

Original Research Article

Evaluation of screening of neonatal sepsis

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ABSTRACT

Background: Neonatal sepsis is an important cause of neonatal mortality and morbidity. Early diagnosis of sepsis is difficult due to its non-specific clinical presentation. The gold standard for diagnosis is blood culture, which is obtained in only 25%-40% of cases and requires 48-72 hours. There is a need for a sepsis screen for early diagnosis of septicemia and identification of culture negative cases. The objective of the study was to study the role of sepsis for early diagnosis of septicaemia and identification of culture negative cases and to compare the rapid diagnostic tests with blood culture singly and in combinations for specificity and sensitivity.

Methods: 60 cases of suspected septicemia were studied. Total leucocyte count, bandforms peripheral smear examination, C-reactive protein assay, micro-ESR, and blood culture study was investigated.

Results: Study revealed that CRP had maximum sensitivity while band neutrophil ratio had balanced sensitivity and specificity. In the two tests, CRP with PS/BF had balanced sensitivity and specificity. In the three tests combination, CRP with TC with micro-ESR had balanced sensitivity and specificity in proven sepsis, While CRP with BF with micro-ESR had balanced sensitivity and specificity in most probable sepsis cases.

Conclusions: Neonatal sepsis has vague signs and symptoms, so high index of suspicion helps in arriving early diagnosis and management. CRP had maximum sensitivity in the individual tests. Using either two tests (CRP + PS/BF) or three tests (CRP + Micro ESR + BF/TC) most of the sepsis cases could be identified and sepsis negative cases can be ruled out. Sepsis screen is helpful in avoiding overuse of antibiotics.

Keywords: BF, CRP, Micro-ESR, Neonatal sepsis, PS, Sensitivity and specificity, Sepsis screen, TC

INTRODUCTION

Neonatal sepsis is an important cause of neonatal mortality and morbidity. Neonatal sepsis is a clinical syndrome resulting from patho physiologic effects of local and systemic infection in the first month of life, survival of very low birth weight infants and their prolonged stay in the hospital poses them for the risk of infection.^{1,2} In India, neonatal septicaemia is responsible for 25-40% of neonatal deaths. EOS refers to sepsis presenting in the first 7 days of life (although some refer to EOS as within the first 72 hours of life), with LOS

referring to presentation of sepsis after 7 days (or 72 hours, depending on the system used). Neonatal sepsis is the single most important cause of neonatal death in hospital as well as community in developing country. Early diagnosis of sepsis is difficult due to its nonspecific clinical presentation. The gold standard for diagnosis of neonatal septicaemia is a positive blood culture.³ A positive blood culture report is obtained in 25-40% of cases and requires 36-48 hours. In developing countries like India, the culture facilities are non-existent in most district hospitals.³⁻⁵ The outcome of sepsis largely depends on its early identification.

Table 1: A practical sepsis screen.

Components	Abnormal value
Total leukocyte count	<5000/mm ³
Abnormal neutrophil count	Low counts as per Manroe chart term and Mouzinho's chart for VLBW infants
Immature/total neutrophil	>0.2
Micro ESR	>15 mm in 1 st hour
C reactive protein	>1 mg/dl

Sepsis related mortality is largely preventable with rational antibiotic therapy and aggressive supportive care.⁶ Thus, there is a role of sepsis screen (a battery of rapid diagnostic test) for early diagnosis of septicaemia and identification of culture negative cases.⁷⁻⁹

Many studies try to correlate clinical and laboratory findings with the presence of proven sepsis. Until date, none of them has managed to define the most adequate parameters to diagnose neonatal sepsis with certainty.¹⁰ In addition, there is the aggravating factor that no laboratory tests and clinical signs exist with sufficiently high sensitivity and negative predictive values for a diagnosis with certainty.

METHODS

The study group comprised of sixty clinically suspected cases of neonatal septicemia who were admitted to neonatal intensive care unit of tertiary care hospital over one-year period.

