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Pattern and Outcome of Traumatic Epidural Hemorrhage in Pediatric Population in Emergency Hospital Mansoura University

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ABSTRACT

Background: Epidural hematomas (EDH) constitute approximately 2–3% of pediatric head injuries and are identified in 1–6% of children admitted with traumatic brain injury (TBI). They represent a critical neurosurgical emergency that requires prompt recognition and timely management.

Aim: To delineate the clinical pattern and short-term outcome of traumatic epidural hemorrhage in pediatric cases, with an emphasis on informing and improving management approaches.

Patients and Methods: In this prospective observational study, patients under 18 years presenting with head trauma were enrolled. Clinical outcomes were assessed by hospital mortality, duration of hospitalization, length of ICU admission, and occurrence of in-hospital complications. Functional recovery at discharge was measured using the Glasgow Outcome Scale (GOS) and the extended Glasgow Outcome Scale (GOSE).

Results: The mean age of the cases was 8.75 ± 4.83 years. The median duration of hospitalization and ICU admission was 9 and 6 days, respectively. Skull fractures were present in 90.5% of cases, and scalp injuries in 93.7%. Age, clinical presentation, and the duration of both hospital and ICU admission were identified through statistical analysis as significant predictors of disability ($P < 0.05$).

Conclusion: Pediatric EDH is among the most common neurosurgical emergencies and, with appropriate management, can achieve favorable outcomes. Prognosis is influenced by several factors, including age, clinical presentation, mechanism of injury, associated intracranial lesions, hospital and ICU stay, GOS on admission, GOSE at discharge, presence of skull fracture, and the location of the hematoma.

Keywords: Epidural Hematomas, Head Injury in Children.

INTRODUCTION

Head injury is a significant contributor to mortality and disability in the young population and continues to represent a pressing public health problem with substantial implications for healthcare services [1].

Traumatic head injury refers to an externally induced acquired injury of the head that produces functional disability, either partial or complete, or psychosocial impairment, and is typically associated with an altered state of consciousness. Classification includes scalp injury, cerebral contusion, skull fracture, intracranial or subarachnoid hemorrhage, concussion, epidural hematoma (EDH), intraventricular hemorrhage, subdural hematoma, and diffuse axonal injury [2].

Among children over one year of age, head injury represents a principal cause of death and long-term disability and accounts for a substantial proportion of emergency department presentations and inpatient admissions [3]. Within the USA, around 75% of injured children admitted to hospitals sustain head injuries, and these injuries account for approximately 70% of all pediatric injury-related deaths [4]. WHO data indicate that 98% of childhood injury-related mortality occurs in low-income countries, where the risk of death is close to five times that recorded in industrialized nations [5]. The susceptibility of children in developing countries to injury is heightened by poor living conditions, escalating traffic exposure, lack of safe play environments, and deficient childcare infrastructure [6]. Gathering comprehensive evidence on pediatric head injuries is fundamental to designing appropriate management protocols and prioritizing interventions that address local needs, a focus highlighted by the WHO as a major research priority [7].

Epidemiological characterization of pediatric traumatic head injuries remains challenging because of definitional and classification discrepancies. Mild traumatic brain injury (TBI) often goes unreported if hospital care is not sought or emergency department discharge is undocumented, while severe injuries may culminate in death before hospital arrival. Moreover, variability in admission criteria and data collection techniques leads to further heterogeneity in reported findings [8]. In the Egyptian context, epidemiological data and up-to-date statistical records on pediatric traumatic head injuries remain insufficient and are challenging to obtain from routine health data collection systems [9].

Accordingly, this investigation aims to evaluate the pattern and short-term outcome of traumatic epidural hemorrhage in children, aiming to optimize the care of pediatric trauma cases at Emergency Hospital, Mansoura University.

PATIENTS AND METHODS

A prospective observational clinical investigation was conducted at Mansoura University Emergency Hospital, enrolling trauma cases admitted between January 2022 and January 2023.

The study enrolled cases younger than 18 years with head trauma, whether isolated or associated with

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polytrauma, from both sexes. Exclusion criteria included age above 18 years, incomplete presentation data (HR, respiratory rate, GCS, SBP), records inconsistent with signs of life (SBP <60 mmHg or HR <30 beats/min), and presentation more than 24 hours after trauma.

