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ORIGINAL ARTICLE

Evaluation of Pediatric Patients Admitted to the Pediatric Intensive Care Unit with Suspected Central Nervous System Infections

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What is already known on this topic?

- *Pediatric central nervous system infections are potentially life-threatening conditions, and early diagnosis is critical for their management.*
- *Although the incidence of acute bacterial meningitis has decreased with the spread of vaccination, it remains a major concern, especially in developing countries.*
- *Meningitis typically presents with fever, headache, and stiff neck, while encephalitis is more associated with altered mental status and neurological symptoms such as seizures.*

What this study adds on this topic?

- *Ventriculoperitoneal shunt infections contribute significantly to CNS infections in pediatric intensive care units, particularly among patients with predisposing conditions, and are associated with a high mortality rate.*
- *The study demonstrated that the initial Pediatric Glasgow Coma Score was better than the Pediatric Risk of Mortality III score in predicting mortality in children with suspected central nervous system infection.*

Abstract

Objective: Central nervous system (CNS) infections, including meningitis and encephalitis, are rare but critical causes of morbidity and mortality, where rapid diagnosis is essential. This study aimed to investigate the clinical and epidemiological characteristics of patients admitted to the pediatric intensive care unit (PICU) with suspected CNS infections.

Methods: This retrospective study included all children aged 1 month to 18 years who were admitted to the PICU at Bağcılar Training and Research Hospital with suspected CNS infections between July 2020 and July 2024.

Results: A total of 95 patients with suspected CNS infections were included in the study, of whom 61.1% were male. Chronic comorbidities were present in 58% of the patients, with neurological disorders being the most common. CNS infections were confirmed in 37.9% (36/95) of the cases. Among those with confirmed CNS infections, ventriculoperitoneal shunt (VPS) infections accounted for 47.2%, bacterial meningitis for 41.7%, herpes simplex virus (HSV) encephalitis for 5.6%, and other viral encephalitis for 5.6%. The overall mortality rate was 23.2% (22/95). Furthermore, the initial Pediatric Glasgow Coma Score (pGCS) demonstrated a strong predictive value for mortality in the ROC analysis (AUC: 0.828, $P < .001$), showing better predictive ability than the Pediatric Risk of Mortality III score.

Conclusions: CNS infections remain a significant cause of mortality in children. VPS infections, particularly in patients with predisposing neurological conditions, have emerged as a notable etiology of CNS infections in PICUs. Additionally, it is proposed that the initial pGCS score serves as a reliable predictor of mortality in patients with suspected CNS infections.

Keywords: Cerebrospinal fluid, Glasgow Coma Scale, mortality, prognosis, ventriculoperitoneal shunt

Introduction

Central nervous system (CNS) infections, including meningitis and encephalitis, are rare but critical causes of morbidity and mortality where rapid diagnosis is crucial.[1] While the incidence of childhood CNS infections is well-documented in developed countries, determining their true prevalence in developing nations remains challenging due to limited medical resources and surveillance variations. Reported incidence rates range from approximately 11 cases per 100 000 in developed countries to 726 cases per 100 000 in developing nations.[2]

Patients with CNS infections may present with non-specific symptoms such as fever, headache, altered mental status, status epilepticus, and behavioral changes. These symptoms necessitate a systematic evaluation to distinguish CNS infections from other critical illnesses, such as metabolic encephalopathies or autoimmune encephalitis.[3] Given the potential for rapid progression and neurological complications, prompt recognition and intervention are essential. The diagnosis of CNS

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infections relies on cerebrospinal fluid (CSF) analysis and imaging. However, early-stage infections may yield inconclusive results, posing challenges in timely diagnosis.[4]

Differentiating CNS infections from other conditions that mimic them, such as metabolic encephalopathies, febrile seizures, or autoimmune encephalitis, is essential for guiding appropriate treatment strategies. This distinction is particularly crucial in the intensive care unit, where children admitted with CNS infections often exhibit overlapping clinical presentations with other critical illnesses. Such scenarios require heightened clinical awareness and a systematic diagnostic approach.[5,6] Given the potential for rapid progression, permanent neurological damage, and serious complications, clinicians must make prompt decisions and initiate treatment without delay.[7]

