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A Prospective Study On Patterns and Management Outcomes of Intracranial Hematoma at Jimma University Medical Center

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ABSTRACT

***Background**: Intracranial hematoma is the collection of blood in the various intracranial spaces. Knowledge of patterns, origins/causes, and outcomes of ICH conditions are important for decision-making for urgent surgical interventions such as craniotomy and hematoma evacuations. No prior study was conducted in our setup. This study aimed to assess patterns and management outcomes of intracranial hematoma at Jimma University Medical center.*
***Method:** An institution-based prospective cross-sectional study design was conducted at Jimma University Medical Center, Jimma, Ethiopia for 6 consecutive months from June to December 2020. The data were cleaned and entered into Epidata version 3.1 and then exported and analyzed using SPSS Version 24. **Results**: A total of 91 neurosurgery-eligible patients were recruited during the study period with a mean age of 34 years. The majority of neurosurgery 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 hours. Upon presentation, loss of consciousness (48.4%), convulsion (11%), aspiration (9.9%), and increased ICP (12%). The majority (49.5%) of the patients had mild head injuries. 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% of the patients died. All the surviving patients were accessed after one month of discharge and re-assessed, 66 patients had good neurologic (62 uppers and 4 lower good recovery), 11 patients had some disability (7 lower and 4 upper-moderate disabilities), two patients had a severe disability and two patients (those among severe disability) had died.*
***Conclusion**: Trauma was invariably the cause of intracranial hematoma and patients with low GCS, papillary abnormality, aspiration, and increased ICP had an increased risk of dying from their illness. It is good to formulate policy to enhance injury prevention and bring health-oriented behavioral change.*

Keywords: Intracranial hematoma, Management outcomes, Trauma, Jimma University Medical Center, Head injury

INTRODUCTION

Intracranial hematoma is a disorder with a very high mortality rate and extremely poor prognosis among traumatic brain injuries. It is estimated that intracranial hematomas occur in 25%–45% of severe traumatic brain injuries, 3%–12% of moderate cases, and approximately 1 in 500 patients with mild head injury [1,2]. Head injury is a nondegenerative 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 the 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 3 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 has got a variable clinical presentation in acute situations [6]. Acute Subdural Hematoma (ASDH) is a collection of clotting blood that forms in the subdural space & 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 of 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 of such patients is mandatory to guide treatment protocols. To date, the outcome 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 traumatic brain injury. A rise in life expectancy in developing countries 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].

Increasing TBI has paralleled the need for decompression surgery for ASDH and AEDH. Knowledge of key determinants of clinical outcomes of such patients is mandatory to guide treatment protocols. To date, the outcome 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 traumatic brain injury. A rise in life expectancy in developing countries increased the incidence of this condition.

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 Jimma University Medical Center, from July 2020 December to 2020/21.

MATERIALS AND METHODS

Study area and period

This study was conducted at the surgery unit of Jimma Medical Center (JUMC), a tertiary medical center, found in Jimma Town, southwestern Ethiopia. Jimma town is located 357 km southwest of the capital city of Ethiopia, Addis Ababa. It is the special zone of the Oromia region, JUMC provides services to 15 million people with 1600 staff members and 800 beds. The Department of surgery is one of the main departments in JUMC, which gives full-fledged clinical service and offers specialty training. An institutional prospective observational study design was conducted for 6 consecutive months from June to – December 2020.

Sampling and sample size calculation

All patients with intracranial hematoma, surgical patients with CT-proven intracranial hematoma, and Patients admitted during the period of 6 consecutive months from June to – December 2020 were conducted to identify eligible patients for the study. Therefore, a total of 91 neurosurgery patients who met the inclusion criteria were included in the study.

Inclusion and exclusion criteria

Inclusion criteria: All surgical patients with CT-proven intracranial hematoma

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

Data collection tools and procedures

The data were collected through face-to-face interviews, observation, hospital records, patient document cards, and morbidity and mortality reports.

Data management and statistical analysis Data analysis

Checked and cleaned data entered into Epi Data version 3.1. After double data entry verification, data were exported into Statistical Package for Social (SPSS, version 24) for analysis. 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 variables. All variables with $P < 0.25$ in the bivariable analysis were selected as candidate variables for the multivariable logistic regression model. A p-value less < than 0.05 in multivariable logistic regression was declared as statistically significant.

