International Journal of Microbiology Research
ISSN: 0975-5276 & E-ISSN: 0975-9174, Volume 11, Issue 5, 2019, pp.-1557-1560.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000234

Research Article

COMPARISON OF THE HEMATOLOGICAL PROFILE, C-REACTIVE PROTEIN AND BLOOD CULTURES FOR THE NEONATAL SEPTICEMIA SCREENING PREVALENT IN THE RAJKOT DISTRICT

CHUNDAWAT B.[1*], MAKWANA N.[2], GOSWAMI Y.S.[3] AND KACKER S.[4]
[1,4]RUHS College of Medical Sciences, Rajasthan University of Health Sciences, Jaipur, Rajasthan 302033, India
[2]GMERS Medical College, Civil Hospital Campus, Gandhinagar, 382012, Gujarat University, Ahmedabad, 380 009, Gujarat, India
[3]GMERS Medical College, Patan, 364265, Hemchandracharya North University, Patan, 384265, Gujarat, India
*Corresponding Author: Email - shubs181011@gmail.com

Received: May 01, 2019; Revised: May 24, 2019; Accepted: May 26, 2019; Published: May 30, 2019

Abstract- Neonates are easily prone to bacterial infection. Diagnosis of neonatal septicemia may be difficult as the early signs of sepsis may be subtle and different at different gestational ages so difficult to diagnose. The present study was undertaken to assess the significance of the hematological scoring system (HSS) for early detection of neonatal sepsis. The HSS is a simple, quick, cost effective tool which can be used as a screening test for early diagnosis of neonatal sepsis through the blood culture is considered gold standard for diagnosis, result comes after 48-72hrs so a practical septic screen is done. Elevated CRP levels, hematological profile and blood culture all together are required in the combination for the diagnosis of sepsis. **Background:** Neonatal septicemia is characterized by clinical signs and symptoms accompanied by bacteremia in the 1st month of life. This is because the new-born especially the premature are prone to serious infections by organisms and partly because the signs of these infections may be absent or minimal and hard to detect. Thus, fatal septicemia may occur with little warning. Hence the timely diagnosis of sepsis in neonates is critical as the illness can be rapidly progressive and, in some instances, fatal. There is no specific laboratory test with 100% sensitivity and specificity. **Aim:** The present study emphasis the role of more than one factor in combination for the diagnosis of the neonatal septicemia. **Material and Methods:** The 100 clinically suspected cases of Neonatal septicemia had undergone microbiological investigation at Microbiology Department, PDU Gov. Medical College which were attended at Ktch-Nicu, P.D.U Gov. Medical College, Rajkot, Gujarat from August 2012 to November 2012.It is a referral centre receiving samples from primary health centre, community health centre & urban health centre under Rajkot district and postgraduate training institute that provides neonatal care for patients from all Saurashtra & Kutch regions. Patients were seen after the initial clinical diagnosis of sepsis was made with signs of Tachypnea, lethargy, poor cry were the main presenting features followed by refusal to feed, jaundice, abdominal distension, fever, diarrhoea, seizure, hypothermia, conjunctivitis. From the birth upto the age of 5days are included Performed by semi quantitative latex agglutination method. **Result:** Out of 100(58 male, 42 female) neonates with suspicion of septicemia, 50 weighed between 1500 and 2000 g,40 weighed between 2001-2499 g and 10 neonates weighed >2500 g. 69% (n = 69) presented within 72 hours of life (early onset septicemia) and 31% (n = 31) after 72 hours (late onset septicemia).According to the HSS sepsis confirmed cases are 65(score> 5), probability of sepsis is seen in 18 cases(score 3-5), Sepsis negative cases are 17(score<2). Blood culture positive in 64 cases amongst them in 54 cases had septic score >5, CRP is elevated in 70 cases amongst them 57 cases had septic score >5, I:T ratio >.2 is seen in 62 cases amongst them 48 cases had septic score >5.Sensitivity and specificity of all the parameters were calculated but none of the laboratory test is 100% sensitive and 100% specific. Though the blood culture is gold standard but didn't prove effective solely. So, all the factors are used in the correlation for the accurate diagnosis of the neonatal septicemia. Even the cost effective hematological septic score is better alternative. **Conclusion:** For the accurate, rapid and cost-effective diagnosis of the neonatal septicemia, hematological septic score is better alternative. Though the blood culture is the gold standard but none of the laboratory test is 100% sensitive and specific so the combination of HSS, Elevated CRP, blood culture are read together for the diagnosis of the neonatal septicemia.

