

**Original article:**

## **A comparative study of Immature: Total WBC ratio, micro ESR and C-Reactive Protein in early diagnosis of neonatal septicemia**

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### **Abstract:**

**Introduction:** In my study 100 neonates admitted to NICU in Sanjay Gandhi memorial hospital associated with shyam shah medical college with clinically suspicion were taken for comparison of I:T ratio, C- Reactive Protein and m-ESR for early diagnosis of neonatal septicemia.

**Material & Method:** In this study I:T ratio was done by peripheral smear and auto analyzer , m-ESR was done by using capillary tube by micro ESR method and CRP was done by using CRP latex kit.

**Observation and result:** Sensitivity of I:T ratio , m-ESR and CRP was 89.6%, 60.3% and 70.6% respectively, specificity is 73.8%, 73.8% and 78.5% respectively, positive predictive value 82.5%, 76% and 82% respectively and negative predictive value 83.7%, 57.4% and 66% respectively and result shows combination of these parameters helps in early diagnosis of neonatal septicemia.

**Conclusion :** My study concluded that not a single parameter for detection of sepsis in neonates is very specific and blood culture takes a long time for diagnosis of septicemia, so combination of these parameters is more sensitive and specific for early detection of neonatal septicemia and it also helps clinician to institute proper antibiotic therapy and helps to avoid unnecessary exposure of neonates to antibiotic therapy and develop resistance.

**Key word:** neonatal septicemia; I:T ratio, CRP.

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### **Introduction**

Neonatal septicemia is a clinical syndrome characterized by systemic signs of infection, and accompanied by bacteremia in the first month of life<sup>1</sup>. Sepsis is the most common cause of neonatal mortality and is responsible for 30-50% of total neonatal deaths, each year in developing countries<sup>2-4</sup>. As per National Neonatal Perinatal Database (NNDP) 2002-2003, incidence of neonatal sepsis in India was 30 per 1000 live birth<sup>5</sup>. 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 India<sup>6</sup>. 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 mother<sup>7</sup>. 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 sepsis<sup>8</sup>. 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 neonates<sup>9</sup>. The complete blood count (CBC) with various neutrophil parameters, mESR, C-reactive protein (CRP) are the most frequently used<sup>10</sup>.

#### Aims & Objectives

To compare the Immature: Total WBC ratio, micro ESR and C-Reactive Protein in early diagnosis of neonatal septicemia.

#### Material Method

This prospective study was carried out at shyam shah medical college and associated hospital during may2016 to april 2017.

Neonates with respiratory distress syndrome, cyanosis, apnea, transient tachypnea, meconium aspirated syndrome, birth asphyxia, lethargy, temperature instability and Neonates with maternal history of infection such as upper respiratory tract infection, pneumonia, UTI, vaginitis, premature rupture of membrane, chorioamnionitis with or without antibiotic intake during pregnancy were included in this study. Under aseptic condition we collected blood sample from the suspected sepsis neonates. BC-5150 Auto hematology analyzer (5parts) [Mindray] had been used for total count and is counter checked by improved neubauer's chamber. Peripheral blood smear was made and stained by leishman stain and I:T ratio was calculated.

For m-ESR blood was obtained by heel prick, done under aseptic precautions. An air free column of blood was then collected in a standard 75mm heparinised micro-hematocrit tube with internal diameter of 1.1mm, and one end of the tube sealed with plasticine. The tube was fixed vertically on the wall against a pre-marked perpendicular line. The height of plasma column was measured after the first hour, and reported as Micro-ESR in mm/hr. CRP was done by using CRP latex kit.

#### Observation and Result:

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.

