International Journal of Contemporary Pediatrics
Sharma D et al. Int J Contemp Pediatr. 2018 Jul;5(4):1666-1673
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: http://dx.doi.org/10.18203/2349-3291.ijcp20182586

Original Research Article

Risk scoring and prediction of early onset septicaemia in neonates through study of perinatal factors

Deepika Sharma[1], Ashish Batham[2]*

[1]Paediatrician, The Child Clinic and Vaccination Center, Indore, Madhya Pradesh, India
[2]Department of Paediatrics, Index Medical College, Indore, Madhya Pradesh, India

Received: 24 April 2018
Accepted: 23 May 2018

***Correspondence:**
Dr. Ashish Batham,
E-mail: pm.mech2008@yahoo.com

ABSTRACT

Background: Diagnosis of early onset septicaemia is often difficult due to lack of specificity of clinical manifestations. Being a common but neglected problem, the present study was undertaken to develop a scoring system which can predict early neonatal septicemia.
Methods: 300 newborns born out of consecutive deliveries were assessed for the total score as combination of physical factors and neuromuscular factors. Information for perinatal factors was collected on a prepared pro forma by questionnaire method. Data was tabulated and subjected to statistical analysis.
Results: Incidence of neonatal infection was higher in the presence of birth asphyxia, unclean vaginal examination, presence of foul smelling vaginal discharge, or when duration of labour exceeded 24 hours as compared to prolonged rupture of membranes. Incidence of infections among babies born before 37 weeks gestation or having a birth weight of 2 kg or less was nearly the same as in the cases of premature rupture of membranes (PROM). 224 cases got score 0-3 and only 0.6% got infected, whereas out of 62 cases with score 4-5, 51.6% were infected and 14 out of 14 having score of 6 or more had infection. The sensitivity of scoring system was 96%, specificity 90%, positive predictive value of 88% and negative predictive value of 60.5%.
Conclusions: Besides PROM there are many other perinatal factors which are of significance in relation to early onset infections. This led to the formulation of the presenting scoring system. Validation of this scoring system through further studies can help in early diagnosis, administration of proper antibiotics and inhibition of the irrational use of antibiotics.

Keywords: Neonate, Perinatal factors, Scoring, Septicemia

INTRODUCTION

The earliest description of infants with sepsis has been attributed to Ylppo, who first recognized sepsis as a cause of infant mortality in 1919 when he documented positive culture results from the heart in infant dying from a variety of pathologic conditions (Ylppo).[1]

It was his belief that postmortem cultures were indicative of antemortem blood stream invasion. However, it was not until the 1930s that case report began to appear in the pediatric literature in which the diagnosis of sepsis was confirmed before death occurred (Cambell 1931). Subsequently, Dunham described 33 cases of neonatal sepsis at New Haven Hospital, most of which were diagnosed antemortem. In 60% of these cases, onset of sepsis was in the first week of life, but only in 10% were the infants symptomatic at birth.

In her original report Dunham, noted the lack of specificity of the clinical manifestations of infections in the neonate

and emphasized the difficulty in making the diagnosis. In 1949, Silverman and Homan described 25 infants in whom blood stream infection appeared to be the major problem.[1] In defining the syndromes these researchers made the important observation that, "the most rigorous definition of the newborn confines itself to a group of infections which are presumably acquired at or shortly after birth."

The basic treatment of infants with sepsis has not changed substantially over the last 50 years, (antibiotics with or without supportive care), so it is likely that further improvements in outcome will result from a greater understanding of the perinatal factors responsible for sepsis, interventions that addresses those factors, and better ways to identify the infected newborns.

Though the blood culture is mandatory for diagnosis and determination of antibiotic therapy, this would result in delay treatment which would lead to adverse outcome in some neonates. However, antibiotics can be started early if we pick up septicemia earlier by scoring system. There have been few scoring system developed using number of variables to make the diagnosis predictable. From the management and diagnosis point of view, as well as being a common but neglected problem, the present topic was undertaken to develop a scoring system which can predict early neonatal septicemia and proper antibiotics can be administered and also it will inhibit the irrational use of antibiotics.