Keywords- *Neonatal sepsis, Hematological scoring system, C - reactive protein, Blood culture*

Citation: Chundawat B., *et al.*, (2019) Comparison of The Hematological Profile, C-Reactive Protein and Blood Cultures for The Neonatal Septicemia Screening Prevalent in The Rajkot District. International Journal of Microbiology Research, ISSN: 0975-5276 & E-ISSN: 0975-9174, Volume 11, Issue 5, pp.-1557-1560.

Academic Editor / Reviewer: Dr Manuja Agarwal, Dr Nilofer Khayyam, Dr Gaurav Dalela

Introduction

Neonatal septicemia is characterized by clinical signs and symptoms accompanied by bacteremia in the 1st month of life. This is because the new-born especially the premature are prone to serious infections by organisms and partly because the signs of these infections may be absent or minimal and hard to detect [1-4]. Thus, fatal septicemia may occur with little warning

Material and Methods

The Study Population:

This is a cross sectional prospective study, performed in the Microbiology Department, P.D.U Medical College, Rajkot, in which 100 patients of the Neonatal infection both early and late presenting to the Keshavlal Tilakchand Pediatric department, P.D.U Government Medical College, Rajkot, Gujarat from August 2012 to December 2012 were included in the study. It is a referral center and postgraduate training institute that provides neonatal care for patients from all Saurashtra & Kutch regions. A total of 100 consecutive patients with neonatal infection were analyzed with the special reference to etiology and predisposing factors, examination in detail of morphological features, microbiological work up, management and follow up.

The case definition and criteria for inclusion in the study

Patients were seen after the initial clinical diagnosis of refusal for feed, abdominal

distension, vomiting, lethargy, jaundice, poor cry, seizures, diarrheal, apnoea, tachypnea, poor capillary refill, hypothermia, fever and umbilical discharge. If baby had three or more than three of above signs or symptoms septicemia was suspected.

The Study Samples

Blood samples collected in EDTA tube for the hematological profiling, plain tube for CRP and 5 ml blood for the brain heart infusion broth blood culture bottles.

Laboratory Procedures

Blood sample was obtained by peripheral venipuncture in an ethylenediaminetetraacetic acid (EDTA) vial. The total leukocyte counts were counted on a Sysmex counter (Sysmex K21) and corrected for nucleated red blood cells. Differential counts were performed on Fields stained blood smears by counting at least 200 cells. A band was defined as a neutrophil in which the nucleus was intended by more than one half, but in which the isthmus between the lobes was wide enough to reveal two distinct margins with nuclear material between.[5] All films were reviewed by a pathologist blinded to the infection status of the infants. Degenerative morphologic changes in neutrophils were graded 0 to 4+ according to Zipursky *et al*. [6]. Immature neutrophils include promyelocyte, myelocyte, metamyelocytes, and band form. Degenerative changes in neutrophils include vacuolization, toxic granulations. The hematological findings were analyzed according to the hematologic scoring system (HSS) of Rodwell *et al.* [7].

Ethical Consideration

The data collected for the purpose of current research is the part of the diagnostic techniques, so the ethical consideration is not needed. The patients presented with the neonatal infection are promptly treated and there privacies are secured and the results are kept confidential. The prompt treatment is provided to all the ailing subjects.

Result

100 patients of neonatal infection studied over a period from August 2012 to December 2012. Out of 100 cases 53 cases were presenting with early onset septicemia and 47 were with late onset septicemia. Amongst 100 cases 59 are pre term and 41 are born full term. Males are affected more than female with 1.77(64 males and 36 females), according to the Rodwell *et al*[7].

