



Original Research

The Impact of Time till Surgery on Post-Operative Outcome of Traumatic Extradural Hematoma

Waseef Ullah¹, Amer Zaman², Junaid Alam², Hameed Ullah³, Irfan Ali³, Faisal Shahzad⁴

¹Department of Neurosurgery, Jinnah International Hospital, Abbottabad

²Department of Neurosurgery, Frontier Medical & Dental College, Abbottabad

³Department of Neurosurgery, Lady Reading Hospital (LRH), Peshawar

⁴Department of Hematology, Frontier Medical & Dental College Abbottabad – Pakistan

ABSTRACT

Objective: Traumatic extradural hematoma (EDH) is a common complication of head injuries, predominantly affecting the working-age male population due to increased outdoor activity. This study aimed to assess the impact of timing in surgical intervention and identify factors influencing outcomes.

Materials and Methods: Seventy-eight consecutive patients diagnosed with traumatic EDH at Lady Reading Hospital, Peshawar, were included. Patients were categorized into two groups based on the timing of presentation: within 6 hours (early) and after 6 hours (late). Craniotomy and hematoma evacuation were performed, and outcomes were assessed at discharge.

Results: In our study mean and SDs for age were 21.83 ± 31.57 . Most of the patients i.e., 54(69.2%) were from the 2nd and 3rd decade of life. The mean hematoma volume was 37.17 ml. The majority of the patients were males 65(83.3%) and RTA 32(42.02%) was the most common cause followed by falls and physical assault respectively. The outcome of early operated (within 6 hours) patients was favorable in 44(95.65%) while 2 (4.34%) did not improve (GOS 2,3). Favorable outcomes (GOS 4,5) in delayed presented patients who operated after 6 hours were 23 (71.87%). 5(15.6%) were not improved (GOS 2,3) and 4(12.5%) died (GOS 1).

Conclusion: Outcomes of patients who operated early are more favorable than those who were operated late. Delayed presentation and intervention increase the mortality and morbidity of patients having traumatic extradural hematoma.

Keywords: Extradural Hematoma, Glasgow outcome scale, Head Trauma, Time to Surgery.

Corresponding Author: Amer Zaman
Department of Neurosurgery, Frontier Medical & Dental
College, Abbottabad
Email: Ayubian8@gmail.com

Date of Online Publishing: 27-3-2024
Date of Print: 31-3-2024

DOI: 10.36552/pjns.v28i1.964

Date of Submission: 10-08-2023
Date of Revision: 15-03-2024
Date of Acceptance: 20-03-2024

INTRODUCTION

Head injury is a significant issue for public health

and a primary cause of morbidity and death in the productive age group i.e., 16-40 years.¹ Among different complications, extradural hematoma (EDH) constitutes a significant source of avoidable death and morbidity in traumatic brain injury (TBI) patients.²

Epidural hematoma is an accumulation of blood between the dura and the inner table of the skull. Classically these are associated with injury to the middle meningeal artery, bleeding from fractured bone, or tearing of venous structures. Data suggests that trauma related to road traffic accidents is the leading cause (53%) followed by falls and physical assault.³

Patients with EDH present with vomiting, lucid interval (10-27%), followed by contralateral hemiparesis and ipsilateral pupillary dilation.⁴ CT brain without contrast is a widely used modality for diagnoses and decision-making, when indicated.^{4,5} The most commonly involved region is temporal followed by frontal, parietal, and occipital regions.⁶ After evacuation of hematoma patient is shifted to ICU and then subsequently to wards.

Historically, the outcome of extradural hematoma was poor but in recent years it has improved because of emergency services infrastructure, resuscitative measures, widespread availability of CT scans in emergency departments, timely management, and adequate intensive care.⁷

Of all the factors affecting outcomes of extradural hematoma evacuation, time from injury to surgery and preoperative GCS (post-resuscitation) have been found to strongly correlate with mortality and morbidity.⁸ Matsushima et al showed that patients operated on within three and half hours of injury will have very good outcomes.⁹ Studies have shown that a favorable postoperative outcome occurs in 88.9% of patients if the extradural hematoma is evacuated within 6 hours.² According to Khalid et al, post-operative outcomes could be improved if the time interval between initial injury and surgery is reduced.¹⁸ Our unit is the largest neurotrauma center in the province with a

population above 35.53 million.¹¹ Patients with extradural hematoma constitute a major portion of the patients presenting to our emergency department (ED). Due to the lack of an integrated emergency response system and coordination between the different hospitals in our setup, most patients presenting to our ED are significantly delayed. This delay occurs either on the way to our center from far-flung areas or staying in local hospitals before worsening the condition of the patient. The purpose of this study is to assess the effect of duration from injury to surgery on post-operative outcomes. We hope the evidence from this study will help in making clear time-based transport and operating protocols to minimize any delay in the transport of these patients from the site of injury to the operating room.

