STUDY OF CLINICAL PROFILE AND OUTCOME OF SEPSIS IN NEONATAL INTENSIVE CARE UNIT IN A TERTIARY CARE HOSPITAL - A PROSPECTIVE OBSERVATIONAL STUDY

By

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Under The Guidance Of

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ABSTRACT

BACKGROUND: "Neonatal sepsis(NS) is defined as a clinical syndrome of bacteremia with systemic signs and symptoms of infection in the first 4 weeks of life." Sepsis is the commonest cause of neonatal morbidity and mortality.[1] Neonatologists managing NICUs constantly encounter the ongoing challenge of addressing newborn infections due to evolving microbial flora patterns. Understanding the microbiological profile and antimicrobial susceptibility patterns is crucial for pediatricians when selecting the most effective antibiotics for treating neonates with sepsis.[2]

OBJECTIVES: "To determine the clinical profile of neonatal sepsis in neonates admitted to NICU and Sick Neonatal Intensive Care Unit(SNICU)."

METHODS: This prospective study was done in neonatal intensive care unit at R.L.JALAPPA HOSPITAL. All neonates who were admitted in NICU or SNICU fulfilling the inclusion criteria were included in the study. and evaluated the clinical profile of sepsis and outcome.

RESULTS: In the present study, among the 80 neonates, sepsis was the most prevalent symptom, noted in 57.5% of cases. Blood culture results showed that 25 neonates (31.2%) were tested positive, while 55 neonates (68.8%) tested negative. The most frequently identified organism was Klebsiella species, found in 11 neonates (13.8%). Additionally, Candida was detected in 3.8% of cases, E. coli in 3.8%, Acinetobacter in 2.5%, and Enterococci in 2.5%. It was observed that 31.25% of neonates had Culture Positive Sepsis (Definitive) while 68.75% had Probable (Clinically Sepsis.

CONCLUSION: This study focuses on the clinical profile and outcome of neonatal sepsis in a NICU setting, highlighting its substantial burden on neonatal health. Clinical manifestations varied widely, with tachypnea being the most common symptom. Blood culture results highlighted Klebsiella species as the most prevalent pathogen. Despite advances, the high mortality rate underscores the ongoing need for better early detection,

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LIST OF ABBREVIATIONS

Glossary	Abbreviations
NS	Neonatal Sepsis
EOS	Early Onset Sepsis
LOS	Late Onset Sepsis
PROM	Premature Rupture Of Membranes
DIC	Disseminated Intravascular Coagulation
NICU	Neonatal Intensive Care Unit
SNICU	Sick Neonatal Intensive Care Unit
IV	Intravenous
VLBW	Very low birth weight
ELBW	Extreme very low birth weight
PDA	Patent Ductus Arteriosus
BPD	Bronchopulmonary dysplasia
CONS	Coagulase negative Staphylococci
HSV	Herpes simplex virus
VZV	Varicella zoster virus
HIV	Human immunodeficiency virus
CRP	C-Reactive Protein
ANC	Absolute Neutrophilic Count
INC	Immature Neutrophilic count
CSF	Cerebrospinal fluid
ESR	Erythrocyte Sedimentation Rate

PCT	Procalcitonin
G-CSF	Granulocyte colony stimulating factor
IVIG	Intravenous Immunoglobulin
GMCSF	Granulocyte Monocyte Colony Stimulating Factors
SVET	Single-volume Exchange Transfusion
CBC	Complete blood count
NVD	Normal Vaginal Delivery
LSCS	Lower segment caesarean section
IUGR	Intrauterine growth restriction
MAS	Meconium aspiration syndrome
AKI	Acute kidney injury
MODS	Multiple organ dysfunction syndrome
DAMA	Discharge against medical advice
UTI	Urinary tract infection

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ABSTRACT

BACKGROUND: Neonatal sepsis(NS) is defined as a clinical syndrome of bacteraemia with systemic signs and symptoms of infection in the first 4 weeks of life. Sepsis is the commonest cause of neonatal morbidity and mortality.[1] Neonatologists managing NICUs constantly encounter the ongoing challenge of addressing newborn infections due to evolving microbial flora patterns. Understanding the microbiological profile and antimicrobial susceptibility patterns is crucial for paediatricians when selecting the most effective antibiotics for treating neonates with sepsis.[2]

OBJECTIVES: To determine the clinical profile of neonatal sepsis in neonates admitted to NICU and Sick Neonatal Intensive Care Unit(SNICU).

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RESULTS: In the present study, among the 80 neonates, tachypnea was the most prevalent symptom, noted in 57.5% of cases. Blood culture results showed that 25 neonates (31.3%) were tested positive, while 55 neonates (68.8%) tested negative. The most frequently identified organism was Klebsiella species, found in 11 neonates (13.8%). Additionally,

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CONCLUSION: This study focuses on the clinical profile and outcome of neonatal sepsis in a NICU setting, highlighting its substantial burden on neonatal health. Clinical manifestations varied widely, with tachypnea being the most common symptom. Blood culture results highlighted Klebsiella species as the most prevalent pathogen. Despite advances, the high mortality rate underscores the ongoing need for better early detection, prompt intervention, and overall care practices to improve outcomes for newborns affected by sepsis.

INTRODUCTION

INTRODUCTION

"Neonatal sepsis (NS) is defined as a clinical syndrome of bacteraemia with systemic signs and symptoms of infection in the first 4 weeks of life." It covers a range of systemic infections affecting newborns, including septicemia, meningitis, pneumonia, arthritis, osteomyelitis, and urinary tract infections. Sepsis is the commonest cause of neonatal morbidity and mortality.[1]

The clinical presentations of NS are nonspecific. This includes symptoms like fever, respiratory distress, lethargy/irritability, convulsions, bulging fontanelles, refusal to feed, jaundice, bleeding, abdominal distension, and temperature dysregulation.[2]

Early-onset sepsis (EOS) presents within 72 hrs of life, and late-onset sepsis (LOS) presents beyond 72 hours of life.[2] In EOS maternal genital tract is the source of the infection. Maternal risk factors like premature rupture of membranes (PROM), chorioamnionitis, peripartum fever, urinary tract infection within 2 weeks prior to delivery and prolonged rupture of membranes > 18 hours, multiple gestations, and caesarean sections are associated with increased risk of EOS.[2]

LOS occurs because of postnatal nosocomial infections or community-acquired infections. The risk factors associated with LOS are prematurity, prolonged invasive interventions like mechanical ventilation and intravascular catheterization, failure of early enteral feeding with breast milk, long duration of parenteral nutrition, hospitalization, surgery, and underlying respiratory and cardiovascular diseases. [2]

The spectrum of bacteria which cause NS varies in different parts of the world. Bacterial infections are the most common cause of morbidity and mortality during the

neonatal period. Fulminant and fatal course of infection may result in complications such as shock, disseminated intravascular coagulation (DIC) and multi-system organ failure.[3] This mandates the need for early diagnosis of these life-threatening conditions for timely treatment and a favourable outcome. [2,3]

Multidrug antibiotic resistance is an emerging problem in Neonatal Intensive Care Unit (NICU) particularly in developing countries. Neonatologists who supervise NICU always face a continuous challenge in managing neonatal infections due to the changing patterns of the microbial flora. The knowledge of the bacteriological profile and its antibiotic sensitivity pattern is of great use to paediatricians in choosing antibiotics optimally to treat neonates with septicaemia. [2]

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AIMS & OBJECTIVES

AIM & OBJECTIVES

- To determine the clinical profile of neonatal sepsis in neonates admitted to NICU and Sick Neonatal Intensive Care Unit (SNICU).
- To determine the complications and outcome associated with neonatal sepsis in neonates admitted to NICU and SNICU.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Neonatal period is considered the most important age group at all times as newborns are most vulnerable to disease and death. Historically, the probability of death during neonatal period was so high that many traditional practices were postponed until after first week of life, ensuring the probability of child's survival. Also, the quality of life and health as the child grows to adult life is partly determined at this stage. Many avoidable handicaps during childhood like, cerebral palsy, mental subnormality and recurrent seizures have their origin in perinatal period. Septicaemias is a major cause of mortality and morbidity in neonatal period[4].

Advances in neonatal intensive care have led to improved survival of neonates, but neonatal sepsis continues to be an important cause of morbidity and mortality. Etiology of NS is multifactorial, but the principal sources of newborn infection are mother and nursery environment. During fetal life, the sources of infection are transplacental and ascending intrauterine infection. Improper handwashing, intravenous (IV) access, ventilation, instrumentation all add to the transmission of infection to the neonate in the nursery [4] (Figure-1).

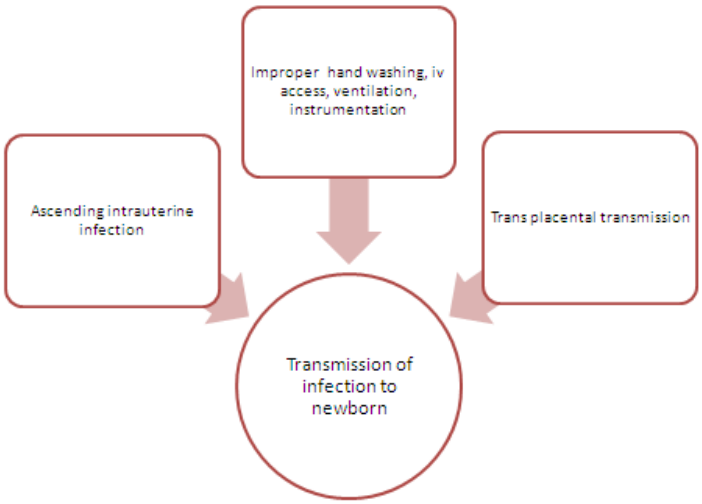


Figure-1: Sources of newborn infection

Neonatal Sepsis: It is a clinical syndrome characterized by signs and symptoms of infection with or without accompanying bacteraemia during first month of life. NS incorporates septicaemia, pneumonia, and meningitis. The pathogen gaining access to blood stream may cause overwhelming infection without much localization called septicaemia or may get predominantly localized to lung or meninges. Superficial infections like conjunctivitis and oral thrush are not included under neonatal sepsis. [5]

Classification: NS can be classified into EOS and LOS depending on the time of onset of symptoms.

EOS: EOS is one which manifests within first 72 hours of life [6]. It is caused by organisms prevalent in the genital tract of mother either due to rupture of membrane or during passage through birth canal.

Risk factors for EOS:

1. Very low birth weight (VLBW) or preterm: Incidence of neonatal sepsis is inversely related to gestational age and birth weight. According to western studies, incidence in preterm is 1:250, while in term babies it is 1:15000[7]. Babies weighing less than 1000gm are called extremely low birth weight (ELBW) and those weighing between1000-1499 gm are called VLBW. The incidence of EOS is nearly ten times greater in an infant with birth weight <1500 gm compared to normal weight babies[8].
2. Febrile illness in the mother within 2 weeks prior to delivery. The associated features of intra amniotic infection are, maternal or fetal tachycardia, uterine tenderness and leukocytosis[9]. Histopathology of the placenta will show chorioamnionitis.
3. Foul smelling liquor or meconium-stained amniotic fluid
4. Prolonged rupture of membrane >18 hours; prolonged labor (1st stage & 2nd stage ≥24 hours)
5. >3 vaginal examinations or single unclean examination during labor.

6. Difficult labor with instrumentation.
7. Birth asphyxia and difficult resuscitation. Apgar <6 at 5 minutes for term, and <3 for preterm[10].

Risk Score: Risk score uses the risk factors to predict the likelihood of developing neonatal sepsis in the newborn. It helps the physician to categorize the babies and plan the management. One of the well-studied risk score developed by Parmar is depicted in Table 1 :[11]

Table 1: Risk score for predicting NS

Risk factor		Significant score
PROM >24 hours	1	5 or more in normal weight babies 2 or more in low birth weight babies
Unclean per vaginal examination	2	
Birth asphyxia	2	
Foul smelling liquor	2	
Maternal intrapartum fever	2	
Prolonged labor	1	
Low birth weight	1	

Bacterial Spectrum: In the West, the most common etiological agent for EOS is Group B streptococci (GBS). Other less commonly found organisms are E. coli, Streptococcus viridans and Staphylococcus aureus[12]. In India, there is a prevalence of gram negative bacteremia - E.coli, Klebsiella and Enterococcus fecalis [13]. Isolation of E.coli (30%), Klebsiella (23%) and Staphylococcus aureus (19%) was reported in one of the Indian studies[14]. The nature of colonizing agent is determined by the pattern of flora in birth canal and in the environment. Babies born at home are colonized by the organisms from the mother[15]. These tend to be community derived and sensitive to commonly used antibiotics. Those organisms also have

limited pathogenicity. One of intestinal organisms acquired by normal babies is Enterobacteria, which is associated with neonatal sepsis. Breast feeding reduces the intensity of colonization by Enterobacteria. Bifidobacteria predominate in breast fed babies[16, 17]. Bacteria colonizing the gastrointestinal tract play a vital role in maintaining gastrointestinal homeostasis, including digestion and nutrient absorption.

