



Frequency of Clinical Presentation and Outcome in Patients with Pyogenic Meningitis at Pediatric Unit of Bacha Khan Medical College Swabi

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ABSTRACT

Background: Pyogenic meningitis remains a major cause of morbidity and mortality among children in developing countries despite advances in antimicrobial therapy. Early diagnosis and prompt management are critical for improving outcomes. This study aimed to determine the frequency of clinical presentations and outcomes in pediatric patients with pyogenic meningitis admitted to Bacha Khan Medical College, Swabi. **Methods:** A cross-sectional study was conducted in the Department of Pediatrics, Bacha Khan Medical Complex, Swabi, from August 2024 to February 2025. A total of 109 children aged 1–6 years, diagnosed with pyogenic meningitis based on cerebrospinal fluid findings, were included through consecutive non-probability sampling. Data regarding demographic variables, clinical presentation, and in-hospital outcome were recorded and analyzed using SPSS version 26. **Results:** The mean age of the participants was 3.42 ± 1.25 years, with a male predominance (56.9%). Fever (92.7%) was the most common presenting symptom, followed by vomiting (73.4%) and seizures (64.2%). Mortality was observed in 8.3% of patients. A significant association was found between seizure presentation and mortality ($p = 0.03$). **Conclusion:** Pyogenic meningitis continues to be a significant pediatric health burden in Pakistan. Fever, vomiting, and seizures remain the hallmark features of presentation, while seizure at onset is a strong predictor of mortality. Early recognition, timely initiation of empirical antibiotic therapy, and improved healthcare accessibility are essential to reducing fatal outcomes and long-term complications.

INTRODUCTION

Pyogenic meningitis is a severe childhood emergency and major cause of morbidity and mortality, especially in developing and middle-income nations (Villalpando-Carrión, Henaó-Martínez, & Franco-Paredes, 2024). It is defined as the inflammation of the meninges as the protective membranes around the brain and the spine as a result of the invasion of bacteria into the cerebrospinal fluid (CSF) and the subarachnoid space (Singh, Gupta, Sharma, and Kumar, 2024). The disease is classically manifested by the classical triad of fever, headache, and neck stiffness, also known as meningismus, but this complex is usually not complete in infants and young children, which makes it difficult to diagnose (Al-Qahtani, Shati, Alqahtani, and Ali, 2022). The condition has to be noticed early and managed to avoid catastrophic neurological consequences, such as cognitive impairment, hearing loss, and developmental delay (Zainel, Mitchell, & Sadarangani, 2021; Schiess, Groce, and Dua, 2021).

In many countries, bacterial meningitis remains the significant rate cause of deaths associated with infectious diseases in childhood (Basu Roy et al., 2021). According to the estimates of the World Health Organization, most cases

are caused by *Neisseria meningitidis*, *Streptococcus pneumoniae*, and *Haemophilus influenzae*, especially in areas with low vaccination rates and with limited access to medical services (Tsang, 2021). Although antimicrobial therapy has made tremendous progress, 5 to 15 percent of the pyogenic meningitis in children result in mortality, and 20 to 50 percent of survivors have reported neurological complications that persist in the long term (Sudo et al., 2024). In third world countries like Pakistan these consequences are compounded by late presentation of cases to the hospital, poor antibiotic stewardship, malnutrition, and inappropriate health-seeking behavior.

The clinical features of pyogenic meningitis depend on age, nutritional condition, and immune response (Hasbun, 2022). Fever, vomiting, headache, and seizures are common in older children, and belong to the nonspecific range of symptoms observed in neonates and infants, such as irritability, lethargy, poor feeding, and bulging fontanelles. In a study that was carried out in Pakistan, Z. Khan et al. (2024) indicated that the most common clinical features included fever (92.1%), vomiting (75.2%), and seizures (64.9%), and mortality was 7.8 percent. Equally, the frequency of fever in Abdelkader et al. (2023) in Egypt

(~92 %), and vomiting in Abdelkader et al. (2022) was found (~60 %), and the similarity of the clinical patterns in different populations supports their consistency.