The diagnosis of CNS infections relies on microbiological analysis and biochemical testing of CSF. Modern imaging techniques also aid in identifying infections and assessing treatment efficacy.[8,9] However, these diagnostic tools may yield inconclusive results during the early stages of infection, presenting a significant challenge in timely diagnosis.[4]

This study aimed to investigate the clinical and epidemiological characteristics of critically ill pediatric patients admitted to the pediatric intensive care unit (PICU) with suspected CNS infections and to evaluate predictors of mortality in this population.

Methods

This retrospective study included pediatric patients admitted to the PICU at Bağcılar Training and Research Hospital, with suspected CNS infections between July 2020 and July 2024. Ethical approval for the study was obtained from the institutional ethics committee (Approval no: 2024/12/13/099, Date: December 3, 2024). Informed consent was obtained from the parents of the patients before hospitalization in the pediatric intensive care unit and for all interventional procedures.

According to the 2024 guideline by the National Institute for Health and Care Excellence (NICE), titled "Meningitis (bacterial) and meningococcal disease: recognition, diagnosis, and management," fever, headache, neck stiffness, and altered level of consciousness were defined as red-flag symptoms for CNS infections.[9] Critically ill pediatric patients aged 1 month to 18 years presenting with these symptoms, either at the time of hospital admission or prior to presentation, were identified as having suspected CNS infections and included in the study. Repeated admissions for the same patient due to different causes were excluded.

The following data were retrospectively collected for included patients: demographic information (age and gender), initial physical examination findings (fever, headache, vomiting, hypothermia, and altered level of consciousness or cognition), acute diagnoses upon PICU admission, comorbid chronic conditions, CSF findings (glucose, protein, lactate dehydrogenase, and cell count), CSF culture results, PICU length of stay, initial pediatric Glasgow Coma Scale (pGCS) score,[10] Pediatric Risk of Mortality III (PRISM-III) score,[11] and mortality status.

The definitive diagnosis of meningitis was established based on the criteria outlined in the NICE 2024 guideline "Meningitis (bacterial) and meningococcal disease: recognition, diagnosis, and management."[9] Ventriculoperitoneal shunt (VPS) infections were defined as positive cultures obtained from wound swabs, ventricular catheter lumens, or reservoirs.[12] Cases of encephalitis, presumed to have an infectious or autoimmune etiology, were diagnosed using the criteria set forth by the International Encephalitis Consortium (IEC).[13]

The primary outcome of this study was to determine the frequency of CNS infections among critically ill pediatric patients presenting with suspected CNS infection symptoms. The secondary outcome was to investigate factors associated with mortality in this patient population.

Statistical Analysis

Continuous variables were assessed for normality using the Kolmogorov-Smirnov test. Normally distributed data are presented as mean ± standard deviation and compared using the independent samples t-test. Non-normally distributed data are expressed as median (interquartile range, IQR) and compared using the Mann-Whitney U test. Categorical variables are presented as frequencies and percentages and analyzed using the chi-square or Fisher's exact test, as appropriate.

Logistic regression analysis was conducted to identify independent predictors of mortality. Receiver operating characteristic (ROC) curve analysis was used to evaluate the predictive performance of the pGCS and PRISM-III scores for mortality, with results reported as the area under the curve (AUC). All statistical analyses were performed using the Statistical Package for Social Sciences version 30.0 software (IBM Corp.; Armonk, NY, USA). A *P*-value of <.05 was considered statistically significant.