Bifidobacteria is important for postnatal development of GI mucosa and gut associated lymphoid tissue. Colonization of gastrointestinal tract occurs in 1-2 weeks of postnatal age where as that of upper respiratory tract occurs rapidly, and 90% of the infants have positive pharyngeal cultures by 3rd day[18].

LOS: LOS is acquired by nursery environment which is characterized by onset beyond 72 hours of life. VLBW babies are more prone for nosocomial infection which is about 20-25%[19]. Babies in NICU are at greatest risk for becoming colonized by organisms resistant to antibiotics [20]. Nursery overcrowding, poor hand washing and contaminated equipment add to the risk of sepsis in the newborn[21]. Contamination of parenteral nutrition solution has been associated with neonatal infection[22]. Most babies become colonized without becoming infected, but in others various factors related to host and microorganisms result in infection.

Risk factors for LOS: [23, 24]

1. Weight less than 750g
2. Presence of central venous catheter
3. Delayed enteral feeding
4. Total parenteral nutrition
5. Lack of breastfeeding
6. Mechanical ventilation
7. Necrotizing enterocolitis
8. Complications of prematurity

9. Patent Ductus Arteriosus (PDA)

10. Bronchopulmonary dysplasia (BPD)

11. Prior antibiotic use

Etiology of NS:

In general, the common bacterial causes of EOS include[19]:

a) Group B- streptococcus

b) Escherichia coli

c) Streptococcus pneumoniae

d) Viridans streptococci

e) Enterococci

f) Haemophilus influenzae

g) Neisseria meningitidis

h) Neisseria gonorrhoea

i) Listeria monocytogenes etc.,

Of these, Group B- streptococcus and Listeria monocytogenes are usually of maternal origin.

The common bacteria causing LOS include[19]:

a) Staphylococcus aureus

b) Coagulase negative Staphylococci (CONS)

c) Enterococci

d) Citrobacter

e) Enterobacter

f) Klebsiella pneumoniae

g) Salmonella

Agents that are implicated to cause nosocomial infection include CONS, Escherichia coli, Klebsiella pneumoniae, Salmonella, Enterobacter aerogenes, Pseudomonas, Serratia and Citrobacter.

The non-bacterial causes of neonatal sepsis include: Adeno virus, Cytomegalovirus, Enterovirus, Human Herpes viruses including Herpes simplex virus (HSV) and Varicella zoster virus (VZV), Human immunodeficiency virus (HIV), Parvovirus, Rubella virus, Candida species, Plasmodia, Toxoplasma gondii etc.. Infection acquired by the neonates after discharge are usually community acquired.

Clinical Features of Sepsis: Sepsis in neonates and infants presents with a spectrum of clinical features that can vary widely in severity and presentation. Respiratory distress is frequently observed, ranging from mild tachypnea to severe respiratory failure, particularly in early-onset sepsis (EOS)[25]. Poor activity is a predominant symptom in late-onset sepsis (LOS).

Other common manifestations include refusal of feed, temperature dysregulation (hypothermia or hyperthermia), bradycardia or tachycardia, and signs of poor perfusion such as shock. Abdominal distention, hepatomegaly, seizures, and jaundice are also noted, along with bleeding manifestations and arthritis in some cases. Additional symptoms may include cyanosis, hypoglycemia (and rarely hyperglycemia), irritability, diarrhea, petechiae, sclerema, arthritis, and hepatosplenomegaly.

Mandal et al in their study on NS reported varying incidences of clinical features among affected infants. Poor activity and refusal of feed were highly prevalent, affecting 82% and 84% of cases, respectively[27]. Hypothermia was noted in 56% of infants, while respiratory distress and abdominal distention were reported in 50% and 48% of cases, respectively. Hepatosplenomegaly affected 34% of infants, whereas hyperthermia was observed in 14%.

Sclerema and seizures were noted in 22% and 24% of cases, respectively. Jaundice was present in 30% of infants, bronchopneumonia in 36%, and bleeding manifestations in 22%. Less commonly observed were arthritis (6%) and shock (2%).

Investigations in NS:

Blood culture: It is the confirmatory test in NS. Causative pathogen can be readily recovered with 0.5ml of blood in culture bottles[28]. Blood for culture should be taken from a peripheral vein after thorough cleaning with antiseptic solution and allowing it to dry. This reduces skin contamination to acceptable levels. A pure growth appearing within 24 - 48 hours is always significant [29]. Automated blood culture (BACTEC) method is a better culture method as it detects the growth faster.

C-Reactive Protein (CRP): CRP is an acute phase reactant which is a nonspecific marker of inflammation or tissue destruction. It is elevated in bacterial sepsis and meningitis. There is a delay of 10-12 hours from the onset of infection to the rise in CRP [30]. Viral infections do not cause rise in CRP [31]. Serial CRP reading is more informative than single CRP value. On day 1 of illness, it has a sensitivity of 62% and a specificity of 88%, and on day 2 of illness, sensitivity increases to 90%[32].

Platelet count: It is a late indicator of NS. The major mechanism causing thrombocytopenia is increased platelet destruction and considered significant when count is less than one lakh.[30]

Leukocyte count: Many aspects of leukocyte count have been studied for their predictive value in diagnosing sepsis. Manroe established reference ranges for Absolute Neutrophilic count (ANC), Immature Neutrophilic count (INC) and Immature to total leukocyte count (IT) ratio which is clinically useful[33] – Table 2. For VLBW infants, the reference ranges are available from Mouzinho's charts[34] – Table 3.

Table 2: Manroe's Reference Chart

	Birth	12hour	24 hour	48 hour	72 hour	>120 hour
ANC	1800- 5400	7800-14400	7200-12600	4200-9000	1800-7000	1800-5400
INC	<1120	<1440	<1280	<800	<500	<500
IT ratio	<0.16	<0.16	<0.13	<0.13	<o.13	<0.12

Table 3: Mouzinho's Reference Chart for ANC[34]

Age	Minimum	Maximum
Birth	500	6000
18hours	2200	14000
60 hours	1100	8800
120 hour	1100	5600

Lumbar puncture[35,36]

Lumbar puncture plays a critical role in the evaluation of neonatal sepsis by obtaining cerebrospinal fluid (CSF) for culture and analysis. It helps differentiate between sepsis and meningitis, guiding targeted antibiotic therapy. Early performance is crucial to prevent complications like neurologic sequelae.

Micro ESR

Micro ESR (Micro Erythrocyte Sedimentation Rate) in neonatal sepsis serves as a rapid screening tool to assess inflammation and infection severity. It provides supplementary information alongside clinical assessment and other diagnostic tests. Elevated Micro ESR

levels suggest an inflammatory response, aiding in early detection and management of neonatal sepsis.

Procalcitonin (PCT)[37]

PCT levels rise rapidly in response to bacterial infections, aiding in early identification of neonates at risk of sepsis. PCT helps distinguish between bacterial and non-bacterial causes of infection, guiding clinicians in targeted antibiotic therapy. Serial PCT measurements assist in assessing response to treatment, allowing timely adjustments in therapy as needed. Integration of PCT into clinical protocols improves diagnostic accuracy and antibiotic stewardship, enhancing overall management of neonatal sepsis.

Cell markers [38]

Granulocyte colony stimulating factor (G-CSF)[39]

G-CSF levels may increase in response to infection, contributing to the mobilization and activation of neutrophils to enhance the immune response.

Cytokines[40]

Elevated levels of pro-inflammatory cytokines (such as interleukin-6, interleukin-8, tumor necrosis factor-alpha) are associated with systemic inflammation in neonatal sepsis.

Diagnosis of NS

Culture positivity with organism known to cause sepsis is confirmatory of NS. [41]

Risk factors associated with poor outcome in sepsis are as follows :[42]

1. Preterm
2. Shock

3. DIC

4. Leukopenia <5000

5. Culture positive sepsis

Treatment

Antibiotics

The indiscriminate use of broad-spectrum antibiotics without appropriate blood cultures and the practice of not stopping their use when no infection is documented have resulted in high antibiotic resistance rates amongst organisms isolated in India. The current data published from India suggests, that cefotaxime must be avoided as an empiric antibiotic. There is also high resistance to ampicillin and gentamicin. Some evidence suggests that use of amikacin and piperacillin-tazobactam may have low failure rates. There may be a justification in using cloxacillin if the incidence of Staphylococcus is high in a given set-up. Antibiotics like carbapenems and vancomycin should be treated as reserve drugs and be used only if primary treatment plan fails. [43]

The recommended duration of antibiotic therapy for uncomplicated culture positive NS (no meningitis, bone and joint or staphylococcal infections) is 7–10 days. Antibiotics may be stopped at 2–3 days in babies in whom these were started empirically, when cultures and CRP are negative and there is improvement symptomatically. In neonates with meningitis or staphylococcal sepsis, the duration of treatment may be 2–3 weeks and for up to 4–6 weeks in bone infections.[43]

Adjunct therapies in treatment of sepsis[43]

- **Intravenous Immunoglobulin (IVIG):** IVIG therapy is aiming to provide passive immunity against a broad spectrum of pathogens. It functions by neutralizing bacterial toxins, modulating inflammatory responses, and enhancing opsonization and phagocytosis by neutrophils, thereby aiding in pathogen clearance.
- **Granulocyte Colony Stimulating Factors (G-CSF) or Granulocyte Monocyte Colony Stimulating Factors (GMCSF**): G-CSF enhances the production and release of neutrophils from the bone marrow, which are crucial for combating bacterial infections in neonates.
- **Single-volume Exchange Transfusion (SVET):** SVET aims to rapidly decrease pathogen load and improve the clinical status of neonates with severe sepsis or septic shock**.** When conventional therapies, including antibiotics and supportive care, are insufficient in managing, it can be considered.

Supportive care: Sepsis is a multiorgan disease that can result in death and disability. Antibiotics alone cannot change the outcome. Supportive care includes ventilation, inotropes, blood products, glucose, and acid-base monitoring and correction, and is the most important determinant of outcome[43].

Complications: Sepsis remains the leading cause of neonatal mortality world over. In the acute phase, hypoglycemia, coagulopathy, organ failures like pneumonia, pulmonary hypertension, shock due to myocardial dysfunction and capillary leaks, renal failure and cholestatic jaundice are not uncommon with Gram negative sepsis. Meningitis can result in complications such as hydrocephalus and developmental delay[43].

Prevention of sepsis: Sepsis in the neonate can be prevented by promoting exclusive breastfeeding and simple hand hygiene at the household level and also by preventing applications on the umbilical cord during the first few days of life. Hospital acquired infections can be minimized by good hand hygiene, promoting provision of breast milk to sick LBW neonates, good adherence to asepsis protocols and strict antibiotic policy that limits its use when required [43].

Literature from previous studies:

In a study on the bacteriological profile and predictors of death among neonates with blood culture-proven sepsis, Ba-Alwi NA et al., (2022) reported a mortality of 45.4% out of 238 neonates with positive blood culture. There was a significant association between VLBW, hyperglycemia, mechanical ventilation, and high neonatal mortality. They further reported that among the different clinical presentations of NS, lethargy, vomiting, and respiratory distress were found to be frequently associated with neonatal mortality. Gram-negative bacteria and early-onset sepsis were also associated with high neonatal mortality[44].

Berhane M et al., (2021) in a study on the clinical profile of neonates admitted with sepsis to NICU reported that out of 304 neonates, 195 (64.1%) had clinical evidence of sepsis. They further reported that the three most frequent presenting signs and symptoms were fast breathing (64.6%), fever (48.1%) and altered feeding (39%). Bacterial pathogens were identified in 94.8 % of neonates. Coagulase negative staphylococci (25.7%), staphylococcal aureus (22.1%) and klebsiella (16.5%) were the most isolated bacteria[45].

In a retrospective study on sepsis profile in NICU, Salama K et al., (2021) observed that out of 153 cases of neonatal sepsis, 41.2% had EOS and 58.8% had LOS. Positive blood culture was detected in 39.8% of neonates and most detected organism was Klebsiella in EOS and CoNS in LOS[46].

Yet in another study on the clinical and bacteriological profile of neonatal sepsis, Jatsho J et al., (2020) reported a blood culture positivity rate of 14 %. Culture positive EOS was present in 54.5 % of neonates. Prematurity, APGAR < 6, LBW and maternal intrapartum antibiotics showed a significantly increased risk of culture positive EOS[47].

Rawat D et al., (2020) conducted a study to determine the bacterial spectrum and antimicrobial susceptibility pattern of neonatal septicaemia. Blood culture reports were positive in 53 (15.31%) cases. Commonest clinical presentation of neonates with septicemia was respiratory distress and commonest maternal risk factor was PROM >18 hours. Gram negative septicaemia (55.10%) was encountered more than Gram positive (44.90%). CoNS (38.78%) was the predominant isolate followed by, Klebsiella spp in 34.69% cases. Best overall sensitivity among Gram-negative isolates was to polymyxin B, colistin and meropenem (100%). Gram-positive isolates had highest sensitivity to Linezolid (100 %) and Vancomycin (100%)[48].