Lumbar puncture and analysis of CSF are among the main methods of making the diagnosis, and the WBC is characterized by neutrophilic predominance, a high level of protein and reduced glucose content compared to serum glucose (Dyckhoff-Shen et al., 2024). But in most resource-deficient environments, lumbar puncture is either not performed or postponed because of diagnostic uncertainty, or because of under-laboratory support, leading to underdiagnosis and poor outcomes of lumbar puncture. Early administration of empirical antibiotic treatment which is often a combination of third-generation cephalosporins e.g. ceftriaxone or cefotaxime combined with vancomycin is the mainstay of treatment and can greatly enhance the prognosis in case of early administration.

Even in Pakistan, where clinical management has improved, and conjugate vaccines against *Haemophilus influenzae* type b (Hib) and *Streptococcus pneumoniae* have been introduced, bacterial meningitis remains a significant health issue among children (Park et al., 2022). This is due to limited regional data, particularly secondary and tertiary hospitals, which limits the development of effective prevention and intervention strategies. Additionally, the local differences in vaccination coverage, access to health services, and bacterial resistance make the clinical environment even more challenging.

Considering the high disease burden, regional variation, and limited modern-day data on Khyber Pakhtunkhwa province, this study was done to assess the prevalence of clinical manifestations and the outcome of pyogenic meningitis among the pediatric patients admitted at the Department of Pediatrics, Bacha Khan Medical College, Swabi. Recognizing the general clinical presentation and the existing death trends among this group of people will help in the timely identification, better managements of cases and efficient use of health facilities. Moreover, the results can be used to improve the empirical treatment regimen and to support the necessity of prophylactic vaccination programs that could help to minimize the occurrence and mortality rates of this life-threatening infection among the Pakistani children.

METHODOLOGY

Study Design and Setting

This cross-sectional research was carried out at the Department of Pediatrics, Bacha Khan Medical Complex, Shahmansoor, Swabi, within a period of six months i.e. between 15th August 2024 and 15th February 2025 after obtaining consent of the synopsis through College of Physicians and Surgeons Pakistan (CPSP). The objective of the study was to establish the incidence of different clinical manifestations and prognoses in children with pyogenic meningitis.

Sample Size and Sampling Technique

Participants were recruited using a consecutive non-probability sampling technique. The WHO sample size calculator was used to calculate a sample of 109 (calculation based on 95% confidence level, 9% absolute

precision, and an estimated frequency of 64.9% of seizures amongst pyogenic meningitis patients).

Inclusion and Exclusion Criteria

The study included children aged 1 to 6 years of any gender, who were diagnosed with pyogenic meningitis based on the established clinical and cerebrospinal fluid (CSF) criteria.

Patients with meningomyelocele, hydrocephalus, recurrent meningitis, or acute head trauma were included in exclusion criteria to reduce the confounding variables.

Ethics and Data gathering

Data collection began once the institutional review board and CPSP Karachi provided their ethical approval. The parents or guardians of all participants signed a written informed consent. All the patients were assessed on the basis of baseline demographics such as age, gender, weight, socioeconomic status, as well as the place of residence.

Pyogenic meningitis was diagnosed by the analysis of CSF where pleocytosis with neutrophil counts over 1000/mL, CSF proteins over 80mg/dL, and CSF glucose under 2/3 rd of serum glucose were detected.

The clinical manifestations were documented as fever, vomiting and seizures, whereas the outcome was measured as in-hospital mortality. Structured pro forma was used to gather data under the guidance of a consultant pediatrician who has at least five years of experience after fellowship.

Data Analysis

Analysis of the data was done in IBM SPSS version 26. Numerical variables (age and weight) were described using the mean standard deviation (SD) or median (IQR) based on the normality of the data (ShapiroWilch test). The frequency and percentages of categorical variables: gender, clinical presentation (fever, vomiting, seizures), outcome (mortality), socioeconomic status, and area of residence were presented.

