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Surgical Outcome of Traumatic Intracranial Hematoma

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Abstract

Objective: To evaluate the factors affecting the surgical outcome of traumatic intracranial hematoma. **Patient and Methods:** This study was retrospectively conducted on 60 patients with traumatic intracranial hematoma admitted to the Neurosurgery Department, Al-Azhar University Hospital and underwent surgical management. **Results:** The age range was 10 - 58 years, mean age was 31.50 years, male-to-female ratio was 3:1. The causative trauma was road traffic accident (45%), direct trauma to the head (30%) and fall from height (FFH) (25%) of all studied patients. Morbidity and/or mortality was reported in 38.3% and unfavorable outcome was significantly associated with longer delay time (time from injury to surgery), increased operative time, long duration of hospital stay and lower Glasgow coma scale at admission and discharge. Otherwise, the unfavorable outcome although increased with old age, there was no significant association. **Conclusion:** Head trauma is considered as a frequent cause of death and disability. Time consuming to reach the hospital, operative time, length of stay in hospital and Glasgow coma score of the patient on admission and discharge markedly determine the surgical outcome of traumatic intracranial hematoma.

Keywords

Intracranial Hematoma, Trauma, Surgical Outcome, Morbidity, Mortality

1. Introduction

Traumatic intracranial Hematomas (TIHs) are life-threatening emergencies. The accumulation of blood inside cranium after traumatic head injury leads to elevation of intracranial pressure, with subsequent damage of the brain that could advance to persistent vegetative state or even death. TIHs are divided into four classes: epidural or subdural hematoma, subarachnoid hemorrhage, and intra-cerebral hematoma [1].

Traumatic brain injury (TBI) is challenging for health care providers and exerts an economic burden on the health care system [2]. Advances in pre-hospital care, management in intensive care units and development of guidelines seem to decrease the burden of TBI [3]. The removal of the hematoma provides release of elevated intracranial pressure and removes the local mass effect. The indications for evacuation of hematoma in such cases are established, and its favorable outcome has been accepted [4]. However, in those under surgical evacuation, favorable outcome and its associated factors have not yet been well studied [5] [6].

2. Aim of the Work

The present study was designed to evaluate the factors affecting the surgical outcome of traumatic intracranial hematoma.

3. Patients and Methods

This study was retrospective included 60 patients, who attended to emergency room (ER) and admitted to the neurosurgery department at Al-Azhar Damietta university hospital. Data collection was extracted from hospital records (patient admission sheets, operative and postoperative details and progressive notes).

All patients included in this study were subjected to the following methodological scheme and followed up for 6 months. The laboratory investigations included complete blood count (CBC), bleeding & coagulation profile, arterial blood gases, serum electrolytes, renal function tests (urea, creatinine), liver function tests (ALT, AST), and blood sampling for typing and cross matching. All had an imaging studies included cranial computed tomography without contrast and with bone window after stabilization of the general condition of the patient, e.g correction of any preexisting hemodynamic instability. In addition, the plain X-ray films were attained for cervical spine, lumbosacral spine, chest and pelvis.

Emergency medical records were reviewed and patients were classified according to cause of trauma (e.g., for example motor vehicle collision). Initial GCS score were assessed in emergency department and documented.

According to the review of radiology report, intracranial hemorrhages were classified into: epidural, subdural, subarachnoid, intraparenchymal, and intraventricular. The degree of midline shift was also determined. Surgical intervention was individualized according to case presentation and results of imaging studies.

The treatment decision was one of the following: conservative treatment with intensive care unit (ICU) admission, immediate surgical intervention or conservative turns into surgical intervention. Indications of surgery were: 1) thickness of hematoma is >1 cm in patients with extra-cerebral hematoma; 2) volume > 30 ml in patients with intra-cerebral hematoma; 3) supratentorial deviation (midline shift) more than 5 mm with compression of lateral ventricle and/or compression of the basal cistern(s).

