UTILITY OF SEPSIS SCREEN IN SCREENING PROBABLE SEPSIS IN NEONATE AT TERTIARY CARE CENTRE.

Paediatrics

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ABSTRACT

Introduction: A clinical syndrome known as neonatal sepsis is characterised by generalised signs and symptoms associated with infection. If sepsis is verified by microbiological growth on sterile blood cultures or other body fluids, it might be deemed "culture-proven." **Aims And Objectives:** To determine the utility of sepsis screen in screening probable sepsis in neonate. **Material And Methods:** The present prospective observational study was carried out in a tertiary care centre in North India. Included were a total of 100 newborns who were admitted to the NICU and had been diagnosed with sepsis. The data was gathered using a clinical proforma with structure. SPSS version 21.0 was utilised to examine the data that was gathered and entered into a Microsoft Excel spreadsheet. **Result:** Findings indicate that increased sensitivity, specificity, positive predictive value, and negative predictive value are associated with parameters such as CRP, micro-ESR, I/T ratio > 0.2, and two or more positive tests. As indicators of sepsis, CRP, micro-ESR, I/T ratio > 0.2, and two or more positive tests were all statistically significant. **Conclusion:** It is concluded that 84% of newborns had positive results from septic screening. Staphylococcus aureus was the identified bacterium in the blood culture (30%).

KEYWORDS

Neonate, Sepsis, Screening, Infection, Early diagnosis and Newborn.

INTRODUCTION

Neonatal sepsis, also known as sepsis in neonates, is a serious medical illness that affects infants under the age of 28 days. Sepsis can be classified into two categories: Early-onset neonatal sepsis: Sepsis that manifests within the first 72 hours of birth is referred to by most healthcare professionals as early-onset neonatal sepsis. Sepsis developing after three days of life is referred to as late-onset neonatal sepsis.[1]

Approximately 4 million of the 130 million babies born worldwide each year pass away within their first four weeks of life, or the neonatal period. According to estimates, severe infection (26%), birth asphyxia (23%), and preterm delivery (28%), are the leading causes of direct neonatal fatalities.[2]

When body reacts severely to an infection, it might lead to sepsis. An infant who has an infection and develops sepsis can have inflammation throughout their body. Reduced blood flow to neonate's critical organs and limbs results from this inflammation and blood clotting. Organ failure and even death may result from it.[3]

Neonatal sepsis is a clinical condition marked by nonspecific infection-related signs and symptoms. Sepsis can be considered culture-proven if it is confirmed by microbiological growth on sterile blood cultures or other bodily fluids.[4,5]

Conventional microbiologic culture procedures are necessary for the diagnosis of confirmed sepsis, and they can be laborious.[6] When a sick newborn is given with negative blood cultures, many physicians approach these with scepticism despite the great sensitivity in identifying low bacterial loads (1–4 CFU/mL). The term culture-negative or clinical sepsis has resulted in a ten-fold rise in the use of antibiotics in newborns, despite evidence of unintended consequences such as an increased risk of death, bronchopulmonary dysplasia, fungal infections, and necrotizing enterocolitis.[7]

The gold standard for diagnosis is a positive blood culture, but it takes time and requires a fully equipped laboratory. High sensitivity and specificity, cost-effectiveness, and quick results turnaround are all desirable characteristics in a diagnostic test. Absolute neutrophil count, total leukocyte count, micro-erythrocyte sedimentation rate, mature:immature neutrophil ratio, C-reactive protein, and serum direct bilirubin are the criteria that are used. When combined, they serve as a sepsis screen. A positive sepsis screen is defined as the presence of two or more abnormal values in the course of a strong clinical suspicion.[8,9,10] Despite proper treatment with contemporary antibiotics, neonatal septicaemia remains a problem due to its high prevalence and poor prognosis.

AIM:

To determine the utility of sepsis screen in screening probable sepsis in neonate.

MATERIAL AND METHODS

The current prospective observational study was conducted in a tertiary care centre in North India over a period of 06 months (January, 2023 to June, 2023) after obtaining the permission from institutional authorities. A total of 100 neonates admitted to NICU with sign and symptoms of sepsis of diagnosed with sepsis were included in the study after obtaining the informed consent from their guardian.

Inclusion Criteria
1. Neonates with sign and symptoms of sepsis of diagnosed with sepsis.
2. Neonates whose guardians were agree to participate in the present study.