Operational definitions

ICH Outcome: The final result of the surgical patient after management based on 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 condition that is potentially life-threatening surgery usually must be completed within 24 hours [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 manifestation of deteriorating GCS, vomiting, seizure, obliterated basal cisterns, and lately with Cushing's triad [14].

Complication: Is 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 hematoma visited JUMC and 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±sd (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 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%), and the rest are employees, drivers, and merchants. Nearly equal numbers of patients came from urban and rural. Seventy-nine patients (86.8%) had no comorbidities, while 10 (11%) of the patients were hypertensive, one cardiac, and one diabetic patient. Eighty-six (93.4%) of patients had trauma while the rest five 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 the two patients (Table 1).

Table 1. Socio-demographic 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	9	9.9
	Others	12	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

Place of occurrence of Trauma or complaint and Time of arrival to the hospital

Most of the patients were in the outdoor environment 49 (53.8%) during the trauma scene or their health-seeking complaint whereas vehicle occupants and pedestrians were 13(14.3%) each, and the rest 16 patients (17.6%) were in the home environment. The majority 44 (48.4%) of the patients arrived in the hospital in the range of 4 hours to 24 hours after injury, and 32 (35.2%) patients arrive after 24 hours. Among the 91 study patients, 75(82.4%) patients 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 greater than 30 minutes, while six patients have a loss of consciousness for less than 30 minutes. The shortest time was 10 minutes while the longest time was 6 days. Historically, 21 patients (23.1%) have at least one episode of convulsion while the rest 70 patients (76.9%) did not report a complaint of convulsion (Table 2).

Table 2. Place of occurrence of trauma, time of arrival after the complaint, and history of loss of consciousness of neurosurgery patients admitted at Surgery unity of JUMC from June to December 2020

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
	24-Apr	44	48.4
	>24	32	35.2
Hx of LOC	Yes	75	82.4
	No	16	17.6
Duration of LOC	≤ 30 minutes	6	6.6
	>30 minutes	69	75.8

Physical findings at the presentation

Forty-four patients (48.4%) had a loss of consciousness at presentation. Ten patients (11%) and nine patients (9.9%) had convulsions and aspiration respectively at presentation. Eleven patients (12.1%) had signs of increased ICP. 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 fixed pupils. The majority of the patients fall into the category of mild head injury 45(49.5%) 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 a 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 neurosurgery patients admitted at Surgery unity of JUMC from June to December 2020

Variables	Categories	Frequency	Percent
LOC at presentation	Yes	44	48.4
	No	47	51.6
Convulsion	Yes	10	11
	No	81	89
Aspiration	Yes	9	9.9
	No	82	90.1
Increased ICP	Yes	11	12.1
	No	80	87.9
GCS after resuscitation	9-Mar	12	13.2
	13-Oct	34	37.4
	14-15	45	49.5
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
	Bilaterally dilated	1	1.1
Associated extracranial injury	No	77	86.6
	Extremity bone fracture	9	9.9
	Chest injury	4	4.4
	Mandibular fracture	1	1.1

CT scan findings and Type of Hematoma

The majority of the patients had acute epidural hematoma 62 (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 hematomas while 39(42.9%) had a left-side hematoma. Five patients had hematomas on both sides. The majority of patients 44 (48.4%) had hematoma volumes of greater than 60cc followed by 38 (41.8%) of the patients who had hematoma volumes between 30 cc and 59 cc. Thirty-eight patients (41.8%) had no midline shift or less than 3 mm if at all followed by those having midline shift of greater than 5 mm, 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).

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
	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	48.4
Midline shift in mm	<3	38	41.8
	5-Apr	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

Management and anesthesia types and surgical intervention

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

Table 5. Management and anesthesia types 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

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 some disability followed by 10 dead patients. 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).

Table 6. Total discharge outcome and Neurologic outcome and causes of death

	Categories	Frequency	Percent
Discharge outcome	Improved	81	89
	Died	10	11
Neurologic outcome	Good	61	67
	Some 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

Cross tab of gender, age, type of hematoma, Increased ICP, and aspiration versus discharge outcome

Out of the 10 dead patients, seven were males and three were females. Reproductive age groups account for seven of the death out of 10. Among the 10 dead patients, 6(60% of the dead) had acute epidural and 3(30% of the 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 which 7 patients had died. Nine patients had an aspiration of which 7 had died (Table 7). 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 severe head injuries (GCS=3-9). Patients with moderate head injury tend to have less risk of death than those with severe head injury (OR=0.031). Patients having pupillary signs tend to have more risk of dying than patients with the reactive pupil (OR=9.571) (Table 8).

