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CLINICAL PROFILE, SYSTEMIC COMPLICATIONS, AND OUTCOMES OF PEDIATRIC MENINGITIS IN A TERTIARY CARE PICU: A CASE SERIES

Paediatric Medicine

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ABSTRACT

Background: Pediatric meningitis and meningoencephalitis remain associated with significant morbidity and mortalitydespite advances in antimicrobial therapy and intensive care (Tunkel et al., 2004; World Health Organization [WHO], 2025). Data describing systemic complications, particularly shock phenotypes and metabolic disturbances, are limited.**Methods:** We conducted a retrospective case series of four children with microbiologically confirmed meningitis or meningoencephalitis admitted to a tertiary pediatric intensive care unit (PICU). Clinical features, microbiology, neuroimaging findings, systemic complications, management, and short-term neurological outcomes were analyzed.**Results:** Streptococcus pneumoniae was identified in three patients (75%), while one case was associated with Mycoplasma pneumoniae. Neurological complications included status epilepticus, cerebral infarcts, ventriculitis, and subdural empyema (Christie et al., 2007; Kaplan & Edwards, 2024). All children presented with altered sensorium and required intensive care. Shock was observed in all cases, with septic, cardiogenic, and neurogenic phenotypes. Electrolyte disturbances such as cerebral salt wasting and SIADH were common (Harrigan, 1996; Kim et al., 2002; Singh et al., 2002). Two patients had residual neurological deficits at discharge.**Conclusion:** Pediatric meningitis is a multisystem illness with frequent hemodynamic, neurological, and metabolic complications. Early molecular diagnosis, advanced neuroimaging, and aggressive PICU-based supportive care are critical to optimizing outcomes (1,2).

KEYWORDS

Pneumococcal meningitis, shock, raised intracranial pressure, cerebral salt wasting, PICU

INTRODUCTION

Meningitis and meningoencephalitis in children are neurological emergencies associated with substantial mortality and long-term morbidity. *Streptococcus pneumoniae* remains a leading cause of severe bacterial meningitis and is frequently complicated by septic shock, raised intracranial pressure (ICP), and cerebrovascular involvement. Despite improvements in antimicrobial therapy and vaccination strategies, outcomes remain poor in severe cases requiring intensive care

This case series describes the clinical spectrum, systemic complications, and short-term outcomes of pediatric meningitis managed in a tertiary PICU, with particular emphasis on shock phenotypes and metabolic disturbances.

Methods

This retrospective case series includes four pediatric patients admitted to the PICU with microbiologically confirmed meningitis or meningoencephalitis. Patients discharged against medical advice were excluded. Data were extracted from medical records, including demographics, clinical presentation, laboratory findings, cerebrospinal fluid (CSF) analysis, neuroimaging, treatment, complications, and outcomes.

Case Descriptions

Case 1

An 11-year-old male presented with two weeks of upper respiratory symptoms followed by four days of high-grade fever and progressive drowsiness. Neurological examination revealed a GCS of 13–14, meningeal signs, and pyramidal hypertonia. CSF analysis showed lymphocytic pleocytosis with elevated protein; nasopharyngeal PCR was positive for *Mycoplasma pneumoniae*. The course was complicated by neurogenic and cardiogenic shock, ischemic hepatitis, and right-sided deep vein thrombosis. MRI brain revealed sulcal hyperintensities with acute parieto-temporal infarcts. He received pulse methylprednisolone, IVIG, anticoagulation, and neuroprotective ventilation. Residual shoulder girdle weakness persisted at discharge.

Case 2

A 4-year-10-month-old girl presented with high-grade fever and refractory status epilepticus. She was obtunded (GCS 8/15) with marked neck stiffness. Laboratory markers were markedly elevated (CRP 264.2 mg/L, procalcitonin >100 ng/mL). Blood and CSF cultures grew *Streptococcus pneumoniae*. Her hospital course was complicated by septic shock and cerebral salt wasting, requiring hypertonic saline. She improved with antimeningitic doses of meropenem and vancomycin and recovered fully without neurological sequelae.

Case 3

A 12-year-old male presented with headache and fever following otalgia and facial trauma. He arrived in compensated septic shock with meningeal signs. Imaging demonstrated pansinusitis and mastoiditis as the infective source. CSF Biofire confirmed *Streptococcus pneumoniae*. He responded well to intravenous ceftriaxone and vancomycin and was discharged without residual deficits.