#### Sex wise distribution of cases

| S.No. | Sex    | No. of cases | Percentage |
|-------|--------|--------------|------------|
| 1.    | Male   | 55           | 55%        |
| 2.    | Female | 45           | 45%        |

I:T ratio:

Sensitivity of the test is 89.6%, specificity is 73.8%, positive predictive value is 82.5% and negative predictive value is 83.7%.p value is <0.05 so the test is significant

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

**CRP:**

Qualitative C-reactive protein test 41 sample shows clumping and 33 samples were showing no clumps. 9 samples were false positive while 17 samples were false negative.

| <b>Qualitative C-Reactive protein test compared with blood culture</b> |          |                    |                 |              |
|--|----------|--------------------|-----------------|--------------|
|  |          | <b>Observation</b> |                 | <b>Total</b> |
|  |          | <b>Positive</b>    | <b>Negative</b> |              |
| 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%.p value is <0.05 so the test is significant.

**Micro ESR:**

- Sensitivity of the test is 60.3%, specificity is 73.8%, positive predictive value is 76% and negative predictive value is 57.4%.p value is <0.05 so the test is significant.

| <b>Micro –ESR compared with blood culture</b> |          |                    |                 |              |
|---|----------|--------------------|-----------------|--------------|
|   |          | <b>Observation</b> |                 | <b>Total</b> |
|   |          | <b>Positive</b>    | <b>Negative</b> |              |
| Micro-ESR                                     | Positive | 35                 | 11              | 46           |
|   | Negative | 23                 | 31              | 54           |
| Total   |          | 58                 | 42              | 100          |

Observation and result table

| Parameter | Sensitivity (%) | Specificity (%) | Positive predictive value (%) | Negative predictive value (%) |
|-----------|-----------------|-----------------|-------------------------------|-------------------------------|
| I:T Ratio | 89.6            | 73.8            | 82.5                          | 83.7                          |
| CRP       | 70.6            | 78.5            | 82                            | 66                            |
| m-ESR     | 60.3            | 73.8            | 76                            | 57.4                          |

All parameters result were compared with blood culture as gold standard

**Discussion:**

The present study includes the Role of hematological profile in diagnosis of clinically suspected cases of neonatal septicemia in 100 neonates in which 55 were male and 45 were females admitted in NICU of Sanjay Gandhi Memorial Hospital and Gandhi Memorial Hospital associated with Shyam Shah Medical College, Rewa (M.P). My study findings on I:TNR hematological parameter correlates with A.C.Buch et al<sup>11</sup> (2011) showing sensitivity 89.23% and specificity 70.91%, Prutha desai et al<sup>12</sup> (2014) showing sensitivity 83.33% and specificity 95%, Supreetha MS et al<sup>13</sup> (2015) showing sensitivity 91% and specificity 79%, Amrita Duhan et al<sup>14</sup> (2016) shows sensitivity 71%and specificity 78.40% whereas my study shows sensitivity 89.6% and specificity 73.8% and this shows that I:TNR can be a good tool for the early evaluation of neonatal sepsis.

My study findings on CRP parameter correlates with Haider shirazi et al<sup>15</sup> (2010) showing sensitivity 23% and specificity 84%, A.C.Buch et al<sup>11</sup> (2011) showing sensitivity 68.46% and specificity 73.64%, Prutha desai et al<sup>12</sup> (2014) showing sensitivity 86.66% and specificity 80% and Amrita Duhan et al<sup>14</sup>(2016) shows sensitivity 51.60% and specificity 79.40% whereas my study shows sensitivity 70.6% and specificity 78.5% this shows the parameter CRP can be a good tool in ruling out the possibility of neonatal sepsis.

My study findings on m-ESR parameter correlates with A.C.Buch et al<sup>11</sup> (2011) showing sensitivity 63.08% and specificity 72.73%, Prutha desai et al<sup>12</sup> (2014) showing sensitivity 71.66% and specificity 65% and Lakhey et al<sup>16</sup> (2017) shows sensitivity 51.4% and specificity 60.2% whereas my study shows sensitivity 60.3% and specificity 73.8% and this shows the parameter CRP can be a good tool in ruling out the possibility of neonatal sepsis.