METHODS

The present study was carried out in nursery of MY Hospital, Department of paediatrics, MGM Medical College, Indore (Madhya Pradesh) over a period from September 2008 to September 2009. 300 newborns born out of consecutive deliveries in MYH were taken and they were assessed for the total score as follows.

Score '2' is given to each one of the following perinatal factors:

- One minute APGAR score of 0-6
- Unclean vaginal examination done before delivery
- Foul smelling liqour aminii
- Duration of labour exceeding 24 hrs

And Score '1' is given when

- The duration of rupture of membranes before delivery exceeded 24 hrs
- Baby born before completing 37 weeks of gestation and/or having a birth wt. of 2 kg or less

The score was added up and in this way the maximum score for a baby could be 10, the minimum being zero.

Then the baby was followed up for sepsis on the basis of clinical and blood culture basis for further 72 hrs of life. Information was collected on a prepared proforma by a questionnaire method.

Information related to mother included: age, education, socioeconomic status, parity, previous obstretic history, period of gestation, any antenatal or postnatal complications with special reference to maternal disease and full details of present pregnancy, type of delivery, number of per vaginal examination and about the time of rupture of membranes, duration between onset of labour pain and delivery, history of fever, tachycardia, condition of amniotic fluid, type of delivery. Information regarding the neonates included: weight and sex of baby, APGAR at birth, any delay in cry, history of resuscitation, detailed record of events since birth.

Examination of mother

All the mothers of study group were examined for evidence of systemic disease, signs of chorioamnionitis and fetal distress. To confirm the premature rupture of membranes sterilized speculum examination was done in good light. Criteria for Diagnosis of Chorioamnionitis

1. Fever (temperature >37.80°C) plus two or more of the following:

- Maternal tachycardia (>100 beats/min).
- Fetal tachycardia (>160 beats/min)
- Uterine tenderness
- Malodorous or cloudy amniotic fluid
- Maternal white blood cell count > 15,000 cells/mm^3

2. No other site for infection.

Prolonged rupture of membranes (PROM)

Prolonged rupture of membranes: time interval from the rupture of membranes to delivery of the baby more than 24 hrs.

Unclean vaginal examination

Single vaginal examination with aseptic precautions or more than 3 vaginal examination with or without aseptic precautions

Duration of labour

It is the duration from onset of labour pains to the expulsion of placenta and membranes.

Examination of newborn

All the newborns were attended and assessed at the time of delivery in labour room or operation theatre and a detailed examination was performed in warm comfortable, well lighted quite atmosphere. Gestational age was assessed at this first examination.

Anthropometric measurements

The body proportion were measured in terms of weight, length and head circumference.

Weight

Weight was recorded by an electronic machine.