Inclusion criteria

All neonates (both inborn and outborn) having signs and symptoms of sepsis like lethargy, refusal of feeds, hypo or hyperthermia, respiratory distress, abdominal distension, history of mother having prolonged rupture of membranes more than 12 hours, instrumental delivery, more than 3 vaginal examinations during labour, mother having signs and symptoms of amnionitis like fever, foul smelling liquor, uterine tenderness.

Exclusion criteria

Babies who had received antibiotics before admission.

All the neonates with clinically suspected sepsis were investigated with the following: total leukocyte count, differential count, band cell count, band cell/neutrophil ratio, peripheral smear, C-reactive protein, micro ESR, gastric aspirate cytology for presence of polymorphs, blood culture.

All the parameters were analysed singly and in combination by comparing it with blood culture and their sensitivity were calculated.

RESULTS

It was a prospective and observational hospital-based study. In the present study 60 neonates (11%) of 545 cases admitted to NICU developed sepsis. There were 40 male babies (66.7%) and 20 female babies (33.3%) demonstrating male preponderance in this study. Out of 545 babies, 380 (70%) were term of which 36(9%) developed sepsis and among 165 preterm babies (30%), 24 (15%) developed sepsis.

Table 2: Weight distribution.

Weight in kg	Percentage
<1.5	11
1.5-2.5	42
>2.5	47
Total	100

Table 2 shows that septicaemia is more common in low birth weight babies.

For analysis of results the study group was divided into 3 subgroups. Group A or PS (n = 15) was positive on culture and their clinical course was like septicaemia (proved sepsis group)

Group B or MPS (n = 35) was considered as most probable sepsis group. This was culture negative septicaemia group diagnosed on the basis of clinical course and investigation.

Group C or NS (n = 10) was no sepsis group. This group was negative on investigation and their clinical course was not like septicaemia.

Table 3: Distribution of symptoms in sepsis babies (n = 6).

Symptoms	Number	Percentage
Refusal of feeds	58	96
Lethargy	21	35
Fever	12	20
Respiratory distress	12	20
Convulsions	5	8.3
Jaundice	4	6.6
Abdominal distension	4	6.6
Hypothermia	3	5
Vomiting	1	1.6
Bleeding	1	

In proven sepsis case the sensitivity is 73% and specificity is 90%. In most probable sepsis cases the sensitivity is 63% and specificity is 90%.

In proven sepsis case sensitivity is 20% and specificity is 100%. In most probable sepsis cases sensitivity and specificity is 17% and 100%.

The sensitivity and specificity in proven sepsis for total leukocyte count (TC) was 60% and 90%. In most probable sepsis cases sensitivity and specificity are 49% and 90% respectively. Similarly, for peripheral smear study the sensitivity and specificity is 20% and 100% for proven sepsis case and for most probable sepsis case it is 17% and 100%.

Table 4: Band form/neutrophil ratio.

Band form	MPS	PS	NS	Total
>0.2	13	4	9	26
<0.2	22	11	1	34
Total	35	15	10	60

MPS: Most probable sepsis; PS: Proven sepsis; NS: No sepsis

Table 5: C-reactive protein.

CRP	MPS	PS	NS	Total
Negative	3	1	4	8
Positive	32	14	6	52
Total	35	15	10	60

In 15 cases (25%) culture was positive, and the study showed that gram negative organisms were common than gram positive organisms. Among the gram-negative organisms *Klebsiella* followed by *E. coli* were isolated.

DISCUSSION

Neonatal sepsis is the major and common cause of morbidity and mortality. The incidence is much higher in the developing world. Early diagnosis and effective treatment is the best way to reduce morbidity and mortality. The delay in diagnosis and initiating therapy are the main reasons for high mortality. Blood culture is still regarded as a gold standard for diagnosis. Different hematologic parameters, multiple inflammatory cytokines and acute phase reactants levels are used in this regard. Among the various tests CRP role in neonatal sepsis has been vastly studied.

