resistance to gentamicin is increasingly being reported. Consequently, some neonatal units have revised their antibiotic policies to include third-generation cephalosporins.[14,15] Nonetheless, emerging resistance to third-generation cephalosporins[16] and even quinolones have also been documented.[10]

In view of these evolving trends in pathogen distribution and antimicrobial resistance, continuous bacteriological surveillance and periodic review of empirical antibiotic policies based on local sensitivity patterns are essential for effective management of neonatal sepsis. This study therefore aims to determine the prevalent bacterial pathogens causing neonatal septicemia in the Special Care Baby Unit of the University of NigeriaTeaching Hospital (UNTH), Enugu,

and to assess their antibiotic susceptibility pattern.

Methods: This prospective study was conducted in the Newborn Special Care Baby Unit (SCBU) of the University of Nigeria Teaching Hospital (UNTH), Enugu. UNTH is a major tertiary healthcare facility in South-Eastern Nigeria, serving predominantly the population of Enugu State, with additional referrals from neighboring states.

All neonates admitted to the SCBU with clinical features suggestive of sepsis were eligible for inclusion in the study. The World Health Organization (WHO) clinical algorithm for the diagnosis of neonatal sepsis was used to identify suspected cases.[17,18] Informed consent was obtained from the parents or guardians of all participating neonates. Ethical approval for the study was granted by the Ethics Review Committee of the University of Nigeria Teaching Hospital, Enugu. The approval number is NHREC/05/01/2008B-FWA00002458-1RB00002323 With reference number UNTH/CSA/329/VOL.5.

Relevant demographic and clinical information were obtained from patients' medical records and structured questionnaires. A total of 112 neonates with suspected sepsis were recruited and studied.

Laboratory Procedures:

Under strict aseptic conditions, 1 mL of venous blood was collected from the femoral vein of each neonate. The blood sample was inoculated into brain–heart infusion broth containing 0.05% cystine and Panmede. In addition, 1 mL of blood was inoculated into 30 mL of the broth in an anaerobic culture bottle. Another 1 mL of blood was inoculated into 2 mL of nutrient broth containing 0.05% liquid medium.

All inoculated culture bottles were incubated at 37 °C and observed for growth over an initial period of 48 hours. Bottles showing evidence of microbial growth were Gram-stained. Based on Gram reaction, subcultures were made onto appropriate selective and differential media using standard bacteriological techniques as described by Cowan and Steel.[19]

Antibiotic susceptibility testing of all bacterial isolates was performed using standard methods. The susceptibility of isolates to commonly used antibiotics was determined and interpreted in accordance with established microbiological guidelines.

Definition of terms

Early-Onset Sepsis: Onset of infection occurring within the first seven days of life.[20]

Late-Onset Sepsis: Onset of infection occurring after the first seven days of life.[20]

Prolonged Rupture of Membranes: Defined as rupture of the fetal membranes 18 hours or more before delivery.

Results

A total of 28 (25.0%) bacterial isolates were recovered, of which 14 (50.0%) were Gram-positive and 14 (50.0%) were Gram-negative. No mixed bacterial growth was observed. The distribution of bacterial isolates is shown in Table 1.

The most common causative organisms of neonatal sepsis were *Staphylococcus aureus* (42.9%), coliform bacilli (32.1%), and *Escherichia coli* (14.3%). Other isolates included *Streptococcus pyogenes* (7.1%) and *Klebsiella* species (3.6%). No bacterial growth was obtained from 84 (75.0%) neonates who were clinically diagnosed with presumed sepsis.

Among the 28 neonates with culture-proven sepsis, 16 were term and 12 were preterm. Fourteen neonates were delivered outside the study hospital, while the remaining 14 were inborn. The median age at presentation was 2.7 ± 3.0 days, with a male-to-female ratio of 1.6:1.

Fever was the most common presenting symptom, occurring in 11.6% of cases, followed by reduced activity (8.0%), refusal to feed (5.4%), and excessive crying (5.4%). Seventy neonates (62.5%) had received antibiotics prior to blood culture sampling.

Classification of proven sepsis cases

The 28 cases of culture-proven neonatal sepsis were further classified according to the time of onset into early-onset sepsis (EOS) and late-onset sepsis (LOS). The distribution of septicemic neonates is shown in **Table 2**.