Methods

In the primary survey, resuscitation was undertaken using the ABCDE protocol, comprising airway protection with cervical spine immobilization, assessment of breathing, evaluation of circulation and bleeding control, determination of disability by neurological examination and GCS, and exposure to ensure environmental control.

The secondary survey consisted of full history taking, which addressed demographic data (age and gender), mechanism and timing of injury, time of arrival and resuscitation, and AMPLE history (Allergies, Medications, Past illnesses, Last meal, and Events/Environment). Clinical examination included measurement of vital signs (BP, HR, respiratory rate), local examination for skull fracture signs and scalp injuries, neurological examination with GCS and lateralizing signs, and systematic general examination to identify associated or occult injuries. Radiological investigations comprised FAST, plain radiographs of the chest, pelvis, lumbosacral and cervical spine, and multi-slice CT brain. Laboratory investigations included CBC, blood grouping and cross-matching, coagulation profile, and liver and kidney function tests.

Outcome Assessment

Outcomes of clinical management were determined by hospital mortality, duration of hospital admission, ICU length of stay, and complications encountered during hospitalization. Functional recovery at discharge was assessed through the Glasgow Outcome Scale (GOS) and the extended Glasgow Outcome Scale (GOSE) [10].

Ethical Consideration

Approval was secured from the IRB of the Faculty of Medicine, Mansoura University. The study aims were clearly communicated to relatives of participating cases through group sessions and one-to-one meetings, with the investigator present throughout. Written informed consent was obtained, and confidentiality was strictly protected. Relatives were informed that participation was voluntary, withdrawal would not influence the quality of care, and data would be used exclusively for research. The study fully complied with the ethical guidelines outlined in the Declaration of Helsinki.

Statistical Analysis

Data analysis was carried out using SPSS software version 28 (PASW Statistics for Windows; SPSS Inc., Chicago, IL, USA). Distribution of continuous variables was first assessed using the Kolmogorov–Smirnov test. Normally distributed data were summarized as mean ± SD, whereas non-normally distributed variables were expressed as median with minimum–maximum values and were compared using Kruskal–Wallis test. Qualitative data were reported as frequencies and percentages, and were compared using the Monte Carlo test. To explore predictors of dichotomous outcomes, binary logistic regression analysis was applied using a stepwise forward entry approach. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

Sixty-three pediatric cases with head trauma were analyzed, with a mean age of 8.75 ± 4.83 years. The largest proportion of cases was between 6–11 years (41.3%). A male predominance was observed, with a male-to-female ratio of 2:1 **(Figures 1, 2)**.

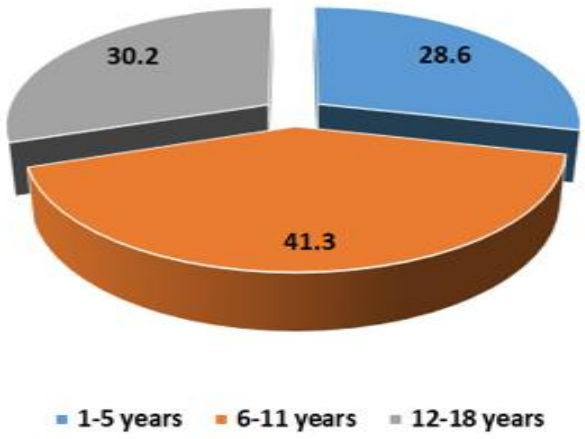

Figure (1): Age of the studied cases.

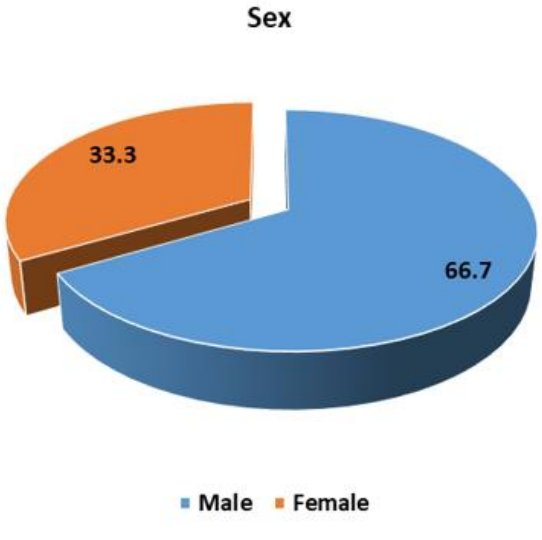

Figure (2): Sex of the studied cases.

