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Original Research Article

A study of pattern of neonatal infections, socio-demographic correlates; clinical manifestations and bacteriological profile of neonatal infections

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ABSTRACT

Background: In the newborns one of the leading causes of deaths and disease is septicemia. Classical clinical features are absent which poses a challenge for early diagnosis. Hence to prevent the deaths and diseases it is essential to go for early diagnosis and early treatment. Objective of this study pattern of neonatal infections, socio-demographic correlates; clinical manifestations and bacteriological profile of neonatal infections.
Methods: A hospital based follow up study was carried out among total of 140 study subjects with age less than 28 days of life were studied over a period of one year. All these subjects were suspected to have neonatal septicaemia. Detailed history, thorough clinical examination was carried out. Samples were sent for culture and sensitivity. Subjects were followed till the outcome.
Results: Among 2.02% was the incidence of the neonatal septicemia. Females were less affected than the males. Late onset septicemia was less common. Chest retraction was the most common clinical manifestation. Culture positivity rate was 44.29%. Gram-negative organisms were detected in 20 cases (64.5%). Case fatality rate was 17.14%. 41 babies (58.6%) affected by septicemia belonged to low socio economic status. 63 babies (90%) were diagnosed to have septicemia, 3 babies (4.28%) were affected by Meningitis, 2 babies were affected by pneumonia. 49 babies (50%) Belonged to Hindu both in case and control group,12 babies (42.9%) belonged to Buddhist in case group, 16 babies in control group.
Conclusions: Males were more susceptible compared to the female babies as well those with higher birth weight. Late onset septicemia was less common.

Keywords: Bacteriological profile, Clinical manifestations, Neonatal infections, Socio-demographic correlates

INTRODUCTION

The reported incidence of neonatal sepsis in the developed country varies from 1-10/1000 live births. The reported incidence of neonatal sepsis in hospital born infants in India is in the range of 11-24.5/1000 live births. The report for the year 2002-03, NNPD suggests, out of 145,623 intramural live births, 5813 were still births and 3680 were neonatal deaths, thus constituting Neonatal mortality rate of 25.3 per 1000 live births.[1]

According to NNPD 2002-03 overall incidence of systemic infection was 3% in India. Among intramural babies early onset sepsis was 67% & incidence of late onset sepsis was 31.6%. NMR is 45/1000 live births (1999) by MCH goals & current level of achievement.[2]

The current infant mortality rate 64/1000 live births (2002) by MCH goals and current level of achievement(India) is in a decreasing trend but still on the very higher side as compared to developed country. According to 2005-06 NFHS-3, the infant mortality rate in Sikkim was 34/1000 live births in the last five years.[3]

There are various risk factors for the neonatal septicemia. They can be broadly classified as maternal, neonatal, and environmental. Illiterate or low literate mothers, poverty are some of the important social risk factors for the neonatal septicemia. Ruptured membranes of longer duration, infection in the birth passage, fever, and delivery before 37 weeks of gestation, premature rupture of membranes, and infection of group B streptococci are some of the maternal risk factors for the neonatal septicemia. Cesarean section delivery, home delivery, is other risk factors for the neonatal septicemia. Prematurity, low birth weight, being male is some of the neonatal risk factors for the neonatal septicemia.[4]

Present study was carried out to study pattern of neonatal infections, socio-demographic correlates; clinical manifestations and bacteriological profile of neonatal infections.

METHODS

Study design *was* case-control study

Study period was 2 months (From 1st September 2007 to 31st August 2008). Central Referral Hospital, Tadong, East District of Sikkim in India.

Case definition

All the babies of age group ≤28 days showing positive sepsis screening irrespective of the gestation, mode and place of delivery would be included as cases.

Definition of control group

All the babies of age group ≤28 days showing negative sepsis screen would constitute the control group.

Sample size

This study is expected to cover at least 70 "Cases" and 70 "Controls". So, a minimum of 140 participants would be included in this study (n=140).

Inclusion criteria

- Babied born in the study hospital
- Age 0 to 28 days of life
- Probable signs of sepsis

Exclusion criteria

- Babied born out of the study hospital
- Age more than 28 days of life
- Those with any congenital anomalies

All basic information was collected form the mother. The data was entered in the predesigned, pretested and semi structured study questionnaire designed for the present study. The study questionnaire was based on the World Health Organization guidelines. Weight of the neonate would be recoded using an Electronic Weighing Machine.

Infants with clinical picture suggestive of sepsis with one or more of the following criteria

Existence of predisposing factor (any one of the following)

- Maternal fever
- Foul smelling liquor
- Prolonged rupture of membrane (>12 hours) 4
- Presence of gastric polymorphs

Positive septic screen (two or more parameters)

- Total leukocyte count (<5000/cumm)
- I:T ≥0.2
- Serum CRP >6 mg /dl
- Peripheral blood smears (Band cells, Toxic granules and Shift to left.)
- Micro ESR >10 AEFH
- Absolute Neutrophil Count. <1500/cumm

Statistical analysis

The data was analyzed using the statistical package SPSS version 17.0 for Windows. Chi-square test was used. OR with 95% Confidence Intervals was calculated. p value less than 0.05 was considered as significant.

