

Recent Trend of Bacteriological Profile and Drug Sensitivity Pattern of Neonatal Septicemia in A Tertiary Care Hospital in Bangladesh

M Rahman¹, B H N Yasmeen², N Jahan³, M M Hoque⁴, S K Halder⁵, A Halder⁶
N R Nupur⁷, I J Zerine⁸, F A Rini⁹

¹ Dr. Maksudur Rahman
Associate Professor, Neonatology
Bangladesh Institute of Child Health
(BICH), Dhaka Shishu (Children) Hospital

² Prof. Dr. B H Nazma Yasmeen
Professor and Head
Dept. of Paediatrics
Northern International Medical
College (NIMC), Dhaka

³ Dr. Nishat Jahan
Registrar

⁴ Prof. Dr. Md. Mahbulul Hoque
Professor

⁵ Dr. Swapan Kumar Halder
Assistant professor, Paediatrics
Sher-e-Bangla Medical College
(SBMC), Barisal

⁶ Dr. Ashis Halder
Assistant professor, Paediatrics
SBMC, Barisal

⁷ Dr. Nondini Rahman Nupur
Resident, MD

⁸ Dr. Israt Jahan Zerine
Resident, MD

⁹ Dr. Fatema Akter Rini
Resident, MD

^{3, 4, 7, 8, 9}
Dept. of Neonatology
Bangladesh Institute of Child Health
(BICH), Dhaka Shishu (Children)
Hospital, Dhaka

Correspondence
Dr. Maksudur Rahman
Associate Professor, Neonatology
Bangladesh Institute of Child Health
(BICH) Dhaka Shishu (Children) Hospital
Email : maksuddu@gmail.com

Abstract

Background : In Bangladesh about 67% of under-five mortality is neonatal mortality. One of three major causes of neonatal morbidity and mortality is septicemia. Recently there is increasing incidence of multidrug resistant neonatal organisms which is alarming.

Objective : The aim of this study was to see the bacteriological profile and drug sensitivity pattern of neonatal septicemia.

Methods : This prospective observational study was done in Dhaka Shishu (children) Hospital over one-year period from June 2018 to May 2019. The admitted neonates were suspected as neonatal septicemia considering the risk factors, clinical profile and investigations (CBC, CRP etc.). Blood from all suspected neonatal septicemia cases were sent for culture and drugs sensitivity along with others necessary investigations. Then data was analyzed with SPSS version-20.

Results : Among the suspected cases only 111(10%) patients were culture positive. Preterm were 77(69%) and term 34(31%). One hundred six cases (95%) had sepsis with gram negative organisms and 5(5%) had sepsis with gram positive organisms with more predominant of *Klebsiella* (76,68%) followed by *Acinetobacter* (16,14%), *Pseudomonas* (6,5%), *Escherichia coli* (3,3%). Majority 80 (72%) cases had Early onset neonatal sepsis (EONS). *Klebsiella* (57, 51%) was more common organism followed by *Acinetobacter* (11,10 %) causing EONS and in late onset neonatal sepsis (LONS), similar type of causative organism were found. Ampicillin, Gentamicin and Ceftazidime were mostly resistance to gram negative organisms - 104(94%), 99(89%) and 93(84%) respectively. Besides these, Amikacin (104,94%), Imipenem (85, 77%) and Ciprofloxacin (73, 66%) were more resistance. *Klebsiella* in 17 cases and *Acinetobacter* in 4 cases were resistant to all commonly used antibiotics.

Conclusion : *Klebsiella* followed by *Acinetobacter* and *Pseudomonas* are now common pathogens of neonatal septicemia found in this study. Ampicillin, Gentamicin and Ceftazidime are more resistant to most of the organisms causing neonatal sepsis. Imipenem is alarmingly resistant. In 19% cases, the organisms are resistance to all commonly used antibiotics.

Key words : Septicaemia, Neonatal sepsis.

