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FREQUENCY OF BACTERIAL MENINGITIS IN PATIENTS PRESENTING WITH ENTERIC FEVER AT TERTIARY CARE HOSPITAL, LARKANA

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Abstract

OBJECTIVE

To determine the frequency of bacterial meningitis in patients presenting with enteric fever at Tertiary Care Hospital, Larkana.

METHODOLOGY

A cross-sectional study was conducted in the Department of Paediatrics, Children Hospital, SMBBU, Larkana. A total of 237 paediatric patients aged 2–16 years presenting with enteric fever were enrolled using non-probability consecutive sampling. Enteric fever was defined by clinical and laboratory criteria. Bacterial meningitis was identified using cerebrospinal fluid analysis. variables were analysed, and associations were assessed using Chi-square test, with $p < 0.05$ considered significant.

RESULTS

The mean age of the study participants was 6.27 ± 7.33 years, with males constituting the majority (152, 64.1%). Bacterial meningitis was identified in 12 (5.1%) patients. No statistically significant associations were found between the occurrence of bacterial meningitis and age, gender, residential status, family monthly income, or maternal occupational status (all p>0.05).

CONCLUSION

Bacterial meningitis occurred in a small proportion of paediatric patients presenting with enteric fever. Its occurrence showed no statistically significant association with the demographic or socioeconomic characteristics evaluated in the study. These findings indicated that bacterial meningitis was observed across the study population without identifiable demographic or socioeconomic predictors

among children diagnosed with enteric fever.

INTRODUCTION

Salmonella Typhi, a gram-negative bacillus, is the causative agent of typhoid fever, a systemic illness characterized by fever, headache, abdominal discomfort, and diarrhoea [1]. Apart from the typical symptoms of typhoid fever, Salmonella Typhi can also lead to various extraintestinal complications, including osteomyelitis, endocarditis, hepatitis, cholecystitis, and meningitis, which necessitate timely diagnosis and treatment [2]. It has been estimated that globally, around 35 million cases of Salmonella Typhi infection occur every year, resulting in approximately 500,000 deaths [3]. It is the most common bacteraemia illness in children in Pakistan, with rates as high as 1000 cases per 100,000 child-years having been reported from Karachi [4].

Salmonella meningitis is an infrequent yet severe complication of Salmonella infection, predominantly affecting infants, children, and immunocompromised individuals [5–6]. While Salmonella meningitis is a rare disease in developed countries, accounting for only 1% of cases, it poses a significant health concern in developing nations, where it affects a considerably higher proportion of infants and children, around 13% [7]. The mortality rate of this condition remains alarmingly high at approximately 90%, regardless of the serotype involved [8].

Salmonella meningitis can manifest with non-specific symptoms, including fever, irritability, lethargy, and altered mental status, making its diagnosis challenging. Isolation of the organism from either cerebrospinal fluid (CSF) or blood cultures is essential for the confirmation of this condition [9–10]. Management of Salmonella meningitis remains a complex and non-standardized process. Over the past few decades, numerous drugs have been employed in treating this condition, including chloramphenicol, ampicillin, co-trimoxazole, third-generation cephalosporins, and fluoroquinolones [11–12]. The presence of serious medical illness precipitated by unhygienic food practices can worsen the prognosis of this serious infection [13]. Cruz et al. evaluated enteric fever children and found the prevalence of bacterial meningitis to be 3.05% [14].

Typhoid fever is still a deadly disease in developing countries. Death in typhoid fever usually occurs when its complication goes unchecked. With advent of multidrug resistant bacteria, rate of complicated fever has grown higher. Very few studies have been reported locally on burden of meningitis in typhoid. Given the overlapping symptoms between enteric fever and bacterial meningitis, including fever, headache, and altered mental status, there exists a possibility of misdiagnosis or co-occurrence of these conditions, which can lead to delayed or inappropriate treatment and potentially life-threatening outcomes. Therefore, understanding the frequency of bacterial meningitis among patients initially presenting with enteric fever is essential for improving the knowledge, guiding appropriate clinical management strategies, and ultimately reducing morbidity and mortality associated with both diseases. This objective will provide valuable insights into the epidemiology and clinical manifestations of these conditions, facilitating better healthcare practices and public health interventions aimed at prevention and control.

