"A study of early identification of sepsis using NOSOCOMIAL SEPSIS(NOSEP) scoring and MODIFIED SICK NEONATAL SCORING (MSNS) – An Observational Cross Sectional study"

By

Dr. C. PRAKASH REDDY, M.B.B.S.

DISSERTATION SUBMITTED TO

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Under the Guidance Of

Dr. BEERE GOWDA Y.C, M.B.B.S, M.D.

Professor of Department

DEPARTMENT OF PEDIATRICS,
SRI DEVARAJ URS MEDICAL COLLEGE, TAMAKA, KOLAR, KARNATAKA – 563101

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DATE:

PLACE: KOLAR

Signature of Guide

Dr. BEERE GOWDA Y.C, MD.

PROFESSOR

DEPARTMENT OF PEDIATRICS,

SRI DEVARAJ URS MEDICAL COLLEGE.

TAMAKA, KOLAR

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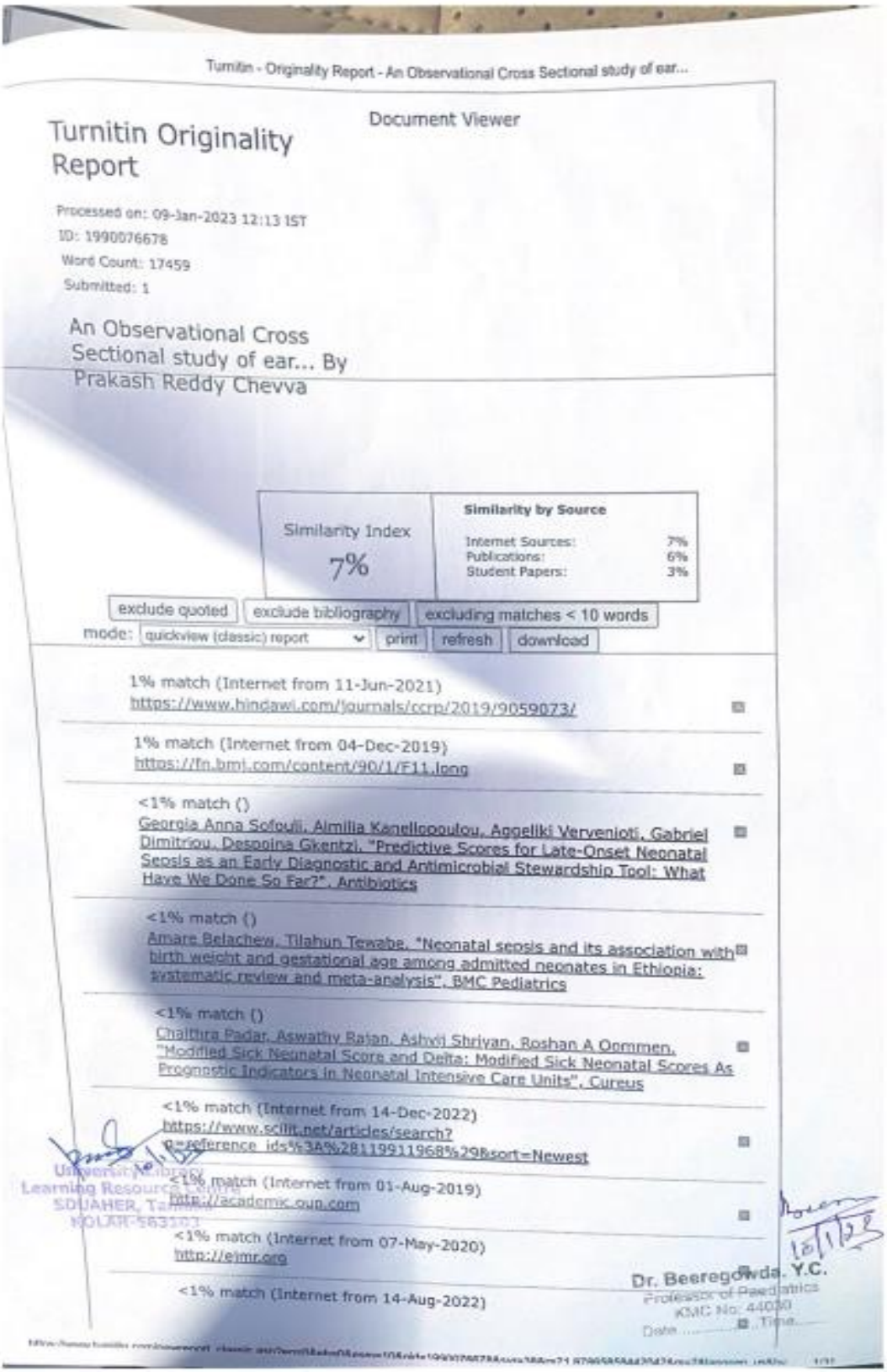

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DATE: Signature of candidate

PLACE: KOLAR **Dr. C.PRAKASH REDDY**

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Glossary	Abbreviations
CBC	Complete blood count
CRIB	Clinical risk index for babies
CRIB	Clinical risk index for babies
CRP	C-reactive protein
ELBW	Extremely low birth weight
EOS	Early onset sepsis
EWS	Early warning scores
GBS	Group B streptococcus
GBS	Group B streptococcus
HER	Electronic health records
HRC	Heart rate characteristics
HSS	Hematologic scoring system
IAP	Intrapartum antibiotic prophylaxis
IL	Interleukin
IV	Intravenous
LOS	Late onset sepsis
MSNS	Modified sick neonatal scoring
NBRS	Neurobiological risk score
NICHHD	National institute of child health andhuman development
NICU	Neonatal intensive care unit
NMPI	Neonatal mortality prognosis index
NMR	Neonatal mortality rate
NOSEP	Nosocomial sepsis
NPV	Negative predictive value
NS	Neonatal sepsis
NTISS	National therapeutic intervention scoringsystem

NTISS	Neonatal therapeutic intervention scoring system
PCR	Polymerase chain reaction
PCT	Procalcitonin
PPV	Positive predictive value
ROC	Receiver operating characteristic
SDs	Standard deviations
SIRS	Systemic inflammatory response syndrome
SNAP	Score for neonatal acute physiology
SNAPPE	Score for Neonatal Acute Physiology Perinatal Extension
SNCU	Sick newborn care unit
SNCUs	Special newborn care units
TNFα	Tumour necrosis factor alpha
VLBW	Very low birth weight

Abstract

Introduction: Early-onset sepsis (EOS) in newborns can be prevented and treated with prompt antibiotic administration and early diagnosis. Due to vague clinical findings and inadequate facilities, this approach is still difficult. Use of antibiotics improperly is linked to ineffective treatment and undesirable results. Hence, this study aimed for early identification of sepsis using Nosocomial sepsis (NOSEP) and modified sick neonatal scoring (MSNS) among newborns referred at RLJ institution, Kolar who were placed in the paediatric, surgical and neuroscience critical care setting.

Material and method: Observational cross- sectional study design. Neonatal patients placed in the three participating newborn critical care settings during the initial three days after birth made up our study population. Neonates were diagnosed with EOS if they displayed triad or additional indications of illness and had tests outcome that indicated blood poisoning and were given antimicrobial medications for five straight days. Blood or cerebrospinal fluid cultures that are positive for EOS were considered culture-proven. The kind and length of antibiotics taken were also recorded.

Results: 173 subjects for final analysis. Male participants outnumbered than females (M/F- 84.97%/ 15.03%). The mean MSNS score was 12.79 ± 3.01 in the study population. The blood culture was negative in majority (76.88%) and in 23.14% it was positive. There was significant variations in the neutrophils, low birth weight, gestational age less than 37 weeks fever, thrompocytopenia and TPN and blood culture (P value <0.001). The mean MSNS score with in Positive blood culture was 8.73 ± 1.93 and it was 14.01 ± 2.05 in Negative blood culture. The mean difference MSNS score in Blood culture was numerically relevant with a probability of test results less than 0.001. The average NOSEP score value with in Positive blood culture was 17.73

± 6.69 and it was 6.34 ± 2.32 in Negative blood culture. The mean difference NOSEP mean value in Blood culture was numerically relevant with a probability of test results less than 0.001. Also, available of a very good predictive validity for MSNS score in predicting blood culture (AUC 0.977) and the association was numerically relevant with a probability of test results less than 0.001. NOSEP lower scores noticed an associated with positivity of blood cultures. The MSNS score had sensitivity of 95.00%, Specificity was 84.21% in predicting Positive blood culture. The probability of true disease was 64.41%, the probability of not the true disease was 98.25% and overall detection rate was 86.71%. There was very good predictive validity for NOSEP score in predicting blood culture (AUC 0.949) and the association was numerically relevant with a probability of test results less than 0.001.The NOSEP score had responsiveness of 81.08% Specificity was 80.85%in predicting Positive blood culture. the probability of not a true disease was 84.44%, and the overall detection rate was 80.95%.

Conclusions: Both NOSEP and MSNS scoring systems good predictivity for positive blood culture in neonates.

INTRODUCTION

INTRODUCTION

A major feature of newborn sepsis is nosocomial sepsis; nonetheless, despite recent breakthroughs in antibiotic treatment, neonatal sepsis remains a significant concern with a severe death and morbidity rate. The prevalence of neonatal sepsis is estimated to be 1-8 per 1,000 live births. In preterm newborns weighing 1500 g, the occurrence has risen to 40-250/1,000. Antenatal aspects such as the flora of both the delivery room and the newborn critical management setting, the ambience of the delivery room, the quality and number of healthcare staff, infection control techniques in the newborn critical management setting, and antibiotics used are key considerations of an occurrence.[1]

Healthcare associated infections is described by applying an order of occurrence, if it occurs throughout the first week of life it is called rapid manifestation of symptoms and if it is occurring after 4 days of a new born it is called late emergence of symptoms. As a result, late-onset maternally acquired sepsis may be included, but early-onset nosocomial sepsis may be excluded. (< 3–7 days of life).

By means of these parameters Healthcare-associated infections (nosocomial sepsis rate was 2.1% in a total of 30,993 hospitalizations to the newborn units of the selected institutions, with an occurrence rate of 0.89 per 1000 patient days. Blood poisoning threat was considerably higher in very low birth weight (VLBW) neonates. Gram-positive organisms were mostly found, mainly Staphylococcus epidermidis.[2]

NOSEP have triad blood markers, a sign, and a threat were identified. Capillary refill time of 14 mg/l; a proportion of white blood cell- neutrophil of >50%; low levels of platelets of 150.000/mm3; fever of >38.2°C; 2 weeks access to parenteral feeding alternatives.[3]

According to univariate analysis, low birth weight, multiple pregnancies, and longer duration of hospitalization were notable risk factors for healthcare associated infections (nosocomial sepsis).[4]

Nosocomial infection is found if the beginning of illness is more than 48 hours after birth

a) Culturing the pure body plasma (blood, cerebral body fluid, urine) reveals a microbial agent.
b) A growth on obtained sputum specimen demonstrating the development of a recognized microbial agent in a newborn on respiratory ventilation with breathing depression and imaging infection inflamed lung air sac;
c) Medical evaluation confirming growth of bacteria at an infection site.[5]

If a neonate showed signs indicative of septicemia that appeared two days after delivery but disinclined multiplication of microbes of body plasma or transtracheal aspiration, they were diagnosed with hospital-acquired infection. Complete white blood cell count (abnormal- 5000/cumm or >20,000/cumm), immature/total polymorphonuclear leucocyte (abnormal- >0.2), micro- erythrocyte sedimentation rate (abnormal >10 mm 1st h), and blood inflammatory marker (CRP) were used to test all newborns suspected of having sepsis. If at least two tests were positive, the sepsis screen was declared positive. CSF examinations were performed in all probable instances of sepsis to find inflammation of the meninges.[6]

Neonatal sepsis are uncommon in wealthy nations (2-4 per 1000 live births), although it is more likely in preterm babies and babies whose mothers have illnesses or have had a protracted rupture of the foetal membranes. Infections caused by organisms received from the mother at delivery have declined during the last two decades, but there has been a rise in nosocomial infections. Because of prematurity or a congenital abnormality, the majority of newborns with sepsis have

spent weeks or months in neonatal critical care units. Antimicrobial treatment is often initiated prior before microbial identification and is based on understanding of the potential microorganisms in the specific medical problem.[7]

The amount of antimicrobial drugs that can be administered effectively in neonates is limited, and dosage intake must be modified according to weight at birth and postmenstrual age. The choice to use antimicrobials is based on the history, physical examination, and laboratory findings. Regardless of these circumstances, the consequences of antimicrobial usage on the flora of the care unit are also evaluated. Bacterial resistance in the normal human life has emerged as a serious issue due to the uncontrolled use of broad-spectrum drugs.[8]

NEED OF THE STUDY

The study's purpose is to evaluate the advance detection of signs and symptoms hospital-acquired sepsis in neonates, prediction of sepsis using NOSEP score, using antibiotic drugs, as well as the advancement of preventative strategies like as maternity vaccinations, to reduce the incidence of neonatal sepsis.

AIMS & OBJECTIVES

AIMS AND OBJECTIVES:

OBJECTIVES

1. To apply Nosocomial sepsis (NOSEP) scoring on babies with suspicion of sepsis.
2. To apply Modified sick neonatal scoring (MSNS) scoring on babies with suspicion of sepsis.
3. To evaluate sepsis using Nosocomial sepsis (NOSEP) and modified sick neonatal scoring (MSNS) Scoring.

REVIEW OF LITERATURE

REVIEW OF LITERATURE:

NEWBORN SEPTICEMIA

Newborn septicaemia is characterised as blood poisoning in infants born younger than 28 days old. It is still a substantial source of illness and death among newborns, particularly in low and middle-down nations. [9] There are duo kinds of Newborn septicaemia based on when it appears after parturition: early-stage sepsis and delayed sepsis. Early stage of sepsis is explained as the prevalence of blood poisoning in newborns in the initial three days of birth, whereas delayed septicaemia is described as blood poisoning progressing after three days of birth. [10].

ETIOLOGY

The spread of infections from the female urogenital tract to the unborn offspring is induced by early stage of septicaemia. These microbial agents spread the amniotic fluid after ascending the vagina, cervix, and uterus. Neonatal infections can also occur in pregnancy or during birth when the newborn exits the vaginal tract. Group B streptococcus (GBS), Escherichia coli, coagulase-negative Staphylococcus, Haemophilus influenzae, and Listeria monocytogenes the most prevalent microbial agents that cause early stage of septicaemia. Following are the significant threat of newborn septicaemia which include intra-amniotic infection, group B streptococcal infection, delivery before 37 weeks, and prolonged membrane rupture lasting more than 18 hours.[11]

Delayed sepsis is caused from pathogens transmitted from surrounding following parturition, surroundings such as contact from health staff or nurses, for example. A portion of delayed sepsis may also be due to a late onset of a vertically transferred illness. Babies who necessitate intravenous catheter placement or other surgical interventions that damage the mucosa are more likely to contract delayed sepsis.

Pre-term newborns are more susceptible to sepsis than term newborns. Premature newborns have a higher vulnerability to infections, which is mostly attributable to:

- Impaired biological system as a result of reduced immunoglobulin G and ineffective phagocytosis process and complement activation
- Innate immune system comes in the form by the immature epithelial barrier triggers
- Because of the accompanying severe diseases, there is a greater requirement for implants such as vascular access, endotracheal tubes, feeding tubes, and urinary tract catheters.
- Coagulase-negative staphylococcal bacteria, particularly Staphylococcus epidermis, are the chief factor, accounting for more than 50% of delayed sepsis incidence in developed nations. Many additional bacterial and viral infections, however, are linked to delayed sepsis.[12]

EPIDEMOLOGY

The occurrence of newborn sepsis has evolved throughout years[13]. Ever since 1990s, the occurrence of blood poisoning (sepsis) has reduced due to the implementation of diagnostic testing for group B streptococcus (GBS) in pregnant women and antimicrobial treatment provided during the act of birth.[14]

However, frequency of delayed sepsis have been constant. E.coli has become responsible for a greater proportion of early stage of sepsis incidence.[15] The occurrence of early stage of sepsis with definite blood tests in the United States is said to be 0.77 to 1 per 1,000 live newborns.[16]

Because of the non-specific newborn appearance of sepsis and the significant risk of death and morbidity in the absence of treatment, several symptomless infants are evaluated for sepsis if

predictor variables are evident or objectively suggested. While 7% to 13% of all newborns are evaluated for sepsis, only 3% to 8% have definite results.[11]

The declining trend of definite blood tests is explained by the use of antimicrobials to mothers and the minimal amount of blood acquired for growth of colonies in serum blood. Sepsis is more common in preterm newborns and those born with a birth weight of less than 1 kg. African American newborns are at a greater risk of group B streptococcus (GBS) and LOS, which is probably due to higher GBS carrier rates in African American mothers. Men are more likely to develop sepsis and meningitis, particularly when gram-negative enteric bacilli are present.[11]

PATHOPHYSIOLOGY

The underdeveloped biological system is a major determinant in increasing newborn sensitivity to sepsis. Because of their immature role, polymorphonuclear white blood cells are unable to undertake a complete inflammatory process in newborns .Consequently, newborns have a restricted quantity of antibodies at birth and are unable to build an appropriate quantitative and/or qualitative defence against pathogenic pathogens. The time limitation that preterm babies have in the uterus, limits the transfer of antibodies. As contrasted to mature newborns, due to insufficient antibodies, premature newborns are at a heightened threat of septicaemia.[17]

DIAGNOSIS

Neonates with bacteraemia are mostly symptomless and has a normal medical assessment, laboratory testing is vital in the evaluation. Blood culture should be performed quickly in newborns with suspected sepsis since low-level bacteraemia may not be identified with smaller portion, thus at least 1 ml of blood should be drawn.[18] Samples should be taken from the catheter location as

well, if any present. Urine samples are not indicated for early stage of sepsis analysis however they should be investigated for delayed sepsis examination.[19]

If a newborn has a definite blood tests and the presence of symptoms and signs implies participation of central nervous system, a lumbar puncture with cerebrospinal fluid examination and culture should be performed. To establish the sterility of the cerebrospinal fluid, a lumbar puncture must be done before 2 days following treatment. Polymerase chain reaction (PCR) technique is now being researched as a screening technique for identifying sepsis and the responsible pathogen quicker than blood specimens.[20]

The cerebrospinal fluid examination might indicate:

- Definite colonies
- Reduced sugar level
- Definite polymer chain reaction
- Elevated protein level
- Elevated WBC

Full blood count and annular pentameric protein in blood plasma are significant laboratory investigations that are frequently obtained in series. These investigators are poor at identifying infant sepsis however can assist eliminate illness.[20] Low concentration of neutrophils is considered an indicator of newborn sepsis because it has a higher precision than higher number of neutrophils.[6] A high immature to total neutrophil (I/T) ratio of more than 0.27 has a maximum probability of not a true disease (99%) but a minimum probability of true disease (25%) because it is detected in up to 50% of unaffected infants.[21] The numbers might incorrectly raise, particularly after delivery. To prevent the typical physiological complete blood count alteration noticed shortly following delivery, test complete blood count 6 to 12 hours later.[22]

C-reactive protein levels in newborns begin to rise after 6 to 8 hours of an infectious event and reach their highest point in 1 day. CRP values that are consistently normal give a solid case for microbial septicaemia. A solid case was utilised to back up the observation and treatment decision to discontinue antimicrobial in a healthy baby. Other inflammatory indicators, such as procalcitonin, haptoglobin, and cytokines, can be collected to help confirm the detection or assess therapy success. In a newborn with respiratory symptoms or indications, lung imaging may be done to search for any pulmonary abnormalities.[23]

VARIANCE DIAGNOSIS

Considering the vague symptoms of newborn sepsis, various variance, among which but not restricted to:

- Illness caused by further pathogens (virus, fungal or parasite)
- Inborn cardiac defect
- Newbron' rapid or shallow breathing
- Aspiration earliest stool of infant
- Low sugar level
- Neonatal encephalopathy
- Metabolic disease
- Pre - term birth and its sequelae (respiratory distress syndrome, intraventricular haemorrhage, prematurity apnea, and others)
- Underactive and overactive thyroid.[12]

CRITERIA FOR DIAGNOSIS OF NEONATAL SEPSIS

Sepsis (blood poisoning) was described as a "systemic inflammatory response syndrome (SIRS) as a consequence of suspicion or confirmed infection" by the International Pediatric Sepsis Consensus Conference in 2005.[24] A systemic inflammatory response syndrome SIRS is evident when at least two of the following four conditions are met, one of which is an abnormal temperature or white blood cell count:

- Body temperature of > 38.5°C or < 36°C.
- Irregular heart beat or slow heart rate for children younger than 1 year old.
- A mean breathing rate that is more than two standard deviations (SDs) exceeding normal age, or mechanical ventilation for an immediate phase that is not connected to preexisting neuromuscular illness or the necessity for general anaesthesia.
- High white blood cell count or low for age (not related to chemotherapy-induced leukopenia), or more than 10% immature neutrophils.

The detection parameter given above were created to enhance the detection of paediatric sepsis, from infants through teenagers up to 18 years of age; however, their analytical significance in neonatal sepsis has not been determined.

Various criteria for diagnosis have been proposed. A team of European experts proposed a list of seven clinical and six laboratory tests to define delayed neonatal sepsis in 2010. Lutsar et al.[25] shown in a prospective research that the predictive value of these criteria for recognising instances of culture-proven late-onset newborn sepsis was 61%, which is nearly similar to flipping a coin. Only 40% of afflicted infants had classic sepsis symptoms such as decreased peripheral perfusion,

increased oxygen need, and discolored skin. As a result, a more accurate set of diagnostic criteria for neonatal sepsis should be devised and confirmed, which should comprise not only clinical data but also laboratory measures such as procalcitonin or interleukin (IL)-6 levels in cord blood, or both. [26]

PROGNOSIS

Premature birth newborns have a greater death rate than term neonates because deaths are negatively correlated to measure of pregnancy. Escherichia coli was discovered to have a greater fatality pace than group B staphylococcal. As previously stated, the use of GBS intrapartum antibiotic prophylaxis reduces GBS fatality rates. Negative culture therapy of clinically suspected newborns has also considerably reduced fatality rates. Premature newborns with sepsis may have delayed neurodevelopment. Some may also have eyesight problems. Preventative aminoglycosides may cause ototoxicity and nephrotoxicity in babies. [27]

RISK FACTOR

Neonatal sepsis resumes being a major cause of the rate of disease and is fatal in newborns. Babies born early and late therapy cause negative results. Low birth weight infants are more apparantely to have chronic respiratory infections, and extremely low birth weight (ELBW) newborns are liable to acquire neuro-developmental hazards such as auditory and sight deficiencies, movement disorder, and poor initiation of conscious movement and intellectual growth. On the contrary side, inappropriate antibiotic usage can raise the likelihood of severe candidiasis and multi-drug resistance pathogens.[28]

HISTORY

The clinical signs of newborn sepsis might vary from clinical manifestations to hemodynamic failure. Early signs may include agitation, exhaustion, and poor eating. Some may immediately develop fever, breathing difficulties, fever, chills, or low blood pressure, as well as poor circulation and stress. Quite often the detection is assumed based on test data that suggest high blood sugar, low blood sugar, excess acid in the body fluids-metabolic acidosis, or jaundice and for early detection, a large degree of evidence is needed. As a result, clinicians should be conscious of every circumstance which might raise a newborn's chance of having septicemia.