Results

A total of 95 patients with suspected CNS infections were included in the study, of whom 61.1% (58/95) were male. Chronic comorbidities were present in 58% (55/95) of the patients, with neurological disorders being the most common (49/95). The most frequently observed findings during emergency department evaluations were altered levels of consciousness or cognition in 78.9% (75/95), fever in 57.9% (55/95), and seizures in 51.6% (49/95). CNS infections were confirmed in 37.9% (36/95) of the patients. Among those with confirmed CNS infections, VPS infections accounted for 47.2% (17/36), bacterial meningitis for 41.7% (15/36), herpes simplex virus (HSV) encephalitis for 5.6% (2/36), and other viral encephalitis for 5.6% (2/36). The most common diagnoses among patients without CNS infections were febrile status epilepticus (15.8%, 15/95), septic shock (11.6%, 11/95), and epilepsy (7.4%, 7/95).

Cerebrospinal fluid cultures were performed for all patients, and microbial growth was detected in 30.5% (29/95) of samples. The most commonly identified microorganisms were *Staphylococcus epidermidis* (5.3%, 5/95), *Acinetobacter baumannii* (3.3%, 3/95), and *Neisseria meningitidis* (3.3%, 3/95). Upon subgroup analysis, *Staphylococcus epidermidis* (5.3%, 5/95), *Acinetobacter baumannii* (3.3%, 3/95), and *Klebsiella pneumoniae* (2.1%, 2/95) were most frequently identified in the VPS infection group. In the bacterial meningitis group, the most common microorganisms were *Neisseria meningitidis* (3.3%, 3/95), *Streptococcus pneumoniae* (2.1%, 2/95), and *Haemophilus influenzae* (1.1%, 1/95). A summary of the patients' general characteristics is presented in Table 1.

The overall mortality rate in the study was 23.2% (22/95). Comparisons between the survivor and nonsurvivor groups revealed no significant differences in age ($P = .805$) or sex distribution ($P = .075$), although 77.3% (17/22) of the nonsurvivors were female. Among chronic comorbidities, hydrocephalus ($P = .02$) and cranial tumors ($P = .006$) were significantly higher in the nonsurvivor group (hydrocephalus: 35.6% (26/73) vs. 63.6% (14/22); cranial tumors: 4.1% (3/73) vs. 22.7% (5/22)) (Table 2).

The median PICU length of stay was significantly longer in the nonsurvivor group compared to the survivor group (16 days [IQR: 8–125] vs. 6 days [IQR: 4–18], $P = .02$). Additionally, PRISM-III

Table 1. Distribution of General Characteristics of All Patients

Characteristics	Percentage (n/total)
Gender	
Female	38.9 (37/95)
Male	61.1 (58/95)
Comorbid chronic conditions	
Neurological disorders	51.6 (49/95)
Hydrocephalus	42.1 (40/95)
Epilepsy	16.8 (16/95)
Neural tube defect	15.8 (15/95)
Cranial tumor	8.4 (8/95)
Cerebral palsy	5.3 (5/95)
Metabolic disorders	3.2 (3/95)
Cardiac disorders	3.2 (3/95)
Presenting symptoms and signs	
Altered mental status	78.9 (75/95)
Fever	57.9 (55/95)
Seizure	51.6 (49/95)
Vomiting	37.9 (36/95)
Hypothermia	8.4 (8/95)
Headache	5.3 (5/95)
Diagnosis	
CNS infections	37.9 (36/95)
VPS infection	17.9 (17/95)
Bacterial meningitis	15.8 (15/95)
Herpes simplex virus encephalitis	2.1 (2/95)
Viral encephalitis	2.1 (2/95)
Other diagnosis	62.1 (59/95)
Febrile status epilepticus	15.8 (15/95)
Septic shock	11.6 (11/95)
Epilepsy	7.4 (7/95)
Metabolic disorder	7.4 (7/95)
VPS dysfunction	6.3 (6/95)
Intracranial neoplasm	4.2 (4/95)
Transverse myelitis	2.1 (2/95)
Autoimmune disorder	2.1 (2/95)
Unspecified encephalitis	2.1 (2/95)
Acute disseminated encephalomyelitis	1.1 (1/95)
Aneurysm rupture	1.1 (1/95)
Pseudotumor cerebri	1.1 (1/95)
CSF culture	
No growth	69.5 (66/95)
Staphylococcus epidermidis	5.3 (5/95)
Acinetobacter baumannii	3.3 (3/95)
Neisseria meningitidis	3.3 (3/95)
Klebsiella pneumoniae	2.1 (2/95)
Pseudomonas aeruginosa	2.1 (2/95)
Escherichia coli	2.1 (2/95)
Staphylococcus aureus	2.1 (2/95)
Staphylococcus haemolyticus	2.1 (2/95)
Staphylococcus hominis	2.1 (2/95)
Streptococcus pneumoniae	2.1 (2/95)
Achromobacter	1.1 (1/95)
Enterococcus faecalis	1.1 (1/95)
Haemophilus influenzae	1.1 (1/95)
Stenotrophomonas maltophilia	1.1 (1/95)
Mortality	23.2 (22/95)

