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Original Article

Role of various hematological parameters in diagnosis of clinically suspected cases of neonatal septicemia

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ABSTRACT

1-To evaluate the various hematological parameters ,CRP, quantitative and qualitative changes in neutrophil and to identify causative organism of sepsis by blood culture . Method: To evaluate the hematological parameters we used 5 part cell counter and peripheral smear stained with leishman stain, for CRP was done by latex kit method and to identify the causative organism we did blood culture of 100 neonates admitted in NICU in Shyam shah medical college and associated Sanjay Gandhi hospital. Results: In my study out of 100 sample sensitivity of total WBC count is 51.7 %, specificity is 66.6%, positive predictive value is 68% and negative predictive value is 50% The Sensitivity of absolute neutrophil count is observed to be 70.6% and specificity is 85.7%. Positive predictive value of the test is 87.2% and negative predictive value is 68%. Sensitivity of I:TNR is 89.6%, specificity is 73.8%, positive predictive value is 82.5% and negative predictive value is 83.7%1. Sensitivity of platelet count is 48.2%, specificity is 80.9%, positive predictive value is 77.7% and negative predictive value is 53.1%. Sensitivity of CRP is 70.6%, specificity is 78.5%, positive predictive value is 82%and negative predictive value is 66%1. Sensitivity of morphological changes (presence of toxic granulation and dohle bodies) in neutrophils is 51%, specificity is 60.7%, positive predictive value is 55.5% and negative predictive value is 56.3%. In blood culture most common pathogenic organism grown is klebsiella followed by acinetobacter in our study.Conclusion:we concluded that in our study blood culture shows more sensitivity and specificity to diagnose neonatal septicemia but ittakes 48 to 72 hours to give result on the other hand TLC, ANC, I:TNR,Platelet count,CRP and morphological changes in neutrophils gives early result and altogether give better sensitivity and specificity to diagnose neonatal septicemia.

Introduction

Neonatal septicemia is a clinical syndrome characterized by systemic signs of infection, and accompanied by bacteremia in the first month of life2. Sepsis is the most common cause of neonatal mortality and is responsible for 30-50% of total neonatal deaths, each year in developing countries3-5. Neonatal sepsis is an invasive infection occurring in the first twenty eight (28) days of life. It could be bacterial, viral or fungal. Early signs are frequently nonspecific and do not distinguish among organisms.

As per National Neonatal Perinatal Database (NNDP) 2002-2003, incidence of neonatal sepsis in India was 30 per 1000 live birth6. The term neonatal sepsis refers to the systemic infections including septicemia, pneumonia, meningitis, arthritis, osteomyelitis and urinary tract infections. Larger number of infants gets admitted for "ruling out sepsis" despite sepsis still continues to be missed.

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Many studies have investigated a variety of Laboratory tests to enhance the early detection of neonatal sepsis. Definitive diagnosis of neonatal septicemia is made by demonstration of the organism in blood Culture and yields positive results in 30-40% of cases. Klebsiella pneumonia commonest causing organism followed by staphylococcus aureus and pseudomonas in India7. Although blood culture is the Gold Standard for the diagnosis of sepsis, reports are available after 48-72 hrs and they may be affected by intrapartum antibiotic administration to the mother8.

Other investigations are necessary for early diagnosis or to rule out sepsis. In order to diagnose septicemia early, several rapid diagnostic tests have been described recently. These can be performed rapidly in an hour or two and antibiotics can then be used judiciously, thereby reducing the incidence of drug resistance and improving the survival rate of septicemia8. The most important risk factors for neonatal sepsis are prematurity, low birth weight, invasive medical procedures and prolonged hospitalization. Neonatal sepsis presents in diverse ways. It may present with fever,

poor feeding, abdominal distension, diarrhea, tachypnea, oliguria, tachycardia or bradycardia, hypotension, irritability, seizures, bulging fontanelle or bleeding9. In recent past, various investigators have evaluated some highly sensitive and specific inflammatory markers (eg: ELISA methods, haptoglobins, interleukins and counter immune electrophoresis etc) to diagnose neonatal sepsis10. Indeed these markers are sensitive and specific, but are sophisticated and expensive. Various cheap but reliable laboratory tests have been evaluated for the diagnosis of systemic infection in neonates11. The complete blood count (CBC) with various neutrophil parameters, C-reactive protein (CRP) are the most frequently used12.

It is therefore a need arises for a test that is cheap, have maximum sensitivity and specificity; can be performed easily and reports made quickly. The present study is aimed to evaluate the usefulness of various parameters of white blood cell count, platelets, CRP as an early indicator of neonatal septicemia because this is simple bed side test which can be done within a short time before putting the neonate on antibiotic therapy.

Material Method:

Total leukocyte count (TLC)

BC-5150 Auto hematology analyzer (5parts) [Mindray] had been used for analyzing the sample and is counter checked by improved neubauer's chamber.Differential white cell counts are usually performed by visual examination of blood films which are prepared on glass slides by spread technique and stained by standard leishman staining.Band neutrophils (with two nucleated lobes) are counted separately. They normally constitute less than 6% of the neutrophils. An increase in band neutrophils may be observed in inflammatory process (in the absence of an absolute leukocytosis)

CRP was done by Quanlitative slide test- All the reagents and samples were at room temperature.

1. Test serum used was undiluted

2. By using the disposable plastic dropper, we place one drop of the test serum within the circled area on the special slide provided in the kit.

3. Add one drop of CRP latex reagent to the above drop and mix well with a disposable applicator stick and spread out to the edge of the test area.