Babies born early to the due date and a lees weight at birth are other key threats to contemplate. Group B staphylococcal rank, the emergence of intra-amniotic infection, baby immaturity, and long-standing puncture of membranes are all connected with materiality and put newborns at risk of early stage of sepsis. Assess if the subject has a form of venous access or catheter for air delivery, is on intravenous nourishment, or is receiving antacids or histamine-2 blocking medication for delayed infection. [11]

MANGEMENT

Regardless of the absence of confirmed test results, medical antibiotic therapy must start as quickly as septicaemia is medically diagnosed. Antimicrobial resistance features of prevalent microorganisms in the neonatal critical care unit should, in general, inform antibiotic selection. To protect against the most frequent infections in early stage of sepsis, standard therapeutic approaches include intravenous (IV) ampicillin and aminoglycosides.[18]

During late-onset sepsis, nosocomial prophylaxis for nosocomial sepsis include coagulase negative Staphylococcus, S. aureus, and Pseudomonas species should be administered. For these

subjects, a combination of glycopeptide antibiotic and a gram-negative antibacterial drug is indicated.[29] Because aminoglycosides invade poorly into the CNS, broad spectrum of antibiotics must be used if there is a central nervous system suspicion of illness.[30]

Ceftriaxone should be taken since it can induce jaundice and significant calcium ceftriaxone crystal precipitation. Antibiotic resistance is another issue to be concerned about in neonatal sepsis. Antibiotic stewardship teams serve a significant responsibility to minimize unnecessary antibiotic usage.[31]

BIOMARKERS OF SEPSIS

In newborn populations, sepsis is a major reason for rate of disease and death. There has been a continual hunt for an ideal sepsis screening tool with high precision, responsiveness, probability of not a true disease and probability of true disease so that neonatal sepsis can be diagnosed and excluded at an early stage, and suitable antimicrobials administered to the newborns. An exemplary septicaemia indicator guide in determining whether or not to begin antimicrobial medications in cases of suspected septicaemia and the complete length of antimicrobial mdications in cases of proved septicaemia.

A number of blood poisoning markers have been evaluated for the rapid recognition of newborn septicaemia, although there isn't specific optimal indicators that meet every important requirement to qualify as a suitable screening tool. C-reactive protein (CRP) and procalcitonin (PCT) represent the most often employed parameters, but its precision, responsiveness, PPV, and NPV have varied in various researches.[32]

C-reactive protein

C-reactive protein, an acute phase reactant generated in a major organ in the vertebrates-liver, and is a commonly used investigator for the identification of newborns septicaemia.[33] The half-life of this indicator is 1 to 2 days.

CRP is an inaccurate sign since it takes 10 to 12 hours after an infection to react in the early stages of an initial illness.[34] Sequential C-reactive proteins values, along with total white blood count and immature/total neutrophils proportion, have commonly been used as an absence of septicaemia 24 to 48 hours following the onset indications.[35]

When used in this fashion, C-reactive protein may be used as an effective delayed indicator for septicaemia with fluctuating trends or ongoing reduced concentrations that can be used to monitor performance or help doctors in options about appropriate antibiotic length. C-reactive protein has more precision and responsiveness as a detection measure of delayed sepsis in newborns than white blood count and proportion of immature/total neutrophils.

Non-communicable newborns situations such as neonatal respiratory discomfort in a baby caused by meconium-stained amniotic fluid, rapid physiological adaptability that can be slowed by consequences, red blood cell rupture, and tendon, ligament, and muscle injuries developing throughout the body, or surgical intervention could also start raising guideline values of C-reactive protein, attempting to make it a non-specific biomarker and an inadequate measure to diagnose infective threat during the initial phases of a presumed newborns illness. [36]

Procalcitonin

Procalcitonin is a calcitonin peptide prohormone and an acute phase reactant that is unrelated to calcitonin levels and is connected with immune-modulation and vascular response in systemic

inflammatory response syndrome. It is generated by monocytes and hepatocytes, and its levels rise early in the acute stage of sepsis, within 2 to 4 hours of contact to a bacterial infection. With a half-life of 24 to 30 hours, levels peak at 6 to 8 hours and untouchability for the following day.[37]

The gestational age at birth had no effect on PCT reactions or levels. However, the standard frequency changes consistently over the first 2 days following delivery. Detect antibiotics as well as total PCT, which includes PCT-1 and the predominant plasma version PCT-3.[38]

The differentiating reactions of the PCT forms throughout formation and with gestational age maturation may increase precision in the detection of early sepsis. When comparable to the usage of CRP, the reaction kinetics of early onset PCT make it an intriguing predictive indicator for early identification of newborn sepsis.[39]

PCT has a responsiveness of 92%, a precison of 97%, probability of true disease of 94%, and probability of not a true disease of 96% in early-onset infection. PCT responds faster to early infection than plasma C-reactive protein concentrations, rendering highly effective for clinicians in neonatal screening workups. PCT serum concentrations continue high in contrast to other indicators such as tumour necrosis factor alpha (TNF) and interleukin (IL)-6, rendering it even more effective in determining intensity of illness and clinical course.[40]

However, the non-specific rises in healthy newborns over the first 2 days of life restrict PCT accuracy as a sole indicator of newborn illness. Furthermore, it can be incorrectly raised in non-infectious situations such cerebral haemorrhage, birth asphyxia, and diseases linked with low blood oxygen in newborns.[41]

When combined with CRP, a positive PCT level raised the detection of microbial agents from 39% to 92%, but a negative CRP level (40 mg/L) offered clinical relevance due to its probability of not

a true disease, offering an approach to direct antimicrobial medications or forecast detected illness progression. More research on species diversity is required to improve the use of PCT in the detection and development of newborn septicaemia.[42]

NEONATAL DISEASE SEVERITY SCORING SYSTEM

In 2003, Singh et al. discovered the first grading criteria established only on clinical characteristics.[43] Kudawla et al. did the first verification of this score in 2008. (the same team).[44] The researchers also attempted to evaluate whether repeating the exam at distinct intervals provides an advantage. The diagnostic grade was obtained at 0 and 24 hours after the sickness began. In Rosenberg et al2010further .'s validation, the indications of drawing intercostal back in and pre-feed aspirates were substituted with breathing difficulties and feeding intolerance, accordingly.[45] The group also attempted to generate a fresh grade. The group also attempted to generate a fresh score. The primary focus of the study was on low-resource settings, and it resulted in the development of the initial diagnostic grade for hospital-acquired infection at the bedside in premature infants. As a result, Singh et al rating .'s method was prospectively verified, potentially boosting its diagnostic usefulness. Dalgic et al. reported a comparative research comparing the Nosocomial Sepsis Predictive Score (NOSEP) (clinical, laboratory, and risk variables) with a clinical score created by their pediatric critical management setting in 2005, a few years following the first study was reported.[3]

Rodwell et al. discovered the first hematopoietic grading classification in 1988 for newborn sepsis using just laboratory factors (both EOS and LOS).[46] The hematopoietic grading classification was then prospectively inspected in 2011 by Narasimha and Harendra, and again in 2013 by Makkar

et al.[47,48] When laboratory results were employed, Rodwell et alcorewas .'s shown to have good responsiveness but low precision in the diagnosis of delayed sepsis.[49]

U. Töllner created the first prediction score for the early detection of infant septicemia in 1982.[50] The study was divided into three stages: symptoms before (when the patient's clinical and haematological values showed no changes), symptoms during (when the first signs of septicemia or haematological changes appeared), and symptoms during (when all clinical symptoms of septicemia/septic shock were present). The score was also studied in a prospective cohort of infants who were both septic and healthy, as well as those who had other clinical problems. Because it was the most complete in terms of variable inclusion at the time, this score served as the foundation for the production of further scores.

Griffin et al. examined the Heart Rate Characteristics (HRC) among several well-known investigational tests data in 2007.[51] hey also created a soundtrack using elements linked to newborn septicaemia. The researchers recorded the indications and symptoms before, during, and after the BC. Aside from clinical data, the estimated HRC index was found to be useful in predicting delayed sepsis. Finally, in 2020, Husada et al. published the first prediction model for bacterial delayed sepsis. It has a high responsiveness and precision and contained a lot of factors.[52]

RATINGS UTILISED IN ASSESSING FATALITY

For the objective of assessing neonatal fatalities, a range of threat prediction ratings has been created and promoted.

CLINICAL RISK INDEX FOR BABIES (CRIB)

The Clinical risk index for newborns score was created to estimate fatality for children delivered at fewer than 32 weeks gestation and was produced from data from four tertiary neonatal centres in the United Kingdom from 1988 to 1990. The derivation cohort included 812 very low birthweight (VLBW) babies, with 25% of them dying. The six characteristics most predictive of death are identified using logistic regression. The final score is determined by a weighted average of these six elements. In the original study, the score had significantly superior detection accuracy than low birthweight merely.[53]

Other experiments utilising CRIB generated similar figures for the area under the ROC curve. The key benefit of CRIB is its ease of data collection; computation takes 5 minutes per newborn, compared to 20-30 minutes for some of the pregnancies assessment scales, such as Score for Neonatal Acute Physiology, Score for Neonatal Acute Physiology-Perinatal Extension and Neonatal Therapeutic Intervention Scoring System. Another benefit is that the clinical risk index for babies is evaluated during the initial half day of birth, lessening the sensitive to therapeutic response than those of other ratings.[54]

CLINICAL INDEX RISK FOR BABIES II

Clinical risk index for babies II is an advance of clinical risk index for babies, which was just released. It predicts mortality using a republished array that forecasts mortality based on a measure of pregnancy and weight at birth, as well as entrance temperature and base abundance. The revised rating was created to improve predictions for minute sets of data, extremely preterm newborns while also excluding elements that may be impacted by the infant's care. The propriety of

incorporating admission temperature is still being debated, given it is certainly impacted by various elements of treatment. CRIB II is still being validated.[55]

SCORE FOR NEONATAL ACUTE PHYSIOLOGY (SNAP)

The score for Neonatal Acute Physiology, a primary alternative to the clinical risk index for babies, was proved in 1990 integrating data from three Boston units, Massachusetts.[56] There were 1643 newborns in the derivation cohort, with 154 weighing <1500 g at birth. This score is relevant to any newborn placed in the paediatric critical management setting, although its sensitivity to distinctions between the most preterm children has been lowered due to a few VLBW newborns in the cohort from which it was generated. According to 28 items, score for Neonatal Acute Physiology obtained from various sources within the first 24 hours of birth, such as every bodily fluids and chosen blood test results. Unlike the the clinical risk index for babies score, which weights factors based on their data relationship to mortality, the factors were followed based on expert judgement, with a score of 0, 1, 3, or 5 awarded to each variable. The original cohort was also used to create the score for newborn acute physiology postnatal extension by combining weight at birth, small for gestational age (weight, 5th centile for gestation), and low grade at 5 minutes of newborn health.[56]

Whereas the Score for Neonatal Acute Physiology assesses numerous body processes and may reliably predict mortality, it is far more difficult to get than the clinical risk index for babies. The score for Neonatal Acute Physiology predicted fatality superior to weight at birth alone in Richardson's study, whereas the score for newborn acute physiology postnatal extension predicted death substantially higher.

SCORE FOR NEONATAL ACUTE PHYSIOLOGY-II AND SCORE FOR NEONATAL ACUTE PHYSIOLOGY WITH PERINATAL EXTENSION-II

Due to the difficulties in collecting data for the Score for Neonatal Acute Physiology and Score for Neonatal Acute Physiology with Perinatal extension-II, the true writers have lately created simpler versions based on North American unit data. The cohorts for induction and accuracy cannot be overstated. The data collecting duration has been reduced to 12 hours, and the factors were limited to six: average blood pressure, minimum temperature, partial oxygen/FIO2 ratio, blood pH, recurrent convulsions, and fluid balance. These were thought to have the closest statistical correlation with death. The score for Neonatal Acute Physiology with Perinatal extension-II, like the original Score for Neonatal Acute Physiology, was extended to produce Score for Neonatal Acute Physiology with Perinatal extension-II by using perinatal extension factors. Since they were produced from exceptionally large cohorts of all birth weights in the second half of the 1990s, Score for Neonatal Acute Physiology -II and Score for Neonatal Acute Physiology with Perinatal extension-II are expected to be as straightforward to obtain as the clinical risk index for babies. Richardson displayed excellent discriminating and measurement powers. for Score for Neonatal Acute Physiology with Perinatal extension-II in estimating death (Hosmer-Lemeshow 0.90).[57]

NATIONAL THERAPEUTIC INTERVENTION SCORING SYSTEM (NTISS)

The National Therapeutic Intervention Scoring System was developed by a review committee in 1992 as a revision of the therapeutic intervention scoring system. The National Therapeutic Intervention Scoring System is unique in that it is dependent on an infant's therapies instead of pathophysiological considerations. Because medication varies widely depending on the policy and practice in units, it is impossible to contrast data utilizing these form of change.[58]

NATIONAL INSTITUTE OF CHILD HEALTH ANDHUMAN DEVELOPMENT (NICHHD)

The National Institute of Child Health and Human Development score was developed by collecting data from 1823 children born between 1987 and 1989 weighing 501 to 1500 g who were admitted to 7 newborn facilities in the United States. Logistic regression was employed to identify the parameters, and additional 1780 babies were utilised for confirmation. It has yet to be widely utilised since its creation.[58]

BERLIN SCORE

From 1988 to 1991, this German score was generated by utilising logistic regression techniques on 396 very low weight at birth developing newborns and 176 very low weight at birth recognition newborns. It is hampered by the presence of several subjective criteria. The incorporation of these attribute values restricts its utility as a tool for objectively comparing units.[59]

NEONATAL MORTALITY PROGNOSIS INDEX (NMPI)

This score was created by applying logistic regression to identify predictive indicators gathered from 336 Mexican newborns up to 12 hours after arrival in 1993. An additional cohort of 300 newborns was used to confirm the model's accuracy. It is not extensively utilised.[60]

SCORES USED IN PREDICTING NEURODISABILITY

There are triads of risk-adjusted scores were evaluated for their potential usage in forecasting subsequent neuro-disability following neonatal intensive care. With the advancements in longevity, there is a surge of interest on persistent results following newborns treatment. Techniques for neuro-disability risk reduction will be a major leap publications.

MODIFIED SICK NEONATAL SCORING SYSTEM

A innovative neonatal illness severity rating method for restricted situations is the modified sick neonatal scoring system.[61]

In neonatal critical care units, illness severity score systems are widely utilised. They are used to compare the outcomes of various units in a standardised manner since the mortality recorded may be modified for the degree of sickness in hospitalized newborns and provide parents of specific newborns being handled in the facilities with prognostic information. They also allow for the detection of patterns in results across duration. [62]

Several scoring systems have been investigated, including the clinical risk index for babies, clinical risk index for babies-II, Score for Neonatal Acute Physiology, Score for Neonatal Acute Physiology Perinatal Extension, Score for Neonatal Acute Physiology-II, Score for Neonatal Acute Physiology Perinatal Extension-II, Neurobiological Risk Score, Neonatal Mortality Prognosis Index, and Neonatal Therapeutic Intervention Scoring System. The clinical risk index for babies score was created specifically to be applied to premature babies and has the benefit of being straightforward to calculate. The clinical risk index for infants II score replaces the earlier result. The score for Neonatal Acute Physiology is a 28-item checklist that is relevant to every newborn, born prematurely or at the due date, admitted to the neonatal critical management setting. Its Score for Neonatal Acute Physiology Perinatal Extension, which includes weight at birth, small for gestational age, and Appearance Pulse Grimace (reflex) Activity Respiration at 5 minutes. The Score for Neonatal Acute Physiology-II is a reduced version with only six variables, making it simple. The National Therapeutic Intervention Scoring System is reliant upon infant's prescription, which may differ depending on the unit protocol, and thus is unable to compare units. [63] . Numerous evaluations include factors that necessitate research, such as potential of hydrogen, the

Horowitz index, and base overload. Such statistics are challenging to attain in resource-constrained environments.

The newborn death rate in urban India is 15 per 1000 live births, whereas it is 31 in rural India.[64] There is a big distinction between the two. The government-created Special Newborn management settings (SNCUs) in district and subdistrict hospitals serve rural communities and play a key role in decreasing newborn mortality rates. There are disparities in the enrollment characteristics and results of SNCUs between provinces.

An appropriate illness severity grading system is required to compare the performance of Special Newborn management settings as well as to encourage the transfer of individual newborns before time with more serious diseases to better-replaced centres. As a result, the purpose of this study was to assess the Modified Sick Neonatal Measure (MSNS), a unique newborn illness intensity grade created for restricted circumstances.[61]

Table 1: Modified Sick Neonatal Measure criteria with a score for each factor

Indicators	Score 0	Score 1	Score 2
Breathing activity	Apnea or grunt	Rapid or shallow breathing (respiratory rate >60/min) with or without retractions	Normal (respiratory rate 40–60/min)
Pulse	Slow heart rate or asystole	Irregular/fast heart rate (>160/min)	Normal (100–160/min)
Axillary temperature (°C)	<36	36–36.5	36.5–37.5
Capillary refilling time (s)	>5	3–5	<3
Random blood glucose (mg/dl)	<40	40–60	>60
Oxygen saturation- SpO_2 (in room air)	<85	85–92	>92
Measure of pregnancy (in weeks)	<32 weeks	32 to 36 weeks + 6/7 days	37 weeks and above
Weight at birth (kg)	<1.5	1.5–2.49	2.5 or above
Total	Highest 16		

ADVANTAGE

- MSNS is easy to use in the present studies
- MSNS has good responsiveness and precision
- MSNS it could be employed early in the course of hospitalisation, and
- MSNS might be utilised in both premature and term newborns.
- MSNS is a superior newborn illness severity score for SNCUs due to resource accessibility.[65]

DISADVANTAGE

- One disadvantage of MSNS scoring is that risks such as maternal blood sugar level, high blood pressure, stages of labour and delivery, prenatal care adequacy, intr-amniotic infection, and steroid treatment in the prenatal period are not taken into account.
- The existence of these risk variables may also be linked to a low MSNS score.
- The assessment was just performed during a admission, and sequential assessment might well have supplied more information.
- Factors such as nosocomial infections may have contributed to an increase in mortality among babies with higher MSNS scores at admission. These factors might have influenced the score's predictive capacity.[65]
-

NOSOCOMIAL SEPSIS SCORING SYSTEM

C-reactive protein, 14 mg/l, neutrtrophil fraction >50%, thrombocytopenia 150/mm3, temperature >38.2°C, and exposure to parenteral feeding solutions for 14 days are the triads of blood parameters, one diagnostic indication, and a threat in the nosocomial sepsis scoring system. The table below compares the accuracy of the NOSEP scoring system with a clinical scoring system created by the NICU to assess the most distinguishing clinical manifestation, and laboratory results for hospital-acquired infection.[3]

Table 2: Nosocomial Sepsis Scoring System and Clinical Scoring System Factors

NOSEP scoring system	Score	Clinical scoring system	Score
CRP (>10 mg/l)	5	Breathing symptom	2
Neutrophils (>50%)	3	Swelling of abdomen- with increase pressure	2
Thrombocytopenia (<150 000/l)	5	Inability to achieve full feeding	2
TPN Duration (≥14 days)	6	Low blood pressure	2
Pyrexia (>38.2°C)	5	Slow heart rate	2
		Minimum and maximum body temperature variation	2

Recent studies

Salsabila, K et al[66] When 2,509 newborns were assessed, 242 (9.6%) were suspected to have EOS, and 83 (5.0% of neonatal admissions in hospitals having culture facilities) had sepsis that was confirmed by culture. Gram-negative bacteria constituted the vast majority of pathogenic organisms (85/94; 90.4%). Ampicillin/amoxicillin and amikacin were the most commonly administered antibiotics in hospitals with culture facilities, whereas third-generation cephalosporins were the most commonly prescribed antibiotics in hospitals without culture facilities. The median periods of antibiotic therapy in the culture-proven and culture-negative EOS groups were 19 and 9 days, correspondingly.

Padar, C et al[67] A cross-sectional research including 248 newborns was conducted to assess the reliability of the MSNS score. The mean score at admission in the expired group was 7.94 (SD = 1.89) and 14.46 (SD = 1.84) in the discharged group. The p-value for each of these was 0.001. The area under the receiver operating characteristic (ROC) curve was 0.98 when MSNS was used as the test variable. A cut-off score of 10 was shown to have a responsiveness of 88.24%, precision of 95.2%, probability of true disease of 57.69%, and probability of not a true disease of 99%. When the first modified sick newborn score was associated with the duration of hospitalization in released patients, a significant negative association was established using a Spearman correlation coefficient of -0.67.

In Yu, S et al[68] study, In the general ward context, the ability of commonly used early warning scores (EWS) for the early identification and prediction of sepsis was directly compared. Between early 2012 and mid-2018, common EWS and patient acuity scoring systems were generated from electronic health records (EHR) data for patients who met and did not satisfy Sepsis-3 criteria for general ward patients at a large academic medical facility. The National Early Warning Score 2 (NEWS 2), Modified Early Warning Score, and Quick Sequential Organ Failure Assessment were all the best at detecting sepsis at the index time (area under the receiver operating characteristic curve: 0.803 [95% CI: 0.795-0.811], area under the precision-recall curves: 0.130 [95% CI: 0.121-0.140]). Although NEWS 2 exceeded all others especially in contrast EWS and patient acuity scores, due to the low occurrence of sepsis (low probability of true disease without significant responsiveness sacrifices), all scoring systems were vulnerable to false positives, allowing space for further computationally advanced techniques.