In the present study the incidence of neonatal sepsis was 11% but the true incidence in the general population could not be obtained because this is a hospital-based study. In the present study CRP has maximum sensitivity but low specificity while peripheral smear had maximum specificity. This is comparable with other authors like Singh M et al and Sharma et al.^{8,11} According to one study, CRP had the sensitivity and specificity of 58.33% and 56.52% respectively. The test had a positive predictive value of 67.74% and 48.27%.¹²

The sensitivity of two tests combination and three tests combination in proven sepsis and most probable sepsis was calculated with no sepsis group acting as control. In the two tests combination, CRP with PS/BF gave balanced sensitivity (80%) and specificity (90%) in both

proven and most probable sepsis group. Sharma et al had similar observation with CRP + PS.¹¹

In the three tests combination CRP+TC+ME had balanced sensitivity (73%) and specificity (90%) in proven sepsis group, while CRP+BF+ME had balanced sensitivity (80%) and specificity (90%) in most probable sepsis. This finding is comparable with Sharma et al and Singh M et al.^{11,8} The three tests combination had no overall advantage over two tests combination in the present study.

In the present study, with the help of sepsis screen 48% of culture negative septicaemia could be diagnosed by sepsis screen, where as 25% of cases were diagnosed by positive culture. Tests used in the present study can be done in the side lab without help of any sophisticated equipment and results are available within 1 hour.

CONCLUSION

Neonatal sepsis has vague signs and symptoms, so high index of suspicion helps in arriving early diagnosis and management. CRP had maximum sensitivity in the individual tests. Using either two tests (CRP + PS/BF) or three tests (CRP + Micro ESR + BF/TC) most of the sepsis cases could be identified and sepsis negative cases can be ruled out. Sepsis screen is helpful in avoiding overuse of antibiotics.

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REFERENCES

- Behrman RE, Kliegman RM, Jeanson HB, Nelson textbook of paediatrics, 17th edition, WB Saunders Publishers; 2016:914-9155.
- Sharma CM, Agarwal RP. Neonatal sepsis: bacteria and their susceptibility pattern towards Antibiotics in Neonatal intensive care unit. J Clin Diagn Res. 2013;7(11):2511-3.
- Sharma A, Kutty CK, Sabharwal U, Rathee S, Mohan H. Evaluation of sepsis screen for diagnosis of neonatal septicemia. Indian J Pediatr. 1993;60(4):559-63.
- Agarwal R, Sarbar N, Ashok K, Deorari, Paul VK. Sepsis in newborn. Indian J Pediatr. 2001;68:1143-7.
- Khatau SP, Das AK. Neonatal septicaemia. Ind J Pediatr. 1986;53:509-14.
- Gerdes JS, Polin R. Early diagnosis and treatment of neonatal sepsis, Ind J Pediatr. 1988;65:63-78.
- Philip AGS, Hewitt JE. Early diagnosis of neonatal sepsis. Pediatr. 1980;65:1036-41.
- Singh M, Paul VK. Strategies that reduced Sepsis related neonatal mortality. Ind J Pediatr. 1988;55:955-60.

9. Robertson NRC. Textbook of Neonatology by Robertson. 5th edition. Churchill Livingstone; 2012;811-4.
10. Polin RA. The "ins and outs" of neonatal sepsis. *J Pediatr.* 2003;143(1):3-4.
11. Sharma M, Yadav A, Yadav S, Goel N, Chaudhury U. Microbial profile of septicaemia in children. *Indian J Pract Doct.* 2008;5:16-8.
12. Mahmood A, Karamat KA, Butt T. Neonatal sepsis: high antibiotic resistance of the bacterial pathogens in a Neonatal Intensive Care Unit in Karachi. *J Pak Med Assoc.* 2002;52(8):348-50.

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