

Research Article

A retrospective study of analysis of various factors affecting the outcome of sepsis in neonates admitted to a tertiary care neonatal intensive care unit

Krishnakumar Chinnusamy*, Devimeenakshi K.

Institute of Social Pediatrics, Government Stanley Medical College, Chennai 600001, India

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*Correspondence:

Dr. Krishnakumar Chinnusamy,

E-mail: gokrishnakumar@gmail.com

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ABSTRACT

Background: Sepsis is an important contributor to neonatal mortality and morbidity. Our aim was to study the various factors determining the outcome in neonatal sepsis in tertiary care hospital. Study was conducted in NICU of Government Stanley medical college, Chennai, India.

Methods: Designed as retrospective study, based on case records of babies admitted between July to December 2015. Out of the 320 cases admitted during the study period, 120 babies with clinical features suggestive of neonatal sepsis. Risk factors were analyzed for their association with the outcome. Results were statistically analyzed.

Results: Among the parameters studied it was observed that birth weight of the baby ($p < 0.001$), maturity of the baby ($p = 0.002$) and laboratory parameters like abnormal leukocyte count ($p < 0.001$) and abnormal platelet count ($p < 0.001$) were significantly associated with poor outcome. These variables retained their significance when subjected to multiple logistic regression analysis.

Conclusions: In our study, we found low birth weight, prematurity, abnormal leukocyte counts and thrombocytopenia on admission were found to be associated with poor outcome.

Keywords: Neonatal sepsis, Risk factors, Neonatal mortality, Maturity

INTRODUCTION

In developing countries, sepsis is an important contributor to neonatal mortality and morbidity, accounting for just over a third of all neonatal deaths annually, as well as being the major reason for admission to the neonatal unit.^{1,2}

Due to the immaturity of their immune system, neonates tends to acquire infections easily as well as have limited ability to overcome these infections.³ These factors increase the neonate's likelihood of developing severe

infection with a higher probability of unfavourable outcome. Any factor that reduces the ability of the already compromised immune system to combat infection has the potential to increase morbidity and mortality. Lack of specific signs and symptoms warrants a high index of suspicion to make correct diagnosis.⁴ It is important to initiate treatment at the earliest to avoid mortality. In addition, bacterial virulence factors as well as timing of intervention and choice of antimicrobial therapy have a significant impact on outcome. In resource limited settings, early identification of risk factors associated with a poor outcome may help to provide information regarding prognosis. So we decided to

evaluate the factors that influenced the outcome in neonates admitted with manifestations of sepsis.

METHODS

The neonatal unit at the Stanley medical college is a tertiary care unit that caters to the out-born babies from the maternity centres in North Chennai region, India. This was a retrospective, hospital-based, single- centre study analyzing the various factors that influenced the outcome of all neonates aged 0–30 days admitted to the neonatal unit at the study centre during the six months period July 1, 2015 to December 31, 2015 with a clinical diagnosis of sepsis. These neonates were categorized into one of two groups (poor outcome or favorable outcome) based on outcome at end of therapy. Data on characteristics such as age, gestational age, gender and birth weight as well as clinical and laboratory features were collected and compared between the two groups.

The study was approved by the institutional ethics committee of Government Stanley medical college, Chennai, India Continuous variables were expressed as means±SD; differences between the two groups were determined using an independent student's *t*-test.

Categorical variables were analyzed using the chi-square test with significance at 5%. Predictors of poor outcome were analyzed using logistic regression. Data were analyzed using the statistical package for the social sciences (SPSS).

RESULTS

The total number of admissions during the study period was 320. Of them, 120 babies met the necessary study criteria and their case records were analyzed. The study population comprised of 79 male babies (65.8%) and 41 female babies (34.2%). 70 babies (58.3%) were admitted within 72 hours of birth while 50 babies (41.6%) were admitted 72 hours after delivery. Extremely low birth weight babies (birth weight <1,000g) constituted 1.7% (n = 2), low birth weight babies (between 2500 g and 1000 g) 25% (n = 30) and normal birth weight babies (above 2500 g) 73% (n = 88). 19 babies (15.8%) were preterm and 101 babies (84.2%) were term. 58.3% babies (n = 70) were admitted less than 72 hours after delivery with a diagnosis of early onset sepsis and 41.6% babies (n = 50) are admitted after 72 hours of birth with diagnosis of late onset sepsis.

Table 1: Descriptive statistics of the cases and controls.

Factors	Number of babies	Outcome		Significance
		Improved	Death	
Birth weight				
<1000 g	2	0	2 (100%)	
1000 -2499 g	30	27 (90%)	3 (10%)	
>2500 g	88	83 (94.31%)	5 (5.68%)	P<0.001
Sex of the baby				
Female	41	39 (95.12%)	2 (4.87%)	
Male	79	71 (89.87%)	8 (10.12%)	P = 0.324
Type of sepsis				
Early onset sepsis	70	63 (90%)	7 (10%)	
Late onset sepsis	50	47 (94%)	3 (6%)	P = 0.434
Maturity of the baby				
Preterm	19	14 (73.68%)	5 (26.31%)	
Term	101	96 (95.04%)	5 (4.95%)	P = 0.002
WBC count on arrival				
Normal	112	107 (95.53%)	5 (4.46%)	
Low	3	1 (33.33%)	2 (66.67%)	
High	5	2 (40%)	3 (60%)	P<0.001
Platelet count on arrival				
Normal	110	104 (94.54%)	6 (5.45%)	
Low	10	6 (60%)	4 (40%)	P<0.001
C – reactive protein				
Normal	66	62 (93.93%)	4 (6.06%)	
High	54	48 (88.88%)	6 (11.11%)	P = 0.319
Culture and sensitivity				
Negative	108	100 (92.59%)	8 (7.41%)	
Positive	12	10 (83.33%)	2 (16.66%)	P = 0.271

