

Risk factors in early neonatal sepsis

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Abstract

Objective: To study the maternal and neonatal risk factors for neonatal sepsis.

Materials and methods: This is prospective case control study, conducted on the neonates up to 7 days of life with a diagnosis of neonatal sepsis. There were 100 cases of neonatal sepsis and 100 control cases. The neonates in the case and control groups were evaluated for various maternal and neonatal risk factors.

Results: The factors which carried a significant risk for development of neonatal sepsis were premature rupture of membrane (PROM), meconium stained amniotic fluid (MSAF), foul smelling liquor, low birth weight, prematurity and low Apgar score at birth. The blood culture was positive in 22% of cases. The commonest organisms isolated were *S. aureus* and *Klebsiella*. The overall mortality was 11%. The incidence of risk factors was almost equal in culture positive and culture negative cases.

Conclusion: The study identifies PROM, MSAF, foul smelling amniotic fluid, prematurity, low birth weight and low Apgar score at birth as strong risk factors for development of neonatal sepsis. In the presence of above factors, the neonate should be screened and observed for sepsis and considered for early institution of antibiotics.

Key words: Risk factors, early neonatal sepsis

In the developing world, the neonatal septicaemia remains as the major cause of mortality and morbidity in spite of recent advances in the technology and therapeutics. Some of the factors responsible for sepsis in newborns are immature immune system, decreased phagocyte activity of white cells, decreased production of cytokines and weak humoral immunity. The natural skin barrier is thin and weak. Various maternal, foetal and environmental factors also contribute towards sepsis in newborns. Some of the maternal factors are premature rupture of membrane, maternal fever within 2 weeks prior to delivery, meconium stained amniotic fluid (MSAF), foul smelling liquor and instrumental delivery. The foetal factors include birth weight, gestation and Apgar score. However, a review of literature does not show the exact impact of above factors in the development of neonatal sepsis in this part of the world. The present study is on various risk factors for neonatal septicaemia. In a developing country like Nepal, where quick laboratory facilities are not available, identification of risk factors and early institution of therapy can improve the mortality and morbidity.

Materials and methods

This is a prospective case control study conducted on the neonates up to 7 days of life, admitted with diagnosis of neonatal sepsis to B P Koirala Institute of Health Sciences, Dharan, Nepal (BPKIHS) during the period from April 2003 to March 2004. Neonates

with clinical diagnosis of sepsis and positive blood culture / positivity of at least two of the following laboratory screening tests were included in the study. The investigations were:

- i. Total leukocyte count < 5000/mm³
- ii. Band cell count ≥ 20%
- iii. Micro ESR ≥ 15 mm/ 1st hour
- iv. C-reactive protein > 6 mg/dL
- v. Absolute neutrophil count <1500/mm³

All the neonates were delivered at BPKIHS. The next asymptomatic neonate delivered at BPKIHS and who could be followed for at least 7 days of life was taken as control. All the neonates in the case and control group were evaluated for possible risk factors. Only the cases in the sepsis group were investigated.

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A total of 100 cases of neonatal sepsis and 100 controls were studied. Babies with gross congenital malformations and birth weight less than 1000g were excluded from the study. A detailed history and examination of the newborn was performed and the informations regarding maternal and foetal risk factors were recorded in a predesigned proforma. The relevant investigations were done in sepsis cases as and when required.

The data were entered in to MS Excel and the statistical analysis was performed by SPSS 10-01 for Window 98. Chi square test and Fisher exact test were used for statistical significance.

Results

The present study comprised of 100 cases of neonatal sepsis and 100 control neonates. All these cases were assessed for various risk factors of neonatal sepsis. The maternal factors included age, educational status, parity, mode of delivery, premature rupture of membrane (PROM), meconium stained amniotic fluid (MSAF), maternal fever, pregnancy induced hypertension (PIH), pre eclamptic toxemia (PET)/eclampsia, foul smelling liquor, ante partum haemorrhage (APH). The foetal factors studied were birth weight, sex of the baby, Apgar score at 1 minute and gestation. Blood culture was positive in 22 neonates with sepsis. The organisms isolated were Staphylococcus (50%), Streptococcus (14%), Klebsiella (14%), Acenatobacter (9%), Enterococcus

(9%) and Pseudomonas (4%). In rest 78 cases, the diagnosis was based on clinical presentation supported by positive laboratory screening tests.

Table 1 depicts the various maternal and foetal risk factors in neonates with sepsis. The maternal factors having a significant risk for the development of

sepsis were PROM, MSAF and foul smelling liquor. The risk of sepsis in PROM and MSAF was about 2 times higher as compared to the control group. Though, the maternal illiteracy, primigravida mothers, PIH/PET/Eclampsia and APH in mother had slightly higher risks of development of sepsis, these were not statistically significant. Low birth weight and prematurity carried 4.85 times each risk for development of sepsis and the p value were highly significant. Similar was the observation for 1 minute Apgar score where a low Apgar score (<7) carried 5.7 times risk for the development of sepsis.

Table 2 shows the various maternal and foetal risk factors according to the blood culture results in neonates with sepsis. Though, there was slightly higher risk of developing culture positive sepsis in low maternal age group, vaginal delivery, foul smelling liquor; in none of the cases, it was statistically significant. The male babies showed significantly higher culture positivity with an odd ratio of 2.91.