Early- Onset Sepsis

The majority of neonates, 26 (92.9%), had early-onset sepsis. Of these, 14 (53.9%) were term neonates, comprising seven males and seven females. The remaining 12 (46.1%) were preterm neonates, of whom eight were males and four were females.

The mortality rate among preterm neonates with early-onset sepsis was 33.3%, whereas no deaths were recorded among term neonates in this group. All recorded deaths in early-onset sepsis occurred among male preterm infants.

Late Onset sepsis

Two neonates (7.1%) had late-onset sepsis. Both were full-term male infants delivered outside the study hospital. One infant was adopted, and therefore details surrounding labor and delivery were unavailable, while the other had a documented maternal history of prolonged rupture of membranes. *Staphylococcus aureus* was isolated in both cases, and the mortality rate in this group was 100%.

Antibiotic Susceptibility

The antibiotic susceptibility patterns of the bacterial isolates are summarized in Table 3. Overall, 39.3% of isolates were susceptible to at least one penicillin, while only 14.3% were susceptible to a combination of a penicillin and gentamicin. In contrast, susceptibility to at least one third-generation cephalosporin was 78.6%, and all isolates (100%) were susceptible to at least one quinolone.

Among individual antibiotics, ceftriaxone and ciprofloxacin were the most effective, demonstrating activity against 64.3% and 82.0% of isolates, respectively. These findings highlight the reduced efficacy of commonly used first-line antibiotics and support the consideration of third-generation cephalosporins or quinolones for empirical therapy in this setting.

Discussion

In this study, the bacterial isolation rate was 25%, slightly lower than the 30–34% reported in other studies both within and outside Nigeria.[21,22] Fifty percent of the bacterial isolates were Gram-positive, and 50% were Gram-negative. This is consistent with the findings of Iroegbu et al.[23] in Abuja but differs from other reports documenting a predominance of Gram-positive organisms. For instance, studies from Qatar, Karachi, and Gwagwalada, Nigeria, reported Gram-positive prevalence of 66%, 54.1%, and 58%, respectively.[24-26] Conversely, Bode-Thomas et al.[27] in Jos observed a predominance of Gram-negative organisms. These variations may reflect differences in the timing and source of neonatal colonization, whether at birth or from the community.

Staphylococcus aureus was the most common Gram-positive organism isolated, while coliform bacilli were the predominant Gram-negative isolates. The predominance of *S. aureus* aligns with several local and international studies.[28,29] However, other studies, such as Iroegbu et al.[23] in Abuja and Anyabuno et al.[30] in Accra, identified *Enterococcus faecalis* as the most common Gram-positive organism. Similarly, while Olutunde et al.[31] in Abuja reported *Escherichia coli* as the most frequent Gram-negative cause of neonatal sepsis, this was not observed in the current study. These differences underscore the

dynamic and region-specific nature of neonatal sepsis pathogens, which may vary over time even within the same unit.

In the present study, early-onset neonatal sepsis (EONS) accounted for most cases (92.9%), whereas late-onset neonatal sepsis (LONS) represented only 7.1%. This pattern is similar to findings in Ethiopia by Shitaye et al.,[32] who reported 67.4% EONS and 32.6% LONS, and in Port Harcourt by West Boma et al.,[21] who documented 71% EONS and 29% LONS. Ogunlesi et al.[22] also reported higher incidences of EONS than LONS. These studies highlight the significant contribution of maternal and perinatal risk factors to neonatal sepsis in developing countries.[26]

In contrast, studies from high-income countries show a different pattern. Afif et al.[24] in Qatar reported EONS in 17% and LONS in 83% of cases, while Motara et al.[33] in South Africa observed 5.2% EONS and 94.8% LONS. Similarly, Mokuolu et al.[34] and Nwankwo et al.[35] in Nigeria documented higher LONS than EONS, attributing this to poor hygiene and lack of potable water at many delivery centres. These differences may reflect the influence of improved obstetric and neonatal care in reducing early-onset infections in developed settings.

Regarding antibiotic susceptibility, Gram-positive organisms (*S. aureus* and *S. pyogenes*) showed high sensitivity to quinolones. This is consistent with studies from South-West Nigeria[34,36] reporting high ofloxacin sensitivity. Sharma et al.[28] in India reported 80% of Gram-positive isolates were sensitive to vancomycin, while Bode-Thomas et al.[27] in Jos documented 67% sensitivity to gentamicin. Iroegbu et al.[23] reported 89% of Gram-positive bacteria were sensitive to amoxicillin/clavulanic acid, and studies from Calabar, India, and Uganda[37-39] observed high gentamicin sensitivity. These findings indicate that Gram-positive susceptibility patterns vary by region and over time, potentially influenced by the use of empirical antibiotics.

