

Retrospective Analysis of Surgical Outcome in Traumatic Extradural Haematoma: An Institutional Experience

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ABSTRACT

Background: Traumatic extradural hematoma (EDH) has been recognized for more than 140 years. 100 years ago, the mortality rate of EDH was as much as 86% and traumatic EDH remains a true neurosurgical emergency. With the introduction and wide availability of cranial CT, early diagnosis and timely surgical intervention for EDH is an attainable gold standard. Indeed, the treatable nature of EDH has led some authors to suggest that "toward zero mortality" is an achievable target with respect to this condition.

Aim and Objective: The aim and objective of this research was to study epidemiology, etiology, clinical presentations and the postoperative outcome in patients with head injury with an extradural hematoma. Also to evaluate mortality and functional outcome (GOS) and to formulate recommendations for improvement of therapy.

Methods and Materials: This study was done at department of neurosurgery at tertiary care center. Retrospective analysis of collected data through hospital information system of patients operated for traumatic extradural hematoma was done between September 2015 and December 2017. Ethical clearance was obtained from institutional review committee. Categorical data were expressed as rates, ratios and percentages and the comparison was done using chi-square test. Continuous data was expressed as mean \pm standard deviation.

Results: In our study maximum patients from third decade of life suffered head injury with male predominance. RTA was the commonest cause of traumatic EDH. 80% cases had history of loss of consciousness, "the hallmark symptom of extradural hemorrhage". 97% of patients presented with equally reacting pupils at the time of admission. Parietal EDH was

most common (41.5%) followed by Temporal EDH (39.2%). 72.3% patients were having EDH volume \leq 60 ml. Following surgery, 93.9% patients had good recovery, 2.3% patients had moderate disability whereas only 4% patients had severe disability, persistent vegetative state or death until discharge. At 3 months follow up 127 patients (97.7%) had good recovery and 1(0.8%) patient had moderate disability.

Conclusion: The present study concludes that, road traffic accident was the commonest mode of causative agent for EDH. Most patients were male and 21-30 years old. Majority of cases had history of loss of consciousness, "the hallmark symptom of extradural hemorrhage" which should be seriously considered while taking history. The degree of brain injury and the GCS difference were notable factors that were significant in determining the functional outcome of EDH. So, early presentation to hospital with mild to moderate GCS has good clinical outcome with minimal disability.

Keywords: Extradural Haematoma; Surgical Management; Outcome.

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INTRODUCTION

Traumatic extradural hematoma (EDH) has been recognized for more than 140 years.¹ 100 years ago, the mortality rate of EDH was as much as 86%² and traumatic EDH remains a true neurosurgical emergency. Until the late 1970s, when angiography was used for diagnosis [the era before computed tomography (CT)], the mortality rate was 30% or higher.³ With the introduction and wide availability of cranial CT, early diagnosis and timely

surgical intervention for EDH is an attainable gold standard. Indeed, the treatable nature of EDH has led some authors to suggest that "toward zero mortality" is an achievable target with respect to this condition.⁴

Head injury is one of the leading causes of severe disability and death in the modern world among individuals under 45.⁵ Traumatic brain injury (TBI) accounts for approximately 70% of these

traumatic deaths and most of the persisting disabilities in accident survivors.⁶

Traumatic extradural hematomas (EDH) comprise 1 to 3% of all head trauma admissions.⁷ The peak incidence of extradural hematoma (EDH) is in the second decade of life and mean age of patient with EDH in different series is between 20 and 30 years of age.^{8,9} Extradural hematoma is very rare in extremes of ages. Mortality rate vary from 10 – 40% and is an index of alertness and efficiency of health care and hospital setup in a country.¹⁰

Risk factors for patients with EDH are advanced age, associated brain parenchymal injuries, temporal location, increased hematoma volume, rapid clinical progression, pupillary abnormalities, increased intracranial pressure (ICP) and low Glasgow coma scale (GCS).¹¹ But others found the most significant factors associated with unfavorable outcome were higher age, lower GCS, and higher EDH volume. Surgical mortality has rapidly decreased since Hutchinson described extradural hemorrhage as an emergency situation in 1867. While zero mortality is common in non-comatose patients, 25% to 71% of comatose patients undergoing surgery have a fatal outcome.¹² Many reports on extradural hematoma have drawn attention to avoidable factors implicated in preoperative deterioration, such as delayed transportation to the hospital and delayed diagnosis, but less consideration has been given to the specific factors that influence the outcome of patients who arrive comatose in the operating room.¹³ EDH remains even now a serious neurological condition.¹³

AIMS AND OBJECTIVES

The aim and objective of this research was to study epidemiology, etiology, clinical presentations and the postoperative outcome in patients with head injury with an extradural hematoma. Also to evaluate mortality and functional outcome (GOS) and to formulate recommendations for improvement of therapy.

