ISSN- O: 2458 - 868X, ISSN–P: 2458 – 8687
National Library of Medicine - ID: 101731606

International Journal of Medical Science and Innovative Research (IJMSIR)
IJMSIR : A Medical Publication Hub
Available Online at: www.ijmsir.com
Volume – 6, Issue – 6, November – 2021 , Page No. : 121 - 128

A Descriptive study of blood culture positive sepsis and antibiotic sensitivity of isolates in neonates admitted to neonatal intensive care unit at a tertiary care hospital in Mandya

[1]Dr Avinash Singraiah, [2]Dr Keerthi Budnoor Jayaram, [3]Dr Pallavi Devaraju

[1-3]Department of Pediatrics, Mandya Institute of Medical Sciences, Mandya, Karnataka.

Corresponding Author: Dr Avinash Singraiah, Department of Pediatrics, Mandya Institute of Medical Sciences, Mandya, Karnataka.

Citation this Article: Dr Avinash Singraiah, Dr Keerthi Budnoor Jayaram, Dr Pallavi Devaraju, "A Descriptive study of blood culture positive sepsis and antibiotic sensitivity of isolates in neonates admitted to neonatal intensive care unit at a tertiary care hospital in Mandya", IJMSIR- November - 2021, Vol – 6, Issue - 6, P. No. 121 – 128.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: Neonatal sepsis contributes to 20% of neonatal mortality in India. In the management of neonatal sepsis, clinicians in many resource limited settings make tentative diagnosis and empirical treatment of neonatal sepsis. Emergence of multi drug resistant bacteria imposes challenges in treatment of neonatal sepsis. As bacterial flora and their resistance pattern of a unit also changes from time to time this study was intended to find bacteriological profile of neonatal sepsis and antibiotic susceptibility pattern of the isolates.

Objectives: To describe the bacteriological profile of blood culture in neonates with culture positive sepsis and to describe the antibiotic susceptibility pattern of the isolates among the study population.

Methods: Retrospective record based study done in NICU, MIMS Mandya during one year period from Jan 2020 - Dec 2020. All the blood culture positive neonatal sepsis cases admitted to NICU were included and analysed using descriptive analysis, incomplete case records subjects were excluded.

Results: A total of 107 blood culture isolates were studied. Male to female ratio was 1:1.4. Term babies constituted for 59%. According to the age of presentation 23% (n-24) were isolated from early onset neonatal sepsis (EONS) and 77% (83) were isolated from late onset neonatal sepsis (LONS). Among positives 74% were gram negative, most common was E coli followed by Klebsiella . Gram negatives were resistant to first and second line antibiotics and cephalosporins. Multi drug resistance was seen in 94% of E coli. In gram positive Staphylococcus epidermidis was predominant followed by Staphylococcus aureus. Highly sensitive to amikacin and gentamicin, and 100% sensitive to vancomycin. 18 cultures showed growth of candida, which was 100% sensitive to Flucanozole. Survival rate was 88%.

Conclusion: Over utilization of empirical antibiotics may be the major cause for high antimicrobial resistance. Hygiene practices, education and strict antibiotic stewardship are the need of the hour.

Keywords: Sepsis, multi-drug resistance, bacterial isolates

Introduction

Neonatal sepsis contributes to 20% of neonatal mortality in India. The incidence of sepsis in hospital-based studies is 30 per 1000 live births and in community-based studies, the incidence is 2.7-17% of all live births.[1]

Neonatal sepsis is classified into early onset sepsis and late onset sepsis. Early onset sepsis is usually caused by organisms from maternal genital tract, whereas late onset sepsis is majorly nosocomial infection.[2]

In the management of neonatal sepsis, clinicians in many resource limited settings make tentative diagnosis and empirical treatment of neonatal sepsis However aetiology of neonatal sepsis as well as response to antimicrobial agents may vary significantly from time to time and geographically which may affect the success of empirical management.[3]

Emergence of multi drug resistant bacteria imposes challenges in treatment of neonatal sepsis. Therefore, the knowledge of prevalence of local isolates and their antimicrobial sensitivity pattern is of utmost necessary for prompt antimicrobial therapy of neonatal sepsis.[4]

As bacterial flora and their resistance pattern of a unit also changes from time to time this study was intended to find bacteriological profile of neonatal sepsis and antibiotic susceptibility pattern of the isolates.

