A Study to Evaluate Early Diagnosis of Neonatal Sepsis using Hematological Scoring System

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ABSTRACT

Introduction: Early diagnosis of neonatal sepsis is important in early initiation of the treatment and prevention of antibiotic resistance. This study examined the utility of haematological scoring system early prediction of neonatal sepsis.

Material and methods: A hospital based prospective study was undertaken in the department of Pathology among the blood samples of 50 neonates for a period of two years. It was instructed to send 0.5 – 1 ml of blood on routine basis from the suspected and was used to make peripheral smears. A number of haematological parameters were assessed to give a scoring system by using available standard criterion.

Results: About 60.0% of the neonates were males, aged less than 7 days, preterm babies. The respiratory distress was in 52% of the cases and 38% delivered by caesarean section. TLC had low specificity, medium specificity, low NPV and medium NPV. The sensitivity and PPV for absolute neutrophilia was low and medium specificity and NPV. The immature neutrophil had shown a low sensitivity and PPV and medium Specificity and NPV. The I:T ratio has shown low sensitivity and PPV and medium specificity and NPV in this study. The I: M ratio had shown low sensitivity and PPV and medium specificity and NPV.

Conclusion: The haematological scoring system had no high predictive accuracy as shown in this study.

Keywords: Neonatal Sepsis, Hematological Scoring System, Sensitivity, Specificity, Diagnosis

INTRODUCTION

Sepsis in neonates is an important cause for mortality and morbidity in children. The mortality rate remains high even after provision of rational therapy which may be due to complications of it including severe sepsis and septic shock, end organ damage such as respiratory, renal, cardiac etc and multiple organ dysfunction syndrome (MODS) or failure.[1]

The burden of sepsis neonatorum varies between 1 – 8% cases of all the live births.[2] Timely diagnosis and accurate treatment is often reported as challenging since no test single dependable test is available for the accurate diagnosis. The non specific nature of the disease will further complicate the situation.[3] The bacterial infection in the neonates especially the premature are prone for serious infections by organisms and partly since signs of infections may be absent or minimal and hard to detect. Fatal septicaemia may occur with little warning.[4]

The literature available shows that, the blood culture positivity is considered as gold standard for declaring the septicaemia. But this test is costly, time consuming and requires well equipped microbiological laboratory.[5,6,7] The prescription of antibiotics before the culture increased the unnecessary exposure to antibiotics and bacterial resistance. Hence, alternative diagnostic methods including hematological scoring system (HSS) plays an important role in diagnosis. But the studies in this aspect are scant in this region which compelled to take up this study.

MATERIAL AND METHODS

A hospital based prospective study was undertaken in the department of Pathology among the 50 neonates for a period of two years from March, 2018 to February, 2020. The blood samples with a clinical suspicion of neonatal sepsis were included in the study and neonates with severe jaundice were excluded from the study. It was instructed to send 0.5 – 1 ml of blood on routine basis from the suspected and was used to make peripheral smears. The accent from the parents was obtained before the neonates were included in to the study. Clearance from institution ethics committee was obtained before the study was started.

Detailed clinical history, perinatal risk factors, physical examination findings of the neonates, significant obstetric history was taken in to account with probable diagnosis. Red blood cell count, haemoglobin, uncorrected WBC count, platelet count was measured using Sysmex 1800i automated analyser. The peripheral smears were stained with Leishman's stain and neonates were evaluated and scored according to 7 of Rodwell's criteria.[8,9] The blood culture was done for all the cases and the values of Micro – ESR, CRP and Procalcitonin were included. The sensitivity, specificity, positive and negative predictive value were calculated and also necessary statistical tests were used as test of significance.

RESULTS

About 60.0% of the neonates were males. Majority of the neonates were aged less than 7 days. About 54% were preterm babies. The respiratory distress was present in 52% of the

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Clinical features		N (%)
Sex	Male	30 (60.0)
	Female	20 (40.0)
	M:F	1: 0.6
Age distribution	< 7 days	31 (62.0)
	1st 24 hours of birth	19 (38.0)
Gestational age	Pre term	27 (54.0)
	Term	23 (46.0)
Respiratory distress	Present	26 (52.0)
Mode of delivery	Caesarean	19 (38.0)
	Vaginal	31 (62.0)
Weight	Less than 2.5 kgs	48 (96.0)
	More than 2.5 kgs	2 (4.0)