DOI: <https://doi.org/10.3329/nimcj.v11i1.50738>

Northern International Medical College Journal Vol. 11 No. 1 July 2019, Page 427-431

Introduction

Bangladesh has made significant progress in reducing under-five mortality in recent years.¹ The neonatal mortality rate is 30/1000 live births which is still high in this country.² About 67% of under-five mortality is neonatal mortality.² One of the three major causes of neonatal morbidity and mortality is septicemia^{3,4} and 19.9% of neonatal death is caused by septicaemia.⁵

Neonatal septicemia is the term used to describe any systemic bacterial infection documented by

a positive blood culture in the first month of life.⁶ Early onset neonatal sepsis (EONS) and late onset neonatal sepsis (LONS) were defined as illnesses appearing from birth to 7 days and from 8 to 28 days postnatal respectively.⁷ Some author defined EONS as- neonatal sepsis that occur within 72 hours of age and LONS as- neonatal sepsis that occur after 72 hours of age.⁸ Clinical features of sepsis are non-specific in neonates and a high index of suspicion is required for the early diagnosis of sepsis.

Although blood culture is the gold standard for

the diagnosis of sepsis, culture reports would be available only after 48-72 hours.⁸ Over the last two decades most of the organisms have developed drug resistance and management of the patients is become a difficult one.^{4,6}

For the effective management of neonatal septicemia with appropriate antibiotics would minimize the risk of severe morbidity and mortality and to reduce the emergence of multi-drug resistant organisms by rational antibiotic use, study of bacteriological profile and their antibiotic sensitivity pattern plays a significant role.^{4,6}

This study was designed to find out the organisms causing septicemia in neonate and their antimicrobial sensitivity pattern in a tertiary care hospital of Dhaka, Bangladesh.

Materials and Methods

This was a prospective observational study conducted at the neonatology department of Dhaka Shishu (children) hospital during the period from June 2018 to May 2019. Informed written consent was obtained from their parents/guardians. In our study *Early onset neonatal sepsis (EONS)* and *late onset neonatal sepsis (LONS)* were defined as illnesses appearing from birth to 3 days and from 4-28 days of age of the neonate, respectively. The ethical clearance of this study was taken from hospital authority.

Total admitted neonates with suspected septicemia were 1102 (both term and preterm). Complete blood count (CBC), C-reactive protein (CRP), blood culture along with other laboratory investigations (if needed) e.g blood sugar, serum electrolytes, chest x-ray were performed for all cases.

Using aseptic technique by applying povidone iodine and 70% alcohol at the site of vein puncture, 2 ml venous blood was drawn from the peripheral vein by the attending nurse and then the blood was inoculated into a blood culture bottle containing Tryptone Soy Broth (TSB) and Brain Heart infusion Broth. The specimens were transported immediately to the microbiology lab and incubated for one week in 37°C and were daily checked for evidence of bacterial growth. For positive broth cultures, subcultures were made on solid media (blood agar and McConkey's agar) and were incubated in 37°C for 24 to 48 hours. The grown bacteria were identified by colony morphology, gram stain and biochemical tests. Antimicrobial susceptibility testing was performed for all blood culture isolates according to the criteria of the National Committee for Clinical Laboratory Standards by disk diffusion method.

In this study main outcome variable was culture positive cases and antibiotic sensitivity of organisms. We collected data on gender, birth weight, gestational age, clinical features, CBC, blood sugar, S.electrolyte, blood culture and sensitivity etc. The data were entered and analyzed using Statistical Package of

Social Science SPSS, version 20.

Results

Among the suspected neonatal septicemia cases only 111(10%) patients were culture positive. Preterm were 77(69%) and term 34(31%). Male cases were 72(65%) and female 39(35%). Male female ratio was 1.8:1. Among them 106 (95%) cases had sepsis with gram negative organisms and 5(5%) had sepsis with gram positive organisms with predominant of *Klebsiella* (76,68%) followed by *Acinetobacter* (16,14%), *Pseudomonas* (6,5%), *Escherichia coli* (3,3%), *Aeromonas* (3,3%), *Streptococcus* (3,3%), *Staphylococcus* (2, 2%), *Citrobacter* (1,1%) and *Flavobacterium* (1,1%) (Table I).