Gram-negative bacteria (coliforms, *E. coli*, and *Klebsiella* spp.) in this study demonstrated high sensitivity to ceftriaxone, ciprofloxacin, and levofloxacin. Similarly, sensitivity to ceftazidime among Gram-negative bacteria was reported as 81.3% in Sagamu,[22] while Mugalu et al.[38] in Uganda observed 94.1% sensitivity of *E. coli* to ceftriaxone. These findings confirm the effectiveness of third-generation cephalosporins against Gram-negative organisms. In contrast, Olutunde et al.[31] reported 100% sensitivity of Gram-

negative bacteria to carbapenems (imipenem and meropenem), which were not tested in the present study.

Conclusion

Neonatal sepsis remains prevalent in our setting. *Staphylococcus aureus* and *Streptococcus pyogenes* were the most common Gram-positive organisms, while coliforms and *Escherichia coli* were the predominant Gram-negative pathogens. The observed variability in antibiotic susceptibility, both within this study and compared to earlier reports, underscores the need for **periodic review of local antibiograms** to guide empirical antibiotic therapy in neonatal units.

Authors Contribution: GNA conceptualized and designed the study, OMI collected the data, participated in data analysis and interpretation, drafted the initial manuscript, and coordinated manuscript revision. HO contributed to the study conceptualization and critically reviewed the manuscript for important intellectual content. KKI critically reviewed the manuscript for intellectual content. All authors read and approved the final manuscript.

.

Conflict of Interest: The authors declare no conflicts of interest.

Financial Support and Sponsorship: This study was self-funded by the authors

Acknowledgement: The authors thank the parents of the neonates recruited for this study for granting consent. We are also grateful to the highly dedicated staff nurses in SCBU for their tireless efforts in some study related documentations and heroic efforts in salvaging sick babies

Ethics approval and consent to participate

The approval of the Health Research and Ethics Committee of University of Nigeria Teaching Hospital Ituku-Ozalla Enugu was obtained before commencement of the study. The approval number is NHREC/05/01/2008B-FWA00002458-1RB00002323 with reference number UNTH/CSA/329/VOL.5. Written informed consent was obtained from a parent and/or guardian for all participants. Participants were informed that voluntary withdrawal at any stage of the study was guaranteed without any adverse effect to their newborn. All information was handled with strict confidentiality.

Table 1: Distribution of Bacterial Species Isolated from Neonates with Septicemia

Bacterial isolates	Number isolated (n)	Percentage (%)
Gram-positive organisms		
Staphylococcus aureus	12	42.9
Streptococcus pyogenes	2	7.1
Gram-negative organisms		
Coliforms	9	32.1
Escherichia coli	4	14.3
Klepsiella spp	1	3.6
Total	28	100

Table 2: Classification of Culture-Proven Neonatal Septicemia Cases

		Term				**Preterm**			
Sepsis category	Total n (%)	neonates n (%)	Male n	Female n	Mortality n (%)	Neonates n (%)	Male n	Female n	Mortality n (%)
Early-onset sepsis	26(92.9)	14(53.9)	7	7	0.(0.0)	12(46.1)	8(66.7)	4(33.3)	4(33.3)
Late-onset Sepsis	2 (7.1)	2(100.0)	2	0	2(100.0)	0.(0.0)	0.(0.0)	0.(0.0)	0.(0.0)
Total	28(100.0)	16(57.1)	9	7	2 (12.5)	12 (42.9)	8(66.7)	4(33.3)	4(33.3)

Table 3: Antibiotic Susceptibility Patterns of Bacterial Isolates

Antibiotic	**S. aureus (%)**	**S. pyogenes (%)**	**Coliforms (%)**	**E. coli (%)**	**Klebsiella spp (%)**
Ampiclox	20.0	0	50.0	0	0
Ampicillin	—	—	14.3	0	—
Amoxicillin-clavulanic	30.0	0	12.5	0	0
Cefuroxime	11.1	50.0	—	—	100
Ceftriaxone	54.6	0	71.4	75.0	100
Cefixime	58.3	0	50.0	0	100
Ceftazidime	—	—	—	—	100
Ciprofloxacin	66.7	100	87.5	100	100
Levofloxacin	100	100	100	100	100
Ofloxacin	66.7	50.0	83.3	50.0	100
Norfloxacin	20.0	50.0	—	0	0
Gentamicin	25.0	50.0	42.9	25.0	100
Erythromycin	40.0	50.0	33.3	0	—
Clindamycin	60.0	50.0	50.0	0	0