CSF, cerebrospinal fluid; VPS, ventriculoperitoneal shunt.

scores were significantly higher in nonsurvivors compared to survivors (19 vs. 6, $P < .001$). Initial GCS scores were significantly lower in the nonsurvivor group (8 vs. 12, $P < .001$).

Comparisons of CSF findings between groups revealed no significant differences in leukocyte count ($P = .966$), erythrocyte count ($P = .819$), or neutrophil percentage ($P = .948$). However, LDH levels in CSF were significantly higher in the nonsurvivor group compared to survivors (83 vs. 31.5, $P = .035$), while there were no differences in protein or glucose levels.

Regression analysis identified cranial tumors ($P = .049$) and altered level of consciousness or cognition at admission ($P = .049$) as factors significantly associated with increased mortality risk (Table 3).

Receiver operator characteristics analysis was performed to evaluate the predictive ability of GCS and PRISM-III scores for mortality in patients with suspected CNS infections. The analysis demonstrated that GCS had an AUC of 0.828 ($P < .001$), and PRISM-III had an AUC of 0.771 ($P < .001$), both indicating good predictive performance for mortality (Figure 1).

Discussion

In this study, the general characteristics of critically ill pediatric patients with suspected CNS infection symptoms and the frequency of confirmed CNS infections were evaluated. Additionally, the impact of initial findings on mortality was investigated. One noteworthy finding of the study is that 17.9% of the patients were diagnosed with VPS infections, 15.8% with bacterial meningitis, and 4.2% with viral encephalitis. Another significant result was that an altered level of consciousness and the presence of cranial

Table 2. Comparison of Survivor and Non-survivor Groups

Characteristics	Survivor (n = 73)	Non-survivor (n = 22)	*P*
Gender			.075*
Female	56.2% (41/73)	77.3% (17/22)	
Male	43.8% (32/73)	22.7% (5/22)	
Age (months)	20.0 (12.0-88.0)	25.5 (9.0-103.0)	.805†
PICU length of stay (days)	6 (4-18)	16 (8-25)	**.020**†
PRISM-III score	6 (2-12)	19 (9-25)	**<.001**†
pGCS score	12 (10-12)	8 (4-10)	**<.001**†
Comorbid chronic conditions			
Neurological disorders	46.6% (34/73)	68.2% (15/22)	.075*
Hydrocephalus	35.6% (26/73)	63.6% (14/22)	**.020***
Epilepsy	15.1% (11/73)	22.7% (5/22)	.400*
Neural tube defect	17.8% (13/73)	9.1% (2/22)	.326*
Cranial tumor	4.1% (3/73)	22.7% (5/22)	.006*
Cerebral palsy	5.5% (4/73)	4.5% (1/22)	.863*
Metabolic disorders	4.1% (3/73)	0.0% (0/22)	.334*
Cardiac disorders	2.7% (2/73)	4.5% (1/22)	.671*
Presenting symptoms and signs			
Altered mental status	26.0% (54/73)	4.5% (21/22)	**.030***
Fever	46.6% (39/73)	27.3% (16/22)	.108*
Seizure	52.1% (38/73)	50.0% (11/22)	.866*
Vomiting	37.0% (27/73)	40.9% (9/22)	.740*
Hypothermia	11.0% (8/73)	0.0% (0/22)	.105*
Headache	5.5% (4/73)	4.5% (1/22)	.863*
Diagnosis			
CNS infections			
Meningitis	17.8% (13/73)	9.1% (2/22)	.336*
VPS infection	15.0% (11/73)	27.3% (6/22)	
Viral encephalitis	2.7% (2/73)	0.0% (0/22)	
Herpes simplex virus encephalitis	1.4% (1/73)	4.5% (1/22)	
Other diagnosis			
Febrile status epilepticus	20.5% (15/73)	0.0% (0/22)	.055*
Epilepsy	9.6% (7/73)	0.0% (0/22)	
Septic shock	8.2% (6/73)	22.7% (5/22)	
VPS dysfunction	5.5% (4/73)	9.1% (2/22)	
Metabolic disorder	5.5% (4/73)	13.6% (3/22)	
Intracranial neoplasm	2.7% (2/73)	9.1% (2/22)	
Transverse myelitis	2.7% (2/73)	0.0% (0/22)	
Unspecified encephalitis	2.7% (2/73)	0.0% (0/22)	
Acute disseminated encephalomyelitis	1.4% (1/73)	0.0% (0/22)	
Autoimmune disorder	1.4% (1/73)	0.0% (0/22)	
Pseudotumor cerebri	1.4% (1/73)	0.0% (0/22)	
Aneurysm rupture	0.0% (0/73)	4.5% (1/22)	