Table (1) reveals clinical presentation of the studied cases. Loss of consciousness was the main presentation (46%). While regarding cause of injury among the studied cases, the main causes were road accidents (54%) and fall (46%). Regarding associated intracranial lesions among studied cases, brain contusion (36.5%) and SAH (33.3%) were the most common associated intracranial lesions. Isolated head trauma was the most common (74.6%).

Table (1): Clinical presentation, cause of injury, associated intracranial lesions, and head trauma of the studied cases**.**

	total number=63	**%**
Clinical presentation		
Loss of consciousness	29	46.0
Seizures	6	9.5
Emesis	3	4.8
Headache	11	17.5
Absence of previous symptoms	14	22.2
Cause of Injury		
Road accidents	34	54.0
Sport fall	11	17.5
Domestic fall	12	19.0
Other fall	6	9.5
Associated Intracranial Lesions		
Brain contusion	23	36.5
SAH	21	33.3
SDH	6	9.5
None	9	14.3
Brain contusion and traumatic SAH	4	6.3
Head Trauma		
Isolated head trauma	47	74.6
Polytrauma	16	25.4

Outcome analysis revealed a median hospital stay of 9 days and a median ICU stay of 6 days. Most common outcome of the studied cases was full recovery (36.5%) **(Figure 3)**.

Table (2) shows GOS score at admission and score extended at the time of discharge. The median GOS on admission was 7, while the median GOSE on discharge was 10. Regarding radiographic findings of the studied cases, skull fracture and scalp injuries were recorded in 90.5% and 93.7% of cases respectively. Regarding EDH site, temporal was the most frequently comprised site (42.9%).

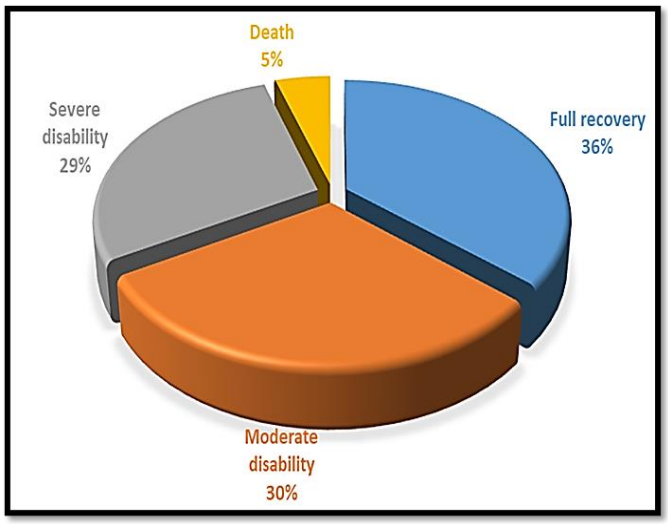

Figure (3): Outcome distribution among the studied cases.

Table (2): Glasgow outcome scale score at admission and score extended at the time of discharge**.**

	n=63
GOS on admission median (min-max)	7(3-14)
GOSE on discharge median (min-max)	10(7-15)
Radiographic Finding	
1) Skull fracture	57 (90.5%)
2) Scalp	59 (93.7%)
3) EDH site	
✓ Frontal	16 (25.4%)
✓ Temporal	27 (42.9%)
✓ Parietal	14 (22.2%)
✓ Occipital	6 (9.5%)

Table (3) presents the association between socio-demographic variables and the outcome of traumatic epidural hemorrhage among pediatric cases. A highly substantial correlation was identified with age, as poorer outcomes were linked to younger cases. No significant correlation was detected with sex. Conversely, clinical presentation demonstrated a strong and marked relationship with outcome. **Table (4)** illustrates the relationship between traumatic epidural hemorrhage outcomes and selected clinical variables in pediatric cases. Cause of injury and associated intracranial lesions each demonstrated highly substantial correlations with outcome. A strong and highly substantial association was also observed between outcome and both hospital stay and ICU stay.