Eighty (72%) cases had EONS and 31(28%) cases had LONS. *Klebsiella* (57,51%) was more common organism followed by *Acinetobacter* (11,10 %) causing EONS and in LONS, *Klebsiella* was present in 19 (17%) cases followed by *Acinetobacter* (5, 5%) that implies type of organisms were same in both EONS and LONS (Table I).

Table I : Bacteriological profile of neonatal sepsis

Bacteria	Total= 111(100%) n(%)	Early onset neonatal Sepsis (EONS)		Late onset neonatal sepsis (LONS)	
		Preterm n(%)	Term n(%)	Preterm n(%)	Term n(%)
<i>Klebsiella</i>	76(68)	42(38)	15(14)	11(10)	8(7)
<i>E. coli</i>	3(3)	2(2)	0(0)	1(1)	0(0)
<i>Acinetobacter</i>	16(14)	7(6)	4(4)	3(3)	2(2)
<i>Pseudomonas</i>	6(5)	2(2)	2(2)	1(1)	1(1)
<i>Aeromonas</i>	3(3)	2(2)	0(0)	0(0)	1(1)
<i>Flavobacterium</i>	1(1)	0(0)	0(0)	1(1)	0(0)
<i>Citrobacter</i>	1(1)	0(0)	0(0)	1(1)	0(0)
<i>Staphylococcus</i>	2(2)	2(2)	0(0)	0(0)	0(0)
<i>Streptococcus</i>	3(3)	1(1)	1(0)	1(1)	0(0)

n=case. %=percentage of case in round figure

Ampicillin, Gentamicin and Ceftazidime were mostly resistance to gram negative organisms - 104 (94%), 99 (89%) and 93(84%) respectively. Besides these, Amikacin (104, 94%), Imipenem (85,77%) and Ciprofloxacin (73,66%) were more resistant (Table 2). *klebsiella* in 17 cases and *Acinetobacter* in 4 cases were resistant to all commonly used antibiotics. *Klebsiella* were more sensitive to Chloramphenicol (30, 40%), Imipenem (19, 25%) then to Ciprofloxacin (14, 18%). *Acinetobacter* were more sensitive to Ceftazidime (7, 44%) then to Ciprofloxacin (5, 31%). *Pseudomonas* were more sensitive to Ceftazidime (3, 50%), Ciprofloxacin (3, 50%) and Cotrimoxazole (3, 50%) (Table 2). In 21 (19%) cases, the organisms were resistant to all commonly used antibiotics comprising *Klebsiella* in 17 cases and *Acinetobacter* in 4 cases. No organisms were found sensitive to all commonly used antibiotics. *Staphylococcus* was also sensitive to Linezolid in 2 cases, Levofloxacin in 2 cases. *Streptococcus* was also sensitive to Linezolid in 3 cases, vancomycin in 3 cases.

Table II : Drugs sensitivity pattern of organisms causing neonatal sepsis

*= drug sensitivity not done to that particular drug. S=sensitive, I=Intermediate, R=Resistance

