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RESEARCH

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Patterns and management outcomes of intracranial extra-axial hematomas in low-resource setup: a 6-month prospective observational study at Jimma University Medical Center, Ethiopia

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Abstract

Introduction Intracranial hematoma is the collection of blood in various intracranial spaces. Knowledge of patterns, origins, causes and outcomes of ICH conditions is important for decision-making for urgent surgical interventions such as craniotomy and hematoma evacuations. No prior study was conducted in our setup. Hence, this study aimed to assess the patterns and management outcomes of intracranial hematomas in low-resource setting and tailored our management approach at Jimma University Medical center.

Methods An institution-based prospective observational study was conducted at Jimma University Medical Center, Ethiopia, for six consecutive months from June to December 2020. Different data sources and interview methods were used and analyzed using SPSS version 24. A bivariate and multivariate logistic regression was conducted to determine the association between the variables.

Results A total of 91 eligible patients were recruited during the study period, with a mean age of 34 years. The majority of patients were males [73 (80.2%)] and more common in reproductive age groups (62.6%), from rural areas (50.5%). About 93.4% of patients reported a history of trauma, and road traffic accidents & fighting account for 63.8% of the trauma cases. Sixty-five percent of patients arrive in the hospital within 24 h. Upon presentation, there were loss of consciousness (48.4%), convulsion (11%), aspiration (9.9%) and increased ICP (12%). The majority (49.5%) of the patients had a mild head injury. The focal neurologic deficits were hemiparesis (29.7%) and hemiplegia (5.5%). Acute epidural hematoma (68.1%) was a common finding, followed by sub-acute subdural hematoma. Of the total study participants, 11% had died. All the surviving patients were accessed at 30 days after discharge and re-assessed, 66 patients had good neurologic recovery (62 upper and 4 lower good recovery), 11 patients had moderate disability (7 lower and 4 upper-moderate disabilities), two patients had a severe disability, and two patients (among those with severe disability) had died.

Conclusion Trauma was invariably the cause of intracranial hematoma, and patients with low GCS, papillary abnormalities, aspiration and increased ICP had an increased risk of dying from their illness. It is good to formulate policies to enhance injury prevention and bring about health-oriented behavioral change.

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Keywords Intracranial hematoma, Management outcomes, Jimma University, Head injury, Neurosurgery

Introduction

Intracranial hematoma is a disorder with a very high mortality rate and an extremely poor prognosis among traumatic brain injuries. It is estimated that intracranial hematomas occur in 25–45% of severe traumatic brain injuries [1], 3%–12% of moderate cases and approximately 1 in 500 patients with mild head injuries [2]. Head injury is a non-degenerative insult to the brain from an external mechanical force and is responsible for up to 50% of fatalities among trauma patients and for a large component of continuing care among survivors [3]. As such, head injury is a critical public health problem, affecting more than 10 million people worldwide and accounting for 15% of the burden of death and disability. This burden disproportionately occurs in low- and middle-income countries, where the incidence of traumatic brain injury (TBI) is nearly three times the incidence in high-income countries. Globally, TBI is projected to be the third leading cause of death and injury by the World Health Organization in 2020 [4]. There are predictions that this figure is set to surpass many diseases as the leading cause of mortality and morbidity by the year 2020 [3, 5].

Acute traumatic epidural hematomas (EDH) and subdural hematomas (SDH) are among the most common clinical entities and life-threatening complications of severe TBI [4]. EDH is the collection of blood in the epidural space (Fig. 1) and has got a variable clinical presentation in the acute situation [6]. Acute subdural hematoma (ASDH) is a collection of clotting blood that forms in the subdural space (Fig. 2), and it remains one of the most difficult tasks faced by neurosurgeons because of the high mortality and morbidity of the disease. ASDH has been recognized as a devastating injury. In patients with severe TBI due to acute SDH, mortality rates range from 60% and more, depending on Glasgow Coma Scale (GCS) scores [7]. TBI has paralleled the need for decompression surgery for ASDH and acute epidural hematoma (AEDH) [8].

Knowledge of key determinants of clinical outcomes in such patients is mandatory to guide treatment protocols. To date, the outcomes of ASDH and AEDH vary from center to center, depending on the resources and quality of care in different regions [9]. CSDH commonly occurs in old people, maybe several weeks after a traumatic brain injury, and has a hypodense crescentic collection on imaging (Fig. 3). A rise in life expectancy in developing countries has increased the incidence of this condition. Its incidence is very high in the 7th and 8th decade of life; however, no age is exempt [10].

In Ethiopia, even though there was not enough research conducted on head injury in the country's context, the prevalence of head injury is a common health problem that causes morbidity and mortality in the productive age group of the population. Therefore, this study aimed to assess the patterns and management outcomes of intracranial hematoma in low-resource setting, particularly at Jimma University Medical Center, from July 2020 up to December 2020, and it will help us tailor our management approach to these patients.

Methods and materials

This study was conducted at the surgery unit of Jimma Medical Center (JUMC), a tertiary medical facility, found in Jimma town, south-western Ethiopia. JUMC provides services to 15 million people with 1600 staff members and 800 beds. The Department of Surgery is one of the main departments at JUMC and provides full-fledged clinical services and offers specialty training.

We used a consecutive sampling technique to identify eligible patients. All patients with intracranial hematoma, patients with CT-proven intracranial hematoma and patients admitted to surgery department during the study period of six consecutive months were recruited to identify eligible patients for the study. We finally got a total of 91 patients with CT-proven intracranial hematoma who met the inclusion criteria and were included in the study.

The socio-demographic, clinical and radiological data were collected through face-to-face interviews, observations, hospital records, patient document cards, and morbidity and mortality reports. Patients were followed weekly through phone calls, and clinical examination was carried out every two weeks until 30 days after discharge. Thirty-day follow-up data was collected at referral clinics and through phone calls.