Table 1: Various maternal and neonatal factors in neonates with sepsis

Parameters	Variables	Case(n=100)	Control (n=100)	Statistical significance
Maternal age	<20	13	19	P=0.247 OR=0.64
	≥20	87	81	
Educational status	Illiterate	13	8	P=0.367 OR=1.53
	Literate or more	87	82	
Parity	Primi	72	62	P=0.133 OR=1.58
	Multi	28	38	
Mode of delivery	Vaginal	77	80	P=0.61 OR=0.84
	LSCS/Instrumental	23	20	
PROM	Yes	46	30	P=0.019* OR=1.99
	No	54	70	
MSAF	Yes	23	12	P=0.040* OR=2.19
	No	77	88	
Maternal Fever	Yes	2	0	P=0.248 OR=0
	No	98	100	
PIH/PET/Eclampsia	Yes	9	5	P=0.267 OR=1.88
	No	91	95	
Foul smelling liquor	Yes	7	0	P=0.0071**
	No	93	100	
APH	Yes	02	01	P=0.5 OR=2.02
	No	98	99	
Birth weight	<2.5 kg	48	16	P=0.0001*** OR=4.85
	≥2.5 kg	52	84	
Apgar score(1 min)	<7	63	23	P=0.0001*** OR=5.70
	≥7	37	77	
Gestation	Preterm	48	16	P=0.0001*** OR=4.85
	Term	52	84	
Sex	Male	59	50	P=0.20 OR=1.44
	Female	41	50	

PROM = Premature rupture of membrane
MSAF = Meconium stained amniotic fluid
PIH = Pregnancy induced hypertension
PET = Pre eclamptic toxemia
APH = Ante- partum haemorrhage

* p < 0.05 , ** p < 0.01 , *** p < 0.001

Table 2: Maternal and foetal risk factors in neonatal sepsis according to blood culture result.

Parameters		Culture +ve	Culture -ve	Statistical significance
Parity	Primi	15	57	P=0.65 OR=0.79
	Multi	07	21	
Mode of delivery	Vaginal	18	59	P=0.324 OR=1.45
	LSCS/Instrumental	04	19	
Foul smelling liquor	Yes	02	05	P=0.48 OR=1.46
	No	20	73	
MSAF	Yes	05	18	P=0.97 OR=0.98
	No	17	60	
Maternal age	<20	05	08	P=0.124 OR=2.75
	≥20	17	70	
Apgar score(1 min)	<7	13	50	P=0.66 OR=0.81
	≥7	09	28	
Birth weight	<2.5 kg	10	38	P=0.786 OR=0.88
	≥2.5 kg	12	40	
Sex	Male	17	42	P=0.048* OR=2.91
	Female	05	36	
Gestation	<37 weeks	12	48	P=0.55 OR=0.75
	≥37 weeks	10	30	

MSAF= Meconium stained amniotic fluid * Statistically significant

Discussion

In the present study, the maternal and neonatal risk factors were assessed in neonates with sepsis. The maternal factors which had significant risk for the development of neonatal sepsis were PROM and MSAF/Foul smelling liquor. Other factors which had higher risk for sepsis were maternal illiteracy, prematurity and maternal toxemia. However, none of the situations the risk was statistically significant.

Prolonged leaking and premature rupture of membranes is considered as a major risk factor for sepsis because of the danger of ascending infection. In the present study, 46% of the neonates with sepsis had PROM. Similar observations were also reported by other workers.¹⁻³ We also observed significant risk of neonatal sepsis with MSAF and foul smelling liquor. Previous workers also found a significant association between foul smelling liquor and neonatal sepsis.³ However, some authors did not observe increased incidence of sepsis in babies born through MSAF.^{2,3} Other maternal risk factors reported by various authors are maternal prematurity,¹ teenage pregnancy,⁴ preeclampsia,¹ maternal urinary tract infection and pyrexia.^{3,5}

The significant neonatal risk factors identified in the current study included low birth weight, prematurity and low Apgar score at one minute. Premature and low birth weight babies are relatively immune deficient, which predispose them to infections. Moreover, these babies as well as babies with low

Apgar score at birth are likely to be subjected to different interventional procedures leading to nosocomial infections. Similar was the observations of different workers, who reported significant risk in prematurity and low birth weight,^{2,3,6} birth asphyxia,^{2,3} assisted ventilation and umbilical catheterization.¹

The culture positivity rate in the current study was 22%. The commonest organisms isolated were S.aureus and K.pneumoniae. This is similar to the report from NNPD 2000,⁷ which revealed K.pneumoniae and S.aureus to be the most frequent causative organism in India. However, some of the previous workers reported Pseudomonas and Klebsiella as common isolates in early onset sepsis.^{3,8}

In the current study, analysis of the different maternal and neonatal risk factors showed that influence of these factors were not different in culture positive and culture negative cases. The overall mortality rate was 11% with similar figures for culture positive and culture negative groups.

The study concludes that PROM, MSAF/Foul smelling liquor, prematurity, low birth weight and low Apgar score at birth as strong risk factors for neonatal sepsis. In the presence of above factors, the neonate should be screened and observed for

development of sepsis and considered for early institution of antibiotics.

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