Table-1: Clinical profile of neonates included in the study

Parameters	Study	Sen%	Spe%	PPV%	NPV%
TLC leukocytosis:					
- 25,000 at birth	This study	26.7	60	22.2	65.6
- > 30,000 at 12 – 24 hours	Narasimha et al[10]	10.5	91.66	80	24.4
≥ 21,000 – day 2 onwards	Priyanka et al[3]	23.6	71.3	35.83	-
Leukopenia - < 5,000/ cm^3	Basu et al[11]	54.6	50.6	45.7	59.4
ANC	This study	33.3	62.5	33.3	62.5
Neutrophilia >5400	Priyanka et al[3]	52.7	91.0	80	73.9
Neutropenia < 1800	Khair BK et al[12]	92	38	43	93
Immature neutrophils	This study	41.2	66.7	38.9	68.8
	Priyanka et al[3]	55.5	92.9	84.2	75.4
	Makkar et al[13]	86.3	79.2	79.2	81.2
I : T ratio	This study	25.0	58.8	22.2	62.5
	Priyanka et al[3]	35.8	72.8	39.2	59.1
	Narasimha et al[10]	63.1	75	88.8	39.1
I : M ratio	This study	27.8	59.4	27.8	59.4
	Priyanka et al[3]	25.8	74.1	26.5	60.2
	Makkar et al[13]	50	95.6	95.6	61.4
Degenerative changes	This study	46.7	68.6	38.9	75.0
	Priyanka et al[3]	45.6	98.2	69.2	70.0
	Makkar et al[13]	72.7	94.1	94.1	73.9
Thrombocytopenia	This study	52.9	72.7	50	75
	Priyanka et al[3]	34.6	78.7	52.5	63.9
	Makkar et al[13]	70.4	93.9	93.9	72.3

Table-2: The predictive accuracy of the individual haematological in culture proven in comparison with studies

cases and 38% delivered by caesarean section (table-1).

The sensitivity of haematological parameters was 26.7%, specificity was 60%, positive predictive value was 22.2% and negative predictive value was 65.6%. The sensitivity for absolute neutrophilia was 33.3%, specificity was 62.5%, positive predictive value was 33.3% and negative predictive value was 62.5%. The sensitivity for 41.2%, specificity was 66.7%, PPV was 38.9% and NPV was 68.8%. The sensitivity of I: T ratio was 25%, specificity was 58.8%, PPV was 22.2% and NPV was 62.5%. The sensitivity of I: M ratio was 25%, specificity was 59.4%, PPV was 27.8% and NPV was 59.4%. The sensitivity of degenerative changes was 46.7%, specificity was 68.6%, PPV was 38.9% and NPV was 70%. The sensitivity of thrombocytopenia was 52.9%, specificity was 72.7%, PPV was 50% and NPV was 75% (table-2).

DISCUSSION

This study was undertaken mainly to test the efficacy of haematological scoring system in diagnosis of neonatal sepsis. This study had shown that, males children aged less than 7 days, majority were pre term babies, had low birth weight and had respiratory distress. Most of the babies were delivered by normal vaginal delivery. A similar study by Priyanka et al had noted by Priyanka et al.[3]

This study had shown that, about 36% of the neonates had positive blood culture for the neonatal sepsis.

TLC had low specificity, medium specificity, low NPV and medium NPV. A study by Narasimha et al had shown low specificity, high specificity, high PPV and low NPV.[10] Priyanka et al had also shown similar results but had not reported NPV.[3] In contrary to these results, Basu et al had reported medium sensitivity, specificity, PPV and NPV.[11]

The sensitivity and PPV for absolute neutrophilia was low and medium specificity and NPV. A study by Priyanka et al had shown that, sensitivity and NPV was medium and high specificity and PPV.[3] A study by Khair et al had shown high sensitivity and NOV were high and specificity and PPV were low.[12]

The immature neutrophil had shown a low sensitivity and PPV and medium Specificity and NPV. A study by Priyanka et al had shown a medium sensitivity and high specificity, PPV and NPV.[3] But a study by Makkar et al had shown a high sensitivity, specificity, PPV and NPV.[13] The I:T ratio has shown low sensitivity and PPV and medium specificity and NPV in this study. Priyanka et al had noted similar results.[3] In contrary to these results, Narasimha et al had shown medium sensitivity, specificity, PPV and similar NPV.[10] The I: M ratio had shown low sensitivity and PPV and medium specificity and NPV. A study by Priyanka et al had also shown similar results.[3] A study by Makkar et al had shown medium sensitivity and NPV and high specificity and PPV.[13] The degenerative changes had shown a sensitivity of 46.7% and PPV of 38.9% which is low and medium specificity and NPV. A study by Priyanka et al had shown similar sensitivity, high specificity and medium PPV and NPV.[3] The sensitivity and NPV was medium and specificity and PPV was high in a study by Makkar et al.[13] The sensitivity of thrombocytopenia was 52.9%, specificity was 72.7%, PPV was 50% and NPV was 75% in this study. These results were comparable with the results of Priyanka et al.[3] Makkar et al reported higher predictive accuracy than this study for thrombocytopenia.[13]

The overuse of antibiotics is under strict vigilance due to development of the antibiotic resistance and may result in out of pocket expenditure to the patient. But the limitation of diagnosis of neonatal sepsis still persists. This study has limitation of sending the sample to the laboratory and resulting in alteration of morphology.

CONCLUSION

The review of different studies have shown heterogeneity with respect to use of haematological score system in early diagnosis of neonatal sepsis. This may be due to age of neonates, seriousness of disease and variation in diagnostic protocols. No single haematological parameter is better in examination of neonatal sepsis. Hence an array of tests can be used in diagnosis of neonatal sepsis.

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