After checking and cleaning, the data were entered into Epi Data version 3.1. After double data entry verification, the data were exported into Statistical Package for Social Science (SPSS, version 24) for analysis. Outcomes were described according to mortality and Extended Glasgow Outcome Scoring systems. Descriptive statistics were used for calculating the frequency and percentage of both dependent and independent variables. Logistic regression (bivariate analysis) was used to explore the relationship between the outcome variable and the independent

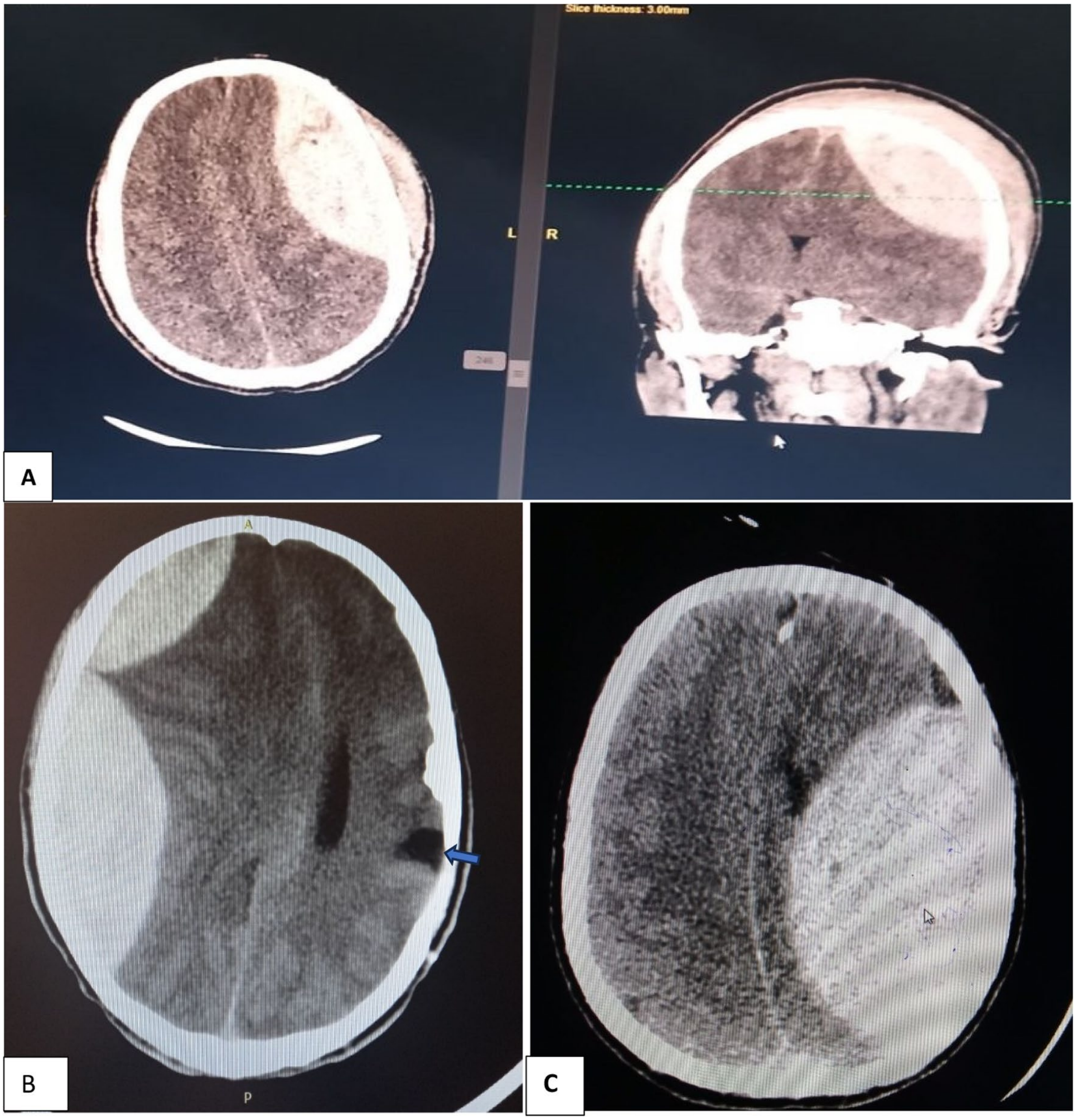

Fig. 1 Traumatic intracranial hemorrhage in three patients. Huge temporo-parieto-occipital epidural hematoma with midline shift and effacement of ventricles and cisterns (**A**), and a biconvex epidural hematoma is present at two sites without crossing the dural attachments with significant midline shift effacement of the ipsilateral ventricle and contralateral pneumocranium (**B**, arrow head). Right-side huge epidural hematoma occupying almost three-fourth of the right hemisphere with significant midline shift, loss of gyri and fissures as well as effacement of both ventricles (**C**)

variables. All variables with a *p*-value of less than 0.25 in the bivariable analysis were selected as a candidate variable for the multivariable logistic regression model. A *p*-value of less than 0.05 in multivariable logistic regression was declared statistically significant.

Surgical procedures and general management

In all patients, the usual management protocol was followed with respect to the types of intracranial extra-axial hematoma. Local or general anesthetic was selected depending on the patient's general status, type of hematoma and ability to co-operate. In