3.1. Inclusion Criteria

1) head injury with indication for surgical intervention.
2) closed head injury.

3.2. Exclusion Criteria

1) brain death.
2) open head trauma.
3) head injury without surgical intervention.
4) associated severe systemic injury.
5) spontaneous intracranial hematoma.

3.3. Indication of Surgery

Acute subdural hematoma

- Thickness greater than 10 mm,
- Midline shift greater than 5 mm on CT,
- A decrease of GCS by 2 or more points,
- ICP is greater than 20 mmHg,
- Asymmetric or fixed and dilated pupils.

Acute epidural hematoma

- Hematoma larger than 30 cc, more than 15 mm thick or more than 5 mm of midline shift was evacuated regardless of the patient's GCS score.

Focal traumatic parenchymal lesions

- Progressive neurological deterioration referable to the lesion,
- Medically refractory intracranial hypertension,
- Signs of mass effect on CT,
- Patients with any lesion greater than 50 cm^3 in size,
- Patients with GCS 6 - 8 with frontal or temporal contusions greater than 20 cm^3 in volume with at least 5 mm of midline shift and/or cisternal compression on CT scan.

The management protocol passes into the following steps:

- Insertion of a central venous line under strict aseptic technique for infusion of fluids and medications which was done during the first 6 hours of admission, then after stabilization of the patient, C.V.P. was measured every 6 hours for adjustment of the I.V fluids balance.
- Foley's catheter was inserted and urine output was recorded hourly and every 24 hours. A Foley catheter is placed for urinary bladder drainage, for evaluation of adequate urine output, and to accommodate increased urinary volume should mannitol be required. Urine is sampled for 24 urine analysis and drug screening.
- Insertion of nasogastric tube (NG) for passive drainage of the stomach contents in the early days of management. Nasogastric intubation done to de-

compress the stomach, prevent aspiration, and detect any gastrointestinal hemorrhage and later on for feeding.

- Continuous monitoring of blood pressure, pulse, respiration and temperature were done. The results were recorded every hour to detect any sudden changes.
- Venous blood samples were taken for CBC and repeated on daily basis. Serum electrolytes, blood sugar, urea and creatinine were also checked.
- Plain chest X-ray for assessment of the endotracheal tube position and the central venous line. It also helps to follow the chest conditions, early detection and treatment of any complications such as chest infection.
- Osmotic agents and diuretics were used in those cases with persistent intracranial hypertension in presence of hyperventilation. "Mannitol" 20% was administered in a dose of 0.5 - 1 gm/kg/day which would be given every 8 - 12 hours Loop diuretics especially "furosemide" was employed in a dose 0.3 - 0.5 mg/kg to potentiate the effect of "mannitol".
- Antiepileptic treatment in the patients with history of post-traumatic fits or for prophylaxis patients more susceptible to develop fits in patients (e.g. cortical lesions and operated patient). "Phenytoin", as a loading dose (15 - 20 mg/kg) and a maintenance dose (5 - 10 mg/kg) was given slowly I.V (1 ml/minute) to avoid cardiovascular depressant effect. "Diazepam", continuous I.V infusion at a rate (0.1 - 0.2 mg/kg/hour or as needed) in cases of "status epilepticus" In combination with "phenytoin". Other "antiepileptic" drugs were given if needed.

Postoperative morbidities, length of hospital stay (LOS), and GCS score at discharge were obtained and recorded.

Regarding outcome, patients were categorized according to the Glasgow outcome scale with the sex exclusive categories (good recover, mild disability, moderate disability, severe disability, persistent vegetative state or death). Good recovery was considered in patient who returned to his/her previous occupation, irrespective of occupational level (*i.e.*, return to former occupational level or not). Mild disability assigned for patient with mild neurological or mental deficit that not affect their occupational level. Moderate disability describes independence in activities of daily life, but inability to resume former occupational level owing to mental, physical disability or both.