Exclusion Criteria
1. Neonates who received antibiotics earlier.
2. Neonates with congenital abnormalities.
3. The data of neonates who died during the study period.

All the patients were screened for the presence of sepsis with the help of NNF criteria (including malnutrition, agitation or prolonged crying, and lethargic behaviour poor cry and reflexes, fever, hypothermia, jaundice, vomiting, abdominal distension, tachypnoea and grunting, convulsions, diarrhoea, pustules, cyanosis, bulged fontanalle, DIC/bleeding, poor perfusion / shock, apnea.). The laboratory investigation i.e. TLC, I/T ratio (band cell ratio), Absolute neutrophil count, micro-ESR and C-reactive protein. Blood culture was done for all the neonates. Positive sepsis screening was defined as having three or more positive parameters. A structure clinical proforma was used to collect the data. The collected data was recorded in Microsoft Excel sheet and analysed with the help of SPSS version 21.0.

RESULTS AND OBSERVATIONS

In the present prospective observational study, a total of 100 neonates were screened for diagnosing the sepsis. Among them the majority of the study subjects were males (58%) followed by 42% females. The male to female ratio was 1.38:1.

Table 1 Neonatal Parameters

Parameters	Mean±SD	
Gestational age (completed weeks at birth)	37.75±2.92	
Birth weight (kg)	2.3±1.7	
Age at blood sample collection (In hours)	≤ 72	76%

|	≥ 72	24%
On TPN	Yes	2%
	No	98%

Table 1 depicted the parameters of studied neonates. The mean gestational age of neonates at the time of birth was 37.75±2.92 weeks. The mean birth weight of neonates was 2.3±1.7 kg. In majority of cases the blood sample was collected at the age of ≤ 72 hours and only 2% neonates were on total parenteral nutrition.
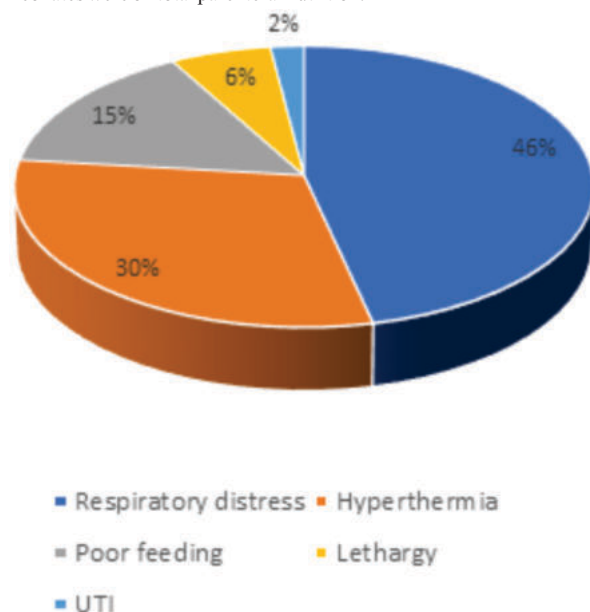
Figure 1. Clinical Manifestations

Figure 1, presented the observed clinical manifestations among studied neonates. It was found that majority of the neonates had respiratory distress (46%) followed by hyperthermia (30%), poor feeding / difficulty in feeding (15%), lethargy (6%) and UTI (2%).
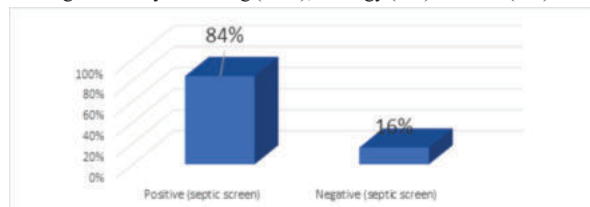

Figure 2. Septic Screening Of The Neonates

Figure 2 shows the blood culture findings of neonates. It was found that septic screening was positive among 84% neonates.

