Section: Paediatrics

Original Research Article

# CROSS SECTIONAL STUDY ON COMMON ETIOLOGICAL AGENTS FOR NEONATAL SEPSIS AND THE ANTIBIOTIC SENSITIVITY PROFILE OF THE PATHOGENS

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**ABSTRACT**

**Background:** Neonatal sepsis is a serious and life-threatening medical condition arising in response to bloodstream infection in neonates. The immune system of neonates, especially those born with lower birth weights is immature, along with increased admission rates compared normal birth weight babies predispose them for neonatal sepsis. Appropriate choice of empirical antibiotics based on the common pathogens isolated in the neonatal intensive care is often life saving. The objective is to know the Etiological agent for sepsis and the antibiotic sensitivity profile of the pathogens.

**Materials and Methods:** It is a hospital based cross sectional study cantered in Gadag Institute of Medical Sciences, District hospital, Mallasamudra, Gadag. The study was conducted for a period of 18 months from January 2021 to June 2022. All the low birth weight babies with neonatal sepsis meeting the inclusion criteria were included in the study.

**Results:** There were a total of 2311 admissions. Out of which 1760 were inborn and 551 were out born. Out of 1760 who were inborn, 196 had sepsis. Early onset sepsis was seen among 137 neonates and late onset sepsis was seen among 59 neonates. Out of the 552 out born babies, 41 had early onset sepsis and 30 had late onset sepsis. Among the risk factors for neonatal sepsis, PPROM was associated with 26.59% of cases, followed by maternal fever 5.24% and chorioamnionitis in 2.62% cases. 36.3% cases were culture positive, among which gram negative isolates were more common than gram positive isolates. Escherichia coli (21.35%) was the most commonly isolated organism, followed by staphylococcus aureus (5.99%), klebsiella pneumonia (4.87%). Most of the organisms were sensitive to amikacin, gentamicin, meropenem, colistin, trimethoprim and sulfamethoxazole.

**Conclusion:** Gram negative organisms were more commonly isolated than gram positive organisms with Escherichia coli, staphylococcus aureus and klebsiella pneumonia were the most common organism isolated. Most of them were sensitive to gentamicin, ofloxacin, meropenm and colistin

**Keywords:** Anti-microbial sensitivity. Risk factors, Blood culture.

## INTRODUCTION

The most important risk factor causing sepsis development in the neonatal period is premature birth and low birth weight. premature babies with low birth weight have risk of developing sepsis three to ten times advanced than full- term babies with normal birth weight. Foetal distress, low APGAR score, resuscitation of the baby and the multipl epregnancie sincrease the risk of early-onset sepsis, whereas invasive procedures, such as frequent blood sampling, intubation, mechanical ventilation,

catheter/probe insertion, insufficient breastfeeding, long-term parenteral nutrition, low stomach acid and surgical interventions especially increase the risk of late-onset sepsis.[1]

Recent advances in neonatal care have successfully bettered survival rate and reduced complications in premature babies. still, sepsis remains a significant and frequent cause of mortality and morbidity in low birth weight and very-low- birth- weight (VLBW) babies. Early recognition of clinical signs inferring significant infection and an applicable choice of empirical antibiotics are vital for successful management of sepsis.[2]

Hence this study is being conducted to know the Etiological agent for sepsis and the antibiotic sensitivity profile of the pathogens.

## MATERIALS AND METHODS

This Prospective Hospital based cross sectional study was conducted in Gadag Institute of Medical Sciences, District hospital, Mallasamudra, Gadag. The study was conducted for a period of 18 months from January 2021 to June 2022.

**Sample size:** According to the study conducted by B Sathyamurthy et al in Chennai the prevalence of the neonatal sepsis was 58. Sample size is calculated by applying the formula $4pq/d^2$ and sample size is taken as 267.

P =60

q =40

d=10%ofprevalence 4x60x40/62

n=267

**Sampling method:** purposive sampling

All the consecutive new-born babies with less than 2500 grams weight, admitted under NICU between January 2021 to June 2022 with neonatal sepsis are included under the studies

**Study Subjects**

**Inclusion Criteria**

All consecutive newborns <2.5kgs, with risk factors and suspected of neonatal sepsis are included in the study

**Exclusion Criteria**

Out born babies already started on antibiotics are excluded from the study

**Statistical Method:** Data was analysed using latest 24th version SPSS software. Association of various factors will be studied by chi-square test. Mean and standard deviation was calculated for the data.