Bacteria	Ampicillin n (%)	Gentamicin n (%)	Ceftazidime n (%)	Amikacin n (%)	Ciprofloxacin n (%)	Imipenem n (%)	Meropenem n (%)	Piparacillin n (%)	Netilmicin n (%)	Chloramphenicol n (%)	Cotrimoxazole n (%)	Ceftriaxone n (%)
<i>Klebsiella</i>	S 0(0) I 1(1) R 75(99)	2(3) 74(97)	0(0) 74(97)	1(1) 75(99)	3(4) 11(14) 52(82)	2(3) 17(22) 57(75)	1(1) 6(9) 69(90)	0(0) 76(100)	0(0) 76(100)	30(39) 46(61)	1(1) 2(3) 73(97)	0(0) 76(100)
<i>E. coli</i>	S 0(0) I R 3(100)	0(0) 3(100)	0(0) 3(100)	0(0) 3(100)	0(0) 3(100)	0(0) 3(100)	0(0) 3(100)	0(0) 3(100)	0(0) 3(100)	1(33) 2(67) 0(0)	0(0) 3(100)	0(0) 3(100)
<i>Acinetobacter</i>	S 0(0) I R 16(100)	1(6) 15(94)	5(31) 9(56)	1(6) 15(94)	2(13) 3(19) 10(68)	0(0) 16(100)	5(31) 11(69)	2(13) 1(6) 13(81)	1(6) 15(94)	1(6) 15(94)	3(19) 1(6) 12(85)	0(0) 4(25) 12(75)
<i>Pseudomonas</i>	S 0(0) I R 6(100)	1(17) 5(83)	3(50) 3(50)	0(0) 6(100)	1(17) 2(33) 3(50)	1(17) 1(17) 4(66)	2(33) 4(66)	1(17) 2(33) 3(50)	1(17) 1(17) 4(66)	2(33) 4(66)	1(17) 2(33) 3(50)	0(0) 1(17) 5(83)
<i>Aeromonas</i>	S 0(0) I R 3(100)	3(100) 0(0)	0(0) 3(100)	0(0) 3(100)	0(0) 3(100)	0(0) 3(100)	0(0) 3(100)	0(0) 3(100)	0(0) 3(100)	1(33) 2(67)	3(100) 0(0)	0(0) 3(100)
<i>Flavobacterium</i>	S 0(0) I R 1(100)	0(0) 1(100)	0(0) 1(100)	0(0) 1(100)	0(0) 1(100)	0(0) 1(100)	0(0) 1(100)	1(100) 0(0)	0(0) 1(100)	0(0) 1(100)	0(0) 1(100) 0(0)	0(0) 1(100)
<i>Citrobacter</i>	S 0(0) I R 1(100)	0(0) 1(100)	1(100) 0(0)	0(0) 1(100)	0(0) 1(100)	0(0) 1(100)	0(0) 1(100)	* 1(100)	0(0) 1(100)	1(100) 0(0)	1(100) 0(0)	0(0) 1(100)
<i>Staphylococcus</i>	S 0(0) I R 2(100)	2(100) 0(0)	0(0) 2(100)	0(0) 2(100)	0(0) 2(100)	* 2(100)	* 2(100)	* 2(100) 0	0(0) 2(100) 0	2(100) 0(0)	0(0) 2(100)	0(0) 2(100)
<i>Streptococcus</i>	S 3(100) I R 0(0)	0(0) 3(100)	1(33) 2(67)	* 0(0)	1(33) 2(67) 0(0)	* 0(0)	* 0(0)	* 0(0)	* 0(0)	1(33) 2(67) 0(0)	3(100) 0(0) 0(0)	1(33) 2(100)

