ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 7, Issue – 2, April - 2024, Page No. : 47 – 52

Bacteriological profile and antibiotic susceptibility pattern of neonatal septicemia at tertiary care hospital, Gujarat

[1]Dr. Sweta Dhaneja, Senior Resident Doctor, P.D.U. Medical College, Rajkot, Gujarat.

[2]Dr. Ghanshyam Kavathia, Professor and Head, P.D.U. Medical College, Rajkot Gujarat.

Corresponding Author: Dr. Sweta Dhaneja, Senior Resident Doctor, P.D.U. Medical College, Rajkot, Gujarat.

How to citation this article: Dr. Sweta Dhaneja, Dr. Ghanshyam Kavathia, "Bacteriological profile and antibiotic susceptibility pattern of neonatal septicemia at tertiary care hospital, Gujarat", IJMACR- April - 2024, Volume – 7, Issue - 2, P. No. 47 – 52.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: The information of the sensitivity pattern of the causative organism is very important for effective control of septicemia in neonates.

Objective: To determine the prevalence of neonatal septicemia, identify the bacterial isolates and study their antimicrobial susceptibility pattern in neonate admitted in neonatal intensive care unit (NICU) of the civil hospital, Gujarat.

Material and Method: A prospective cross-sectional study was conducted over a period of 6 month (July 2023 – December 2023). The study included 1064 patients admitted in civil hospital, Gujarat. Blood samples for culture were taken aseptically before starting antibiotic therapy. Blood culture of all neonates who are suspected for septicemia was performed. Organism should be isolated and identified by standard microbiological process which includes culture, colony morphology, gram stain and biochemical profile. Antimicrobial susceptibility testing (AST) was done by Kirby Bauer's disc diffusion method.

Result: Study included total 1064 patients. Blood culture were found positive in 138 (12.96%) neonates, Out of which 81(58.69%) males and 57(41.30%) females. The organism isolated were Klebsiella pneumonia 58(42.02%), Coagulase negative Staphylococci 42(30.43%), Staphylococcus aureus 16(11.59%), E-coli 13(9.42%) and Acinetobacter spp 12(8.69%). Gram negative bacilli (60.13%) predominated over Gram positive cocci (42.02%). Most of the gram positive isolates showed higher resistance to penicillin and it was more sensitive to Vancomycin, Linezolid and Chloramphenicol. Similarly, most of the gram negative organism showed more resistance to Ampicillin and it was more sensitive to Carbapenems antibiotics.

Conclusion: The problem can be solved by careful selection and proper use of available antibiotics.

Keyword: Blood Stream Infection, Multidrug Resistance

Introduction

Neonatal septicemia refers to generalized bacterial infection documented by a positive blood culture in the first 4 week of life. Septicemia is a significant cause of morbidity and mortality among the neonates. It is caused by invasion of micro-organism, their active multiplication in blood and release of toxic substance. It is diagnosed by a positive blood culture during the first month of life [1].

But it is common that many times the neonates present with sign and symptoms of septicemia and the blood culture may not reveal any growth. In such situation, other indirect evidence may help to diagnose neonatal septicemia. These include blood investigations, antenatal and natal predisposing factors [2].

Early onset neonatal sepsis is commonly caused by the micro-organism acquired from the mother before or during birth. Whereas late onset infection is generally caused by the micro-organism acquired from the environment rather than from the mother [3].

The fact is that the isolated organism have developed increased drug resistance over the last few years [4] But early diagnosis and proper management of neonatal septicemia can substantially reduce morbidity and mortality. For this life threatening emergency, rapid treatment with antimicrobials is essential for a favourable outcome.

It may be necessary to treat neonatal infections by empirically used antimicrobial drugs as soon as to reduce the mortality of newborn by identified organism and its antimicrobial susceptibility pattern [5].

Aim of this study was to identify the common etiological agents of neonatal septicemia and to determine their antimicrobial susceptibility pattern in civil hospital, Gujarat.