MATERIALS AND METHODS

Study Design & Setting

A Descriptive case series study was carried out at the Neurosurgery Department, Lady Reading Hospital, Peshawar for 7 months from 26th April 2021 to 30th November 2021.

Sample Size & Technique

The sample size was 78. The confidence interval was kept at 95% and the margin of error at 7% using the WHO sample size estimation formula. The sampling technique was Consecutive non-probability sampling.

Inclusion Criteria

The study included either gender, aged between 2 to 70 years old patients presenting to ED with traumatic extradural hematoma, who need surgical intervention.

Exclusion Criteria

Patients with coagulopathy, brain contusions, co-existing subdural hematoma, significant traumatic

subarachnoid hemorrhage, and traumatic condition requiring surgery other than extradural hematoma (neurosurgical otherwise).

Data Collection Procedure

After approval from the ethical committee of the hospital, patients presenting to the emergency department who were diagnosed with traumatic extradural hematoma having indication for craniotomy and fulfilling the above inclusion and exclusion criteria were included in the study. Patients were assessed, investigated, stabilized, and prepared for surgery as required. Informed consent was taken for surgery and inclusion into the study separately from the patient or attendant of the patient as the condition allowed. Age, gender, mechanism of injury, size of hematoma, and time from injury to surgery were recorded. After surgery, the patients were followed up in the ICU and wards. Daily progress reports were noted. No surgical or medical complications were reported. Post-operative outcome at discharge time and length of stay in the hospital were recorded. Data were filled in the attached proforma.

Data Analysis

After collection data were entered, saved, and analyzed in SPSS of version 23. Mean \pm SD were Calculated for age; hematoma size and length of hospital stay. Frequencies and percentages were calculated for gender, mechanism of injury, presentation time categories, and postoperative outcomes. The postoperative outcome was stratified by presentation time category, gender, and hematoma location. The chi-square test was used at a 5% significance level. All results were presented in the form of tables and graphs.

RESULTS

This study was conducted at the Department of Neurosurgery, MTI-Lady Reading Hospital,

Peshawar in which 78 patients were noted to determine the impact of time till surgery on the outcome of traumatic extradural hematoma.

Age and Gender Distribution

The mean and SDs for age was 21.83 ± 31.57 . 19(24.4%) patients were recorded in 2- 20 years, 54 (69.2%) patients in 21-40 years, and 5(6.4 %) patients in 41 – 70 years of age group. In this study, males were more than females. Male to female ratio was 4.9:1 i.e., out of 78 patients 65(83.3%) were male and 13 patients (16.7%) were female.

Causes of Traumatic Extradural Hematoma

Road traffic accidents (RTA), falls, or physical assault in which most of the cases were from road traffic accidents i.e., 35 (44.87%) patients having traumatic extradural hematoma were due to road traffic accidents, 32(41.02%) were from falls and 11 (14.11%) were from physical assaults (as shown in table 1).

Table 1: Frequency and Percentage of Mode of Injury (N=78).

Mode of Injury	Frequency	%age
RTA	35	44.87
Falls	32	41.02
Physical Assaults	11	14.11
Total	78	100.0

Table 2: Time of Presentation (N=78).

Time of Presentation	Frequency	Percent
Early (Within 6 Hours of Injury)	46	58.97
Delayed (After 6 Hours of Injury)	32	41.03
Total	78	100.0

Time of Presentation

Most of the patients were presented early. A total of 46 (58.97%) patients presented early (within 6 hours) of head injury and 32(41.03%) presented

late (after 6 hours) of head injury as (shown in Table 2). The mean hematoma volume was 37.17±12.23 ml (table 3).

Hematoma Location

The extradural hematoma was recorded in different sites of the brain. Location and frequency of hematoma site were; 29 (37.17 %) patients had temporal EDH, 13(16.67%) partial, 19 (24.36%) frontal, 7(8.98%) posterior fossa and 10 (12.82%) patients had Temporoparietal extradural hematoma as shown in table 4.

Table 4: Hematoma Location (n=78).

Feature	Frequency	%age
Temporal	29	37.17
Partial	13	16.67
Frontal	19	24.36
Posterior fossa	7	8.98
Temporoparietal	10	12.82
Total	78	100.0

Post-Op Medical Complications

Mean and SDs of post-op hospital stay was 6.44±6.0 days, during which different complications were recorded and shown as; 12(15.38%) patients developed aspiration pneumonia, 7(8.97%) developed post-op seizures and 5(6.41%) developed deep venous thrombosis (table 5).