Belachew, A et al [69] The study aims to identify the cumulative occurrence of neonatal septicaemia and its connection to birth weight and gestational age in neonates admitted to Ethiopian hospitals. This systematic review and meta-analysis includes the final eight studies from a total of 952 research publications reviewed. Ethiopia had a 49.98% random effect pooled prevalence of neonatal sepsis. (CI: 36.06, 63.90). In subgroup analysis, the cohort was 40.56%, but the pooled estimated neonatal sepsis across cross-sectional studies was 53.15%. Newborns weighing less than 2.5 kg were 1.42 times more likely to acquire septicaemia than healthy newborns. When contrasted to term babies, preterm neonates had a 3.36 odds ratio of developing newborn septicaemia.

Khan, F et al[70] The purpose of this study was to evaluate the reliability of C-reactive protein (CRP) as a screening measure newborn septicaemia, as well as to compare the screening reliability of EONS and LON (LONS). 385 newborns with neonatal sepsis-related clinical characteristics were sampled using the sequential sampling approach, ranging in age from 0 to 28 days. CRP as a screening measure for newborn septicaemia has low responsiveness, precision, probability of true disease, and probability of not a true disease values, according to the analysis. In compared to delayed septicaemia (responsiveness =77.45%, precision =57.14%, probability of true disease =92.94%, and probability of not a true disease =25.80), initial newborn septicaemia (responsiveness =17.16%, precision =58.33%, probability of true diseas=72.72%, and probability of not a true disease =9.81%) had low initial screening test validity for CRP (responsiveness=17.16%, precision=58.33%, probability of true disease=72.72%, and probability of not a true disease=9.81%). CRP shows in initial newborn septicaemia, screening accuracy is lower than in delayed septicaemia.

Sodani, S et al[71] The purpose of this study was to evaluate the accuracy of CRP with blood culture in the diagnosis of newborn septicemia. The study included 148 babies with neonatal sepsis over the course of six months. A blood culture and a semi-quantitative CRP analysis were done on each patient. Out of 148 newborns, 53 had positive blood cultures and 101 had high CRP levels. CRP had responsiveness, precision, probability of not a true disease and detection rate of 86.7 percent, 43.5 percent, 45.5 percent, 85%, and 69%, respectively. The precision and responsiveness of CRP against blood cultures support its use as an acute phase protein in the detection of newborn septicaemia.

A cross sectional analytical study conducted by Mansoor KP, Ravikiran and et al[72], on 585 neonates admitted to NICU in KMC Mangalore. Dieasese severity was mentioned based on Modified sick neonatal scoring (MSNS) score which included 8 parameters and inclusion criteria of preterm and 2500gms .0,1,2 for each parameter.The study conducted that any score of less than or equal to 10 , had good specificity (88%) and sencitivity (86%)and study applied to both preterm and term.It was concluded that MSNS is a noninvasive and practical indicator of when used at an earlier source of hospitalization.

A prospective observational study conducted by Ludo M Mahiew[73], A simple bedside scoring system comprising of c-reactive protein,neutrophils fraction,thrombocytopenia,fever, and extended parental nourishment was found to be effective in 104 episodes of suspected neonatal sepsis in 80 newborns. Exposure is a useful method for detecting nosocomial sepsis early on. The study found that adding central vascular catheter insertion location and hub colonisation to the score increased its prediction power.

Rathod D, et al.[74] In 303 newborns, a descriptive research was carried out. The study's goal was to examine an objective grade for evaluating the state of ill newborns upon birth and usage in predicting death. With 30.7%, 17.5%, and 15.2%, respectively, the most prevalent reasons for newborn transport were sepsis, birth asphyxia, and respiratory distress. The death rate was 20%. The average SNS for all newborns was 10, whereas those who died had an SNS of 6. SNS 8 evaluated death with responsiveness and specificity of 58.3% and 52.7%, respectively. According to the findings of the study, SNS is a good grading system for predicting the prognosis of ill newborns in resource-limited situations.

Rosenberg, R et al[45] sought to confirm and expand on the sole possible score produced by Singh et al. in 2003. They used a secondary study of daily assessments of 497 newborns 33 weeks of pregnancy measure placed in paediatric critical management settings in Dhaka, Bangladesh, to construct and internally validate our own bedside predicting score. The Singh score showed a poor probability of true disease of 78.1% but a high sensitivity of 56.6% in their sample. The area under the receiver operating characteristic of this study's five-sign criteria (temporal cessation of breathing, enlarged liver, icterus, fatigue, and pale skin), which needed at least one clinical indication of infection, was 0.70, the sensitivity was 77.1%, and the PPV was 64.9%.

Afrosa et al[75] The goal of this study was to determine the clinical profile and link blood culture results with the sepsis score in infant septicaemia. In this prospective investigation, septicaemia was suspected based on clinical signs such as unwillingness to feed, lethargy, fever, abdominal

distension, and so on. As soon as they were accepted into the trial, they were all tested for sepsis. Thirty-one of the fifty newborns tested were male, while the other neonates were female. The majority of them (74% of them) were delivered vaginally, however there were no noticeable differences between home and institutional delivery. 24 babies experienced complications during birth, with perinatal asphyxia affecting 83.3% of them. 59% of the babies in the research were not exclusively breastfed.

Kumhar, G et al [76] Aerobic isolates from infant blood colonies were studied to evaluate their antibiotic sensitivity profile and trends. Blood cultures were positive in 42% (770/1,828) of the cases. The majority (93.2%) of bactaeremic episodes were caused by a single organism, whereas polymicrobial aetiology was detected in 52 (6.8%) instances. Gram-negative bacteria were identified in 493 (60%) of the 823 cases, with Klebsiella (33.8%), Enterobacter (7.5%), Alcaligenes faecalis (4.9%), and Escherichia coli (4.6%) being the most common. The majority of Gram-positive isolates (7.9%) were coagulase-negative staphylococci, with Staphylococcus aureus coming in second (24.4%). Vancomycin was effective against the vast majority (80%) of Gram-positive isolates, whereas ciprofloxacin and amikacin were effective against 50-75% of Gram-negative infections.

Mokuolu, A et al[77] the study sought to determine the frequency and microbiological epidemiology of newborn sepsis and produce baseline information and the pertinent research questions for a proposed study on the newborns blood poisoning forecast in our center. The organisms that triggers early stage and delayed sepsis were distributed differently. The Gram-negative bacilli were the

most leading triggers of early stage of sepsis, whereas the Gram-positive bacilli were the predominant common sources of delayed sepsis were Staphylococcus aureus. When compared to reports from other regions of the country, sepsis was less common.

Laborada, G et al[78] compared the cytokine levels in different subpopulations of neonates was the secondary goal. There were 75 preterm and 30-term infants admitted. Blood serum samples were taken at the first indication of sepsis (at 0 hours) and again 18 to 30 hours later for the cytokine levels and "presently utilised laboratory investigations" ("24-hours"). Patients were categorized as either nonseptic (48) or septic (48). (57). Blood cultures from 32 septic patients were positive, and 16 of them had sepsis symptoms. Sepsis had two onset times: early in 20 septic patients and late in 28. The best "0-hour" test was a combo of C-reactive protein more than 10 pg/mL and IL-6 > 18 pg/mL (responsiveness more than 89%, precision more than 73%, probability of true disease more than 70%, probability of not a true disease more than 90%), and C-reactive protein (responsiveness more than 78%, precision more than 94%) was the best "24-hours" test. Patients with coagulase-negative staphylococci exhibited lower levels of interleukin-6 at 0 hours ($p = 0.018$) and interleukin-8 at 24 hours ($p = 0.023$) than those with other bacteria. The mixture of CRP and IL-6 enhanced over the first 24 hours of septicaemia presence, there was no variation between infected and no-infected subjects.

LACUNAE OF LITERATURE

Although infection rates have dropped slightly as a result of continuous quality improvement initiatives, neonatal sepsis remains a common and severe condition among hospitalised preterm newborns. Except for many attempts to meet this unmet need, there have been few breakthroughs in clinical care, results, and diagnostic testing reliability during the past 30 years. A changing case definition of sickness is one major factor to a lack of medical advancement. The inability to agree on a specific definition limits the chance of harmonising data from epidemiologists, physicians, and researchers, which, in turn, substantially impedes development achieving better results.

MATERIALS & METHODS

Study site: This study was conducted in the Department of Paediatrics at Sri Devaraj Urs Medical College, Tamaka, Kolar- 563101.

Study population: All the eligible patients are neonates admitted in the neonatal intensive care unit (NICU) and sick newborn care unit (SNCU), in the Department of Paediatrics at Sri Devaraj Urs Medical College were considered as study population.

Study design: The current study was a observational cross sectional study.

Sample size: Estimated based on sensitivity of MSNS and NOSEP scoring 87% with an absolute of 5% estimated sample size of the study for the study will be 174.

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

Here

$Z_{1-\alpha/2}$ = Is standard normal variate (at 5% type 1 error ($P<0.05$) it is 1.96 and at 1% type 1 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 – Has to be decided by researcher.

Sampling method: All the eligible subjects were recruited into the study consecutively by convenient sampling till the sample size is reached.

Study duration: The data collection for the study was done between January 2017 to December 2017 for a period of 1 year.

Inclusion Criteria:

Neonatal Criteria:

The study includes neonates with Risk factors include:

- Neonates with suspicion of sepsis.
- Deficient supply of oxygen shortly before or after birth asphyxia (Apgar score less than 4 within 6o seconds)
- Birth weight less than 2400 grams.
- Pre term babies (< 37 weeks of gestational age)

Exclusion criteria:

Maternal Criteria:

- Mother's body temperature elevated within 14 days of childbirth.
- Extreme unpleasant smell of a mixture of bacteria and vaginal fluid and/or amniotic fluid tinged with faecal material
- Presence of intra-amniotic infection.
- Membrane break lasting more than 18 hours.
- Persistent labour (the total of the first and second stages of labour exceeds a day)

Ethical considerations: Study was approved by institutional human ethics committee. Informed written consent was obtained from all the study participants and only those participants willing to sign the informed consent were included in the study. The risks and benefits involved in the study and voluntary nature of participation were explained to the participants before obtaining consent. Confidentiality of the study participants was maintained.

Data collection tools: All the relevant parameters were documented in a structured study proforma.

Methodology:

This study was conducted in R.L Jalappa hospital affiliated to Sri Devaraj Urs Medical College affiliated to Sri Devaraj urs academy of higher education and research.

This study was started after seeking ethical approval from the parents and permission from the Institutional review board. All neonates fulfilling inclusion criteria were included in the study.

Basic demographic data, which includes

- Gestational Age Birth weight
- Vaccination Status
- Socioeconomic parameters of MSNS and NOSEP with scoring for each parameter.

Statistical methods:

As an outcome variable, blood culture was explored. Secondary outcome factors included MSNS and NOSEP mean values. Explanatory factors were CRP >54mg/L, Neutrophils >50%, Thrombocytopenia 550x 509/L, TPN >64 days, and fever.

Descriptive analysis was performed using mean and standard deviation for quantitative data and frequency and percentage for categorical variables. Data was also depicted using relevant diagrams such as a bar graph and a circle chart.

All quantitative variables were evaluated for normal distribution within each explanatory variable category using histograms and normality Q-Q plots. The Shapiro-Wilk test was also used to determine normal distribution. Normal distribution was defined as a p value of >0.05 in the Shapiro-Wilk test.

Statistical test was used to evaluate the average values of normal infinite dimensional among research groups (2 groups). To compare categorical data amongst blood cultures, the Chi-squared distribution was performed.

ROC analysis: Receiver Operative curve (ROC) analysis was used to evaluate the Modified Sick Neonatal Score and Nosocomial sepsis mean value in predicting blood culture. The area under the ROC curve, as well as its 95% CI and p-value, are displayed. The responsiveness, precision, analytical values, and detection limit of the screening test with the chosen cut-off values were provided, along with their 95% confidence interval.

A probability of test results of 0.05 was used to determine numerically relevant. The information was gathered using coGuide software, version 1.01.[79]

RESULTS

Result:

The overall result comprised 173 subjects in total.

Table 3: Gender review illustrated in the research subjects (N=173)

Genus	Incidence	Percentage
Men	147	84.97%
Women	26	15.03%

The research subjects formed 147 (84.97%) men subjects and 26 (15.03%) women subjects. (Table 3 & Figure 1)

Figure 1: Gender distribution in the research subjects as a bar diagram (N=173)

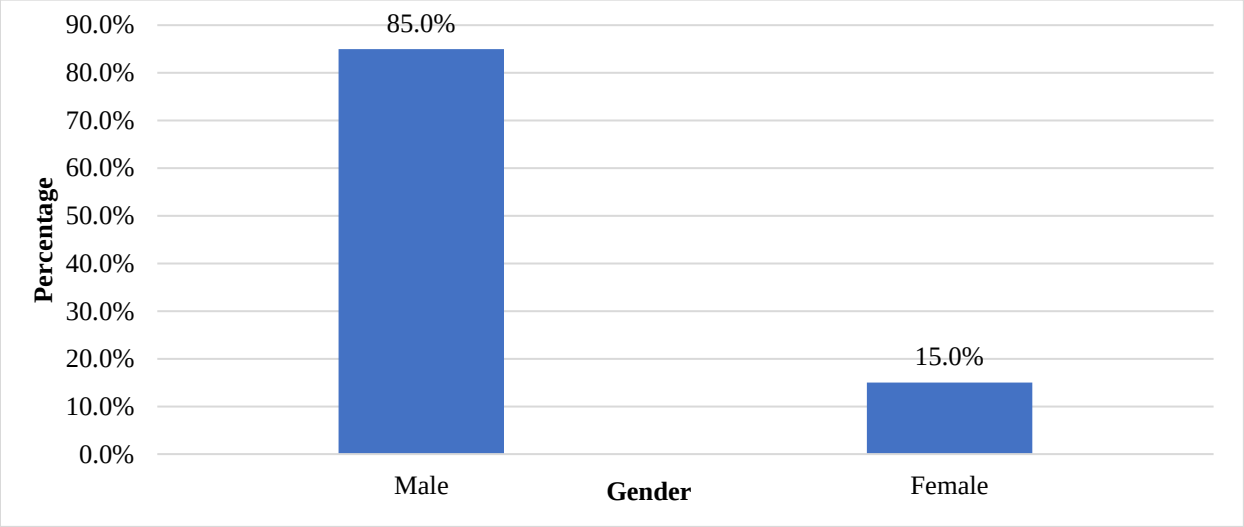


Table 4: Respiratory effort review Illustrated in the research subjects (N=173)

Respiratory effort (BPM)	Frequency	Percentage
Apnea/grunting	36	20.81%
40 to 60	116	67.05%
> 60	21	12.14%

Among the study population, 36 (20.81%) participants were Apnea/grunting Respiratory effort, 116 (67.05%) were Respiratory effort between 40 to 60 and 21 (12.14%) were Respiratory effort more than 60. (Table 4 & Figure 2)

Figure 2: Respiratory effort in the research subjects is depicted as a bar diagram. (N=173)

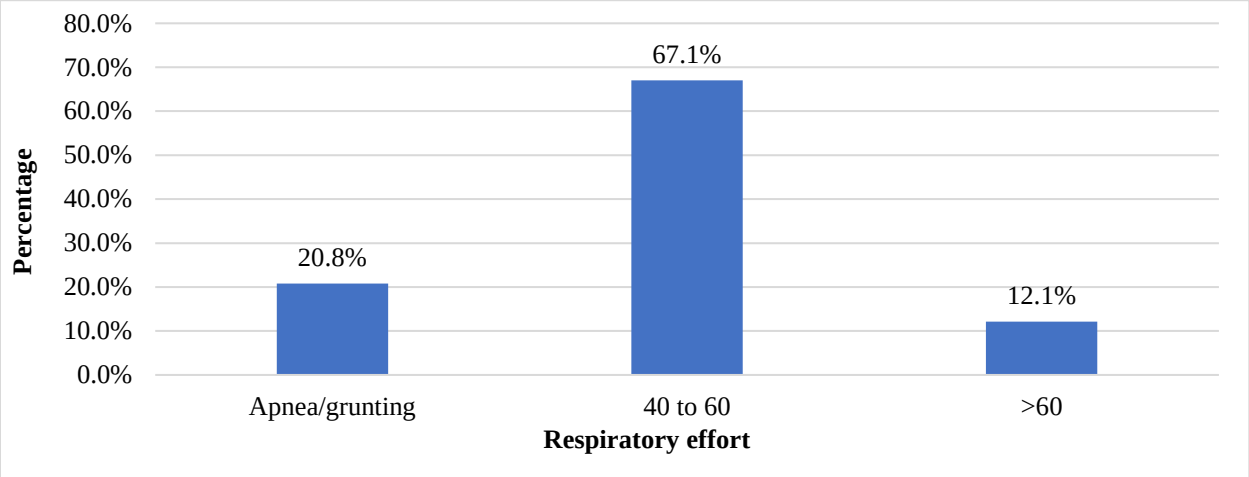


Table 5: Descriptive analysis of Heart rate (beats/mints) in the study population (N=173)

Heart rate (beats/mints)	Frequency	Percentage
Bradycardia	11	6.36%
100 to 160	141	81.50%
>160	21	12.14%

Among the study population, 11 (6.36%) participants were Bradycardia Heart rate (beats/mints), 141 (81.50%) were Heart rate (beats/mints) between 100 to 160 and 21 (12.14%) were Heart rate (beats/mints) more than 160. (Table 5 & Figure 3)

Figure 3: Heart rate (pulse) distribution in the research subjects as a circle chart (N=173)

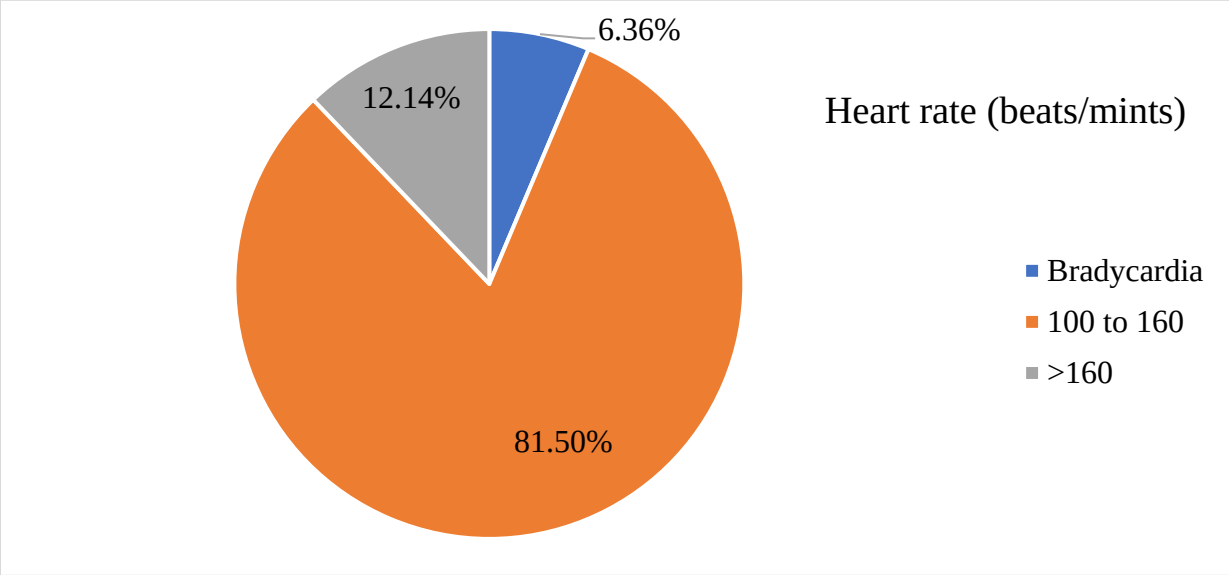


Table 6: Time taken for colour-capillary refill time (CRT) in the research subjects (N=173)

Capillary refilling time	Frequency	Percentage
<3	154	89.02%
3 to 5	15	8.67%
>5	4	2.31%

Among the study population, 154 (89.02%) participants were capillary refilling time less than 3, 15 (8.67%) were capillary refilling time between 3 to 5 and 4 (2.31%) were capillary refilling time more than 5. (Table 6 & Figure 4)

Figure 4: Time taken for colour-capillary refill time (CRT) in the research subjects depicted as a circle chart (N=173)

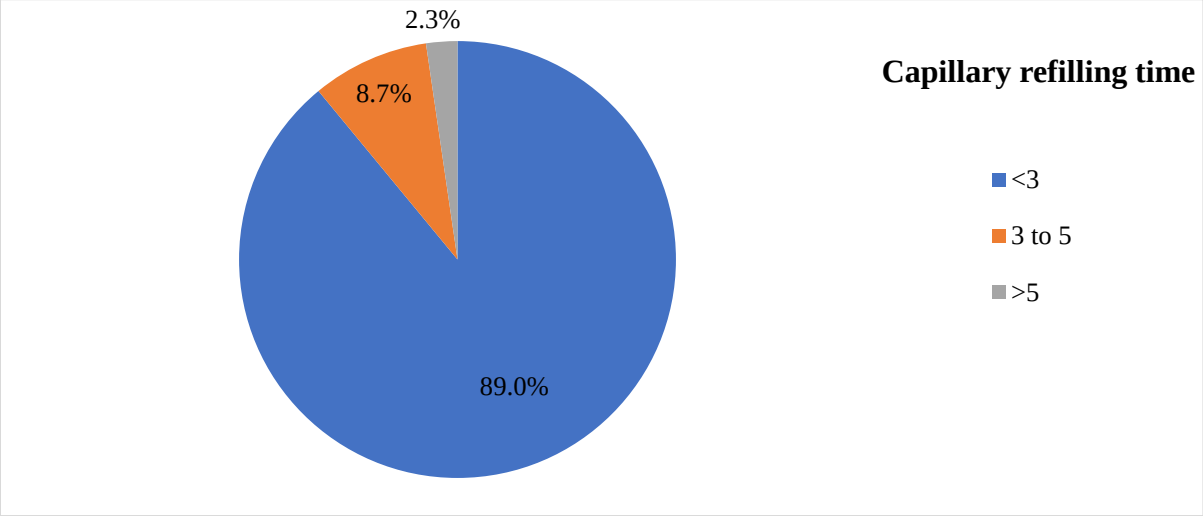


Table 7: Descriptive analysis of Random blood sugar (mg/dL) in the study population (N=173)

Random blood sugar (mg/dL)	Frequency	Percentage
<40	2	1.16%
40 to 60	25	14.45%
>60	146	84.39%

Among the study population, 2 (1.16%) participants were Random blood sugar less than 40, 25 (14.45%) were Random blood sugar between 40 to 60 and 146 (84.39%) were Random blood sugar more than 60. (Table 7)

Table 8: Oxygen saturation-SpO2 (in room air) review illustrated in the research subjects (N=173)

SpO2 (in room air)	Frequency	Percentage
<85	14	8.09%
85 to 92	27	15.61%
>92	132	76.30%