"—" for untested data

REFERENCES

1. Bech CM, Stensgaard CN, Lund S, et al. Risk factors for neonatal sepsis in Sub-Saharan Africa: a systematic review with meta-analysis. *BMJ Open.* 2022;12(9):e054491. doi:10.1136/bmjopen-2021-054491.
2. Moreno MT, Vargas S, Poveda R, et al. Neonatal sepsis and meningitis in a developing Latin American country. *Pediatr Infect Dis J.* 1994;13:516–520.
3. Tallur SS, Kasturi AV, Nadgir SD, et al. Clinico-bacteriological study of neonatal septicemia in Hubli. *Indian J Pediatr.* 2000;67:169–174.
4. Lim CT, Thong MK, Parasakthi N, et al. Group B streptococcus: maternal carriage rate and early neonatal septicaemia. *Ann Acad Med Singapore.* 1997;26:421–425.
5. Mulholland EK, Ogunlesi OO, Adegbola RA, et al. Etiology of serious infections in young Gambian infants. *Pediatr Infect Dis J.* 1999;18(10 Suppl):S35–41.
6. Muhe L, Tilahun M, Lulseged S, et al. Etiology of pneumonia, sepsis and meningitis in infants younger than three months of age in Ethiopia. *Pediatr Infect Dis J.* 1999;18(10 Suppl):S56–61.
7. Kuruvilla KA, Thomas N, Jesudasan MV, et al. Neonatal group B streptococcal bacteraemia in India: ten years' experience. *Acta Paediatr.* 1999;88:1031–1032.
8. Tan KW, Tay L, Lin R, et al. Group B streptococcal septicaemia/meningitis in neonates in a Singapore teaching hospital. *Aust N Z J Obstet Gynaecol.* 1998;38:418–423.
9. Daoud AS, Abuekteish F, Obeidat A, et al. The changing face of neonatal septicaemia. *Ann Trop Paediatr.* 1995;15:93–96.
10. Rahman S, Hameed A, Roghani MT, Ullah Z. Multidrug resistant neonatal sepsis in Peshawar, Pakistan. *Arch Dis Child Fetal Neonatal Ed.* 2002;87:F52–54.
11. WHO Young Infants Study Group. Bacterial etiology of serious infections in young infants in developing countries: results of a multicenter study. *Pediatr Infect Dis J.* 1999;18:S17–22.
12. Moreno MT, Vargus S, Poveda R, Saez-Llorens X. Neonatal sepsis and meningitis in a developing Latin American country. *Pediatr Infect Dis J.* 1994;13:516–520.
13. Ako-Nai AK, Adejuyigbe EA, Ajayi FM, et al. The bacteriology of neonatal septicaemia in Ile-Ife, Nigeria. *J Trop Pediatr.* 1999;45:146–151.
14. Al-Harthi AA, Dagriri KA, Asindi AA, et al. Neonatal meningitis. *Saudi Med J.* 2000;21:550–553.