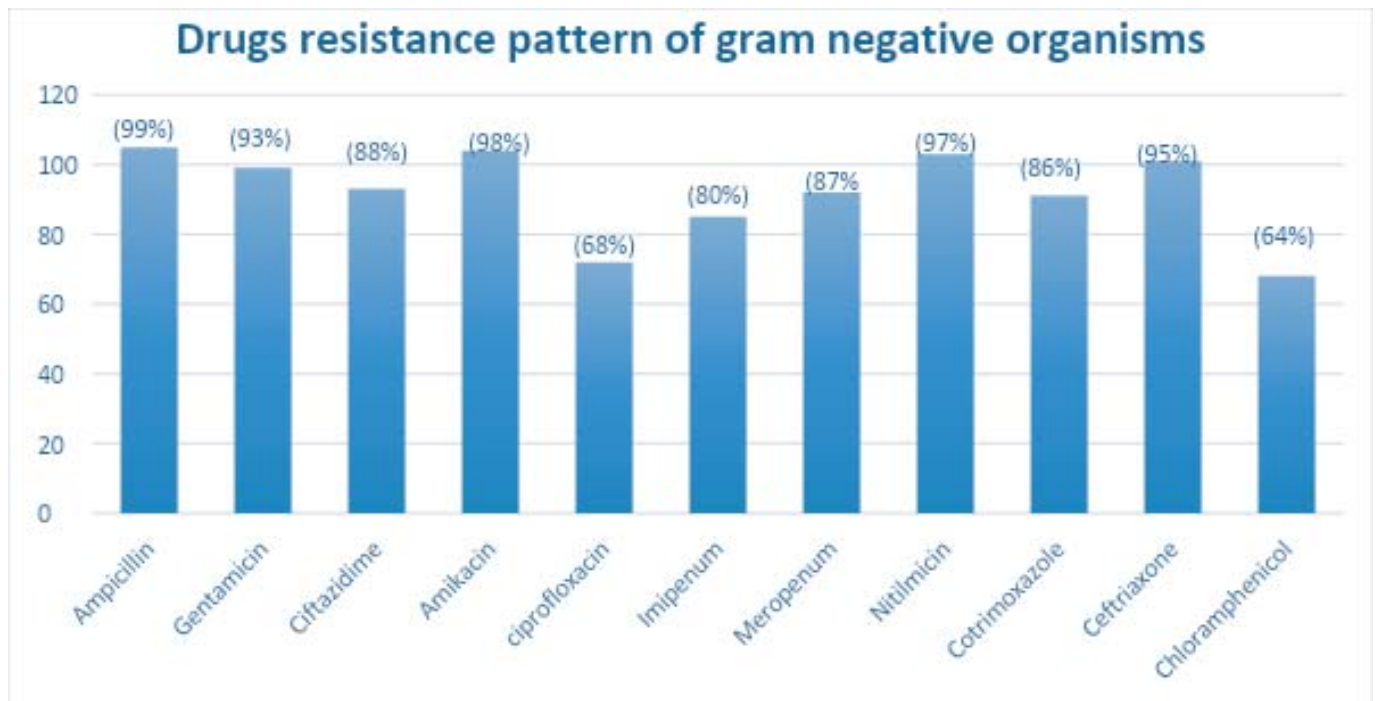


Figure I : Antibiotics Resistance of gram-negative organisms causing neonatal sepsis

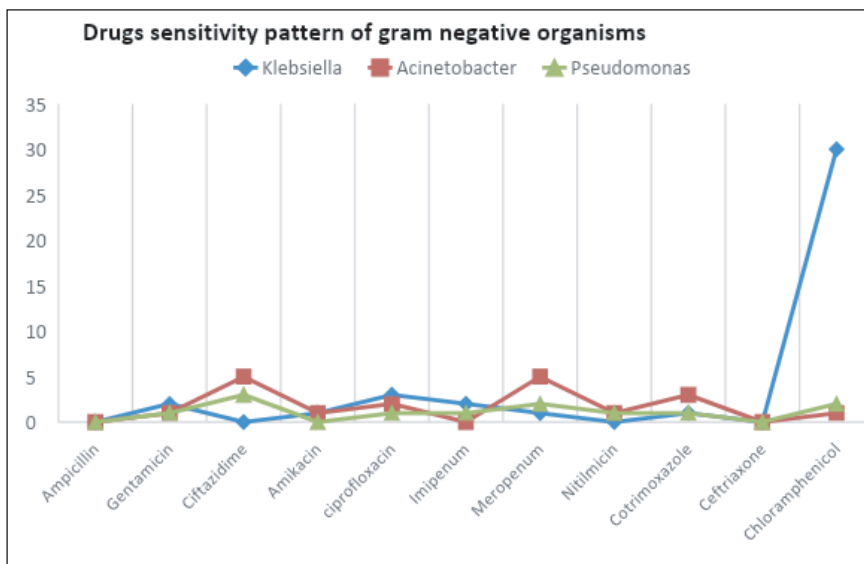


Figure II : Antibiotics sensitivity pattern of gram-negative organisms causing neonatal sepsis