Methods

Retrospective observational record based study carried out in Mandya Institute of Medical Sciences, Mandya , Karnataka.

Study Period

Case records of neonates with positive blood culture during one year period i.e., from Jan 2020 to Dec 2020 was analyzed using pre-defined proforma.

Inclusion Criteria: All the blood culture positive neonatal sepsis cases admitted to NICU

Exclusion criteria: Incomplete case records.

Analysis

From the case records, gestational age, onset of disease in days, sex, birth weight, inborn/out born cases, identified organisms with sensitive pattern and survival outcome was recorded for analysis using Microsoft excel. Data analysed using SPSS software.

Descriptive summary statistics were used to describe demographic profile of cases, culture identified organisms, sensitive pattern and clinical outcome. Distribution of sensitive pattern by gram positive, and gram-negative status was described. The distribution of multi drug resistance (MDR) among each gram-negative species was detailed.

Results

A total of 107 blood culture isolates were retrieved during the above mentioned study period. Incidence of culture proven sepsis in inborn babies was 68% (n=73) and that of outborn babies was 32% (n-34).

From those culture confirmed neonatal sepsis, male constituted for 59% while females were 41%. Among culture positive sepsis 63 were term and 44 were preterm babies**.**

According to the age of presentation 23% (n-24) were isolated from early onset neonatal sepsis (EONS) and 77% (83) were isolated from late onset neonatal sepsis (LONS).

Among the positive blood cultures 10 were gram positive sepsis , 79 were gram negative and 18 were found to be fungal sepsis.

Out of 79 gram negative sepsis E coli was predominant accounting for 81% (64), followed by Klebsiella species. In gram positive sepsis (n-10) predominant

isolate was Staphylococcus epidermidis (n-8) followed by Staphylococcus aureus (n-2).

Candida was the only organism isolated as fungal sepsis in 18 isolates constituted for 16% of total positive cultures.

In LONS gram negative sepsis was predominant in which E coli constituted for 57% of all gram negative cultures (Fig 1). In EONS E coli was the major organism isolated (Fig 2). Term and preterm babies both had predominantly gram negative sepsis and also accounted for 54% (n=58) of LONS (Fig 3).

Among both inborn and outborn , gram negative sepsis was the most common (74%) and E coli was the major organism isolated. Among 18 fungal cultures, all were Candida species which were isolated from inborn preterm in LONS.

Sensitivity patterns of isolated bacteria

Gram positive organism: Most gram positive isolates were seen among term outborns as LONS (Table 1 and 2). These were highly resistant to first and second line antibiotics used in our unit (ampicillin and amoxicillin). Staphylococcus aureus was sensitive to Gentamycin and amikacin. But 38% of staphylococcus epidermidis was resistant to amikacin. Among cephalosporins all gram positive organisms were resistant to cefotaxime and ceftriaxone except for one isolate of staphylococcus aureus. Vancomycin and linezolid were shown resistance in 75% of staphylococcus epidermidis isolates. There was no methicillin resistance noted among Staphylococcus aureus isolates.

Gram negative organism

Majority of gram negative sepsis was seen among term inmates as LONS (Table 3) . And about 95% of E coli species were resistant to ampicillin/amoxicillin and cephalosporins.

Sensitivity to meropenem and pipericillin-tazobactum was noted in 4 and 1 isolate of E coli respectively. Aminoglycoside and Ciprofloxacin sensitivity was very poor accounting for only 2% and 12% respectively. Carbapenem resistance was seen in 96%. E coli showed predominant sensitivity of 94% to colistin (Table -4).

Acinetobacter was resistant all the antibiotics except tigecycline and colistin.

Candida species were 84% sensitive to flucanozole.

In our study most bacterial isolates were found to be Multi Drug Resistant (MDR). About 94% (n-60) of E coli, 83% (n-10) of Klebsiella were reported to be MDR.