15. Lim NL, Wong YH, Boo NY, et al. Bacteraemic infections in a neonatal intensive care unit: a nine months survey. *Med J Malaysia.* 1995;50:59–63.
16. Musoke RN, Revathi G. Emergence of multidrug resistant gram negative organisms in a neonatal unit and the therapeutic implications. *J Trop Pediatr.* 2000;46:86–91.
17. WHO. *Handbook IMCI: Integrated Management of Childhood Illnesses.* Geneva: WHO; 2000. WHO/FCH/CAH/00.12.
18. WHO Multicentre Study Group. Clinical prediction of serious bacterial infections in young infants in developing countries. *Pediatr Infect Dis J.* 1999;18:S23–31.
19. Cowan ST, Steel KJ. *Manual for the Identification of Medical Bacteria.* 4th ed. Cambridge: Cambridge University Press; 1985.
20. Stoll JB. Infections of the neonatal infant. In: Behrman RE, Kliegman RM, Jenson HB, editors. *Nelson Textbook of Pediatrics.* 17th ed. Philadelphia: W.B. Saunders; 2007. p. 623–640.
21. West BA, Tabansi PN. Prevalence of neonatal septicemia in the University of Port Harcourt Teaching Hospital Nigeria. *Niger J Paediatr.* 2014;41:33–37.
22. Ogunlesi TA, Ogunfowora OB, Osinupebi O, Olanrewaju DM. Changing trends in newborn sepsis in Sagamu, Nigeria: Bacterial aetiology, risk factors and antibiotic susceptibility. *J Paediatr Child Health.* 2011;47:5–11. doi:10.1111/j.1440-1754.2010.01882.
23. Iregbu KC, Elegba OY, Babaniyi IB. Bacteriological profile of neonatal septicaemia in a tertiary hospital in Nigeria. *Afr Health Sci.* 2006;6(3):151–154. doi:10.5555/afhs.2006.6.3.151.
24. Afif A, Samawal L, Abdul Rouf PV, et al. Incidence of bacterial isolates from blood culture in the neonatal intensive care unit of a tertiary care hospital. *Int J Drug Dev Res.* 2012;4:359–367.
25. Khetam HRA, Deia KK, Lamia A. The bacterial profile and C-reactive protein of suspected septic neonates admitted to the Al-Kadyemia Teaching Hospital. *Int J Recent Sci Res.* 2013;11:1723–1727.
26. Olateju EK, Okechukwu AA, Mokuolu OA. Neonatal septicaemia at the University of Abuja Teaching Hospital, Gwagwalada, Nigeria. *New Nig J Clin Res.* 2011;1:95–103.
27. Bode-Thomas F, Ikeh EI, Pam SD, Ejeliogu EU. Current aetiology of neonatal sepsis in Jos University Teaching Hospital. *Niger J Med.* 2004;13:130–135.

28. Sharma P, Kaur P, Aggarwal A. Staphylococcus aureus: the predominant pathogen in the neonatal ICU of a tertiary care hospital in Amritsar, India. *J Clin Diagn Res.* 2013;7(1):66–69. doi:10.7860/JCDR/2012/4913.2672.
29. Shadbolt R, We MLS, Kohan R, et al. Neonatal Staphylococcus aureus sepsis: a 20-year Western Australian experience. *J Perinatol.* 2022;42:1440–1445. doi:10.1038/s41372-022-01440-3.
30. Anyebuno M, Newman M. Common causes of neonatal bacteraemia in Accra, Ghana. *East Afr Med J.* 1995;72:805–808.
31. Oluyinka O, Airede KI, Olateju KE, et al. Incidence, bacteriological profile and antibiotic sensitivity pattern of neonatal sepsis in a tertiary health facility in Abuja, North-central Nigeria. *Eur PMC.* 2021.
32. Shitaye D, Asrat D, Woldeamanuel Y, Worku B. Risk factors and etiology of neonatal sepsis in Tikur Anbessa University Hospital, Ethiopia. *Ethiop Med J.* 2010;48:11–21.
33. Motara F, Ballot DE, Perovic O. Epidemiology of neonatal sepsis in Johannesburg. *S Afr J Epidemiol Infect.* 2005;20:90–93.
34. Mokuolu AO, Jiya N, Adesiyun OO. Neonatal septicaemia in Ilorin: bacterial pathogens and antibiotic sensitivity pattern. *Afr J Med Sci.* 2002;31:127–130.
35. Nwankwo EOK, Shehu AU, Farouk ZL. Risk factors and bacterial profile of suspected neonatal septicaemia at a teaching hospital in Kano, Nigeria. *Sierra Leone J Biomed Res.* 2011;3:104–109.
36. Satar M, Özlü F. Neonatal sepsis: a continuing disease burden. *Turk J Pediatr.* 2012;54:449–457.
37. Antia-Obong OE, Utsalo SJ, Udo JJ, Udo KT. Neonatal septicaemia in Calabar, Nigeria. *Cent Afr J Med.* 1992;38:161–165.
38. Mugalu J, Nakakeeto MK, Kiguli S, Kaddu-Mulindwa DH. Aetiology, risk factors and immediate outcome of bacteriologically confirmed neonatal septicaemia in Mulago Hospital, Uganda. *Afr Health Sci.* 2006;6:120–126.
39. Ramesh BY, Leslie ESL, Vandana KE. Bacterial isolates of early-onset neonatal sepsis and their antibiotic susceptibility pattern between 1998 and 2004: an audit from a center in India. *Ital J Pediatr.* 2011;37:32.