Table-1 *Heamatological septic score (HSS) of Rodwelletal*

	Blood Culture Positive	Blood Culture Negative	Total
Sepsis Confirmed (Score>5)	54	11	65
Sepsis Negative (Score 3-4,<2)	10	25	35

P value = 0.0001, chi square value = 27.02

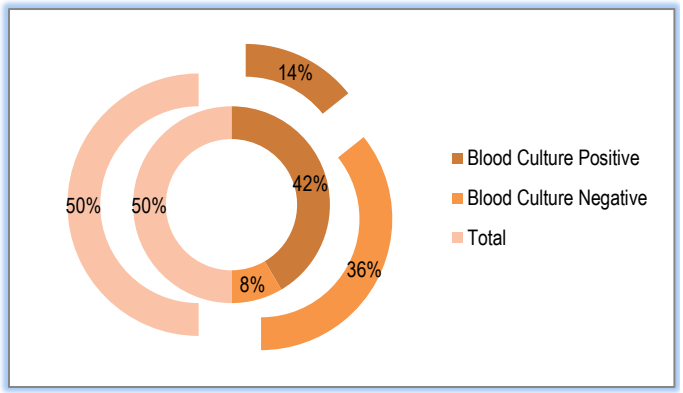


Table-2 *Blood culture correlation with sepsis score.*

	Blood Culture Positive	Blood Culture Negative	Total
Score >5	54	11	65
Score 3-5	5	13	18
Score<2	5	12	17

P value= 0.0003, chi square value= 13.22

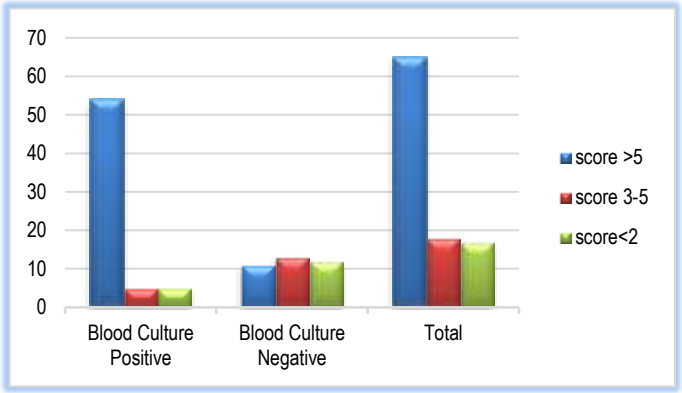


Table-3 *Elevated CRP correlation with sepsis cases.*

	CRP Pos	CRP Neg
Sepsis Positive	57	8
Sepsis Negative	13	22

Elevated CRP is used to assess the neonatal septicemia has: sensitivity of81.43% and specificity of 73.33%

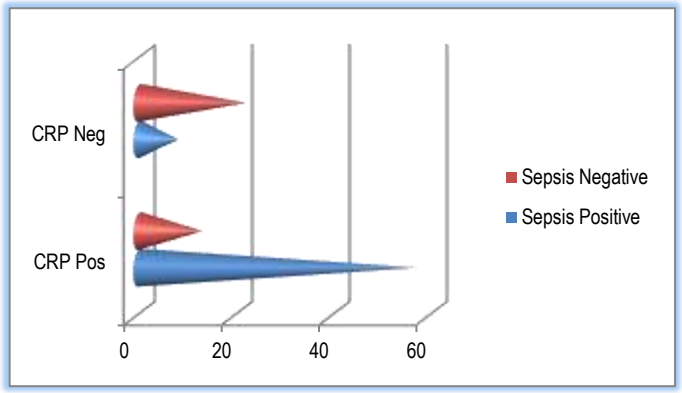


Table-4 *Blood culture correlation with sepsis cases.*

	Blood Culture Positive	Blood Culture Negative
Sepsis Positive	54	11
Sepsis Negative	10	25