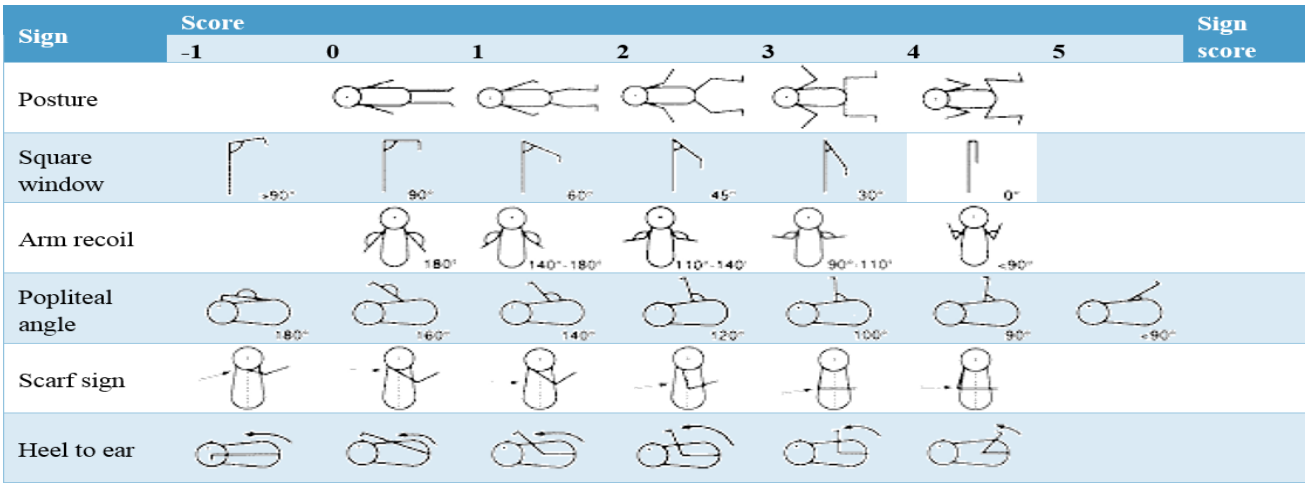

Figure 1: Total neuromuscular score.

Table 1: Total physical maturity score.

Sign	Score							Sign score
	-1	0	1	2	3	4	5	
Skin	Sticky, friable, transparent	gelatinous, red, translucent	smooth pink, visible veins	superficial peeling and/or rash, few veins	cracking, pale areas, rare veins	parchment, deep cracking, no vessels	leathery, cracked, wrinkled	
Lanugo	none	sparse	abundant	thinning	bald areas	mostly bald		
Plantar Surface	heel-toe 40-50mm: -1 <40mm: -2	>50 mm no crease	faint red marks	anterior transverse crease only	creases ant. 2/3	creases over entire sole		
Breast	imperceptable	barely perceptable	flat areola no bud	stippled areola 1-2 mm bud	raised areola 3-4 mm bud	full areola 5-10 mm bud		
Eye / Ear	lids fused loosely: -1 tightly: -2	lids open pinna flat stays folded	sl. curved pinna; soft; slow recoil	well-curved pinna; soft but ready recoil	formed and firm instant recoil	thick cartilage ear stiff		
Genitals (Male)	scrotum flat, smooth	scrotum empty, faint rugae	testes in upper canal, rare rugae	testes descending, few rugae	testes down, good rugae	testes pendulous, deep rugae		
Genitals (Female)	clitoris prominent and labia flat	prominent clitoris and small labia minora	prominent clitoris and enlarging minora	majora and minora equally prominent	majora large, minora small	majora cover clitoris and minora		

Length

The crown to length was measured by the infantometer by carefully holding the baby to avoid flexion at joints.

Head circumference

The head circumference was measured by a measuring tape passing through glabella in front and occipital protuberance in behind.

Gestational age

Assessment of gestational age done by History and Examination of newborn done according to modified Ballard's score criterion from Cloherty.

Table 2: Maturity rating.

Total score (neuromuscular + physical)	Weeks
-10	20
-5	22
0	24
5	26
10	28
15	30
20	32
25	34
30	36
35	38
40	40
45	42
50	44

Various risk factors predisposing to early onset sepsis were analyzed in detail for each baby e.g. birth weight, number of vaginal examination PROM and its duration, duration of labour, maternal fever, foul smelling liquor, resuscitation at birth, gestational age.

RESULTS

In this study 16% cases were small for date (SFD), 80.6% were appropriate for date (AFD) and 3.33% were large for date (LFD). Morbidity for SFD was 50%, for AFD was 9.5% and for LFD as 10%. Calculated chi square is more than the tabulated chi square for p=0.05. Therefore, the association is significant (Table 3).

