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Factors Affecting the Surgical Outcome in Extradural Hematoma in Punjab Institute of Neurosciences, Lahore, Pakistan

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Head injury is a leading cause of death in young age group. Extradural hematoma, a complication of head injury, is often fatal if not treated in time. The surgical outcome of EDH is dependent upon many variables including preoperative GCS, time between injury and surgery, associated intracranial injuries, anisocoria and hematoma volume. In order to reduce the mortality near to nil, it is essential to determine the magnitude of effect of affecting factors on surgical outcome which will also help us in preoperative counseling and prioritizing the operative candidates.

This study was conducted determine the factors affecting surgical outcome of traumatic intracranial extradural hematoma in Punjab Institute of Neurosciences/ Lahore general hospital, Lahore. It was a Cross sectional study conducted for 3 years from 28th May 2012 to 28th May 2015.

The study was conducted on the patients admitted through emergency and diagnosed as Extradural hematoma. These patients underwent surgical evacuation of EDH on emergent basis and outcome was measured by Glasgow Outcome Scale (GOS) after 48 hours of surgery.

Using GOS, good surgical outcome was observed in 80.9% (157 out of 194) patients. Preoperative GCS, anisocoria, hematoma volume, associated intracranial injuries and time between injury and surgery were the factors affecting the outcome significantly (p value=0.000) while age and sex of the patient had no significant effect.

In Conclusion, good surgical outcome is associated with patients with solitary Extra Dural Hematoma of volume less than 60ml, preoperative GCS more than 8, absence of anisocoria and undergoing surgical evacuation within 6 hours of injury.

Key Words: Head injury, Extradural hematoma, Surgical outcome, Affecting factors.

Head injury is a leading cause of death in the age group of 16 - 40 years.[3] Intracranial Extradural Hematoma (EDH) , a common complication of head injury, is often fatal if not treated in time.[15] With the advent of wide availability of CT Scan, the diagnosis of EDH is improved. The incidence of EDH in traumatic brain injury has been reported to be in the range of 2.7 – 4 %.[6] Temporal region is most prone for developing EDH in head injury, followed by frontal and parietal regions, making the Posterior fossa least common.[2] Most of patients

present with headache, vomiting, altered sensorium and lucid interval.[7,8]

The surgical outcome of traumatic intracranial extradural hematoma is dependent upon many variables, in which the following five have special importance: Associated intracranial injuries, Anisocoria, Time between injury and surgery, hematoma volume and pre-operative GCS.[7]

Associated intracranial injuries are found in 32.46% of cases of EDH and are important to prognosticate the outcome, as 15 out of 45 patients (33.3%) who expired with EDH had associated brain injuries.[2,8,10] These injuries may be subdural hematoma, contusion and intracerebral hemorrhage. About 15-22% of patients have anisocoria prior to surgical evacuation of EDH.[2,8]Extradural hematoma persisted for more than 70 minutes were associated with 100% mortality.[3] Chowdhury NK SM et al and Ayub S et al mentioned the time between injury and surgery and the hematoma volume as important factors affecting the surgical outcome.[1,5] Mortality rate of 23.5% in patients having surgery later than 6 hours of injury can be reduced to 18.5%, if surgery is performed within 6 hours of injury.[15] While, hematoma volume of < 50 ml and > 50 ml are associated with poor outcome(G.O.S10 = 3-5) in 10% and 44.4% of patients respectively.9 The patients having GCS 13-15 at admission have a good outcome in 85% of cases, while those with GCS 9-12 and 3-8 have 67% and 39% respectively.[7]

This most rewardingly considered injury treated by neurosurgeons has still many things to be uncovered to reduce the mortality near to nil. The rationale of this study is to determine the magnitude of the effect of the said factors on the surgical outcome, which will help not only in preoperative counseling and in prioritizing the operative candidate but also in minimizing the mortality and morbidity in youth in a developing country like ours.

Material and Methods

The patients with traumatic intracranial extradural hematoma diagnosed on CT Scan Brain Plain, fulfilling the inclusion criteria admitted through emergency at department of neurosurgery unit 1, Punjab Institute of Neurosciences/ Lahore general hospital, Lahore were included in this study after taking informed consent from the patient if he/she was able for it, or without consent if otherwise in the best benefit of patient.

After initial resuscitation in Emergency, a CT scan Brain plain was performed as per NICE (National Institute for Health and Clinical Excellence) Guidelines for CT Scan in Head Injury. Conservative management was decided for the patients who had all of the following:

1. Volume < 25 cm^3 2. Thickness < 10 mm 3. Midline shift < 5m 4. GCS > 8 5. No focal neurological deficit.

All the other patients were shifted to emergency operation theatre on emergent basis after blood arrangement and consent. Surgical evacuation was performed within first 24hrs in all patients. Under general anesthesia, after all aseptic measures, incision was given according to site of hematoma. Craniotomy was done by 3 or 4 burr holes, followed by evacuation of hematoma. Hemostasis was secured and hitch sutures were applied prior to wound closure. Postoperatively all the patients were shifted to neurosurgical ICU. Surgical outcome was measured by the Glasgow Outcome Scale after 48 hours of surgery.