Among the study population, 14 (8.09%) participants were SpO2 (in room air) less than 85, 27 (15.61%) were SpO2 (in room air) between 85 to 92 and 132 (76.30%) were SpO2 (in room air) more than 92. (Table 8 & Figure 5)

Figure 5: Oxygen saturation-SpO2 (in room air) depicted as a bar diagram in the research subjects (N=173)

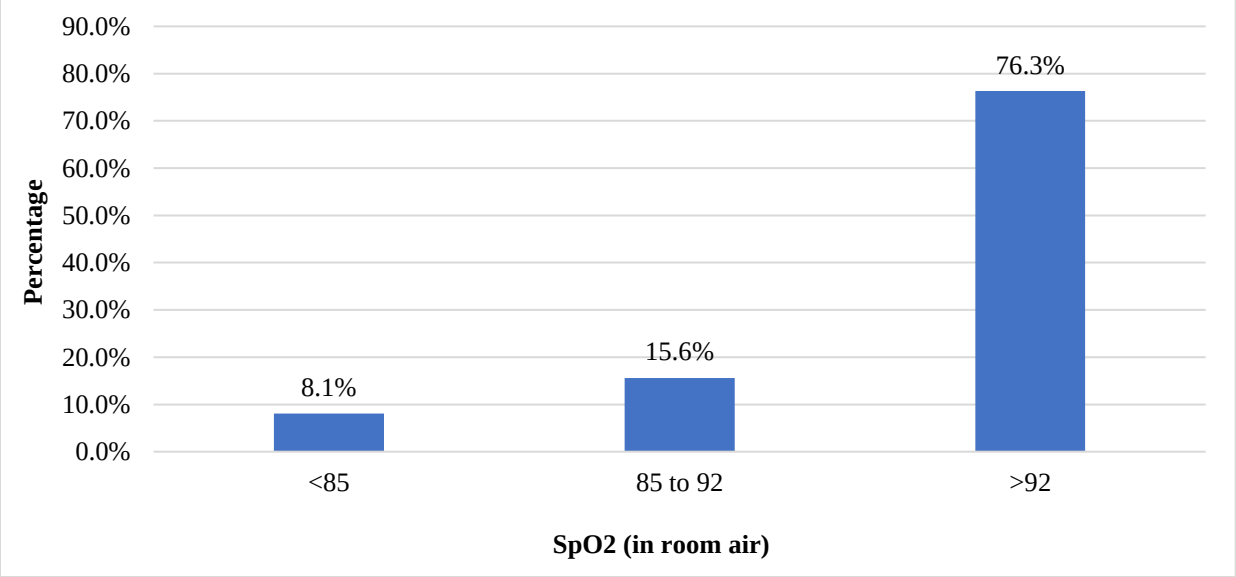


Table 9: Measure of pregnancy (in weeks) review illustrated in the research subjects (N=173)

Gestational Age (in weeks)	Frequency	Percentage
<32	21	12.14%
32 to 36	63	36.42%
>=37	89	51.45%

Of the research subjects, 21 (12.14%) were less than 32 weeks pregnant, 63 (36.42%) were between 32 and 36 weeks pregnant, and 89 (51.45%) were more than 37 weeks pregnant. (Table 9 and Figure 6)

Figure 6: Measure of pregnancy in the research subjects depicted as a circle chart (N=173)

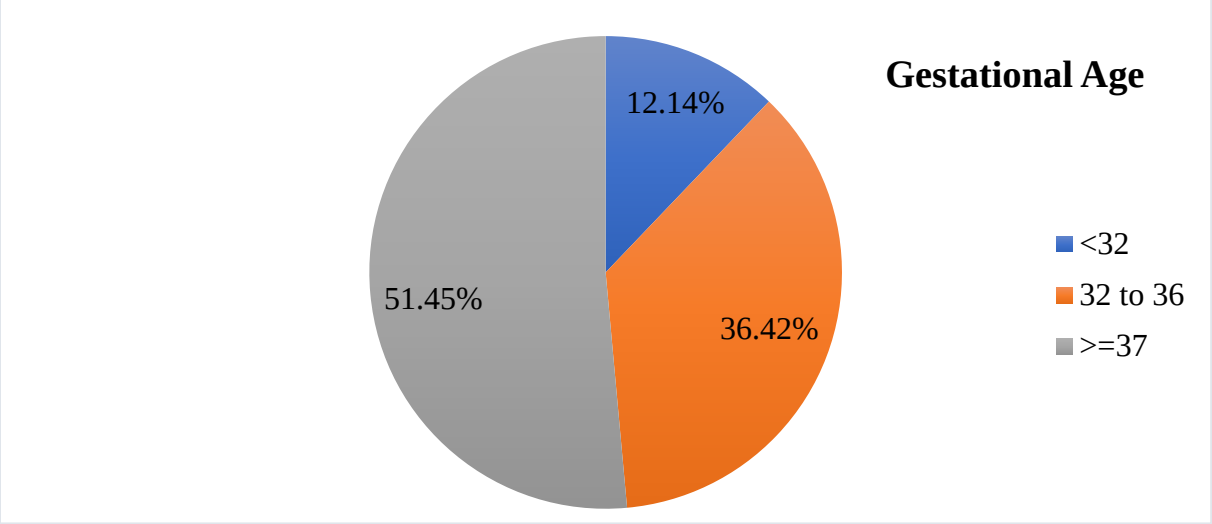


Table 10: Weight at birth review illustrated in the research subjects (N=173)

Birth weight (in kg)	Frequency	Percentage
<1.5	31	17.92%
1.5 to 2.49	61	35.26%
2.49 and above	81	46.82%

In the study population, 31 (17.92%) individuals had a weight at birth of less than 1.5 kg, 61 (35.26%) had a weight at birth of 1.5 to 2.49 kg, and 81 (46.82%) had a weight at birth of 2.49 kg or higher. (Figure 7 and Table 10)

Figure 7: Weight at birth depicted as a bard diagram in the research subjects (N=173)

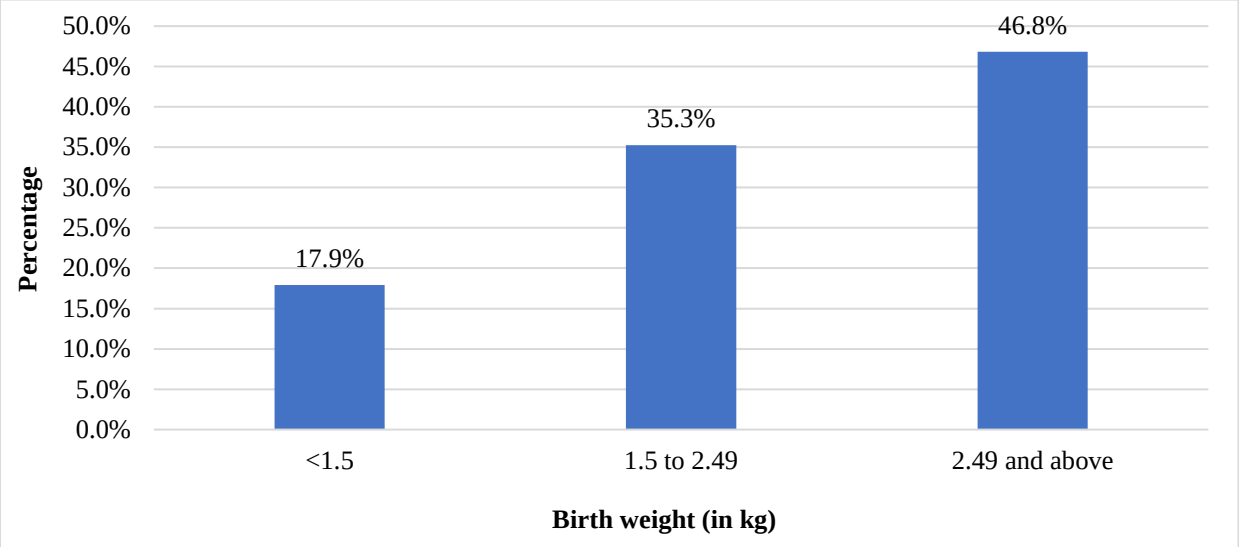


Table 11: Modified Sick Neonatal Score review illustrated in the research subjects (N=173)

System	Average ± S. D	Median	Lowest	Highest	95% CI	
					Lower CI	Upper CI
MSNS score	12.79 ± 3.01	13.00	5.00	30.00	12.34	13.23

The average modified sick neonatal score in the study sample was 12.79 3.01, with the lowest score of 5 and a highest score of 30 (95% CI 12.34 to 13.23). (Figure 8 and Table 11)

Figure 8: Boxplots of MSNS score in the study population (N=173)

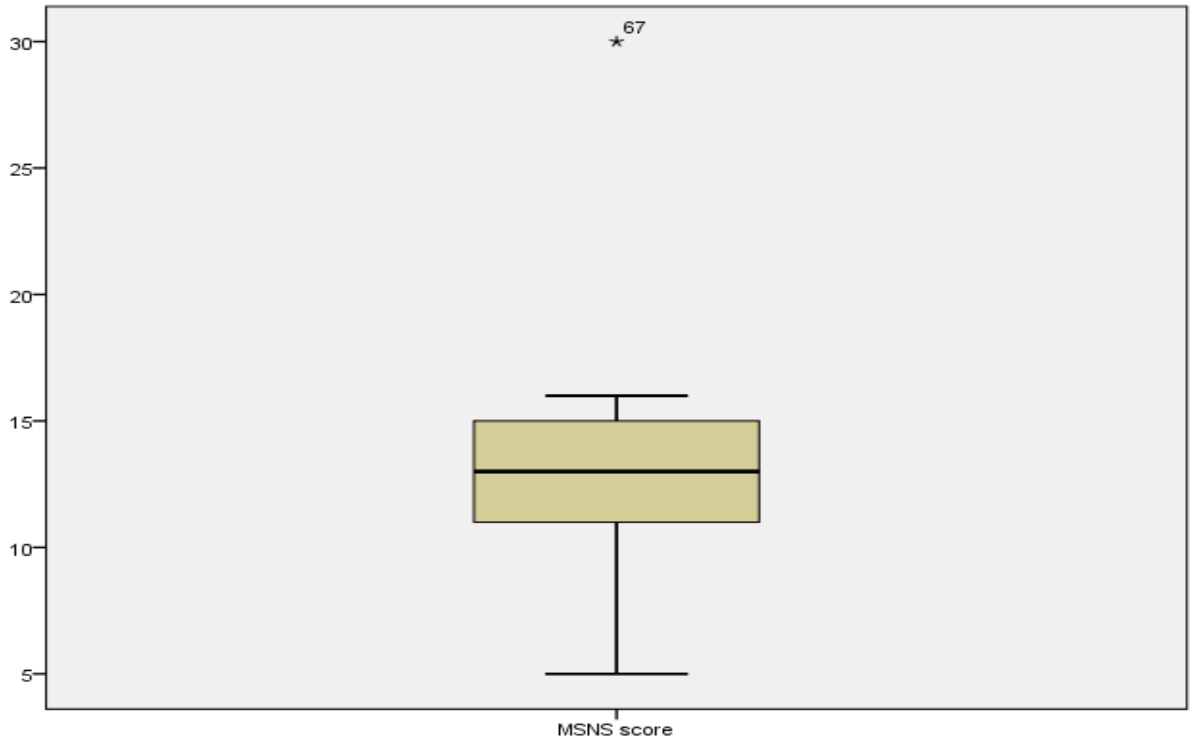


Table 12: Foreign body (Presence or absence) detected in subjects' blood test review illustrated in the research subjects (N=173)

Foreign body	Incidence	Percentage
Presence	40	23.12%
Absence	133	76.88%

40 (23.12%) of the subjects in the research showed the presence of a foreign body while 133 (76.88%) showed the absence of a foreign body in blood tests. (Table 12 and Figure 9)

Figure 9: Blood tests outcome in the research subjects depicted in a form of a circle chart (N=173)

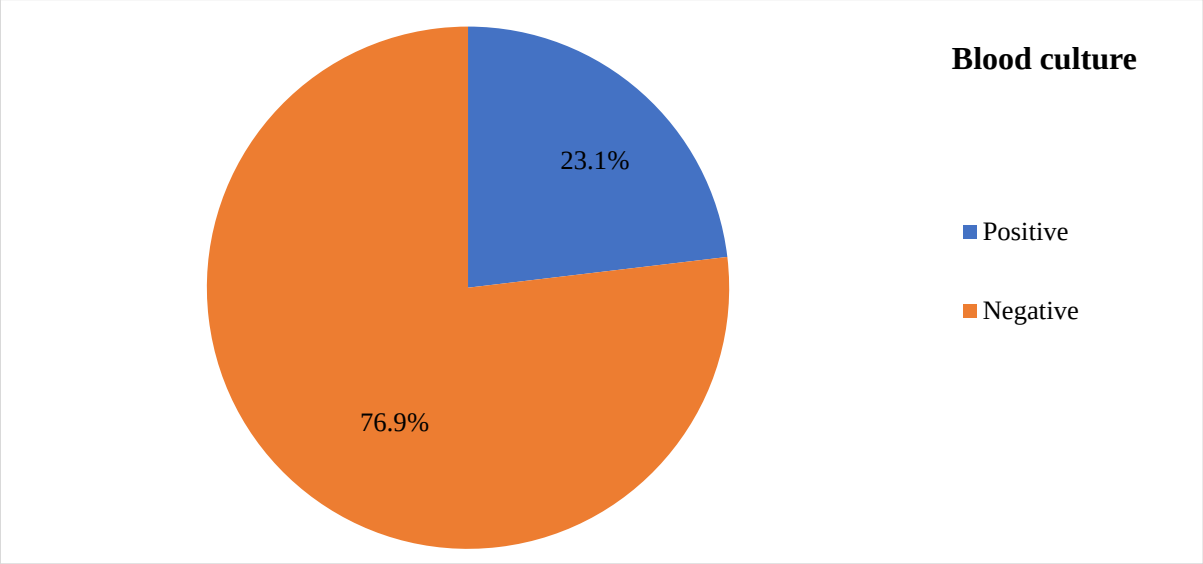


Table 13: Descriptive analysis of CRP >54mg/L(5) in the study population (N=173)

CRP >54Mg/L	Frequency	Percentages
Yes (score 5)	67	38.73%
No	106	61.27%

Among the study population, 67 (38.73%) participants had CRP score 5. (Table 13)

Table 14: Neutrophils >50%(3) review illustrated in the research subjects (N=173)

Neutrophils >50%	Frequency	Percentages
Yes (score 3)	69	39.88%
No	104	60.12%

Among the study population, 69 (39.88%) participants had Neutrophils >50% score 3. (Table 14)

Table 15: Descriptive analysis of Thrombocytopenia <550x 509 /L (5) in the study population (N=173)

Thrombocytopenia <550X 509 /L	Frequency	Percentages
Yes (score 5)	43	24.86%
No	130	75.14%

Among the study population, 43 (24.86%) participants had Thrombocytopenia score 5. (Table 15)

Table 16: Descriptive analysis of TPN >_64 days (6) in the study population (N=173)

TPN >64 Days	Incidence	Proportions
Yes (score 6)	52	30.06%
No	121	69.94%

Among the study population, 52 (30.06%) participants had TPN score 6. (Table 16)

Table 17: Pyrexia review illustrated in the research subjects (N=173)

Fever	Frequency	Percentages
Yes (score 5)	98	56.65%
No	75	43.35%

Among the study population, 98 (56.65%) participants had Fever score 5. (Table 17 & Figure 10)

Figure 10: Pyrexia in the research subjects depicted as a bar diagram (N=173)

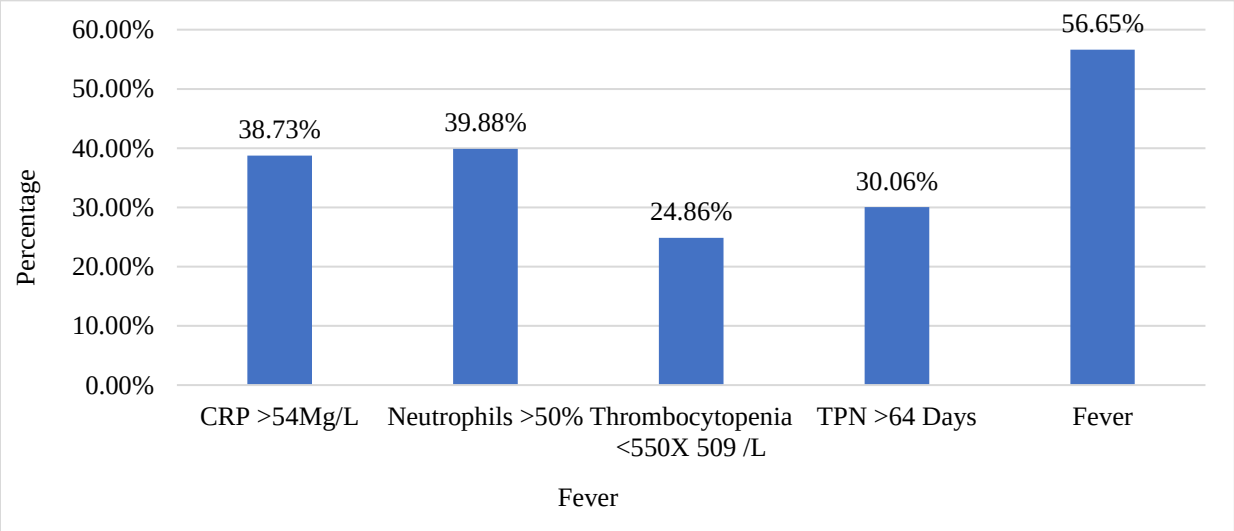


Table 18: Descriptive analysis of NOSEP mean value in the research subjects (N=173)

Data	Average ± S. D	Median	Lowest	Highest	95% CI	
					Lower CI	Upper CI
NOSEP mean value	8.96 ± 6.17	6.00	0.00	24.00	8.04	9.88

In the study population, the average NOSEP mean score was 8.96 6.17, with the lowest score of 0.0 and the highest score of 24 (95% CI 8.04 to 9.88). (Table 18 and Figure 11)

Figure 11: Box plots of NOSEP mean value in the research subjects (N=173)

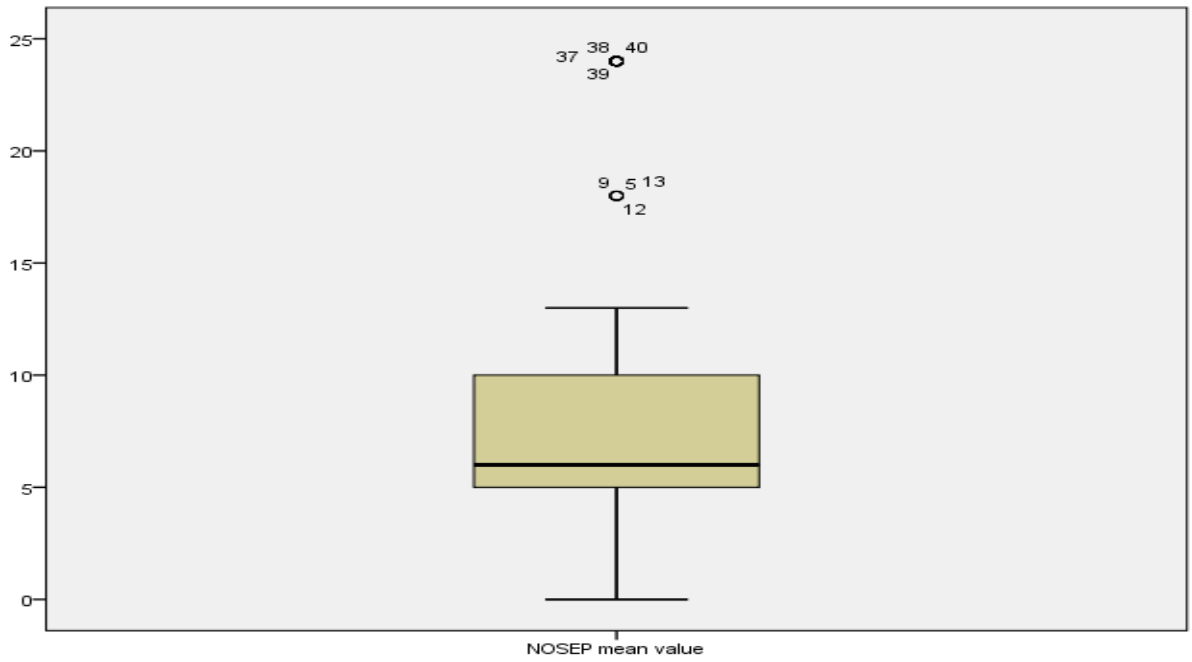


Table 19: Variations between male and female blood tests (N=173)

Genus	Blood Culture		Chi square	P value
	Positive	Negative		
Female (N=26)	9 (34.62%)	17 (65.38%)	2.274	0.132
Male (N=147)	31 (21.09%)	116 (78.91%)		

Out of 26 Females, 9 (34.62%) were positive blood culture and 17 (65.38%) were negative blood culture. Out of 147 Males, 31 (21.09%) were positive blood culture and 116 (78.91%) were negative blood culture. The variation in blood test percentages across males and females was numerically insignificant, with a P value of 0.132. (Table 19 and Figure 12)

Figure 12: Cluster bar graphic contrasting males and females blood tests outcome (N=173)

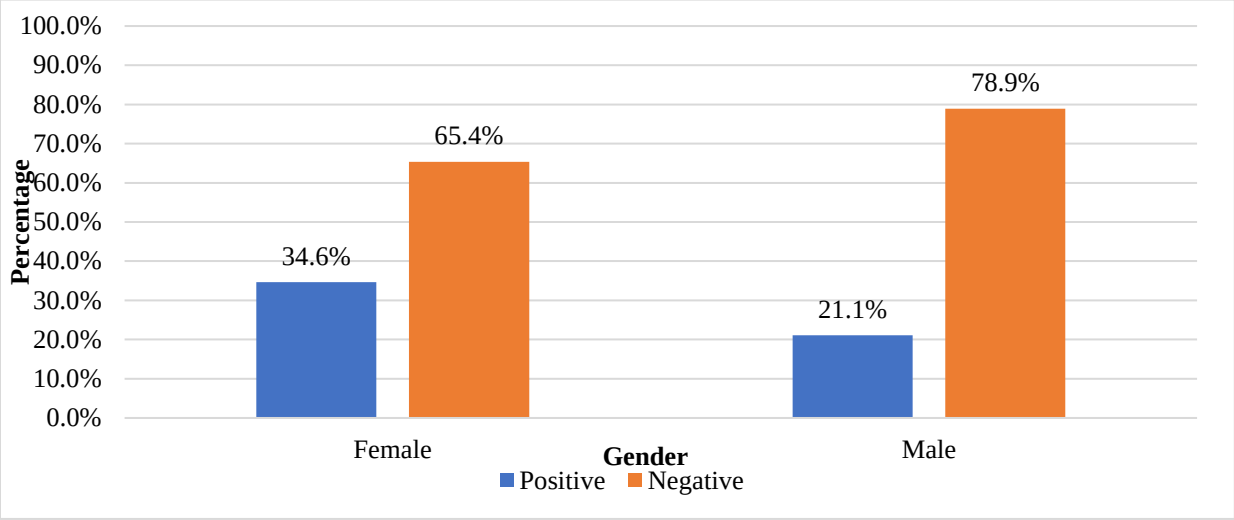


Table 20: Comparison of respiratory effort between blood culture (N=173)