Table (3): Relation between outcome of traumatic epidural hemorrhage in pediatric population with socio-demographic characteristics and clinical presentation of the studied cases**:**

	Outcome				**Test of significance**
	Full recovery	Moderate disability	Severe disability	Death	
	N=23(%)	N=19(%)	N=18(%)	N=3(%)	
Age/years					
1-5	9(39.1)	5(26.3)	1(5.6)	3(100)	
6-11	5(21.7)	7(36.8)	14(77.8)	0	MC=21.78
12-18	9(39.1)	7(36.8)	3(16.7)	0	P=0.001*
Sex					
Female	6(26.1)	7(36.8)	6(33.3)	2(66.7)	MC=2.15
Male	17(73.9)	12(63.2)	12(66.7)	1(33.3)	P=0.542
Clinical presentation					
Loss of consciousness	2(8.7)	1(5.3)	1(5.6)	0	
Seizures	0	2(10.5)	0	3(100)	MC=56.37
Emesis	0	8(42.1)	16(88.9)	0	P<0.001*
Headache	9(39.1)	5(26.3)	1(5.6)	0	
Absence of previous symptoms	12(52.2)	3(15.8)	0	0	

MC: Monte Carlo test, *: Statistically significant.

Table (4): Relation between causes of injury, associated intracranial lesions, hospital length stay and ICU stay with outcome of traumatic epidural hemorrhage in pediatric cases**:**

	Outcome				**Test of significance**
	Full recovery	Moderate disability	Severe disability	Death	
	N=23(%)	N=19(%)	N=18(%)	N=3(%)	
Cause of Injury					
Road accidents	6(26.1)	9(47.4)	16(88.9)	3(100)	MC=27.03
Sport fall	4(17.4)	5(26.30	2(11.1)	0	P<0.001*
Domestic fall	7(30.4)	5(26.30	0	0	
Other fall	6(26.1)	0	0	0	
Associated Intracranial Lesions					
Brain contusion	0	2(10.5)	18(100)	3(100)	
SAH	5(21.7)	16(84.2)	0	0	MC=86.36
SDH	5(21.7)	1(5.3)	0	0	P<0.001*
None	9(39.1)	0	0	0	
Brain contusion and traumatic SAH	4(17.4)	0	0	0	
Hospital length stay (days)					
Median (min-max)	5(3-17)	9(8-15)	9(7-18)	15(5-17)	KW=16.69 P<0.001*
ICU Stay (days)					
Median (min-max)	4(2-7)	6(3-9)	8(5-10)	7(6-7)	KW=31.67 P<0.001*

MC: Monte Carlo test, KW: Kruskal-Wallis test, *: Statistically significant.

Table (5) demonstrates relation between GOS score at admission; score extended at the time of discharge and outcome of traumatic epidural hemorrhage in pediatric cases. Both GOS on admission and GOSE on discharge demonstrated highly statistically significant correlations with outcome. **Table (6)** demonstrates predictors of disabilities among studied cases. Age, clinical presentation, hospital length stay and ICU stay could be used as significant predictors of disabilities.

Table (5): Relation between Glasgow outcome scale score at admission, score extended at the time of discharge and radiographic findings with outcome of traumatic epidural hemorrhage in pediatric cases**:**

	Outcome				**Test of significance**
	Full recovery	Moderate disability	Severe disability	Death	
	N=23(%)	N=19(%)	N=18(%)	N=3(%)	
GOS on admission					
Median (min-max)	10(9-14)	7(7-9)	4(4-7)	3(3-3)	KW=55.56, P<0.001*
GOSE on discharge					
Median (min-max)	14(10-15)	9(7-12)	7(7-12)	NA	KW=36.56, P<0.001*
Radiographic Findings					
1) Skull Fracture	17(73.9)	19(100)	18(100)	3(100)	MC=11.53, P=0.009*
2) Scalp	19(82.6)	19(100)	18(100)	3(100)	MC=7.43, P=0.06
3) EDH site					
✓ frontal	0	0	14(77.8)	2(66.7)	
✓ temporal	3(12)	19(100)	4(22.2)	1(33.3)	MC=88.01
✓ parietal	14(60.9)	0	0	0	P<0.001*
✓ occipital	6(26.1)	0	0	0	

KW: Kruskal Wallis test, MC: Monte Carlo test, *statistically significant, NA: Not applicable.