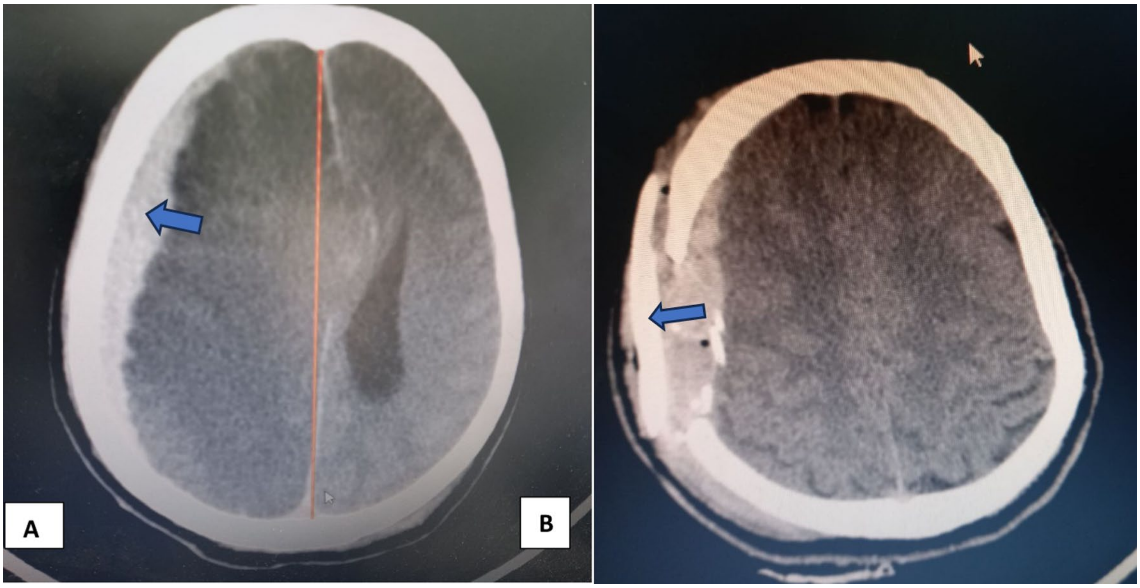

Fig. 2 Acute subdural hematoma. CT images in a patient with left hemispheric acute subdural hematoma. The subdural hematoma (**A**, arrow head) results in effacement of the basal cisterns and ipsilateral ventricle (**A**), and left subdural hematoma with dural and parenchymal disruption with pieces of broken bone (**B**, arrow head)

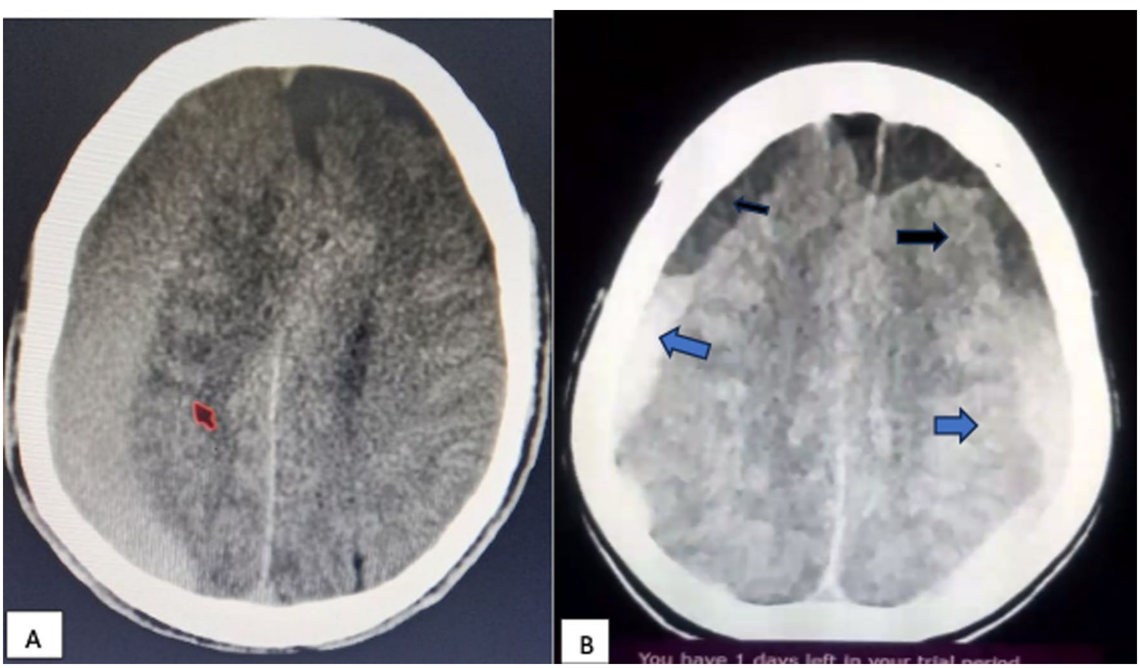

Fig. 3 Computed tomography scans demonstrating classification of left subacute subdural hematoma (**A**) with effaced ventricles and midline shift. Chronic subdural hematoma evident with the hematocrit effect (**B**, blue arrow heads) and supernatant (**B**, black arrow heads) as well as the trophied brain parenchyma