Materials and Methods

Study type and place: A prospective cross-sectional study was conducted, which include 1064 suspected cases of septicemia admitted in neonatal intensive care unit (NICU) of the civil hospital, Gujarat over a period of 6 month (July 2023 – December 2023).

Inclusion and exclusion criteria: Blood samples (1-2 ml) were collected from all neonates admitted to the civil hospital, Gujarat during the study period suspected to have septicemia. Septicemia was suspected to have if one or more of the following symptoms were present – vomiting, lethargy, refusal to feed, respiratory distress, hypothermia, grunting, abdominal distension, cyanosis, seizure, jaundice, instability etc.

Neonates admitted in ward other than NICU and OPD sample of blood culture was excluded from the study.

Collection of blood sample and antimicrobial susceptibility test: Volume of 1-2ml blood was drawn aseptically before starting of antimicrobial treatment and inoculated into brain heart infusion broth (BHI) in a ratio of blood:BHI is 1:10. The processing of samples done by standard microbiological methods. The antimicrobial susceptibility testing was conducted on Mueller Hinton agar (MHA) by Kirby-Bauer disk diffusion technique that is recommended by clinical laboratory standards institute (CLSI) guideline. The concentration of various antibiotics that were used for susceptibility testing are Penicilline (P 10U), Ampicillin (AMP 10mcg), Piperacillin-tazobactem (PIT 100mcg/10mcg), Cefepime (CPM 30mcg), Ceftazidime (CAZ 30mcg), Cefotaxime (CTX 30mcg), Cefuroxime (CXM 30mcg), Aztreonam (AT 30mcg), Meropenem (MRP 10mcg), Amikacin (AK 30mcg), Gentamicin (GM 10mcg), Ciprofloxacin (CIP 5mcg), Levofloxacin (LE 5mcg), Tetracycline (TE 30mcg), Cotrimoxazol (COT 25mcg), Polymyxin-B (PB

50U), Erythromycin (E 10mcg), Rifampicin (RIF 5mcg), Clindamycin (CD 2mcg), Chloramphenicol (CH 30mcg), Linezolide (LZ 30mcg), Vancomycin (VA 30mcg).

Results

Study included total 1064 patient suspected of neonatal septicemia. Bacterial growth was observed in 138 (12.96%) of the samples, Out of which 81 (58.69%) was male and 57 (41.30%) was female. The incidence of gram positive and gram negative organism was 42.02% and 60.13% respectively. Coagulase negative Staphylococci (30.43%) remained the predominant isolate followed by klebsiella spp (42.02%). Among the study population, 627 (58.93%) were aged < 7 days (early onset) and 437 (41.07%) were aged >7 days (late onset). Most of the gram positive isolates showed higher resistance to Penicillin and it was more sensitive to Vancomycin, Linezolid and Chloramphenicol. Similarly, most of the gram negative organism showed more resistance to Ampicillin and it was more sensitive to Carbapenems antibiotics. Frequency of isolates is shown in Table 1. Antimicrobial susceptibility pattern of gram negative and gram positive organism are shown in Table 2 and Table 3 respectively and Table 4 show the age of onset of neonatal septicemia

Table 1: Frequency of isolates

Organism	Frequency	Percentage (%)
Escherichia Coli (E-Coli)	13	9.42%
Klebsiella Spp.	58	42.02%
Coagulase Negative Staphylococci (CONS)	42	30.43%
Staphylococcus Aureus	16	11.59%
Acinetobacter Spp.	12	8.69%