Recollection developed in 4(5.12%) patients and wound infection occurred in 10(12.82%) of patients.

Table 3: Hematoma Volume (n=78).

Feature	Minimum	Maximum	Mean	±Std. Deviation
Hematoma volume	20.00ml	70.00ml	37.1739ml	12.23130

Table 5: Post-Op Medical Complications (n=24).

Feature	Frequency	%age
Aspiration pneumonia	12	15.38
Seizures	7	8.97
DVT	5	6.41
Total	24	30.76

Pre and Post-Operative Glasgow Outcome Score

The total number of patients who presented early (within 6 hours) was 46 (58.97%), in which 44(95.65%) patients were improved i.e. had good outcomes (GOS 4,5) and 2(4.34%) patients not improved (GOS 2,3). Number of late (after 6 hours) presented patients were 32 (41.02%), in which 23 (71.87%) were having good outcomes (GOS 4,5), 5(15.6%) were not improved (GOS 2,3) and 4(12.5%) died (GOS 1) as shown in tables 6 and 7.

Glasgow Outcome Score in Both Early and Late Groups

4 (5.13%) patients had severe outcomes. One (1.29%) had moderately severe outcomes. 6 (7.6%) had moderate outcomes. 19(24.35%) had moderately good outcomes. The majority, 48(61.53%), had good outcomes as shown in Table 8.

Table 6: Receiving Time and Glasgow Outcome Score (N=78).

FEATURE		Glasgow outcome scale					Total	P Value
		1	2	3	4	5		
Receiving time	Early (within 6 hours) N=46	0	0	2	5	39	46	0.003
	Delayed (after 6 hours) N=32	4	1	4	14	9	32	(significant result)
Number of patients in each scale		4	1	6	19	48	78	

Table 7: Frequency of Outcomes (N=78).

Feature	Improved (GOS 4,5)		Not improved (GOS 2,3)		Died (GOS 1)		Total
	Frequency	%age	Frequency	%age	Frequency	%age	
Early (Within 6 hours) N=46	44	95.6	2	4.34	0	0	46
Late (After 6 hours) N=32	23	71.9	5	15.6	4	12.5	32

Table 8: Frequency of Glasgow Outcome Score (GOS) (N=78).

GOS	Frequency	%age
1	4	5.13
2	1	1.29
3	6	7.6
4	19	24.35
5	48	61.53
Total	78	100.0

DISCUSSION

Head injury is a major health problem causing 1% of all deaths and 15% of deaths in the young age group.¹² Extra Dural hematoma is one of the frequent consequence of head injury i.e., occur in 2.7-4% of traumatic brain injury patients.¹³

20-50% of the patients having traumatic extradural hematoma have classic lucid interval i.e., patients recover from unconsciousness initially and then again fall into deep unconsciousness.¹⁴ If it is not diagnosed in time and operated on early then it may result in high mortality and morbidity.¹⁵

Extradural hematoma is most common in the young age group.¹⁶ Like other different studies traumatic extradural hematoma occurred in our study most commonly in the 3rd and 4th decade of life i.e., 69.2%.¹⁷ In Khaled et al.'s work, most of the patients were also from the 3rd decade (29%) followed by the 2nd decade (27.55%).¹⁸ This is because young people are most active and come out of their homes for jobs, earning money, etc.

Male patients in our study were 83.3% and female patients were 16.7% another survey was done in Pakistan.² Male to female ratio was 4.9:1 in our study similar to Ayub et al.¹⁹ Results of our study are also similar to another series shown by Oertel et al.²⁰ This male predominance over

females is because of social culture in which females are mostly home bounded and mostly male comes out for external work which resulted in increased percentage of head trauma.

In this study road traffic accidents (RTA) were the most frequent cause of traumatic extradural hematoma followed by falls and then physical assaults which is similar to a study performed by Serveries et al.²¹ In another series performed by Ramzan et al, RTA causes 50% of traumatic extradural hematoma followed by fall from Height.²² Our results were also comparable to the Kelly and Becker series.²³ In our province RTA was the most common cause because most of the people didn't follow traffic rules and safety measures.

After a thorough examination of the patients presented to our emergency department, a CT scan of the brain was done for prompt diagnoses. CT scans have significantly reduced mortality of EDH from pre-CT Scan era due to prompt diagnoses and management.²⁴ In our study, the mean volume and SDs of extra Dural hematoma was 37.17 ± 12.23 . Temporal location in our study was the most common site of extradural hematoma which constitutes 37.17% followed by frontal, partial, Temporoparietal, and posterior fossa respectively.