A study on the bacteriological profile of neonatal septicemia and their antibiotic susceptibility pattern was done by Thapa S et al., (2019). Out of 516 specimens, bacterial growth was obtained in 56 specimens (10.8%). Prevalence of EOS was higher (62.5%) in neonates compared to LOS (37.5%). Majority of neonatal septicemia were caused by gram negative isolates (69.6%). The predominant isolates in early onset septicemia were Acinetobacter species (32.1%) and Staphylococcus aureus (16%) and in late onset septicemia it was Staphylococcus aureus (19.6%) and Acinetobacter species (8.9%) [49].

In a study on clinical spectrum, bacteriological profile and antibiotic sensitivity pattern in NICU, Kurma et al, (2019) reported that out of 519 neonates, 35.2% had blood culture positivity, among them 65% had EOS, 59 % were preterm and 58.5 % were LBW neonates. They further reported that the major clinical presentation was respiratory distress (31.2%) and

most isolated organisms were Klebsiella pneumonia (34.7%) and Staphylococcus aureus (21.8%)[50].

In a study on the bacteriological profile and antibiotic susceptibility pattern of culture positive NS in the NICU, Pokhrel B et al., (2018) reported that out of 336 neonates admitted in the NICU, 69 (20.5%) had culture-positive sepsis. The majority were EOS (n = 54, 78.3%) and were among the preterm babies (n = 47, 68.1%). Most bacterial isolates were gram-negative, predominantly the Klebsiella species (n = 23, 33.3%). Klebsiella showed high resistance to commonly used antibiotics such as; Cefotaxime (90.5%), Gentamicin (75%), Ciprofloxacin (76.2%), Ofloxacin (72.2%) and Chloramphenicol (65%). However, they showed good susceptibility to Carbapenems (100%), Colistin (88.8%) and Tigecycline (81.8%). Among cultures with gram-positive species, CONS (n = 14, 20.3%) predominated. CONS showed high resistance to Oxacillin (80%), Cefotaxime (66.7%) and Meropenem (80%) but good susceptibility (100%) to Vancomycin and Linezolid. Prevalence of multidrug-resistant strain was 73.9% [51].

A study on the common bacterial agents associated with NS and their antibiotic susceptibility pattern was conducted by Shidiki A et al., (2018). They observed that gram positive isolates (82.6%) were found more than gram negative isolates (16.4%).The most common isolates were Staphylococcus aureus (86.9%), Klebsiella pneumonia (60%) and others. Staphylococcus aureus showed resistance against penicillin G, ceftazidime, cephalexin, cefixime, ampicillin, ofloxacine [52].

In a study on early detection of neonatal septicaemia along with its infective etiological agent(s) and assessment of antimicrobial sensitivity pattern, Ghosh S et al., (2018) observed that out of 92 neonates, 53 were male and 39 were female. Bad obstetric history (BOH) was present in 23 mothers. Low to VLBW was seen in more than two thirds culture

positive neonates. All neonates (100%) had poor cry, sucking and reflex problems. Culture positivity was present in 55.43% of which bacterial pathogens was detected in 27(52.94%) and fungal agents in 24 (47.05%) cases. Bacterial sepsis was predominantly caused by different gram-negative organisms (66.66%). Klebsiella sp. and Staphylococcus sp. were the principal isolates. Candida was the commonest fungus reported. Klebsiella isolates were most sensitive to cefotaxime and amikacin while Staph. epidermidis isolates were sensitive to Amoxicillin clavulinic acid [53].

Ekwochi U et al., (2018) documented the clinical symptomatology, bacterial profile, and antibiotic sensitivity for newborn sepsis. In all, 1920 newborns were admitted to the Special Care Baby Unit during the study period. Fifty-seven were managed for culture-proven sepsis, resulting in an in-hospital incidence rate of 29.7 per 1000 admitted newborns (95% confidence interval 21.9–37.4). A total 228 newborns were recruited (57 cases and 171 controls; ratio of 1:3). The most common presenting clinical features were fever (84.2%) and depressed primitive reflexes (50.9%). A case-fatality rate of 7.4% was observed. Newborn's place of birth (P = 0.02) and the final outcome (P = 0.004) were significantly associated with the development of sepsis, while gender (P = 0.12), birth weight (P = 0.33), gestational age (P = 0.53), and mode of delivery (P = 0.74) were not. Nearly 60% of the organisms implicated were coliforms, while one-quarter were Staphylococcus aureus. The most sensitive antibiotics were the fluoroquinolones, particularly ciprofloxacin, while amoxicillin, ampicillin, and clindamycin were generally not effective[54].

MATERIALS & METHODS

MATERIAL AND METHODS

Source of Data: All neonates admitted to NICU and SNICU with sepsis or later who develop sepsis in NICU and SNICU at R.L. Jalappa Hospital & Research Centre.

Study Design: A Prospective observational study.

Study Period: 1 year 4 months from September 2022 to December 2023.

Method of Collection of Data:

Inclusion Criteria:

All neonates admitted to NICU and SNICU having 1 or more established clinical features suggestive of sepsis such as fever (temperature >38^{o}C), hypothermia, poor suck, lethargy, irritability, seizure, apneic spells, respiratory distress, abdominal distention, poor moro reflex,

with or without maternal risk factors (PROM of >12 hours, maternal fever during delivery, prolonged labour, urinary tract infection, chorioamnionitis and meconium- stained amniotic fluid).

Exclusion Criteria:

- Birth asphyxia
- Congenital anomalies
- Suspected metabolic disease.
- Refusal of parental consent.

Sample Size:

The sample size was estimated by using the proportion of death in subjects who had sepsis (9.7%) from the study by Melkamu Berhane et al.[45] by using the formula

$$\text{Sample Size} = \frac{Z_{1-\alpha/2}^2 \, P \, (1-P)}{d^2}$$

$Z_{1-\alpha/2}$ = is standard normal variate(at 5% type 1 error (P<0.05) it is 1.96 and at 1% type1 error(P<0.01) it is 2.58).As in majority of studies P values are considered significant below 0.05 hence 1.96 is used in formula.

P= Expected proportion in population based on previous studies or pilot studies

d= Absolute error or precision

P = 9.7% or 0.097

q = 90.3 or 0.903

d = 7.5% or 0.075

Using the above values at 95% Confidence level a sample size of 60 subjects were included in the study. Considering 10% Non response a sample size of 60 + 6 ≈ **66 minimum subjects** were included in the study.

Methodology:

- This study was started after obtaining approval from the institutional ethical committee and taking informed consent from parents. All neonates fulfilling the inclusion criteria were included in the study.

- Complete physical examination of neonates was performed.
- After taking informed consent, the following investigations were done for all subjects: Complete blood count (CBC), CRP and blood culture.
- The following investigations were done as and when required: Chest X- ray; Neurosonogram; Cerebrospinal fluid (CSF) analysis; Liver function tests; Renal function tests; CT; MRI.
- Based on the results of the investigations, the subjects were divided into 2 groups namely Probable (Clinical) Sepsis and Culture Positive Sepsis (Definitive).
- Neonates were treated as per the institutional protocol and followed up till discharge from the NICU.

For the study purpose following definitions were used:

EOS: Sepsis which manifests within first 72 hours of life and **LOS** is one which manifests beyond 72 hours of life. [6]

Probable (Clinical) Sepsis: In a neonate having clinical picture suggestive of septicemia, if there was presence of **any one** of the following criteria:

- Positive septic screen
- Presence of predisposing factors (maternal fever or foul-smelling liquor or PROM or gastric polymorphs (>5 hpf)
- Radiological evidence of pneumonia.[55]

Culture Positive Sepsis (Definitive): In a neonate having clinical picture suggestive of septicemia, pneumonia or meningitis with isolation of pathogens from blood or CSF or urine or abscess.[55]

Septic screen was considered positive **when 2 or more** of the following parameters were present:[55]

1. Total leukocyte count: < 5000/mm^3 or > 24,000/mm^3.

2. Absolute neutrophil count: low count as per Monroe chart for term infant and Mouzinho chart for VLBW infants.

3. Immature or band cells to total neutrophil ratio: >0.2

4. Micro ESR: >15 mm 1st hour

5. CRP: >1mg/dL.

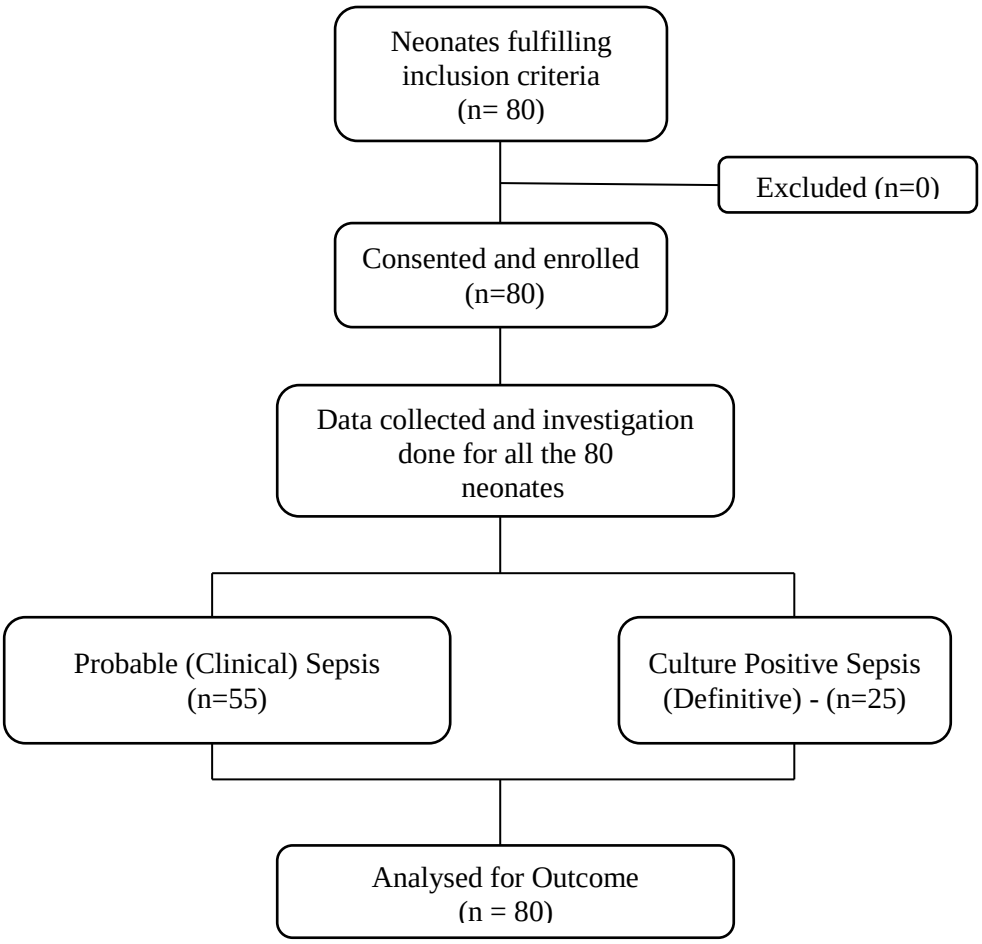
CBC: Venous blood sample (2 ml) was collected in EDTA vacutainer and processed in Automated Haematology Analyser Sysmex Autoloader Processing.

CRP: Venous blood sample (2 ml) was collected in a sterile tube without anticoagulant and allowed to clot at room temperature. Serum was separated and stored at $+2^0$ to 4^0 C and processed in Diagnostic Reagent Kit in the microbiology lab of RLJH&RC, ARKRAY Healthcare Pvt Ltd.

Blood Culture:

Venous blood sample (at least 1 ml) was collected using aseptic technique in a container having specific culture media. Bottles were loaded into Bact/ALERT equipment. It was considered as positive if there was a beep or if the screen showed yellow light and was considered as negative if the screen showed green after 7 days.

Figure 2: Flow diagram for collection and analysis of data



Statistical Analysis:

Data was entered into Microsoft excel data sheet and analysed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square was used as test of significance. Continuous data were represented as mean and standard deviation. Independent t test was used as test of significance to identify the mean difference. P value <0.05 was considered as statistically significant.

RESULTS

RESULTS & OBSERVATIONS

Table 4: Distribution of neonates based on gender (n=80)

		Frequency	Percentage
Gender	Male	45	56.3
	Female	35	43.8
	Total	80	100

Figure 3: Distribution of neonates based on gender

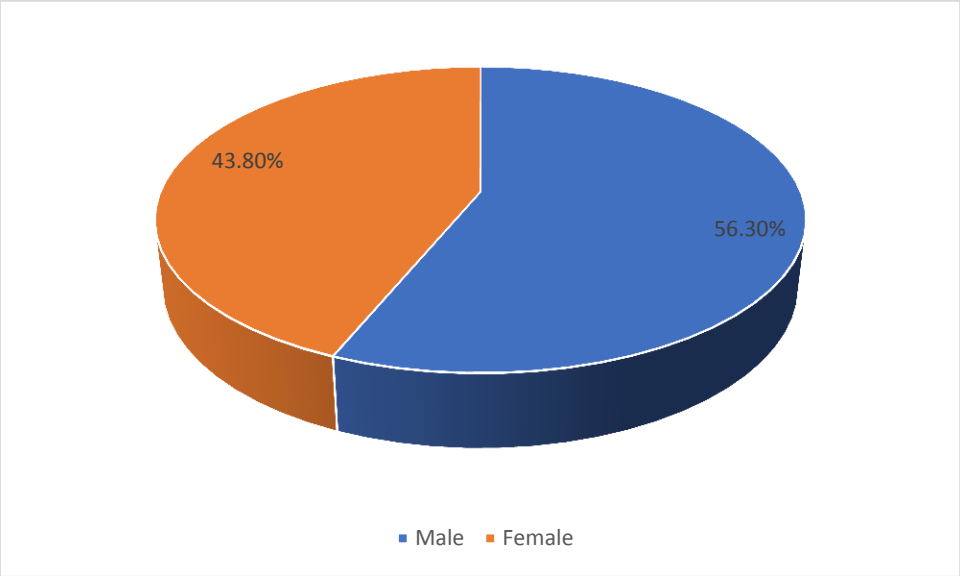


Table 4 & Figure 3 depict the distribution of cases based on gender. It was observed that out of 80 neonates diagnosed with NS, 45 (56.3%) were males while 35 (43.8%) were females.