METHODOLOGY

A cross-sectional study was conducted in the Department of Paediatrics, Children Hospital, SMBBU, Larkana, after obtaining ethical approval from the institutional Ethics Review Committee and written informed consent from parents or guardians. The study population comprised paediatric patients of either gender aged 2–16 days presenting with enteric fever of up to one-month duration and fever persisting for at least two days, enrolled through non-probability consecutive sampling, while those with a history of febrile seizures, malaria, dengue fever, pneumonia, encephalitis, malnutrition, congenital heart disease, immunosuppression, or

malignancy were excluded. Enteric fever was defined as blood culture positivity for *Salmonella* species or the presence of fever exceeding 38°C for more than three days along with diarrhoea, haematological abnormalities including leukopenia or thrombocytopenia, and elevated serum alanine transaminase levels. Bacterial meningitis was defined as cerebrospinal fluid culture positivity with neutrophilic pleocytosis of ≥100 cells/mm³, cerebrospinal fluid glucose <40 mg/dL, and protein concentration >60 mg/dL. The sample size of 237 patients was calculated using an expected prevalence of bacterial meningitis of 4%, a margin of error of 2.5%, and a confidence level of 95%. Data was collected using a predesigned structured proforma that recorded demographic details, socioeconomic characteristics, and clinical findings. Lumbar puncture was performed under strict aseptic measures. Fundoscopy was carried out in children with closed fontanelle to exclude raised intracranial pressure, and cerebrospinal fluid samples were analysed for cytology, biochemistry, and culture, with random blood glucose measured concurrently; no follow-up beyond hospital stay was required. Data analysis included descriptive variables, with associations assessed using appropriate Chi-square tests for stratified comparisons, with a significance level of ≤0.05.

RESULTS

A total of 237 study participants were included in the analysis. The mean age of the participants was 6.27 ± 7.33 days. The mean family monthly income was PKR 28,434.60 ± 9,696.72. Regarding gender distribution, 152 (64.1%) participants were male, while 85 (35.9%) were female. With respect to residential status, 123 (51.9%) participants belonged to urban areas, whereas 114 (48.1%) were from rural areas. In terms of maternal occupational status, 179 (75.5%) parents were employed, while 58 (24.5%) were unemployed. Concerning maternal educational status, 103 (43.5%) mothers were illiterate, 46 (19.4%) had primary education, 62 (26.2%) had secondary education, and 26 (11.0%) had intermediate or higher education **Table I**.

Table I: Baseline Characteristics of Study Participants (n=237)

Mean ± Standard Deviation		**95% Confidence Interval**
Age in days = **6.27 ± 7.33**		5.33~~7.21
Family Monthly Income in PKR = **28434.60 ± 9696.722**		27193.71~~29675.48
Frequency %		
Gender	Male	152 (64.1)
	Female	85 (35.9)
Residential Status	Urban	123 (51.9)
	Rural	114 (48.1)
Occupational Status	Employed	179 (75.5)
	Unemployed	58 (24.5)
Maternal Educational Status	Illiterate	103 (43.5)
	Primary	46 (19.4)
	Secondary	62 (26.2)
	Intermediate	26 (11.0)

Table II shows the association of selected demographic and socioeconomic factors with bacterial meningitis. Patients with bacterial meningitis had a mean age of 5.67 ± 3.98 years compared with 6.30 ± 7.47 years in those without bacterial meningitis (p = 0.771), and a mean

family monthly income of PKR 27,500.0 ± 9,931.58 versus PKR 28,484.44 ± 9,704.14, respectively (p = 0.733). Among patients with bacterial meningitis, 9 (75.0%) were male and 3 (25.0%) were female, compared with 143 (63.6%) males and 82 (36.4%) females in the non-meningitis group (p = 0.421). Regarding residential status, 5 (41.7%) patients with bacterial meningitis were from urban areas and 7 (58.3%) from rural areas, while 118 (52.4%) urban and 107 (47.6%) rural patients had no meningitis (p = 0.467). Maternal occupational status also showed no significant association, with 9 (75.0%) employed and 3 (25.0%) unemployed mothers among

Table II: Comparison of Baseline Characteristics with Bacterial Meningitis (n=237)