Table (6): Predictors Among Studied Cases

		Univariate analysis		**Multivariate analysis**	
		P value	Crude odds ratio (95%CI)	P value	Adjusted Odds Ratio (95%CI)
Age/years	**1-5 (r)**	0.068	1		
	6-11	0.036*	4.2(1.096-16.09)		1
	12-18	0.873	1.11(0.306-4.04)	0.04*	5.1(1.15-14.5)
Sex					
Male					
Female (r)		0.357	1.70(0.549-5.26)		
Clinical presentation					
Loss of consciousness		0.792	1		1
Seizures		<0.001*	0.750(0.088-6.38)		
Emesis		0.999	60.75(7.44-496.16)	0.002*	55.15(6.89-400.58)
Headache		0.999	undefined		
Absence of previous symptoms			undefined		
Cause of Injury					
Road accidents		0.085	1		1
Sport fall		0.204	0.375(0.083-1.70)		
Domestic fall		0.011*	0.153(0.036-0.651)	0.07	0.145(0.024-1.005)
Other fall		0.999	Undefined		
Associated Intracranial Lesions					
Brain contusion					
SAH		0.998	undefined		
SDH		0.999	undefined		
None		0.999	undefined		
Brain contusion and traumatic SAH		1.000	undefined		
Hospital length stay (days)		0.002*	1.38(1.12-1.69)	0.104	1.18(0.966-1.45)
ICU Stay		<0.001*	2.76(1.69-4.55)	0.001*	2.49(1.49-4.17)
GOS on Admission		0.993	undefined		
Radiographic					
Skull Fracture		0.999	undefined		
Scalp		0.999	undefined		
EDH site	Frontal	0.998	undefined		
	Temporal	0.999	undefined		
	Parietal	1.000	undefined		
	Occipital				

DISCUSSION

Among pediatric cases, EDH represent 2–3% of all head injuries and 1–6% of hospital admissions after TBI. As a major neurosurgical emergency, EDH must be rapidly recognized and adequately managed. Therapeutic options include conservative monitoring or surgical evacuation, with surgical decision-making guided by clinical condition and imaging parameters. The presence of advanced trauma care facilities and immediate neurosurgical access markedly improves outcomes [11,12].

This prospective observational clinical study was carried out at Mansoura University Emergency Hospital over a one-year period (January 2022–January 2023) to evaluate the pattern and short-term outcomes of traumatic epidural hemorrhage in pediatric cases, with the aim of enhancing the management of pediatric trauma cases.

With respect to socio-demographic variables, the current investigation demonstrated that: the mean age was 8.75±4.83. Most common ages of the studied cases were within the age between 6 and 11 years old (41.3%), followed by age between 12 and 18 years old (30.2%) and lately the age between 1 and 5 years old (28.6%). Male to females (M/F) ratio was 2/1.

Khan *et al.* [13] reported on 24 pediatric cases with EDH, comprising 19 males and 5 females, with a mean age of 8.6 ± 6.1 years.

Hossain *et al.* [14] investigated 171 pediatric patients with EDH, comprising 72% boys (n = 122) and 28% girls (n = 48), yielding a M/F ratio of 2.54:1. The participants were aged between 1.8 and 18 years, with a mean age of 9.49 years. The majority of cases, 44% (n = 74), occurred in the 11–18-year age group.

According to **Cremonini *et al.*** [15] a retrospective review of pediatric admissions to a Level I Trauma Center from 2008 to 2018 identified 699 cases of blunt TBI, of which 106 with EDH were included in the study cohort.

The current study demonstrated a mortality rate of 4.8%, consistent with prior studies that have also documented a rate near 5% [16-18].

Khan *et al.* [13] observed a mortality rate of 12.5%, which they attributed to restricting their analysis to surgically managed cases, representing more severe presentations. When conservatively treated cases were added, the mortality rate dropped to 4.9%, consistent with published data.