Table 4 shows that 8% cases are 30-33 wks, 12% are 34-37 wks, and 80% cases are of >37 wks of gestation. Morbidity is 50% for 30-33 wks, 33% for 34-37 wks, and 10% for >37wks of gestation

Calculated X^2 = 34 tabulated X^2 = 5.99 for degree of freedom 2 and p= 0.001

Table 3: Distribution of newborn according to birth weight and early onset septicemia (EOS).

SFD/AFD/LFD	No. of patients	Culture positive
SFD	48 (16%)	24 (50%)
AFD	242 (80.6%)	23 (9.5%)
LFD	10 (3.33%)	1 (10%)
Total	300	48

Table 4: Gestational age and EOS.

Gestational age in wks	No. of patients	Culture positive
<33 wks	24 (8%)	12 (50%)
34-37wks	36 (12%)	12 (33%)
>37wks	240 (80%)	24 (10%)
Total	300	48 (16%)

There is a highly significant association of gestational age and septicemia.

Table 5: Sex and EOS.

Sex	No. of patients	Culture positive
Male	161 (53.6%)	24 (14.9%)
Female	139 (46.33%)	24 (17.2%)
Total	300	48

Table 5 shows that the ratio between male to female is 1.15. calculated chi square for incidence of sepsis came to be 0.2 which is lower than the tabulated value for p = 0.05 therefore there is no significant correlation between sex and sepsis.

Table 6: Relation of APGAR and EOS.

APGAR	No. of patients	Culture positive
<6	18 (6%)	16 (88%)
6	60 (20%)	12 (20%)
>6	222 (74%)	20 (9%)
Total	300	48

Table 6 shows that there were 18 cases with apgar <6 and out of them 88% were culture positive in contrast to 9% being culture positive when APGAR is >6.

Table 7: Vaginal examination and EOS.

Unclean vaginal examination	No. of patients	Culture positive
Yes	260 (86.6%)	48 (18.4%)
No	40 (13.3%)	0 (0%)
Total	300	48

Chi square was applied and the calculated value was much greater than the tabulated value for p= 0.001 which shows that there is a strong association between APGAR at 1min. and early onset septicemia.

Table 7 shows that majority of cases had unclean or multiple vaginal examinations i.e. 86.6% out of which 18.4% were culture positive while none without unclean vaginal examination had proven sepsis. Chi square was calculated with Yate's correction. calculated chi square was 5.29 and tabulated chi square was 3.84 at p= 0.05 which shows that there is definite relationship between unclean vaginal examination and EOS.

Table 8: Duration of labour and EOS.

Duration of labour	No. of patients	Culture positive
<24 hrs	240 (80%)	18 (7.5%)
>24 hrs	60 (20%)	30 (50%)
Total	300	48 (16%)

Table 8 shows that 60 cases had labour more than 24 hrs and out of them 50% had the blood culture positive which came to be statistically significant as calculated chi square came to be much higher than the tabulated chi square value for p= 0.001.

Table 9: Latency of PROM and EOS.

Latency of PROM	No. of cases	Culture positive
18-24 hrs	9 (3%)	2 (22.3%)
> 24 hrs	7 (2.33%)	3 (42.8%)
Total	16 (5.3%)	5 (31.25%)

Table 9 shows that morbidity is more i.e. 42.8% when the duration of PROM is more than 24 hrs. chi square test was applied to this observation and the calculated value (3.89) was slightly more than the tabulated value (3.84) for p= 0.05 which shows significant relationship between prom and early onset septicemia but to a lesser degree.

Table 10: Chorioamnionitis and EOS.

chorioamnionitis	No. of patients	Culture positive
Yes	10 (3.33%)	8 (80%)
No	290 (96.66%)	40 (13.79%)
Total	300 (100%)	48 (16%)

Table 10 shows that there were 10 mothers who had features of chorioamnionitis and out of which 8 i.e. 80% had blood culture positive which came to be statistically significant as calculated chi square came to be much higher than the tabulated chi square value for p= 0.001.