Baseline Characteristics		Bacterial Meningitis		95% Confidence Interval	P-value
		Yes (n=12)	No (n=225)		
Age in years		5.67 ± 3.98	6.30 ± 7.47	-4.926–3.655	0.771
Family Monthly Income (PKR)		27500.0 ± 9931.58	28484.44 ± 9704.14	-6654.950–4686.061	0.733
Gender	Male	9 (75.0)	143 (63.6)	0.453–6.534	0.421
	Female	3 (25.0)	82 (36.4)		
Residential Status	Urban	5 (41.7)	118 (52.4)	0.200–2.102	0.467
	Rural	7 (58.3)	107 (47.6)		
Occupational Status	Employed	9 (75.0)	170 (75.6)	0.254–3.712	0.965
	Unemployed	3 (25.0)	55 (24.4)		

meningitis cases compared with 170 (75.6%) employed and 55 (24.4%) unemployed mothers among non-meningitis cases (p = 0.965).

DISCUSSION

Enteric fever continues to pose a significant diagnostic and therapeutic challenge in paediatric populations in endemic regions, particularly due to its wide spectrum of clinical manifestations and potentially fatal complications. Among these, bacterial meningitis represents a rare but life-threatening condition that often presents with non-specific symptoms overlapping with enteric fever itself, thereby increasing the risk of delayed diagnosis. Early recognition of meningitis in children presenting with enteric fever is therefore of critical clinical relevance, as timely cerebrospinal fluid evaluation and appropriate antimicrobial therapy are essential to reduce neurological morbidity and mortality

In the present study, bacterial meningitis was identified in 5.1% of paediatric patients diagnosed with enteric fever. This frequency is comparable to, though slightly higher than, that reported by Cruz et al., who documented a prevalence of 3.05% among hospitalised children with enteric fever [14]. The difference in observed frequency may be attributable to regional variations in disease burden, referral patterns, antimicrobial resistance, and timing of hospital presentation. Studies from other endemic settings have similarly reported meningitis as an uncommon but clinically important complication of invasive Salmonella infections [15,16]. Importantly, the consistency of these findings across diverse populations reinforces the need for heightened clinical vigilance.

The demographic characteristics of the study population revealed a male predominance; however, no statistically significant association was observed between gender and the occurrence of bacterial meningitis (p=0.421). Similarly, age did not demonstrate a significant relationship with meningitis, as the mean age of affected

patients was comparable to those without meningitis (p=0.771). These findings agree with previous literature indicating that while younger age groups are more susceptible to enteric fever, progression to neurological complications does not appear to be strongly influenced by age or gender alone [14,15]. This suggests that host immune response and disease severity may play a more substantial role than basic demographic factors.

Socioeconomic variables were also analysed to identify potential predictors of bacterial meningitis. Residential status showed no statistically significant association, with comparable proportions of meningitis cases observed among urban and rural residents (p=0.467). Likewise, family monthly income did not differ significantly between patients with and without meningitis (p=0.733), and maternal occupational status was not associated with meningitis occurrence (p= 0.965). Although poor socioeconomic conditions are well-established risk factors for the acquisition of enteric fever due to inadequate sanitation and unsafe water supply [3,4], the present findings indicate that these factors do not independently predict the development of meningitis once infection has occurred. Similar observations have been reported in large epidemiological analyses, where complications were found to be more closely linked to prolonged bacteraemia and delayed initiation of effective therapy rather than socioeconomic indicators alone [14,16].

From a pathophysiological perspective, Salmonella meningitis is believed to result from sustained bacteraemia with subsequent penetration of the blood–brain barrier, particularly in children with immature or compromised immune defences [5,8]. The absence of identifiable demographic or socioeconomic predictors in this study supports the hypothesis that meningitis represents an unpredictable complication driven primarily by microbial virulence and host–pathogen interactions rather than baseline patient characteristics. Emerging evidence has also highlighted the contribution of antimicrobial resistance to persistent infection and dissemination, particularly in regions with high prevalence of multidrug-resistant and extensively drug-resistant Salmonella strains [6,15,17].