Table 5: Distribution of neonates based on birth weight (n=80)

		Frequency	Percentage
Birth Weight	<1 kg	4	5.0
	1- <1.5 kg	23	28.8
	1.5 - < 2 kg	36	45.0
	2.0 - <2.5 kg	11	13.8
	>2.5 kg	6	7.5
	Total	80	100

Figure 4: Distribution of neonates based on birth weight

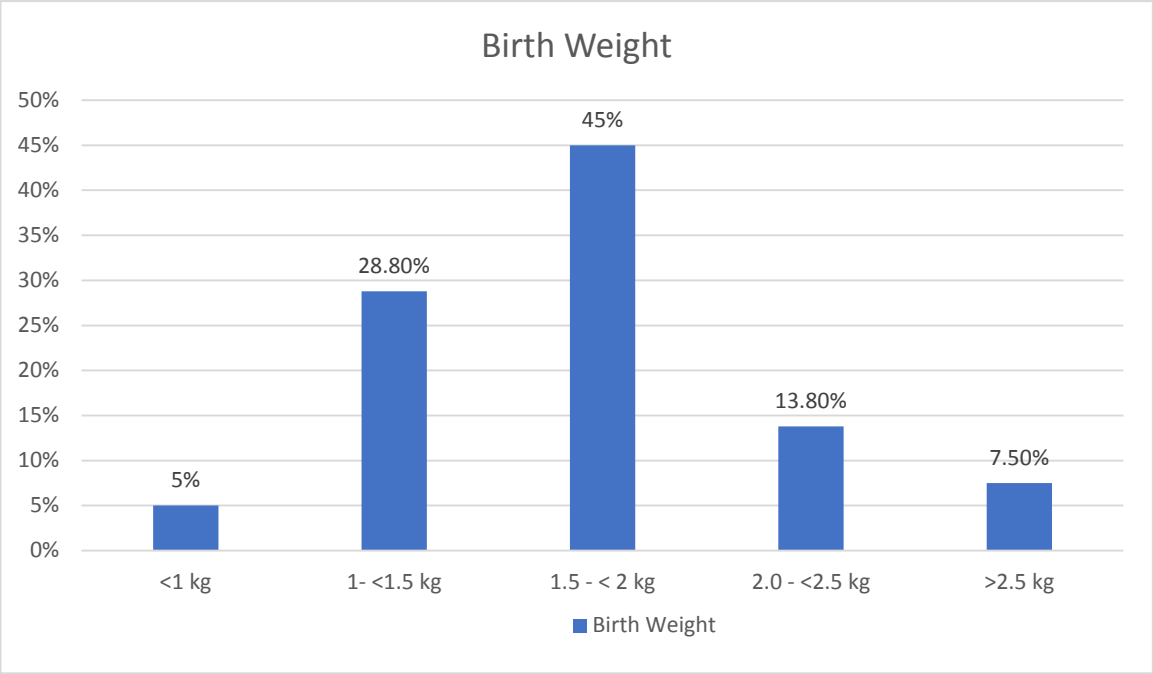


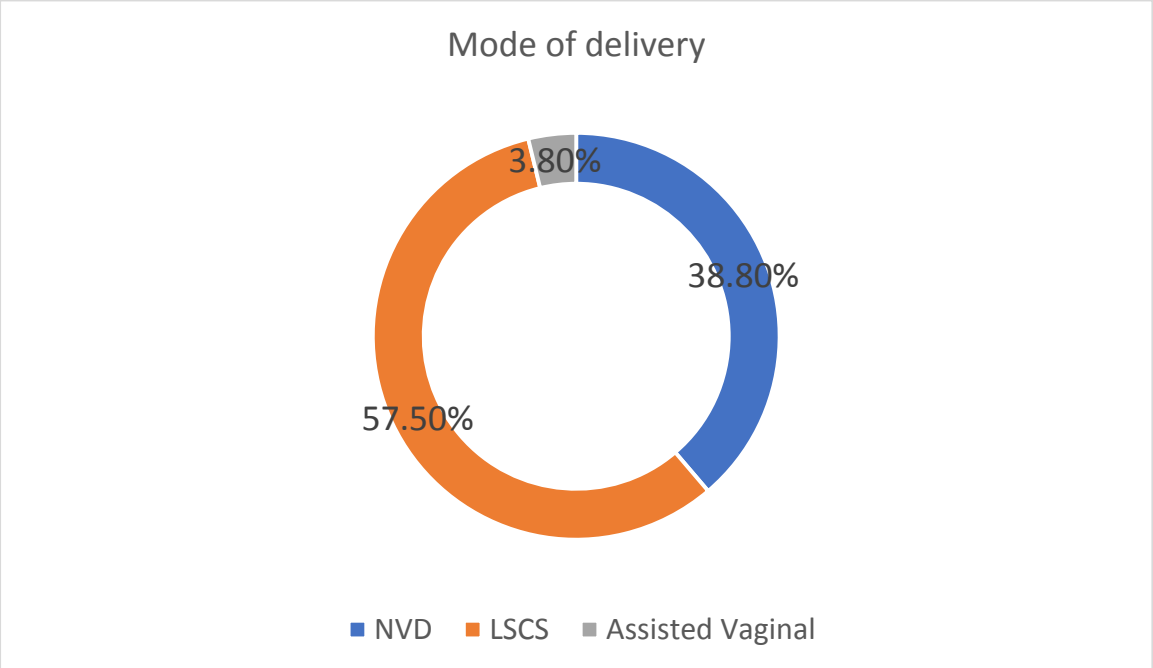
Table 5 & Figure 4 depict the distribution of cases based on birth weight. Majority (45%) of neonates were in the birth weight category of 1.5 Kg to <2 Kg. In the birth weight category of 1 Kg to < 1.5 Kg, 23 (28.8%) neonates were present. There were 11(13.8%) neonates in the birth weight category of 2 Kg to < 2.5 Kg. Four (5%) and 6 (7.5%) neonates were in the birth weight categories of < 1 Kg and > 2.5 Kg respectively.

Table 6: Distribution of neonates based on mode of delivery (n=80)

		Frequency	Percentage
Mode of Delivery	*NVD	31	38.8
	#LSCS	46	57.5
	Assisted Vaginal	3	3.8
	Total	80	100

*Normal vaginal delivery; #Lower segment caesarean section

Figure 5: Distribution of neonates based on mode of delivery (n=80)



It was observed that majority (57.5%) of neonates were delivered by LSCS while 31 neonates (38.8%) were delivered through NVD, and 3 neonates (3.8%) were delivered through assisted vaginal methods. (Table 6 & Figure 5)

Table 7: Distribution of neonates based on time of onset of sepsis (n=80)

Time of onset of sepsis	Frequency	Percentage
*EOS	32	40
#LOS	48	60
Total	80	100

*Early onset sepsis; #Late onset sepsis

Table 7 depicts distribution of neonates based on time of onset of sepsis. It was observed that 60% of neonates had LOS while 40% had EOS.

Table 8: Distribution of neonates based on risk factors (n=80)

Risk Factors	Frequency	Percentage
Central Line	44	55.0
*PROM	34	42.5
#IUGR	17	21.3
^MAS	12	15.0
Intrapartum Fever	6	7.5

* Premature rupture of membranes; # Intrauterine growth restriction; ^ meconium aspiration syndrome

Table 8 depicts distribution of cases based on risk factors. More than half (55%) of the neonates with sepsis had central lines. History of PROM was noted in 34 cases (42.5%), IUGR was seen in 17 (21.3%) and MAS was present in 12 (15.0%) neonates. Maternal history of intrapartum fever was present in 6 (7.5%) cases.

Table 9: Distribution of cases based on clinical features

Clinical features	Frequency	Percentage
Tachypnea	46	57.5
Lethargy	36	45.0
Refusal of feeds	32	40.0
Temperature instability	32	40.0
Abdominal distension	29	36.3
Conjunctivitis	29	36.3
Vomiting	27	33.8
Grunting	25	31.3
Bleeding	24	30.0
Apnea	22	27.5
Sclerema	21	26.3
Seizures	19	23.8
Weak cry	18	22.5
Umbilical sepsis	7	8.8

Table 9 depicts the distribution of neonates based on clinical features. It was observed that tachypnea was the most common symptom observed in 46 neonates (57.5%). The other

clinical features noted were lethargy in 36 neonates (45.0%), refusal of feeds and temperature instability in 32 neonates each (40.0%), abdominal distension and conjunctivitis in 29 (36.3%) neonates each, vomiting in 27 (33.8%), grunting in 25 (31.3%), bleeding in 24 (30.0%), and apnea in 22 cases (27.5%). Sclerema was present in 21 neonates (26.3%), seizures in 19 (23.8%), weak cry in 18 (22.5%) and umbilical sepsis in 7 cases (8.8%).

Table 10: Distribution of neonates based on complications

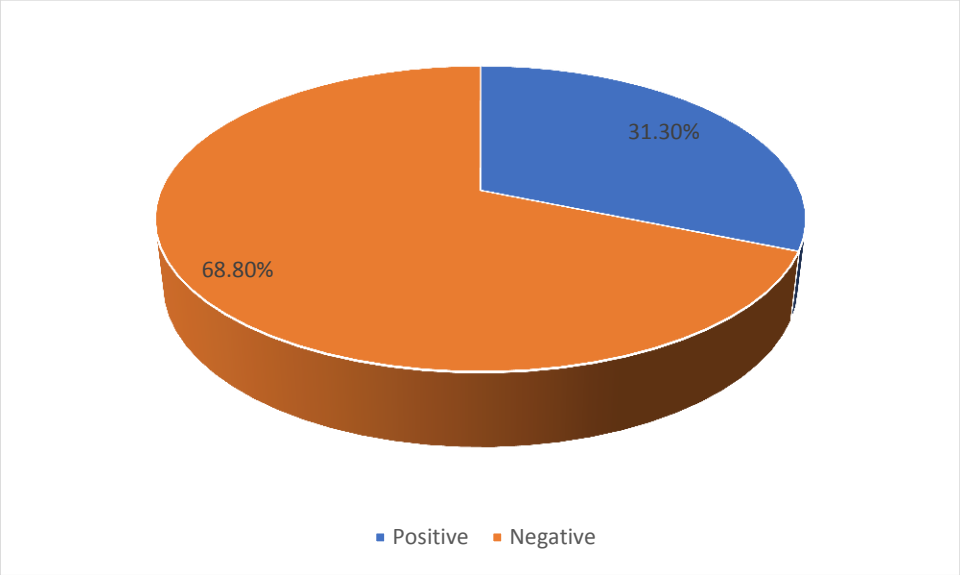
Complications	Frequency	Percentage
Hypoglycemia	34	42.5
Thrombocytopenia	32	40.0
AKI	26	32.5
MODS	21	26.3
Meningitis	4	5.0

Hypoglycaemia was present in 34 neonates (42.5%) and thrombocytopenia in 32 neonates (40.0%). Acute kidney injury (AKI) was seen in 26 cases (32.5%), multiple organ dysfunction syndrome (MODS) in 21 neonates (26.3%) and meningitis in 4 cases (5.0%) – Table 10.

Table 11: Distribution of neonates based on the blood culture report (n=80)

		Frequency	Percentage
Blood culture	Positive	25	31.3
	Negative	55	68.8
	Total	80	100

Figure 6: Distribution of neonates based on the blood culture report



Out of 80 neonates, blood culture was positive in 25 neonates (31.3%) – Table 11 & Figure 6.

Table 12: Spectrum of organisms isolated from blood culture (n=25)

		Frequency	Percentage
Organism			
	Gram Negative organisms		
	Klebsiella pneumoniae	11	44
	E coli	3	12
	Acinetobacter	2	8
	Enterobacter	1	4
	Kleb oxytoca	1	4
	Gram positive organisms		
	Enterococci	2	8
	CONS	1	4
	Fungus		
	Candida	4	16
	Total	25	100

Klebsiella species was the most isolated organisms (44%) followed by Candida (16%) and E. coli (12%). Other organisms identified were Acinetobacter and Enterococci in 2 (8%) neonates each. Coagulase-negative Staphylococci (CONS), Enterobacter, and Klebsiella oxytoca were identified in 1 (4%) neonate each – Table 12.