Stratification was used to control effect modifiers like age, weight, socioeconomic status and area of residence. The Chi-square test or the Fisher exact test was used to compare post-stratification and a p-value under 0.05 was considered significant. The results were given in tables and graphs to be easily interpreted.

RESULTS

In this study, 109 pediatric patients with a diagnosis of pyogenic meningitis were utilized. The average age of the patients was 3.42 1.25 years with a range of 1-6 years. Out of the 125 out of the 125 were males and 47 out of the 125 were females, although there was a slight male preponderance. Most of the children were of less socioeconomic standing, 70 (64.2%), and those of middle or upper classes, 39 (35.8%). The majority of the patients were living in rural regions (76, 69.7 percent) and only 33 (30.3 percent) patients lived in urban regions.

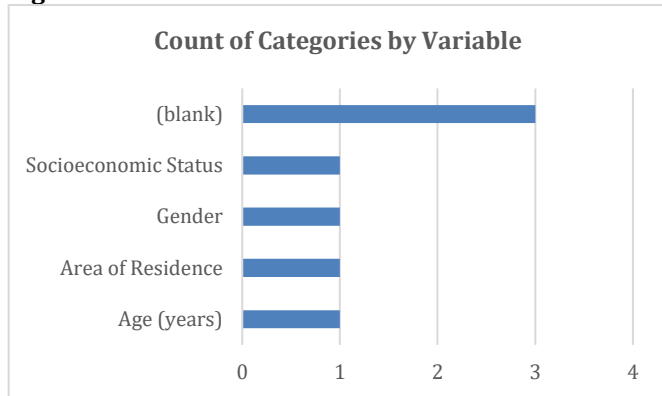
Table 1

Baseline Characteristics of the Study Population (n = 109)

| Variable | Categories | Frequency (n) | Percentage (%) |
|-------------|------------|---------------|----------------|
| Age (years) | Mean ± SD | 3.42 ± 1.25 | — |

| | | | |
|----------------------|--------------------|----|------|
| Gender | Male | 62 | 56.9 |
| | Female | 47 | 43.1 |
| Socioeconomic Status | Lower Class | 70 | 64.2 |
| | Middle/Upper Class | 39 | 35.8 |
| Area of Residence | Rural | 76 | 69.7 |
| | Urban | 33 | 30.3 |

Figure 1



Clinical Presentation

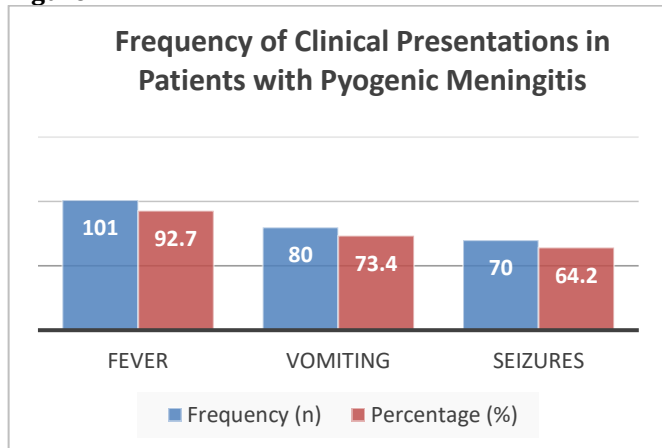
Among the clinical features observed, fever was the most frequent presentation, noted in 101 (92.7%) of the patients. Vomiting was seen in 80 (73.4%), while seizures occurred in 70 (64.2%) of the children.