When patient become dependent on others for the activities of daily life, severe disability was assigned. On the other side, persistent vegetative state is defined as absence of adaptation to the environment and of any speech or evidence of mental function in a patient apparently awake and at times displaying spontaneous eye opening.

Finally, patients die immediately due to head injury were differentiation from those died due to secondary systemic complications.

Reassessment was done by Glasgow Coma Scale, pupillary size and reactivity, neurological deficit, eye movement and vital signs. In addition, Serial follow-up

CT brain were done starting from 24 hours following admission if not earlier, in patients who do not show improvement or deteriorate in neurological status, follow up CT in patient with hematoma was done after 6, 12, 24 and 48 hours to detect any increase in the hematoma size or developing of mass effect. According to the degree of recovery, patients were scheduled to attend the neurosurgery outpatient clinic for the follow up.

4. Results

The study included 60 patients (15 Females and 45 Males) diagnosed as intracranial hematoma. Preoperatively all the patients were evaluated using a standardized sheet and the findings were tabulated as preoperative clinical (subjective and objective) and radiological data.

The causative trauma responsible for the head injury in our serious were road traffic accident (45%), direct trauma to the head (30%) and fall from height (FFH) (25%) of all Causes of head injuries (**Table 1**).

The youngest patient included in this serious was 10 years, the oldest patient was 58 years with mean age 31.5 and standard deviation ±14.07, and males were more commonly involved, male to female ratio 3:1.

The time calculated between trauma and hospital admission ranged from 1 to 24 hours, 42 patients were admitted in the first 6 hours after trauma (7 (16.7%) of them had developed morbidity or died). In addition, 6 patients were admitted to our hospital within 7 to 12 hours after trauma (4 of them (66.7%) developed complications or died); while 12 patients were admitted to general hospital then transferred to our hospital with 13 to 24 hours after trauma (All developed complications or died); and there was significant association between delay time and development of complications or death (with increased delay time, the incidence of complications or mortality was increased) (**Table 2**).

Table 1. Frequency of causes of head injury.

Causes	No. of cases	%
Road traffic accident	27	45.0%
Direct trauma	18	30.0%
Falling from high	15	25%
Total	60	100.0%

Table 2. Time to reach hospital and developed morbidity and/or mortality.

	Time to reach Hospital (n = 60)		Morbidity and/or Mortality (n = 23)		X^2	p
	No.	%	No.	%		
First 6 hours	42	70.0%	7	16.7%	29.68	<0.001*
7 - 12 hours	6	10.0%	4	66.7%		
12 - 24 hours	12	20%	12	100%		

For evaluation of pre hospital care patients were divided into 2 groups (both received medical care at hospital) but one did not provide emergency medical services at the field by paramedics and was delivered to the hospital by their relatives (37; 61.7%) and 23 patients (38.3%) received pre-hospital care by paramedics. Death was reported in 8.7% of those who received pre-hospital care and in 24.3% of those who did not receive pre hospital care with no significant difference (Table 3).

In the present work, there was no association between good or unfavorable outcome and each of age or sex of studied patients. However, favorable outcome was significantly associated with shorter delay time. In addition, favorable outcome was associated with shorter operative time, shorter duration of hospital stay, high GCS at admission and at discharge (Table 4).

Here is an illustrative case: A-57-year male presented with loss of consciousness

Table 3. Prehospital care and related mortality.

	Total no.	Percent	survival	Dead	X^2	p
With prehospital Care	23	38.3%	21 (91.3%)	2 (8.7%)	2.3	0.2
Without prehospital care	37	61.7%	28 (75.7%)	9 (24.3%)	1	1

Table 4. Factors associated with outcome in operated cases.