Table 13: Distribution of cases based on type of sepsis (n=80)

Type of sepsis	Frequency	Percentage
Probable (Clinical) Sepsis	55	68.75
Culture Positive Sepsis (Definitive)	25	31.25
Total	80	100

Tabe 13 depicts type of sepsis based on investigations. It was observed that 31.25% of neonates had Culture Positive Sepsis (Definitive) while 68.75% had Probable (Clinical) Sepsis.

Table 14: Distribution of neonates based on duration of NICU stay (n=80)

		Frequency	Percentage
NICU Stay (Days)	≤7 days	18	22.5
	8-14 days	30	37.5
	15-21 days	25	31.3
	>21 days	7	8.8
	Total	80	100

Eighteen neonates (22.5%) were in NICU for a duration of ≤7 days, while 30 neonates (37.5%) stayed for 8 to 14 days. Twenty-five neonates (31.3%), and 7 neonates (8.8%) were in NICU for 15-21 days and >21 days respectively.

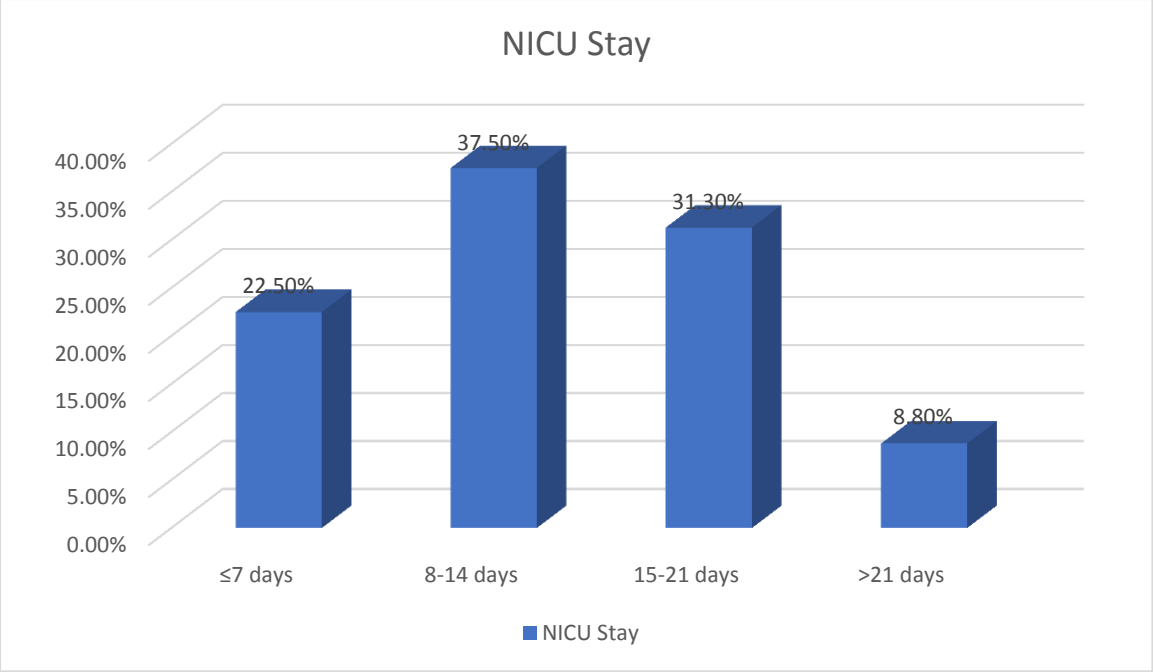


Figure 7: Distribution of neonates based on the NICU stay duration

Table 15: Distribution of neonates based on their outcome (n=80)

		Frequency	Percent
Outcome	Death	7	8.75
	Recovered	67	83.75
	*DAMA	6	7.5
	Total	80	100

* Discharged against medical advice

Out of 80 neonates with sepsis, 67 (83.75%) recovered while 7 neonates (8.75%) died due to sepsis-related complications. Six neonates (7.5%) were discharged against medical advice for various reasons – Table 15.

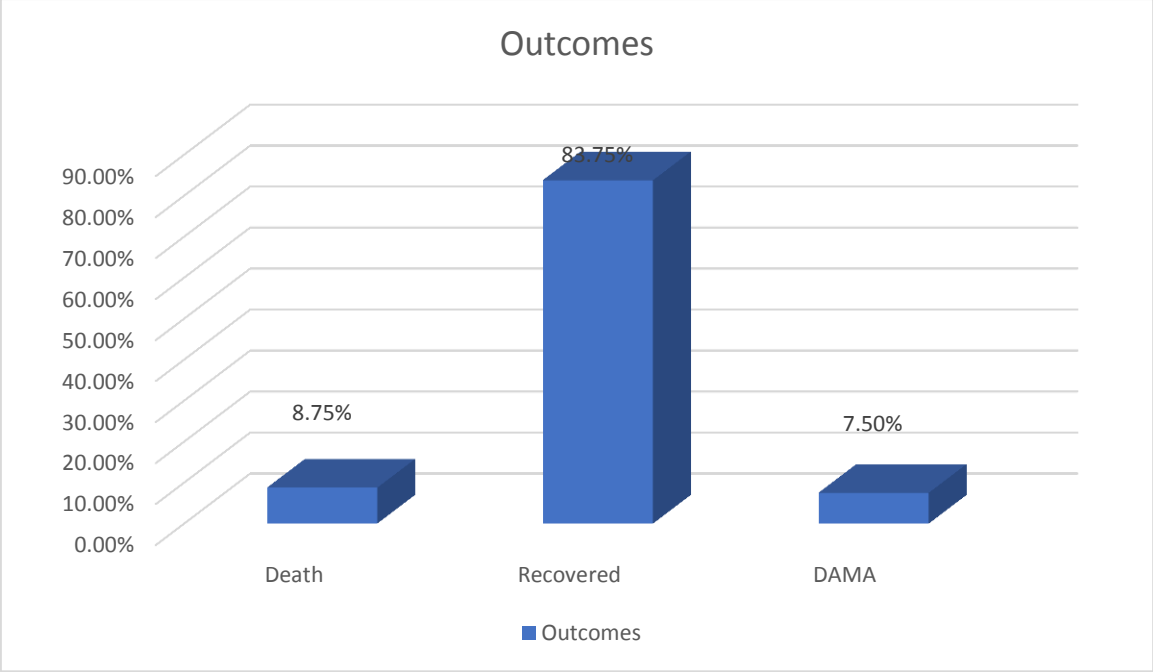


Figure 8: Distribution of neonates based on the outcome

DISCUSSION

DISCUSSION

NS is considered the leading cause of infant mortality and morbidity in the NICU. Early diagnosis and therapy are essential for the prevention of morbidity and mortality of NS. The incidence and the causative organisms of sepsis vary from place to place. Knowledge of the bacterial profile and the antibiotic susceptibility pattern of the isolates play an important role in the management of sepsis. The present study was conducted to determine the clinical profile of NS in neonates admitted to NICU and SNICU.

Sepsis and Gender

In this study, a total of 80 neonates diagnosed with sepsis were included. Among these patients, 45 were male, accounting for 56.3% of the sample, while 35 were female, representing 43.8%. This distribution indicates a slight predominance of male neonates. Similar findings were reported by Thapa S et al., [49], Pokhrel B et al.,[51], Ghosh S et al.,[53], Ekwochi U et al., [54], Yadav SK et al., [57] , Panda PK et al., [58]. Shrivastava AK et al., [60] Devkota K et al., [61] . However, no explanation can be offered for this male preponderance.

Sepsis and Birth weight

In the present study, majority (45%) of neonates were in the birth weight category of 1.5 Kg to <2 Kg. In the birth weight category of 1 Kg to < 1.5 Kg, 23 (28.8%) neonates were present. There were 11(13.8%) neonates in the birth weight category of 2 Kg to < 2.5 Kg. Four (5%) and 6 (7.5%) neonates were in the birth weight categories of < 1 Kg and > 2.5 Kg respectively.

In Budhiarta KDL et al., [56] found that lower birth weight was associated with higher mortality, particularly in neonates with birth weights less than 2500 grams. Yadav SK et al., [57] reported that 45% of the neonates had a birth weight of less than 2.5 kg. Panda PK et al., [58]

highlighted that preterm and low birth weight neonates had lower discharge rates and higher mortality. Siwakoti S et al., [59] reported that 55% of the neonates with culture-positive sepsis had a birth weight of less than 2500 grams. Shrivastava AK et al., [60] highlighted that preterm (41.46%) and low birth weight (22.73%) were the most common associated factors in early-onset neonatal septicemia. Devkota K et al., [61] reported that 25.36% of neonates with sepsis had low birth weight, and 18.12% had very low birth weight. These studies consistently demonstrate that neonates with birth weights below 2500 grams are at increased risk of mortality and sepsis. This highlights the increased vulnerability of preterm and low birth weight infants to serious health complications, particularly early-onset neonatal septicemia.

Sepsis and Mode of delivery

In the present study it was observed that majority (57.5%) of neonates were delivered by LSCS while 31 neonates (38.8%) were delivered through NVD, and 3 neonates (3.8%) were delivered through assisted vaginal methods. Ghosh S et al.,[53] reported that 52.18% of neonates were delivered normally, while 47.82% were delivered by caesarean section. Siwakoti S et al.,[59] found that 32% of neonates with sepsis were born by caesarean section. Similarly, Devkota K et al.,[61] reported that 62.32% of neonates with sepsis were delivered via spontaneous vaginal delivery and while 37.68% were delivered via caesarean section. However, no significant interpretations or conclusions were drawn regarding these differences in delivery methods across the studies.

Time of onset of sepsis

In present study it was observed that 60% of neonates had LOS while 40% had EOS.

Devkota K et al., [61]reported that 71.01% of neonates had early-onset NS, while 28.99% had late-onset NS. In a study conducted by Gurung B et al.,[3] among neonates with sepsis, 30.2%

had early onset and 69.8% had late onset neonatal sepsis. Berhane M et al.,[45] reported that out of 304 neonates, 195 (64.1%) had clinical evidence for sepsis, majority (84.1%) of them having early onset neonatal sepsis.

Sepsis and risk factors

In the present study more than half (55%) of the neonates with sepsis had central lines. History of PROM was noted in 34 cases (42.5%), IUGR was seen in 17 (21.3%) and MAS was present in 12 (15.0%) neonates. Maternal history of intrapartum fever was present in 6 (7.5%) cases. Rawat et al.,[48] reported various maternal risk factors affecting neonatal septicaemia; rupture of membranes for more than 18 hours was the commonest factor with 63.64% cases followed by foul smelling liquor in 27.27%. febrile illness in mother 18.18% and maternal urinary tract infection (UTI) in 9.09%. Studies conducted by Rawat et al.,[48] Devkota K et al., [61] concluded that factors such as low birth weight, prematurity, mechanical ventilation, invasive procedures were the predisposing factors for sepsis in neonates.

Sepsis and Blood culture

In the present study Klebsiella species was the most isolated organisms (44%) followed by Candida (16%) and E. coli (12%). Other organisms identified were Acinetobacter and Enterococci in 2 (8%) neonates each. Coagulase-negative Staphylococci (CONS), Enterobacter, and Klebsiella oxytoca were identified in 1 (4%) neonate each.

In the study by Rawat et al.,[48] the etiology of bacterial culture-positive isolates comprised Gram-negative bacilli in 55.10% and Gram-positive cocci in 44.90% of cases. The most common isolates were Coagulase-negative Staphylococci (38.78%), Klebsiella spp. (34.69%), Acinetobacter (14.29%), Enterobacter (4.08%), Enterococcus spp. (4.08%), Coagulase-positive Staphylococci (2.04%), and Escherichia coli (2.04%).

Thapa et al.,[49] reported that the majority (69.6%) of neonatal septicemia cases were caused by gram-negative isolates. Acinetobacter species were the most frequently isolated pathogens (32.1%), followed by Staphylococcus aureus (19.6%). In early-onset septicemia, Acinetobacter species (32.1%) and Staphylococcus aureus (16%) predominated, while in late-onset septicemia, Staphylococcus aureus (19.6%) and Acinetobacter species (8.9%) were most prevalent.

According to Pokhrel et al.,[51] the majority (77%) of bacterial isolates were gram-negative. Klebsiella species, Coagulase-negative Staphylococci (CONS), and Enterobacter were identified as the most common pathogens. However, the blood culture positivity rate in our study is low compared to the results reported by Rawat et al.,[48]Thapa et al.,[49] and Pokhrel et al..[51]

Sepsis and clinical profile

In the present study it was observed that tachypnea was the most common symptom observed in 46 neonates (57.5%). The other clinical features noted were lethargy in 36 neonates (45.0%), refusal of feeds and temperature instability in 32 neonates each (40.0%), abdominal distension and conjunctivitis in 29 (36.3%) neonates each, vomiting in 27 (33.8%), grunting in 25 (31.3%), bleeding in 24 (30.0%), and apnea in 22 cases (27.5%). Sclerema was present in 21 neonates (26.3%), seizures in 19 (23.8%), weak cry in 18 (22.5%) and umbilical sepsis in 7 cases (8.8%).

