

## Epidemiological approach to emergent cranial surgery of cranial traumas

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### Abstract

**Objective:** In this study, we aim to define the emergent cranial surgery of cranial trauma cases in terms of the reason of occurrence, diagnosis, prognostic factors and results.

**Methods:** 153 cases hospitalized in our clinic during a four year period were statistically analysed in accordance with trauma etiology, age, gender, application GCS (Glasgow Coma Score) mortality rate, location and established pathology.

**Results:** 76% (116) of the 153 cases were male. The most frequent etiological reasons were, in descending order, traffic accident 52% (n = 80), fall 34% (n = 53), direct trauma to the head 14% (n = 20). 45% (n = 69) were diagnosed epidural haematomas, 26% (n = 40) were diagnosed depression fractures and 3% (n = 5) were diagnosed intracerebral haematomas.

A meaningful statistical difference was found in the comparison of the diagnosis regarding gender (p=0,012) age group (p=0,0282) and GCS (p=0,0001).

**Conclusions:** In order to prevent cranial traumas, studies aimed at minimizing traffic accidents should be undertaken. The most essential action after the accident has occurred is triage, and this is of great importance in order to establish communication among the health institutions.

*Key words: cranial trauma, Glasgow Coma Score, trauma etiology*

### Introduction

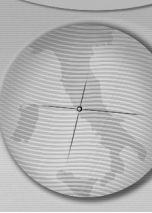
Cranial traumas are not only a significant cause of death but also a cause of severe disability which require long-term medical care. The major cause of cranial traumas is traffic accidents. Cranial traumas, resulting from traffic accidents, are more frequently seen among the young. 60% of the cranial trauma fatalities are due to traffic accidents. Cranial traumas include cranial fractures as well as diffuse and focal brain injuries. Epidural haematomas, acute subdural haematomas and intracerebral haematomas are considered to be focal injuries. Cranial fractures may appear as linear, comminuted, diastatic, basal or depressed fractures. [1-5]

Depressed fractures result from highly concentrated energy; 75% of depressed fractures are in the frontal and parietal regions. 50% of

depressed fracture cases do not result in loss of consciousness, and in this group of patients the mortality rate is pretty low. However, open fractures consist of depressed fractures, for which there is a high risk of infection. Dural lacerations, contusions and haematomas may also exist. [2,3,5]

Epidural haematomas are among the most known and treatable complications. The major factors defining prognosis are the existence of extra intracranial pathologies in computerised cranial tomography, neurological examination evidence and patient's level of consciousness before the operation.

Extra intracranial pathologies are frequently seen with linear fractures [2,5,6]. Even though high mortality rates (10 cases- 55%) were reported for epidural haematoma cases before the active



use of computerised cranial tomography, mortality rates decreased as a result of optimal diagnosis and treatment [2-10]

The vast majority of acute subdural haematomas are of venous origin. They are caused by either the bridging vein tears or arterial canals torn by cerebral contusions. Acute subdural haematomas are most frequently seen in frontal, temporal and parietal regions. 3/4 of cranial trauma deaths result from acute subdural haematomas [1,2,7]. Mortality is higher than 50% in most series. The reason of the high mortality rate is parenchymal lesions appearing with acute subdural haematomas [3,5,11,12]. Early diagnosis and surgical intervention is of the utmost importance [5,11].

80 - 90% of intracerebral haematomas are seen in frontal and temporal regions. They are frequently accompanied by occipital and lateral fractures. Clinical condition depends on not only trauma severity but also the growth, dimension and localisation of haematomas. These haematomas do not respond positively to medical treatment; whatever the clinical condition is large haematomas must be drained. In most cases, there are extra cranial lesions [2-5].

In this study, we aim define emergent cranial surgery in terms of the reason for its occurrence, diagnosis, prognostic factors and results.

## Methods

This defining type of research, consisting of cases hospitalized by cranial trauma in our clinic, was conducted retrospectively by examining archives, MRI (Magnetic Resonance Imaging) results and operation notes. The cases were diagnosed through medical history as well as clinical and radiological research. Computerised Cranial Tomography, lateral cervical graphies, lateral craniographies, and X-ray were used for radiological diagnosis.

Glascow Coma Score (GCS) was used to evaluate the patients' level of consciousness. The cases were analysed in accordance with trauma etiology, age, gender, Glascow Coma Score, mortality rate, localization and established pathologies. For the statistical analysis, as we comparing categorical variables for each group the chi-square test was used, the level of the significance was set at  $p \leq 0.05$ .