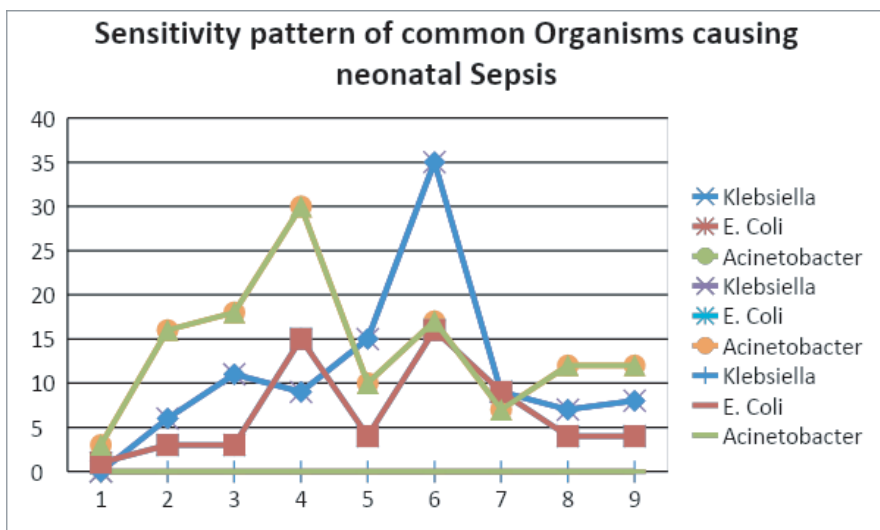


Figure III : Antibiotics sensitivity pattern of Common Organisms causing neonatal septicemia in the previous study in the same department.⁹ Figure III,N=119

Discussion

A total of 1107 suspected cases of neonatal septicaemia were admitted and their blood send for culture and sensitivity. Among them only 111(10%) patients were found culture positive. This is low compared to previous study done by Nyma et al and Ahmad et al.^{10,11} They showed in their study that the incidence of culture positive cases was 69.35%. and 26% respectively.^{10,11} Besides this, other studies done by karthikeyan et al and Tallu et al. also found higher level of culture positive cases (51% and 64% respectively).^{12,13}

In our study preterm were 77(69%) and term 34(31%). Begum et al demonstrated preterm was 63% and term 37% that is similar to our study.⁶

In this study Male cases were 72(65%) and female 39(35%). Male female ratio was 1.8:1 Shirin et al demonstrated male and female ratio was 3:1 in their study.⁴

In this study it was found that 106 (95%) cases had sepsis with gram negative organisms and 5(5%) had sepsis with gram positive organisms with more predominant of *Klebsiella* 76(68%) followed by *Acinetobacter* 16(14%), *Pseudomonas* 6(5%), *Escherichia coli* 3(3%), *Aeromonas* 3(3%), *Streptococcus* 3(3%). Similar results were found in others studies done in Bangladesh.¹⁴⁻¹⁸ But in developed countries GBS is common organisms.¹⁹ Robillard et al. showed in their study that gram positive organisms predominated causing neonatal sepsis.²⁰

Majority cases 80 (72%) cases had EONS. *Klebsiella* (57,51%) was more common organism followed by *Acinetobacter* (11,10%), causing EONS. In LONS, *Klebsiella* was present in (19,17%) cases followed by *Acinetobacter* (5, 5%), this implies type of organisms were same in both EONS and LONS. Begum et. al. showed in their study that EONS was more than LONS (77.27% vs 22.64%). Common pathogen causing EONS was *Klebsiella* followed by *Acinetobacter* and in LONS *Acinetobacter* was common organism that was found in the study of Begum et al.⁶ This result is like our study.