Rawat D et al., [48] reported respiratory distress (65.30%) as the commonest presentation among culture positive cases followed by encephalopathy (22.44%) and seizures (14.28%). Common clinical findings observed by Pokhrel B et al.,[51] were respiratory distress (79.7%), tachycardia (60.9%), cyanosis (59.4%) and hypothermia (53.6%). Ekwochi U et al., [54] reported fever as the most common symptom, with 84.2% of the presentations manifesting as

such. Poor suckling (39.3%), fast breathing (43.6%), jaundice (39.3%), lethargy (31.6%), and poor cry (30.4%) were other common symptoms, while vomiting (17.5%), diarrhea (1.8%), abdominal distention (15.8%), excessive cry (12.5%), and bleeding from the cord (3.5%) were not very common. Budhiarta KDL et al., [56] included common symptoms such as respiratory distress, jaundice, and signs of infection in the clinical profiles of neonates with sepsis. Yadav SK et al., [57] emphasized clinical signs like tachypnea, respiratory distress, and abdominal distension as key indicators of sepsis. Siwakoti S et al., [59] reported common clinical features such as refusal to feed, fever, jaundice, and respiratory distress. Shrivastava AK et al., [60] reported common symptoms such as respiratory distress, fever with jaundice, and poor feeding.

The study observed tachypnea as the most prevalent symptom among neonates (57.5%), with additional common features including lethargy, refusal of feeds, and temperature instability. Other symptoms such as abdominal distension, conjunctivitis, vomiting, grunting, and bleeding were also noted. Comparisons with other studies underscored variations in clinical presentations of neonatal sepsis, highlighting respiratory distress, fever, jaundice, and feeding difficulties as frequent symptoms across different research findings.

Sepsis and Outcome

In the present study, 7 (8.75%) neonates died due to sepsis-related complications. Majority (83.75%) of neonates recovered and were discharged from the NICU. Six neonates (7.5%) were discharged against medical advice (DAMA) due to various reasons. Siwakoti S et al., [59] reported an in-hospital mortality rate of 7% among neonates with culture-positive sepsis and Rawat D et al., [48] observed a mortality of 10.2% among neonates with sepsis which was almost similar to the findings of our study. Panda PK et al., [58] reported a slightly higher mortality rate of 11%. Higher mortality rates of 15.94% and 28.2% were reported by Pokhrel

B et al.,[51] and Budhiarta KDL et al., [56] respectively. NS is a major cause of death in low- and middle-income countries. Various characteristics have been reported to be associated with mortality in NS such as sclerema, ELBW, thrombocytopenia, leukopenia and hyperglycemia.[62]

CONCLUSION

CONCLUSION

This study focuses on the clinical profile and outcome of neonatal sepsis in a NICU setting, highlighting its substantial burden on neonatal health. The findings emphasize the vulnerability of neonates with lower birth weight and stresses the need for careful monitoring and targeted treatments. Clinical manifestations varied widely, with tachypnea being the most common symptom. Blood culture results highlighted Klebsiella species as the most prevalent pathogen. Effective treatment depends on understanding local bacterial types and which antibiotics are effective against them. Despite advances, the high mortality rate underscores the ongoing need for better early detection, prompt intervention, and overall care practices to improve outcomes for newborns affected by sepsis.

LIMITATIONS

- Small sample size.
- The study did not include long-term follow-up of neonates, which is essential to understand the chronic impacts and long-term outcomes of NS.

SUMMARY

SUMMARY

- In this study, a total of 80 neonates diagnosed with NS were included. Among these neonates, 45 were male, accounting for 56.3% of the sample, while 35 were female, representing 43.8%.
- Among neonates with sepsis, the distribution of birth weights showed that 5.0% weighed < 1 kilogram, 28.8% weighed between 1 and <1.5 kilograms, 45.0% had a birth weight of 1.5 to <2 kilograms, 13.8% weighed between 2 and <2.5 kilograms, and 7.5% had a birth weight > 2.5 kilograms.
- The distribution of delivery modes among neonates with sepsis indicated that 38.8% were delivered via NVD, 57.5% via LSCS, and 3.8% via assisted methods. Cesarean deliveries were predominant, comprising more than half of the cases among neonates affected by sepsis.
- It was observed that 60% of neonates had LOS while 40% had EOS.
- More than half (55%) of the neonates with sepsis had central lines. History of PROM was noted in 34 cases (42.5%), IUGR was seen in 17 (21.3%) and MAS was present in 12 (15.0%) neonates. Maternal history of intrapartum fever was present in 6 (7.5%) cases.
- In the present study, various clinical features were observed among neonates with sepsis. Tachypnea was the most prevalent symptom, noted in 57.5% of cases. Lethargy was observed in 45.0% of neonates, while refusal of feeds and temperature instability were observed in 40.0% each. Other symptoms included abdominal distension and conjunctivitis (36.3% each), vomiting (33.8%), grunting (31.3%), bleeding (30.0%), apnea (27.5%), sclerema (26.3%), seizures (23.8%), weak cry (22.5%), and umbilical sepsis in 8.8% of cases.

- Hypoglycaemia was present in 34 neonates (42.5%) and thrombocytopenia in 32 neonates (40.0%). Acute kidney injury (AKI) was seen in 26 cases (32.5%), multiple organ dysfunction syndrome (MODS) in 21 neonates (26.3%) and meningitis in 4 cases (5.0%)
- Blood culture results showed that 25 neonates (31.3%) were tested positive, while 55 neonates (68.8%) tested negative. The most frequently identified organism was Klebsiella species, found in 11 neonates (13.8%). Additionally, Candida was detected in 5.0% of cases, E. coli in 3.8%, Acinetobacter in 2.5%, and Enterococci in 2.5%.
- It was observed that 31.25% of neonates had Culture Positive Sepsis (Definitive) while 68.75% had Probable (Clinical) Sepsis
- The duration of NICU stay varied among the neonates studied: Eighteen neonates (22.5%) were in NICU for a duration of ≤7 days, while 30 neonates (37.5%) stayed for 8 to 14 days. Twenty-five neonates (31.3%), and 7 neonates (8.8%) were in NICU for 15-21 days and >21 days respectively.
- Out of 80 neonates with sepsis, 67 (83.75%) recovered while 7 neonates (8.75%) died due to sepsis-related complications. Six neonates (7.5%) were discharged against medical advice for various reasons

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ANNEXURE

PATIENT INFORMATION SHEET

Principal investigator: DR.GURRAM KAMALAKAR/DR.SUDHA REDDY V R

I Dr. GURRAM KAMALAKAR , Post graduate student in Department at Sri Devraj Urs Medical College, will be conducting a study titled **"Study of Clinical profile and outcome of Sepsis in neonatal intensive care unit in a tertiary care hospital-A prospective observational study,** for my dissertation under the guidance of Dr.SUDHA REDDY V.R, Professor of Department of Paediatrics. The participants of this study include neonates who are admitting to NICU and SNICU with sepsis or later who develops sepsis in NICU and SNICU, You will not be paid any financial compensation for the participation of your child in this research project.

All the data will be kept confidential and will be used only for research purpose by this institution. You are free to provide consent for the participation of your child in this study. You can also withdraw your child from the study at any point of time without giving any reasons whatsoever. Your refusal to participate will not prejudice you to any present or future care at this institution.

Name and Signature of the Principal Investigator

Contact number :

Date-

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ದಿನಾಂಕ:

ನಾನು, ಶ್ರೀ/ಶ್ರೀಮತಿ

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_____ ನನ್ನ ಮಗುವನ್ನು ನಿರೀಕ್ಷಿತ ವೀಕ್ಷಣಾ ಅಧ್ಯಯನದಲ್ಲಿ ಸೇರಿಸಲಾಗುವುದು ಎಂದು ವಿವರಿಸಲಾಗಿದೆ - ಕ್ಲಿನಿಕಲ್ ಪ್ರೊಫೈಲ್‌ನ ಅಧ್ಯಯನ ಮತ್ತು ತೃತೀಯ ಆರೈಕೆ ಆಸ್ಪತ್ರೆ-ನಿರೀಕ್ಷಿತ ವೀಕ್ಷಣಾ ಅಧ್ಯಯನದಲ್ಲಿ ನವಜಾತ ತೀವ್ರ ನಿಗಾ ಘಟಕದಲ್ಲಿ ಸೆಪ್ಸಿಸ್‌ನ ಫಲಿತಾಂಶ, ಈ ಮೂಲಕ ನಾನು ಹೆಮಟೊಲಾಜಿಕಲ್ ಮತ್ತು ಕ್ಲಿನಿಕಲ್ ನಿಯತಾಂಕಗಳ ಅವಲೋಕನಗಳನ್ನು ದಾಖಲಿಸಲು ಯಾವುದೇ ಬಲ ಅಥವಾ ಪೂರ್ವಾಗ್ರಹವಿಲ್ಲದೆ ನನ್ನ ಮಾನ್ಯವಾದ ಲಿಖಿತ ತಿಳುವಳಿಕೆಯನ್ನು ನೀಡುತ್ತೇನೆ. ಒಳಗೊಂಡಿರುವ ಸ್ವಭಾವ ಮತ್ತು ಅಪಾಯಗಳನ್ನು ನನಗೆ ವಿವರಿಸಲಾಗಿದೆ, ನನ್ನ ತೃಪ್ತಿ. ನಡೆಸುತ್ತಿರುವ ಅಧ್ಯಯನದ ಬಗ್ಗೆ ನನಗೆ ವಿವರವಾಗಿ ವಿವರಿಸಲಾಗಿದೆ. ನಾನು ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆಯನ್ನು ಓದಿದ್ದೇನೆ ಮತ್ತು ಯಾವುದೇ ಪ್ರಶ್ನೆಯನ್ನು ಕೇಳಲು ನನಗೆ ಅವಕಾಶವಿದೆ. ನಾನು ಕೇಳಿದ ಯಾವುದೇ ಪ್ರಶ್ನೆಗೆ ನನ್ನ ತೃಪ್ತಿಗೆ ಉತ್ತರಿಸಲಾಗಿದೆ. ನನ್ನ ಮಗುವನ್ನು ಈ ಸಂಶೋಧನೆಯಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳುವಂತೆ ಅನುಮತಿಸಲು ನಾನು ಸ್ವಯಂಪ್ರೇರಣೆಯಿಂದ ಒಪ್ಪಿಗೆಯನ್ನು ನೀಡುತ್ತೇನೆ. ಇತಿಹಾಸವನ್ನು ಒದಗಿಸಲು, ದೈಹಿಕ ಪರೀಕ್ಷೆಗೆ ಒಳಗಾಗಲು, ಕಾರ್ಯವಿಧಾನಕ್ಕೆ ಒಳಗಾಗಲು, ತನಿಖೆಗೆ ಒಳಗಾಗಲು ಮತ್ತು ಅದರ ಫಲಿತಾಂಶಗಳು ಮತ್ತು ದಾಖಲೆಗಳನ್ನು ಇತ್ಯಾದಿಗಳನ್ನು ವೈದ್ಯರು / ಸಂಸ್ಥೆ ಇತ್ಯಾದಿಗಳಿಗೆ ಒದಗಿಸಲು ನಾನು ಈ ಮೂಲಕ ಒಪ್ಪಿಗೆ ನೀಡುತ್ತೇನೆ. ಶೈಕ್ಷಣಿಕ ಮತ್ತು ವೈಜ್ಞಾನಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಕಾರ್ಯಾಚರಣೆ / ಕಾರ್ಯವಿಧಾನ, ಇತ್ಯಾದಿಗಳನ್ನು ವೀಡಿಯೊ ಗ್ರಾಫ್ ಅಥವಾ ಛಾಯಾಚಿತ್ರ ಮಾಡಬಹುದು. ಎಲ್ಲಾ ಡೇಟಾವನ್ನು ಪ್ರಕಟಿಸಬಹುದು ಅಥವಾ ಯಾವುದೇ ಶೈಕ್ಷಣಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಬಳಸಬಹುದು. ಕಾರ್ಯವಿಧಾನ / ಅಧ್ಯಯನದ ಸಮಯದಲ್ಲಿ ಯಾವುದೇ ಅಹಿತಕರ ಪರಿಣಾಮಗಳಿಗೆ ನಾನು ವೈದ್ಯರು / ಸಂಸ್ಥೆ ಇತ್ಯಾದಿಗಳನ್ನು ಜವಾಬ್ದಾರರನ್ನಾಗಿ ಮಾಡುವುದಿಲ್ಲ.