## Results

This defining type of research, consisting of 153 operated cases from 777 patients hospitalized with cranial trauma in our clinic, was conducted retrospectively by examining archives, MRI results

and operation notes. 116 cases (76%) were male. Cranial traumas are most frequently seen among men. The most frequent reasons were, in descending order, 52% (80) of cases were from traffic accidents, 34% (53) of cases were from fall and 14% (20) of cases were from direct trauma to the head. 45% (69) of cases were diagnosed as epidural haematomas, 26% (40) were diagnosed as depressed fractures, and 3% (5) of cases were diagnosed as intracerebral haematomas. The age groups of the cases who were operated on were as follows; 22% of cases were between 21-30 years, 20% of cases were between 11-20 years, 18% were between 0-10 years, 18% of the patients were above 51 years, 13% of cases were between 31-40 years and 9% of cases were between 41-50 years. At the point of hospitalization in our clinic the Glascow Coma Scores of 50% of cases were between 14-15, 22% were between 9-13, and 28% were between 3-8. Sixty-three of the cases were parietal lesions and 52 of the cases were temporal lesions.

Thirty-eight cases died, while 25 cases (66%) had acute subdural haematomas; the mortality rate in our clinic was 24%.

A statistically significant difference was found in the diagnostic comparison of depressed fracture and intracerebralhaematomas in terms of gender with  $p=0.0212$ ;

The respective rates for male and female with the following were: epidural haematomas 85.5% and 14.5%; depressed fractures 77% and 23%; intracerebral haematomas 60% and 40%; while the rates for men and women with acute subdural haematomas were 60% and 40%.

In Table 1, the frequencies of diagnosis according to gender can be seen.

When age is considered, epidural haematomas are diagnosed mostly in those between 11-20 years (27,5%), and 21-30 years (26%); depressed fractures are seen mostly between 0-10 years (35,89%); and subdural haematomas are mostly seen among those above 51 years (45%).

The majority of cases were between 21-30 years (22%) and 11-20 years (20%). A statistically significant difference was found in diagnosis range in terms of age groups ( $p=0,0282$ ). The difference results from the acute subdural haematoma and depressed fracture cases. In Table 1, the frequencies of cases in terms of age groups has been presented.

A significant difference was observed when the diagnosis was evaluated concerning trauma causes ( $p=0,5982$ ). When diagnosis is evaluated with regard to trauma causes, traffic accidents are the most frequent reasons in epidural haematomas (53,6%), depressed fractures (43,6%), and acute subdural haematomas (60%). In Table 2, the

Table 1. The frequencies of diagnosis regarding gender and age groups.

	Epidural haematoma		Depression fracture		Subdural haematoma		Intracerebral haematoma		Total		p*
	Number	%	Number	%	Number	%	Number	%	Number	%	
<b>Gender</b>											
Male	59	85.5	30	77	24	60	3	60	116	76	
Female	10	14.5	9	23	16	40	2	40	37	24	0.0212
<b>Age groups</b>											
0-10 years	12	17	14	36	2	5	-	-	28	18	
11-20years	19	27.5	6	15.5	5	12.5	-	-	30	20	
21-30 years	18	26	8	20.5	6	15	-	-	32	22	
31-40years	8	11.5	7	18	5	12.5	1	20	21	13	
41-50years	5	7.5	3	7.5	4	10	2	40	14	9	
Above 51	7	1.5	1	2.5	18	45	2	40	28	18	0.0282

\*p-value of gender, age groups (with chi-square test)

diagnosis frequencies regarding the trauma reasons has been presented.

There was statistically significant difference in the comparison of diagnosis regarding Glasgow Coma Score ( $p=0,0001$ ). A comparison of diagnosis in terms of Glasgow Coma Score is as follows; the Glasgow Coma Score ranges between 14 to 15 in 59.4% of epidural haematoma cases, between 14 to 15 in 74.3% of depressed fracture cases, between 3 to 8 in 65% of acute subdural haematoma cases, and between 3 to 8 in 80% of intracerebral haematoma cases. The frequencies of diagnosis according to Glasgow Coma Score is presented in Table 2.

There was no statistically significant difference in localization and diagnosis ( $p=0,2432$ ). In terms of localization, epidural haematomas are most frequently temporally localized with a rate of 47,8% (33 cases), depressed fractures are most frequently

parietally localized with a rate of 56,4% (22 cases) and intracerebral haematomas are most frequently parietally localized with a rate of 80% (4 cases). In Table 2, the frequencies of cranial localization of the cases has been presented.