Table 11 shows relationship between incidence of EOS and various socioeconomic strata. Mother from the lowermost socioeconomic class consisted of 26%. There were 30% cases belonging to upper lower and lower middle class, only 2% were of upper class. Infection rate was maximum in lowermost group i.e. 32%. In upper lower and lower middle, the infection rate was same i.e. 12.2%. There were only 6 cases belonging to upper class and none of them develop sepsis.

Table 11: Parental socioeconomic status and EOS.

Socioeconomic status	No. of patients	Culture positive
Upper	6 (2%)	0 (0%)
Upper middl	36 (12%)	1 (2.7%)
Lower middle	90 (30%)	11 (12.2%)
Upper lower	90 (30%)	11 (12.2%)
Lower	78 (26%)	25 (32.0%)
Total	300	48

Application of chi square test shows that the calculated value of X2 at 0.1% level of significance (28.48) is greater than the tabulated value of X 2 at 0.01% level of significance (18.47) which shows that the socioeconomic status has significant effect on the incidence of early onset septicemia. It is more common in lower socioeconomic groups.

Table 12: Modes of presentation and EOS.

Mode of presentation	No. of patients	Culture positive
Cephalic	268 (89.3%)	36 (13.4%)
Breech	30 (10%)	10 (33.3%)
Transverse	2 (0.6%)	2 (100%)
Total	300 (100%)	48 (16%)

Table 12 shows that most of the cases are vertex presentation (89.3%) and the breech and transverse presentation are 10% and 0.6% respectively. Early onset infection rate is much more in transverse presentation (100%) than in breech (33.3%) and vertex (13.4%). Chi square test was applied to this observation and calculated value (18.48) was greater than tabulated value (13.82%) for p= 0.05, which shows that there is a significant relationship between mode of presentation and early onset septicemia.

Table 13: Mode of delivery and EOS.

Mode of delivery	No. of patients	Culture positive
NVD	210 (70%)	31 (14.7%)
LSCS	60 (20%)	2 (3.3%)
Vaginal delivery with forceps	30 (10%)	15 (50%)
Total	300 (100%)	48 (16%)

According to Table 13 normal vaginal delivery without induction or medically induced are 70%, LSCS delivered are 20% and forceps delivered are 10%. Among them the infection rate is maximum in forceps delivery i.e. 50% and in NVD it is minimum i.e. 14.7%. chi square test was applied to this observation and calculated value (29.25) was much greater than the tabulated value (13.82) for 0.1% of significance which showed that there is a significant

correlation between mode of delivery and early onset septicemia.

Table 14: Sepsis score and EOS.

Sepsis score	No. of patients	Culture positive
0-3	224 (74.6%)	2 (0.8%)
4-5	62 (20.6%)	32 (51.6%)
6 or more	14 (4.6%)	14 (100%)
Total	300	48 (16%)

According to Table 14, 74.6% cases have score between 0 to 3 and only 2 i.e. 0.8% had blood culture positive, 20.6% cases had score between 4-5 and 51.6% cases developed septicemia and 4.6% cases had score 6 or more and all of them developed septicemia. Chi square test was applied and it was found that calculated value was much more than the tabulated value for p=0.001, which shows that it is statistically significant.

The sensitivity of scoring system was 96%, specificity 90%, positive predictive value of 88% and negative predictive value of 60.5%.

DISCUSSION

Neonatal mortality constitutes 2/3 mortality in infants. The most common cause of neonatal mortality is infections. Incidence of neonatal infections is quite high in our country as compared to western countries. Neonatal septicemia is the most common form of infections among neonates. Septicemia carries a high mortality in this age group. In this study 300 newborns constituted the material. All were MYH delivered. All were followed longitudinally for 72 hrs and signs and symptoms of septicemia were recorded as they appear during stay.