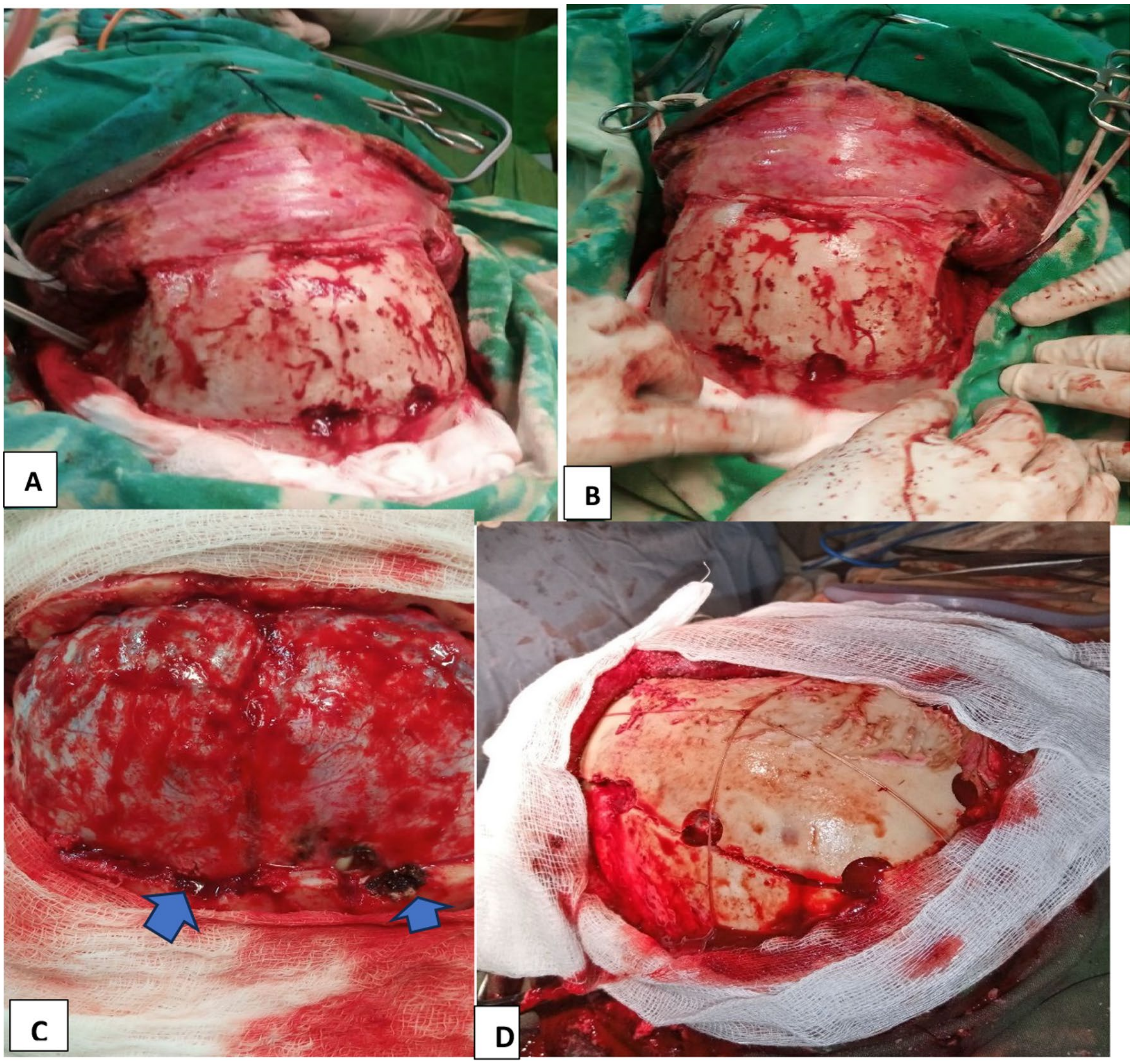

Fig. 4 Emergent hematoma evacuation. For typical EDH, intraoperative photographs on reflecting the scalp flap (**a**), Burr holes for craniectomy (**b**), after the evacuation of the epidural hematoma (**c**) and after fixing the bone flap back into the original place (**d**) are depicted. Abnormal vasculature or injury of the dural arteries is not observed. Arrow in (**c**) indicates the site of a large diploic channel that was cut during craniotomy caused brisk bleeds which later gets stopped by thermal coagulation

epidural hematomas, craniotomy and evacuation were performed (Fig. 4). Craniotomy with dural incision and evacuation was performed for acute and difficult forms of subacute subdural hematomas. Patients with depressed skull fracture and hematoma were managed with craniotomy, elevation and evacuation. Moreover, burr hole and drainage were performed for all cases of chronic subdural hematoma (Fig. 5). Other cases qualifying for conservative management were managed with supportive interventions and follow-ups.

Inclusion criteria

All patients admitted to surgery department with CT-proven intracranial hematoma at JUMC were eligible for inclusion.

Exclusion criteria

Those Patients who self-discharged themselves, referred, not having a CT scan of the head, having subarachnoid hemorrhage, aneurysm rupture, ventricular hemorrhage and those having a hemorrhagic stroke were excluded from the study.