		Total		Outcome				X^2	p
				Good recovery		Morbidity & mortality			
		No.	%	No.	%	No.	%		
Age	>10 - 20	10	16.7%	8	80.0%	2	20.0%	3.79	0.43
	>20 - 30	16	26.7%	8	50.0%	8	50.0%		
	>30 - 40	16	26.7%	9	56.3%	7	43.8%		
	>40 - 50	12	20.0%	7	58.3%	5	41.7%		
	>50 - 60	6	10.0%	5	83.3%	1	16.7%		
	Mean ± SD; range	31.50 ± 14.07; 10 - 58		31.45 ± 15.15; 10 - 58		31.5 6± 12.44; 10 - 53		0.03	0.97
Sex	Male	45	75.0%	29	64.4%	16	35.6%	0.58	0.44
	Female	15	25.0%	8	53.3%	7	46.7%		
Delay time (hours)		6.03 ± 5.07; 2 - 19		3.35 ± 1.49; 2 - 8		10.34 ± 5.82; 2 - 19		**6.97**	**<0.001***
Operative time (minutes)		114.15 ± 23.47; 71 - 185		106.92 ± 22.35; 71 - 145		125.78 ± 20.75; 85 - 185		**3.26**	**0.002***
Hospital stay (days)		11.15 ± 3.02; 6 - 17		10.43 ± 2.60; 7 - 17		12.30 ± 3.35; 6 - 17		**2.42**	**0.018***
GCS at admission		8.20 ± 1.58; 5 - 12		8.73 ± 1.59; 6 - 12		7.35 ± 1.15; 5 - 10		**3.61**	**0.001***
GCS at discharge		13.46 ± 1.01; 12 - 15		13.68 ± 1.0; 12 - 15		12.85 ± 0.80; 12 - 14		**2.69**	**0.010***

following motor vehicular accident, while he was riding bicycle hit by speeding car with right sided hemiparesis associated with repeated episodes of vomiting and ear-nose bleed with one episode of generalized tonic-clonic seizure. He was immediately intubated in emergency department and put on ventilatory support. Examination at arrival, vitals were stable with GCS was 8/15 (E3M4V1). On neurological examination revealed, his right pupil was dilated not reacting to light with left sided paucity of movement. Non-contrast CT scan head revealed presence of left extradural hematoma located over the left temporoparietal region of intracranial compartment, more on left side with right temporal contusion with presence of mass effect, as chinked ventricle on right side with subfalcine herniation (**Figure 1**). He was rushed to operation theatre from CT room, left trephine craniotomy (**Figure 2**) was made with about 75 ml on left sided was evacuated (**Figure 3**). The source of bleed was identified and coagulated, hemostasis secured. At the end of surgery the brain was lax, multiple hitch sutures was taken. The bone flap was replaced and central hitch taken subgaleal extradural drain placed and wound were closed in layers. Following surgery (**Figure 4**) he was extubated on third post-operative day with slow recovery of hemiparesis.

Figure 1. CT Brain showing left parietal extradural hematoma causing mass effect with midline shift >5 mm.

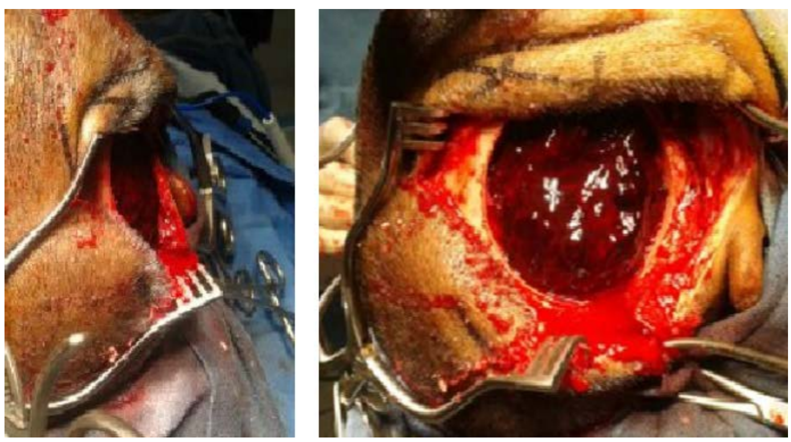

Figure 2. Intra-operative view of trephine craniotomy (right) and left side extradural hematoma (left).

