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ASSESSMENT OF NEONATAL MENINGITIS IN A UNIQUE PRESENTATION WITH SEPSIS

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ABSTRACT

Objective: To assess meningitis in neonates presented with sepsis to a tertiary care hospital of the province Khyber Pakhtunkhwa.

Methodology: This hospital based cross sectional study was conducted at Department of Pediatrics, Hayatabad Medical Complex, Peshawar from 24th January 2021 to 24th July 2021. The neonates were enrolled through Out Patient Department (OPD) and Emergency Department (ER) with signs and symptoms that were suggestive of sepsis. The diagnosis was confirmed using lumbar puncture investigation. The extracted data was then evaluated using SPSS v.24.0 for descriptive and inferential analysis.

Results: In total of 168 neonates with mean age of 13.36±9.26 days, 54.9% individuals were born full term, wherein 51.2% had decreased feed, 54.9% were lethargic, and 42.7% were hypothermic. In total, 57.3% had negative blood culture, while 52.4% were diagnosed to have meningitis. In addition, 61% of the neonates had raised Total Leukocyte Count (TLC), and 64% of the neonates had increased C-Reactive Protein (CRP) of more than 0.5mg/dl. Meningitis was found to have significant association ($p < 0.05$) with gender, hyperthermia, decreased oral feed, lethargic condition, blood culture positivity and TLC while had a insignificant ($p > 0.05$) relationship with hypothermia, age group and age at birth (grouped) and CRP levels.

Conclusion: The study concluded that more than half of the neonates presented with suggestive signs and symptoms of sepsis were positive for meningitis. High number of neonates had increased TLC and CRP.

Keywords: Meningitis; Neonates; Sepsis; Total Leukocyte Count; C-Reactive Protein.

INTRODUCTION

Sepsis neonatorum, another name for neonatal sepsis, is a clinical illness characterized by infection-related signs and symptoms in the first month of life, either with or without bacteremia. It includes a variety of infant systemic diseases, including septicemia, meningitis, pneumonia, arthritis, osteomyelitis, and urinary tract infections.¹ In the first month of life, up to 10% of infants suffer infections. In underdeveloped nations, newborn infections are currently responsible for 1.6 million fatalities. According to the World Health Organization, 2.5 million newborn deaths occur annually in the entire world². 98% of them take place in developing nations, including those in Asia, Africa, and Latin America. The most common causes of death in neonatal period are infections (32%) including septicemia, meningitis, pneumonia, diarrhea and neonatal tetanus followed by birth asphyxia (29%) and prematurity (24%).²

Pediatricians continue to face a public health prob-

lem with neonatal meningitis because of the disease's high mortality and long-term consequences. It occasionally happens in isolation, and affects 15–25% of newborns with sepsis.³ Neonates have immature humoral, cellular, and phagocytic immunity, which puts them at higher risk for sepsis and meningitis than other age groups. With case fatality rates of 15–25 percent and morbidity rates of at least 25 percent and more, neonatal meningitis has a dreadful prognosis.⁴

Despite powerful antimicrobial medications and techniques for quick pathogen identification, newborn meningitis is a major cause of neurological impairment worldwide.⁵⁻⁷ Because more babies are being delivered prematurely and as developing countries have less access to medical resources, neonatal meningitis continues to be a problem. Additionally, diagnosing meningitis in newborns is more challenging than it is in older children and adults^{8,9} due to the lack of distinct clinical symptoms. Compared to full-term infants, babies under 32 weeks of gestation receive only a little amount of maternal immunoglobulin. Finally, neutrophils inadequate migration and phagocytosis make newborns

more susceptible to infections of low pathogenicity. A research done on 190 newborns in Lahore found that 39.5% of the neonates who presented with sepsis also had meningitis⁷. In a study conducted in Srinagar by Roshi Bhagat, 16 percent of the 423 newborns who presented with sepsis were found to have meningitis.⁸

Gram-negative bacteria continue to be the main contributor to newborn sepsis in the majority of developing nations.^{9,10} Over the past 20 years, these organisms have become more resistant to drugs.¹¹ However, in affluent nations, Group B Streptococcus (GBS) has been the most common etiological cause of newborn sepsis, causing substantial morbidity and mortality.¹² Since even within the same city/country, the range of organisms that cause newborn sepsis evolves over time and differs from area to area and hospital to hospital.