METHODS AND MATERIALS

This study was done at department of neurosurgery at tertiary care center. Retrospective analysis of collected data through hospital information system of patients operated for traumatic extradural hematoma was done between September 2015 and December 2017.

Inclusion Criteria

- All patients admitted at emergency trauma center diagnosed with traumatic extradural hematoma which undergone surgery

Exclusion Criteria

- Postoperative extradural collection
- Pediatric patients < 5 years age
- Patients having traumatic extradural hematoma managed conservatively
- Patients operated for EDH outside our hospital and referred for post-operative treatment or management of complications
- Patients lost to follow up

Ethical clearance was obtained from institutional review committee.

Statistical Analysis

Categorical data were expressed as rates, ratios and percentages and the comparison was done using chi-square test. Continuous data was expressed as mean ± standard deviation.

RESULTS

In our study, maximum of 42 patients were of 21-30 years age group comprising 32.3%. Mean age of patient was 30 years.

In our study, maximum of 124 patients were males comprising 95.4% showing clear male predominance.

In our study, maximum of 73 patients were having RTA as a cause of EDH comprising 56%.

In our study, History of Unconsciousness was present in 104 patients comprising 80%. Vomiting was the most common symptom with 76 patients having it, comprising 58.5% patients followed by ENT bleeding in 18.5% patients.

In our study, majority (126, 97%) of patients presented with equally reacting pupils at the time of admission.

In our study, 103 patients presented with pure EDH (79.2%), 27 patients were having associated brain injury (20.8%), 3 patients were having associated limb fracture (2.3%).

In our study, Parietal EDH was most common (41.5%) followed by Temporal EDH (39.2%). In our study, 94 patients (72.3%) were having EDH volume ≤60 ml and 36 patients (27.7%) were having EDH volume >60 ml.

In our study, maximum 56 patients presented with GCS score of 14–15 followed by 53 patients with GCS score of 9–13. Focal Neurological Deficit was present in 16 patients of which only 2 patient had deficit at discharge and rest 14 patients improved post operatively.

Table 1: Age distribution

Age (Years)	No. of Patients	%
5-10	6	4.61
11-20	28	21.53
21-30	42	32.30
31-40	32	24.61
41-50	15	11.53
51-60	6	4.61
61-70	1	0.76
Total	130	100

Table 2: Sex distribution

Sex	No. of Patients	%
Male	124	95.4
Female	6	4.6
Total	130	100

Table 3: Cause of Injury

Cause Of Injury	No. of Patients	%
RTA	73	56
Fall	39	30
Assault	18	14
Total	130	100

Table 4: Mode of Presentation

Mode of Presentation	No. of Patients	%
Ext. Swelling	1	0.8
Ext Bleeding	24	18.5
Convulsion	4	3.1
Vomiting	76	58.5
Unconsciousness	104	80
Headache	0	0

Table 5: Pupil Status

Pupil Status	No. of Patients	%
Equal/Reactive	126	97
Unequal/Nonreactive	2	1.5
Both Dilated /Nonreactive	2	1.5
Total	130	100

Table 6: Presentation of EDH

EDH	No. of Patients	%
Pure EDH	103	79.2
Associated Brain Njury	27	20.8
Associated Limb Injury	3	2.3
Associated Chest Injury	0	0
Associated Abdominal Injury	0	0
Associated Spine Injury	0	0

Table 7: EDH Location

EDH Location	No. of Patients	%
Frontal	17	13.1
Temporal	51	39.2
Parietal	54	41.5
Occipital	1	0.8
Post. Fossa	7	5.4
Total	130	100

Table 8: Volume

Volume	No. of Patients	%
≤60	94	72.3
>60	36	27.7
Total	130	100

Table 9: GCS and Focal Neurological Deficit

Parameter	No. Of Patients		
	Pre Op	24 Hrs	Discharge
GCS			
3—8	21	3	0
9—13	53	27	4
14—15	56	100	124
FND	pre op	24 hrs	discharge
Present	16	8	2
Absent	114	122	126

Table 10: Type of Operative Procedure, Time to Surgery and Admission Days

Parameter	No. of Patients	%
Op. Procedure		
Craniotomy	119	91.5
Craniectomy	11	8.5
Time To Surgery	No. of Patients	%
<24 Hrs	98	75.4
>24 Hrs	32	24.6