Sepsis work up done on admission revealed low total leukocyte count in 2.5% (n = 3), high total leukocyte count in 4.2% (n = 5) and normal leukocyte count in 93.3% (n = 112). Platelet count was low in 10 babies (8.3%) and normal in 110 babies (91.7%). C reactive protein was elevated in 54 babies (45%) and normal in 66 babies (55%). Culture of blood samples showed positive growth in 12 babies (10%) and no growth in 108 babies (90%). Of the 120 babies included in the study, 110

babies (91.7%) improved and were successfully discharged while 10 babies (8.3%) did not survive.

Blood culture report showed positive growth in 12 babies. It included coagulase negative *staphylococcus* in 3 cases, *Klebsiella pneumoniae* and *Non candida albican* in two cases each and one each of *Acinetobactor*, *E.coli*, *Pseudomonas aeruginosa*, non fermenting gram negative cocci and *Stap aureus*.

Table 2: Multiple logistic regression of variables.

Predictor variable	Co-efficient	Standard error	Odds ratio	Significance p value
Maturity	3.116	1.489	22.552	0.036
WBC count abnormality	-5.526	2.345	0.004	0.018
Platelet	2.562	0.776	12.964	0.001
CRP	2.463	1,294	11.742	0.057
Culture	- 3.390	1.750	0.034	0.053

DISCUSSION

Univariate analysis of the various parameters were compared to the outcome using Chi square test. Among the 88 babies with normal birth weight, 5 babies (5.68%) died whereas 3 babies (10%) out of the low birth weight babies and all two babies (100%) with extremely low birth weight babies died on the course of treatment. 2 (4.87%) out of the 41 female babies died compared to 8 (10.12%) out of 79 male babies died. But the difference is statistically not significant (p = 0.324). 7 babies (10%) out of the 70 babies with a diagnosis of early onset sepsis died compared to 3 babies (6%) out of the 50 babies with the diagnosis of late onset sepsis. But the difference is not statistically significant (p = 0.434).

Based on duration of hospital stay, of the 29 babies who stayed in NICU for less than 7 days, 8 babies (27.58%) died compared to 2 deaths (2.19%) out of the 91 babies who stayed for more than 7 days making an apparently better outcome in the babies who were treated for longer periods, but analysis of case records showed that those babies who died early were more critical on arrival than those treated for more than 7 days. 5 babies (4.95%) out of the 101 term babies died compared to 5 deaths (26.31%) of the 19 preterm babies, making a statistically significant increase in mortality in sick preterm babies compared to term babies (p = 0.002).

5 babies (4.46%) babies of the 112 babies who had normal total leukocyte count at admission died compared to 2 (66.67%) out of 3 babies with low total leukocyte count and 3 (60%) out of the 5 babies with high total leukocyte count died making a statistically significant increase in mortality in babies with abnormal initial total leukocyte count (p<0.005). 6 babies (5.45%) of the 110 babies with initial normal platelet died compared to 4 babies (40%) of the 10 babies with low platelet count

died making a statistically significant mortality in babies with low platelet count (p<0.005).

4 babies (6.06%) with negative CRP results died compared to 6 babies (11.11%) of the 54 babies with positive CRP results, the difference is not statistically significant (p = 0.319). 8 babies (7.4%) of 108 babies with negative blood cultures died compared to 2 babies (16.6%) of the 12 babies with positive blood culture reports died. The difference is not statistically significant in both the groups.

Stepwise multiple logistic regression analysis was conducted to evaluate the predictors of independent mortality due to neonatal sepsis. Factors included were birth weight, maturity of the baby, duration of hospital stay, laboratory parameters like initial total leukocyte count, platelet count, CRP and blood culture results. Among them, birth weight of the baby, maturity of the baby, total leukocyte count and platelet count were found to be significant independent risk factors for mortality in babies with sepsis.

The overall mortality in our study was 8.3% which varies widely in other studies from 7% by Trotman H and 48.5% by Mathur NB et al.^{5,6} The mortality for preterm and term neonates were equal in the present study although many studies quoted higher mortality in preterm babies.⁷ Early onset sepsis carried higher mortality when compared to late onset sepsis in our study was similar to other studies.^{6,8} The present study showed higher mortality in babies with abnormal leukocyte count similar to other studies.⁶ Troman H et al reported thrombocytopenia as a major complication of sepsis which is well documented in the present study.⁵

CONCLUSION

Although all the parameters used in the study have excellent value in predicting sepsis in newborn babies, only the birth weight of the baby, maturity level, abnormal initial total leukocyte count and platelet count have significant role in predicating mortality in newborn with sepsis.

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