

ORIGINAL ARTICLE

CO-EXISTENCE OF BACTERIAL MENINGITIS IN NEONATAL SEPSIS

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Background: Neonatal sepsis in preterm and term babies is one of the leading causes of morbidity and mortality, reaching up to 50% for untreated infants, though advanced neonatal care has reduced complications. The aim of this study was to determine the co-existence of bacterial meningitis in neonates diagnosed with sepsis. **Methods:** This Descriptive cross-sectional study was conducted in Department of Paediatrics and Neonatology, Ayub Teaching Hospital, Abbottabad from Jan 2017 to Jan 2018. After getting approval from the Hospital Ethics Committee, data was collected from all patients with neonatal sepsis admitted in the neonatology unit. Informed consent was taken from parent or guardian. Detailed history and complete physical examination was carried out. A lumbar puncture was performed and CSF was collected from the patient and analysis for cell count, proteins, sugar, and culture & sensitivity was done. Cranial ultrasonography was done to exclude intra-ventricular, intra-cerebral, extradural or subdural haemorrhage. **Results:** Out of 188 patients, 124 (65.95%) male and 64 (34.05%) females, with 43 (22.87%) diagnosed neonatal septic meningitis were included. The mean age of the infants was 18 ± 6.65 days and mean weight was $2,500 \pm 156.55$ grams. Statistically insignificant correlation was observed between bacterial meningitis and age and gender. However, significant correlation ($p < 0.01$) was found between bacterial meningitis and weight of the patients. **Conclusion:** Bacterial meningitis is significantly associated with neonatal sepsis and needs to be ruled out in these babies to avoid neurological complications.

Keywords: Septicaemia, Bacterial, Meningitis, Sepsis, Neonates

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INTRODUCTION

Neonatal sepsis is one of the common causes of morbidity and mortality in preterm and term infants. In untreated cases, its mortality is as high as 50%.¹ Although advancements in neonatal care have led to an increased overall survival and a decrease in overall complications in neonates who are delivered before term, yet sepsis remains a common and significantly important cause of mortality and morbidity specially in preterm and low birth weight babies in Neonatal Intensive Care Units (NICUs).²

Based on the timing of infection, neonatal sepsis is classified as early onset and late onset. Sepsis in the first week of life is termed as early onset sepsis (EOS). Still some authors are of the view that sepsis occurring in the first 3 days is EOS which is secondary transmission of invasive organisms during delivery. Sepsis, which is developed after one week, termed as late onset sepsis, is acquired after the birth.³

Bacterial meningitis (BM) is cranial spread of infection and in neonates it is associated with high morbidity and mortality. The mortality in the affected neonates reaches up to 10% approximately and 20–50% of the survivors develop other morbidities.⁴ Complications of neonatal meningitis like cerebral palsy, motor disorders, blindness, sensory-neural hearing loss, seizures, and learning deficiencies are increased with delayed treatment.⁵

Diagnosis of BM is based on the report of routine examination (RE) of cerebrospinal fluid (CSF).

Features like high CSF neutrophil count, increased protein levels in CSF, depleted glucose are indicative of septic meningitis or an identification of bacterial pathogen by culture or by Gram stain are confirmation of bacterial meningitis.⁶

Frequency of bacterial meningitis in neonatal sepsis is different in different areas and ranges from 22.7 to 30%.^{7,8} As bacterial meningitis is common, especially in developing countries, therefore, its frequency in our setup and its association with age and gender was the primary objective of this study.

METHODOLOGY

After approval from Hospital Ethics Committee, this cross-sectional project was carried out in the Department of Neonatology, Ayub Teaching Hospital, Abbottabad from January 2017 to January 2018. The sample size was calculated as 188 neonates based on previous work⁷, with confidence level of 95% and absolute precision of 6%. Informed written consent was obtained from parents of all patients with neonatal sepsis using non-probability, consecutive sampling. Neonatal sepsis was established as any full term infant 28 or less days of age, with suspected or proven infection having two out of the following four, one of which must be abnormal temperature or abnormal leukocyte count:

1. Body temperature less than 36 °C or more than 38 °C
2. Tachycardia or persistent bradycardia over 0.5 hour

3. Respiratory rate more 60 breaths per minute or recurrent apnoea
4. White blood cell count less than 5,000/mm³ or more than 15,000/mm³

Septic meningitis was confirmed on CSF culture and sensitivity. On the basis of clinical diagnosis and laboratory investigations, patients with viral meningitis, viral encephalitis, subdural, extradural, intra-cerebral and intra-ventricular haemorrhage and ischemic stroke were excluded from the study. Data analysis was done on SPSS-20. Chi-square test was used to find the significance between dependent and independent variables, $p < 0.01$ was considered significant. Results were calculated as frequencies and percentages.