*Pearson chi-square and †Mann-Whitney U test.
CNS, central nervous system; pGCS, Pediatric Glasgow Coma Scale; PICU, pediatric intensive care unit; PRISM-III, Pediatric Risk of Mortality III; VPS, ventriculoperitoneal shunt.

tumors were identified as contributors to mortality in critically ill pediatric patients with suspected CNS infections. Moreover, the pGCS score emerged as a superior predictor of mortality compared to the PRISM-III score in these patients.

The male predominance observed in the study population (61.1%) aligns with the findings of previous studies.[7,14] Ulusoy et al. reported that 57.6% of patients with suspected CNS infections were male.[15] In the cohort, 58% of the patients had chronic comorbidities, predominantly neurological disorders such as hydrocephalus and cranial tumors. The most frequent diagnosis in the study group was VPS infection, which is expected given that hydrocephalus was the most common underlying condition. Additionally, in patients with acute infection symptoms and pre-existing neurological disorders, the manifestation of neurological findings during this period may have heightened suspicion for CNS infections.

Clinical manifestations of CNS infections vary depending on age, the time interval between symptom onset and hospital presentation, prior antibiotic use, the causative microorganism, and coexisting chronic conditions. While symptoms are often nonspecific, those involving neurological findings, in particular, raise a high degree of clinical suspicion for CNS infections. The most commonly reported symptoms include fever, headache, nausea, and altered level of consciousness or cognition.[9,13,14,16] In the study, altered level of consciousness or cognition was the most frequently presenting symptom (78.9%) and was identified as a factor contributing to increased mortality risk. Fever and seizures were observed in 57.9% and 51.6% of the patients, respectively, as other significant presenting findings. In a study by Ulusoy et al., neurological symptoms were the most common presenting findings in pediatric patients with suspected CNS infections, with seizures being the most frequent among them.[15] Similarly, Nepesov et al. found that fever, fatigue, decreased appetite, and altered consciousness were the most common complaints among pediatric patients with suspected CNS infections.[7] In a study by Duyu et al. on critically ill pediatric patients with encephalopathy, the most frequent symptoms accompanying altered consciousness were seizures, vomiting, and fever.[17] The variability in the reported frequency of acute altered consciousness, fever, and seizures across the literature likely reflects differences in the age distribution and underlying etiologies of the study populations. While these symptoms are consistently prominent in CNS infections, their relative prevalence appears to be influenced by patient-specific factors.