Data regarding age, sex, mean time between injury and surgery, GCS at admission, pupillary asymmetry, associated intracranial injuries & hematoma volume on CT scan, and outcome measured by G.O.S were recorded on the predesigned Performa (enclosed). GOS 4 and 5 was regarded as good surgical outcomes and 1 to 3 GOS was regarded as poor surgical outcome. The data were entered in SPSS (Statistical program for social sciences) version 20. Data entry was double checked for any human error. Mean ± standard deviation was employed for numerical variables like age; whereas frequencies and percentages were computed for categorical variables like gender, time between injury and surgery, GCS, anisocoria, hematoma volume on CT, associated intracranial injuries, Glasgow outcome scale and final outcome. The stratification was done with regard to age, gender, time between injury and surgery, anisocoria and hematoma volume on CT to control the effect modifier. Chi-square test was used to observe relationship between different variable factors and surgical outcome. Any association having a probability value (p-value) of <0.05 was considered statistically significant.

Results

Out of 194 patients, 142 were males and 52 were females with a male to female ratio 2.2:1.

Patients with minimum age were 16 years and maximum was 45 years, majority of the patients were around 30 years of age with a mean age of 30.1 years.

109 patients (56.2%) presented in A&E Department with a GCS was in 9-13. The GCS was in 14-15 and 3-8 ranges in 26.8% and 17% respectively.

15% of patients (29 out of 194) with extra dural hematoma had anisocoria when examined preoperatively. The rest 165 patients had bilateral equal pupils on inspection.

Majority of patients (i.e. 54.6%) showed extra dural hematoma volume on CT scan brain plain in the range

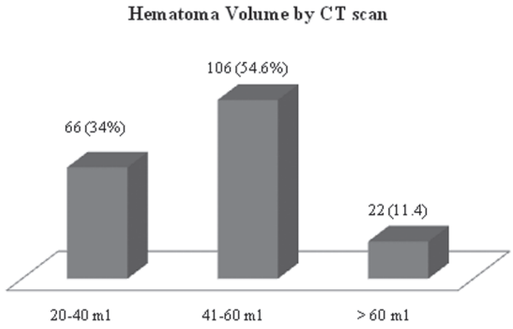

Figure 1: Hematoma Volume by CT scan

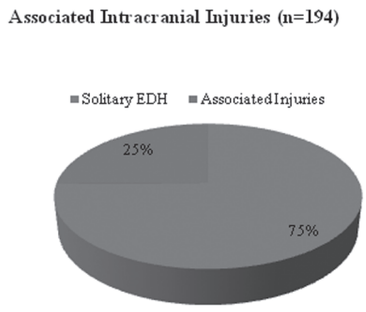

Figure 2: Associated Intracranial Injuries

between 41-60 ml. Hematoma volume of 20-40 ml was found in 66 patients (34%). The rest 11.4% of patients had hematoma volume more than 60ml. (Figure 1)

One fourth of 194 patients showed associated intracranial injuries on CT scan brain plain like contusions, subdural hematoma and subarachnoid hemorrhage. While 75% had solitary EDH (Figure 2).

Almost 70% of patients were operated within 6 hours of injury. The remainder 30% (i.e. 58 patients) had time between injury and surgery more than 6 hours.

After surgery 80.0% of patients (157 out of 194) with extra dural hematoma had good surgical outcome, out of which 104 patients (53.6%) had Glassgow Outcome Scale of 5 and the remainder 53 (27.3%) had GOS 4. The remaining 19% (37) of patients were in poor surgical group. Patients with GOS 3 and 2 were 26 and 3 respectively. Eight patients expired after surgery (GOS=1) (Table 1)

The sex of the patients had no significant effect on final outcome when analyzed statistically, with a P value of 0.372.