_____

(ಪಿಟಿ. ಅಟೆಂಡೆಂಟ್‌ನ ಸಹಿ ಮತ್ತು ಹೆಸರು) (ರೋಗಿಯೊಂದಿಗಿನ ಸಂಬಂಧ)

ಸಾಕ್ಷಿ:

_____

(ಸಂಶೋಧನಾ ವ್ಯಕ್ತಿ/ವೈದ್ಯರ ಸಹಿ ಮತ್ತು ಹೆಸರು)

INFORMED CONSENT FORM

Date:

I, Mr/Mrs _____ ,have been explained in my own vernacular language that my child will be included in A Prospective Observational Study-**Study of Clinical profile and outcome of Sepsis in neonatal intensive care unit in a tertiary care hospital- A prospective observational study,** hereby I give my valid written informed consent without any force or prejudice for recording the observations of haematological and clinical parameters . The nature and risks involved have been explained to me, to my satisfaction. I have been explained in detail about the study being conducted. I have read the patient information sheet and I have had the opportunity to ask any question. Any question that I have asked, have been answered to my satisfaction. I provide consent voluntarily to allow my child as a participant in this research. I hereby give consent to provide history, undergo physical examination, undergo the procedure, undergo investigations and provide its results and documents etc to the doctor / institute etc. For academic and scientific purpose the operation / procedure, etc may be video graphed or photographed. All the data may be published or used for any academic purpose. I will not hold the doctors / institute etc responsible for any untoward consequences during the procedure / study.

_____ _____

(Signature & Name of Pt. Attender) (Signature/Thumb impression & Name of Pt.Attender/Guardian)

(Relation with patient)

Witness:

_____

(Signature & Name of Research person/doctor)

PROFORMA FOR NEONATAL SEPSIS

UHID: IP NO:

NAME: SEX:

GESTATION AGE: WKS TERM/PRETERM:

BALLARD SCORE:

Birth Wt:_____gm

Wt at admission:___gm

Date of Birth

Date of Admission:

Date of Discharge:

Date of Death :

Duration of stay :_____days

Self Referral : Y / N

MATERNAL DELIVERY DATA

1.Mode of delivery: [1/2/3] [1-Vaginal/2-Assisted/3-caesarian]

2. Place of delivery: [1/2] [1-Home/2-Institution]

- Home: [1/2]

  [1-Untrained/2-Trained personnel]

- Institutional: [1/2/3/4/5/6]

[1-HSC/2-PHC/3-Taluk HQ hospital/4-District HQ hospital/5-Tertiaryreferral unit/6-Private Nursing home]

- Conducted by: [1/2/3/4]

  [1-Nurse/2-Doctor/3-Obstetrician/4-None]

3. Type of facility

   - Equipment: [1/2/3] [1-Labour room/2-Theatre facilities/3-facilities for neonatal care]

MATERNAL RISK FACTORS

1. Birth order [1/2/3/4/5/more]
2. Multiple gestations [Y/N/NK]
3. Intrapartum fever [Y/N/NK]
4. PROM > 18hrs [Y/N/NK]
5. Vaginal examinations >3 in labour [Y/N/NK]
6. Meconium staining: [Y/N/NK]
7. Cloudy amniotic fluid: [Y/N/NK]
8. Foul smelling amniotic fluid: [Y/N/NK]
9. UTI in the last trimester: [Y/N/NK]
10. Maternal Illness: [1/2/3/4/5]

    [1-PIH/2-Anaemia/3-Diabetes/4-Heart disease/5-Others]

11. Maternal education:_____Paternal education: _____

NEONATAL RISK FACTORS

1. Birth asphyxia: [Y/N/NK]

2. Cord status: [1/2/3] [1-Bandage/2-Ointment/3-Dry]

3. Feeding

    a. Feeding pattern [1/2/3] [1-Exclusive/2-Not exclusive]

    b. Prelacteal feeds: [Y/N] If Yes specify _____

4. Clean clothes: [Y/N]

5. Bath to the baby: [Y/N]

6. Home remedies: [Y/N/NK] If Yes specify _____

CLINICAL EXAMINATION

1. Superficial infections

    - Umbilical sepsis: [Y/N]
    - Pyoderma: [Y/N]
    - Conjunctivitis: [Y/N]

2. Apneic spells: [Y/N]

SYMPTOMATOLOGY

General

- Lethargy
- Refusal to suck
- Poor cry
- Poor weight gain
- Incessant cry

Respiratory System

- Respiratory rate____/min
- Chest retractions
- Grunt
- Apnea

Central nervous system

- LOC
- Seizures
- Bulging Fontanels

Shock

Temperature

- Fever
- Hypothermia

Gastrointestinal

- Abdominal distention
- Vomiting

Diarrhea

others

- Sclerema
- Bleeding

LABORATORY FINDINGS

Blood culture: [Positive/Negative]

If positive- organism and sensitivity

C-reactive protein:[Positive/Negative]

Peripheral smear studies:

WBC Count: [1/2/3] [1-<5000/2-5000-15,000/3->15,000]IT

Ratio>0.2: [Y/N]

Toxic granules: [Y/N]