Positivity in blood culture used to assess the neonatal septicemia has: Sensitivity of 84.38%% and specificity of 69.44%

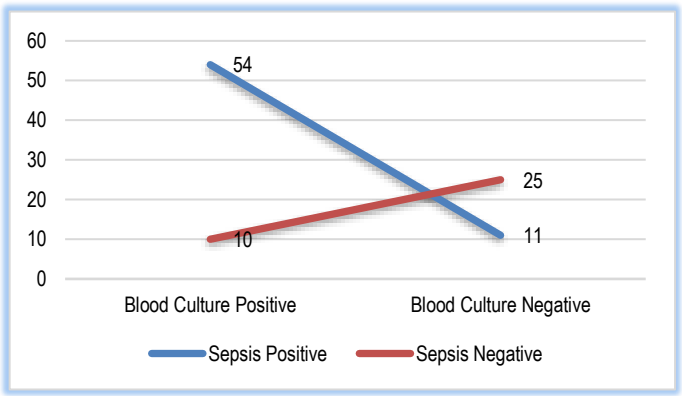
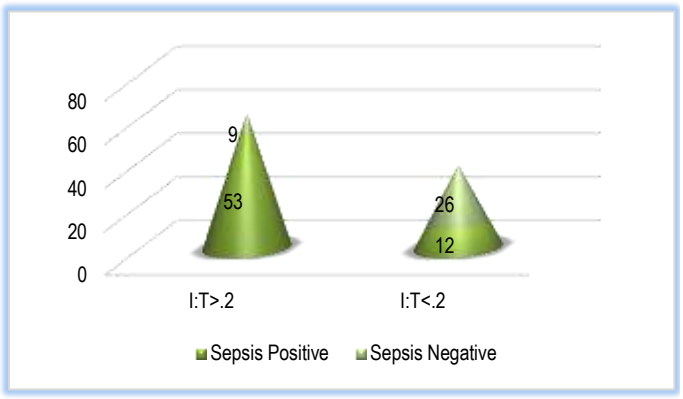


Table-5 *Heamatologicalcorrelation with sepsis cases*

	I:T>.2	I:T<.2
Sepsis Positive	53	12
Sepsis Negative	9	26

I:T>.2 used to assess the neonatal septicemia has: sensitivity of 85.48% and specificity of 68.42%.

Blood culture is considered as the gold standard test for the diagnosis of neonatal septicemia, but my study shows the almost equal sensitivity and specificity with the parameters to assess the septicemic cases. None of the laboratory test is 100% sensitive and 100% specific. So, all the laboratory parameters are used in synergistic way for the accurate diagnosis of neonatal septicemia.



Discussion

Males are affected more than female with 1.77(64 males and 36 females) among the infected newborns, the predominance of male was due to the factors regulating the synthesis of ã globulin are situated on the X chromosome. Male has only one X chromosome; he is less immunologically protected than the female. Amongst 100 cases 59 are pre term and 41 are born full term. Preterm and very low birth weight babies are more susceptible to infection due to low level of IgG and lower defense mechanism [8]. Neonatal diagnosis may be difficult as the early signs of sepsis may be subtle and different at different gestational ages [9]. The definitive diagnosis of septicemia is made by a positive blood culture, which requires a minimum of 48-72 h and yields a positive result in only 10-60% of cases [10, 11]. In this study 54% neonates were considered as proven sepsis by blood culture. However suspected sepsis groups (11%) comprises a difficult diagnostic group and could not be ignored, because fatal infection had been reported in other study in the presence of negative blood culture .No single individual hematological parameter is superior in comparison to another in predicting neonatal sepsis, a combination of these parameters in the form of HSS has been recommended. Hematologic scoring system (HSS) should improve the efficiency of the CBC as a screening test for sepsis until a reliable diagnostic test is available

Table-6 Hematologic scoring system (HSS)