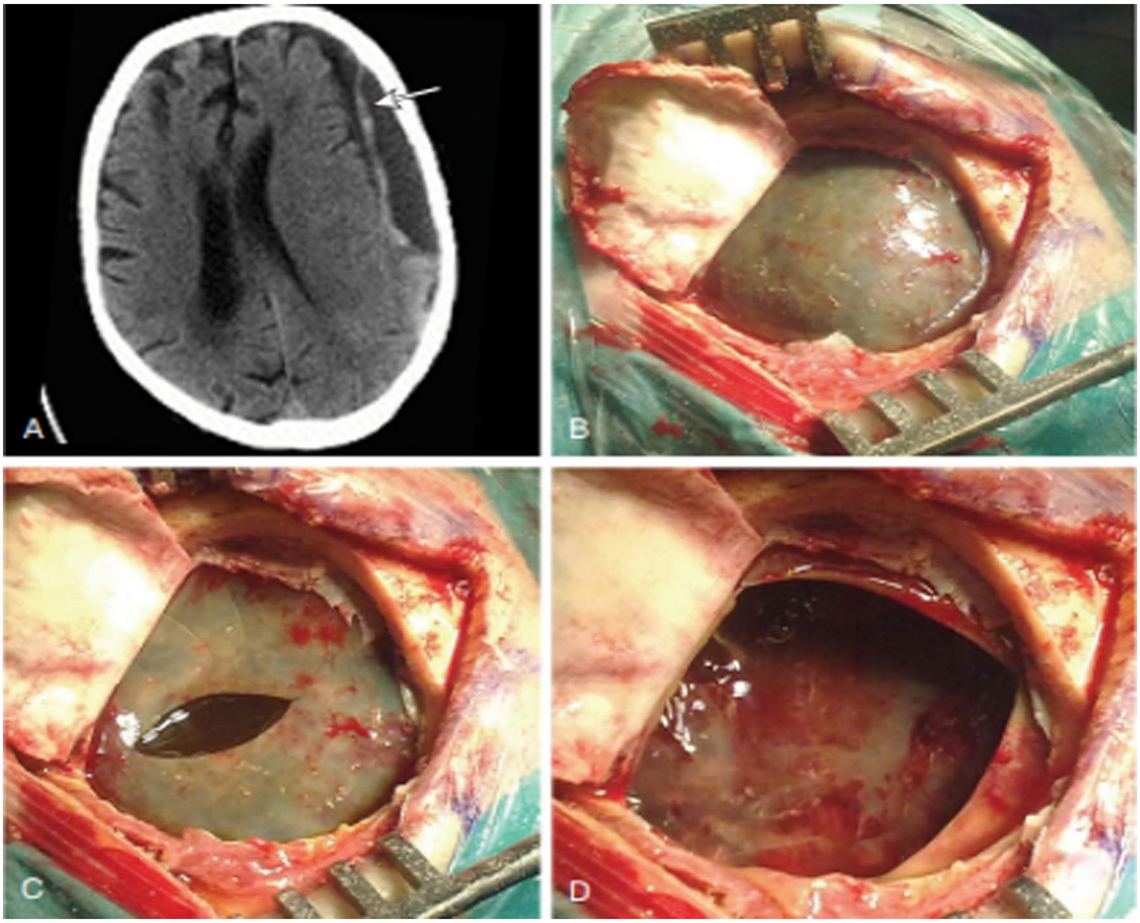

Fig. 5 Mini-craniotomy for laminar type chronic subdural hematoma (CSDH). **A** Computed tomography scan demonstrating a laminar type CSDH. The hyperdense inner septum of the parietal membrane is marked with an arrow. **B** Dural flap was raised, demonstrating the parietal membrane. **C** The parietal membrane was incised, showing yellow-green subdural fluid. **D** The parietal membrane was widely excised, and the subdural fluid from the outer compartment was washed out, revealing the hemorrhagic inner septum of the membrane. (*Reproduced from Schmidek and Sweet*)

Operational definition

ICH outcome: the final result of a surgical patient after management based on the Extended Glasgow Outcome Score (good = 7–8, moderate disability = 5–6, severe disability = 3–4, vegetative = 2 and dead = 1) [11].

Emergent surgery: surgery for a condition that is immediately life-threatening. Surgery must be performed within a few hours [12].

Urgent surgery: surgery for a potentially life-threatening condition usually must be completed within 24 h [12].

Comorbidity: the presence of one or more additional diseases or disorders co-occurring with a primary disease or disorder [13].

Increased ICP: finding with clinical manifestations of deteriorating GCS, vomiting, seizure, obliterated basal cisterns and lately with Cushing's triad [14].

Complication: the unfavorable evolution or consequence of a disease, a health condition or a therapy [15].

Results

Socio-demographic characteristics

A total of 91 neurosurgery patients with intracranial hematomas visited JUMC and were managed. Seventy-three (80.2%) of the study subjects were males, and 18 (19.8%) were females, with a male-to-female ratio of 4:1 (Table 1). The mean age was 34 years (ranging from 2 to 90 years), of which 15 (16.5%), 57(62.6%) and 19 (20.9%) were less than 15, between 15 and 49 and greater than 49 years old, respectively. Regarding to their marital status, 53 (58.2%) were married and 38 (41.8%) were single. Most, 29 (31.9%) of the patients were farmers followed by students 23 (25.3%); the rest are employees, drivers and merchants. Nearly equal patients came from urban and rural. Seventy-nine patients (86.8%) have no comorbidities, while 10 (11%) of the patients are hypertensive, one cardiac and one diabetic patient.

Table 1 Sociodemographic characteristics

Variable	Categories	Frequency	Percent
Sex	Male	73	80.2
	Female	18	19.8
Age	< 15	15	16.5
	15–49	57	62.6
	> =50	19	20.9
Marital status	Married	53	58.2
	Single	38	41.8
Occupation	Farmer	29	31.9
	Student	23	25.3
	Employee	16	17.6
	Merchant	10	10.9
	Others	13	14.3
Residence	Urban	46	50.5
	Rural	45	49.5
Chronic illness	HTN	10	11
	DM	1	1.1
	Cardiac	1	1.1
	No	79	86.8
History of medication intake	Antihypertensive	10	10.8
	Antidiabetics	1	1.1
	Cardiac	1	1.1
Personal habit	Smoking	2	2.2
	Alcohol	6	6.6
History of trauma to the head	Yes	85	93.4
	No	6	6.6
Mechanism of injuries	Road traffic accident	29	31.9
	Fighting	29	31.9
	Falls	20	22
	Thrown stone	3	3.2
	Not known	2	2.2
	Others	2	2.2

Eighty-five (93.4%) of patients had trauma while the rest six patients didn't have trauma. Road traffic accidents and fighting account for the commonest mechanism of injury, 29 (31.9%) each followed by falls 20 (22%). There was no known mechanism of injury for two patients (Table 1).

Place of occurrence of trauma and time of arrival at the hospital

Most of the patients were in the outdoor environment 49 (53.8%) during the trauma scene or their health-seeking complaints, whereas vehicle occupants and pedestrians were 13 (14.3%) each, and the rest of the 16 patients (17.6%) were in the home environment. The majority of 44 (48.3%) of the patients arrived at the hospital in the range of 4–24 h after injury, and 32 (35.2%) patients arrived after 24 h. Among the 91 study patients, 75 (82.4%) reported a history of loss of consciousness and 16 patients didn't have a loss of consciousness. Sixty-nine of the patients have a loss of consciousness that lasts longer than 30 min, while six patients have a loss of consciousness for less than 30 min. The shortest time was 10 min, while the longest time was 6 days. Historically, 21 patients (23.1%) have had at least one episode of convulsion, while the rest of the 70 patients (76.9%) did not report a complaint of convulsion (Table 2).