RESULTS

Table 1 shows distribution of cases & controls according to sex. Males in cases were 38 and males in controls were 37. Females in cases were 32 and females in controls were 33. Thus, there was no statistically significant difference between the cases and the controls. Birth weight of less than two kg were significantly more in cases compared to the controls and birth weight of more than two kg were significantly more in controls compared to the cases. Term babies were significantly more in controls compared to the cases and preterm babies were significantly more in cases compared to the controls.

Table 2 shows clinical Presentations in study groups. Cyanosis was present in 29 subjects among the cases. Grunting was present in 23 subjects among the cases. Tachypnea was present in 56 subjects among the cases. Apnea was present in 22 subjects among the cases. Chest retraction was present in 53 subjects among the cases. Poor feeding was present in 24 subjects among the cases.

Vomiting was present in 18 subjects among the cases. Distension was present in 13 subjects among the cases. Jaundice was present in 24 subjects among the cases. Hypothermia was present in 22 subjects among the cases. Lethargy was present in 18 subjects among the cases. Irritability was present in 6 subjects among the cases. Jitteriness was present in 11 subjects among the cases. Seizure was present in 8 subjects among the cases. Hypoglycemia was present in 22 subjects among the cases. Sclerema was present in 4 subjects among the cases.

Table 1: Distribution of cases and controls according to sexes.

Variable		Cases	Control	Total	Chi-square	p value
Sex	Male	38 (54.3%)	37 (52.9%)	75 (53.6%)	0.029	0.865
	Female	32 (45.7%)	33 (47.1%)	65 (46.4%)		
Birth weight	<2 kg	27 (38.6%)	9 (12.9%)	36 (25.7%)	12.12	0.0001
	>2 kg	43 (61.4%)	61 (87.1%)	104 (74.3%)		
Gestational age	Term	38 (54.3%)	57 (81.4%)	95 (67.9%)	11.82	0.0006
	Pre term	32 (45.7%)	13 (18.6%)	45 (32.1%)		

Table 2: Clinical Presentations in study groups.

Clinical presentation	Cases		Controls	
	Yes	%	Yes	%
Cyanosis	29	41.4	15	21.4
Grunting	23	32.9	14	20
Tachypnea	56	80	45	64.3
Apnea	22	31.4	8	11.4
Retraction	53	75.7	38	54.3
Poor feeding	24	34.3	22	31.4
Vomiting	18	25.7	8	11.4
Distention abdomen	13	18.6	5	7.1
Jaundice	24	34.3	24	34.3
Hypothermia	22	31.4	7	10
Lethargic	18	25.7	9	12.9
Irritability	06	8.6	2	2.9
Jitteriness	11	15.7	5	7.1
Seizure	08	31.4	1	1.4
Hypoglycemia	22	31.4	8	11.4
Sclerema	04	5.7	1	1.4

Table 3 shows organisms isolated in culture positive cases. Acinetobacter was seen in one case. Citrobacter species was seen in two cases. Enterobacter was seen in five cases. Klebsiella was seen in eight cases. Proteus vulgaris was seen in one case. Pseudomonas species was seen in three cases. Staph Aureus was seen in 11 cases. 39 samples were sterile i.e. there was no growth of any kind of the organisms were found. Gram negative organisms were more commonly found in the present study compared to the gram positive organisms. The incidence of the gram negative organisms was 64.5% in the present study. The incidence of the gram positive organisms was 35.4% in the present study.

Table 4 shows distribution of mortality among study group. Out of 70 cases 12 died during the study period. 58 cases i.e. 45.3% survived during the study period. There were a total of 70 controls and all of them survived. No neonate among the control died. Out of total 140 study subjects, 12 neonates died during the study period and 128 neonates survived during the study period. The difference of mortality between the cases and the controls was found out to be statistically significant ($p < 0.05$).

Table 3: Organisms isolated in culture positive cases.

Variable		Number	%
Organisms	Acinetobacter	1	1.4
	Citrobacter species	2	2.9
	Enterobacter	5	7.1
	Klebsiella	8	11.4
	Proteus vulgaris	1	1.4
	Pseudomonas species	3	4.3
	Staph. aureus	11	15.7
	Sterile	39	55.7
	Total	70	100.0
Gram positivity	Gram +ve	11	35.4
	Gram -ve	20	64.5

Table 4: Distribution of mortality among study group

Outcome	Cases	Control	Total	Chi-square	p value
Survived	58 (45.3%)	70 (54.7%)	128 (100%)	13.13	0.003
Died	12 (100%)	0	12 (100%)		

DISCUSSION

We found that males were more susceptible than females which are similar to the observation by Nelson 5 who said that the susceptibility rate was twice in males.