Case 4

A 2-year-11-month-old male with a history suggestive of prior CSF leak presented with fever, seizures, and altered sensorium. He was in profound shock with anisocoria, third nerve palsy, and hemiparesis. CSF PCR was positive for *Streptococcus pneumoniae*. MRI revealed ventriculitis and evolving subdural empyema. His course was complicated by cardiogenic shock, disseminated intravascular coagulation, and SIADH. Following prolonged intensive care and antibiotic therapy, sensorium normalized, but third nerve palsy persisted.

RESULTS

Table 1. Demographic and Microbiological Profile

Parameter	Case 1	Case 2	Case 3	Case 4
Age / Sex	11 y / M	4 y 10 m / F	12 y / M	2 y 11 m / M
Pathogen	M. pneumoniae	S. pneumoniae	S. pneumoniae	S. pneumoniae
Diagnostic Modality	NP PCR	CSF + Blood culture	CSF Biofire	CSF PCR

Table 2. Systemic and Neurological Complications

Parameter	Case 1	Case 2	Case 3	Case 4
Shock Type	Neurogenic / Cardiogenic	Septic	Septic (compensated)	Cardiogenic / Septic
Seizures	EEG abnormalities	Status epilepticus	No	Yes
Raised ICP	Yes	Yes	No	Yes
Electrolyte Disorder	Hypernatremia	Cerebral salt wasting	None	SIADH
Vascular Complications	DVT, infarct	None	None	DIC

Table 3. Neuroimaging Findings and Outcomes

Case	MRI Findings	PICU Interventions	Outcome
1	Acute infarcts	Ventilation, steroids, IVIG	Residual weakness
2	Leptomeningeal enhancement	Ventilation, hypertonic saline	Complete recovery
3	Mastoiditis, meningitis	Antibiotics	Complete recovery
4	Ventriculitis, empyema	Prolonged ventilation, inotropes	Persistent CN III palsy

Table 4. Case-wise Clinical Summary

Parameter	Case 1	Case 2	Case 3	Case 4
Pathogen	M. pneumoniae	S. pneumoniae	S. pneumoniae	S. pneumoniae
Shock Type	Neurogenic/Cardio	Septic	Septic (Compensated)	Cardiogenic/ Septic
Key Neurological Event	Acute Infarct	Status Epilepticus	Meningeal signs	Subdural Empyema
Electrolyte Issue	Hypernatremia (AKI)	Cerebral Salt Wasting	Normal	CSW / SIADH
Source of Infection	URI Symptoms	Fever/Sepsis	Mastoiditis/ Sinusitis	Prior CSF Leak
Residual Deficit	Weakness (Shoulder)	None	None	3rd Nerve Palsy

Results

All patients required PICU admission for altered sensorium and shock. Septic shock predominated, although cardiogenic and neurogenic components were also observed. Neurological complications included seizures, cerebral infarction, ventriculitis, and cranial nerve palsy. Electrolyte disturbances were frequent and required targeted management. Two patients had residual neurological deficits at discharge.

DISCUSSION

This series highlights pediatric meningitis as a systemic inflammatory illness rather than an isolated CNS infection (Tunkel et al., 2004; WHO, 2025). Shock was universal, with heterogeneous phenotypes necessitating individualized hemodynamic management. Neurological complications were common and closely associated with adverse outcomes (Christie et al., 2007; Kaplan & Edwards, 2024; Thigpen et al., 2011). Metabolic disturbances such as cerebral salt wasting and SIADH posed additional management challenges (Harrigan, 1996; Kim et al., 2002; Palmer, 2003; Singh et al., 2002).

Early molecular diagnostics facilitated rapid pathogen identification, particularly in culture-negative cases, while MRI was superior to CT in detecting parenchymal and vascular complications (Kralik et al., 2022; Mohan et al., 2012).

CONCLUSION

Severe pediatric meningitis is characterized by multisystem involvement and a high critical care burden. Early diagnosis, advanced neuroimaging, and aggressive multidisciplinary PICU management are essential to improving survival and neurological outcomes (Tunkel et al., 2004; WHO, 2025). Long-term follow-up remains crucial given the risk of persistent neurological sequelae.

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