Table 2 Place of occurrence of trauma, time of arrival after complaint and history of loss of consciousness

Variable	Place	Frequency	Percent
Place of occurrence	Vehicle occupant	13	14.3
	Pedestrian	13	14.3
	Outdoor	49	53.8
	Home	16	17.6
Time in hours	< 4	15	16.5
	4–24	44	48.3
	> 24	32	35.2
History of LOC	Yes	75	82.4
	No	16	17.6
Duration of LOC	≤ 30 min	6	6.6
	> 30 min	69	75.8

Physical findings at presentation

Forty-four patients (48.4%) had a loss of consciousness at presentation. Ten patients (11%) and nine patients (9.9%) had convulsion and aspiration, respectively, at presentation. Eleven patients (12.1%) had signs of increased ICP. In the moderate category, 34 (37.4%) and 12 (13.2%) patients were comatose. The lowest GCS record in this study was 6, and 38 patients had a GCS of 15 at presentation. The study found body weakness in 32 patients; hemiparesis in 27 patients; and hemiplegia in five patients. Twenty patients (22%) had unilaterally dilated and fixed pupils, while one patient had bilaterally dilated and fixed pupils. The majority of the patients fall into the category of mild head injury 45(49.4%) followed by moderate category 34(37.4%) and 12(13.2%) patients were comatose. The lowest GCS record in this study was 6, and 38 patients had GCS of 15 at presentation. The associated extracranial injury was seen in 14 patients (15.4%), the majority of which is extremity fracture in 9 patients (9.9%) followed by chest/abdominal injury in 4 patients (4.4%) (Table 3).

Table 3 Clinical findings at presentation and associated extracranial injury

Variables	Categories	Frequency	Percent
LOC at presentation	Yes	44	48.4
	No	47	51.6
Convulsion	Yes	10	11.0
	No	81	89.0
Aspiration	Yes	9	9.9
	No	82	90.1
Increased ICP	Yes	11	12.1
	No	80	87.9
GCS after resuscitation	3–9	12	13.2
	10–13	34	37.4
	14–15	45	49.4
Body weakness	No	59	64.8
	Hemiparesis	27	29.7
	Hemiplegia	5	5.5
Pupillary sign	Midsized and reactive	70	76.9
	Unilaterally fixed	20	22.0
	Bilaterally dilated	1	1.1
Associated extracranial injury	No	77	84.6
	Extremity bone fracture	9	9.9
	Chest injury	4	4.4
	Mandibular fracture	1	1.1

Table 4 Type of Hematoma, lateralization volume and other CT scan findings of neurosurgery patients admitted at Surgery unity of JUMC from June to December 2020

Variable	Categories	Frequency	Percent
Type of hematoma	Acute epidural	62	68.1
	Acute subdural	10	11.0
	Sub-acute subdural	12	13.2
	Chronic subdural	7	7.7
Hematoma lateralization	Right	47	51.6
	Left	39	42.9
	Both	5	5.5
Volume in cc	< 30	9	9.9
	30–59	38	41.8
	≥ 60	44	48.3
Midline shift in mm	< 3	38	41.7
	4–5	16	17.6
	> 5	37	40.7
Other CT scan findings	Linear skull fracture	26	28.6
	DSF	21	23.1
	Contusion	16	17.6

CT scan findings and types of hematomas

The majority of the patients had acute epidural hematoma (68.1%) followed by sub-acute subdural hematoma in 12 patients (13.2%), whereas the rest were caused by acute and chronic subdural hematoma in 10 (11%) and 7 (7.7%) patients, respectively. Forty-seven patients (51.6%) had right-side hematoma while 39 (42.9%) had left-side hematoma. Five patients had hematomas on both sides. The majority of patients 44 (48.3%) had hematoma volumes of greater than 60 cc followed by 38 (41.8%) of the patients who had hematoma volumes between 30 and 59 cc. Thirty-eight patients (41.7%) had no midline shift or less than 3mm if at all followed by those having midline shift of greater than 5mm, 37 patients (40.7%).

Linear skull fracture, DSF and contusion were seen in 26(28.6%), 21(23.1%) and 16(17.6%) patients, respectively (Table 4).

Management approaches and surgical intervention

Among the 91 patients, 79 (86.8%) were operated on and 12 (13.2%) were managed conservatively. Mannitol was given to 44(48.4%) patients. Five patients were admitted to the ICU. Among the operated patients, 62 (78.5%) took general anesthesia and the remaining 17 (21.5%) took local anesthesia. Craniotomy & evacuation were the leading procedure performed for 41 patients (52%), followed by elevation & evacuation and burr hole (Table 5).

Discharge outcome

Among the managed patients, 81 had improved-discharged while 10 patients had died. Sixty-one patients had good neurologic outcomes while 16 had moderate disability. Four patients had a severe disability, but there was no patient with a vegetative state in this study. Primary brain injury and respiratory failure were the major causes of death accounting for the death of six and four patients, respectively (Table 6).

Gender, age, type of hematoma, ICP and aspiration versus discharge outcome

Out of the 10 dead patients, seven were male and three were female. Reproductive age groups account for seven deaths out of 10. Among the 10 dead patients, 6 (60%) had acute epidural and 3 (30% of dead) had acute subdural, while the rest of one patient had a sub-acute subdural hematoma.

Eight of the dead patients had hematoma volumes equal to or greater than 60 cc. Eleven patients had increased ICP, of whom seven had died. Nine patients had an aspiration, of whom seven had died (Table 7).

Table 5 Management approaches and surgical intervention

Variable	Categories	Frequency	Percent
Management type	Conservative	12	13.2
	Operative	79	86.8
Mannitol given	Yes	44	48.4
	No	47	51.6
ICU admission	Yes	5	5.5
	No	86	94.5
Type of anesthesia	Local anesthesia	17	21.5
	General anesthesia	62	78.5
Type of surgical intervention	Burr hole	17	21.5
	Craniotomy and evacuation	41	52
	Elevation and evacuation	21	26.5

Table 6 Discharge and neurologic outcome, and causes of death

	Categories	Frequency	Percent
Discharge outcome	Improved	81	89
	Died	10	11
Neurologic outcome	Good	61	67
	Moderate disability	16	17.6
	Severe disability	4	4.4
	Died	10	11
Cause of the death	Primary brain injury	6	60
	Respiratory failure	4	40

There is a significant relationship between increased ICP & aspiration and death (OR = 44.9 and OR = 92.167, respectively). Nine of the dead patients had other CT findings, but there is no statistically significant relationship with the outcome. Eight of the 10 dead patients had a severe head injury (GCS = 3–9). Patients with moderate head injury tend to have a lower risk of death than those with severe head injury (OR = 0.031). Patients with pupillary signs tend to have a higher risk of dying than patients with reactive pupils (OR = 9.571; Table 8).