Early diagnoses and management of extradural hematoma are necessary for better outcomes. It can decrease mortality by up to 5%.²⁵ It is because the density of blood clots causing midline shift and obliterating basal cisterns for more time will decrease the functional outcome EDH treated surgery.²⁶ In this study, we were looking for the outcome of the impact of time on EDH management. 58.97% of the patients presented early and operated within 6 hours while 41.02% of

the patients presented late and operated after 6 hours of close head injury which is also comparable to another study.¹⁶ All patients were assessed through the Glasgow coma outcome scale at the time of discharge. In 58.97% early presented patients i.e., who were operated on within 6 hours 95.65% of patients were improved (having GOS 4,5) Similar to another study.¹⁶ In the University Hospital of Verona's Department of Neurosurgery, 107 patients were evaluated in 57% of patients were operated on within 6 hours of close head trauma. Results of favorable outcome were 91% which is comparable to our study.¹⁸ Ortler et al, also showed in their retrospective analysis that if the patient is operated early within 6 hours it can reduce mortality and will improve outcome.²⁷ 4.3% of the patients operated on did not improve similar to another study conducted in Pakistan.² This is because of surgical and medical complications. Out of 41.02% delayed operated patients, 71.87% of the patients improved (GOS 4, 5), 15.62% did not improve (GOS 2, 3) and 12.5% of patients expired (GOS 1) post-surgically. Ortler et al. also showed in their retrospective study that patients who operated late have poor outcomes and have a mortality of 13% similar to the result of our study.²⁷ This poor outcome is because by permanent brain damage due to the prolonged pressure effect of blood clots on brain parenchyma. Therefore, patients with early removal of blood clots from the brain surface will have good outcomes as compared to delayed evacuation as shown in our study.

CONCLUSION

The number of patients having good outcomes was high among those who were operated on early i.e. within 6 hours. Poor outcomes were high in those patients who were operated late. So, the outcome of the patients operated on for extradural hematoma was inversely related to preoperative time interval i.e., the longer the time till surgery worse would be the outcome.

REFERENCES

1. Soon WC, Marcus H, Wilson M. Traumatic acute extradural haematoma – Indications for surgery revisited. *Br J Neurosurg.* 2016;30(2):233-4.
2. Niaz A NM, Niraula K, Majeed S, Neupane J, Ghimire M, Vohra A. Factors Affecting the Surgical Outcome in Extradural Hematoma in Punjab Institute of Neurosciences, Lahore, Pakistan. *Nepal Journal of Neuroscience.* 2017;14(3):13-8.
3. Bhat AR, Kirmani AR, Wani MA. Disappearance of Intracranial Extradural Hematomas: Role of Diastatic Cranial Fracture and Intracranial Pressure – An Institutional Experience. *Asian J Neurosurg.* 2018;13(2):375-9.
4. Adams H, Kolias AG, Hutchinson PJ. The Role of Surgical Intervention in Traumatic Brain Injury. *Neurosurgery Clinics.* 2016;27(4):519-28.
5. Gutowski P, Meier U, Rohde V, Lemcke J, von der Brölie C. Clinical Outcome of Epidural Hematoma Treated Surgically in the Era of Modern Resuscitation and Trauma Care. *World Neurosurg.* 2018;118:e166-e74.
6. Krishna G, Beitchman JA, Bromberg CE, Currier Thomas T. Approaches to Monitor Circuit Disruption after Traumatic Brain Injury: Frontiers in Preclinical Research. *Int J Mol Sci.* 2020;21(2).
7. P Prahaladu, M V Vijay Sekhar, K Satyavara Prasad, Hemal Chheda. Assessment of Extra Dural Hematoma – Factors affecting morbidity, mortality and outcome. *IAIM.* 2019;6(9):102-7.
8. Kandregula S, Sadashiva N, Konar S, Rao KN, Shukla D, Bhat D, et al. Surgical management of traumatic extradural hematomas in children: an analysis of 201 patients at a tertiary neurosurgical center. *Child's nervous system: ChNS: official journal of the International Society for Pediatric Neurosurgery.* 2019;35(5):807-13.
9. Matsushima, K., et al. "Emergent operation for isolated severe traumatic brain injury: Does time matter?" *Journal of Trauma and Acute Care Surgery* 2015;79(5): 838-84
10. Kulesza B, Litak J, Grochowski C, Nogalski A, Rola R. The Initial Factors with Strong Predictive Value in Relation to Six-Month Outcome among Patients Operated due to Extra-Axial Hematomas. *Diagnostics (Basel).* 2020;10(3):174.
11. Provisional summary results of 6th population and housing census – 2017: Pakistan bureau of statistics,