RESULTS

A total of 188 patients, 124 (65.95%) male and 64 (34.05%) female, with neonatal septic meningitis were included in the study. The mean age of the patients was 18 ± 6.65 days. Mean weight was $2,500 \pm 156.55$ grams. Age of majority of patients (100, 53.19%) was 15–28 Days. (Table-1).

Bacterial meningitis was seen in 43 (22.87%) patients with statistically insignificant correlation to age and gender ($p > 0.05$). However significant correlation ($p < 0.001$) was found between bacterial meningitis and weight of the patients. (Table-2).

Table-1: Frequencies and percentages for age, gender and bacterial meningitis (n=188)

Parameter	Frequency	Percentage
Age Group		
1–14 Days	88	46.81
15–28 Days	100	53.19
Gender		
Male	124	65.95
Female	64	34.05
Bacterial Meningitis		
Present	43	22.87
Absent	145	77.13
Total	188	100

Table-2: Stratification of bacterial meningitis with respect to age, gender and weight (n=188) [n (%)]

Parameter	Bacterial meningitis		p
	Present	Not present	
Age			
1–14 Days	22 (11.70)	66 (35.10)	0.514
15–28 Days	21 (11.17)	79 (42.02)	
Gender			
Male	29 (15.42)	95 (50.53)	0.815
Female	14 (7.44)	50 (26.59)	
Weight			
<2,300 grams	37 (19.68)	32 (17.02)	<0.001
>2,300 grams	6 (3.19)	113 (60.10)	

DISCUSSION

Neonatal sepsis is an important health problem resulting in high mortality and morbidity, and sometimes lifelong complications, especially

neurological complications.⁹ Due to its association with long term complications, morbidity and mortality, various studies have been done to find out the exact frequency of bacterial meningitis in neonatal sepsis.⁷ The studies indicated more prevalence of BM in underdeveloped countries as compared to the developed countries, and range between 22.7% to 30%.^{7,8} In our study, 43 (22.87%) of 188 septic patients had septic meningitis. In a local study conducted in Multan¹⁰, it was found to be 27.4% which is comparable to our study. In contrast to our figures, others reported very few cases of septic meningitis associated with sepsis in neonates. Tsai *et al*¹¹ observed 0.68% neurological complications, while Maoulainine *et al*¹² reported only 3.3% meningitis in their septic patients. In a study in Taiwan Chu *et al*¹³ observed 5.5% cases developing meningitis following septicaemia and Giannoni *et al*⁹ observed 6.76% case of neonatal meningitis.

In our study meningitis was positive in 67.44% male and 32.56% females of the total neonates with septicaemia. These results are comparable to a study by Zhu *et al*¹⁴. Similar male predominance (63%) was noted by Giannoni *et al*⁹. Chu *et al*¹³ observed that male patients having septicaemia were 58.8% while females were 47.2% with development of meningitis in 62.5% and 37.5% respectively.

The mean age of presentation in our study was 18 ± 6.65 days, however there was no statistically significant relation of septic meningitis with age of the patients. The mean weight of the patients was $2,500 \pm 156.55$ grams with significant relation ($p < 0.01$) to development of septic meningitis. Zhu *et al*¹⁴ reported 92 patients of late onset and 20 patients of early onset. They reported predominance of late onset meningitis which is similar to our study. Similarly lower age and lower weight was observed to be predominantly affected in another study by Zhu *et al*.¹⁵ In contrast to our study and some other studies, Giannoni *et al*⁹ reported only 20% patients with early onset sepsis compared to 80% late onset sepsis but the disease was more commonly seen in those with low birth weight and median age of 9 days.

Septic meningitis following septicaemia is more common in underdeveloped countries compared to developed countries. Also it is commonly seen in neonates with lower birth weight. Sepsis in developing countries is more likely to be associated with meningitis as compared to the developed countries.

CONCLUSION

Bacterial meningitis is associated with late onset sepsis and in neonates with low birth weight. Bacterial meningitis is significantly associated with neonatal sepsis and needs to be ruled out in those babies to avoid neurological complications.

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