Respiratory Effort (BPM)	Blood Culture		Chi square	P value
	Positive	Negative		
>60 (N=21)	5 (23.81%)	16 (76.19%)	44.318	<0.001
40 To 60 (N=116)	12 (10.34%)	104 (89.66%)		
Apnea/Grunting (N=36)	23 (63.89%)	13 (36.11%)		

Out of 21 participants with >60 Respiratory Effort, 5 (23.81%) were positive blood culture and 16 (76.19%) were negative blood culture. Out of 116 participants with Respiratory Effort between 40 to 60, 12 (10.34%) were positive blood culture and 104 (89.66%) were negative blood culture. Out of 36 participants with Apnea/Grunting Respiratory Effort, 23 (63.89%) were positive blood culture and 13 (36.11%) were negative blood culture. The variation in blood tests outcome percentage between Respiratory Effort (BPM) was numerically notable with a P value of 0.001. (Table 20 and Figure 13)

Figure 13: comparing respiratory effort in blood tests outcome depicted as a stacked bar graph (N=173)

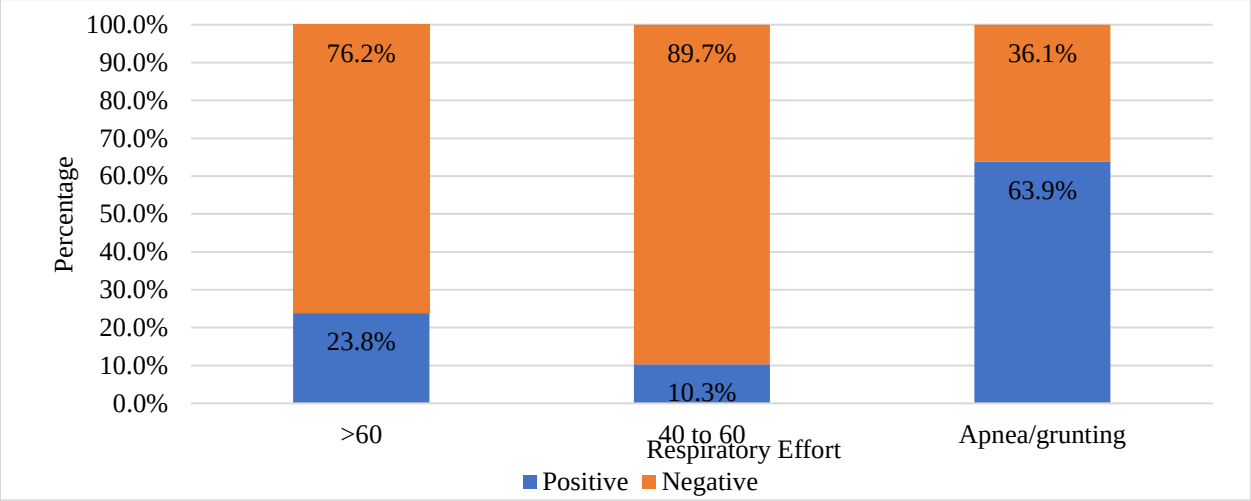


Table 21: Comparison of heart rate between blood culture (N=173)

Heart Rate (beats/mints)	Blood Culture		Chi square	P value
	Positive	Negative		
Bradycardia (N=11)	10 (90.91%)	1 (9.09%)	35.569	<0.001
100 To 160 (N=141)	22 (15.6%)	119 (84.4%)		
>160 (N=21)	8 (38.1%)	13 (61.9%)		

Out of 11 participants with Bradycardia Heart Rate (beats/mints), 10 (90.91%) were positive blood culture and 1 (9.09%) was negative blood culture. Out of 141 participants with Heart Rate between 100 to 160, 22 (15.6%) were positive blood culture and 119 (84.4%) were negative blood culture. Out of 21 participants with Heart Rate >160, 8 (38.1%) were positive blood culture and 13 (61.9%) were negative blood culture. The variation in blood sample outcome percentage of Heart Rate (beats/mints) was numerically notable with a probability of test results of 0.001. (Table 21)

Table 22: Comparison of capillary refilling time between blood culture (N=173)

Capillary Refilling Time	Blood Culture	
	Positive	Negative
<3 (N=154)	30 (19.48%)	124 (80.52%)
3 To 5 (N=15)	6 (40%)	9 (60%)
>5 (N=4)	4 (100%)	0 (0%)

No statistical test was applied- due to 0 subjects in the cells

From 154 participants with <3 Capillary Refilling Time, 30 (19.48%) were positive blood culture and 124 (80.52%) were negative blood culture. Out of 15 participants with Capillary Refilling Time between 3 to 5, 6 (40%) showed the presence in blood cultures, whereas 9 (60%) showed nil results. Of 4 participants with >5 Capillary Refilling Time, all of them 4 (100%) were positive blood culture. (Table 22)

Table 23: A random blood glucose level analyzed in blood samples (N=173)

Random Blood glucose (mg/dl)	Blood Culture	
	Positive	Negative
<40 (N=2)	2 (100%)	0 (0%)
40 To 60 (N=25)	16 (64%)	9 (36%)
>60 (N=146)	22 (15.07%)	124 (84.93%)

No statistical test was applied- due to 0 subjects in the cells

Of 2 participants with <40 Random Blood Sugar (mg/dl), all of them 2 (100%) participants were positive blood culture. Out of 25 participants with Random Blood Sugar between 40 to 60, 16 (64%) showed the presence in blood cultures, while 9 (36%) showed nil results. Out of 146 participants with >60 Random Blood Sugar, 22 (15.07%) participants were positive blood culture and 124 (84.93%) were negative blood culture. (Table 23)

Table 24: Comparison of spo2 (in room air) between blood culture (N=173)

Spo2 (In Room Air)	Blood Culture		Chi square	P value
	Positive	Negative		
<85 (N=14)	13 (92.86%)	1 (7.14%)	46.567	<0.001
85 To 92 (N=27)	9 (33.33%)	18 (66.67%)		
>92 (N=132)	18 (13.64%)	114 (86.36%)		

Out of 14 participants with <85 Spo2 (In Room Air), 10 (90.91%) were positive blood culture and 1 (9.09%) was negative blood culture. Out of 141 participants with Heart Rate between 100 to 160, 22 (15.6%) were positive blood culture and 119 (84.4%) were negative blood culture. Out of 21 participants with Heart Rate >160, 8 (38.1%) were positive blood culture and 13 (61.9%) were negative blood culture. The variation in serum samples' percentage of oxygen saturation-SpO2 was numerically notable, with a probability test results of 0.001. (Table 24)

Table 25: Blood tests outcome and measure of pregnancy (in weeks) correlation (N=173)

Gestational Age (in weeks)	Blood Culture		Chi square	P value
	Positive	Negative		
<32 (N=21)	18 (85.71%)	3 (14.29%)	67.573	<0.001
32 To 36 (N=63)	19 (30.16%)	44 (69.84%)		
>=37 (N=89)	3 (3.37%)	86 (96.63%)		

Out of 21 participants with Gestational Age <32 weeks, 18 (85.71%) participants showed the presence in blood tests outcome, while 3 (14.29%) showed nil results. Out of 63 participants with Gestational Age between 32 to 36, 19 (30.16%) were positive blood culture and 44 (69.84%) were negative blood culture. Out of 89 participants with Gestational Age >37 weeks, 3 (3.37%) were positive blood culture and 86 (96.63%) were negative blood culture. The variation in blood sample

percentage among measures of pregnancy (in weeks) was numerically notable, with a probability test results of 0.001. (Table 25)

Table 26: Weight at birth correlation among blood tests outcome (N=173)

Weight at birth (in kg)	Blood Culture		Chi square	P value
	Positive	Negative		
<1.5 (N=31)	18 (58.06%)	13 (41.94%)	30.922	<0.001
1.5 To 2.49 (N=61)	15 (24.59%)	46 (75.41%)		
2.49 And Above (N=81)	7 (8.64%)	74 (91.36%)		

Out of 31 participants with Birth Weight <1.5 kg, 18 (58.06%) participants were positive blood culture and 13 (41.94%) were negative blood culture. Out of 61 participants with Birth Weight between 1.5 to 2.49 kg, 15 (24.59%) were positive blood culture and 46 (75.41%) were negative blood culture. Out of 81 participants with Birth Weight 2.49 kg and above, 7 (8.64%) were positive blood culture and 74 (91.36%) were negative blood culture. The difference in the proportion blood culture between Birth Weight (in kg) was numerically notable with a P value <0.001. (Table 26)

Table 27: Correlation of capillary refilling time levels more than 54mg/l in blood samples (N=173)

CRP >54Mg/L	Blood Culture	
	Positive	Negative
Yes (Score 5) (N=67)	40 (59.7%)	27 (40.3%)
No (N=106)	0 (0%)	106 (100%)

No statistical test was applied- due to 0 subjects in the cells

From 67 subjects with CRP Score 5, 40 (59.7%) participants were positive blood culture and 27 (40.3%) were negative blood culture. (Table 27 & Figure 14)

Figure 14: Capillary refilling time >54mg/l analysis among blood cultures depicted as a cluster bar graph (N=173)

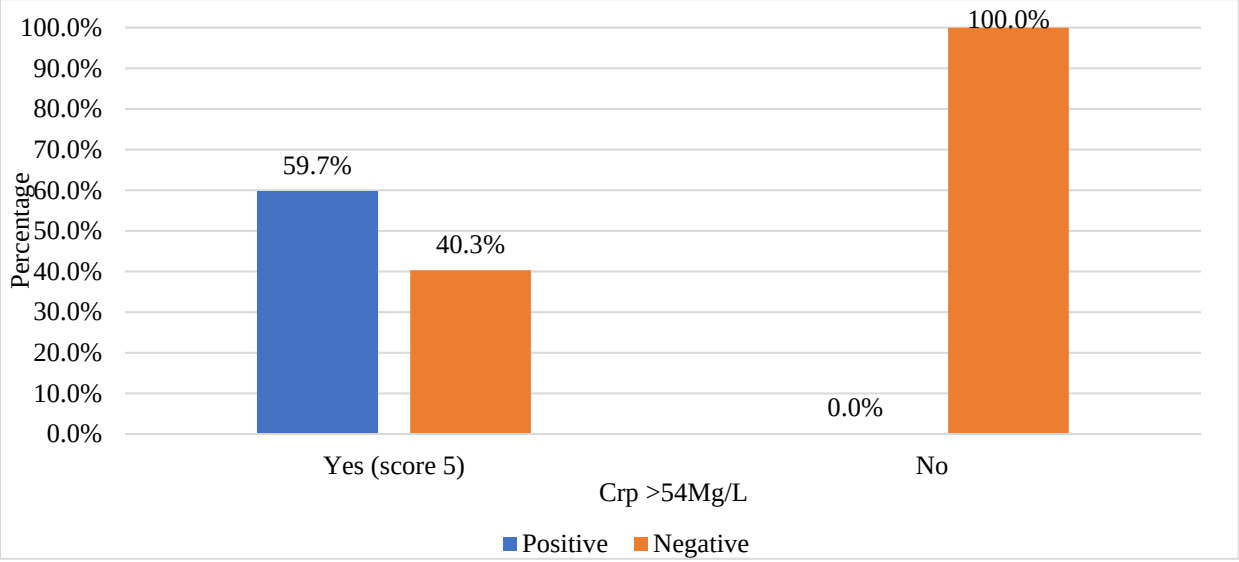


Table 28: Comparison of neutrophils >50% between blood culture (N=173)

Neutrophils >50%	Blood Culture		Chi square	P value
	Positive	Negative		
Yes (Score 3) (N=69)	39 (56.52%)	30 (43.48%)	72.035	<0.001
No (N=104)	1 (0.96%)	103 (99.04%)		

Out of 69 participants with Neutrophils Score 3, 39 (56.52%) participants were positive blood culture and 30 (43.48%) were negative blood culture. The variation in the blood sample percentage of Neutrophils was numerically relevant, with a P value of 0.001. (Table 28 and Figure 15)

Figure 15: Staked bar chart of comparison of neutrophils >50% between blood culture (N=173)

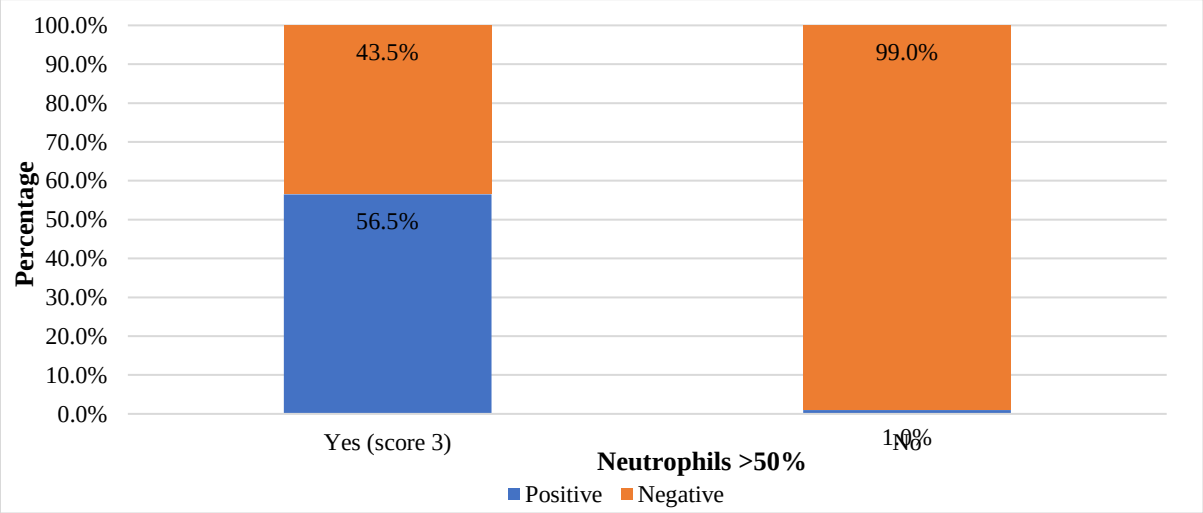


Table 29: Comparison of thrombocytopenia <550x 509 /l between blood culture (N=173)

Thrombocytopenia <550X 509 /L	Blood Culture		Chi square	P value
	Positive	Negative		
Yes (Score 5) (N=43)	24 (55.81%)	19 (44.19%)	34.407	<0.001
No (N=130)	16 (12.31%)	114 (87.69%)		

Out of 43 participants with Thrombocytopenia <550X 509 /L Score 5, 24 (55.81%) participants were positive blood culture and 19 (44.19%) were negative blood culture. The difference in the proportion blood culture between Thrombocytopenia <550X 509 /L was numerically relevant with a P value <0.001. (Table 29 & Figure 16)

Figure 16: Correlation of thrombocytopenia <550x 509 /l in blood sample depicted as a cluster bar graph (N=173)

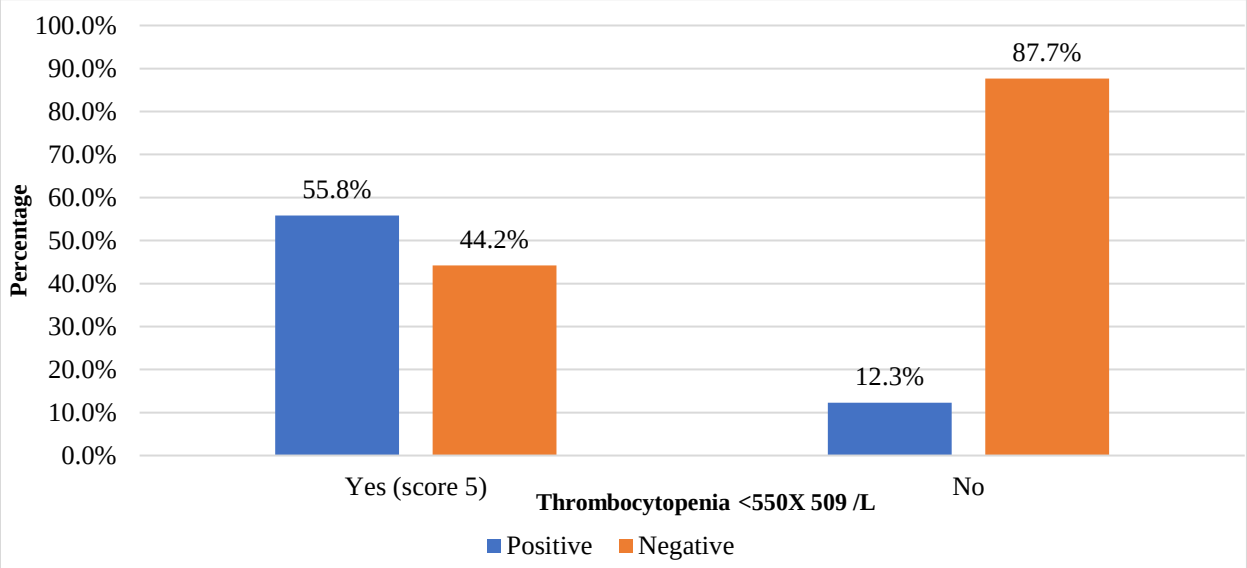


Table 30: Comparison of TPN >64 days between blood culture (N=173)

TPN >64 Days	Blood Culture		Chi square	P value
	Positive	Negative		
Yes (Score 6) (N=52)	18 (34.62%)	34 (65.38%)	5.526	0.019
No (N=121)	22 (18.18%)	99 (81.82%)		

Out of 52 participants with TPN >64 Days, 18 (34.62%) participants were positive blood culture and 34 (65.38%) were negative blood culture. The difference in the proportion blood culture between TPN >64 Days was numerically relevant with a P value 0.019. (Table 30 & Figure 17)

Figure 17: Correlation of TPN >64 days of blood sample depicted as a cluster bar graph (N=173)

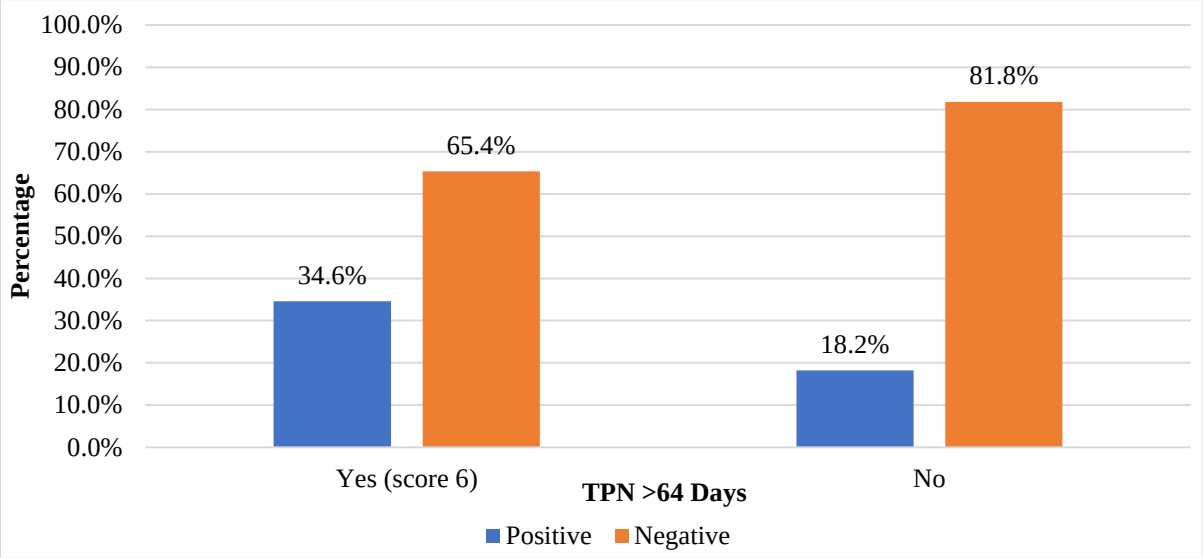


Table 31: Comparison of fever between blood culture (N=173)

Fever	Blood Culture		Chi square	P value
	Positive	Negative		
Yes (Score 5) (N=98)	32 (32.65%)	66 (67.35%)	11.554	<0.001
No (N=75)	8 (10.67%)	67 (89.33%)		

Out of 98 participants with Fever score 5, 32 (32.65%) participants were positive blood culture and 66 (67.35%) were negative blood culture. The variations in blood sample percentage of pyrexia were numerically relevant with a P value <0.001. (Table 31 & Figure 18)

Figure 18: Correlation of pyrexia of blood sample depicted as a stacked bar graph (N=173)

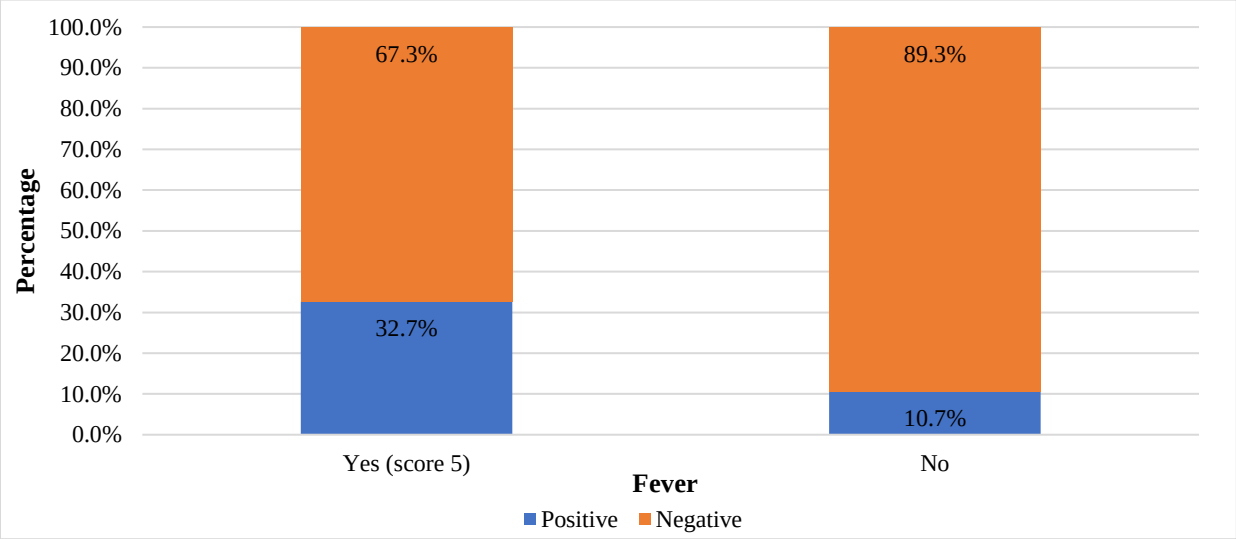


Table 32: Comparison of mean of MSNS score between blood culture(N=173)