4. Rock the slide gently to and fro for 2 minutes and examine for macroscopic agglutination under the direct light source.

For blood culture we collected the blood under aseptic condition from venipuncture. After that we inoculate it in nutrient broth and incubate it for one day at 37 degree Celsius.Then it is sub-cultured in blood agar where it is kept overnight at 37 degree Celsius.On the basis of colony morphology and gram stain we probably identify the organism.

Results :

In my study 100 neonates are evaluated for sepsis on the basis of clinical history and sign and symptoms that present at the time of admission at neonatal intensive care unit, Sanjay Gandhi memorial hospital and Gandhi memorial hospital associated with S.S.Medical College.

Table -1 Sex wise distribution of cases

Sex	No. of cases	Percentage
Male	55	55%
Female	45	45%

Table -2 Maturity wise distribution of cases

Term/Pre term babies	No. of cases	Percentage (%)
Term babies	29	29%
Pre term babies	71	71%

False positive and false negative test results shown in below table after comparing with results of Blood culture.

Table 3

Total WBC Count compared with blood culture				
		Observation		Total
		Positive	Negative	
Total WBCs Count	Positive	30 (TP)	14(FP)	44
	Negative	28(FN)	28(TN)	56
	Total	58	42	100

Table 4

Absolute neutrophil count compared with blood culture				
		Observation		Total
		Positive	Negative	
Absolute neutrophil count	Positive	41	6	47
	Negative	17	36	53
Total		58	42	100

The Sensitivity of absolute neutrophil count is observed to be 70.6% and specificity is 85.7%. Positive predictive value of the test is 87.2% and negative predictive value is 68%.

Table 5

Immature to Total neutrophil count ratio (I:TNR)compared with blood culture				
		Observation		Total
		Positive	Negative	
I:TNR	Positive	52	11	63
	Negative	6	31	37
Total		58	42	100

Sensitivity of the test is 89.6%, specificity is 73.8%, positive predictive value is 82.5% and negative predictive value is 83.7%.

Table-6

Platelet count compared with blood culture				
		Observation		Total
		Positive	Negative	
Platelet count	Positive	28	8	36
	Negative	30	34	64
		58	42	100

Sensitivity of the test is 48.2%, specificity is 80.9%, positive predictive value is 77.7% and negative predictive value is 53.1%.

Table-7

Qualitative C-Reactive protein test compared with blood culture				
		Observation		Total
		Positive	Negative	
Qualitative C-Reactive protein test	Positive	41	9	50
	Negative	17	33	50
Total		58	42	100

Sensitivity of the test is 70.6%, specificity is 78.5%, positive predictive value is 82%and negative predictive value is 66%.

Table 8. Morphological change in neutrophil

		Positive	Negative	
Morphological change in neutrophil	Positive	25	20	45
	Negative	24	31	55
Total		49	51	100

Sensitivity of this test is 51%, specificity is 60.7%, positive predictive value is 55.5% and negative predictive value is 56.3%.

Blood culture :

In our study of 100 samples 58 were blood culture positive while 42 were blood culture negative. Out of 76 blood culture positive 25 cases have shown growth of klebsiella sp.,12 cases shown growth of Acinetobacter sp., 08 cases shown growth of Coagulase negative staphylococcus, 6 cases shown growth of E.coli, 3 cases shown growth of Enterococcus sp., 2 cases shown growth of Staphylococcus sp. and 2 were showing growth of Streptococcus sp.

Table 9

Blood culture	Positive	negative
Klebsiella sp.	25	42
Acinetobacter sp.	12	
Coagulase negative staphylococcus (CONS)	8	
E.coli	6	
Enterococcus sp.	3	
Staphylococcus sp.	2	
Streptococcus sp.	2	
Total	58	42

Discussion

My study findings correlates with Haider shirazi et al13 (2010) on Role of the hematological profile in early diagnosis of neonatal sepsis shows the parameters including CRP, Platelet count together can be a good tool in ruling out the possibility of neonatal sepsis.

In my study sensitivity of traditional hematological parameter including (TLC, CRP, Platelet count, I: TNR ratio) are satisfactory whereas Ramesh Bhat et al14 (2010) on The performance of hematological screening parameters and CRP in Early onset neonatal infections shows not satisfactory for neonatal early onset of sepsis in symptomatic then asymptomatic. My study correlates with A.C.Buch et al15 (2011) study for Evaluation of hematological profile in early diagnosis of clinically suspected cases of neonatal sepsis that different parameters and combination of hematological parameter act as a rapid adjunct to diagnosis and exclude neonatal sepsis and also correlate the result which is nearer to above study. My study correlates with the study of Rekha sriram16 (2011) on the correlation of blood culture results with the sepsis score and the sepsis screen in the diagnosis of neonatal septicemia concluded that the sepsis scoring system in predicting neonatal septicemia clinically needs further evaluation . Blood culture remains the gold standard for the diagnosis of neonatal septicemia. Also agreement with the combination of two or more sepsis screen parameter has better results in diagnosing neonatal septicemia compared to single test while awaiting the blood culture results.

Conclusion:

We concluded that in our study blood culture shows more sensitivity and specificity to diagnose neonatal septicemia but ittakes 48 to 72 hours to give result on the other hand TLC, ANC, I:TNR,Platelet count,CRP and morphological changes in neutrophils gives early result and altogether give better sensitivity and specificity to diagnose neonatal septicemia that helps clinician for proper use of antibiotics.

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