Table 2: Antimicrobial susceptibility pattern of gram negative organism

Drugs	Escherichia coli (13)		Klebsiella Spp. (58)		Acinetobacter spp.(12)	
	Sensitive	Resistance	Sensitive	Resistance	Sensitive	Resistance
MRP	13 (100%)	0 (0%)	58 (100%)	0 (0%)	12 (100%)	0 (0%)
PIT	13 (100%)	0 (0%)	43 (74.13%)	15 (25.49%)	8 (66.66%)	4 (33.34%)
CIP	6 (46.15%)	7 (53.84%)	9 (15.51%)	49 (84.49%)	1 (8.33%)	11 (91.67%)
A/S	1 (7.69%)	12 (92.31%)	6 (10.34%)	52 (89.66%)	6 (50%)	6 (50%)
COT	6 (46.15%)	7 (53.84%)	12 (20.68%)	46 (79.32%)	2 (16.66%)	10 (83.34)
LE	6 (46.15%)	7 (53.84%)	10 (17.24%)	48 (82.76%)	7 (58.33%)	5 (41.67%)
TE	6 (46.15%)	7 (53.84%)	50 (86.20%)	8 (13.8%)	10 (16.66%)	2 (83.34%)
AK	8 (61.53%)	5 (38.47%)	11 (18.96%)	47 (81.04%)	6 (50%)	6 (50%)
GM	7 (53.84%)	6 (46.15%)	7 (12.06%)	51 (87.97%)	3 (25%)	9 (75%)
CPM	7 (53.84%)	6 (46.15%)	6 (10.34%)	52 (89.66%)	5 (41.66%)	7 (58.34%)
CAZ	1 (7.69%)	12 (92.31%)	4 (6.89%)	54 (93.11%)	3 (25%)	9 (75%)

CTX	0 (0%)	13 (100%)	3 (5.17%)	55 (94.83%)	0 (0%)	12 (100%)
CXM	0 (0%)	13 (100%)	2 (3.44%)	56 (96.56%)	6 (50%)	6 (50%)
AMP	0 (0%)	13 (100%)	-	-	-	-

Table 3: Antimicrobial susceptibility pattern of gram positive organism

Drugs	Coagulase negative Staphylococcus (42)		Staphylococcus aureus (16)	
	Sensitive	Resistance	Sensitive	Resistance
RIF	34 (80.95%)	8 (19.05%)	15 (93.75%)	1 (6.25%)
LZ	42 (100%)	0 (0%)	16 (100%)	0 (0%)
VA	42 (100%)	0 (0%)	16 (100%)	0 (0%)
CH	41 (97.61%)	1 (2.39%)	16 (100%)	0 (0%)
CD	30 (71.42%)	12 (28.58%)	7 (43.75%)	9 (56.25%)
COT	24 (57.14%)	18 (42.86%)	9 (56.25%)	7 (43.75%)
E	15 (35.71%)	27 (64.29%)	6 (37.50%)	10 (62.50)
P	2 (4.76%)	40 (95.24%)	0 (0%)	16 (100%)
CIP	8 (19.04%)	34 (80.96%)	4 (25%)	12 (75%)
TE	35 (83.33%)	7 (16.67%)	15 (93.75%)	1 (6.25%)
GM	9 (21.42%)	33 (78.58%)	10 (62.5%)	6 (37.50%)
CX	17 (40.47%)	9 (59.53%)	8 (50%)	8 (50%)

Table 4: Age of onset of septicemia

Onset	Frequency	Percentage (%)
Early onset (< 7 days)	627	58.93%
Late onset (>7 days)	437	41.7%

Discussion

Present study aimed at finding the prevalence of bacterial pathogens associated with neonatal septicemia and their sensitivity to conventional antibiotics. Out of total 1064 sample, Bacterial growth was observed in 138 (12.96%) samples; similar results were found by Mudzikati et al. 2015[6] (9.8%) and Ansari et al. 2015[7] (12.6%).

The incidence of gram negative and gram positive organism was 60.13% and 42.02% respectively. Similar to a study conducted by Agnihotri et al., [8] which reported that Gram negative and Gram positive organism were responsible for 59% and 41% of the septicemia cases, respectively. similar observation were made by other workers.[9-10] Klebsiella spp. Was predominant among Gram negative organism and Coagulase negative Staphylococci (CONS) was the most frequently isolated Gram positive organism. In this study, organism isolated from blood culture was Escherichia coli, Klebsiella Spp., Acinetobacter spp., Coagulase negative Staphylococcus, Staphylococcus aureus.