**Methodology:** This study was conducted in NICU, GIMS, Gadag from January 2021 to June 2022 in low-birth-weight babies. 267 consecutive low birthweight babies with septicaemia are included in the study. Voluntary, wilful, and informed consent was taken from the parents. In neonates suspected of having neonatal sepsis detailed clinical history noted and examination done according to the pro-forma.1.5ml to 2ml venous blood was drawn under strict aseptic precautions.0.5-1 ml of which was transferred directly to BACTEC PEDS culture vials. The remaining portion was used for assessment of CRP by nephelometry method (quantitative method) and slide method (qualitative method), Total leucocyte count measured by flow cytometry method, cyanide free SLS method for Hb, DC sheath method for platelets, RBC, HCT. All the samples were transferred at room temperature as soon as possible to the laboratory. BACTEC vials was placed in BACT/ALERT system. A positive result is indicated by an audible alarm and the red illumination light at the sight of the inoculation as shown by the computer monitor attached to the machine. The bottles wereincubatedfor5days before being reported as negative. A gram stain and a subculture on blood agar and MacConkey agar were performed from each presumptive positive vial. After incubation, the bacterial isolates are identified by gram staining, colony characteristics and biochemical tests. Antibiotic sensitivity was tested by KIRBY-BAUER disc diffusion method.

For all the babies less than 2500 grams and with risk factors for sepsis, above investigations will be sent and started on antibiotics, culture positive babies will be given antibiotics for 14 days according to sensitivity of antibiogram and CSF will be sent, if CSF study shows meningitis, then antibiotics will be given for 21 days according to sensitivity pattern.

## RESULTS

The most commonly observed risk factor in our study was, PROM (71 cases), maternal fever (14cases), chorioamnionitis (7 cases), and 2 cases each with risk factors such as UTI, unclean vaginal examination and home delivery.

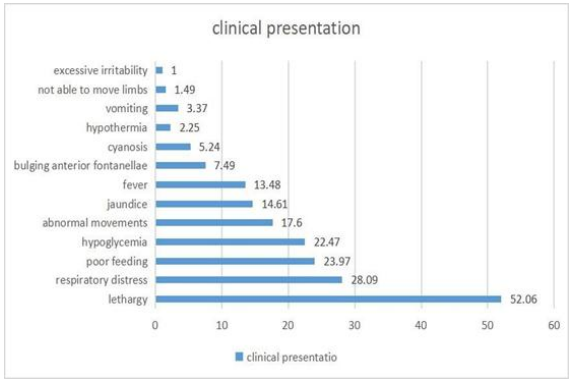
**Table 1: Risk factor for early onset sepsis and late onset sepsis.**

| Risk factor | No of cases | Percentage |
|---|---|---|
| Maternal fever | 14 | 5.24 |
| Homedelivery | 2 | 0.75 |
| PROM | 71 | 26.59 |
| Unclean virginal examination | 2 | 0.75 |
| UTI | 2 | 0.75 |
| Chorioamnionitis | 7 | 2.62 |

**Table 2: Distribution of Organism with respect to types of sepsis**

| | Type of neonatal Sepsis EOS/LOS | | Total |
|---|---|---|---|
| **Organism** | **EOS** | **LOS** | |
| Acinetobacter Species | 1(0.56) | 1(1.12) | 2(0.75) |
| Candida Albicans | 0(0.0) | 1(1.12) | 1(0.37) |

| | | | |
|---|---|---|---|
| Enterococci Species | 3(1.69) | 0(0.0) | 3(1.12) |
| Escherichia Coli | 42(23.60) | 15(16.85) | 57(21.35) |
| Gram Positive Cocci | 1(0.56) | 0(0.0) | 1(0.37) |
| Klebsiella Pneumonia | 9(5.06) | 4(4.49) | 13(4.87) |
| No Growth | 111(66.85) | 59(66.29) | 170(63.67) |
| Non-Candida Albicans | 0(0.0) | 1(1.12) | 1(0.37) |
| Pseudomonas Species | 2(1.12) | 1(1.12) | 3(1.12) |
| Staphylococcus Aureus | 9(5.06) | 7(7.87) | 16(5.99) |
| Total | 178(66.67) | 89(33.33) | 267(100.0) |




In our study, organism isolated in sepsis were as follows: Acinetobacter Species Isolated: EOS: 1(0.56), LOS:1(1.12) Candida Albicans Species Isolated: EOS: none, LOS:1(1.12) Enterococci Species Isolated: EOS:3(1.69), LOS: none Escherichia Coli: EOS:42(23.60), LOS:15(16.85) Gram Positive Cocci: EOS:1(0.56), LOS: none Klebsiella Pneumonia: EOS:9(5.06), LOS:4(4.49) No Growth: EOS:111(66.85), LOS:59(66.29) Non-Candida Albicans Noted: EOS: none, EOS:1(1.12) Pseudomonas Species: EOS:2(1.12), LOS:1(1.12) Staphylococcus