OUTCOME

1. Recovered

2. Expired

FINAL DIAGNOSIS

MASTER CHART

UHID	GESTATION	BT WT	GENDER	DOA	MODE OF DELIVERY	PLACE	PROM	MAS	INTRAPARTM FEVER	IUGR	CENTRAL LINE	FEEDING	UMBLICAL SEPSIS	CONJUCTIVITIS	APNEA	LETHARGY	REFUSAL OF FEEDS	WEAK CRY	TCHYPNEA	GRUNTING	SEIZURES	TEMPERATURE INSTABILITY	DISTENSION	VOMITING	BLEEDING	SCLEREMA	HYPOGLYCEMIA	AKI	THROMBOCYTOPENIA	MENINGITIS	MODS	CULTURE	ORGANISM	NICU STAY	OUTCOME
209393	37WK 3 D	2.3	F	13-03-2023	NVD	RLJH	NO	NO	NO	NO	NO	DBF+FORMULA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		8DAYS	RECOVERED
191277	30WK 2D	1.6	M	22-01-2023	LSCS	RLJH	YES	NO	YES	NO	YES	FORMULA	NO	NO	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES	YES	NO	YES	YES	YES	NO	NO	POSITIVE	ENTEROCOCCI	8DAYS	RECOVERED
252757	35WK	1.24	M	01-07-2023	LSCS	RLJH	YES	NO	NO	YES	YES	EBM+FORMULA	NO	NO	YES	YES	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		14DAYS	RECOVERED
252730	36WK	1.8	M	01-08-2023	LSCS	RLJH	NO	NO	NO	YES	NO	EBM+FORMULA	NO	YES	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	NO	NO	POSITIVE	KLEBSIELLA	16DAYS	RECOVERED
254646	32WK	1.6	F	04-07-2023	ASSISTED VD	RLJH	NO	NO	NO	NO	YES	EBM+FORMULA	NO	YES	YES	YES	YES	NO	NO	NO	YES	YES	YES	YES	NO	NO	NO	NO	YES	YES	YES	POSITIVE	KLEBSIELLA	18DAYS	RECOVERED
241305	36WK	2.9	M	07-06-2023	NVD	OUTBORN	NO	NO	NO	NO	NO	DBF+EBM	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	YES	NEGATIVE		8DAYS	DAMA
185767	38WK	2.3	M	08-01-2023	LSCS	OUTBORN	NO	YES	NO	NO	NO	DBF+FORMULA	NO	NO	NO	YES	YES	YES	NO	NO	NO	YES	YES	YES	NO	YES	YES	YES	YES	NO	YES	POSITIVE	KLEBSIELLA	22DAYS	DEATH
169790	38WK	1.8	M	03-12-2022	NVD	RLJH	NO	NO	NO	NO	NO	DBF+EBM	NO	NO	NO	YES	YES	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	NO	YES	YES	POSITIVE	KLEBSIELLA	14DAYS	RECOVERED
159339	39WK	2.08	F	09-11-2022	NVD	RLJH	YES	NO	NO	NO	NO	DBF+FORMULA	NO	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	NO	NO	NO	NO	POSITIVE	KLEBSIELLA	12DAYS	RECOVERED
265709	26WK	0.9	M	01-09-2023	NVD	RLJH	NO	NO	NO	NO	YES	EBM+FORMULA	NO	YES	YES	YES	NO	YES	YES	NO	YES	NO	YES	YES	YES	YES	NO	YES	YES	YES	NO	NO	POSITIVE	CANDIDA	54DAYS	DAMA
243006	36WK	1.8	F	04-06-2023	NVD	RLJH	YES	NO	NO	NO	NO	DBF+EBM	NO	NO	NO	YES	YES	NO	YES	NO	YES	YES	YES	YES	YES	NO	YES	NO	NO	YES	NO	POSITIVE	KLEBSIELLA	16DAYS	RECOVERED
284793	36WK	1.74	M	20-09-2023	LSCS	OUTBORN	YES	NO	NO	NO	NO	DBF+EBM	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		5DAYS	RECOVERED
284205	33WK	1.84	F	19-09-2023	LSCS	RLJH	YES	NO	NO	NO	NO	DBF+FORMULA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		7DAYS	RECOVERED
168596	33WK	1.2	M	01-12-2022	LSCS	RLJH	NO	NO	NO	NO	YES	EBM+FORMULA	NO	YES	YES	YES	YES	NO	YES	NO	NO	YES	YES	YES	NO	YES	NO	YES	NO	NO	YES	POSITIVE	KLEBSIELLA	14DAYS	RECOVERED
160367	35WK	1.9	F	02-01-2023	LSCS	RLJH	NO	NO	NO	NO	NO	EBM+FORMULA	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		20DAYS	RECOVERED
234349	36WK	2.2	F	16-05-2023	LSCS	RLJH	YES	NO	NO	NO	NO	EBM+FORMULA	NO	YES	NO	YES	YES	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NEGATIVE		7DAYS	RECOVERED
191174	39WK	1.8	F	21-02-2023	LSCS	RLJH	NO	YES	NO	YES	NO	EBM+FORMULA	NO	NO	NO	YES	YES	YES	YES	NO	NO	YES	YES	YES	YES	NO	YES	YES	NO	NO	NO	POSITIVE	KLEBSIELLA	17DAYS	RECOVERED
189662	38WK	2.9	M	17-01-2023	NVD	RLJH	NO	NO	NO	NO	YES	EBM+FORMULA	NO	NO	NO	YES	YES	NO	YES	YES	NO	YES	NO	NO	NO	YES	YES	NO	NO	NO	NO	POSITIVE	KLEBSIELLA	13DAYS	RECOVERED
186204	35WK	2.3	F	07-01-2023	LSCS	RLJH	NO	YES	NO	NO	NO	EBM+FORMULA	NO	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO	NO	NO	NO	NO	NO	YES	NO	NO	NEGATIVE		7DAYS	RECOVERED
251483	29WKS	1.1	M	26-06-2023	NVD	RLJH	NO	NO	NO	NO	YES	EBM	NO	NO	YES	YES	YES	NO	YES	YES	NO	YES	NO	NO	NO	NO	NO	NO	YES	NO	NO	NEGATIVE		22DAYS	RECOVERED
256498	32WKS	2	F	07-07-2023	LSCS	RLJH	YES	NO	YES	NO	NO	EBM+FORMULA	NO	YES	NO	YES	YES	NO	YES	NO	YES	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		20DAYS	RECOVERED
258133	34WKS	1.8KG	M	10-02-2024	NVD	RLJH	NO	NO	NO	NO	NO	EBM+FORMULA	NO	NO	NO	YES	YES	NO	YES	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		12DAYS	RECOVERED
259380	35WKS	1.9	M	15-07-2023	LSCS	RLJH	NO	NO	NO	YES	NO	EBM+FORMULA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	POSITIVE	CANDIDA	14DAYS	RECOVERED
259379	34WKS	1.8KG	F	15-07-2023		RLJH	NO	NO	NO	NO		EBM+FORMULA	NO	YES	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	YES	NO	NO	NO	NO	POSITIVE	CANDIDA	16DAYS	RECOVERED
268029	36WKS	1.8	M	30-07-2023	LSCS	RLJH	YES	NO	NO	YES	NO	EBM+FORMULA	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NEGATIVE		10DAYS	RECOVERED
259479	35WKS	1.7	F	15-07-2023	NVD	RLJH	YES	NO	NO	NO	NO	EBM+FORMULA	NO	NO	NO	NO	YES	NO	NO	YES	NO	YES	YES	YES	NO	YES	NO	NO	NO	YES	NO	POSITIVE	CANDIDA	18DAYS	RECOVERED
295612	36WKS	1.8	F	18-10-2023	LSCS	RLJH	NO	NO	NO	YES	NO	EBM+FORMULA	NO	NO	NO	YES	YES	NO	YES	NO	NO	NO	YES	YES	NO	NO	NO	YES	YES	NO	NO	NEGATIVE		6DAYS	RECOVERED
294995	31WKS	1.64	F	17-10-2023	LSCS	RLJH	YES	NO	NO	NO	YES	EBM+FORMULA	NO	NO	YES	YES	YES	NO	YES	YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NEGATIVE		20DAYS	RECOVERED
294187	35WK	1.9	M	14-10-2023	NVD	RLJH	NO	NO	NO	NO	NO	EBM+FORMULA	NO	YES	NO	YES	YES	NO	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	NO	NO	NEGATIVE		16DAYS	RECOVERED
292289	36WK	2.1	M	09-10-2023	LSCS	RLJH	NO	YES	NO	NO	NO	EBM+FORMULA	NO	YES	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO	POSITIVE	CONS	6DAYS	RECOVERED
291670	32WKS	1.3	M	08-10-2023	VACCUM	RLJH	NO	NO	NO	YES	YES	NO	YES	YES	YES	YES	YES	NO	NO	NO	YES	YES	YES	NO	YES	YES	NO	NO	YES	NO	YES	POSITIVE	KLEB OXYTYCA	14DAYS	DAMA
291273	31WKS	1.3	M	07-10-2023	LSCS	RLJH	YES	NO	NO	NO	YES	EBM+FORMULA	NO	NO	NO	NO	NO	NO	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		20DAYS	RECOVERED
290437	34WKS	1.4	M	05-10-2023	NVD	RLJH	YES	NO	NO	NO	YES	EBM+FORMULA	NO	NO	YES	YES	YES	NO	YES	YES	YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NEGATIVE		10DAYS	RECOVERED
286352	40WKS	3.6	M	01-10-2023	FAILED VACCUM -LSCSrlj	RLJH	NO	NO	NO	NO	YES	EBM+FORMULA	YES	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	YES	NO	NO	YES	POSITIVE	ECOLI	12DAYS	RECOVERED
287850	38WKS	1.8	F	01-10-2023	LSCS	RLJH	NO	YES	NO	YES	YES	EBM+FORMULA	NO	NO	NO	NO	YES	NO	YES	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	NO	NO	NEGATIVE		10DAYS	RECOVERED
285319	37WKS	2.3	F	23-09-2023	NVD	RLJH	NO	NO	NO	NO	NO	EBM+FORMULA	NO	YES	NO	YES	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		8DAYS	RECOVERED
287850	37WKS	1.9	F	27-09-2023	LSCS	RLJH	YES	NO	YES	YES	YES	EBM+FORMULA	NO	YES	NO	YES	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NEGATIVE		5DAYS	RECOVERED
287744	32WKS	1.46	F	27-09-2023	NVD	RLJH	NO	NO	NO	YES	NO	EBM+FORMULA	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	YES	NO	YES	NO	NO	NO	NO	NEGATIVE		16DAYS	RECOVERED
285281	38WKS	2.4	M	26-09-2023	NVD	RLJH	YES	YES	NO	NO	NO	EBM+FORMULA	NO	YES	NO	YES	YES	NO	YES	NO	NO	YES	NO	NO	NO	NO	NO	NO	YES	NO	NO	NEGATIVE		10DAYS	RECOVERED
284205	34wks	2.02	F	19-09-2023	NVD	RLJH	NO	NO	NO	NO	NO	EBM+FORMULA	NO	YES	NO	NO	NO	NO	NO	NO	YES	YES	YES	NO	NO	NO	NO	NO	YES	NO	NO	NEGATIVE		7DAYS	RECOVERED
280037	31wks	1.1	F	08-09-2023	NVD	RLJH	NO	NO	NO	NO	YES	EBM	NO	NO	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	NO	NO	YES	NO	NO	NO	NO	NEGATIVE		18DAYS	RECOVERED
386724	34WKS	1.46	F	02-04-2024	NVD	RLJH	YES	NO	NO	YES	YES	EBM+FORMULA	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	YES	YES	YES	NO	NO	YES	NO	NEGATIVE		14DAYS	DEATH
358180	29WKS	980GMS	M	16-02-2024	NVD	RLJH	NO	NO	NO	NO	YES	EBM	NO	NO	YES	NO	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES	YES	YES	YES	NO	YES	NEGATIVE		22DAYS	DEATH
368813	31WKS	1.24	M	06-03-2024	NVD	OUTBORN	YES	NO	NO	NO	YES	EBM	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	YES	NO	YES	YES	NO	YES	YES	NO	YES	NEGATIVE		20DAYS	DEATH
366098	37WKS	2.12KG	M	06-03-2024	LSCS	RLJH	NO	NO	NO	NO	NO	EBM+DBF	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NEGATIVE		7DAYS	RECOVERED
368782	30WKS	1.22KG	M	05-03-2024	LSCS	RLJH	YES	NO	NO	NO	YES	EBM+FORMULA	NO	NO	YES	NO	NO	YES	YES	NO	NO	YES	YES	YES	NO	NO	YES	NO	YES	NO	NO	NEGATIVE		18DAYS	RECOVERED
372506	38WKS	3.02KG	F	12-03-2024	LSCS	RLJH	NO	YES	NO	NO	YES	EBM+FORMULA	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	YES	NO	NO	YES	YES	NO	YES	NO	NO	NEGATIVE		10DAYS	DEATH
368121	29WKS	1.16KG	M	04-03-2024	LSCS	RLJH	NO	NO	NO	NO	YES	EBM	NO	YES	YES	NO	NO	NO	YES	YES	NO	NO	YES	NO	YES	YES	YES	YES	YES	NO	YES	NEGATIVE		20DAYS	DEATH
364859	32WKS	1KG	F	01-03-2024	NVD	RLJH	NO	NO	NO	NO	YES	EBM	NO	NO	YES	NO	NO	NO	YES	YES	NO	NO	NO	NO	YES	YES	YES	NO	YES	NO	YES	NEGATIVE		14DAYS	DAMA
347242	32WKS	1.80KG	M	29-02-2024	LSCS	RLJH	YES	NO	NO	NO	YES	EBM+FORMULA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		18DAYS	RECOVERED
317719	41WKS	1.67KGS	M	08-12-2023	LSCS	RLJH	YES	YES	NO	YES	YES	EBM+FORMULA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		4DAYS	RECOVERED
311742	37WKS	1.6KG	M	01-11-2023	NVD	RLJH	NO	YES	NO	YES	YES	EBM+FORMULA	YES	YES	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		5DAYS	RECOVERED
327631	29WKS	950GMS	F	22-12-2023	NVD	RLJH	NO	NO	NO	NO	YES	EBM	NO	NO	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	NO	NO	NO	NO	POSITIVE	ECOLI	28DAYS	RECOVERED
340922	30WKS	1.22KG	M	17-01-2024	LSCS	RLJH	NO	NO	NO	YES	YES	EBM	NO	YES	YES	YES	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	NO	NO	POSITIVE	ACITINOBACTER	22DAYS	RECOVERED
339947	32WKS	1.72 KG	F	02-02-2024	LSCS	RLJH	YES	NO	NO	NO	NO	EBM+FORMULA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		16DAYS	RECOVERED
346175	39WKS	2.74KG	F	26-01-2024	LSCS	RLJH	NO	NO	NO	NO	NO	EBM+FORMULA	YES	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		7DAYS	RECOVERED
347828	31WKS	1.02KG	F	30-01-2024	LSCS	RLJH	YES	NO	NO	NO	YES	EBM	NO	YES	NO	YES	YES	YES	YES	NO	NO	YES	YES	YES	NO	NO	YES	YES	YES	NO	NO	NEGATIVE		12DAYS	RECOVERED
358174	40WKS	2.74KG	M	16-02-2024	NVD	OUTBORN	YES	YES	YES	NO	YES	EBM+FORMULA	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	YES	YES	NO	YES	POSITIVE	ENTEROBACTER	14DAYS	RECOVERED
361888	30WKS	1.58KG	M	22-02-2024	LSCS	RLJH	NO	NO	NO	NO	YES	EBM+FORMULA	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		18DAYS	RECOVERED
327635	28WKS	980GMS	M	03-02-2024	NVD	RLJH	NO	NO	NO	NO	YES	EBM	YES	NO	YES	YES	YES	YES	YES	NO	NO	NO	YES	YES	NO	YES	YES	NO	YES	NO	YES	POSITIVE	ECOLI	16DAYS	DEATH
	29WKS	1.2KG	M	25-12-2023	LSCS	RLJH	NO	NO	NO	NO	YES	EBM	NO	YES	YES	YES	YES	YES	NO	YES	NO	YES	YES	YES	YES	NO	YES	NO	YES	NO	YES	POSITIVE	ACITINOBACTER	32DAYS	RECOVERED
259380	31WKS	1.6KG	M	15-07-2023	LSCS	RLJH	YES	NO	YES	NO	YES	EBM	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		14DAYS	RECOVERED
258133	34WKS	1.7KG	M	12--02-2024	LSCS	RLJH	YES	NO	NO	NO	YES	EBM+FORMULA	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		12DAYS	RECOVERED
268029	36WKS	1.8KG	M	30-07-2023	LSCS	RLJH	NO	NO	NO	NO	NO	EBM+FORMULA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	POSITIVE	ENTEROCOCCI	14DAYS	RECOVERED
169790	38WKS	1.8KG	M	03-12-2024	NVD	RLJH	YES	YES	NO	YES	NO	EBM+FORMULA	NO	NO	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO	YES	NO	NO	YES	NO	NO	NO	POSITIVE	KLEBSIELLA	16DAYS	RECOVERED
326642	36WKS	1.96KG	M	22-12-2023	LSCS	RLJH	YES	NO	NO	YES	NO	EBM+FORMULA	NO	YES	NO	YES	YES	YES	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NEGATIVE		4DAYS	RECOVERED
324706	34WKS	1.06KG	M	20-12-2023	LSCS	RLJH	NO	NO	NO	NO	YES	EBM	NO	NO	NO	NO	NO	NO	YES	YES	YES	NO	YES	YES	NO	NO	YES	NO	NO	NO	NO	NEGATIVE		6DAYS	RECOVERED
256498	34WKS	2.0KG	F	07-07-2023	NVD	RLJH	YES	NO	NO	NO	YES	EBM+FORMULA	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		16DAYS	RECOVERED
259379	33WKS	1.04KG	F	15-07-2023	LSCS	RLJH	NO	NO	NO	NO	YES	EBM	YES	NO	NO	YES	YES	YES	YES	NO	NO	YES	YES	YES	NO	YES	YES	YES	NO	NO	NO	NEGATIVE		10DAYS	RECOVERED
401613	34WKS	1.3KG	M	18-04-2024	NVD	RLJH	NO	NO	NO	NO	YES	EBM+FORMULA	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	YES	YES	NO	YES	YES	YES	YES	NO	YES	NEGATIVE		16DAYS	RECOVERED
383036	31WKS	1.4KG	M	28-03-2024	NVD	RLJH	YES	NO	NO	NO	YES	EBM+FORMULA	NO	YES	YES	YES	YES	NO	YES	YES	NO	YES	NO	NO	NO	NO	NO	NO	YES	NO	NO	NEGATIVE		18DAYS	RECOVERED

UHID	GESTATION	BT WT	GENDER	DOA	MODE OF DELIVERY	PLACE	PROM	MAS	INTRAPARTM FEVER	IUGR	CENTRAL LINE	FEEDING	UMBLICAL SEPSIS	CONJUCTIVITIS	APNEA	LETHARGY	REFUSAL OF FEEDS	WEAK CRY	TCHYPNEA	GRUNTING	SEIZURES	TEMPERATURE INSTABILITY	DISTENSION	VOMITING	BLEEDING	SCLEREMA	HYPOGLYCEMIA	AKI	THROMBOCYTOPENIA	MENINGITIS	MODS	CULTURE	ORGANISM	NICU STAY	OUTCOME
398591	35WKS	1.9KG	F	15-04-2024	LSCS	RLJH	YES	NO	NO	NO	NO	EBM+FORMULA	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO	YES	YES	NO	NO	YES	NO	NO	NO	NO	NEGATIVE		10DAYS	RECOVERED
399356	37WKS	1.5KG	M	16-04-2024	LSCS	OUTBORN	YES	YES	YES	YES	YES	EBM+FORMULA	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	NEGATIVE		7DAYS	DAMA
398618	36WKS	1.8KG	M	16-04-2024	LSCS	OUTBORN	NO	NO	NO	NO	NO	EBM+FORMULA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	YES	NO	YES	NO	YES	NEGATIVE		8DAYS	DAMA
23-10-2955	36WKS	1.7KG	F	01-04-2024	LSCS	RLJH	YES	NO	NO	YES	NO	EBM+FORMULA	NO	YES	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	YES	NO	NO	NO	YES	NO	YES	POSITIVE	KLEBSIELLA	12DAYS	RECOVERED
376397	31WKS	1.38KG	F	20-03-2024	LSCS	RLJH	NO	NO	NO	NO	YES	EBM	NO	NO	YES	NO	NO	NO	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	NO	NO	NO	NEGATIVE		12DAYS	RECOVERED
376398	31WKS	1.1KG	F	20-03-2024	LSCS	RLJH	YES	NO	NO	NO	YES	EBM	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	NO	NEGATIVE		21DAYS	RECOVERED
366813	37WKS	1.9KG	M	02-03-2024	NVD	RLJH	NO	NO	NO	NO	YES	EBM+FORMULA	YES	YES	NO	NO	YES	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		4DAYS	RECOVERED
368786	2.4KG	38WKS	F	05-03-2024	LSCS	RLJH	NO	NO	NO	NO	NO	EBM+FORMULA	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO	NEGATIVE		7DAYS	RECOVERED
35345	1.8KG	32WKS	F	26-01-2024	LSCS	RLJH	YES	NO	NO	NO	NO	EBM+FORMULA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEGATIVE		3DAYS	RECOVERED