Sex

Out of 300, 161 (53.66%) babies were male, and 139(46.33%) were females indicating a male predominance. This observation is comparable to various authors.[2-4] Rhodes et al found that serum IgM level were directly related with number of X chromosomes.[5] Moro ML reported no gender association of septicemia. In our study also there was no difference in incidence of sepsis between both the genders.[6]

Birth weight

In present study AFD predominated over small for date newborns. Incidence of infection was more frequent in SFD newborns as 50% of SFD newborn became infected while only 9.5% AFD newborns were infected. Beuman, Breese, Eastman, Sachs reported increased perinatal loss in LBW.[7-10] Bhakoo and singh has reported the increased incidence of early neonatal infections in LBW babies, probably as a result of poor immune system and impaired granulocyte functions. It has also been suggested that ascending infections may lead to fetal sepsis and adrenal hypertrophy leading to increased cortisol secretion thus predisposing for premature labour.[11]

Gestational age

Gestational age not only affects weight of baby but also predisposes babies to increased risk of infections. In the present study 20% babies were preterms, while 80% were term. 40% out of all preterm were infected. 8% cases are 30-33 wks, 12% are 34-37 wks, and 80% cases are of >37 wks of gestation. Morbidity is 50% for 30-33 wks, 33% for 34-37 wks, and 10% for >37wks of gestation. These observations were supported by different authors.[12-14]

Socio-economic status

Mother from the lowermost socioeconomic class consisted of 26%. There were 30% cases belonging to upper lower and lower middle class, only 2% were of upper class. Infection rate was maximum in lowermost group i.e. 32%. In upper lower and lower middle the infection rate was same i.e. 12.2%. There were only 6 cases belonging to upper class and none of them develop sepsis. Calculated value of chi square test was higher than tabulated value at 0.05 level of significance for incidence of EOS. This relation is statistically significant.

Unclean vaginal examination

This study shows that majority of cases had unclean or multiple vaginal examinations i.e. 86.6% out of which 18.4% were culture positive while none without unclean vaginal examination had proven sepsis. Chi square was calculated with Yate's correction. Calculated chi square was 5.29 and tabulated chi square was 3.84 at p= 0.05 which shows that there is definite relationship between unclean vaginal examination and EOS.

Chorioamnionitis

There were 10 mothers who had features of chorioamnionitis and out of which 8 i.e. 80% had blood culture positive whereas 13.7% from the group not having chorioamnionitis became infected, which came to be statistically significant.

Duration of labour

There were 60 cases who had labour more than 24 hrs and out of them 50% had the blood culture positive, in contrast to 7.5% cases affected with labour less than 24 hrs, which came to be statistically significant.

Mode of presentation

In present study proportionally, vertex presentation predominated within the series i.e. 89.3%. Infection was associated with 33.3% cases of breech in comparison to 13.4% in vertex presentation. Early onset infection rate is much more in transverse presentation (100%) than in

breech (33.3%) and vertex(13.4%). Chi square test was applied to this observation and calculated value (18.48) was greater than tabulated value (13.82%) for p= 0.05, which shows that there is a significant relationship between mode of presentation and early onset septicemia. Similar findings were reported by Hall and Ekvall.[15,16]

Mode of delivery

According to reviewed literature incidence of LSCS has been found 2.7% to 5.9%.[17,18] In present study LSCS delivered are 20% and forceps delivered are 10%. Among them the infection rate is maximum in forceps delivery i.e. 50%. Forceps application was done for 30 cases out of which 15 were septic. In group were induction was done incidence of infection was 23.21% than 12.5% cases infection in non induced group which may be explained by assuming that labour might be difficult and prolonged thus predisposing for infection. Incidence of sepsis is minimum in LSCS group i.e. 3.3%.

Total duration of PROM

It is documented that there is an exceedingly high incidence of fetal and maternal infection in relation to duration of PROM. Howard and Bauer reported a lower incidence of infections within 24 hrs.[19] Most of authors agree that risk of infection increases with increase in total duration of PROM.[20-22] A period of latency more than 12 hrs has been said to be predisposing to infection.[23] In this study there were 12 cases in 12-17 hrs group with incidence of infection 16.6%. 22.3% newborns out of 9 cases of 18-24 hrs group were infected and 42.8% of 7 cases having latent period of >24 hrs became infected. This data was found statistically significant. The incidence of PROM from this study came to be 5.3%.