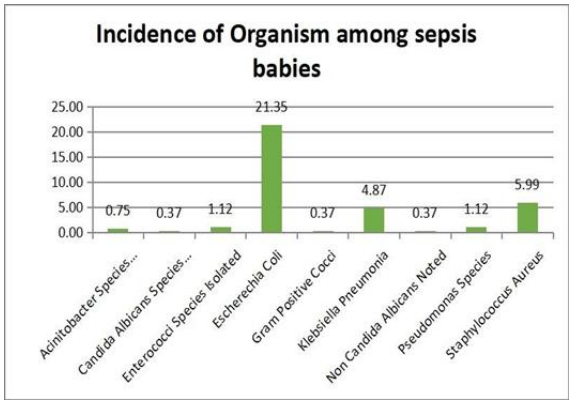



**Figure 1: incidence of organism among sepsis babies**

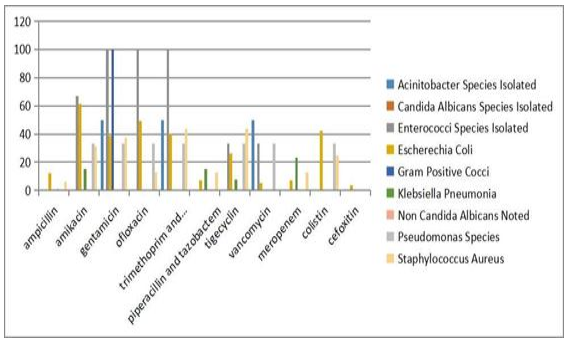



**Figure 2: antibiotic sensitivity pattern**

**The antibiotic sensitivity pattern was as follows:**
Acinetobacter Species Isolated: Gentamycin (1), trimethoprim and sulfamethoxazole (1), vancomycin (1).
Candida Albicans Species Isolated: None
Enterococci Species Isolated: amikacin (2), gentamycin (3), ofloxacin (3), trimethoprim and sulfamethoxazole (3), tigecycline (1), vancomycin (1).
Escherichia Coli: ampicillin (7), amikacin (35), gentamycin (22), ofloxacin (28), trimethoprim and sulfamethoxazole (23), piperacillin and tazobactam (4), tigecycline vancomycin (3), meropenem (4), colistin (24) and cefoxitin (2).
Gram Positive Cocci: gentamycin (1)
Klebsiella Pneumonia: amikacin (2), piperacillin and tazobactam (2), tigecycline (1), meropenem (3)
Non-Candida Albicans: None
Pseudomonas Species: amikacin (1), gentamycin (1), ofloxacin (1), trimethoprim and sulfamethoxazole (1), tigecycline (1), vancomycin (1), colistin (1).
Staphylococcus Aureus: ampicillin (1), amikacin (5), gentamicin (6), ofloxacin (2), trimethoprim and sulfamethoxazole (7), piperacillin and tazobactam (2), tigecycline(7), meropenem (2), Colistin (4).
In our study, 234 patients were discharged with recovery, 27 babies die, 3 were referred for further management.2 discharge against medical advice and 1 leave against medical advice.
In <28 WOG category, 1 baby died, 1 baby discharged and 1 baby was referred out. In 28-31 WOG category 10 babies died, 16 babies discharged. In 32-35 WOG category 2 went DAMA, 11 babies died, 87 discharged and 2 babies were referred out. In 36-38WOG category 5 babies died, 115 babies discharged, 1 baby left LAMA. In >38WOG category, 15 babies discharged.
Out of 209 patients with birth in the range of 1500-2499 range: 200 were discharged, 8 dies, 1 with LAMA.
Among 50 patients weighing 1000-1499g range: 31 were discharged, 15 dies, 2 went DAMA and 2 were referred.
Among 8 patients weighing<1000g: 3 were discharged, 4 Dies, and 1 patient was referred.

