Micro ESR in the evaluation of neonatal sepsis

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Abstract

Introduction: Neonatal sepsis is a major cause of neonatal morbidity and mortality in the developing countries like Nepal. Early diagnosis and treatment is crucial for the outcome but it is difficult in many situations especially in places with limited resources. Objective of this study is to evaluate the role of micro ESR in the diagnosis of neonatal sepsis.

Methods: A prospective analytical study was done where newborns with suspected sepsis admitted for septic work up and IV antibiotics were included in the study. Micro ESR was measured with relevant septic screening investigations. The micro ESR value was compared to age specific normal values and the results were compared with various clinical presentations, laboratory findings and outcome variables.

Results: Out of 111 babies micro ESR was elevated in 63 babies and blood culture was positive in 15 cases and meningitis was present in 8 cases. Total proven cases were 16 and probable sepsis were 34. Correlation of elevated micro ESR was statistically significant with PROM >18 hours, presence of clinical symptoms, clinical and systemic signs. It had significant clinical association with blood culture and CSF findings. The sensitivity, specificity, positive and negative predictive value compared with blood culture was 100%, 47.5%, 15.6% and 20.8%, comparing with proven or no sepsis cases was 70.5%, 48.1%, 36.9% and 50% respectively.

Conclusions: Micro ESR is simple cheap and relatively sensitive, specific with good negative predictive value in the prediction of neonatal sepsis and can be useful test in settings with limited resources.

Key words: Micro ESR, neonate, sepsis

Introduction

Neonatal sepsis is an invasive bacterial infections that involve primarily the bloodstream in infants during the first month of life.[1] Its incidence varies from 2.7/1000 live births in developed countries to 10-15/1000 live births in developing countries. The incidence is 1 per 250 live premature births.[2] The neonatal mortality rate of Nepal is 33/1000 live births which accounts for 69 % of the infant mortality rate (48/1000 live births).[3] The most common causes of neonatal mortality being sepsis, birth asphyxia, prematurity and hypothermia.[4] The contribution of neonatal sepsis for such high mortality and morbidity rates makes it an important subject for study as well as action. The early diagnosis is crucial but is difficult because of the subtle and nonspecific features.[1]

There is no rapid and reliable test for confirmation of etiologic diagnosis. The treatment is generally started when clinical picture is supported by indirect early markers of neonatal infections.[5] Recovery of the organisms from blood and body fluids substantiate the clinical impression of sepsis. Due to unavailability of blood culture report till 48 to 72 hours, various combination of laboratory tests are useful in the prediction of early neonatal sepsis.[2]

The erythrocyte sedimentation rate (ESR) is a useful test

applied to screening for, or the serial monitoring of disease states.[6] Determination of ESR in capillary blood can be of value in evaluating sick newborns.[7] The basis of the micro-ESR method is the reduction of the required specimen volume by using a column with an internal diameter of only 1 mm rather than the 2.5 mm or more of a standard method.[8] The micro method is simple to perform and reproducible and requires only 0.2 ml blood.[6]

Though being simple and oldest bed side test Micro ESR is not routinely measured and no study has been done in Nepalese Population. This is an attempt to see the predictive value of this test. If it shows good predictive value physicians working at settings with limited resources can benefit and contribute in early diagnosis and prompt treatment of sepsis thus reducing neonatal morbidity and mortality.

Methods

This was a prospective analytical study carried out at Neonate unit and Maternity ward of Tribhuvan University Teaching Hospital (TUTH), Kathmandu. A total of 111 babies admitted with diagnosis of suspected sepsis fulfilling the inclusion and exclusion criteria were included in the study from 1st January 2009 till 30th June 2009. Inclusion Criteria was neonates admitted as suspected neonatal sepsis and with Hb >10Gm % and <20 Gm %. Exclusion criteria were anemia (Hb <10 Gm%) and polycythemia (Hb > 20 Gm%), presence of a chromosomal, genetic, or inborn metabolic disorder neonates already on treatment and neonates without risk factors and clinical criteria for sepsis. Ethical approval was taken from Institutional Review Board before conducting the study.

Neonates suspected of sepsis were enrolled in the study after getting written consent from the care givers or parents. During the septic work up of the baby minimum amount of blood (0.2 ml) of blood is collected in a capillary tube using full aseptic precautions and micro ESR is read at 1 hour .The treatment of the baby was continued as per the protocol irrespective of micro ESR values

The neonates were evaluated by a thorough history from mother, maternal parameters at birth and detail clinical examinations. The weight of the babies was taken using Electronic scale with calibration of 50 grams. Gestational assessment was done using Modified Ballard Score.

The risk factors for sepsis were premature rupture of membranes, foul smelling liquor, maternal fever during 24 hours of delivery, maternal chorioamnionitis, foul smelling liquor and meconium staining of liquor. The neonatal risk factors included babies with refusal to feed, Fever, lethargy,

tachypnea, hypothermia, breathing difficulty, eye discharge, jaundice, skin pustules and any other signs of sepsis.