Points	Abnormality	Score
I:T ratio*	>.2	1
Total PMN count*†	Or	1
I:M ratio	≥ 0.3	1
Immature PMN count*		1
Total WBC count	or (d" 5,000/mm3 or > 25,000, 30,000, and 21,000/mm3 at birth, 12-24 hrs, and day 2 onward, respectively)	1
Degenerative changes	≥3+	2
in PMN‡	≤ 100,000/ mm3	
Platelet count		1

*Normal values as defined by reference ranges of Manroe *et al* (1979).
†If no mature PMNs are seen on blood film, score 2 rather than 1 for abnormal total PMNs count.
‡ Quantified to 0 to 4+ scale according to classification of Zipursky *et al*
Total PMNs counts: 7,800-14,500 /mm3 (<72 hours), 1,750-4500 / mm3 (>72 hours)
Immature PMNs counts: 500-1450 (<72 hours), 500 (Upto 28 days)

Table-7 Interpretation

Score	Interpretation
≤ 2	Sepsis is very unlikely
3 or 4	Sepsis is suspected
≥ 5	Sepsis or infection is very likely

Minimum score: 0, Maximum score: 8

Out of 100 cases 53 cases were presenting with early onset septicemia and 47 were with late onset septicemia. Dulay et al., studied neonatal hematological indices and assessed sepsis categorization in all 68 neonates. And white blood cell (WBC) count and absolute neutrophil count (ANC) were not significant. In contrast, the associations with absolute band count (ABC), hematocrit, hemoglobin, bandemia, lymphocytes, and I:T ratio continued as significant [12]. I/T ratio >0.2 had a Sensitivity of 85.48% and specificity of 68.42%. While an I/T ratio >0.2 suggested by Rodwell, Lesilie, and Tudehope had a sensitivity of 96% and NPV of 99%. So this result for an elevated I/T ratio were consistent with other reports [13]. Considering high mortality and morbidity associated with sepsis, tests with high sensitivity are most desirable because all infants with sepsis have to be identified Aggarwal *et al.,* [14] reported that sepsis was the commonest cause of neonatal mortality and was responsible for 30-50% of the total neonatal deaths each year in developing countries. The incidence of neonatal sepsis was reported to be 38 per 1,000 live births in tertiary care institutions [15]. Blood culture was considered as the gold standard test. But as the results obtained are delayed upto 72 hrs. False positive results 10% was obtained due to faulty techniques in the blood collection, contamination at the time of collection, common use of needle, aseptic techniques not followed strictly. False negative results 11% was obtained due to decreased volume of blood collected, no proper sample transport, delayed transit time, antibiotics given prior to culture hence Sensitivity of 84.38%% and specificity of 69.44% was obtained. Elevated CRP is found in the infective and inflammatory conditions correlating to septicemia with Sensitivity of 84.38%% and specificity of 69.44%Shirazi *et al*., studied 138 neonates with suspected sepsis. They evaluated the usefulness of white blood cell count and C-reactive protein as an early indicator of neonatal septicemia. The advantage of HSS is that it is easy to perform and applicable to all infants, including those who have received antibiotics [16]. Inability to adequately exclude the diagnosis of neonatal sepsis can result in unnecessary and prolonged exposure of the newborn to antibiotics. Thus, laboratory tests that assist the clinician in diagnosis of infection in neonates have considerable relevance [17].

Conclusion

The HSS is simple, quick, cost effective and readily available tool in the early diagnosis of neonatal sepsis [18]. It could provide a guideline to decisions regarding antibiotic therapy and thereby minimizes the risk of emergence of various resistant organism like MRSA and ESBL [19]. The regular blood culture of affected low birth weight neonate and microorganism detection along with the sensitivity pattern of antibiotics done to curtail the problem [20,21].

Application of research: This study is done to find the best parameter to screen the neonatal septicemia, as early as possible. As neonatal septicemia is most threatening life condition, so accurate and early diagnosis is must.