Table 2 Parameters Of Sepsis Screen (in %)

Parameters	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value	P value
CRP (>0.6 mg/dl)	90.1	67.5	63.1	58.2	0.001*
Leucopenia (< 5000/cmm)	52.1	49.5	46.1	51.3	0.23
Neutropenia (> 1750/cmm)	42	52.4	45.1	48	0.15
micro-ESR	81	71	75.1	72.9	0.001*
I/T ratio > 0.2	80	65	81.1	63.4	0.001*
Serum direct bilirubin	47	53	69	72	0.21
Two or more tests positive	89.4	74.3	74	84	0.001*

Table 2 shows the parameters of sepsis screen (in %) and their predictive accuracy. It was found that parameters CRP, micro-ESR, I/T ratio > 0.2 and Two or more tests positive shows the higher sensitivity, specificity, positive predictive value and negative predictive value. All these parameters (CRP, micro-ESR, I/T ratio > 0.2 and Two or more tests positive) were statistically significant as the sepsis parameters.
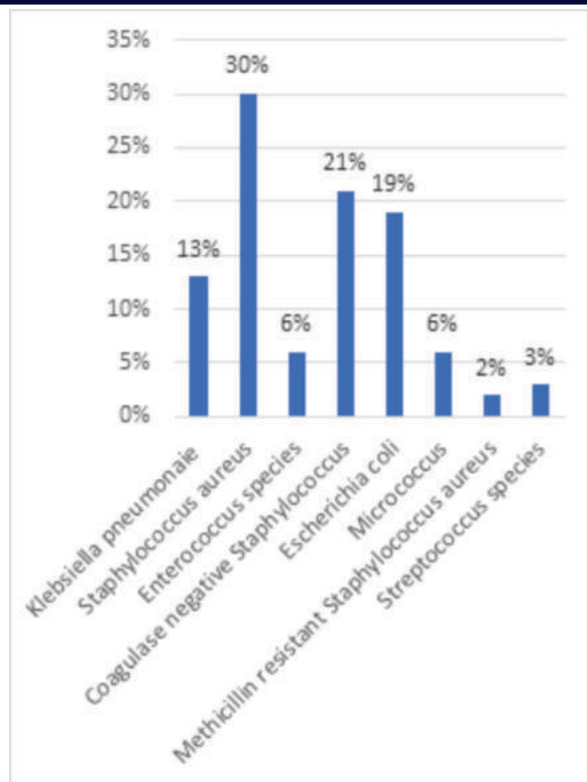
Figure 3. Isolated Microorganism In Blood Culture

It was reported that the most common isolated microorganism in blood culture was Staphylococcus aureus (30%) followed by Coagulase negative Staphylococcus (21%), Escherichia coli (19%), Klebsiella pneumonaie (13%), Enterococcus species & Micrococcus (6% each respectively), Streptococcus species (3%) and Methicillin resistant Staphylococcus aureus (2%) as shown in figure 3.

DISCUSSION

Severe inflammation brought on by a microbial infection that compromises organ function is known as sepsis, and it is a worldwide health concern. When early management is delayed, sepsis—which is defined as systemic inflammatory response syndrome (SIRS) with an infectious process—is linked to high rates of morbidity and mortality.[11] In our study the male to female ratio was 1.38:1. The mean gestational age of neonates at the time of birth was 37.75±2.92 weeks. The mean birth weight of neonates was 2.3±1.7 kg. In majority of cases the blood sample was collected at the age of ≤ 72 hours and only 2% neonates were on total parenteral nutrition. The observed clinical manifestations were respiratory distress (46%) followed by hyperthermia (30%), poor feeding / difficulty in feeding (15%), lethargy (6%) and UTI (2%). These outcomes are correlated with the study done by Fell DB et al. (2017) reported that most of the study subjects were males. The mean gestational age of neonates at the time of birth was 38.86±1.72 weeks. The mean birth weight of neonates was 3,355.01±550.98. In majority of cases the blood sample was collected at the age of ≤ 72 hours.[12] In other study conducted by Misra RN et al. (2013) observed that the commonest clinical manifestation was respiratory distress followed by UTI, umbilical sepsis, etc.[13]

The study reported that septic screening was positive among 84% neonates. The isolated microorganism in blood culture was Staphylococcus aureus (30%) followed by Coagulase negative Staphylococcus (21%), Escherichia coli (19%), Klebsiella pneumonaie (13%), Enterococcus species & Micrococcus (6% each respectively), Streptococcus species (3%) and Methicillin resistant Staphylococcus aureus (2%). Statistically significant sepsis parameters were CRP, micro-ESR, I/T ratio > 0.2 and Two or more tests positive (p≤0.001). These results are comparable with the study performed by Lakhey A et al. (2017) reported that the septic screening was positive among 65.3% neonates The isolated microorganisms were Coagulase positive Staphylococcus (41.7%), Coagulase negative staphylococcus (CONS) (30.6%), Citrobacter (11.1%), Acinitobacter, E coli & Enterobacter (5.5% each respectively). The highest predictive