Parameter	Serum sample (Mean± SD)		P value
	Presence (N=40)	Absence (N=133)	
MSNS score	8.73 ± 1.93	14.01 ± 2.05	<0.001

The average Modified Sick Neonatal Score in Positive blood sample was 8.73 1.93, while in Negative blood sample it was 14.01 2.05. With a P value of 0.001, the mean differential Modified Sick Neonatal Score in Blood culture was numerically relevant. (Table 32 and Figure 19)

Figure 19: Comparing the average Modified Sick Neonatal Score of serum samples depicted as a bar graph (N=173)

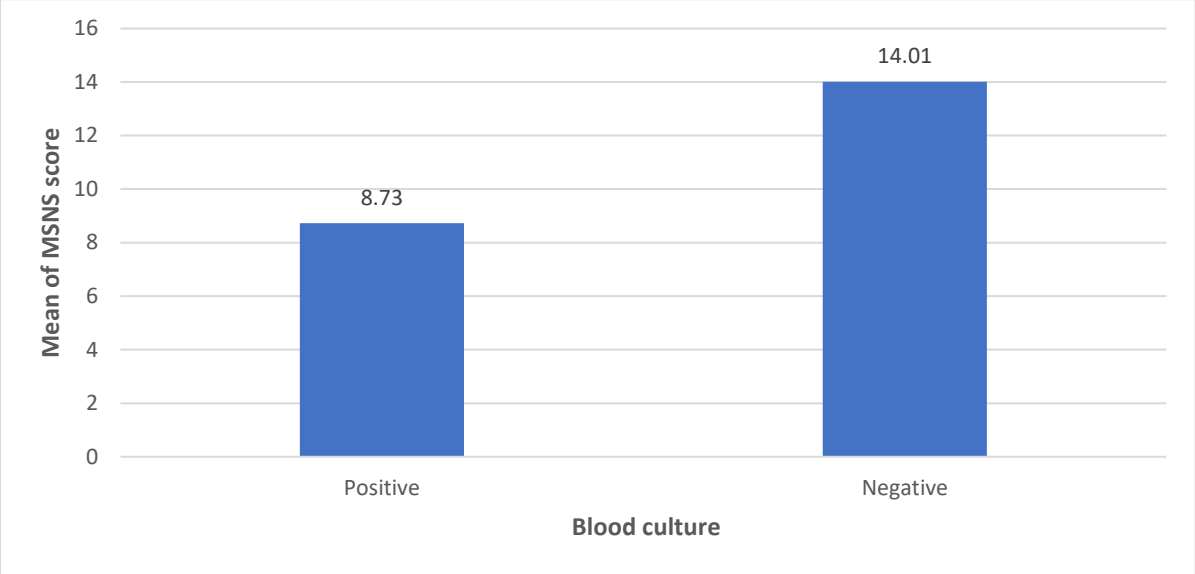


Table 33: Comparison of NOSEP mean value between blood culture(N=84)

Parameter	Serum sample (Mean± SD)		P value
	Presence (N=37)	Absence (N=47)	
NOSEP mean value	17.73 ± 6.69	6.34 ± 2.32	<0.001

Note: Gestational age is <37 weeks only

The mean NOSEP mean value with in Positive blood culture was 17.73 ± 6.69 and it was 6.34 ± 2.32 in Negative blood culture. With P value <0.001 the mean difference NOSEP mean value in Blood culture was numerically relevant. (Table 33 & Figure 20)

Figure 20: Comparison of NOSEP average value among blood sample depicted as a bar diagram (N=173)

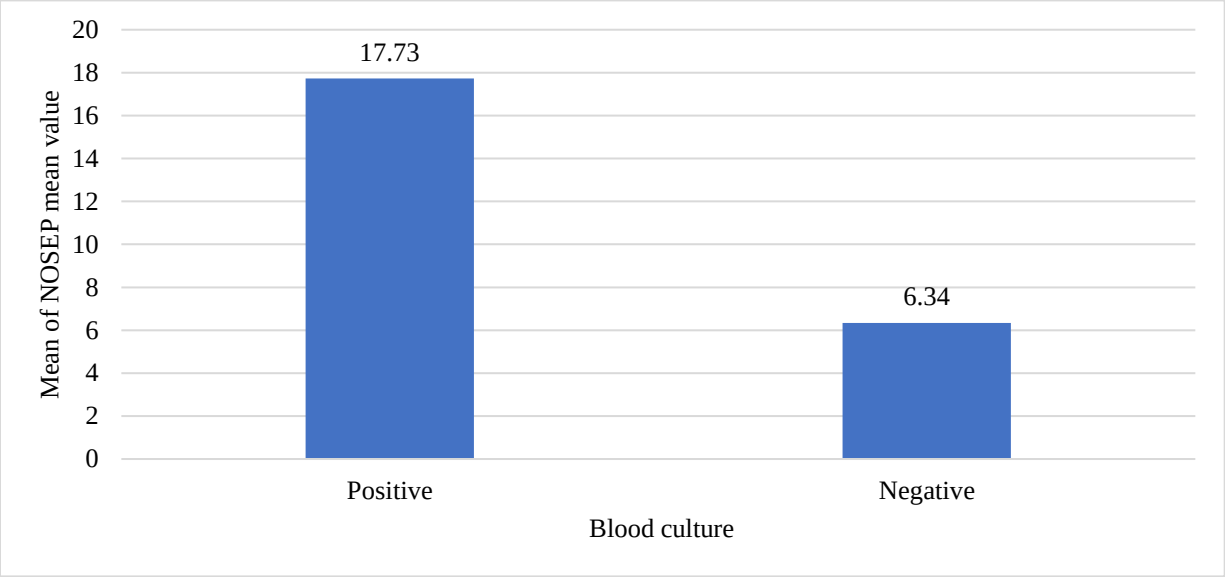
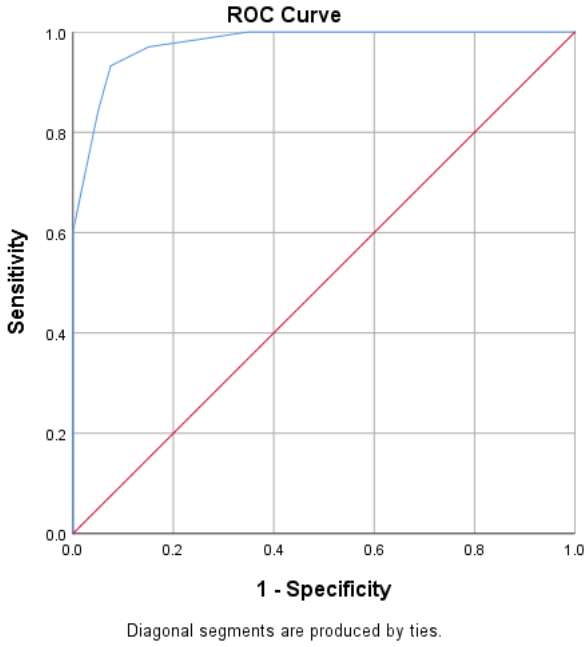


Figure 21: Receiver operating curve for MSNS score in predicting Positive blood culture (N=173)



Definite integral	Standard Error	P value	95% CI	
			Below the limit	Above the limit
0.977	.011	<0.001	.955	.999

Modified Sick Neonatal Score had extremely strong predictive validity in predicting blood culture (AUC 0.977), and the relationship was numerically relevant (P value 0.001).

Table 34: Correlation of Modified Sick Neonatal Score among blood culture (N=173)

MSNS score	Blood Culture		Chi square Value	P Value
	Positive(N=40)	Negative(N=133)		
Low (<12.5)	38 (95%)	21 (15.79%)	85.855	<0.001
High (>=12.5)	2 (5%)	112 (84.21%)		

In Positive blood culture, 38 (95%) participants had low MSNS score and 21 (15.79%) had high MSNS score. In Negative blood culture, 21 (15.79%) participants had low MSNS score and 112 (84.21%) had high MSNS score. With a probability of test results of 0.09, the variation in MSNS score percentage among Blood Cultures is numerically insignificant. (Table 34)

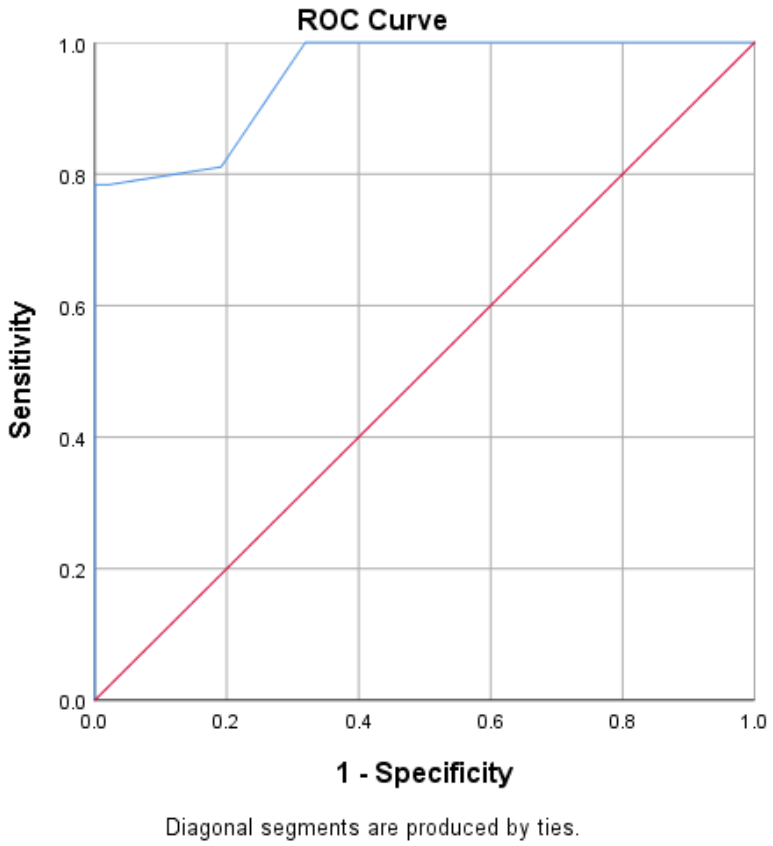
Table 35: Modified sick newborn score rating value statistical analysis in determining Positive Blood Culture (N=173)

Indicators	Percentage	95% CI	
		Lower	Upper
Sensitivity	95.00%	83.08%	99.39%
Specificity	84.21%	76.88%	89.95%
False positive rate	15.79%	10.05%	23.12%
False negative rate	5.00%	0.61%	16.92%
Positive predictive value	64.41%	50.87%	76.45%
Negative predictive value	98.25%	93.81%	99.79%
Diagnostic accuracy	86.71%	80.72%	91.38%

The Modified Sick Neonatal Score predicted Positive blood culture with a responsiveness of 95.00% (95% confidence interval 83.08% to 99.39%). Precision was 84.21% (95% CI 76.88% to 89.95%), probability of falsely rejected was 15.79% (95% confidence interval 10.05% to 23.12%), probability of incorrect results showing the condition was 5.00% (95% confidence interval 0.61%

to 16.92%), probability of not a true disease was 98.25% (95% confidence interval 93.81% to 99.79%), and overall detection rate was 86.71% (95% CI 80.72% to 91.38%). (Table 35)

Figure 22: Receiver operating curve for NOSEP mean value (Less than 37 weeks only) in predicting Positive blood culture (N=84)



Definite integral	Standard Error	P value	95% CI	
			Below the limit	Above the limit
0.949	.021	<0.001	.908	.990

The NOSEP score had extremely strong predictive validity in predicting blood culture (AUC 0.949), and the relationship was numerically relevant (P value 0.001)

Table 36: Correlation of NOSEP average value among serum sample (N=84)

NOSEP mean value	Blood Culture		Chi square Value	P Value
	Positive(N=37)	Negative(N=47)		
High (>=9)	30 (81.08%)	9 (19.15%)	31.925	<0.001
Low (<9)	7 (18.92%)	38 (80.85%)		

In Positive blood culture, 30 (81.08%) participants had High NOSEP mean value and 7 (18.92%) had Low NOSEP mean value. In Negative blood culture, 9 (19.15%) participants had High NOSEP mean value and 38 (80.85%) had Low NOSEP mean value. With a P value of 0.09, the difference in the fraction of NOSEP average value among serum sample was numerically insignificant. (Table 36)

Table 37: Predictive validity of NOSEP mean value in predicting Blood culture (N=84)

Indicators	Percentage	95% CI	
		Below	Above
Sensitivity	81.08%	64.84%	92.04%
Specificity	80.85%	66.74%	90.85%
False positive rate	19.15%	9.15%	33.26%
False negative rate	18.92%	7.96%	35.16%
Positive predictive value	76.92%	60.67%	88.87%
Negative predictive value	84.44%	70.54%	93.51%
Diagnostic accuracy	80.95%	70.92%	88.70%

In determining Positive blood culture, the NOSEP score demonstrated a sensitivity of 81.08% (95% CI 64.84% to 92.04%). Specificity was 80.85% (95% CI 66.74% to 90.85%), probability of falsely rejected was 19.15% (95% confidence interval 9.15% to 33.26%), probability of incorrect results showing the condition was 18.82% (95% confidence interval 7.96% to 35.16%), probability

of not a true disease was 84.44% (95% confidence interval 70.54% to 93.51%), and overall detection rate was 80.95% (95% CI 70.92% to 88.70%). (Table 37)

DISCUSSION

Discussion

Screening for early infant septicaemia is near to all the difficult aspects of newborn management nowadays. Before time NS diagnosis is essential, but it is also crucial to avoid overusing antibiotics**.**[49] The first week of life are known to be when 75% of neonatal deaths take place.[80] In order to minimise death and rate of disease occurrence in intensive care units, prompt disease severity recognition and intervention are essential.[81]

Over the years, several risk prediction measures have been created and verified, and each is employed to check the results across separate neonatal intensive care units.[62] Early intervention and, consequently, a decrease in death and rate of disease in the NICU are made possible by a score that accurately predicts subsequent clinical deterioration in sick new-borns.[67] Hence this study aimed to evaluate early onset sepsis using Nosocomial sepsis (NOSEP) and modified sick neonatal scoring (MSNS) Scoring.

A cross-sectional study with 173 subjects for final analysis was taken up for the current study. Male participants outnumbered than females (M/F- 84.97%/ 15.03%). More than half of the study population (51.45%) were gestational age more than and equal to 37weeks, followed by 36.42% were gestational age between 32-36 weeks and 12.14% were Gestational Age less than 32 weeks. Nearly 46.82% had birth weight more than 2.49kg, 35.26% had weight at birth ranging from 1.5 to 2.49 kg and 17.92% had weight at birth < 1.5 kg.

Mansoor, K et al.[61] study involved 585 subjects with male proportion of 54.7% and female where 45.3%. gestational age where as follows: preterm where 41%, term where 58.5% and post-term

where only 0.5%, birth weight: normal(>2500gms) where 15.9%,low birth weight (1500-2500gms) where 36.1% and <1500 gms where 48%. In Padar, C et al[67] study involving 248 subjects found male subjects 56% and female 44%, gestational age: less than 32weeks were 5.65%,32-36weeks were 20.95% and ≥ 37weeks were 73.3% ; birth weight were as follows:<1.5kg were 6.5%, 1.5-2.49kg were 26.2%, ≥ 2.5kg were 73.3%.

Components of scoring systems (NOSEP and MSNS)

In the total study population, maximum subjects (67.05%) had respiratory effort between 40-60, followed by 20.81% having apnoea or grunting respiratory effort, and only 12.14% had respiratory effort more than 60. Majority (81.50%) of the study population had heart rate between 100-160 beats /min followed by 12.14% having heartrate more than 160 and only 6.36% had bradycardia heart rate. Most (89.02%) of them had capillary refilling time less than 3 followed by 8.67% had capillary refilling time between 3-5 and 2.31% had capillary refilling time more than 5. Majority (84.39%) of the subjects had random blood sugar levels more than 60 followed by 14.45% having RBS between 40-60 and only 1.16% had RBS levels less than 40. At room air, majority (76.30%) showed SpO2 levels more than 92 followed by 15.61% had SpO2 had between 85-92 and only 8.09% had SpO2 less than 85.

Blood culture and laboratory findings

The blood culture was negative in majority (76.88%) and in 23.14% it was positive. Though indications of systemic infection and a definite blood serum sample are typically indicators of neonatal sepsis (also known as septicaemia), this isn't always the case. Positivity toward culture can range from 20% to 70%. Blood cultures in some developing nations were definite in 30.8%

[77]and 42% [76] instances of formerly verified neonatal blood-poisoning, compared to 20% in the Afroza et al study.[75] Salsabila, K et al[66] study found that of the 242 newborns that met EOS criteria, 83 (34.3%) were culture-proven, with the Provincial Hospital recording the maximum of definite results (76/83; 91.6%). The present study findings were in comparison to Afroza et al study.[75]

The CRP score 5 was found in only 38.73%. The Neutrophils >50% score 3 was found in 39.88%.The Thrombocytopenia score 5 was found in 24.86%.The TPN score 6 was found in 30.06%. The fever score 5 was found in 56.65%.

Among the females, positive blood culture was found in 34.62%, negative was found in 65.38%. Out of 147 Males, 21.09% had positive blood culture and 78.91% showed negative blood culture. The variation in blood serum sample proportions across genders was numerically relevant, with a probability of test results of 0.132. similarly in Rosenberg, R et al[45] study there was no big variation between patients with favourable or unfavourable hospital-acquired infection samples in the ratio of boys (50.9% vs. 49.1%), average measure of pregnancy (in weeks) at admittance (30.8 vs. 30.5 weeks), or average weight at birth (1242.2 vs. 1216.2 g).

Out of 21 participants with >60 Respiratory Effort, 5 (23.81%) were positive blood culture and 16 (76.19%) were negative blood culture. Out of 116 participants with Respiratory Effort between 40 to 60, 12 (10.34%) were positive blood culture and 104 (89.66%) were negative blood culture. Out of 36 participants with Apnea/Grunting Respiratory Effort, 23 (63.89%) were positive blood culture and 13 (36.11%) were negative blood culture. The variation in blood tests outcome

percentage between Respiratory Effort (BPM) was numerically notable with a probability of test results of <0.001.

Out of 11 participants with Bradycardia Heart Rate (beats/mints), 10 (90.91%) were positive blood culture and 1 (9.09%) was negative blood culture. Out of 141 participants with Heart Rate between 100 to 160, 22 (15.6%) were positive blood culture and 119 (84.4%) were negative blood culture. Out of 21 participants with Heart Rate >160, 8 (38.1%) were positive blood culture and 13 (61.9%) were negative blood culture. The variation in blood sample outcome percentage of Heart Rate (beats/mints) was numerically notable with a probability of test results of <0.001.

Out of 154 participants with <3 Capillary Refilling Time, 30 (19.48%) were positive blood culture and 124 (80.52%) were negative blood culture. Out of 15 participants with Capillary Refilling Time between 3 to 5, 6 (40%) were positive blood culture and 9 (60%) were negative blood culture. Out of 4 participants with >5 Capillary Refilling Time, all of them 4 (100%) were positive blood culture.

Out of 2 participants with <40 Random Blood Sugar (mg/dl), all of them 2 (100%) participants were positive blood culture. Out of 25 participants with Random Blood Sugar between 40 to 60, 16 (64%) had definite results from blood tests and 9 (36%) had opposing results from blood tests. Out of 146 participants with >60 Random Blood Sugar, 22 (15.07%) participants were positive blood culture and 124 (84.93%) were negative blood culture.

Out of 14 participants with <85 Spo2 (In Room Air), 10 (90.91%) were positive blood culture and 1 (9.09%) was negative blood culture. Out of 141 participants with Heart Rate between 100 to 160, 22 (15.6%) were positive blood culture and 119 (84.4%) were negative blood culture. Out of 21 participants with Heart Rate >160, 8 (38.1%) were positive blood culture and 13 (61.9%) were negative blood culture. The variation in blood culture percentage among oxygen saturation-SpO2 was numerically relevant, with a probability of test results of 0.001. As a result, the study discovered that lower oxygen saturation-Spo2 was connected with definite blood serum sample.

From 21 participants with a measure of pregnancy <32 weeks, 18 (85.71%) participants had definite results from blood tests and had opposing results from blood tests 3 (14.29%) had opposing results from blood tests. Out of 63 participants with Gestational Age between 32 to 36, 19 (30.16%) were positive blood culture and 44 (69.84%) were negative blood culture. Out of 89 participants with Gestational Age >37 weeks, 3 (3.37%) were positive blood culture and 86 (96.63%) were negative blood culture. The variation in blood sample percentage among measures of pregnancy (in weeks) was numerically notable, with a P value of <0.001. Hence this study found lesser gestational age (less than 32weeks) with significant positivity. Numerous variables influenced neonatal sepsis. Compared to term newborns, premature infants had a 3.36 times increased risk of developing neonatal blood-poisoning. This result is consistent with research from Tanzania[82], the United States[83], and Afghanistan [84]. Based on a concept, premature infants' underdeveloped immune systems (low neutrophil storage) and body fluids that inhibit the growth of bacteria might be the reason. As a result, medical professionals when undertaking treatments such as invasive therapy and being vulnerable to nosocomial infections, infants are highly susceptible to develop neonatal illnesses. During sepsis, the bone marrow reserve is rapidly

depleted. Immune replacement therapies are now being studied extensively to treat preterm babies' immune deficiencies and stop infections from spreading to the newborns.[69]

Mansoor A et al.[61] study found a significant positivity of sepsis in gestational age less than 32weeks where they have assessed this variable with mortality and hospital discharge. However, in our study we only have assessed the association gestational age with positivity of blood culture and not with mortality as we did not encounter mortality.