Table 7. Cross tab of 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. Binary logistic regression of increased ICP, aspiration, GCS categories, and pupil 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	9-Mar		1		
	13-Oct	-3.466	0.031	(0.005, 0.202)	<0.001
	>13	-22.041	0		0.997
Pupil sign	Midsize reactive		1		
	Unilaterally fixed	2.259	9.571	(2.134, 42.931)	0.003
	Bilaterally fixed	24.309	36078938157	0	1

DISCUSSION

There were a total of Ninety-one patients recruited in this study. Most of the patients sustained trauma and were admitted to JUMC during the study period from July - 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 and a study done in India at Lahore hospital (M: F ratio of 12.4:1, with a mean age of 36.1years and M: F ratio of 5:1, mean age 34 years). The main reason why intracranial hematoma is more common in males may be due to their more outdoor activities and fighting compared to females [16, 17].

Among these patients, reproductive age groups are having the highest chances of sustaining head injuries and developing an intracranial hematoma. This is because people work hard in this age group and remain susceptible to road traffic accidents and of course physical violence. Pakistani study of 367 patients with epidural hematoma shows similar results with the 20 years -50 years' age group being most affected [18].

Road traffic accident and fighting was the major contributor to neurotrauma admission and operation (63.8%) which is comparable to findings in studies done at Tikur Anbesa hospital (53.2%) and in Taiwan (68.7%) [5,16]. Patients with road traffic accidents tend to have worse outcomes compared to others. Most of the trauma happened in the outdoor environment. The majority of this study patients arrive in the hospital within 24 hours (64.9%) with a median of 14 hours which is the longer time elapsed compared to the Swiss study in which the median time elapsed is 3 hours [7,19].

The majority of patients historically reported a loss of consciousness (82.4%). Upon presentation 13.2% were comatose, 37.45% moderate TBI, and 49.5% mild TBI which is almost similar to the Pakistani study (14.71%, 36.51%, and 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 almost comparable to a study done in Uganda [9]. Contrary to this result studies in Pakistan at Lahore hospital showed subdural hematoma contributing to 33.3% among patients with TBI while epidural hematoma accounts for 16.7% [17]. There is also a comparable finding of skull fracture (51.7% versus 46.7%) while posttraumatic 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 about 43% for acute subdural hematoma which is almost comparable to other literature [20].

About 48.4% of study patients had hematoma volume of ≥ 60 cc and 40.7% had midline shift of >5 mm but neither of them holds a strong statistically significant predictor of poor outcome. The majority of our patients (86.8%) were operated and the rest 13.2% man-aged conservatively. Conservative management was mainly supportive and most patients in this were group given mannitol. Fifteen pa-tients were subjected to respiratory support but only five of them get 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 done at Kenyatta hospital in Kenya [3]. Craniotomy &evacuation was the major procedure (52%) followed by elevation evacuation (26.5%) and Burrhole (18.6%) which is almost comparable with the Kenyan study but burrhole is the second most common Aboprocedre there.ut 84% of the patients had favorable neurologic outcomes (GOS of 4 and 5, 17 and 67% respectively), 4.4% had a severe dis-ability 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 uppers and 4 lower good recovery), 11 patients had some 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 more chance of having favorable neurologic outcomes [3,18].

Among the ten dead patients, eight had a GCS of 6&7, while the rest two had a 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 demon-strated to be the other predictor of death (OR=9.57, p=0.003). Studies in China and other countries showed comparable results [21-23]. The presence of increased ICP and aspiration shows a strong predictor of poor outcome (OR=44.9 and 92.16, p<0.001 respectively).

CONCLUSION

The current finding showed that Intracranial hematoma is more common in males than females. Intracranial hematoma often oc-curred among youths and young adults, which are economically active and reproductive age groups of society. Road traffic accidents and fighting account for the commonest mechanism of injury. Most of the patients arrived in the hospital within 24 hours after trauma and the majority reported a history of loss of consciousness. The acute epidural hematoma was the commonest diagnosis and the major-ity of the patients were operated on. The majority of the patients had a favorable neurologic outcome. Lower GCS increased ICP, aspira-tion, and papillary abnormality were strong predictors of mortality. As trauma is almost invariably the cause of intracranial hematoma, policy formulations to enhance injury prevention, and establish better rehabilitation programs and facilities should be sought. There is a need for health education in society to rid physical violence-induced injury and create awareness about the importance of seeking early hospital visits.

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