Table 2

Frequency of Clinical Presentations in Patients with Pyogenic Meningitis

| Clinical Presentation | Frequency (n) | Percentage (%) |
|-----------------------|---------------|----------------|
| Fever | 101 | 92.7 |
| Vomiting | 80 | 73.4 |
| Seizures | 70 | 64.2 |

Figure 2



Outcome

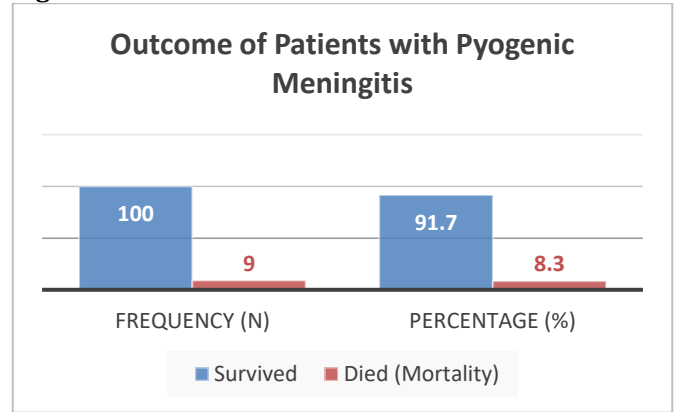
In terms of outcome, 9 (8.3) patients succumbed to death in hospital stay, and 100 (91.7) survived and were discharged after improvement in clinical conditions. Patients with severe clinical presentation, low socioeconomic status and those who reported seizures had higher mortality.

Table 3

Outcome of Patients with Pyogenic Meningitis

| Outcome | Frequency (n) | Percentage (%) |
|------------------|---------------|----------------|
| Survived | 100 | 91.7 |
| Died (Mortality) | 9 | 8.3 |

Figure 3



Association of Clinical Features with Mortality

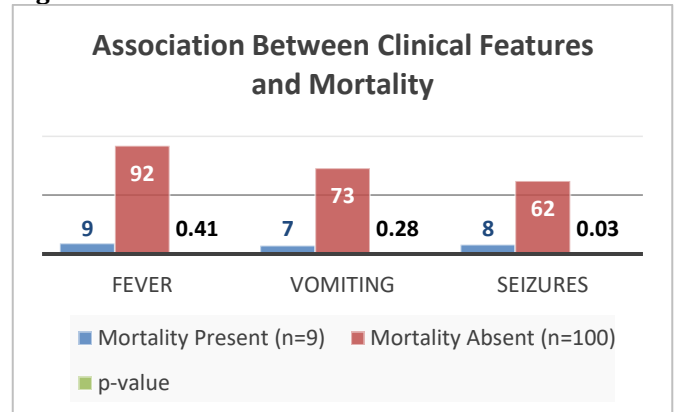
There was a statistically significant correlation between seizures and mortality (p = 0.03), which means that patients who were presenting with seizures were at a greater risk of in-hospital death. Fever or vomiting and mortality did not show a significant relationship.

Table 4

Association Between Clinical Features and Mortality

| Clinical Feature | Mortality Present (n=9) | Mortality Absent (n=100) | p-value |
|------------------|-------------------------|--------------------------|---------|
| Fever | 9 | 92 | 0.41 |
| Vomiting | 7 | 73 | 0.28 |
| Seizures | 8 | 62 | 0.03 |

Figure 4



Summary of Findings

- The **mean age** of affected children was **3.42 years**, with a **male predominance (56.9%)**.
- **Fever (92.7%)** was the most common symptom, followed by **vomiting (73.4%)** and **seizures (64.2%)**.
- The **mortality rate** was **8.3%**, consistent with previous studies reporting mortality between 7–10% in pediatric bacterial meningitis.
- **Seizure at presentation** was significantly associated with poor prognosis and higher mortality.

DISCUSSION

The current research has compared the clinical presentation and prognosis of pediatric patients with pyogenic meningitis who presented to the Department of Pediatrics, Bacha Khan Medical Complex, Swabi. The results showed that the most common symptoms were

fever, vomiting and seizures, where the first was seen in 92.7% of the patients, the second in 73.4% and the third in 64.2. The median mortality was at 8.3, which means that even with the current development of antimicrobial therapy and supportive management, pyogenic meningitis is a serious morbidity and mortality issue among children in the developing world.