Out of 31 participants with Birth Weight <1.5 kg, 18 (58.06%) participants were positive blood culture and 13 (41.94%) were negative blood culture. Out of 61 participants with Birth Weight between 1.5 to 2.49 kg, 15 (24.59%) were positive blood culture and 46 (75.41%) were negative blood culture. Out of 81 participants with Birth Weight 2.49 kg and above, 7 (8.64%) were positive blood culture and 74 (91.36%) were negative blood culture. The variation in blood sample percentage of weight at birth (in kg) was numerically notable with a probability of test results <0.001. Numerous effects was tested on neonates who were preterm/very preterm and/or LBW/VLBW.[43,44,48,52] According to three studies done in the past, NS was more frequent in patients who were preterm and/or LBW. [46,51,85] The assessment in this population is very beneficial because neonates, particularly groups at an increased risk of death for delayed blood poisoning (late onset sepsis), make up a significant portion of premature and LBW patients. These infants do not, however, react to blood-poisoning as fully-term infants do. For instance, pyrexia is less common in early born infants, and hematological response change with years and weight at birth. This study found low birth weight with significant proportion of positive blood culture.

Out of 67 participants with CRP Score 5, 40 (59.7%) participants were positive blood culture and 27 (40.3%) were negative blood culture. Khan, F et al[70] found that when compared to late-onset sepsis, the detection accuracy of capillary refilling time in early-onset newborn sepsis is poor. However, a research by Sodani, S et al[71] compared the validity of capillary refilling time and blood cultures to predict acute neonate sepsis found that CRP to be very useful (For capillary refilling time, the responsiveness, precision, positive and negative predictive values, and detection rate were 86.7%, 43%, 45.5%, 85%, and 69%, correspondingly.) compared to blood cultures(n=148 diagnosed with neonatal sepsis, 53 showed positive for blood culture and 101 positive for CRP). Our study assessed the early onset of sepsis in neonates and found inconclusive results.

Out of 69 participants with Neutrophils Score 3, 56.52% participants had definite results from blood tests and and 43.48% had opposing results from blood tests. The variation in the blood sample percentage of Neutrophils was numerically relevant, with a probability of test results < 0.001.

Out of 43 participants with Thrombocytopenia <550X 509 /L Score 5, 24 (55.81%) participants were positive blood culture and 19 (44.19%) were negative blood culture. The difference in the proportion blood culture between Thrombocytopenia <550X 509 /L was numerically relevant with a probability of test results <0.001.

Out of 52 participants with TPN >64 Days, 18 (34.62%) participants were positive blood culture and 34 (65.38%) were negative blood culture. The difference in the proportion blood culture between TPN >64 Days was numerically relevant with probability of test results 0.019.

Out of 98 participants with Fever score 5, 32 (32.65%) participants were positive blood culture and 66 (67.35%) were negative blood culture. The variations in blood sample percentage of pyrexia were numerically relevant with a probability of test results <0.001.

NOSEP score

In the research subjects, the average nosocomial sepsis intend value was 8.96 ± 6.17, with a lowest score of 0.0 and a highest score of 24. (95% CI 8.04 to 9.88).

The mean NOSEP mean value with positive blood culture was 17.73 ± 6.69 and 6.34 ± 2.32 in Negative blood culture. The mean difference NOSEP mean value in Blood culture was numerically relevant with P value <0.001. Higher mean score of NOSEP indicated positivity of blood culture. There was very good predictive validity for NOSEP score in predicting blood culture (AUC 0.949) and the association was numerically relevant (P value <0.001)

In Positive blood culture, 30 (81.08%) participants had High NOSEP mean value and 7 (18.92%) had Low NOSEP mean value. In Negative blood culture, 9 (19.15%) participants had High NOSEP mean value and 38 (80.85%) had Low NOSEP mean value. With a P value of 0.09, the variation in the fraction of nosocomial sepsis score average value between Blood Culture was statistically insignificant.

In forecasting a definite blood sample, the nosocomial sepsis score demonstrated a responsiveness of 81.08% (95% CI 64.84% to 92.04%). Precision was 80.85% (95% CI 66.74% to 90.85%), the false positive rate was 19.15% (95% CI 9.15% to 33.26%), the false negative rate was 18.82%

(95% CI 7.96% to 35.16%), probability of not a true disease was 84.44% (95% CI 70.54% to 93.51%), and cumulative detection rate was 80.95% (95% CI 70.92% to 88.70%).

In order to foretell nosocomial sepsis, three hematologic parameters- blood sample, one clinical indication, and one epidemiological variable were used, Mahieu et al.[73] created the NOSEP scoring system. These variables included capillary refilling time of more than 14 mg/l, a neutrophil fraction of 450%, low levels of platelets 5150.000/mm3, pyrexia 438.28C, and 2-week contact to parenteral feeding alternatives. Dalgic, N et al.[3] found that the nosocomial sepsis grading system's responsiveness, precision, probability of true disease and negative predictive value (NPV) were 64, 58, 45, and 75%, respectively.

MSNS scoring

Only a fundamental set of criteria that may be measured properly with minimum practice are included in MSNS. The mean MSNS score was 12.79 ± 3.01 in the study population. The average modified sick newborns score definite blood serum results was 8.73 ± 1.93 and it was 14.01 ± 2.05 in Negative blood culture. The mean difference MSNS score in Blood culture was numerically relevant with probability of test results of <0.001. The MSNS score had extremely strong statistical accuracy in forecasting blood serum sample (AUC 0.977), and the relationship was numerically notable (P value 0.001). In Positive blood culture, 38 (95%) participants had low MSNS score and 21 (15.79%) had high MSNS score. In Negative blood culture, 21 (15.79%) participants had low MSNS score and 112 (84.21%) had high MSNS score. With P value 0.09the mean difference in the Modified Sick Newborn Score among blood serum sample was numerically relevant.

The modified sick newborns score predicted Positive blood culture with a responsiveness of 95.00% (95% CI 83.08% to 99.39%). Precision was 84.21% (95% CI 76.88% to 89.95%), probability of falsely rejected was 15.79% (95% confidence interval10.05% to 23.12%), probability of incorrect results indicating the condition was 5.00% (95% confidence interval 0.61% to 16.92%), probability of not a true disease was 98.25% (95% confidence interval 93.81% to 99.79%), and overall detection rate was 86.71% (95% CI 80.72% to 91.38%).

Despite its simplicity, Padar, C et al [67] study showed fair sensitivity (88.24%), precision (95.24%) and negative predictive value (99%) are also high. They discovered that a precision and responsiveness ratio of 10 had been a strong determinant of death. Mansoor et al. [61] study with an ideal cut-off score of 10, modified sick newborn score had a responsiveness of 80% and a precision of 88.8% when predicting mortality. The ROC curve's area under it had a value of 0.913 (95% confidence interval: 0.879–0.946), this is equivalent to the commonly employed SNAP-II method score for assessing the severity of neonatal diseases.[86,87] In comparison to SNS, the primary grading system used in the current study, MSNS had higher sensitivity and specificity. SNS had at a designated limit of 8, the responsiveness is 58.3% and the precision is 52.7%. However, SNS was only examined in babies that were transported, whereas the present investigation additionally evaluated inborn neonates.[74]

CONCLUSIONS

Conclusions

- A cross-sectional study with 173 subjects for final analysis was taken for the current study. Male participants outnumbered than females (M/F- 84.97%/ 15.03%).
- In the total study population, maximum subjects (67.05%) had respiratory effort between 40-60, followed by 20.81% having apnoea or grunting respiratory effort, and only 12.14% had respiratory effort more than 60.
- Majority (81.50%) of the study population had heart rate between 100-160 beats /min followed by 12.14% having heartrate more than 160 and only 6.36% had bradycardia heart rate.
- Most (89.02%) of them had capillary refilling time less than 3 followed by 8.67% had capillary refilling time between 3-5 and 2.31% had capillary refilling time more than 5.
- Majority (84.39%) of the subjects had random blood sugar levels more than 60 followed by 14.45% having RBS between 40-60 and only 1.16% had RBS levels less than 40.
- At room air, majority (76.30%) showed SpO2 levels more than 92 followed by 15.61% had SpO2 had between 85-92 and only 8.09% had SpO2 less than 85.
- More than half of the study population (51.45%) were gestational age more than and equal to 37weeks, followed by 36.42% were gestational age between 32-36 weeks and 12.14% were Gestational Age less than 32 weeks.
- Nearly 46.82% had birth weight more than 2.49kg, 35.26% had a weight at birth ranging from 1.5 to 2.49 kg, and 17.92% had a weight at birth of < 1.5 kg.
- The mean MSNS score was 12.79 ± 3.01 in the study population.

- The blood culture was negative in majority (76.88%) and in 23.14% it was positive.The CRP score 5 was found in only 38.73%.The Neutrophils >50% score 3 was found in 39.88%.The Thrombocytopenia score 5 was found in 24.86%.The TPN score 6 was found in 30.06%. The fever score 5 was found in 56.65%.
- The mean NOSEP mean value was 8.96 ± 6.17 in the research subjects, the lower limit was 0.0 and the greatest limit was 24. (95% CI 8.04 to 9.88).
- Among the females, positive blood culture was found in 34.62%, negative was found in 65.38%. Out of 147 Males, 21.09% had positive blood culture and 78.91% showed negative blood culture. The variation in blood tests outcome percentage between gender was numerically notable with a probability of test results of 0.132.
- Out of 21 participants with >60 Respiratory Effort, 5 (23.81%) were positive blood culture and 16 (76.19%) were negative blood culture. Out of 116 participants with Respiratory Effort between 40 to 60, 12 (10.34%) were positive blood culture and 104 (89.66%) were negative blood culture. Out of 36 participants with Apnea/Grunting Respiratory Effort, 23 (63.89%) were positive blood culture and 13 (36.11%) were negative blood culture. The variation in blood tests outcome percentage between Respiratory Effort (BPM) was numerically notable with a probability of test results of <0.001.
- Out of 11 participants with Bradycardia Heart Rate (beats/mints), 10 (90.91%) were positive blood culture and 1 (9.09%) was negative blood culture. Out of 141 participants with Heart Rate between 100 to 160, 22 (15.6%) were positive blood culture and 119 (84.4%) were negative blood culture. Out of 21 participants with Heart Rate >160, 8 (38.1%) were positive blood culture and 13 (61.9%) were negative blood culture. T The variation in blood sample outcome percentage of Heart Rate (beats/mints) was numerically notable with a probability of test results <0.001.

- Out of 154 participants with <3 Capillary Refilling Time, 30 (19.48%) were positive blood culture and 124 (80.52%) were negative blood culture. Out of 15 participants with Capillary Refilling Time between 3 to 5, 6 (40%) had definite results from blood tests and 9 (60%) had opposing results from blood tests. Out of 4 participants with >5 Capillary Refilling Time, all of them 4 (100%) were positive blood culture.
- Out of 2 participants with <40 Random Blood Sugar (mg/dl), all of them 2 (100%) participants were positive blood culture. Out of 25 participants with Random Blood Sugar between 40 to 60, 16 (64%) had definite results from blood tests and 9 (36%) had opposing results from blood tests. Of 146 participants with >60 Random Blood Sugar, 22 (15.07%) participants were positive blood culture and 124 (84.93%) were negative blood culture.
- Out of 14 participants with <85 Spo2 (In Room Air), 10 (90.91%) had definite results from blood tests and 1 (9.09%) had opposing results from blood tests. Of 141 participants with Heart Rate between 100 to 160, 22 (15.6%) were positive blood culture and 119 (84.4%) were negative blood culture. Out of 21 participants with Heart Rate >160, 8 (38.1%) were positive blood culture and 13 (61.9%) were negative blood culture. The variation in serum samples' percentage of oxygen saturation-SpO2 was numerically notable, with a probability of test results of <0.001.

- Of the 21 patients with a measure of pregnant of 32 weeks, 18 (85.71%) had definite results from blood tests and 3 (14.29%) had opposing results from blood tests. Out of 63 participants with Gestational Age between 32 to 36, 19 (30.16%) were positive blood culture and 44 (69.84%) were negative blood culture. Out of 89 participants with Gestational Age >37 weeks, 3 (3.37%) were positive blood culture and 86 (96.63%) were

negative blood culture. The variation in blood sample percentage among measures of pregnancy (in weeks) was numerically notable, with a probability of test results of <0.001

- Out of 31 participants with Birth Weight <1.5 kg, 18 (58.06%) participants were positive blood culture and 13 (41.94%) were negative blood culture. Out of 61 participants with Birth Weight between 1.5 to 2.49 kg, 15 (24.59%) were positive blood culture and 46 (75.41%) were negative blood culture. Out of 81 participants with Birth Weight 2.49 kg and above, 7 (8.64%) were positive blood culture and 74 (91.36%) were negative blood culture. The difference in the proportion blood culture between Birth Weight (in kg) was numerically relevant with a P value <0.001.
- Out of 67 participants with CRP Score 5, 40 (59.7%) participants were positive blood culture and 27 (40.3%) were negative blood culture.
- Out of 69 participants with Neutrophils Score 3, 39 (56.52%) participants were positive blood culture and 30 (43.48%) were negative blood culture. The variation in the blood sample percentage of Neutrophils was numerically relevant, with a probability of test results of < 0.001
- Thrombocytopenia <550X 509 /L Score 5 was seen in total 43 subjects, 24 (55.81%) participants were positive blood culture and 19 (44.19%) were negative blood culture. The difference in the proportion blood culture between Thrombocytopenia <550X 509 /L was numerically consequential with a P value <0.001.
- Out of 52 participants with TPN >64 Days, 18 (34.62%) participants were positive blood culture and 34 (65.38%) were negative blood culture. The difference in the proportion blood culture between TPN >64 Days was numerically notable with a P value 0.019.

- Out of 98 participants with Fever score 5, 32 (32.65%) participants were positive blood culture and 66 (67.35%) were negative blood culture. The variations in blood sample percentage of pyrexia were numerically relevant with a P value <0.001.
- The mean MSNS score with in Positive blood culture was 8.73 ± 1.93 and it was 14.01 ± 2.05 in Negative blood culture. The mean difference MSNS score in Blood culture was numerically notable with P value <0.001.
- The average nosocomial sepsis intend value with in Positive blood culture was 17.73 ± 6.69 and it was 6.34 ± 2.32 in Negative blood culture. The mean difference NOSEP mean value in Blood culture was numerically relevant with a probability of test results of <0.001.
- The MSNS score had extremely strong statistical accuracy in forecasting blood serum sample (AUC 0.977), and the relationship was numerically notable a probability of test results of 0.001.
- In Positive blood culture, 38 (95%) participants had low MSNS score and 21 (15.79%) had high MSNS score. In Negative blood culture, 21 (15.79%) participants had low MSNS score and 112 (84.21%) had high MSNS score. With P value 0.09the mean difference in the Modified Sick Newborn Score among blood serum sample was numerically relevant.
- The Modified Sick Newborn Score score predicted Positive blood culture with responsiveness of 95.00% (95% CI 83.08% to 99.39%). Precision was 84.21% (95% CI 76.88% to 89.95%), probability of falsely rejected
- Probability of incorrect results indicating the condition. Probability of not a true disease result was 15.79% (95% confidence interval 10.05% to 23.12%), probability of falsely rejected. probability of incorrect results indicating the condition. probability of not a true disease was 5.00% (95% confidence interval 0.61% to 16.92%), probability of falsely

rejected probability of incorrect results indicating the condition probability of not a true disease was 98.25% (95% confidence interval 93.81% to 99.79%), and gross detection rate was 86.71% (95% CI 80.72% to 91.38%).

- There was very good predictive validity for NOSEP score in predicting blood culture (AUC 0.949) and the association was numerically relevant (P value <0.001)
- In Positive blood culture, 30 (81.08%) participants had High NOSEP mean value and 7 (18.92%) had Low NOSEP mean value. In Negative blood culture, 9 (19.15%) participants had High NOSEP mean value and 38 (80.85%) had Low NOSEP mean value. With a P value of 0.09, the variation in the fraction of nosocomial sepsis score average value between Blood Culture was statistically insignificant.

- The nosocomial sepsis score predicted Positive blood culture with a responsiveness of 81.08% (95% CI 64.84% to 92.04%). Precision was 80.85% (95% CI 66.74% to 90.85%), probability of falsely rejected results was 19.15% (95% confidence interval 9.15% to 33.26%), probability of incorrect results indicating the condition was 18.82% (95% confidence interval 7.96% to 35.16%), probability of not a true disease was 84.44% (95% CI 70.54% to 93.51%), and overall detection rate was 80.95% (95% CI 70.92% to 88.70%).

Limitations and recommendations

- One disadvantage of the Modified sick newborn score is that it neglects threats including intra-amniotic infection, stages of labour and delivery, maternal diabetes, high blood pressure, proper care of pregnant women, and prenatal steroid therapy.
- Though, a low MSNS score may also be linked to the existence of such risk factors. Serial scoring might have given more information because the scoring was only done once, at admission.
- Additionally, complications such as nosocomial infections may have increased alarmingly across neonates with higher Modified Sick Newborn Score grades at admittance.
- These might have had an impact on the score's capacity for prediction.
- Before being put into practice, the study needs extensive validation because it was a single-center study.
- Future research is also required to confirm applicability in various contexts.

SUMMARY

Summary

Neonatal illness severity rating systems are necessary for prognostic information to parents of admitted babies with prognostic information and conduct systematic comparisons among the activities of different components. For resource-constrained environments without tests like potential of hydrogen-to specify acid/base, Horowitz ind3ex, an excess amount of base in blood, and existing scoring systems are inappropriate. The Modified Sick Newborn Score (MSNS) and NOSEP, an indicator of the intensity of neonatal disorders developed for resource-limited contexts, were the focus of this study.

A cross-sectional study with 173 subjects for final analysis taken up for the current study. Male participants outnumbered than females (M/F- 84.97%/ 15.03%). The mean MSNS score was 12.79 ± 3.01 in the study population. The blood culture was negative in majority (76.88%) and in 23.14% it was positive. With a P value of 0.001, the variation in the percentage of serum sample among Respiratory Effort (BPM) was numerically relevant. The difference in the proportion of blood culture between pulse rate (beats/mints) was numerically relevant with a P value <0.001. Greater (>5) time for capillary refilling found significant positive blood culture. The variation in serum samples' percentage of oxygen saturation-SpO2 was numerically notable, with a probability of test results of 0.001 The variation in blood sample percentage among measures of pregnancy (in weeks) was numerically notable, with a probability of test results of 0.001. The variation in blood sample percentage among weight at birth (in kg) was numerically notable, with a probability of test results of <0.001. The variation in blood sample percentage among neutrophils was numerically notable, with a P value of <0.001. The variation in blood sample percentage among Thrombocytopenia <550X 509 /L was numerically notable, with a probability of test results of

<0.001. The variation in blood sample percentage among TPN >64 Days was numerically notable with a probability of test results of 0.019. The variation in blood sample percentage among pyrexia was numerically notable with a probability of test results <0.001. As a result, there were substantial differences in neutrophils, low birth weight, a measure of pregnancy <37 weeks, pyrexia, thrombocytopenia, TPN, and serum sample (P value 0.001).

The average Modified Sick Newborn Score with definite blood serum sample was 8.73 ± 1.93 and it was 14.01 ± 2.05 in Negative blood culture. The mean difference MSNS score in Blood culture was numerically consequential with a P value <0.001. The average NOSEP intend value with positive blood culture was 17.73 ± 6.69 and 6.34 ± 2.32 in Negative blood culture. The mean difference NOSEP mean value in Blood culture was statistically significant with P value <0.001. Modified Sick Newborn Score has strong statistical value in determining blood serum sample (AUC 0.977) and the association was numerically consequential with a probability of test results <0.001. Lower scores of NOSEP found to be associated with positivity of blood cultures.

In Positive blood culture, 38 (95%) participants had low MSNS score and 21 (15.79%) had high MSNS score. In Negative blood culture, 21 (15.79%) participants had low MSNS score and 112 (84.21%) had high MSNS score. With probability of test results 0.09the mean difference in the Modified Sick Newborn Score among blood serum sample was numerically relevant.

The Modified Sick Newborn Score predicted Positive blood culture with a responsiveness of 95.00%. probability of true disease was 64.41%, probability of not a true disease was 98.25%, and overall detection rate was 86.71%.

There was very good predictive validity for NOSEP score in predicting blood culture (AUC 0.949) and the association was numerically relevant (P value <0.001).

In Positive blood culture, 30 (81.08%) participants had High NOSEP mean value and 7 (18.92%) had Low NOSEP mean value. In Negative blood culture, 9 (19.15%) participants had High NOSEP mean value and 38 (80.85%) had Low NOSEP mean value. With a P value of 0.09, the variation in the fraction of nosocomial sepsis score average value between Blood Culture was statistically insignificant.

The nosocomial sepsis score predicted Positive blood culture with an accuracy of 81.08 probability of true disease was 76.92%, probability of not a true disease was 84.44%, and cumulative detection rate was 80.95%.

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ANNEXURES

A study of early identification of sepsis using NOSOCOMIAL SEPSIS(NOSEP) scoring and MODIFIED SICK NEONATAL SCORING (MSNS) – An Observational Cross Sectional study

PROFORMA

- **Name:**
- **Sex:**
- **Referred: Y/N**

- **Respiratory effort: 0(Apnea/grunting)**

  1(RR>60)

  2(RR-40 to 60)

- **Heart rate: 0(Bradycardia/asystole)**

  1(HR->160

  2(HR-100-160)

- **Axillary temperature: 0**

  1

  2

- **Capillary refilling time: 0(>5)**

  1(3-5)

  2(<3)

- **Random blood sugar: 0(<40)**

  1(40-60)

  2(>60)

- **SpO2 (in room air): 0(<85)**

  1(85-92)

  2(>92)

- **Gestational age:** **0(<32)**

  1(32-36)

  2(37)

- **Birth weight:** **0(<1.5)**

  1(1.5-2.49)

  2(2.49 and above)

MSNS SCORE:

DIAGNOSTIC ITEM POINT SCORE

- **CRP >14mg/L- YES: 5 ; NO: 0**
- **Neutrophils >50%- YES: 3 ; NO: 0**
- **Thrombocytopenia <150x 109 /L- YES: 5 ; NO: 0**
- **TPN >_14 DAYS- YES: 6 ; NO: 0**
- **Fever >38.2 C ,100.8F- YES: 5 ; NO: 0**

NOSEP VALUE:

PATIENT INFORMATION SHEET

A study of early identification of sepsis using NOSOCOMIAL (NOSEP) scoring and MODIFIED SICK NEONATAL SCORING (MSNS) – An Observational Cross-Sectional study.