APGAR scoring

In this study there were 18 cases who had APGAR score <6 and 16 out of 18 develop sepsis. 12 out of 60 cases became morbid from the group having APGAR score 6 (20% incidence of infection). 222 cases in the group scored more than 6, 20 developed infection. High association coefficient was there in between low APGAR and infection. It has been postulated by Dais et al that complication of pregnancy or labour leading to fetal hypoxia may lead to respiratory infection in the newborn.[24] These authors suggested congenital pneumonia to be a passive condition due to asphyxia leading to aspiration of infected maternal secretions.

Scoring system for septicemia

In this study, the incidence of neonatal infection was higher in the presence of birth asphyxia, unclean vaginal examination, presence of foul smelling vaginal discharge, or when duration of labour exceeded 24 hrs as compared to prolonged rupture of membranes.[25] These observations suggested that besides PROM there are many other perinatal factors which are of significance in relation to early onset infections. This led to the formulation of the presenting scoring system. In the present study there were 224 cases having score 0-3 and only 0.6% got infected, but there were 62 cases with score 4-5 out of which 51.6% were infected and 14 out of 14 having score of 6 or more had infection.

In this study the sensitivity of scoring system was 96%, specificity 88%, positive predictive value of 60.5% and negative predictive value of 99.1%. Observed value of chi square was more than tabulated value at 0.01 significance level. In the study done by Bhakoo, Narang, Takkar they got 0.5%, 17.6%, and 85.7% affected in the group having score of 0-3, 4-5, and 6 or more respectively.[17]

Infections are the big challenge in the field of perinatology. Incidence of EOS in present study was found to be 16% of my study. It stimulates one to think about well being of newborn. It is clear from this study that not only duration of PROM was an important factor to decide the development of infection, but several other factors had their role. Several traditionally incriminated risk factors were invariably present in infected cases, like vaginal examinations done at 3 or more times before the delivery. In our circumstances the reliability of process of sterilization adopted for vaginal examination is questionable. Maternal fever, bad obstretic history of recurrent abortions, antenatal history of UTI, male sex, low birth weight, prematurity, low APGAR, foul smelling liquor, were the factors in absence of which neonates frequently escaped the infections. Dependency of variable risk factors was an important observation in this study.

A suitable approach to identify the high risk newborns to limit the number of cultures and unnecessary antibiotic use was selected. The scoring system developed byBhakoo ON et al has been evaluated and showed satisfactory results. In their original study they recommend that any baby with a score of four or five needs intensive evaluation for the presence of infection.[17] The incidence of infection among cases having a score of 6 or more is so high that hardly any may escape infections and these cases needs certainly need cover with an effective antibiotics after sending the relevant bacteriological investigations, but in my study cases with score of 4-5 has also incidence of infections of 51% so this study recommends that in our setup babies with score of more than 3 should be started with antibiotics.

CONCLUSION

The study concluded that being a vast topic with a variety of etiology and effects, neonatal infections needs more evaluation and prompt calculation for risk. Looking at over all incidence of 16% early neonatal infection in this study it is needed to have an ‘eagle eye’ observation on high risk cases.