Antibiotic resistance is now a global problem. Most gram-negative organisms are now resistant to commonly used antibiotics. In this study

Ampicillin, Gentamicin and Ceftazidime were mostly resistant to gram negative organisms 104(94%), 99(89%) and 93(84%) respectively. Besides these, Amikacin 104(94%), Imipenem 85(77%) and Ciprofloxacin 73(66%) were also resistant. Similar results were found in the studies of Shirin et al and Begum et al,^{3,6}

In this study, in 21 (19%) cases, the organisms (*Klebsiella* in 17 cases and *Acinetobacter* in 4 cases) were resistant to all commonly used antibiotics. No organisms were found sensitive to all commonly used antibiotics. Regarding individual organism sensitivity to antibiotics, *Klebsiella* were more sensitive to

Chloramphenicol 30(40%), Imipenem 19 (25%) then to Ciprofloxacin 14(18%). *Acinetobacter* were more sensitive to Ceftazidime 7(44%) then to Ciprofloxacin 5(31%). *Pseudomonas* were more sensitive to Ceftazidime 3(50%), Ciprofloxacin 3(50%) and Cotrimoxazole 3(50%). Several studies also showed similar results.^{3,6, 21-23}

In previous study done in this hospital showed that *E. coli* was the common organisms and *Acinetobacter* was rare.⁹ Chowdhury et al, Ahmed et al, and Shirin et al. all showed same observation in their studies.¹⁵⁻¹⁸ But in our study we found that *Klebsiella*, *Acinetobacter* followed by *E. coli* are common bacteria causing neonatal septicemia.

In this study, we found that there is changing pattern of organisms causing neonatal septicemia. Moreover, in most of cases, the antibiotic resistance is so high that the organisms were not sensitive at all to commonly used antibiotics. This reflects the current situation of neonatal septicemia.

Conclusion

There is changing pattern of organisms as well as emergence of multidrug resistant organisms causing neonatal septicemia. *Klebsiella* followed by *Acinetobacter* and *Pseudomonas* are now common pathogens. Ampicillin, Gentamicin and Ceftazidime are more resistant to most of the organisms causing neonatal sepsis. Imipenem is alarmingly resistant. Therefore, we should give emphasis on rationale use of antibiotics according to blood culture and sensitivity result. As well as when there is a need of empirical use of antibiotic in neonatal septicemia, we should follow the recent trend of bacteriological profile and drug sensitivity pattern to save our neonates.

Acknowledgements

The authors are grateful to the microbiology department of Dhaka Shishu (Children) Hospital providing facilities to carry out the research work.

Conflict of Interest

Conflict of interest declared none.

References

- Islam S, Munira S, Farzana S, Sarker S, Ahmed R, Sarker M. K. Aktaruzzaman. Infant and Child Mortality Status of Bangladesh: A Study on Demographic and Health. Asian Journal of Social Science Studies.2018; 3(1): 43-53.
- Bangladesh demographic and health survey.2019
- Shirin M, Hossain M M, Mamun AA, Chowdhury AK, Qader A, Chowdhury MAK. Nosocomial sepsis in neonate in intensive care unit: Aetiology, drug resistance, haematological profile and outcome.DS (Child) H J 2005; 21 (1): 19- 24