Principal investigator: Dr CHEVVA PRAKASH REDDY/Dr. BEERE GOWDA .Y.C

I Dr. CHEVVA PRAKASH REDDY, Post graduate student in Department at Sri Devraj Urs Medical College, will be conducting a study titled **"- A study of early identification of sepsis using NOSOCOMINAL (NOSEP) scoring and MODIFIED SICK NEONATAL SCORING(MSNS) – An Observational Cross Sectional study"** for my dissertation under the guidance of Dr.BEERE GOWDA.Y.C, Professor of Department of Paediatrics. The participants of this study include 174 neonates satisfying the inclusion criteria admitted in NICU and SNCU of R.L Jalappa Hospital.

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-

Date-

INFORMED CONSENT FORM

Date:

I, Mr/Mrs _____ ,have been explained in my own vernacular language that my child will be included in **A study of early identification of sepsis using NOSOCOMIAL (NOSEP) scoring and MODIFIED SICK NEONATAL SCORING (MSNS) – An Observational Cross Sectional 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. Attendant) (Signature/Thumb impression & Name of Patient/Guardian)

(Relation with patient)

Witness:

_____

(Signature & Name of Research person/doctor)

ಮಾಹಿತಿ ಕಾನ್ಸೆಂಟ್ ಫಾರ್ಮ್

ದಿನಾಂಕ:

ನಾನು, ಶ್ರೀ / ಶ್ರೀಮತಿ _____, ನನ್ನ ಮಗುವನ್ನು ಸೇರಿಸಲಾಗುವುದು ಎಂದು ನನ್ನ ಸ್ವಂತ ಸ್ಥಳೀಯ ಭಾಷೆಯಲ್ಲಿ ವಿವರಿಸಲಾಗಿದೆ, ನೋಸೊಕೊಮಿಯಲ್ (ನೋಸೆಪ್) ಸ್ಕೋರಿಂಗ್ ಮತ್ತು ಮಾರ್ಪಡಿಸಿದ ಸಿಕ್ ನಿಯೋನಾಟಲ್ ಸ್ಕೋರಿಂಗ್ (ಎಂಎಸ್ಎನ್ಎಸ್) ಅನ್ನು ಬಳಸಿಕೊಂಡು ಸೆಪ್ಸಿಸ್ ಅನ್ನು ಮೊದಲೇ ಗುರುತಿಸುವ ಅಧ್ಯಯನದಲ್ಲಿ - ಒಂದು ಅವಲೋಕನ ಕ್ರಾಸ್ ಸೆಕ್ಷನಲ್ ಅಧ್ಯಯನ. ಹೆಮಟೊಲಾಜಿಕಲ್ ಮತ್ತು ಕ್ಲಿನಿಕಲ್ ನಿಯತಾಂಕಗಳ ಅವಲೋಕನಗಳನ್ನು ದಾಖಲಿಸಲು ಯಾವುದೇ ಬಲ ಅಥವಾ ಪೂರ್ವಾಗ್ರಹವಿಲ್ಲದೆ ನನ್ನ ಮಾನ್ಯ ಲಿಖಿತ ತಿಳುವಳಿಕೆಯ ಒಪ್ಪಿಗೆಯನ್ನು ಈ ಮೂಲಕ ನೀಡುತ್ತೇನೆ. ಒಳಗೊಂಡಿರುವ ಸ್ವರೂಪ ಮತ್ತು ಅಪಾಯಗಳನ್ನು ನನ್ನ ತೃಪ್ತಿಗೆ ವಿವರಿಸಲಾಗಿದೆ. ನಡೆಸುತ್ತಿರುವ ಅಧ್ಯಯನದ ಬಗ್ಗೆ ನನಗೆ ವಿವರವಾಗಿ ವಿವರಿಸಲಾಗಿದೆ. ನಾನು ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆಯನ್ನು ಓದಿದ್ದೇನೆ ಮತ್ತು ಯಾವುದೇ ಪ್ರಶ್ನೆ ಕೇಳುವ ಅವಕಾಶ ನನಗೆ ಸಿಕ್ಕಿದೆ. ನಾನು ಕೇಳಿದ ಯಾವುದೇ ಪ್ರಶ್ನೆಗೆ ನನ್ನ ತೃಪ್ತಿಗೆ ಉತ್ತರಿಸಲಾಗಿದೆ. ಈ ಸಂಶೋಧನೆಯಲ್ಲಿ ನನ್ನ ಮಗುವಿಗೆ ಪಾಲ್ಗೊಳ್ಳಲು ನಾನು ಸ್ವಯಂಪ್ರೇರಣೆಯಿಂದ ಒಪ್ಪಿಗೆ ನೀಡುತ್ತೇನೆ. ಇತಿಹಾಸವನ್ನು ಒದಗಿಸಲು, ದೈಹಿಕ ಪರೀಕ್ಷೆಗೆ ಒಳಗಾಗಲು, ಕಾರ್ಯವಿಧಾನಕ್ಕೆ ಒಳಗಾಗಲು, ತನಿಖೆಗೆ ಒಳಗಾಗಲು ಮತ್ತು ಅದರ ಫಲಿತಾಂಶಗಳು ಮತ್ತು ದಾಖಲೆಗಳನ್ನು ವೈದ್ಯರಿಗೆ / ಸಂಸ್ಥೆಗೆ ಒದಗಿಸಲು ನಾನು ಈ ಮೂಲಕ ಒಪ್ಪಿಗೆ ನೀಡುತ್ತೇನೆ. ಶೈಕ್ಷಣಿಕ ಮತ್ತು ವೈಜ್ಞಾನಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಕಾರ್ಯಾಚರಣೆ / ಕಾರ್ಯವಿಧಾನ ಇತ್ಯಾದಿಗಳನ್ನು ವೀಡಿಯೊ ಗ್ರಾಫ್ ಅಥವಾ .ಾಯಾಚಿತ್ರ ತೆಗೆಯಬಹುದು. ಎಲ್ಲಾ ಡೇಟಾವನ್ನು ಯಾವುದೇ ಶೈಕ್ಷಣಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಪ್ರಕಟಿಸಬಹುದು ಅಥವಾ ಬಳಸಬಹುದು. ಕಾರ್ಯವಿಧಾನ / ಅಧ್ಯಯನದ ಸಮಯದಲ್ಲಿ ಯಾವುದೇ ಅಹಿತಕರ ಪರಿಣಾಮಗಳಿಗೆ ನಾನು ವೈದ್ಯರು / ಸಂಸ್ಥೆ ಇತ್ಯಾದಿಗಳನ್ನು ಹೊಣೆಗಾರರನ್ನಾಗಿ ಮಾಡುವುದಿಲ್ಲ.

_____ _____

(ಪಂ. ಅಟೆಂಡೆಂಟ್‌ನ ಸಹಿ ಮತ್ತು ಹೆಸರು) (ಸಹಿ / ಹೆಬ್ಬೆರಳು ಅನಿಸಿಕೆ &

ರೋಗಿಯ ಹೆಸರು / ರಕ್ಷಕ)

(ರೋಗಿಯೊಂದಿಗಿನ ಸಂಬಂಧ)

ಸಾಕ್ಷಿ:

ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆ

ನೊಸೊಕೊಮಿಯಲ್ (ನೋಸೆಪ್) ಸ್ಕೋರಿಂಗ್ ಮತ್ತು ಮಾರ್ಪಡಿಸಿದ ಸಿಕ್ ನಿಯೋನಾಟಲ್ ಸ್ಕೋರಿಂಗ್ (ಎಂಎಸ್ಎನ್ಎಸ್) ಅನ್ನು ಬಳಸಿಕೊಂಡು ಸೆಪ್ಸಿಸ್ನ ಆರಂಭಿಕ ಗುರುತಿಸುವಿಕೆಯ ಅಧ್ಯಯನ - ಒಂದು ಅವಲೋಕನ ಕ್ರಾಸ್ ವಿಭಾಗೀಯ ಅಧ್ಯಯನ.

ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿ: ಡಾ.ಚೇವವ ಪ್ರಕಾಶ್ ರೆಡ್ಡಿ / ಡಾ. ಬಿಯರ್ ಗೌಡ .ವೈ.ಸಿ
ಶ್ರೀ ದೇವರಾಜ್ ಉರ್ಸ್ ಮೆಡಿಕಲ್ ಕಾಲೇಜಿನಲ್ಲಿ ವಿಭಾಗದಲ್ಲಿ ಸ್ನಾತಕೋತ್ತರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿ ಡಾ. ಪೀಡಿಯಾಟ್ರಿಕ್ಸ್ ವಿಭಾಗದ ಪ್ರಾಧ್ಯಾಪಕ ಡಾ.ಬೀರ್ ಗೌಡ.ವೈಸಿ ಅವರ ಮಾರ್ಗದರ್ಶನದಲ್ಲಿ ನನ್ನ ಪ್ರಬಂಧಕ್ಕಾಗಿ ತೃತೀಯ ಆರೈಕೆ ಕೇಂದ್ರದಲ್ಲಿ ಸೆಪ್ಸಿಸ್ - ಒಂದು ವೀಕ್ಷಣಾ ಅಡ್ಡ ವಿಭಾಗೀಯ ಅಧ್ಯಯನ ". ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವವರು ಆರ್.ಎಲ್ ಜಲಪ್ಪ ಆಸ್ಪತ್ರೆಯ ಎನ್ಐಸಿಯು ಮತ್ತು ಎಸ್ಎನ್ಸಿಯುನಲ್ಲಿ ದಾಖಲಾದ ಸೇರ್ಪಡೆ ಮಾನದಂಡಗಳನ್ನು ಪೂರೈಸುವ 174 ನಿಯೋನೇಟ್ಗಳನ್ನು ಒಳಗೊಂಡಿದೆ.
ಈ ಸಂಶೋಧನಾ ಯೋಜನೆಯಲ್ಲಿ ನಿಮ್ಮ ಮಗುವಿನ ಭಾಗವಹಿಸುವಿಕೆಗಾಗಿ ನಿಮಗೆ ಯಾವುದೇ ಹಣಕಾಸಿನ ಪರಿಹಾರವನ್ನು ನೀಡಲಾಗುವುದಿಲ್ಲ.
ಎಲ್ಲಾ ಡೇಟಾವನ್ನು ಗೌಪ್ಯವಾಗಿಡಲಾಗುತ್ತದೆ ಮತ್ತು ಈ ಸಂಸ್ಥೆಯು ಸಂಶೋಧನಾ ಉದ್ದೇಶಕ್ಕಾಗಿ ಮಾತ್ರ ಬಳಸುತ್ತದೆ. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ನಿಮ್ಮ ಮಗುವಿನ ಭಾಗವಹಿಸುವಿಕೆಗೆ ನೀವು ಒಪ್ಪಿಗೆ ನೀಡಲು ಮುಕ್ತರಾಗಿದ್ದೀರಿ. ಯಾವುದೇ ಕಾರಣಗಳನ್ನು ನೀಡದೆ ನೀವು ಯಾವುದೇ ಸಮಯದಲ್ಲಿ ನಿಮ್ಮ ಮಗುವನ್ನು ಅಧ್ಯಯನದಿಂದ ಹಿಂತೆಗೆದುಕೊಳ್ಳಬಹುದು. ನೀವು ಭಾಗವಹಿಸಲು ನಿರಾಕರಿಸುವುದರಿಂದ ಈ ಸಂಸ್ಥೆಯಲ್ಲಿ ಯಾವುದೇ ಪ್ರಸ್ತುತ ಅಥವಾ ಭವಿಷ್ಯದ ಆರೈಕೆಗೆ ನೀವು ಪೂರ್ವಾಗ್ರಹ ಮಾಡುವುದಿಲ್ಲ.

ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿಯ ಹೆಸರು ಮತ್ತು ಸಹಿ-

ದಿನಾಂಕ-

Master Chart:

Sr. No	Gender	REFERRAL	Respiratory effort	Heart rate	AXILLARY TEMPERATURE	Capillary refilling time	Random blood sugar	SpO2	Gestational Age	Birth weight	MSNS SCORE	Blood culture positive/negative	CRP >54mg/L(5)	Neutrophils >50%(3)	Thrombocytopenia <550x 500 /L (5)	TPN >_64 DAYS(6)	FEVER	NOSEP MEAN VALUE
1	Male	2	40 to 60	100 to 160	1	<3	>60	>92	32 to 36	1.5 to 2.49	13	Positive	5	0	0	0	5	10
2	Female	1	>60	>160	0	<3	40 to 60	85 to 92	<32	<1.5	7	Positive	5	3	5	6	5	24
3	Male	2	Apnea/grunting	Bradycardia	1	<3	>60	<85	<32	1.5 to 2.49	6	Positive	5	3	0	0	5	13
4	Male	2	Apnea/grunting	Bradycardia	1	3 to 5	>60	>92	32 to 36	<1.5	7	Positive	5	3	5	6	5	24
5	Male	1	Apnea/grunting	100 to 160	1	<3	>60	>92	<32	<1.5	9	Positive	5	3	5	0	5	18
6	Female	2	Apnea/grunting	100 to 160	1	<3	>60	85 to 92	<32	1.5 to 2.49	9	Positive	5	3	0	0	5	13
7	Male	2	Apnea/grunting	Bradycardia	1	<3	>60	<85	<32	<1.5	5	Positive	5	3	5	6	5	24
8	Male	2	Apnea/grunting	100 to 160	2	<3	>60	85 to 92	32 to 36	<1.5	10	Positive	5	3	0	0	5	13
9	Male	2	Apnea/grunting	100 to 160	1	<3	>60	<85	<32	1.5 to 2.49	8	Positive	5	3	5	0	5	18
10	Male	2	Apnea/grunting	Bradycardia	1	<3	40 to 60	85 to 92	32 to 36	1.5 to 2.49	7	Positive	5	3	5	6	5	24
11	Female	2	Apnea/grunting	Bradycardia	2	<3	>60	>92	<32	<1.5	8	Positive	5	3	5	6	5	24
12	Male	2	Apnea/grunting	100 to 160	1	<3	>60	<85	>=37	<1.5	9	Positive	5	3	5	0	5	18
13	Female	2	40 to 60	>160	1	<3	40 to 60	85 to 92	<32	1.5 to 2.49	9	Positive	5	3	5	0	5	18
14	Female	1	>60	100 to 160	1	<3	>60	>92	32 to 36	2.49 and above	13	Positive	5	3	0	0	0	8
15	Male	2	Apnea/grunting	Bradycardia	1	<3	>60	>92	<32	<1.5	7	Positive	5	3	5	6	5	24
16	Male	2	Apnea/grunting	100 to 160	1	>5	40 to 60	85 to 92	32 to 36	1.5 to 2.49	7	Positive	5	3	5	6	5	24
17	Male	1	>60	>160	1	<3	>60	<85	<32	<1.5	7	Positive	5	3	5	6	5	24
18	Female	2	Apnea/grunting	100 to 160	2	3 to 5	>60	>92	32 to 36	1.5 to 2.49	11	Positive	5	3	0	0	5	13
19	Male	1	40 to 60	>160	1	<3	40 to 60	>92	32 to 36	1.5 to 2.49	11	Positive	5	3	0	0	5	13
20	Male	2	Apnea/grunting	100 to 160	1	<3	>60	>92	32 to 36	<1.5	10	Positive	5	3	0	0	0	8

21	Male	2	Apnea/grunting	100 to 160	2	<3	>60	<85	32 to 36	<1.5	9	Positive	5	3	0	0	5	13
22	Male	1	40 to 60	Bradycardia	0	>5	40 to 60	<85	32 to 36	1.5 to 2.49	5	Positive	5	3	5	6	5	24
23	Female	2	40 to 60	100 to 160	1	<3	>60	>92	<32	<1.5	11	Positive	5	3	0	0	0	8
24	Male	1	Apnea/grunting	100 to 160	0	>5	>60	85 to 92	<32	1.5 to 2.49	6	Positive	5	3	5	6	5	24
25	Female	2	>60	100 to 160	1	<3	<40	>92	32 to 36	1.5 to 2.49	10	Positive	5	3	0	0	0	8
26	Male	2	Apnea/grunting	>160	1	<3	>60	>92	>=37	<1.5	10	Positive	5	3	0	0	5	13
27	Male	1	40 to 60	100 to 160	1	3 to 5	40 to 60	>92	32 to 36	<1.5	10	Positive	5	3	0	0	5	13
28	Male	2	Apnea/grunting	100 to 160	0	<3	40 to 60	>92	<32	2.49 and above	9	Positive	5	3	5	6	5	24
29	Male	2	40 to 60	>160	1	3 to 5	40 to 60	<85	<32	2.49 and above	8	Positive	5	3	5	6	5	24
30	Male	2	Apnea/grunting	100 to 160	1	<3	>60	85 to 92	<32	<1.5	8	Positive	5	3	5	6	5	24
31	Male	2	40 to 60	>160	1	<3	40 to 60	>92	32 to 36	2.49 and above	12	Positive	5	3	0	0	0	8
32	Male	2	>60	100 to 160	2	<3	40 to 60	>92	<32	<1.5	10	Positive	5	3	0	0	0	8
33	Female	2	Apnea/grunting	Bradycardia	2	<3	>60	<85	32 to 36	1.5 to 2.49	8	Positive	5	3	5	6	5	24
34	Male	2	40 to 60	100 to 160	2	>5	40 to 60	<85	32 to 36	2.49 and above	10	Positive	5	3	5	0	0	13
35	Male	2	Apnea/grunting	100 to 160	0	<3	40 to 60	<85	>=37	2.49 and above	9	Positive	5	3	5	6	5	24
36	Male	2	40 to 60	>160	1	<3	40 to 60	85 to 92	32 to 36	1.5 to 2.49	10	Positive	5	3	0	0	0	8
37	Male	1	40 to 60	100 to 160	1	3 to 5	<40	<85	<32	1.5 to 2.49	7	Positive	5	3	5	6	5	24
38	Male	2	Apnea/grunting	Bradycardia	1	<3	40 to 60	>92	32 to 36	2.49 and above	9	Positive	5	3	5	0	5	24
39	Male	2	40 to 60	100 to 160	1	3 to 5	40 to 60	<85	<32	<1.5	7	Positive	5	3	5	6	5	24
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41	Male	2	>60	>160	1	<3	>60	>92	>=37	<1.5	11	Negative	5	0	0	0	0	2
42	Male	1	40 to 60	>160	2	<3	>60	>92	32 to 36	2.49 and above	14	Negative	0	0	5	0	0	5
43	Male	2	40 to 60	>160	1	<3	40 to 60	85 to 92	>=37	2.49 and above	12	Negative	5	0	0	0	5	10
44	Female	1	>60	100 to 160	1	<3	>60	>92	>=37	1.5 to 2.49	13	Negative	0	0	0	0	5	5
45	Male	2	40 to 60	100 to 160	2	<3	>60	>92	>=37	2.49 and above	16	Negative	5	0	5	0	0	10
46	Male	2	>60	100 to 160	1	<3	>60	>92	32 to 36	2.49 and above	13	Negative	0	3	0	0	5	8
47	Male	2	Apnea/grunting	100 to 160	1	<3	>60	>92	>=37	2.49 and above	13	Negative	0	0	0	6	0	6
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49	Female	1	40 to 60	100 to 160	1	3 to 5	>60	>92	>=37	2.49 and above	14	Negative	0	0	0	0	5	5
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53	Male	2	>60	100 to 160	2	<3	>60	>92	>=37	1.5 to 2.49	14	Negative	0	0	0	6	0	6
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56	Male	2	Apnea/grunting	>160	2	<3	>60	>92	>=37	2.49 and above	13	Negative	0	0	0	0	0	0
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58	Male	1	40 to 60	100 to 160	1	<3	40 to 60	>92	>=37	2.49 and above	14	Negative	0	0	0	0	5	5
59	Male	1	40 to 60	100 to 160	1	<3	>60	>92	32 to 36	2.49 and above	14	Negative	0	0	0	6	0	6
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61	Female	2	40 to 60	>160	2	<3	>60	>92	32 to 36	2.49 and above	14	Negative	0	3	0	0	0	3
62	Female	2	>60	>160	2	<3	>60	>92	32 to 36	1.5 to 2.49	12	Negative	5	0	0	0	5	10
63	Male	1	40 to 60	100 to 160	1	<3	>60	>92	>=37	2.49 and above	15	Negative	0	0	0	6	0	6
64	Male	2	Apnea/grunting	Bradycardia	2	<3	>60	85 to 92	32 to 36	2.49 and above	10	Negative	5	0	0	0	5	10
65	Male	2	>60	100 to 160	1	<3	>60	>92	32 to 36	2.49 and above	13	Negative	0	0	0	0	0	0
66	Female	2	Apnea/grunting	100 to 160	1	3 to 5	>60	>92	>=37	<1.5	10	Negative	5	0	5	0	0	10
67	Male	2	40 to 60	>160	2	<3	>60	>92	>=37	1.5 to 2.49	30	Negative	0	3	0	0	5	8
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74	Male	1	40 to 60	100 to 160	1	<3	>60	>92	32 to 36	2.49 and above	14	Negative	0	0	0	6	0	6
75	Male	2	Apnea/grunting	100 to 160	2	<3	>60	>92	>=37	1.5 to 2.49	13	Negative	0	0	0	6	0	6
76	Male	1	40 to 60	100 to 160	2	<3	>60	>92	32 to 36	2.49 and above	15	Negative	0	3	0	0	5	8
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107	Male	2	40 to 60	100 to 160	1	<3	>60	>92	32 to 36	2.49 and above	14	Negative	0	0	0	6	0	6
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109	Male	2	40 to 60	100 to 160	1	<3	>60	>92	32 to 36	<1.5	12	Negative	5	0	0	0	5	10
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167	Female	2	40 to 60	100 to 160	2	<3	>60	>92	>=37	1.5 to 2.49	15	Negative	0	0	5	0	0	5
168	Male	2	>60	100 to 160	1	<3	>60	>92	32 to 36	2.49 and above	13	Negative	0	0	0	0	5	5
169	Male	2	40 to 60	100 to 160	2	<3	>60	>92	>=37	1.5 to 2.49	15	Negative	0	3	0	0	0	3
170	Male	2	40 to 60	100 to 160	2	<3	>60	>92	32 to 36	<1.5	13	Negative	0	0	0	6	0	6

171	Male	2	Apnea/grunting	100 to 160	1	<3	>60	>92	32 to 36	2.49 and above	12	Negative	0	0	0	0	5	5
172	Male	2	40 to 60	100 to 160	2	<3	>60	>92	32 to 36	2.49 and above	15	Negative	0	0	0	0	5	5
173	Male	2	40 to 60	100 to 160	1	3 to 5	>60	>92	>=37	1.5 to 2.49	13	Negative	0	0	5	0	0	5