The placement of CSF shunts is a common neurosurgical intervention for managing congenital or acquired hydrocephalus.[18] The primary goal of shunt placement is to divert CSF from the central nervous system to another part of the body, such as the peritoneal cavity, thereby relieving pressure and preventing further neurological damage.[19] Shunt infections are among the significant complications in pediatric practice and can lead to severe conditions such as meningitis, ventriculitis, and acute hydrocephalus. When infection is suspected, the diagnostic process involves identifying infection risk factors and thoroughly reviewing the history of the implanted device. Management typically includes surgical removal of the infected device, appropriate microbiological treatment, and, if necessary, reimplantation of the device.[16]

In this study, VPS infection was the most frequently encountered diagnosis, observed in 17.9% of patients, with 35.3% (6/17) of these cases resulting in mortality. Ventriculoperitoneal shunt infections are the most common among shunt-related complications and are associated with high mortality.[18] In a study by Vinchon

Table 3. Regression Analysis for Factors Predicting Mortality

Variable	B	SE	Wald	Sig.	Exp(B)	95% CI for Exp(B)	
						Lower	Upper
Presence of hydrocephalus	1.147	0.619	3.426	0.064	3.147	0.935	10.598
Cranial tumor	2.789	1.417	3.877	**0.049***	**16.271**	1.013	261.386
Altered mental status	3.672	1.545	5.653	**0.017***	**39.347**	1.906	812.289

Variables with a significance level of $P < .05$ are marked with an asterisk (*). Exp(B) represents the odds ratio, and the 95% confidence interval (CI) for Exp(B) is provided.

et al, among 1163 patients who underwent VPS placement, infections were reported in 158 patients, with a mortality rate of 10.1% in those with infections.[20] Similarly, Turgut et al reported an 8.6% mortality rate among pediatric patients with shunt infections.[21] The relatively high frequency of VPS infections in the cohort may be attributed to the status of the hospital as a referral center for pediatric neurosurgery. Furthermore, although a higher mortality rate than reported in the literature was found, it should be noted that many prior studies excluded patients with intracranial tumors, while no such exclusion was made in the study. The oncological conditions themselves could have contributed to the elevated mortality rate in the cohort. Additionally, the inclusion of critically ill pediatric patients in the study likely contributed to the higher observed mortality rate.

In the study by Duyu et al. on critically ill pediatric patients presenting with encephalopathy, 31.4% were diagnosed with CNS infections, approximately half of which were viral encephalitis, while one-quarter were acute bacterial meningitis. Additionally, the mortality rate for acute bacterial meningitis in the same study was reported as 15.4%.[17] Similarly, in a study by Page et al. conducted in Uganda, 10.2% of pediatric patients with suspected CNS infections were diagnosed with bacterial meningitis, with 1 in 4 of these patients succumbing to the infection.[14] In this cohort, 15.8% of the patients were diagnosed with bacterial meningitis, and the mortality rate was 13.3% (2/15), aligning with findings from the broader literature. Variations in bacterial meningitis diagnosis rates across different geographic regions can be attributed to differences in socioeconomic development, access to healthcare services, and preventive measures against infections.

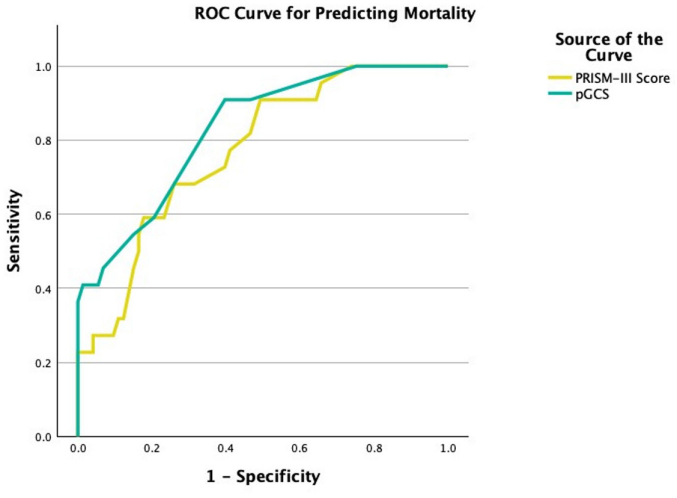

Figure 1. ROC curve analysis for predicting mortality. The PRISM-III score demonstrated an AUC of 0.771 ($P < .001$) for predicting mortality. The pGCS score, which was inversely coded to align with the direction of PRISM-III, showed superior performance with an AUC of 0.828 ($P < .001$).