The laboratory and radiological investigations were done for diagnosis and confirmation of the diagnosis and confirmation of infection as per clinical scenario. Complete blood count including peripheral smear for band cells toxic granulations and degenerative changes in Neutrophils, blood culture were sent and relevant radiological investigation and CSF examination was done. Relevant swab and surface and discharge cultures like skin pustule, eye swab, culture of stool and urine when indicated and Tracheal aspirate in cases of ventilated babies. Stool culture was sent in babies with persistent abdominal distension and significant nasogastric aspirate or persistent vomiting. Neonates were classified as proven sepsis for those with culture proven sepsis, Probable sepsis for those with clinical impression of sepsis with other abnormal laboratory or radiological results but negative for culture and no sepsis when clinical parameters, lab or radiological parameters all were normal.

Antibiotics were started as per the Unit protocol on the on the babies of clinical presentation or obstetric risk factors. Initial empiric antibiotics used were Crystalline Penicillin and Gentamycin. Antibiotics were changed according to sensitivity patter in cases of culture positive sepsis and on clinical grounds in cases of culture negative sepsis. Babies were followed till discharge.

Measurement of Micro ESR was performed using 0.2ml blood in microhematorit capillary tubes in all babies suspected of sepsis and the readings are read at 1 hour of the test and labeled as normal to age or elevated for age based on the conventional values age in day of life +3 being the 95th percentile value as given by Alder and Denton in 1975.[9] The babies continued to get treatment as per the protocol irrespective of the micro ESR Values.

The collected data was entered into SPSS software and analysis was also done by the same. Main statistical methods used were Cross tabulation and comparison using micro ESR as a dependent variable and other variables as independent variable. Odds ratio (OR) with 95% confidence interval(CI),Pearson's Chi square test and Fishers Exact test .P value of < 0.05 is considered statistical analysis. Binary and multiple logistic regression was applied using micro ESR as test or dependent variable

Results

Out of 111 babies micro ESR was elevated in 63 babies and blood culture was positive in 10 cases and meningitis was present in eight cases but CSF culture was positive in only

one case and other cultures like stool, eye swab and endotracheal aspirate was positive in 2 and 1 each respectively. Total culture proven cases were 15 only as shown in Figure 1. Probable sepsis based on other laboratory abnormalities and clinical features were 34 as shown in Table 1.
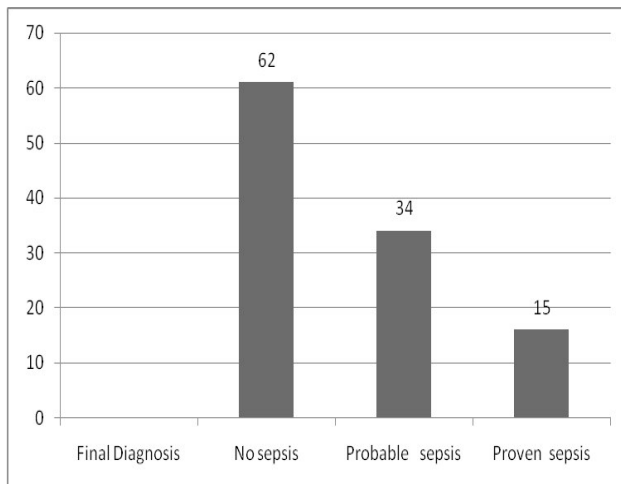
Fig 1: The final diagnosis of neonates enrolled in the study

Of the babies with predispostion to sepsis and subjected for septic work up premature rupture of membrane was the most important cause ,65 ie 58.5% had premature rupture of membranes (PROM) more for than 18 hours (Fig. 2).
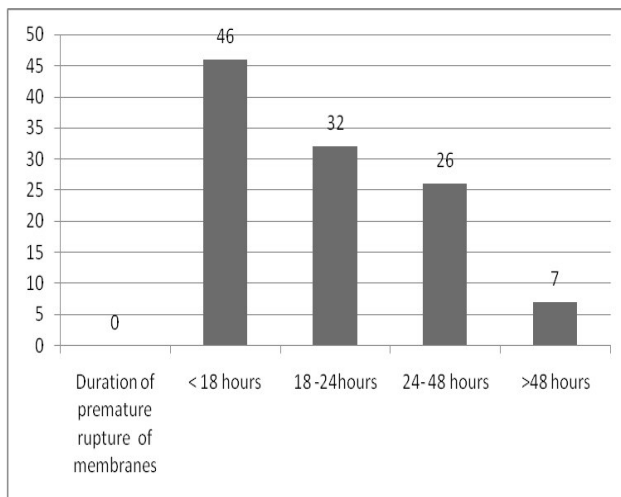
Fig 2: Duration of PROM in study subjects

50 neonates were included in the study because of obstetric risk factors without any clinical symptoms, however 61 had clinical symptoms of sepsis. Of the clinical symptoms fast breathing, fever and refusal to feed were commonest 3 clinical symptoms at presentation as shown in Table 1.