Table 7 Gender, age, type of hematoma, increased ICP and aspiration versus discharge outcome

Discharge outcome	Gender		Age categories		
	Male	Female	< 15	15–49	≥ 50
Improved	66	15	15	50	16
Died	7	3	0	7	3
Total	73	18	15	57	19

Discharge outcome	Type of hematoma				
	Acute epidural	Acute subdural	Sub-acute subdural	Chronic subdural	Acute epidural
Improved	56	7	11	7	56
Died	6	3	1	0	6
Total	62	10	12	7	62

Discharge outcome	Increased ICP		Aspiration	
	Yes	No	Yes	No
Improved	4	77	2	79
Died	7	3	7	3
Total	11	80	9	82

Table 8 Multivariate logistic regression of increased ICP, aspiration, GCS categories and pupillary sign versus discharge outcome

Variables	Categories	B	OR	95% C.I. for EXP(B)	*p* value
Increase ICP	No		1		
	Yes	3.805	44.9	(8.32, 242.23)	< 0.001
Aspiration	No		1		
	Yes	4.524	92.167	(13.12, 647.16)	< 0.001
GCS categories	3–9		1		
	10–13	− 3.466	0.031	(0.005, 0.202)	< 0.001
	> 13	− 22.041	0.000		.997
Pupil sign	Midsize reactive		1		
	Unilaterally fixed	2.259	9.571	(2.134, 42.931)	0.003
	Bilaterally fixed	24.309	36078938157	0.000	1.000

Discussion

Extra-axial hemorrhagic lesions, such as acute subdural hematomas (SDH) and epidural hematomas (EDH), are the most frequent aftereffects of severe head injuries. These lesions typically require prompt surgical treatment [16]. There was a total of ninety-one (91) patients recruited in this study. Most of the patients sustained trauma and were admitted to JUMC during the study period from July to December/2020. Male patients (80.2%) account for most of the cases with a mean age of 34 years, which is a similar finding from Tikur Anbesa hospital [17] and a study performed in India [18] at Lahore hospital (M: F ratio of 12.4:1, mean age 36.1 years, and M: F ratio of 5:1, mean age 34 years). The main reason why intracranial hematomas are more common in males may be due to their more outdoor activities and involvement in violence compared to females.

Among these patients, reproductive age groups have the highest chances of sustaining head injuries and developing an intracranial hematoma. This is because people in this age group remain susceptible to road traffic accidents, and of course physical violence. A Pakistani study of 367 patients with epidural hematoma shows similar results, with the 20–50 age group being most affected [19]. Road traffic accident and fighting were the major contributor to neurotrauma admission and operation (63.8%) which is comparable to findings in studies performed at Tikur Anbesa hospital (53.2%) [17] and in Taiwan (68.7%) [5]. Patients with road traffic accidents tend to have a worse outcome compared to the others. The commonest cause being road traffic accidents (RTAs), global TBI incidence is estimated at 27 million per year, with a particularly high prevalence in the developing world. In low- and middle-income countries (LMICs), the incidence is estimated at 3.2 million per year, with a 3.5-fold increase in Sub-Saharan Africa, estimated to reach 14 million per year by 2050 [20].

Most of the trauma happened in the outdoor environment (53.8%). Growing middle class, affordability of motorcycles and urbanization in the lack of a developed healthcare system are all contributing factors to the rising prevalence of TBI. Furthermore, Africa lacks sufficient data on traumatic brain injury (TBI) to develop resource-appropriate clinical management, create public health policies and lessen the burden of TBI. Injury to the central nervous system may account for as much as half of trauma-related mortality in low- and middle-income countries (LMICs), where an estimated 90% of all trauma-related deaths occur [21].

Majority of the patients arrive in hospital within 24 h (64.9%) with a median of 14 h, which shows that longer time has elapsed compared to a Swiss study in which the median time elapsed was 3 h [7]. Litak and colleagues on their study of initial predictors of outcome of extra-axial hematoma stated that the time elapsed between trauma and surgery is the most significant prognostic factor, and reducing this period can potentially eliminate mortality. The notified that if surgery is performed for SDH within 4 h, mortality would decrease from 90 to 30% [22]. In our study, most (84%) of the patients arrived after 4 h; however, there is no statistically significant association between mortality and time of arrival. Contrary to this, patients managed in the earliest time possible has favorable Glasgow outcome score at 1 month.

The majority of patients historically reported loss of consciousness (82.4%). Upon presentation, 13.2% were comatose, 37.45% had moderate TBI, and 49.5% had mild TBI, which is almost similar to the Pakistani study (14.71%, 36.51%, 48.77%, respectively [18]. The asymmetric or unilaterally fixed pupil was seen in 22% of study patients which is slightly lesser compared to findings in the Muscat study, where 39% of the patients had this finding [7].

Acute epidural hematomas account for 68.1% of hematomas, followed by sub-acute subdural hematomas, which are almost comparable to a study performed in Uganda [9]. Contrary to this result, studies in Pakistan at Lahore Hospital showed subdural hematoma contributing 33.3% among patients with TBI, while epidural hematoma accounts for 16.7% [18]. Generally, SDHs are associated with high-energy trauma and its incidence is five times more common in severe TBI and three times more common in milder forms of TBI than EDHs [23]. There is also a comparable finding of skull fracture (51.7% versus 46.7%), while post-traumatic seizure and contusion are less common in our study than in the Pakistani study (11 and 17.6% versus 66.7 and 50%, respectively). The mortality rate for epidural hematoma was about 10.7%, while it was 43% for acute subdural hematoma which is almost comparable to other reports [24]. It is reported that an estimated 3.1 million people, the most of whom are in their prime working years, require surgery annually for traumatic epidural hematomas globally. Traumatic EDH is a wise investment for enhancing national neurosurgery capacity because of the good prognosis with therapy [25].