Research Category: Medical microbiology

Abbreviations:
HSS: Hematologic scoring system
PMN: Polymorph neutrophil count
ABC: absolute band count
WBC: white blood cell count
ANC: Absolute neutrophil count
ABC: Absolute band count, CRP: C reactive protein

Acknowledgement / Funding: Authors are thankful to P.D.U. Government Medical College, Rajkot, 360001, Saurashtra University, Rajkot, 360005, Gujarat, India. Authors are also thankful to GMERS Medical College, Patan, 364265, Gujarat University, Ahmedabad, 380 009, Gujarat, India

***Research Guide or Chairperson of research: Dr Yogesh S Goswami**
University: Hemchandracharya North University, Patan, 384265, Gujarat
Research project name or number: Clinical research

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Blood samples collected Ktch-Nicu, Microbiology Department, P.D.U Medical College, Rajkot,

Conflict of Interest: None declared

Ethical approval: Ethical approval taken from UHS College of Medical Sciences, Rajasthan University of Health Sciences, Jaipur, Rajasthan 302033, India.
Ethical Committee Approval Number:

References

[1] Bang A.T., Bang R.A., Bactule S.B., Reddy H.M., Desmukh M.D. (1999) *Lancet*, 354, 1955-61.

[2] Barbara J.S. (2008) *In, Behrman R.E, Kliegman R.M, Jenson H.B, Stanton B.F, editors. Nelson textbook of Paediatrics*. 18th ed.2008, 794-811.

[3] Xanthour M. (1970) *Arch Dis Child*., 45,242-249.

[4] Speer C.P., Gahr M., Schrotter W. (1985) *Monatsschr Kinderheilkd*, 133(9), 665-668.

[5] Manroe B.L., Weinberg A.G., Rosenfeld C.R., Browne R. (1979) *J. Pediatr*., 95,89-98.

[6] Zipursky A., Alko J., Mitner R., Akenzua G.I. (1976) *Pediatric*., 57,839-53.

[7] Rodwell R.L., Leslie A.L., Tudehope D.I. (1988) *J Pediatr*., 112,761-67.

[8] Khalada Binte Khair, Mohammad Asadur Rahman, Tuhin Sultana, Chandan Kumar Roy, Md. Quddusur (2010) *BSMMU J*., 3(2), 62-67.

[9] Ghosh S., Mittal M., Jaganathan G. (2001) *Indian J Med Sci*., 55,495-500.

[10] Khair K.B., Rahman M.A., Sultana T., Roy C.K., Rahman M.Q., Shahidullah M., et al. (2010) *BSMMU J*., 3,62-7.

[11] Dulay A.T., Buhimschi I.A., Zhao G.B., Luo G., Abdel-Razeq S., Cackovic M., et al. (2008) *Am J Obstet Gynecol*,198(426) e1-426.e9

[12] Philip A.G.S., Hewitt J.R. (1980) *Pediatrics*, 65(5), 1036-1041.

[13] Aggarwal R., Sarkar N., Deorari A.K., Paul V.K. (2001) *Indian J Pediatr*., 68, 1143-7.

[14] Shirazi H., Riaz S., Tahir R. (2010) *Ann Pak Inst Med Sci*., 6, 152-6.

[15] Narasimha A., Harendrakumar M.L. (2011) *Indian J Hematol Blood Transfus*, 27, 14-7.

[16] RonnimolJoJi, Aparna Y. Takpere and Shilpi Gupta (2018) *Asian J of Microbiology, Biotechnology and Environmental Science*, 20(2), 409-412.

[17] Mihir J. Bhalodia Surekha B. Hipping, M.M. Patil. (2017) J. *of Clinical Neonatology*, 6(3), 144-147.

[18] Abimbola Ellen Akindolire, Olukemi Tongo, Hannah Dada Adegbola. (2016) *The Journal of Infections in Developing Countries*, 10 (12), 1338-1344.

[19] Shamshul Ansari, Hari Prasad Nepal, Rajendra Gautametal (2015) *International Journal of Pediatrics*, Article id 379806.

[20] Shah B.A. and Padbury J.F. (2014) *Virulence* 5 (1), 170-178.