Table 1: Clinical symptoms and signs observed in our study

Clinical symptoms and signs	Frequency	Percent
None	50	45.0
Refusal to feed	12	10.8
Vomiting	8	7.2
Lethargy	9	8.1
Abdominal distension	1	.9
Fever	11	9.9
Seizures	2	1.8
Cyanosis	2	1.8
Tachypnea, breathing difficulty or apnea	14	12.6
skin pustules	1	.9
Eye Discharge /Bacterial conjunctivitis	1	.9
Total	111	100.0

Correlation of elevated micro ESR was statistically significant with PROM >18 hours, period of gestation, age at admission, presence of clinical symptoms, clinical signs and systemic signs. The elevated micro ESR showed significant clinical association with clinical sepsis scoring, hematological scoring system and blood culture and CSF findings at P vale of <0.05.

The blood culture was positive only in 10 babies in our study and E. coli was the grown in 5 cases followed by Klebsiella Pneumonia in 4 and S. aureus in 1 cases as shown in Table 2.

Table 2: Blood Culture report in our study

Blood Culture report	Frequency	Percent
No growth	101	90.9
Escherichia coli	5	4.5
Klebsiella pneumonia	4	3.6
Staphylococcus aureus	1	0.9
Total	111	100.0

The sensitivity, specificity and positive and negative predictive value of micro ESR compared with blood culture was 100%, 47.5%, 15.6% and 20.8% respectively.

The performance of micro ESR in diagnosing probable sepsis in comparison to proven or no sepsis cases was with sensitivity, specificity and positive and negative predictive value of 70.5%, 48.1%, 36.9% and 50% respectively.

Discussion

Neonates of <24 hours of age comprised of 81.1%(n = 90) as the babies with various obstetric and neonatal risk factors or features were subjected to septic work up and evaluation soon after birth and these babies were all born at T U

Teaching Hospital. The rate of early onset sepsis as 1 to 4 cases per 100 live births and clinical signs of early onset sepsis are usually apparent in the first hour life and 90% of them will be symptomatic by 24 hours of age.[10]

The common predisposing obstetric risks for sepsis in our study were PROM > 18 hours which comprised of 58.6 % (n = 65) and maternal fever in 9% (n =10) babies. This observation is higher that than studied in various other places. In a similar study done by Joshi BD[11] 25.9% of cases of sepsis were associated with PROM of > 24 hours.

Blood culture, the gold standard test for diagnosis of neonatal sepsis[12] was positive in 10 (9.0%) babies in the study and CSF culture was positive in only one (0.9%) baby. Other cultures like culture of tracheal secretions in ventilated babies was positive in one, stool culture was positive in two and Eye swab was positive in only one of the babies. Thus the total culture positive were 15 cases only. The blood culture positivity was 10.2 % and CSF positivity was 5.45%.in a study done by Kaiser JR et al [13] The blood culture positivity correlates well with this study but the low turnout of CSF culture could be due to delayed lumbar puncture or delayed processing of CSF in sick babies in our study.

Blood culture positivity was 25% in studies done by Mathur et al [14] and Joshi et al [15].Highest blood culture positive rates of up to 59.7% was observed in a study done by Karki et al .[16]The lower culture positive results in our study could be due to the fact that 81.1% of included neonates were <24 hours of age and blood culture was sent at the time of first examination as screening procedure before they developed any signs of sepsis clinically. Of the 10 Blood culture positive cases in our study Gram Negative bacilli Escherichia Coli was isolated in five (4.5%) cases followed by Klebsiella Pneumonea in four (3.6%) cases and Staphylococci in 1(0.9%).This is similar to a study done by Ghosh et al[17] where the commonest organism isolated was E. Coli 9(30%) followed by Staphylococcus aureus 8(27%) and Klebsiella 5(17%). While Kumar and Singhi [18] isolated Klebsiella as the commonest organism followed by Staphylococcal Aureus, Pseudomonas and E.Coli.[18] Guha et al[19] also found E. coli as the commonest organism followed by Klebsiella. Joshi BD[11] observed staphylococci as the commonest pathogen followed by Klebsiella and Entreococcus.

Micro ESR elevated beyond the cutoff for the age of babies was taken as elevated in the babies. This was elevated in total 63 (56.8%) of babies and normal in 48(43.2%) of the babies included in the study. This value is similar to a study done by Kumar and Singhi [18] where 66% of sick infants had raised micro ESR values.

Conclusions

Micro ESR is a simple cheap and relatively sensitive, specific with good negative predictive value in the prediction of neonatal sepsis and can be useful test in the settings with limited resources.

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