This study's primary goal is to assess the presence of meningitis in newborns who come with sepsis. Studies examining easy-to-implement strategies are urgently needed to lessen the burden of neonatal infection. It is also critical to define the various bacteria that cause neonatal sepsis and their shifting drug susceptibility profiles, to which this study would provide foundational data. In cases where sepsis is present, early evaluation of neonates for associated meningitis is crucial because, by providing proper care and effective management, before the patient's clinical condition worsens to a point of clinical severity at which the neonate is less likely to recover fully, the likelihood of experiencing a poor neonatal outcome as well as antibiotic resistance will be significantly reduced. Newborn morbidity and death can be decreased by early detection and appropriate treatment of neonatal meningitis.

■ METHODOLOGY

This descriptive cross sectional study

was conducted at Department of Pediatrics, Hayatabad Medical Complex, Peshawar. The sample size was calculated using PASS Sample Size version 15.0. considering 39.5%⁷ as proportion of meningitis in neonatal sepsis keeping margin of error at 7.5% and confidence interval at 95%, the calculated sample size came to be as 164. Consecutive non-probability testing sampling was used to enroll the study participants. The neonates from birth to 30 days of life of either gender can be premature and full term and presenting with signs and symptoms suggestive of sepsis were included in this study while neonates with the having gross congenital anomalies on examination such as spinabifida, meningocele, meningomyelocele, having deranged coagulation profile, decreased platelets count (<50,000/mm³), very low birth weight (weight <2500g), peri-natal asphyxia were excluded from this study. After receiving approval from the hospital's ethical and review board, the study was executed. Neonates from Out Patient Department (OPD) and Emergency fulfilling the exclusion and inclusion criteria were assessed as per study objective. All newborns underwent a thorough physical examination after a detailed history. Blood was drawn from all newborns using stringent aseptic procedures, and the sample was then transferred to the hospital laboratory for measurement of the serum C-Reactive Protein (CRP) levels, blood culture, and Total Leukocyte Count (TLC). According to a defined protocol, lumbar puncture was carried out, and the CSF was transferred to the hospital laboratory for routine analysis. Data was extracted on a pre-designed research perform having details regarding neonates' demographic, clinical, and laboratory features. The SPSS v.24.0 was used to conduct the statistical analysis, the numerical variables like age, weight at birth, gestational age, TLC, and serum CRP recorded as mean±standard deviation (SD), while the categorical variables like gender and blood culture positivity were reported as frequencies and percentages.

Post stratification, association was measured among different variables using Chi-square tests to assess effect modification at a P-value of ≤0.05.

■ RESULTS

In total 164 neonates with mean age of 13.36±9.26 days, 64.6% were males, while 35.6% were females. The reported that maximum of the neonates had less than 15 days (59.8%) of age. Among neonates, 54.9% were born full term while rest were 45.1% were preterm. In the study, mean weight and length was recorded to be 3.01±0.47 KG and 49.99±2.46 cm respectively. A total of 51.2% of subject's had decreased intake, 54.9% were lethargic, 42.7% were hypothermic, and 53% were hyperthermic. Among all, 57.3% had negative blood culture, and 52.4% were diagnosed as meningitis via lumbar puncture. In laboratory investigations, 64% had raised C-Reactive Protein (CRP) levels and 61% had raised Total Leukocyte Count (TLC) respectively. Meningitis were stratified with age group, weight at birth (strata's), symptoms like hypothermia, decreased oral feed, lethargy and blood culture, details give in Table No 3.

■ DISCUSSION

The most vulnerable period in a person's life during which bacterial meningitis manifests and causes serious consequences is during infancy. Since sepsis and meningitis are the most common causes of neonatal mortality, doctors must have a high index of suspicion while treating newborns who exhibit vague clinical symptoms. On how to categorize meningitis and neonatal sepsis in the postpartum period, there is no agreement. According to the current study, the majority of the participants in the study were male (64.6 percent). According to Bhagat R et al., 2015¹⁴, the majority of the individuals in their study on late-onset meningitis were male as opposed to female. In contrast to the

Table 1: Clinical signs and symptoms present in neonates

Variables		Frequency (%)
Decreased Intake	Yes	84 (51.2)
	No	80 (48.8)
Lethargic (Unconscious)	Yes	74 (45.1)
	No	90 (54.9)
Hypothermia	Yes	70 (42.7)
	No	94 (57.3)
Hyperthermia	Yes	87(53.0)
	No	77 (47.0)

Table 2: Biochemical characteristics and prevalence of meningitis of studied population

Variables		Frequency (%) / Mean ± SD
Total leukocytes count		14676.83 ± 4820 ± 63
Total Leukocytes Count Categories	4000-11,000	64 (39.0)
	>11,000	100 (61.0)
CRP Categories (mg/dL)	<0.5	59 (36.0)
	>0.5	105 (64.0)
Blood Culture Positivity	Yes	70 (42.7)
	No	94 (57.3)
Meningitis	Yes	86 (52.4)
	No	78 (57.6)

SD= Standard Deviation, %= Frequency, mg= milligram, dL=

Table 3: Association of meningitis with different stratified variables.