**Conclusion:**

My study concluded that not a single parameter for detection of sepsis in neonates is very specific and blood culture takes a long time for the diagnosis of sepsis, so combination of various hematological parameters like I:TNR, CRP and m-ESR are more sensitive and specific for early detection of neonatal sepsis and it also help clinician to institute proper antibiotic therapy and helps to avoid unnecessary exposure of neonates to antibiotic therapy and develop resistance.

**References:**

1. Barbara JS. Infection of the neonatal infant. In: Behrman RE, Kliegman RM, Jenson HB, Stanton BF, editors. Nelson textbook of Paediatrics. 18th ed. Philadelphia: Saunders Company; 2008. p. 794-811.
2. Bang AT, Bang RA, Baitule SB, Reddy MH, Deshmukh MD. Effect of home-based neonatal care and management of sepsis on neonatal mortality: field trial in rural India. *Lancet*. 1999; 354(9194):1955-61.

3. Stoll BJ. The global impact of neonatal infection. *Clin Perinatol*. 1997; 24(1):1-21.
4. Indian Council of Medical Research New Delhi. National Neonatal Perinatal Database. Report 2002-2003. *NNPD Network*. Available at [http://www.newbornwhocc.org/pdf/nnpd\\_report\\_2002-03.PDF](http://www.newbornwhocc.org/pdf/nnpd_report_2002-03.PDF) Accessed Jun, 2005.
5. Tripathi Shalini, Malik G. K.. Neonatal Sepsis: Past, present and future; a review article. *Internet Journal of Medical Update* 01/2010;
6. Aggarwal R, Sakar N, Deorari AK, Paul VK. Sepsis in the newborn. *Indian J Pediatr* 2001; 68:1143-1147.
7. Chandna A, Rao MN, Srinivas M, Shyamala S. Rapid Diagnostic Tests in Neonatal Septicemia. *Indian J Pediatr* 1988; 55:947-953
8. Mehr S, Doyle LW. Cytokines as markers of bacterial sepsis in newborn infants: a review. *Pediatr Infect Dis J*. 2000; 19:879-887.
9. Chadna A, Rao MN, Srinivas M, Shyamala S. Rapid diagnostic tests in neonatal septicemia. *Indian J Pediatr*. 1988; 55:947-53.
10. Manroe BL, Weinberg AG, Rosenfeld CR, Browne R. The neonatal blood count in health and disease. I. Reference values for neutrophilic cells. *J Pediatr*. 1979; 95:89-98.
11. A.C.Buch, V. SRivastava, Harsha kumar, P.S. jadhav. Evaluation of haematological profile in early diagnosis of clinically suspected cases of neonatal sepsis. *International journal of basic and applied medical sciences*. 2011; 1(1): 1-6.
12. Prutha Desai, Amrisha N. Shah, Tejas Pandya, Pankaj Desai and Tejal Pandya. C-Reactive protein, immature to total neutrophil ratio and micro ESR in early diagnosis of neonatal sepsis. *International journal of Biomedical and Advance Research*. 2014; 05(08):364-366.
13. Supreetha MS, Sathyavathi R Alva, Shivendra VS, Kariappa TM. Evaluation of neonatal septicemia using hematological parameters. *International journal of recent scientific research*. 2015; 6(2):2775-2778.
14. Amrita Duhan, Anu Berwal, Preeti Raikwar, Anita Punia, Kalpana Beniwal, Hemlata T Kamra. Utility of Hematological Parameters in Detection of Neonatal Sepsis. *Journal of Krishna institute of medical sciences and university*. 2016; 5(3):98-106.
15. Haider Shirazi, Sadia Riaz, Rida Tahir. *Ann. Pak. Inst. Med. Sci.* Role of hematological profile in early diagnosis of neonatal sepsis. 2010; 6(3): 152-156.
16. Lakhey A, Shakya H. Role of sepsis screening in early diagnosis of neonatal sepsis. *Journal of pathology of Nepal*. 2017; vol 7:1103-1110.