Out of 107 culture positive neonates , 12 expired and 95(88%) completed the treatment.

Discussion

A periodical review of blood culture isolates is mandatory because of varying microbiological pattern of neonatal septicemia. As blood culture is the gold standard investigation for diagnosis of sepsis , this study was conducted retrospectively to know the bacteriological profile and the sensitivity pattern of the isolates. The higher rate of growth positivity was observed in male compared to female neonates, which was similar to studies done by Yadav et al[4] and Bhat et al.[5]

Majority of the culture positive sepsis were inborn babies which was consistent with Yadav et al[4]. The low prevalance in outborn is possibly because of administration of prior antibiotics at primary hospital before referral.

The prevalence of positive blood culture was found to be higher in 3 or above 3 days of age (late onset neonatal sepsis) constituting of 77% compared to 23% of below 3 days of age (early onset neonatal sepsis) .

Most of the previous studies by Yadav et al[4], Rath et al[6] have shown similar pattern of high prevalence of neonatal sepsis in late onset of sepsis.

Premature babies accounted for 59% of all the positive blood cultures concluding prematurity as a strong risk factor that leads to cause neonatal sepsis. This study also showed highest infection among low birth weight neonates compared to appropriate weight neonates.This was similar to studies done by Shreshta et al[7] and Pinaki et al[8].

Gram negative organisms were the most commonly isolated organism (74%) causing neonatal sepsis in this finding which is congruent with study reports from Rath et al[6] and Jajoo et al.[9] But in contrast gram positive predominant cultures were seen in Sorsa et al[10] and Ramesh et al.[11]

Gram negative sepsis was more common among term inborn babies having LONS. Most common gram negative organism isolated was E coli (81%) followed by Klebsiella. Rath et al[6] and Jajoo et al[9] studies showed Klebsiella followed by Acinetobacter as prevalent organism. Our study showed the frequency of isolation of Gram-negative bacteria was higher compared to Gram-positive bacteria. Probabilities would be variation in geographical area and also neonates have high chance to acquire large proportion of vaginal Gram-negative bacteria.

E coli showed high resistance to ampicillin , amikacin, cephalosporins, ciprofloxacin. But showed 94% sensitivity to colistin. Carbapenem resistance was seen in 96%. Isolates were sensitive to gentamicin and ampicillin in Yadav et al[4] study, and sensitive to piperacillin/tazobactam and meropenem in Rath et al[6] study.

Multi drug resistance (MDR) was seen in 94% of E coli and 83% of Klebsiella species which was way more than in studies by Jajoo et al[9] (80%). In our study Acenitobacter was resistant to all the antibiotics except colistin and tigecycline.

Gram positive sepsis was more common among term outborn babies having LONS. Among gram positive organisms, staphylococcus aureus was 100% sensitive to amikacin, gentamicin, vancomycin, linezolid which was not seen in any other studies where all other studies had prevalence of methicillin resistance and vancomycin resistance.[5,6,7] Stapylococcus epidermidis showed 62% sensitivity to amikacin, 50% sensitivity to vancomycin, but Pokhrel et al study showed 100% sensitivity to vancomycin.[12]

Fungal culture was predominant among preterm inborn babies with LONS. Out of 18 candida cultures, all isolates were sensitive to flucanozole, in contrast to report by Jajoo et al where they demonstrated resistance to flucanozole and voriconazole.[9]

The demonstrated high rates of antimicrobial resistance could be indicating over utilization of the named drugs as empiric treatment for most other common neonatal problems which were not actually infectious in origin. Additionally, most neonates with culture proven bacteremia were born at a health institution where most neonatal sepsis is arising from hospital acquired infections. Resistance rates of isolated Gram-positive bacteria against third generation cephalosporins were also high in our study which is consistent with studies aforementioned studies.[8,9,10,11,12]

Conclusion

E coli, Klebsiella, Candida were the leading cause of neonatal sepsis in our unit. These bacterial isolates were highly resistant to first and second line antibiotics

and also to cephalosporins. Third line antibiotics are relatively safe. Over utilization of empirical antibiotics may be the major cause for high antimicrobial resistance. Hygiene , education and strict antibiotic stewardship are the need of the hour.