The preoperative GCS of the patient showed significant effect on final outcome. 48 out of 52 patients (92.3%) with GCS 14-15 had good surgical outcome just like 100 out of 109 (91.7%) with GCS 9-12. While the patients with poor GCS of 3-8 had poor surgical outcome in (71.4%). (P value<0.001) (Table-2)

Anisocoria is associated with poor surgical outcome as 82.7% of the patients with anisocoria ended up in poor outcome group. Only five out of 29 patients with anisocoria were in good outcome group. (P value <0.001) (Table-2)

All the patients with hematoma volume more than 60ml had poor outcome while 94% and 89.6% of the patients with volume 20-40ml and 41-60ml respectively had good surgical outcome following evacuation of EDH. (P value <0.001) (Table-2)

When EDH was associated with other intracranial injuries on CT scan, 53.1% of patients (28 out of 48) had poor surgical outcome while, in patients with no associated intracranial injuries with EDH only 9 out of 146 (6.2%) showed poor outcome. (P value<0.001) (Table-2)

All the patients (70%) who were operated within 6 hours of injury ended up in good outcome (i.e. GOS 4 and 5). The patients in which the surgery was delayed (more than 6 hours since injury) 63.7% and 36.3 % had poor and good outcome respectively. (P value <0.001) (Table-2)

Discussion

In our study the highest number of victims was in their most active period of life with a mean age of 30.13 years. This age is comparable with the age mentioned in studies of Ozkan U et al and Cheung PS et al, who found the mean age of patients with traumatic extradural hematoma as 26.9 years and 37.7 years respectively in their series.[7,15] Babu ML in his experience of 300 EDH cases noticed the third decade as the most frequent age group which was later reproduced in 2008 by Chowdhury NK SM in his study of 610 patients.[1,4]

In our series of 194 patients, 142 were males and 52 were females with a male to female ratio 2.2:1. Much higher male predominance 0f 13:1 was reported in a Pakistani study on 38 patients at Pakistan Institute of Medical Sciences, Islamabad by Mushtaq etal.[13] In the larger series the ratio of male to female ranges from 3.18:1 to 6.27:1 that can be comparable with our result.

Patients with traumatic EDH frequently present with altered state of consciousness[8] that is measured in terms of Glasgow coma scale. In our study, 109 patients (56.2%) presented with a GCS with, while the GCS was in 13-15 and 3-8 ranges in 26.8% and 17% respectively.[5, 9, 13, 14] This is in contrary to the results of Cohen J et al and Cheung PS et al in which the GCS of the majority of patients was in 13-15 range, i.e. 67% and 70% respectively.[7,9] The reason of more patients with decreased GCS in our series is due to the inclusion of the very cases who underwent neurosurgical evacuation of hematoma as compared to the studies mentioned in which patients who needed conservative management only were also included.

In literature, about 15-22% of patients have anisocoria prior to surgical evacuation of EDH.[2,8] Our result with

S.no.		GOS	Number (%)	Total n (%)
1.	Good Outcome	5	104 (53.6)	157 (80)
2.		4	53 (27.3)	
3.	Poor Outcome	3	26 (14.4)	37 (20)
4.		2	3 (1.5)	
5.	Expired	1	8 (4.1)	
Total				194 (100)

Table 1: Gcs Of The Patients And Their Effect On Surgical Outcome (Gos)

S.no.	Factors	Pre-op GCS		Outcomes	
		GCS	n (%)	Good (GOC 4, 5) n (%)	Poor (GOC 1-3) n (%)
1.	Pre-operative GCS	14-15	52	48 (92.3)	4 (7.7)
		9-13	100	92 (92.0)	8 (8.0)
		3-8	42	12 (28.6)	30 (71.4)
		P value		<0.001	
2.	Anisocoria	Present	29 (15)	5 (17.5)	24 (82.5)
		Absent	165 (85)	158 (95.8)	7 (4.2)
		P value		<0.001	
3.	Hematoma Volume	> 60 ml	22 (34)	0 (0)	22 (100)
		41-60ml	106 (54.6)	95 (89.6)	11 (10.4)
		20-40 ml	66 (11.4)	63 (94)	3 (6)
		P value		<0.001	
4.	Intracranial Injuries	Present	48 (25.0)	20 (41.7)	28 (58.3)
		Absent	146 (75.0)	137 (93.8)	9 (6.2)
		P value		<0.001	
5.	Time of Surgery	≤ 6 hours	136 (70)	136 (100)	(0)
		>6 hours	58 (30)	21(36.3)	37 (63.7)
		P value		<0.001	

P value significant for chi square test

Table 2: Factors Affecting Surgical Outcome (Gos) In Edh

15% of patients with anisocoria is comparable with these studies.

One of the most important prognostic factors in extradural hematoma is its volume.[13] Chowdhury and Ayub also explained the importance of volume in surgical outcome.[1,8] In our series, there were three groups with respect to EDH volume i.e 20-40ml, 41-60ml and > 60ml. Majority of the patients (54.6%) were with volume between 41- 60ml, followed by 34% with 20-40 ml volume. Only 11.3% of patients had volume > 60 ml.