Early onset septicemia is <72 hours was present in 49 cases (70%) and late onset septicemia is >72 hours was present in 21 cases (30%). Upadhyay A et al, observed EOS constituted 41.8% of all NNS while rest of 58.2% was LOS.[6]

Case group showed that low birth weight i.e. <2000 gm was present in 27 cases (38.6%) and 43 (61.4%) affected babies were >2 kg which is similar with the control group these findings are not consistent with other studies. Nellian AR et al, Mehrotra N et al.[7,8] Among 32 preterm babies (45.7%) were affected in comparison to term babies 38(54.3%). Anand NK et al, observed that 62% preterm babies were affected.[9]

Commonly observed clinical manifestations were chest retraction (53%), Tachypnea (56%), cyanosis (29%), poor feeding (24%) temperature abnormality (22%), jaundice. Similar findings were also given by Gupta P et al.[10]

Culture was positive in 31cases (44.29%). So, in our study culture positivity rate was 44.29%. Which is similar to observed culture positivity rate of Sugandhi RP et al, (42.5%) and close to result of Namdeo UK et al, (50%) Gupta P et al, observed culture positivity rate of 33%.[10-12]

Staphylococcus Aureus (15.7%), *Klebsiella* (11.4%), *Enterobacter* (7.1%) *Pseudomonas* (4.3%) was the common organisms isolated in our study. The incidence of *Staphylococcus Aureus* is more than the reported incidence of NNPD but is not the most common isolated organism. Upadhyay A et al, showed Staph aureus was the most common isolate (25.3%), followed by *Klebsiella* (17%) and CONS (11.3%). Staph aureus has reported to be an important cause of sepsis in neonates in Finland and East Africa, but not elsewhere in United States, Staph aureus accounted for 8.5% of all isolates.

Gram-negative organisms were detected in 20 cases (64.5%). So, in our study gram-negative septicemia was more common than gram-positive septicemia. Our study findings are similar with others. Mathur NB et al, observed that gram-negative septicemia was present in 66.5% cases.[13]

Out of 21 culture positive cases of early-onset septicemia, Gram-negative organisms were detected in 14 cases (66%). So, in our study Gram-negative organisms were common cause of early-onset septicemia. Khatua SP et al, observed that both early and late onset septicemia were associated with predominant Gram-negative organisms.[14]

Gram-negative organisms were detected in 68.4% of cases of birth weight >2000 gm. So, in our study Gram-negative septicemia was more common in low birth-weight babies. Our findings are not consistent with other studies. Mishra JN et al, observed that gram-negative septicemia was commonly found in the newborn weighing <2 Kg.[15]

Ciprofloxacin had sensitivity of 29.03%, Amikacin had sensitivity of 51.6%, Cefotaxime had sensitivity of 12.9%, Gentamycin had sensitivity of 29.5%, Imipramine had sensitivity of 41.93% and Cloxacillin had sensitivity of 9.6%. Karthikayan G et al, observed that Gentamycin had sensitivity of 21.6%, Amikacin had sensitivity of 50%, and Ciprofloxacin had sensitivity of 90.3%.[16] 12(17.14%) died out of 70 cases of neonatal sepsis. Thus, in our study case fatality rate was 17.14%.

It was observed that death occurred in 7(58.3%) pre terms and 5(41.7%) full term. Thus, in our study mortality was higher in preterm babies. Our observations are consistent with other studies. Khatua SP et al, observed that mortality was 65.5% in preterm babies.

It shows that 8 cases (66.7%) with early onset septicemia died, while 4 cases (33.3%) with late onset septicemia died. So, in our study mortality was higher in early onset septicemia. Our observations are consistent with other studies. Mathur NB et al, observed mortality of 64.5% when the onset of illness was early.[13]

It shows that 7 cases (25.9%) with birth weight <2000 gm died while 5 cases (11.6%) with birth weight >2000 gm died. In our study mortality was higher in low birth-weight babies i.e. <2000 gm. Our findings are consistent with other studies, but the incidence is less in comparison to other studies. Mathur NB et al, and Khatua SP et al, observed 60.2% and 61.5% mortality in low birth-weight babies. Mishra JN et al, observed 70% mortality in low birth-weight babies.[13-15]

It shows that out of 12 deaths, in 2 cases (16.6%) of Gram negative organisms were isolated while in 1 case (8.3%) Gram-positive organisms were isolated. So, in our study mortality was higher in Gram negative septicemia.

CONCLUSION

Male babies are more prone for septicemia. Term and birth-weight >2 kg has been found to be more prone for septicemia which is not the case in other studies. Early-onset septicemia is more common than late-onset septicemia. Gram-negative septicemia is more common than Gram-positive septicemia. Gram-negative organisms are common cause of early-onset septicemia. But Gram-negative septicemia is common in birth-weight >2 kg babies. The most common clinical manifestations were chest retraction (53%), Tachypnea (56%), cyanosis

(29%). Staphylococcus Aureus (15.7%) was the most common isolated organism, in succession was the Klebsiella (11.4%). The antibiogram of staph aureus showed highest sensitivity to Amikacin, Gentamicin, Netilmycin and Imipramine. Klebsiella showed maximum sensitivity to Amikacin, Ciprofloxacin and Imipramine. Septicemia was more common in low socio-economic status and Hindu religion, Nepali community. Mortality is higher in preterm babies, in early-onset septicemia and Gram-negative Organisms.

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