References

1. Sankar MJ, Neogi SB, Sharma J, Chauhan M, Srivastava R, Prabhakar PK, Khera A, Kumar R, Zodpey S, Paul VK. State of newborn health in India. Journal of Perinatology. 2016 Dec;36(3):S38.

2. Shane A, Sánchez P, Stoll B: Sepsis Neonatal. Lancet 2017, 390(10104):1770-1780

3. Edmond K, Zaidi A. New approaches to preventing, diagnosing, and treating neonatal sepsis. PLoS medicine. 2010 Mar 9;7(3)

4. Yadav NS, Sharma S, Chaudhary DK, Panthi P, Pokhrel P, Shrestha A, Mandal PK. Bacteriological profile of neonatal sepsis and antibiotic susceptibility pattern of isolates admitted at Kanti Children's Hospital, Kathmandu, Nepal. BMC research notes. 2018 Dec;11(1):1-6.

5. Bhat YR, Lewis LE, 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

6. Rath S, Panda S, Nayak M, Pradhan D. Blood culture positive sepsis and sensitivity pattern in a tertiary care neonatal centre in eastern India. Int J Contemp Pediatr. 2019 Mar;6(2):487-90.

7. Shrestha RK, Rai SK, Khanal LK, Mandal PK. Bacteriological study of neonatal sepsis and antibiotic susceptibility pattern in Kathmandu, Nepal. Nepal Med Coll J. 2013;15:71–3

8. Panigrahi P, Chandel DS, Hansen NI, Sharma N, Kandefer S, Parida S, Satpathy R, Pradhan L, Mohapatra A, Mohapatra SS, Misra PR. Neonatal sepsis in rural India: timing, microbiology and antibiotic resistance in a population-based prospective study in the community setting. Journal of Perinatology. 2017 Aug;37(8):911-21.

9. Jajoo M, Manchanda V, Chaurasia S, Sankar MJ, Gautam H, Agarwal R, Yadav CP, Aggarwal KC, Chellani H, Ramji S, Deb M. Investigators of the Delhi neonatal infection study (DeNIS) collaboration, New Delhi, India. Alarming rates of antimicrobial resistance and fungal sepsis in outborn neonates in North India. PLoS One. 2018;13(6).

10. Sorsa A, Früh J, Stötter L, Abdissa S. Blood culture result profile and antimicrobial resistance pattern: a report from neonatal intensive care unit (NICU), Asella teaching and referral hospital, Asella, south East Ethiopia. Antimicrobial Resistance & Infection Control. 2019 Dec;8(1):1-6.

11. 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):1–5

12. Pokhrel B, Koirala T, Shah G, Joshi S, Baral P. Bacteriological profile and antibiotic susceptibility of neonatal sepsis in neonatal intensive care unit of a tertiary hospital in Nepal. BMC pediatrics. 2018 Dec;18(1):1-8