Figure 3. Clinical photograph of evacuated extradural hematoma.

Figure 4. CT Brain showing post-surgical evacuation of left parietal extradural hematoma.

5. Discussion

Head trauma represents one of the causes of significant morbidity and permanent disability in the adult population. Emergency room traumatic brain injury (TBI) admissions include a spectrum that goes from concussions to significant intra-axial and extra-axial cerebral hematomas [4]. In our study number of patient treated surgically are 60 and the morbidity and mortality of surgical treatment is 38.3%. This study in accordance with [7] that included 103 patients operated and overall reported morbidity and mortality was 35.2%. On the other side [8] included 115 patients with extradural hematoma and reported 23.0% rate of morbidity, which is lower than the present work. In addition, [9] reported a mortality rate of 50.0% in patients with subdural hematoma, and [10] reported a favorable outcome to range between 19% - 27% after acute subdural hematoma. Studies from Europe and United States revealed that traumatic acute subdural hematoma (ASDH) has a significant role on the mortality under the age of 45. [11] reported that 63% of traumatic ASDH were males (like the present work) and the mean age of them was 58 years (higher than the present work). [12] reported that 67% of the patients of traumatic ASDHs were male and the mean age was 43 years. [13] reported a male percentage of 60% with a mean age of 51 years, and reported that the majority of the affected patients were males and the mean age of 36 years (near the present work). [14] studied traumatic ASDH patient population with a mean age of 39 years and they observed that 76% of the patients were males.

In the present work, there was no association between patient age and operative outcome. This is contradictory to results reported by [15] who reported that favorable outcome was associated with younger age. In addition, the direct relationship between increasing age and unfavorable outcome after surgical intervention in patients with intracranial hematoma or refractory increased intracranial tension is well reported in other studies [5] [16]. The possible explanation could be attributed to the fact that, the majority of our patients were younger in age.

In the present work, preoperative and at discharge GCS score were positively associated with favorable outcomes, which are reflected in previous studies [17] [18] [19] found that GCS score on the first postoperative day was the single best predictor of good prognosis. The present work also revealed that shorter operative times were associated with more favorable outcomes. The operative time itself could be affected by many additional factors, however. Patients with more severe injuries would be expected to have longer operative time. The surgeon experience would also possibly affect the length of operative time. Similar to operative duration, a measure that has been broadly studied is the time it takes for patients to be taken to the operating room, classically known as injury-to-incision time [20] [21] found that subjects who underwent an early decompression with a mean injury-to-incision time of 4.5 hours had significantly favorable outcome than patients who underwent a delayed decompression. Another work found that longer injury-to-incision time is really associated with better outcome [20]. This, however, can be a selection bias of patients with more severe injuries needing to be operated on sooner.

In our study show Morbidity and Mortality of surgically treated cases of age group less than 20 year was 20% and 21 - 30 year 50% and for 30 - 40 year was 43.8% and 40 - 50 was 41.7% so the increase age (from second to fourth decades) lead to increase morbidity and mortality outcome, then decreased with fifth and sixth decades. This is in accordance with. [22] that reported an increased mortality and morbidity in elderly populations attributed to systemic complications such as pulmonary infection. Also [23] reported that there is strong correlation exists between age and outcome (which could not be proved in the present work).

In our study the causative trauma responsible for the head injury in our serious were road traffic accident (RTA) (45%), direct trauma to the head (30%) and fall from height (FFH) (25%). These are in accordance with [24] who reported that, the RTA most common cause of intracranial hemorrhage (62%), while fall from height (FFH), direct trauma to the head and sports injuries represent (38%).

6. Conclusion

In our study, the morbidity and mortality outcome with respect surgical management is 38.3%. Time calculated to reach hospital, GCS at admission and at discharge, length of operation and duration of hospital stay were the significantly associated factors with morbidity and/or mortality. Road traffic accidents remain the most common cause of intracranial hematoma.

Conflicts of Interest

The authors whose names are listed immediately below certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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