Funding: No funding sources

Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Polin R, Parravicini E, Regan J. Bacterial Sepsis and Meningitis, Chapter 39. Hostetter M. Fungal Infections in the Neonatal Intensive Care Unit, Chapter 41. In: Avery's Diseases of the Newborn, 8th ed. Taeusch HW, Ballard RA, Gleason CA. Saunders, Philadelphia;2005:551-561,595-600.
2. Misalliti A, El- Bagharthy S, Shembesh N. Blood Culture proven neonatal septicemia: A review of 36 cases. Ind J Ped. 2000;6:483-6.
3. Malik Abida, Hasani SE, Khan HM, Ahmad AJ. Nosocomial infections in newborn. Ind Pard.2001:38:68-71.
4. Pawa AK, Ramji SK, Prakash, Thirupuram S. Neonatal nosocomial infections: profile and risk factors. Indian Pediatr. 1997;34:297-302.
5. Andrew J. Daley Westmead Hospital neonatal infection surveillance 1999. Innoculum. 2000;9(3).
6. Moro ML, De Toni A, Carrrieri MP, Braga M, Zunin C. Risk factors for nosocomial sepsis in newborn ICU. Euro. J. Ped. 1996;155:315-22.
7. Buemann B, Lange P. Premature Rupture of the Membranes at Fœtal Weights of 1,000-2,500 G. Acta Obstetricia et Gynecologic Scand. 1962 Jan 1;41(4):346-56.
8. Breese MW. Spontaneous rupture of membrane. Am J Obst Gynecol. 1961;81:7086.
9. Eastman NJ. Editorial discussion of Roth N.E. Early rupture of membrane. Sig Etiology Prognosi Obst Gynec Surv. 1955;10:14.
10. Baker CJ, Kasper DL. Immunological Investigation of septicaemia or meningitis due to Grp. B. streptococcus. J. Infect. Dis. 1977;136:S98-S104.
11. Naye RC, Delfenger WS, Blanc VJA. Fetal and maternal features of antenatal bacterial infection. J Pediatr. 1971;79:733.
12. Daley AJ. Westmead Hospital neonatal infection surveillance 1998. Innoculum. 1999:6-13.
13. Gitlin, D, Rosen FS, Michael JG. Transient 19s y globulin deficiency in the newborn infants and its significance. Pediatrics. 1963;31:197.
14. Ment LR. Bacterial meningitis as an etiology of perinatal cerebral infection Paed. neuro. 1986;2:276-9.
15. Hall JE, Schuyler GK. Breast carcinoma associated with pregnancy. Am J Obst Gynec. 1965;91:665.
16. Ekwa LD, Wixted WG. Spontaneous premature rupture of the fetal membranes Am J Obst Gynecol. 1961;8:848.
17. Bhakoo ON, Narang AK, Bhatacharjee S. Prognosis and treatment of neonatal septicemia. A clinical and Bacteriological study of 100 cases. Ind. Pediatr.1974;11:519.
18. Russel KP, Anderson GV. Am J.Obst Gynec. 1962;83:930.
19. Howard PJ, Bauner AR. Infection of newborn infants and its association with prolonged rupture of membrane. Henry Ford Hospital Med J. 1967;15:161.
20. Gunn GC, Mishell DR, Morton DG. PROM. Am J Obst Gynec. 1970;106:469.
21. Johnson JNC, Daikoku NH. PROM and prolonged latency. Obstet Gynecol. 1981;57:547-56.
22. Shubeck P, Benson R, Clark WW, Berendes H. Weiss W. Obst Gynecol. 1966;28:22.
23. Chaudhary P, Shrivastava G, Aggarwal DS, Saini L, Gupta S. Bacteriological study of neonatal infection. Ind Pediatr. 1975;12(6):459-63.
24. Davis CA, Vallotta EHS. Competent levels in infancy age related changes. Paediatr Res. 1979;13:1043-6.
25. Geme Jr JW, Murray DL, Carter J, Hobel CJ, Leake RD, Anthony BF, Thibeault DC, Ross IB, Drage JS. Perinatal bacterial infection after prolonged rupture of amniotic membranes: an analysis of risk and management. J Pediatr. 1984 Apr;104(4):608-13.

Cite this article as: Sharma D, Batham A. Risk scoring and prediction of early onset septicaemia in neonates through study of perinatal factors. Int J Contemp Pediatr 2018;5:1666-73.