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ORIGINAL ARTICLE

To evaluate the role of CRP for diagnosis of neonatal septicaemia

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ABSTRACT:

Aim: The aim of the present study to evaluate the role of CRP for diagnosis of neonatal septicaemia. **Methods:** This study was carried out in the Department of Microbiology. 80 neonates with suspected sepsis or those coming to hospital with signs and symptoms of sepsis up to 28 days of life were included in the study. The colonies grown on blood agar and MacConkey agar were identified by conventional methods according to the standard laboratory protocol, including colony morphology, Gram staining and biochemical reactions. CRP estimation was done by Latex Agglutination Card test. CRP was reported as positive if agglutination particles were detected and negative if no particles were seen. Samples positive for CRP were further subjected to CRP estimation using Automated Clinical Chemistry Analyser. **Results:** In present study, the sensitivity and specificity of CRP against blood culture was 85.98% and 45.63% respectively. The positive and negative predictive value was 55.89% and 75.77% respectively. The diagnostic accuracy of CRP against blood culture in detecting neonatal septicaemia was 62.73%. **Conclusion:** The specificity and sensitivity of CRP against blood culture strengthen the use of this acute phase protein in the diagnosis of neonatal sepsis

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INTRODUCTION

Septicemia means a severe form of infection in which bacteria multiply and release toxin into the blood stream. Neonatal septicemia is a clinical syndrome occurring in the first 30 days of life characterized by symptomatic systemic illness due to infectious agents.[1] Septicemia arises from various infections, including those of the skin, lungs, abdomen, and urinary tract.[2] Septicemia in newborns remains a significant cause of morality in developing countries. The fulminant nature of neonatal septicemia and its high mortality rate has always posed a challenge to the skill of a paediatrician. In general, 2% of infants are infected during intra uterine life and 10% during delivery. However, inflammatory lesions were found in about 25% newborn autopsies.[1] Previous studies on neonatal septicemia in south India[3] revealed that neonatal septicemia has contributed for the infant mortality (14.40%).

The newborn infants host resistant mechanism particularly that of preterm infant may be immature and easily overcome by invading organisms. Infection therefore becomes fulminant and causes death within few hours or days. A variety of organisms including bacteria, viruses, fungi and protozoa are the etiological agents. Etiological agents vary in different geographical area.[4] In this study we adopted, Acridine orange which is a fluorochrome stain, particularly for the demonstration of bacteria in blood and binding with the nucleic acid occurs in both living and dead bacteria, also other microorganisms.[5] Bacterial and yeast cells will appear as brilliant orange against a black, light green or yellow background.[6] CRP is an acute phase protein produced by the liver and its interaction with the complement system, in response to inflammation, infection and tissue injury.[7] CRP is useful in detecting the early infection of neonatal septicemia/meningitis and urinary tract infection by using semi quantitative latex-agglutination as a rapid screening method.[8]

MATERIAL AND METHODS

This study was carried out in the Department of Microbiology, after taking the approval of the protocol review committee and institutional ethics committee. 80 patients were included in this study. 80 neonates with suspected sepsis or those coming to hospital with signs and symptoms of sepsis up to 28 days of life were included in the study. Babies who had suffered from birth asphyxia, birth weight less than 1500 grams, extremely premature (less than 32 weeks of gestation) and neonates who were already given antibiotics were excluded from the study. After written informed consent from the patient's parents, detailed history, clinical examination findings and laboratory findings were noted on pre-designed proforma. 1-2 mL of blood collected aseptically was inoculated into blood culture bottle containing 5 mL of Brain Heart Infusion Broth. Blood culture bottles were incubated at 37°C aerobically. After overnight incubation blood culture bottles were examined for indicators of growth like turbidity, gas production, haemolysis or discrete colonies on the surface of sedimented red cells. If any of these were present subculture was done on to blood agar and MacConkey agar. If indicators of growth were not present primary

subculture was done after 48 hours of incubation on blood agar and MacConkey agar. If no growth occurred on plates after overnight incubation, bottles were incubated further and observed daily for indicators of growth till 7 days. A final subculture was done at the end of day 7 or at appearance of indicators of growth which ever was earlier. The colonies grown on blood agar and MacConkey agar were identified by conventional methods according to the standard laboratory protocol, including colony morphology, Gram staining and biochemical reactions.[9]

CRP estimation was done by Latex Agglutination Card test. CRP was reported as positive if agglutination particles were detected and negative if no particles were seen. Samples positive for CRP were further subjected to CRP estimation using Automated Clinical Chemistry Analyser (ERBA Diagnostics Mannheim GmbH- Germany).[10]

RESULTS

In the present study, the male to female ratio was 1.86:1. The mean age of the study population was 7.12 days. Out of the total 80 neonates, 37 were blood culture positive from which 33 were positive for CRP also. Among the blood culture negative samples, 19 were CRP positive. The mean value of CRP in blood culture positive neonates was 50.22 mg/l whereas in blood culture negative neonates were 16.02mg/L. In present study, the sensitivity and specificity of CRP against blood culture was 85.98% and 45.63% respectively. The positive and negative predictive value was 55.89% and 75.77% respectively. The diagnostic accuracy of CRP against blood culture in detecting neonatal septicaemia was 62.73%.