As regards, clinical presentation, the present study reported that; loss of consciousness was the main presentation (46%) followed by absence of symptoms (22.2%) and headache (17.5%) and lastly seizures (9.5%) and emesis (4.8%).

Similarly, according to **Khan *et al.*** [13] loss of consciousness represented the predominant presenting complaint, occurring in 70.8% (n = 17) of children, while vomiting was reported in 45.8% (n = 11). Some cases manifested more than one presenting symptom. Anisocoria was found in nine cases, with pupillary assessment showing one nonreactive pupil, sluggish reaction in five, and fixed pupils in three. Cerebellar signs were absent in all cases; one case had facial nerve weakness, four demonstrated abnormal respiratory movements, and five had cervical tenderness [13].

Likewise, **Hossain *et al.*** [14] found that altered sensorium was the most common presenting feature, occurring in 61% (n = 104) of cases, followed by headache and/or vomiting in 56% (n = 96). Early seizures were reported in 13% (n = 22) of children with EDH. The classic "lucid interval", defined as an initial loss of consciousness with subsequent transient recovery and later deterioration, was present in 28% (n = 48) of cases. In addition, **Rocchi *et al.*** [17] observed that among surgically managed cases, the most common neurologic features were consciousness deterioration (22 cases), signs of raised intracranial pressure (13 cases), pupillary abnormalities (11 cases), hemiparesis (9 cases), and cerebellar signs (3 cases). Coma was present in four cases at the time of injury and in 10 cases by the time of surgery.

Regarding cause of injury, the current study demonstrated that; the main causes were road accidents (54%) and fall (46%). Sport fall, domestic fall and other falls represented about 17.5%, 19% and 9.5% of the studied cases respectively.

On the contrary, **Hossain *et al.*** [14] reported that falls were the most frequent mode of injury, accounting for 41% (n = 70) of cases, followed by road traffic accidents (32%, n = 54). As described by **Khan *et al.*** [13] falls represented the most frequent cause of injury, accounting for 12 cases (50%), whereas road traffic accidents were noted in 9 (37.5%). Two cases (8.3%) resulted from blunt object trauma, and a single case (4.6%) was due to the dropping of a heavy object on the head.

The variation noted between this study and the two previous reports could reflect age-dependent differences in trauma etiology. Children younger than five years are more prone to falls, whereas motor vehicle accidents are more frequent in children above this age group, a finding highlighted in [16] and confirmed by an additional study [19].

In the context of associated intracranial lesions, the present study demonstrated that brain contusion (36.5%) and SAH (33.3%) were the most common associated intracranial lesions, followed by none (14.3%), then SDH (9.5%) and lastly combined brain contusion and traumatic SAH (6.3%).

As demonstrated by **Khan *et al.*** [13] 9 cases (37.5%) presented with contusions and 6 cases (25%) with subdural hematoma (SDH). The basal cisterns remained patent in 13 cases (54.2%), whereas effacement was recorded in 11 cases (45.8%).

Outcome analysis in the present study showed median lengths of hospital and ICU stay of 9 and 6 days, in respective manner. Most of the studied cases were

associated with full recovery (36.5%), while moderate disability, severe disability and death were recorded in of cases 30.2%, 28.6% and 4.8% respectively.

Binder *et al.* [16] reported outcomes in 41 pediatric EDH cases, noting that 2 patients (5%) died within 24 hours and 39 (95%) survived. Of the surgically treated group, one (2%) remained in a vegetative state, one experienced severe disability, while 32 (78%) exhibited good recovery at final follow-up.

Also, as documented by **Rocchi *et al.*** [17] 17 out of 18 patients with isolated acute EDH recovered completely, with only 1 case showing moderate disability and no severe disability. However, among those with additional intracranial lesions, complete recovery occurred in 4 of 8 patients, moderate disability in 3 of 8, and severe disability in 1 of 8.

As regards, radiographic findings, the current study demonstrated that; skull fracture and scalp injuries were recorded in 90.5% and 93.7% of cases respectively. Regarding EDH site, Temporal was the most frequently comprised site (42.9%), followed by frontal (25.4%) then parietal (22.5%) and lastly occipital (9.5%).