Table 11: Outcome

GOS	No. Of Patients	
	Discharge	F'up 3 Month
Good Recovery	122(93.9%)	127(97.7%)
Moderate Disability	3(2.3%)	1(0.8%)
Severe Disability	3(2.3%)	0
Vegetative State	0	0
Death	2(1.5%)	0

Table 12: Relation of Age, Sex, Volume and GCS to Outcome

Parameter	Outcome		P Value
	Good	Bad	
Age			
≤40 Yrs	105	3	0.16
>40 Yrs	20	2	
Sex			
Male	120	4	0.09
Female	5	1	
Volume			
≤60 ml	93	1	0.007
>60 ml	32	4	
GCS			
3—8	18	3	0.006
9—15	107	2	

In our study, 119 patients underwent craniotomy whereas 11 patients underwent craniectomy. 98 patients underwent surgery within 24 hrs of injury while 32 patients after 24 hrs. Average admission period was 5.8 ± 3.2 days for EDH patients.

In our study, 93.9% patients had good recovery, 2.3% patients had moderate disability whereas only 4% patients had severe disability, persistent vegetative state or death until discharge. At 3 months follow up 127 patients (97.7%) had good recovery and 1(0.8%) patient had moderate disability.

In our study, we analyzed if age, sex, volume and pre op GCS has any effect on outcome. Outcome is regarded as GOOD if GOS (Glasgow outcome scale) is 5 or 4 and BAD if GOS is 3, 2, or 1. There was no much difference in outcome of patients ≤40 yrs or >40yrs and between male and female patients. Outcome of patients with volume of EDH ≤60 ml was much better than patients with EDH volume >60 ml and the result were statistically significant with p value 0.007. Outcome of patients with GCS 9--15 was much better than patients with GCS 3--8 and the result was statistically significant with p value 0.006.

DISCUSSION

A total of 130 cases of extradural hemorrhage were registered during the period of study and out of these 56% cases were of RTA, 30% cases were of fall from height, 14% cases were of assault. In this study, the commonest age was 21-30 years (32.3%). Incidence of head injury was more in age range of 21 to 30 years with 32.3% cases as compared to both extremes of life. The study was compared with various other studies conducted across India, described in Table - 13.^{14,15}

Males were more prone to EDH comprising 95.4% compared to females which accounts for making a Male: Female ratio of 19:1.

Mode of Injury as Determinant

When compared with other studies, present results are similar in mode of injury i.e. RTA followed by falls and next is assaults, which are compared and shown in Table - 14.

The dominant type of EDH observed in the study was parietal presenting in 41.5% cases followed by temporal in 39.2% cases. Posterior fossa EDH presentation was relatively less found in 5.4% followed by occipital.

Pathak A et al reported from their study that the dominant type of EDH observed was temporoparietal in 43% cases followed by temporal in 21% of cases followed by Frontal in 17% of cases.

Posterior fossa EDH presentation was relatively less found in 1% of cases in a study conducted by Singh G et al. We observed in present study that in 79.2% cases EDH presented as isolated finding, as per explanation by Charles Bell, that concussion injury causes stripping of dura aggravated further by negative intracranial pressure found at the antipode of compression force of skull. 20.8% cases had brain parenchyma injury in the form of (10% Saxena et al.¹⁴) contusion, SAH (subarachnoid Hemorrhage) subdural hemorrhage, and depressed fracture of skull.

104 patients (80%) presented with symptom of loss of consciousness. The next prominent symptom being vomiting observed in 58.5% cases and is better indicator of raised intracranial pressure. ENT bleeding constitutes 18.5% cases and 3.1% cases had convulsion.

In our study, on initial clinical examination 43.1% cases had Glasgow coma scale score of 14-15 (mild head injury), 40.8% with range of 9-13 (moderate head injury), 16.1% with range of 3-8 (severe head injury), 97% had normal equally reacting pupils, 1.5% unequal and non-reacting, 1.5% bilateral dilated and fixed status shown in Table - 15.

Focal Neurological Deficit was present in 16 patients of which only 2 patient had deficit at discharge and rest 14 patients improved post operatively.