Legend Graphs and Tables

Fig 1: Organisms in Early Onset Sepsis

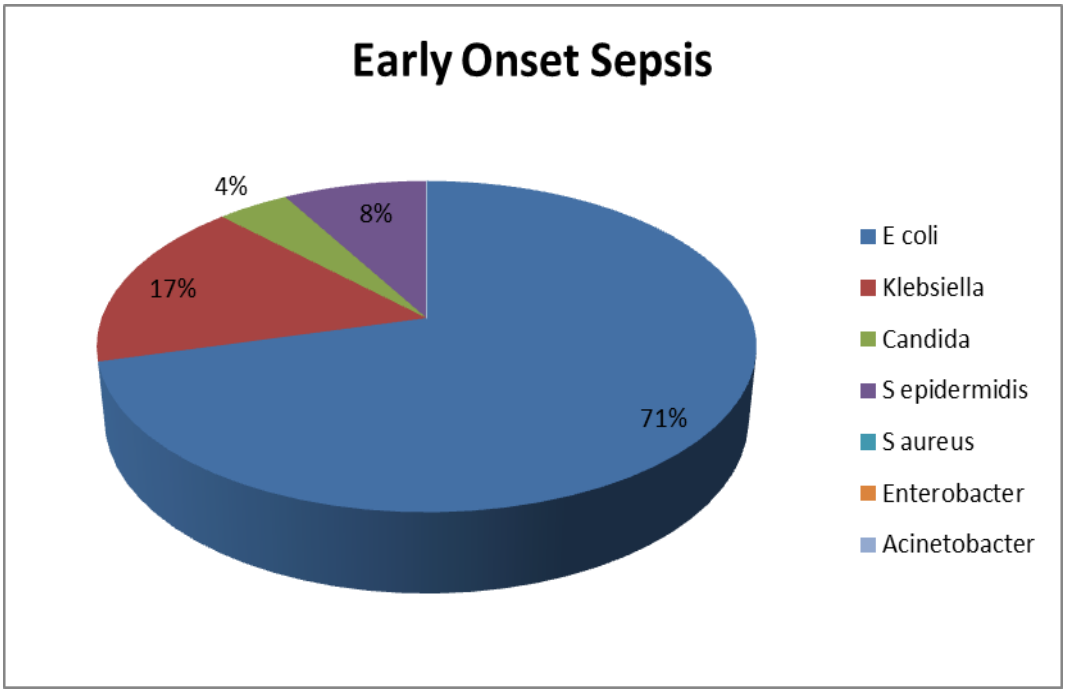

Fig 2: Organisms in Late Onset Sepsis

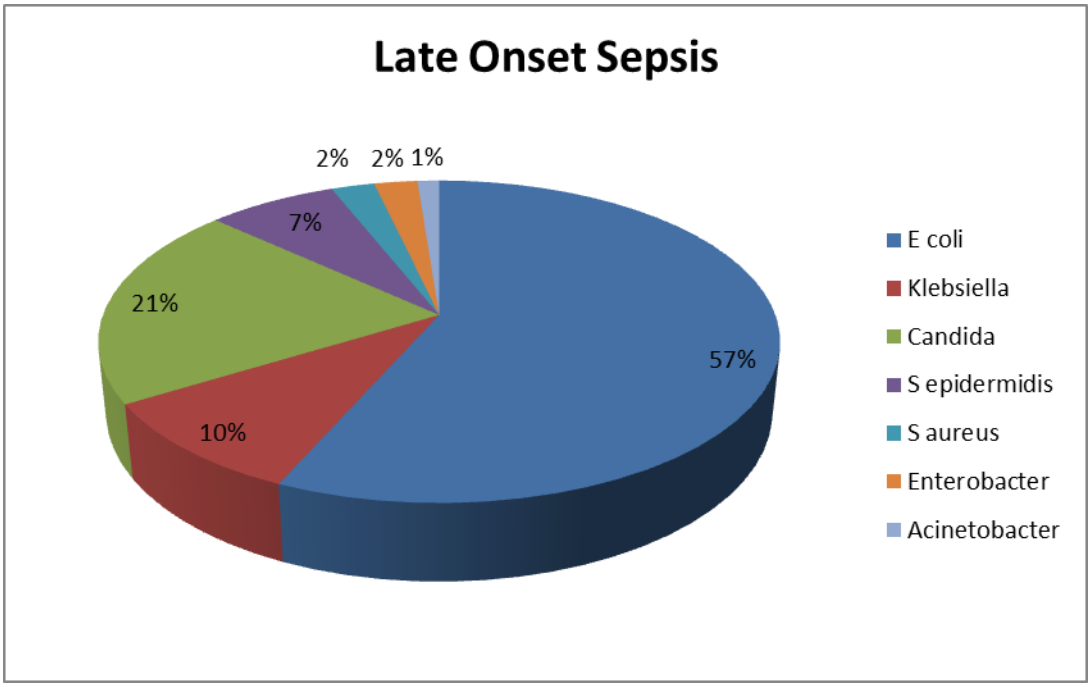

Fig 3: Gestational age vs Sepsis

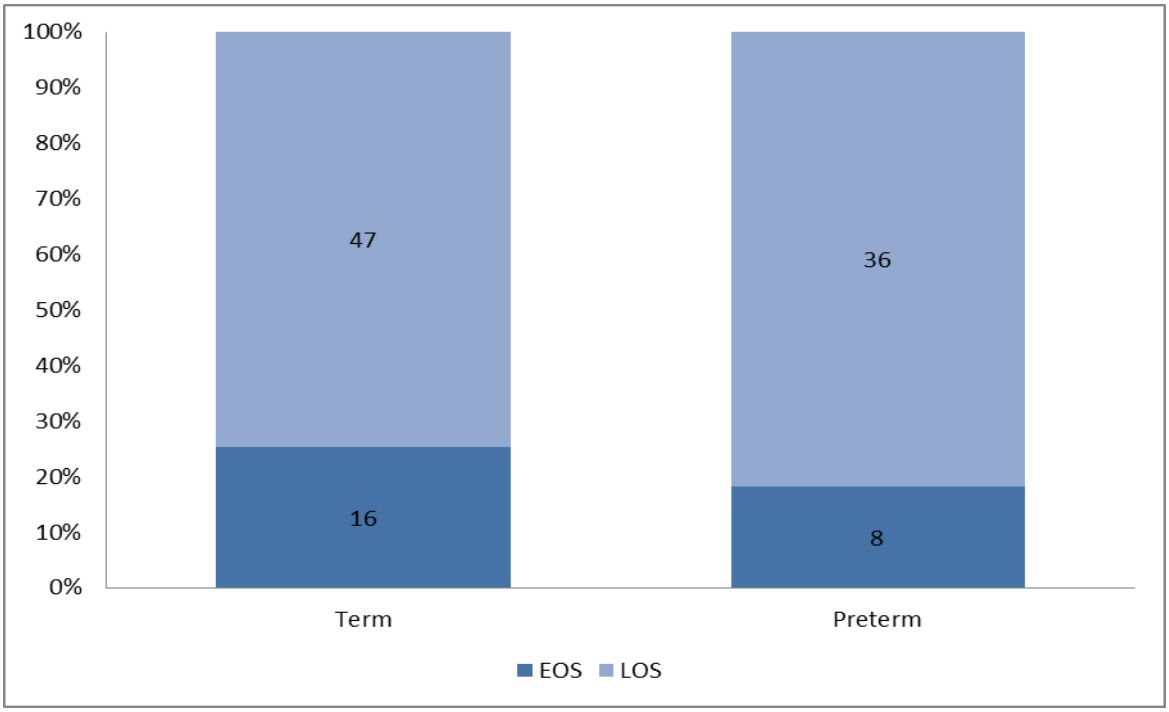

Table 1: Gestation vs Type of organism

	Term	Preterm	Total
Gram positive	10	0	10
Gram negative	46	33	79
Fungal	7	11	18
Total	63	44	107

Table 2: Type of admission vs Sepsis

	EOS	LOS	Total
Inborn	20	53	73
outborn	4	30	34
Total	24	38	107

Table 3: Type of admission vs Type of Organism

	Inborn	Out born	Total
Gram positive	2	8	10
Gram negative	60	19	79
Fungal	11	7	18
Total	73	34	107

Table 4: Antibiotic sensitivity in gram-negative sepsis

Gram- negative	E coli		Klebsiella		Enterobacter		Acenitobacter	
	No.	%	No.	%	No.	%	No.	%
Amoxicillin	03	0.5	02	16	00	00	00	00
Gentamycin	06	1	02	16	02	100	00	00
Amikacin	08	1.2	02	16	02	100	00	00
Piperacillin+Tazobactam	01	1	01	08	02	100	00	00
Cefotaxim	05	0.7	01	06	02	100	00	00
Meropenam	04	0.6	01	06	02	100	00	00
Ciprofloxacin	01	0.1	01	06	02	100	00	00
Tigecyclin	50	78	11	69	02	100	01	100
Colistin	60	94	12	75	00	00	01	100