- Chacko B, Sohi I. Early onset neonatal sepsis. Indian journal of paediatrics.2005;72(1):23-26
- Maternal and neonatal health disparities, Unicef, Bangladesh.2015
- Begum M, Hassan M, Haque ZSM, Jahan N, Chowdhury K, Rob AWS.Study of Bacteriological pathogen causing neonatal sepsis at NICU in Ad-din medical college hospital. Northern International Medical College Journal.2013;5(1):297-99
- Singh R, Singh S, Singh S P and Sachan D. Prenatal and susceptibility pattern of *E. coli* in low birth weight neonates of early onset sepsis..IJPSR. 2011;2(12):3122-28.
- Sankar MJ,Agarwal R,Deorani AK,Poul VK.Sepsis in newborn. Indian journal of paediatrics. 2008;75:261-266
- Rahman M, Tayab M A, Sarkar PK, Jahan R A. Bacteriological profile and drug sensitivity pattern of neonatal septicemia in a tertiary care hospital in Bangladesh. Bangladesh private medical practitioners journal .2013;19(1):1-5
- Nyma Z, Rahman M, Hasan S, et al. Prevalence and Associated Risk Factors of Sepsis among Neonates Admitted into Neonatal Intensive Care Units of Public Hospitals in Dhaka. Cureus 2020; 12(3):1-12
- Ahmed AS, Chowdhury MA, Hoque M, Darmstadt GE. Clinical and bacteriological profile of neonatal septicemia in a tertiary level pediatric hospital in Bangladesh. Indian Pediatr.2002; 39(11): 1034-39.
- Karthikeyan G, Premkumar K: Neonatal sepsis: Staphylococcus aureus as the predominant pathogen. Indian journal of paediatrics.2001;6:715-17
- Tallur SS, Kasturi AV, Nadgir SD, Krishna BVS: Clinico-bacteriological study of neonatal septicemia in Hubli. Indian journal of paediatrics.2000; 67:169-74.
- Islam Q. R, Shahidullah M, Islam M.M.Z, Mridha M. A, Akter S. Bacterial profile of neonatal septicemia and antibiotic susceptibility pattern of the isolates in tertiary care hospital, Dhaka, Bangladesh "Bangladesh J Child Health 2019; 43 (1): 35-40
- Chowdhury MAK A, Rahman MA, Karim AQMR. Characteristics of septicemia in newborns in Dhaka Shishu Hospital. DS(Child)HJ.1998;14(2):12-16
- Hoque MM,Ahmed ASM,Ahmad SS,Chowdhury MAK.Clinical manifestation and bacteriological profile of septicemia in preterm neonates:experience from a tertiary level paediatric Hospital, BJMS.2004;10(1)29-32.
- Shirin M,Hossain MM,Mamun MA,Chowdhury NA.Sensitivity and specificity of C-Reactive protein(CRP) and thrombocytopenia in the diagnosis of neonatal sepsis. BJCH. 2005;29(2):41-45.
- Ayub M,Raj AY,Mannan MA,Shahidulla M.Perinatal risk factors in neonatal sepsis.DS(child)H J.2002;18(1):6-10
- Shahian M, Pishva N,,Kalani M.Bacterial etiology and antibiotic sensitivity patterns of early-late onset neonatal sepsis among newborns in Shiraz, Iran 2004-2007.IJMS.2010. 35; 4:294-298.
- Robillard P Y, Beth P,Hulsey T C,Sergent M P, Perianin J and Janky E.Neonatal bacterial septicemia in a tropical area.Four-year experience in Guadeloupe (French West Indies). Acta Paediatr.1993; 82: 687-89.
- Hoque MM,Ahmed ASM,Ahmad SS,Chowdhury MAK.Clinical manifestation and bacteriological profile of septicemia in preterm neonates:experience from a tertiary level paediatric Hospital, BJMS.2004;10(1):29-32.
- Loureiro MM, Moraes BA, Quadra MRR, et al. Study of multi-drug resistant microorganisms isolated from blood cultures of hospitalized newborns in Rio de Janeiro city, Brazil. Brazil J Microbiol. 2002;33(1):73-78.
- Abdul Hannan A, Qamar M U,Usman M, Ahmad K Waheed I and Rauf K. Multidrug resistant microorganisms causing neonatal septicemia: In a tertiary care hospital Lahore, Pakistan. African Journal of Microbiology Research. 2013;7(19):1898-1902.