Table 13: Various studies showing age and sex determinants

Study	Male	Female	Age Group
Saxena et al. ¹⁴	86%	14%	20-40 years Mean 28 years
Iqbal et al. ¹⁵	81%	19%	21-30 years Mean 21 years
Kumar et al. ¹⁶	95%	5%	21-30 years Mean 23 years
Present Study	95.4%	4.6%	21-30 years Mean 29.9 years

Table 14: Mode of injury as determinant

Mode of Injury	RTA	Fall	Assault	Others
Saxena et al. ¹⁴	72%	17%	5%	6%
Iqbal et al. ¹⁵	40%	44%	14%	2%
Kumar et al. ¹⁶	58%	27%	10%	5%
Present Study	56%	30%	14%	-

Table 15: Comparison of clinical determinant with other studies

Study	GCS-Score		Pupil-Status	
	9-15	3-8	E/R	Di/NR
Saxena et al. ¹⁴	54%	46%	73%	27%
Kumar et al. ¹⁶	86%	14%	77%	23%
Present Study	43.1%	56.9%	97%	4%

The neurological status at the time of intervention is the most significant factor affecting the outcome. Kunday et al. showed in their series that the neurological status of patient (GCS) was found out to be the primary factor determining the result.¹⁷ In some series, 35-40% of the patients were in the comatose group and 60-65% in non-comatose group.^{18,19}

The mortality rates have been reported 18-44% and 1% in comatose and non-comatose subjects, respectively.^{17,19-21} 44.6% (29 out of 65) of the comatose patients died, whereas, only one death (0.8%) occurred among non-comatose patients.

The level of consciousness significantly influenced the outcome.¹⁹ Seeling et al.²² reported 41% mortality in comatose patients with EDH. There were no deaths among patients with a GCS score of 8 or better in the series of Bricolo and Pasut.²³ Higher mortality rates have been reported in patients unconscious at the time of surgery.²⁴⁻²⁶ Özkan et al. found that all of the comatose patients died, whereas only two deaths occurred among non-comatose patients. The level of consciousness was significantly influenced the outcome. Level of consciousness just before surgery largely influence prognosis. Mortality is higher in comatose patients.²⁷ Heinzelmann et al., Mohanty et al., and Kunday et al. have reported that lower GCS correlated with a more unfavorable outcome.^{17,28,29} Rivas et al.²⁵ found that unfavorable outcome was determined by rapid clinical deterioration and EDHV of more than 150 ml. Lobato et al., Lee et al. and Servadei et al. have reported that outcome was influenced by GCS and EDHV among other factors.^{20,24,30} In contrast, van den Brink et al.³¹ found no correlation between EDHV and GCS, and outcome at six months. Paterniti et al.³² reported that when an EDH was operated within six hours then EDHV did not correlate with outcome. The highest mortality (74%) was found in patients of EDH with subdural hemorrhage and a GCS between 3 and 5. Patient with an EDH and a GCS of 3 to 5 had a mortality of 36% and patients with an EDH and a GCS of 6 to 8 had a mortality of only 9%.³⁶

In our study, Outcome is regarded as GOOD if GOS is 5 or 4 and BAD if GOS is 3, 2, or 1. There was no much difference in outcome of patients ≤40 yrs or >40yrs and between male and female patients. Outcome of patients with volume of EDH ≤60 ml was much better than patients with EDH volume >60 ml and the result were statistically significant with p value 0.007. Outcome of patients with GCS 9--15 was much better than patients with GCS 3--8 and the result was statistically significant with p value 0.006. We observed that the GCS and volume of EDH were the most important predictors of outcome. Factors like gender and age had no influence on outcome. After initial resuscitation in appropriate cases, an emergency CT scan was obtained in all cases and found to have positive finding which was added by follow up CT scan. Emergency decompressive craniotomy with evacuation of blood clot for supratentorial isolated EDH and emergency craniectomy with evacuation of clot was done for EDH with severe brain parenchymal injury and posterior fossa EDH.

At discharge,

- 93.9% cases achieved good recovery as per Glasgow outcome scale.
- 2.3% sustained moderate disability and 2.3% sustained severe disability.
- In 2 (1.5%) cases (13% Gurupreeth et al) the head injury presenting as EDH was so severe that the victim could not survive even after emergency surgical intervention. They all presented to emergency ward with poor GCS score of 3 with both pupils fixed dilated non reacting to light.

At 3 month follow up,

- 97.7% cases achieved good recovery as per Glasgow outcome scale.
- 0.8% sustained moderate disability.

CONCLUSION

The present study concludes that, road traffic accident was the commonest mode of causative agent for EDH accounting for 56 percent. Most patients were male and 21-30 years old. And also 80% cases had history of loss of consciousness, "the hallmark symptom of extradural hemorrhage" which should be seriously considered while taking history. The degree of brain injury and the GCS difference were notable factors that were significant in determining the functional outcome of EDH. So, early presentation to hospital with mild to moderate GCS has good clinical outcome with minimal disability.

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