- Government of Pakistan; 2017 [Available from: <https://www.pbs.gov.pk/content/provisional-summary-results-6th-population-and-housing-census-2017-0>].
12. Mushtaq, Rehman L, Khaleeq S, Zaman KU. Association of outcome of traumatic extradural haematoma with glasgow coma scale and haematoma size. *Ann. Pak. Inst. Med. Sci.* 2010;6(3):133-8.
 13. Dur and P, Adamson GJ. On the field management of athletic head injuries. *J Am Acad Orthop Surg* 2004;12(3):191-5.
 14. Mahmood S, Mahmood R, Ali S, Mirza I, Butt R. Surgical outcome of traumatic brain injury: a retrospective experience of two months at Lahore general hospital, Lahore. *Pak J of Neuronal . surg.* 2019;23(1):23-27.
 15. Arrind D, Shibu VP, Kollerli S. Does volume of extradural hematoma influence management strategy and outcome. *Neurol India* 2004;52(4):443-5.
 16. Hyder AA, Wunderlich CA, Puvanachandra P, Gururaj G, Kobusingye OC. The impact of traumatic brain injuries: a global perspective. *Neuro Rehabilitation.* 2007;22(5):341-53
 17. Tsang KK, Whitfield PC. Traumatic brain injury: review of current management strategies. *British Journal of Oral and Maxillofacial Surgery.* 2012 Jun 1;50(4):298-308.
 18. Khaled CN, Raihan MZ, Chowdhury FH, Ashadullah AT, Sarkar MH, Hossain SS. Surgical management of traumatic extradural haematoma: Experiences with 610 patients and prospective analysis. *The Indian Journal of Neurotrauma.* 2008;5(2):75-9.
 19. Ayub S, Ali M, Ilyas M. Acute extradural hematoma; factors affecting outcome. *JPMI.* 2005;19(2):208-211.
 20. Oertel M, Kelly DF, McArthur D, Boscardin WJ, Glenn TC, Lee JH, Gravori T. Progressive hemorrhage after head trauma: *J Neurosurg.* 2002;96:109-16.
 21. Servadei F, Faccani G, Rocella P, et al. Asymptomatic extradural haematomas. Results of a multicentre study of 158 cases in minor head injury. *Acta Neurochir Wien* 1989;96:39-45.
 22. Ramzan A, Wani A, Malik AH, Kirmani A, Wani M. Acute bilateral extradural hematomas. *Neurology India.* 2002;50(2):217.
 23. Kelly DF, Becker DP. Advances in management of neurosurgical trauma: USA and Canada. *World Journal of Surgery.* 2001;25(9):1179.
 24. Babu ML, Bhasin SK, Kumar A. Extradural hematoma-an experience of 300 cases. *JK Science.* 2005;7(4):205-7.
 25. Jamous MA, Aziz HA, Al Kaisy F, Eloqayli H, Azab M, Al-Jarrah M. Conservative management of acute epidural hematoma in a pediatric age group. *Pediatric neurosurgery.* 2009;45(3):181-4.
 26. Shin JJ, Kuh SU, Cho YE. Surgical management of spontaneous spinal epidural hematoma. *European Spine Journal.* 2006 Jun; 15(6):998-1004.
 27. Ortler M, Lang Mayr JJ, Stockinger A, Golser K, Russegger L, Resch H. Post operative outcome of traumatic brain injury. *Surg Neurol* 1997;48(2):193-1.

Additional Information

Disclosures: Authors report no conflict of interest and all data can be provided if needed.

Ethical Review Board Approval: The study conformed to the ethical review board requirements. Approval was taken from the ethical board of the hospital.

Human Subjects: Consent was obtained by all patients/participants in this study.

Conflicts of Interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following:

Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Financial Support: No financial support has been taken from any funding agency or organization.

Data Availability Statement: The data record could be available at the request of the corresponding author.

AUTHORS CONTRIBUTIONS

Authors Full Name	Contribution of Each Author
Waseef Ullah	Study design and methodology.
Amer Zaman	Analyzing the data and interpretation of results.
Hameed Ullah	Data collection, paper writing and calculation.
Irfan Ali	Data collection and calculation.
Junaid Alam	Quality insurer and literature review.
Faisal Shehzad	Editing, referencing and final approval.