The clinical spectrum as seen in this study is closely similar to those seen in other previous reports in the regional and international literature. According to Sial et al. (2021), the most common presenting symptom was fever and the other common symptoms were vomiting and seizures among the Pakistani children with bacterial meningitis, which aligns with the trends in our cohort. In a similar study, Jimma University (2022) in tertiary care Ethiopia reported the same proportions of fever and seizure manifestations, indicating that the clinical manifestations are similar among various groups. These results indicate that the classical triad of fever, vomiting and seizures remain important diagnostic signs in bacterial meningitis in children, even though etiological agents and immunizations vary.

The mortality rate of 8.3% in our study concurred with past studies that have been related to the same environment. Such uniformity in mortality patterns indicates the persistence of the issue of early diagnosis and the necessity to commence empiric antibiotic treatment in time, especially in low-resource environments where the delays in diagnosis occur frequently. Additionally, our research discovered that there is a significant correlation between the presentation of seizures and mortality ($p = 0.03$) which indicates that the presence of neurological involvement at the time of hospitalization is one of the most important prognostic factors. Southern Ethiopia Study (2023) supports this finding by showing that altered consciousness and seizures were largely associated with poor outcomes and increased rate of case fatality in pediatric bacterial meningitis.

The significant rate of cases in children with low socioeconomic status (64.2) and rural population (69.7) highlight the impact of poles on disease burdens. The inability to access healthcare facilities, late presentation at hospitals, and insufficient vaccination coverage are likely to increase the disease rates and poor outcomes of these groups. Exploring Risk Factors in Infants and Toddlers (2024) highlighted the importance of similar social determinants and noted that malnutrition and late presentation were the predictors of complications and mortality among children with pyogenic meningitis.

Even with the enhanced antimicrobial regimens, such as the administration of third-generation cephalosporins, and vancomycin combinations, the outcomes still are not

optimal in most of the developing regions. This is highly explained by the trends of delayed recognition, lack of supportive care, and antimicrobial resistance. Our results reveal that it is high time to enhance surveillance systems, early administration of antibiotics, and preventive measures, including pneumococcal and Haemophilus influenzae type b (Hib) vaccinations, which have shown significant decreases in the incidence of bacterial meningitis in all parts of the world (Sial et al., 2024).

Clinically, this research supports the reasoning behind the need to keep the index of suspicion high when assessing children with fever, vomiting, or seizures, specifically in endemic or low-resource settings. Early lumbar puncture and immediate administration of antibiotic therapy is a pillar to proper management. In addition, the seizures have been discovered to be substantially correlated with mortality, thus early identification and vigilant control of neuromuscular manifestations has the potential of enhancing survival rates.

To conclude, the research contributes to the scant literature on the understanding of pyogenic meningitis in Pakistani children by providing important local data. The findings highlight that although classical symptoms remain the basis of early diagnosis, socio-demographic variables and the presentation severity have a significant impact on outcomes in patients. More multicenter prospective trials that are microbiological confirmed on etiological agents is justified to inform evidence-based treatment regimens and community health initiatives to minimize the mortality and long-term sequelae of pyogenic meningitis in children.

CONCLUSION

As noted in this study, pyogenic meningitis remains a serious health issue in the pediatric population especially in resource-deficient environments. The most common presenting symptoms included fever, vomiting and seizures with significant association of mortality with seizures. The results underscore the need to diagnose and treat cases early to enhance survival and reduce neurological sequelae. The existence of socioeconomic differences and late presentation are the causes of poor outcomes, which implies that the level of public health awareness and the system of early referrals needs improvement. Immunization, quality supply of effective antibiotics and clinical vigilance among health practitioners are important steps that will help to reduce the burden of the disease. The subsequent multicenter research ought to be based on pathogen-specific trends and resistance to antibiotics to inform empirical treatment guidelines in bacterial meningitis in children.

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