The incidence of encephalitis in the general population is estimated at 3.5-10 cases per 100 000 individuals annually, with HSV identified as the most common causative agent.[22] Although the overall mortality rate for encephalitis has been reported as 8-10%, HSV encephalitis carries a higher risk, with studies from developed countries reporting mortality rates between 50 and 70%.[23-25] In a study by Fouad et al, 28% of pediatric patients presenting to the emergency department with non-traumatic coma (pGCS <12) were diagnosed with CNS infections, nearly half of which were viral encephalitis, and 53.3% of these patients died.[26]

In the study, 4.2% (4/95) of patients were diagnosed with viral encephalitis, and half of these (2/95) were HSV encephalitis. One of the patients with HSV encephalitis was referred to the unit in a comatose state (GCS <8) 48 hours after experiencing febrile status epilepticus and unfortunately succumbed on the fifth day of admission.

Consistent with the literature, *Staphylococcus epidermidis* as the most common causative agent in VPS infections was identified, highlighting that colonization from the skin is often the primary source of infection.[18,20,27] Among patients diagnosed with meningitis, the most frequently isolated microorganisms were *Neisseria meningitidis*, *Streptococcus pneumoniae*, and *Haemophilus influenzae*, which is also consistent with previous studies.[17,28] The relatively low rate of culture positivity in the study suggests that many patients may have received antibiotics prior to definitive diagnosis, potentially reducing the yield of microbiological cultures.

The PRISM-III score, widely used for mortality prediction in pediatric intensive care units, demonstrated good performance in the study (AUC: 0.771). However, the initial pGCS score showed superior predictive performance (AUC: 0.828) for mortality in the group with suspected CNS infections. Numerous studies in the literature have examined the association between initial pGCS scores and mortality, consistently reporting that lower pGCS levels are correlated with higher mortality in critically ill pediatric populations.[26,29,30]

In a study by Dubot-Pérès et al, which included patients of all age groups with CNS infections, a reduced GCS score was identified as a predictor of mortality.[31] Similarly, in the study by Duyu et al., a pGCS score below 6 in critically ill pediatric patients with encephalopathy was significantly associated with mortality (odds ratio: 20.27, 95% CI: 3.91–105.05; $P < .001$).[17] The association of lower initial pGCS scores with poor outcomes in critically ill pediatric patients with suspected CNS infections underscores the need for rapid diagnosis and timely initiation of appropriate treatments in this patient group.

The study has several limitations, the most significant being its retrospective design and single-center nature. Additionally, the limited sample size did not allow for a comparative analysis of CNS infection subcategories. Due to these constraints, other factors potentially influencing mortality could not be evaluated. For example, the timing of antibiotic initiation has been identified in the literature as a critical determinant of mortality, but this information was not available in the study and could not be assessed.[32] To better elucidate the epidemiology of CNS infections and the factors affecting mortality in PICUs, prospective, multicenter studies are warranted.

Conclusion

Central nervous system infections remain a significant cause of pediatric mortality. Ventriculoperitoneal shunt infections, particularly in patients with underlying neurological conditions, are a notable etiology of CNS infections in PICUs. Additionally, the initial pGCS score serves as a strong predictor of mortality, surpassing PRISM-III in predictive performance. These findings provide valuable insights for clinicians managing critically ill pediatric patients with suspected CNS infections.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author

Ethics Committee Approval: The study was approved by the Non-Interventional Clinical Research Ethics Committee of Health Sciences University, Bağcılar Training and Research Hospital (Approval no: 2024/12/13/099, Date: December 3, 2024).

Informed Consent: Informed consent was obtained from the parents of the patients before hospitalization in the pediatric intensive care unit and for all interventional procedures.

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