Variables		Meningitis		P-value
		Yes	No	
Gender	Male	61	45	0.05
	Female	25	33	
Age	0-15 days	48	50	0.17
	16-30 days	38	28	
Age at Birth	<36 weeks	40	34	0.41
	>36 weeks	46	44	
Decreased Intake	Yes	25	57	<0.00
	No	51	19	
Lethargic (Unconscious)	Yes	50	24	<0.00
	No	36	54	
Hypothermia	Yes	42	31	0.15
	No	44	47	
Hyperthermia	Yes	32	40	0.05
	No	54	46	
Blood Culture Positivity	Yes	60	4	<0.00
	No	26	74	
Total Leukocyte Count (TLC)	Normal	28	36	0.05
	Raised	58	42	
C-Reactive Protein (CRP)	Normal	27	32	0.13
	Raised	59	46	

current findings, Fredrick et al. claimed that male is a minority group that was based on the study (51 %).

According to earlier studies, sepsis affected 36.4 percent of preterm infants and 49.2 percent of LBW newborns. Meningitis, however, was noted in an earlier study in 63.3 percent of LBW infants and 61.7 percent of preterm neonates¹⁴. The findings of the present investigation are further supported by a study by Anjos da Silva et al.,¹⁵ Among their investigation, Jiang et al¹⁶ found a strong correlation between meningitis in newborns and low birth weight.

Clinical signs and symptoms indicated that 51.2% of newborns had poor feeding, 54.9% were lethargic, 42.7% had hypothermia, and 53% had hyperthermia. The findings of Bhagat R, et al¹⁴, were used to corroborate these findings, which showed that lethargy and decreased oral feed were present in 100% and 46.4% of the subjects, respectively. In accordance with the current findings, Laving et al¹⁷ identified feed intolerance and lethargy as the two most prevalent clinical characteristics of meningitis, both of which were present in 73.3 percent and 60 percent of cases, respectively.

The current study found no significant association between meningitis and gestational age. The results of Fredrick et al³, were in support of the observation that there was no statistically significant difference in gestational age. Mean gestational age was 38.8 weeks was (28-42 weeks). According to a study conducted by Thomas E. et al¹⁸, 16 percent of the pregnancies were under 36 weeks.

Out of total sample 57.3% had negative blood culture. Blood culture was positive in 42.6 percent and 7.04 percent of patients with meningitis and sepsis, respectively, according to a prior study by Bhagat R et al¹⁴, and was found to be statistically substantially

linked with both conditions.

The results of earlier research on meningitis prevalence in neonates by Visser et al¹⁹, and Tisukumara et al²⁰, supported the 52.4 percent meningitis prevalence found in the current study. In another investigation, meningitis incidence in was found to be 16 percent (Bhagat R et al¹⁴, Laving et al¹⁷ and Anjos De Silva et al¹⁵, both made a similar observation. Biochemical data revealed that 64% of patients had elevated CRP levels and 61% had elevated total leukocyte counts. CRP was not substantially linked with meningitis. The results of earlier research by Fredrick DS et al³, showed that the mean CRP was 54.4±38.6 and that meningitis was not substantially associated with it.

CONCLUSION

The study concluded that more than half of the neonates presented with suggestive signs and symptoms of sepsis were positive for meningitis. High number of neonates had increased Total Leukocyte Count (TLC) and C-Reactive Protein (CRP). A significant association was recorded for meningitis with gender, hyperthermia, decreased oral feed, lethargic condition, blood culture positivity and TLC while had a insignificant relationship with hypothermia, age group and age at birth (stratified) and CRP levels.

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Author's Contribution

The study was conceived and designed by JKZ, who also wrote the manuscript. RK, MI, and GL assisted with data collection and contributed to the final write-up of the manuscript. SY and HG were responsible for data analysis and also contributed to the manuscript write-up. Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of Interest

Authors declared no conflict of interest

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None

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.