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Original Research Article

Comparative Assessment of the Efficacy of CRP with Blood Culture in the Diagnosis of Neonatal Septicaemia

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Abstract

Aim: Comparison of CRP with blood culture in the diagnosis of neonatal septicaemia

Methods: This study was carried out in the Department of Microbiology, Madhubani medical college Madhubani, Bihar, India, for 12 months. 100 patients were included in this study. 100 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 the present study, the male to female ratio was 1.5:1. The mean age of the study population was 7.25 days. Out of the total 100 neonates, 44 were blood culture positive from which 38 were positive for CRP also. Among the blood culture negative samples, 26 were CRP positive. The mean value of CRP in blood culture positive neonates was 49.1 mg/l whereas in blood culture negative neonates were 15.7mg/L.

Conclusion: Early diagnosis of neonatal sepsis with the aid of biomarkers like CRP may serve as an important tool in reducing the mortality and morbidity among neonates.

Keywords: biomarkers, CRP, neonates

Introduction

Sepsis is a major cause of morbidity and mortality among neonates.it is one of the leading cause of death in neonates in our country.[1] Neonatal septicaemia is defined as localized or systemic condition resulting from adverse reaction to the presence of an infectious agent(s) or its toxin(s).[1] Clinical manifestations of neonatal sepsis are non-specific, therefore, clinical diagnosis of sepsis is difficult and laboratory help is required. The gold standard for diagnosis of bacterial sepsis is blood culture, may be primary or secondary to a focal infection (osteomyelitis, gastroenteritis, pyelonephritis, and endocarditis). [2] The clinical manifestation of neonatal sepsis are not specific and usually occur in the late stages of the infection. [3] C-reactive

protein (CRP) is a part of a protein group called acute phase reactants that is produced by the liver and is considered as an inflammatory marker. C- reactive protein is commonly elevated during an infection but are not specific for infection and do not identify any specific infection. These tests can be used to monitor response to therapy. [3] The half life of CRP is 19 hours and in acute response its level increases up to thousand fold and comes down rapidly as the source is removed. After effective treatment, its levels can fall rapidly in 5-7 hours. CRP crosses through placenta in very low quantities, so any elevation in a newborn always represents endogenous synthesis. [4]

Material and methods

This study was carried out in the Department of Microbiology, Madhubani medical college Madhubani, Bihar, India,for 12 months 100 patients were included in this study.

Inclusion and exclusion criteria

100 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.

Methodology

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.[5]

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).[6]

Results

In the present study, the male to female ratio was 1.5:1. The mean age of the study population was 7.25 days. Out of the total 100 neonates, 44 were blood culture positive from which 38 were positive for CRP also. Among the blood culture negative samples, 26 were CRP positive. The mean value of CRP in blood culture positive neonates was 49.1 mg/l whereas in blood culture negative neonates were 15.7mg/L.

Table: 1 Demographic profile

Demographic profile	No. of Neonates	Percentage
Gender		
Male	60	60
Female	40	40
Age (in days)		
0-7	69	69
8-14	12	12
15-21	8	8
22-28	11	11
Preterm (<37 weeks)	54	54
Term (>37 weeks)	46	46
Maternal Risk Factors		
PROM	32	32
MSAF	29	29
Febrile illness in mother	18	18
More than 3 vaginal examinations	7	7
Preterm labour	4	4
Delivery at home	3	3
Risk factors not identified	4	4
Birth Weight		
Low birth weight	40	40
Normal birth weight	60	60

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

Variables	Blood Culture Positive	Blood Culture Negative	Total
CRP Positive	38	26	64
Mean Value	49.1 mg/L	15.7 mg/L	35.2 mg/L
CRP Negative	6	30	36
Total	44	56	100

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

Parameters	Value
Sensitivity	86.11%
Specificity	44.40%
Positive Predictive Value	56.14%
Negative Predictive Value	77.67%
Diagnostic Accuracy	64.00%

Table:4 Mean value of CRP in relation to organisms isolated in patients with neonatal septicaemia

	Blood Culture Positive (n=44)	CRP Positive (n=38)	Mean (in mg/L)
Gram Negative Bacteria	18	18	97.4

Gram Positive Bacteria	26	20	35.55

Discussion

Neonatal sepsis is one of the leading causes of morbidity and mortality among the newborns in the developing countries. It is a life threatening clinical emergency that demands urgent diagnosis and treatment.[7]

The present study was carried out in the Department of Microbiology of a tertiary care teaching hospital to evaluate the diagnostic accuracy of CRP in neonatal septicaemia.

In the present study male babies (60%) were affected more than female babies (40%) who were similar to findings of other studies reported from India.8-10 The development of thymus and antibody production is X-linked which may be the reason for male preponderance.[11] In our study, incidence of septicaemia was higher in preterm neonates (54%) compared to term neonates (46%). Our results were consistent with studies conducted by Patel BM et al.,[8] and Shah AJ et al.,[12] 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.[13-15] In our study, incidence of suspected neonatal septicaemia was more common in normal birth weight neonates (60%) 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.,8 The rate of infection is inversely proportional to birth weight. Low birth weight neonates have low IgG level and are more susceptible to infections.[16]

In the present study, out of 100 neonates suspected of neonatal septicaemia, 44% were blood culture positive. Our results were comparable with many studies conducted in India.[17,18] 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, 64% of the suspected cases of neonatal sepsis were CRP positive which was comparable to the studies done by Shah AJ et al.,[12] and Hisamuddin E et al.[18]

In our study, out of the 44 blood culture positive samples, 38(86.36%) were positive for CRP which was similar to studies done by Gowsami Y et al.17 [22] and Hisamuddin E et al.18 In present study, the sensitivity and specificity of CRP against blood culture was 86.11% and 44.40% respectively. The positive and negative predictive value was 58.14% and 77.67% respectively. The diagnostic accuracy of CRP against blood culture in detecting neonatal septicaemia was 64%. Our results were comparable to studies done by Younis S et al.[19] and Chauhan S et al.[20]

Conclusion

Early diagnosis of neonatal sepsis with the aid of biomarkers like CRP may serve as an important tool in reducing the mortality and morbidity among neonates. In the present study mean CRP value was higher in gram negative organisms as compared to gram positive organisms.

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