The strengths of this study include the use of clearly defined diagnostic criteria for both enteric fever and bacterial meningitis, a calculated sample size, and systematic evaluation of multiple demographic and socioeconomic variables. However, certain limitations must be acknowledged. The single-centre, cross-sectional design limits external validity, and the relatively small number of meningitis cases may have reduced statistical power to detect subtle associations. Additionally, microbiological characterisation of Salmonella serotypes and resistance patterns was not performed, which could have provided further insight into disease severity and complication risk.

CONCLUSION

Bacterial meningitis occurred in a small proportion of paediatric patients presenting with enteric fever. Its occurrence showed no statistically significant association with the demographic or socioeconomic characteristics evaluated in the study. These findings indicated that bacterial meningitis was observed across the study population without identifiable demographic or socioeconomic predictors among children diagnosed with enteric fever.

REFERENCES

Rahman T, Hosen I, Chakraborty S. A rapid glimpse on typhoid fever: an updated mini review. J Life Med. 2013;1(3):71-82.

Khan KH. Recent advancement in typhoid research: a review. Adv Biotech. 2008.

Nwadike VU, Fowotade A, Tuta KE, Olusanya OO. A rare case of Salmonella typhi meningitis in an eleven-month-old infant: a case report. Ann Ib Postgrad Med. 2012;10(1):38-39.

Owais A, Sultana S, Zaman U, Rizvi A, Zaidi AK. Incidence of typhoid bacteremia in infants and young children in southern coastal Pakistan. *Pediatr Infect Dis J.* 2010;29(11):1035-1039.

Carr BG, Weisbein JL, Gaieski DF. Salmonella meningitis in an immunocompetent adult. J Emerg Med. 2011;40(3):267-270.

Khurshid N, Khan BA, Bukhari SW, Shahid A, Punshi A, Ahmed NK. Extensively drug-resistant Salmonella typhi meningitis in a 16-year-old male. Cureus. 2019;11(10).

Mahalakshmi R, Rajeshbabu B, Mohan R, Balakumaran D, Venkataraman P, Nagarajan VP. Salmonella paratyphi B meningitis in an infant. Australas Med J. 2013;6(7):350.

Price EH, de Louvois J, Workman MR. Antibiotics for Salmonella meningitis in children. J Antimicrob Chemother. 2000;46(5):653-655.

Lim SY, Lee KW, Seow WL, Mohamed NA, Devaraj NK, Amin-Nordin S. Effectiveness of integrated technology apps for supporting healthy food purchasing and consumption: a systematic review. Foods. 2021;10(8):1861.

Feigin RD, McCracken GH Jr, Klein JO. Diagnosis and management of meningitis. Pediatr Infect Dis J. 1992;11(9):785.

Bartt R. Acute bacterial and viral meningitis. Continuum. 2012;18(6):1255-1270.

Kaplan SL, Feigin RD. Treatment of meningitis in children. Pediatr Clin North Am. 1983;30(2):259-269.

Nwadike VU, Fowotade A, Tuta KE, Olusanya OO. A rare case of Salmonella typhi meningitis in an eleven-month-old infant: a case report. Ann Ib Postgrad Med. 2012;10(1):38-39.

Cruz Espinoza LM, McCreedy E, Holm M, Im J, Mogeni OD, Parajulee P, et al. Occurrence of typhoid fever complications and their relation to duration of illness preceding hospitalization: a systematic literature review and meta-analysis. Clin Infect Dis. 2019;69(Suppl 6):S435-S448.

Crump JA, Sjölund-Karlsson M, Gordon MA, Parry CM. Epidemiology, clinical presentation, laboratory diagnosis, antimicrobial resistance, and antimicrobial management of invasive Salmonella infections. Clin Microbiol Rev. 2015;28(4):901-937.

Stanaway JD, Reiner RC, Blacker BF, Goldberg EM, Khalil IA, Troeger CE, et al. The global burden of typhoid and paratyphoid fevers: a systematic analysis for the Global Burden of Disease Study 2017. Lancet Infect Dis. 2019;19(4):369-381.

Gray AP, Chung E, Hsu RL, Araki DT, Hayoon AG, Weaver ND, et al. Global, regional, and national sepsis incidence and mortality, 1990–2021: a systematic analysis. Lancet Glob Health. 2025;13(12):e2013-e2026.