Table:1 Demographic parameter

Demographic parameter	No. of Neonates	Percentage
Gender		
Male	52	65
Female	28	35
Age (in days)		
0-7	59	73.75
8-14	10	12.5
15-21	4	5
22-28	7	8.75
Preterm (<37 weeks)	49	61.25
Term (>37 weeks)	31	38.75
Maternal Risk Factors		
PROM	26	32.5
MSAF	23	28.75
Febrile illness in mother	17	21.25
More than 3 vaginal examinations	6	7.5
Preterm labour	3	3.75
Delivery at home	2	2.5
Risk factors not identified	3	3.75
Birth Weight		
Low birth weight	31	38.75
Normal birth weight	49	61.25

Table 2 Comparison of blood culture and CRP in patients with neonatal septicaemia

Parameter	Blood Culture Positive	Blood Culture Negative	Total
CRP Positive	33	19	52
Mean Value	50.22 mg/L	16.02 mg/L	36.01 mg/L
CRP Negative	4	24	28
Total	37	43	80

Table:3 Predictive values of CRP in patients with neonatal septicaemia

Parameters	Value
Sensitivity	85.98%
Specificity	45.63%
Positive Predictive Value	55.89%
Negative Predictive Value	75.77%
Diagnostic Accuracy	62.73%

Table:4 Mean value of CRP

	Blood Culture Positive (n=37)	CRP Positive (n=33)	Mean (in mg/L)
Gram Negative Bacteria	15	15	96.7
Gram Positive Bacteria	22	23	34.81

DISCUSSION

In the present study male babies (65%) were affected more than female babies (35%) who were similar to findings of other studies reported from India.[11-13] The development of thymus and antibody production is X-linked which may be the reason for male preponderance.[14] In our study, incidence of septicaemia was higher in preterm neonates (61.25%) compared to term neonates (38.75%). Our results were consistent with studies conducted by Patel BM et al.,[11] and Shah AJ et al.,[15] who reported 67.37% and 70% blood culture positivity rates respectively in preterm babies. Preterm neonates are more prone to septicaemia because they have increased susceptibility to infection due to an immature immune system, inefficient neutrophil function and lack of antigen type-specific antibodies to pathogens in their environment.[16-18] In our study, incidence of suspected neonatal septicaemia was more common in normal birth weight neonates (61.25%) but incidence of culture proven sepsis was significantly higher in low birth weight than normal weight neonates which was similar to the studies conducted by Patel BM et al.,[11] The rate of infection is inversely proportional to birth weight. Low birth weight neonates have low IgG level and are more susceptible to infections.[19]

In the present study, out of 80 neonates suspected of neonatal septicaemia, 46.25% were blood culture positive. Our results were comparable with many studies conducted in India.[20, 21] Low blood culture positivity in our study might be due to the low amount of blood drawn or possibility of infection with anaerobes or presence of fastidious organisms.

For definitive diagnosis of septicaemia, blood culture is the gold standard method but it takes at least 48-72 hours for reporting and by that time the infection may progress, especially if antibiotic treatment is not started. So there is a need of a screening test which can diagnose septic neonates rapidly and prevent injudicious antibiotic therapy in non septic neonates.

CRP is a screening test that can be used to assess neonatal sepsis as it is easily available, cost effective and results are readily available. In our study, 65% of the suspected cases of neonatal sepsis were CRP positive which was comparable to the studies done by Shah AJ et al.,[15] and Hisamuddin E et al.[21]

In our study, out of the 37 blood culture positive samples, 33(89.19%) were positive for CRP which was similar to studies done by Gowsami Y et al.[20] and Hisamuddin E et al.[21] In present study, the sensitivity and specificity of CRP against blood culture was 85.98% and 45.63% respectively. The positive and negative predictive value was 55.89% and 75.77% respectively. The diagnostic accuracy of CRP against blood culture in detecting neonatal septicaemia was 62.73%.

CONCLUSION

The specificity and sensitivity of CRP against blood culture strengthen the use of this acute phase protein in the diagnosis of neonatal sepsis

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