In this study, a male (58.69%) predominance over female (41.30%), this might be because of the importance given to the male infants and also because of more number of male infant born compared to female infant. Higher rate of early onset (<7 days) septicemia may be due to early horizontal transmission of pathogen from NICU and delivery rooms or vertical transmission from maternal genital tract. Late onset (>7 days) septicemia is caused by pathogens present in external environment.

The antimicrobial sensitivity pattern differs in different studies as well as at different times in the same hospital[11]. This is because of emergence of resistant strains as a result of unnecessary used of antibiotics. In this study, Gram negative organism showed more resistance to Ampicillin and it was more sensitive to Carbapenems antibiotics. Most of the gram positive isolates showed higher resistance to Penicillin and it was more sensitive to Vancomycin, Linezolid and Chloramphenicol antibiotics. In overall, neonatal septicemia is a life threatening emergency, so early diagnosis and rapid treatment with proper antibiotics is essential.

Conclusion

In this study, high bacterial resistance among the pathogen responsible for development of neonatal septicemia is demonstrated which can be controlled by proper use of antibiotics. The study suggests proper monitoring of antimicrobial susceptibility pattern and implementation of infection control policies at a particular setup for effective management of infection.

Abbreviations

NICU - Neonatal intensive care unit

OPD - Outdoor patient

MHA - Mueller Hinton agar

AST - Antimicrobial susceptibility testing

CLSI - Clinical laboratory standards institute

References

1. Richard E Behrman, Martin R.J. Fanaroff A.A. Neonatal Septicemia. Behrman's Neonatal Perinatal Medicine, 3rd Ed 1983, 650-656.
2. Richard E Behrman, Robert M Kleigman, Nelson Textbook of Pediatrics, 17thEd 623-638, 847-848.
3. Kerur BM, Vishnu Bhat B, Harish BN, Habeebullah S, Uday Kumar C. Maternal genital bacteria and surface colonization in early neonatal sepsis. Ind J Pediatr 2006;73:29-32.
4. Ang OY, Ezike E, Asmar BI. Antibacterial resistance. Indian J Pedatr. 2004;71:229-39.
5. Yu L,Wu SX, Jia HQ. Study on antimicrobial susceptibility of bacteria causing neonatal infection: A 12 year study (1987-1998). Singapore Med J 2001;42:107-10
6. Mudzikati L., Dramowski A. Neonatal Septicemia: Prevalence and antimicrobial susceptibility pattern of common pathogens at princess Marina hospital, Botswana. Southern African Journal of Infectious Diseases. 2015;30(3):108-113.doi:10.1080/23120053.2015.1074443.
7. Ansari S., Nepal H.P., Gautam R., Shrestha S., Neopane P., Champagain M.l. Neonatal Septicemia in Nepal:Early-Onset versus Late-Onset. International Journal of Pediatrics. 2015:6.doi10.1155/2015/379806.379806
8. Agnihotri N, Kaistha N, Gupta V. Antimicrobial susceptibility of isolates from neonatal septicemia. Jpn J Infect Dis. 2004;57:273-5.
9. Kumhar GD, Ramachandra VG, Gupta P. Bacteriological analysis of blood culture isolates

from neonates in a tertiary care hospital in india. J Health Popul Nutr.2002;20:343-7.

10. Kaistha N, Mehta M, Singla N, Garg R, Chander J. Neonatal septicemia isolates and resistance patterns in a tertiary care hospital of North India. J Infect Dev Ctries.2009;4:55-7.
11. Rosenberg RE, Ahmed AN, Saha SK, Chowdhury MA, Ahmed S, Law PA, et al. Nosocomial sepsis Risk Score for Preterm Infant in Low-resource Setting. J Trop pediatr 2010;56:82-9.