accuracy was found for CRP and I/T ratio among all sepsis screening measures. As the single parameter CRP per se had the highest sensitivity (77.8%), specificity (66.7%), positive predictive value (68.2%) and the negative predictive value (76.5%). The predictive accuracy of the screening test increased significantly when two or more positive values were combined, even if the CRP and I/T ratio were both statistically significant as the sepsis parameters.[14] In another study conducted by Garland SM et al. (2003) found that When predicting the diagnosis of newborn sepsis, C-reactive protein (CRP)—either by itself or in conjunction with a complete blood examination (FBE) and the microbiology of gastric aspirate—is superior to commonly used infection markers. CRP exhibited a 67.0% sensitivity and an 86.0% negative predictive value (NPV); FBE had a 63.0% sensitivity and an 80.0% NPV; and gastric aspirate had a 57.0% sensitivity and an 83.0% NPV.[15]

CONCLUSION

The present observational study concluded that septic screening was positive among 84% neonates. The isolated microorganism in blood culture was Staphylococcus aureus (30%). The commonest clinical manifestation was respiratory distress. CRP, micro-ESR, I/T ratio > 0.2 and Two or more tests positive were the significant sepsis screening parameters.

REFERENCES

1. Zaidi AK, Ganatra HA, Syed S, Cousens S, Lee AC, Black R, Bhutta ZA, Lawn JE. Effect of case management on neonatal mortality due to sepsis and pneumonia. BMC Public Health. 2011 Apr 13;11 Suppl 3(Suppl 3):S13.
2. Lazarus Monica, J. Seth Riti and Kinnare Amit, B. 2018. Role of Sepsis Screen Parameters in Early Diagnosis of Neonatal Septicemia. Int.J.Curr.Microbiol.App.Sci. 7(01): 2410-2419.
3. Cleveland Clinic. Sepsis in Newborns. 2024. Available at: https://my.clevelandclinic.org/health/diseases/15371-sepsis-in-newborns.
4. Shane AL, Sánchez PJ & Stoll BJ Neonatal Sepsis. Lancet. 2017;390: 1770–1780.
5. Cantey JB & Baird SD Ending the Culture of Culture-Negative Sepsis in the Neonatal Icu. Pediatrics. 2017;140.
6. Jardine L, Davies MW & Faoagali J Incubation Time Required for Neonatal Blood Cultures to Become Positive. J Paediatr Child Health. 2006;42:797–802.
7. Sarkar S, Bhagat I, DeCristofaro JD, Wiswell TE & Spitzer AR A Study of the Role of Multiple Site Blood Cultures in the Evaluation of Neonatal Sepsis. J Perinatol. 2006;26:18–22.
8. Gessner B, Castrodale L, Soriano-Gabarro M. Etiologies and risk factors of neonatal sepsis and pneumonia mortality among Alaskan infants. Epidemiol Infect. 2005;133(5): 877–81.
9. Buch A, Shrivastava, Kumar H, Jadhav P. Evaluation of hematological profile in early diagnosis of clinically suspected cases of neonatal sepsis. Int J BAMS. 2011;1(1):01-06.
10. Bhat R Y AND Rao A. The performance of haematological screening parameters and CRP in early onset neonatal infections. Journal of Clinical and Diagnostic Research. 2010;4:3331-36.
11. Sridharan P, Chamberlain RS. The efficacy of procalcitonin as a biomarker in the management of sepsis: Slaying dragons or tilting at windmills? Surg Infect (Larchmt) 2013;14:489–511.
12. Fell DB, Hawken S, Wong CA, Wilson A, Murphy SQ, Chakraborty P, et al. Using newborn screening analytes to identify cases of neonatal sepsis. Scientific reports. 2017;7:18020.
13. Misra RN, Jadhav SV, Ghosh P, Gandham N, Angadi K, Vyawahare C. Role of sepsis screen in the diagnosis of neonatal sepsis. Med J DY Patil Univ 2013;6:254-7.
14. Lakhey A, Shakya H. Role of sepsis screening in early diagnosis of neonatal sepsis. Journal of Pathology of Nepal. 2017;7:1103-1110.
15. Garland SM, Bowman E. D., Reappraisal of C-reactive protein as a screening tool for neonatal sepsis. Pathology. 2003; 35(3):240–243.