Hossain *et al.* [14] in partial agreement, reported that CT findings revealed involvement of the temporoparietal region in 34% (n = 68), followed by the frontal region in 29% (n = 50) and the parietal region in 14% (n = 21). Posterior fossa involvement was uncommon, occurring in only 6% (n = 10) of cases. Skull fractures were detected in 62% (n = 106), identified through X-ray, CT imaging, or intraoperatively.

As demonstrated by **Khan *et al.*** [13] hematomas occurred most often in the frontal region (n = 11), with additional involvement of the occipital (n = 9), parietal (n = 8), and temporal (n = 6) regions. Multilobar clots were observed in 4 cases. Midline shift was detected in 7 patients (29.1%) on initial CT, and skull base fractures were identified in 19 patients (79.2%).

With respect to GOS, the present study showed a median score of 7 at admission, whereas the median GOSE at discharge was 10. **Cremonini *et al.*** [15] reported that 40% of EDH cases presented with a GCS of 15. Four patients (4%) had a GCS of 15 and were entirely asymptomatic at admission, while in three (3%) a scalp hematoma was the sole finding. Half of all EDH cases underwent craniotomy, a rate not significantly different among those presenting with GCS 15 (45%, p = 0.192). Reported mortality was 2%, and 13% (n = 14) of patients were discharged with residual cognitive or motor deficits.

With regard to relation of outcomes, the current study demonstrated that outcomes of traumatic epidural hemorrhage in pediatric cases were associated with significant correlations with age, clinical presentation, cause of injury, associated intracranial lesions, hospital length stay, ICU Stay, GOS on admission, GOSE on discharge, skull fracture, and EDH site. Concerning predictors of disabilities among studied cases, the current study illustrated that age, clinical presentation, hospital length stay and ICU stay could be used as significant predictors of disabilities ($P<0.05$).

In the same line, **Khan *et al.*** [13] demonstrated that the admission GCS was a strong predictor of outcome ($\rho = 0.566$, $P = 0.006$). Age at the time of trauma also showed a significant correlation with GOS ($\rho = 0.471$, $P = 0.021$). Furthermore, both the interval between injury and surgery ($\rho = 0.451$, $P = 0.028$) and the interval between injury and admission ($\rho = 0.512$, $P = 0.027$) were substantially associated with GOS at one month. Anisocoria on presentation ($P = 0.004$) and effacement of basal cisterns ($P = 0.017$) were linked with worse outcomes, while delayed surgical intervention was substantially correlated with poor prognosis ($P = 0.021$). While, **Spazzapan *et al.*** [11] reported that a GCS of less than 8 at the time of admission was the only factor significantly predictive of neurological deficit at six months ($P = 0.048$).

With regard to the role of skull fractures, **Lee *et al.*** [20] reported a significant association between cranial fractures and poor outcomes in 115 surgically managed EDH cases, a finding consistent with the results of the present study. On the contrary, **Leggate *et al.*** [21] observed no substantial correlation between skull fractures and outcome in their study of 200 cases managed with a similar approach. **Rivas *et al.*** [22] also documented a markedly reduced mortality rate in patients with cranial fractures. Notably, the incidence of skull fractures in children within their series was lower compared to adults [23]

The current study showed that younger age was significantly associated with unfavorable outcomes. This finding is consistent with most previous reports [24,25], however, some authors have reported contrasting results, indicating that older age is more strongly linked to poor prognosis [26].

CONCLUSION

Pediatric EDH represents a major neurosurgical emergency, yet it is associated with favorable prognosis when identified and treated early. Outcome is significantly influenced by variables including age, clinical presentation, etiology of trauma, coexisting intracranial lesions, length of hospital and ICU admission, GOS at presentation, GOSE at discharge, skull fracture, and the site of the hematoma.

LIMITATIONS

The promising results of this study should be interpreted in light of its limitations, which include the small number of cases and the absence of evaluation of the time elapsed from trauma to surgery and from trauma to emergency room admission.

RECOMMENDATIONS

To validate these findings, additional studies involving a greater number of cases are needed,

particularly those accounting for the duration between trauma and surgery and trauma and emergency department admission.

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