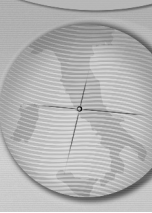
## Discussion

In many studies of acute subdural haematoma, mortality rate ranges from 50 to 90%; here it was 62.5% which is similar to findings in other studies [11,13]. Early surgical intervention is of utmost importance, mortality rate is 30% in those operated on in the first four hours; whereas, it increases to 90% in those cases operated on later than the first four hours. These results emphasize the importance of organized health care. Early surgical intervention should be made possible by the effective application of triage and a well-

Table 2. The frequencies of diagnosis regarding trauma reasons, Glasgow Coma Score and cranial localisation.

	Epidural haematoma		Depression fracture		Subdural haematoma		Intracerebral haematoma		Total		P*
	Number	%	Number	%	Number	%	Number	%	Number	%	
<b>Trauma Reasons</b>											
Traffic accidents	37	54	17	43	24	60	2	40	80	52	
Fall	27	39	13	33.5	10	25	3	60	53	34	
Direct trauma to the head	5	7	9	23	6	15	-	-	20	14	0,5982
<b>GCS</b>											
GCS 3-8	10	14.5	3	8	26	65	4	80	43	28	
GCS 9-13	18	26	7	18	9	22.5	1	20	35	22	
GCS 14-15	41	59.5	29	74	5	12.5	-	-	75	50	0,0001
<b>Cranial localisation</b>											
Temporal	33	48	6	15	12	30	1	20	52	33	
Frontal	9	13	9	23	15	37.5	-	-	34	22	
Parietal	24	35	22	56	13	32.5	4	80	63	42	
Posteriorfossa	3	4	2	6	-	-	-	-	5	3	0,2432

\*p-value of trauma reasons, GCS, cranial localisation (with chi-square test)



organised health care system [14].

In the etiology of many acute subdural haematoma series, fall and direct trauma to the head appear to be the major causes. In many series of epidural haematomas, traffic accidents are the major reason; whereas, in some other series, fall appears as the major reason [7,22,23].

In our series of cases, the most frequent reason was traffic accidents (60%). The frequency of traffic accidents in our country has an undeniable effect on the mentioned results [14,15]. There is a direct relationship between Glasgow Coma Score and mortality. In severe cranial traumas mortality rate increases in those with a with Glasgow Coma Score of 3 to 8.

Also, in our series of acute subdural haematoma cases those with a Glasgow Coma Score of 3 to 8 had a mortality rate of 96%. Glasgow Coma Score of all the acute subdural exitus cases were between 3 and 8. This is also valid for epidural haematoma [7,16,17] When the existus rate is considered, it was found that prognosis is worse for acute subdural haematoma. Glasgow Coma Score is of utmost importance in the evaluation of mortality and prognosis. Mortality rate increased in severe cranial trauma cases whose Glasgow Coma Score ranged from 3 to 8, which is also clarified in acute subdural haematoma cases.

In different series, the major cause of cranial trauma is traffic accidents, particularly in male patients. It has been stated that motorcycle accident mortality rates increase in severe cranial traumas. In our series, the frequency of traffic accidents is significant. However, motorcycle accidents were not considered as a separate group among all the traffic accidents.

Perhaps it is the popularity of motorcycle riding in countries in which these studies were conducted, that causes the majority of traffic accidents. It may also be stated that being a part of the daily activities of men more so than for women might be the major reason of men being exposed to cranial traumas. [18-21]

The findings of our research show the factors affecting trauma. While conducting the research, we faced several limitations one of which was related to the records. It was difficult for us to confirm the period between trauma and surgical intervention due to the inadequacy of emergency records.

Another limitation relates to the number of cases. The number of study participants was 153 all of which were cranial trauma patients.

The relationship between variables was compared using only the chi-square test and the tables contain only absolute frequencies and

percentages. Multivariate analysis approach has not been used.

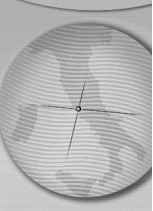
### Conclusions

In this study, the results of cranial trauma cases which were applied to emergent surgical intervention were evaluated. Traffic accidents are the major causes of cranial traumas which require surgical interventions. Cranial traumas are severe problems with high mortality and morbidity rates. Solutions for the problem requires not only early and effective surgical interventions but also protective and preventive services. Due to the inadequacy of emergency records, the period between trauma and surgical intervention could not exactly be confirmed; however, in our opinion, early surgical intervention results are better.

In order to decrease the number of cranial traumas, research to prevent traffic accidents should be conducted. The most important stage after the accident is triage. Triage is a continuous and lasting process and its application at all levels might have an important role in finding a solution to this problem. Ensuring communication among the different medical institutions is beneficial to the existence of exact and efficient health care.

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