About 48.3% of study patients had a hematoma volume of ≥ 60 cc and 40.7% had midline shift of >5 mm, but neither of them held a strong statistically significant predictor of poor outcome in our study. The majority of our patients (86.8%) were operated and the rest (13.2%) managed conservatively. Conservative management was mainly supportive, and most patients in this group were given mannitol. Fifteen patients were subjected to respiratory support, but only five of them got mechanical respiratory support. The majority of the conservatively managed patients died (eight out of twelve). The proportion of conservative management was about 26% in a study performed at Kenyatta Hospital in Kenya [3]. Craniotomy &evacuation was the major procedure (52%), followed by elevation-evacuation (26.5%) and burr hole (18.6%) which is almost comparable with Kenyan study, but burr hole is the second common procedure there. It is generally agreed upon that craniotomy and decompressive craniectomy are the best surgical methods for managing extra-axial hematomas, while opinions on which is better remain divided. The majority of data come from hospital-based studies, and most complications are reported with decompressive craniotomies. Several studies have compared the results of the two surgical methods. Phan et al. observed this in their study, which suggested that decompressive craniectomy had greater complication rates than craniotomy. Compared to the group that had a craniectomy, patients who had a craniotomy had greater rates of residual hematoma; nevertheless, the craniectomy group had worse results and increased mortality [26]. Moreover, traumatic hemorrhagic injuries, subdural hygroma, seizure, meningitis, post-traumatic hydrocephalus and need of latter cranioplasty are the additional risky complications of craniectomy compared to craniotomies [27]. We recommend craniotomy as first procedure of choice whenever there is no compelling reason to do decompressive craniectomy.

About 84% of the patients had favorable neurologic outcomes (GOS of 4 and 5, 17and 67%, respectively), 4.4% had a severe disability, and 11% had died, which is almost comparable with other studies. All the surviving patients were accessed after one month of discharge and re-assessed, 66 patients had good neurologic (62 upper and 4 lower), 11 patients had moderate disability (7 lower and 4 upper moderate disability), two patients had severe (those among severe disability) disability, and two patients died.

The proportion of patients with low GCS is higher to have poor/unfavorable neurologic outcomes while patients with GCS >10 had a higher chance of having favorable neurologic outcomes [3, 19]. Among the ten dead patients, eight had GCS of 6 and 7, while the rest two had GCS of 10. It was also noted that 7 among the dead patients had aspiration, increased ICP and pupillary abnormalities. Patients with GCS ≥ 10 had less risk of dying than patients with coma (OR = 0.031, p < 0.001) and papillary abnormality demonstrated to be the other predictor of death (OR = 9.57, p = 0.003). Studies in China [28] and other countries showed comparable results [29]. The presence of increased ICP and aspiration shows a strong predictor of poor outcome (OR = 44.9 and 92.16, p < 0.001, respectively). Likewise, Wu and colleagues studied the predictors of mortality in traumatic intracranial hemorrhage from a massive national data bank found that high injury severity score, low GCS score, advanced age, subdural hemorrhage and delayed presentation with aspiration and expanding hematoma as a significant predictor of poor outcome [30].

It is true that patients who have been operated on for chronic subdural hematoma die at a rate associated with their average advanced age and frailty. Older age, antithrombotic medication and alcohol intake are the most well-known risk factors for chronic SDH, which causes brain atrophy, coagulation failure and an increased risk of unintended falls [31]. These days, the illness is recognized as an occurrence that frequently results in a decline in an older individual's health, but it may not be the direct cause; rather, it may be a sign of an impending decline or an exacerbation of other underlying conditions [32]. Most of our patients with chronic SDH have the same history being old, have some degree of frailty and that they don't remember any history of trauma.

However, some reported only a trivial trauma like colliding with a door while walking.

Conclusion

Intracranial hematoma is a major cause of morbidity and mortality worldwide and is particularly challenging to manage in low-resource settings. The current finding shows that intracranial hematomas are more common in males than females. Intracranial hematomas often occur among youths and young adults, which are economically active and reproductive groups of the society. Road traffic accidents and fighting account for the commonest mechanisms of injury. Acute epidural hematoma was the commonest diagnosis, and the majority of patients were operated. The majority of patients had a favorable neurologic outcome while lower GCS, increased ICP, aspiration and pupillary abnormalities were strong predictors of mortality. Patients with ICH often require critical care support, such as mechanical ventilation and monitoring. However, critical care resources are often limited in low-resource settings. As a result of these challenges, the outcomes for patients with ICH in low-resource settings are typically worse than in high-resource settings. Mortality rates are high, and many patients who survive experience significant disability. As trauma is almost invariably the cause of intracranial hematoma, policy formulations to enhance injury prevention, establish better rehabilitation programs and facilities should be sought. There is a need for health education to society to reduce violence-induced injury and create awareness about the importance of seeking early hospital visits.

Abbreviations

JUMC	Jimma University Medical Center
GCS	Glasgow Coma Scale
GOS	Glasgow Outcome Scale
TBI	Traumatic brain injury
AEDH	Acute epidural hematoma
ASDH	Acute subdural hematoma
CSDH	Chronic subdural hematoma
ICP	Intracranial pressure
DSF	Depressed skull fracture
ICH	Intracranial hematoma

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Author contributions

N.S and M.F involved in conceptualizations, data curation, formal analysis, investigations, methodology, supervision, validation, visualization, writing an original draft, and writing review and editing the manuscript. M.A and A.T took part in formal analysis, investigations, methodology, visualization, and writing review and editing the manuscript.

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Availability of data and materials

The data that support the finding of this study are included in the article.

Declarations

Ethical approval and consent for participation

Ethical clearance with Ref No. JHRPGGD/735/20 was obtained from the institutional review board of Jimma University and was brought to the office of JUMC medical director and head of the Surgery department. Then, a formal letter of permission to conduct the study was taken from both administrative bodies. A written informed consent was also obtained from each study participant who was able to communicate and from first degree relatives from those who weren't able to communicate after a clear-orientation of the objectives, benefits, purpose and procedures of the study.

Consent for publication

The participants of this study were informed about the potential for publication of this study material, and their consent was taken.

Competing interests

The authors declare that they have no conflict of interest regarding the publication of this paper.

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