Cheung PS in his study in Hong Kong showed 5 patients out of 89 (5.6%) to have associated intracranial injuries in traumatic EDH cases.[7] In the relatively larger series of 300 patients, Babu ML et al got a higher i.e. 14.3 % cases with associated injuries along with EDH.[2] Later in 2008, Chowdhury NK SM et al published still a higher percentage of 32.4% (in 610 patients) for associated injuries.[8] While comparing, our result of 25% associated traumatic injuries is somewhat in between these two larger series. Our result is very comparable with the study at Saudia Arabia, in which 73% had EDH alone and 27% had additional intradural injury. [8]

In the present study, 70% of the patients had operation and evacuation in less than 6 hours of injury; the remainder had time between injury and surgery more than 6 hours. This was contrary to the retrospective clinical study of Ozkan in which 76.5 % of cases with EDH were operated later than 6 hours and only 23.5% got operation in less than 6 hours. [2]

There are multiple studies in the literature explaining the possible factors on which the surgical outcome of extradural hematoma depends in which the following five

have special importance: Associated intracranial injuries, Anisocoria, Time between injury and surgery, hematoma volume and pre-operative GCS. [1, 2, 4, 7, 8]

In the present study the surgical outcome of EDH was measured by Glasgow outcome scale (GOS). After surgery 80.9% of patients (157 out of 194) with extradural hematoma had good surgical outcome (GOS 4 & 5). The remaining 19% (37) of patients were in poor surgical group (GOS 1-3). Mushtaq et al got comparable postsurgical outcome i.e. 86.8% were in good scale and the remaining 13.2% were in poor scale.[13] Similarly, Cheung experienced postsurgical good and poor outcome in 76.6% and 23.3% respectively.[6] The mortality rate of 4.1% in our study is comparable to the 2.63% of Mushtaq's series[13]. Cheung PS et al reported a higher mortality of 13.3%.[7]

In our series, the impact of preoperative GCS on outcome was significant. The patients with GCS 13-15 and 9-12 had good surgical outcome in majority of cases i.e. 92.3% and 91.7% respectively; while the GCS 0f 3-8 had poor outcome in majority (72.7%). This result is supported by the Hong Kong series; in which GCS of 13-15 and 9-12 had good final outcome in 90.5% & 100% respectively and GCS 3-8 had poor outcome in 71.4%.[7] The Pakistani study published better outcome of 100% for GCS of either 13-15 or 9-12, with only 55.5% poor outcome for GCS 3-8. [13]

In the present study, anisocoria was associated with poor surgical outcome as 82.7% of the patients with anisocoria ended up in poor outcome group. This is not supported at all by Haselsberger K et al, who achieved good outcome in 100% of cases who presented with anisocoria. Cohen et al reported 100% mortality if anisocoria persists for more than 70 mins. [9,11]

Hematoma volume is calculated on CT Scan Brain by measuring the three dimensions (i.e. transverse, anteroposterior and craniocaudal) in mm and using the formula: 0.5 x transverse diameter x anteroposterior diameter x craniocaudal diameter. Many studies included this variable while determining the factors affecting outcome in EDH patients.[13] In our series, volume of >60ml had poor outcome in 100% of cases, while volume of 20-40ml and 41-60 ml had good surgical outcome in majority (i.e. 94% and 89.6% respectively). This observation is partly supported by Mushtaq, with 90% good outcome when hematoma volume is < 50ml. In contrary, Mushtaq et al. reported good outcome in still 83.3% of cases even when the volume was >50ml. [13]

A study identified associated brain lesions as one of the four independent predictors of unfavorable outcome after surgery for EDH and this has been confirmed by several others [5, 6]. In the present , when EDH was associated with other intracranial injuries on CT scan, 53.1% of patients had poor surgical outcome while, in patients with no associated intracranial injuries with EDH only 6.2% showed poor outcome. Our this result is in favor of the previous studies and shows that these are associated injuries rather than EDH per se that affects prognosis in these patients.

Ozkan in his retrospective analysis published that mortality rate of 23.5% in patients having surgery later than 6 hours of injury can be reduced to 18.5%, if surgery is performed within 6 hours of injury.[15] Similarly in our study, all the patients who were operated within 6 hours of injury ended up in good outcome (i.e. GOS 4 and 5); while the patients in whom the surgery was delayed (more than 6 hours since injury) 63.7% and 36.2 % had poor and good outcome respectively. Eight patients (4.1%) expired in our series, all of whom had time between injury and surgery of more than 6 hours. Thus, by our study, mortality of 4.1% can be reduced to 0% by simply expediting the evacuation of blood in traumatic EDH patients.

Conclusion

Time between injury and surgery, preoperative GCS, anisocoria, hematoma volume and associated intracranial injuries affect the surgical outcome significantly. Good surgical outcome is associated with patients with solitary extra dural hematoma of volume less than 60ml, preoperative GCS more than 8, absence of anisocoria and undergoing surgical evacuation within 6 hours of injury.

Conflict of Interest: None to declare

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