## DISCUSSION

In present study the most observed risk factor in our study was, PROM (71 cases), maternal fever (14 cases), chorioamnionitis (7 cases), and 2 cases each with risk factors such as UTI, unclean vaginal examination and home delivery. The clinical

presentation was as follows: Respiratory distress (71), Jaundice (39), Hypoglycaemia (60), Lethargy (139), abnormal movements (47), Hypothermia (6), Fever (36), Poor feeding (64), Bulging anterior fontanelle (20), Vomiting (9), Crying on moving limbs (4), Cyanosis (14), Excessive irritability (1). The most common indication for admission was prematurity (44.19%), followed by sepsis (29.21%), respiratory distress (12.36%), birth asphyxia (4.87%) and other (9.36%). In our study, most common mode of delivery was LSCS (50.94%), followed by normal vaginal delivery (47.94%) and only 1.12% had assisted delivery. The neonatal sepsis profile observed in this study was as follows: 40 cases with pneumonia, 13 cases with meningitis, 6 with necrotizing enterocolitis and 6 with septic arthritis.

In our study, organism involved in sepsis were as follows: Acinetobacter Species Isolated: EOS: 1(0.56), LOS:1(1.12) Candida Albicans Species Isolated: EOS: none, LOS:1(1.12) Enterococci Species Isolated: EOS:3(1.69), LOS: none Escherichia Coli: EOS:42(23.60), LOS:15(16.85) Gram Positive Cocci: EOS:1(0.56), LOS: none Klebsiella Pneumonia: EOS:9(5.06), LOS:4(4.49). No Growth: EOS: 111(66.85), LOS:59(66.29)

Non-Candida Albicans Noted: EOS: none, EOS:1(1.12) Pseudomonas Species: EOS:2(1.12), LOS:1(1.12) Staphylococcus Aureus: EOS:9(5.06), LOS:7(7.87)

In the Nigerian study, coagulase-negative staphylococci also contributed for 21% cases while Staphylococcus epidermidis for 5 %. of the isolates. Listeria monocytogenes was cultured from 8.4 % of septic neonates, Pseudomonas aeruginosa from 3 %, Klebsiella pneumoniae from 14 % and Escherichia coli from 7% isolates. The bacterial isolates were resistant to traditional antibiotics that were employed to treat septicaemia. The study showed a high prevalence of neonatal sepsis of bacterial origin.[3]

A study from Hubli, Karnataka reported slightly higher positive results where the blood culture positivity was found in 64.87% cases.[4] In contrast, much lower positive results were reported from studies in Turkey and Saudi Arabia (15.8%and5%).[5] These variations could be attributed to various factors like the antibiotic therapy prior to the laboratory diagnosis that might had the most important impact on the culture results.

The findings were compatible to the Georgia study where gram-negative organisms were recovered from 78% isolates and gram-positive organisms from 22% neonates. Klebsiella pneumonia was the most common gram-negative bacterial pathogen, similar with the present study.[6] The antibiotic sensitivity pattern was as follows: Acinetobacter Species Isolated: Gentamycin (1), trimethoprim and sulfamethoxazole (1), vancomycin (1). Candida Albicans Species Isolated: None. Enterococci Species Isolated: amikacin (2), gentamycin (3), ofloxacin (3), trimethoprim and sulfamethoxazole (3), tigecycline (1), vancomycin (1). Escherichia Coli: ampicillin (7), amikacin (35), gentamycin (22), ofloxacin (28), trimethoprim and sulfamethoxazole (23), piperacillin and tazobactam (4), tigecycline (15), vancomycin (3), meropenem (4), colistin (24) and cefoxitin (2).

Gram Positive Cocci: gentamycin (1). Klebsiella Pneumonia: amikacin (2), piperacillin and tazobactam (2), tigecycline (1), meropenem (3). Non-Candida Albicans: None

Pseudomonas Species: amikacin (1), gentamycin (1), ofloxacin (1), trimethoprim and sulfamethoxazole (1), tigecycline (1), vancomycin (1), colistin (1).

Staphylococcus Aureus: ampicillin (1), amikacin (5), gentamicin (6), ofloxacin (2), trimethoprim and sulfamethoxazole (7), piperacillin and tazobactam (2), tigecycline (7), meropenem (2), Colistin(4).

Macharashvili study where the gram-negative organisms showed a high degree of resistance to commonly used antibiotics such as ampicillin and amoxicillin/ clavulanate.[7] In the study by Karthikeyan et al, 66% of Staph. aureus was methicillin resistant. Antibiotic resistance was common with the sensitivity to various antibiotics liketoampicillin19%, gentamicin 21.6%, cefotaxime 32.8%, amikacin 50%, chloromycetin 59.6% and ciprofloxacin 90.3%.[8]

## CONCLUSION

Gram negative organisms were more commonly isolated than gram positive organisms with Escherichia coli, staphylococcus aureus and klebsiella pneumonia were the most common organism isolated. Most of them were sensitive to gentamicin, ofloxacin, meropenm and colistin.

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