

Original Article

Association of Outcome of Traumatic Extradural Hematoma with Glasgow Coma Scale and hematoma size

Mushtaq*
Lal Rehman**
Samina Khaleeq***
Khaleeq-Uz-Zaman****

*Consultant Neurosurgeon, Neurosurgery
Department Hayatabad Medical Complex
Peshawar

**Assistant Professor,
Institute Of Neurosurgery Jinnah Post
Graduate Medical Centre Karachi

***Associate Professor
Neurosurgery Department
Pakistan Institute of Medical Sciences
Islamabad

****Head Department of Neurosurgery,
Pakistan Institute of Medical Sciences
Islamabad

Objective: To find out the correlation between size of traumatic extradural hematoma (EDH), Glasgow coma scale (GCS) and outcome of the patients.

Study Design: Descriptive study.

Place and Duration of Study: This study was conducted in the department of Neurosurgery, Pakistan Institute of Medical Sciences (PIMS), Islamabad, from January 2004 to January 2005.

Materials and Methods: Total patients studied were thirty-eight with EDH diagnosed on CT scan. They were received through emergency. History and examination findings were noted and they were operated in emergency. The correlation between the size of EDH, GCS and Outcome was determined. For data analysis SPSS 12 software was used.

Results: There were total thirty-eight patients of traumatic EDH. Among them twelve Patients had temporoparietal EDH, four patients had frontal hematoma, four patients had parietal hematoma, five patients parietooccipital hematoma, while six patients had temporal hematoma and three patients had frontoparietal hematoma. Among them there were two cases of posterior fossa extradural hematoma and two cases of bilateral EDH. Male to female ratio was 11.7:1. The mean age was 27.6 years. In 4 patients the hematoma size was less than 30 ml. Out of them, one was in GCS 8/15 and 3 patients were in GCS 13 to 15/15. Three patients with extradural hematoma of more than 120ml were in GCS 8 or below. The sizes of hematoma and GCS were correlated. Out of 4 patients with hematoma size less than 30 ml, one had severe disability while remaining had excellent outcome. Three patients of hematoma size of more than 120 ml, one was in vegetative state, one amongst severe disability and one died. There was a good correlation between hematoma size and outcome. Pre- operative GCS had a direct relation with outcome. Out of 9 patients with GCS 3-8/15, two had excellent outcome, two had mild disability, three had severe disability, and one was in vegetative state while one died. Out of 15 patients with GCS 13-15/15, 14 had excellent outcome, one had mild disability while there was no expiry. The outcome correlated with GCS was determined.

Conclusion: The outcome of extradural hematoma is affected by GCS and hematoma size. In small hematoma there was a good outcome but in large size hematoma the prognosis is poor. In higher GCS the outcome will be excellent but in low GCS the outcome is poor

Key Words: EDH, CT scan and GCS.

Address for Correspondence:

Dr Lal Rehman
Assistant Professor Institute of
Neurosurgery JPMC Karachi
E. mail: drlalrehman@yahoo.com

Introduction

Head Injury is becoming major a health problem and it has been reported that 1% of all deaths and 15% of deaths occurring in the 15-24 years of age group are due to head injury.¹ The major cause of preventable deaths is a delay in diagnosing and treating intra cranial hematomas². Among the hematomas, extradural

hematomas assume the greatest importance as they can be diagnosed and treated easily. Extradural hematoma is an acute neurosurgical emergency. The prognosis of patients with EDH depends upon a number of factors. The Glasgow Coma Scale at presentation is the most important factor which determines the prognosis.³

At the time of impending of the skull or a fracture line crossing the groove of middle meningeal

vessels may tear the trunk or branches of middle meningeal artery, diploic vein, or dural venous sinus would result in EDH.⁴ Rupture of arterial wall results in rapid expansion of hematoma and rapid deterioration of conscious level, while bleeding from a vein or diploic channels develop EDH after sometime. Frequent neuro-observation should be done in such cases and GCS should be monitored.⁵ Deterioration of conscious level and developing focal signs like ipsilateral pupil dilatation and contra lateral hemiplegia, and up going planters signify a rapidly expanding EDH. An urgent CT scan in such cases will reveal biconvex hyper dense, extra dural lesion causing effacement of ventricle and midline shift. Craniotomy and evacuation of hematoma is the only way to save the life of these patients from a potentially fatal benign lesion.

The present study was carried out on patients of extra dural hematoma, with a view to define correlation between the size of extra dural hematoma and GCS with Outcome.

Materials and Methods

This descriptive study was conducted in the department of neurosurgery, PIMS, Islamabad from January 2004 to January 2005. The total number of patients was 38.

All patients with traumatic extradural hematoma of any gender were included while patients below the age of 12 years and those with post operative hematoma were excluded from the study.

The usual delay in reaching the hospital was primarily due to two reasons: The formidably long distances the patients had to travel on one hand, and the poor means of transport available on the other. However, factors like a delayed referral from peripheral hospitals, illiteracy on one part of the patients and general practitioners, etc also played a part in some cases.

A detailed history was obtained and a thorough clinical examination was carried out in every patient. A special effort was made to ascertain the mode of injury, the exact time and place of injury, the details of the initial management at peripheral hospitals, the means of transport used to reach PIMS Islamabad and the details of the behaviour of the patient's conscious level from time of injury to admission in our hospital. In the hospital, the classical signs of extradural hematoma like deterioration in conscious level, pupil difference and hemiparesis were especially checked during the period of observation. A record of the vital signs and the Glasgow Coma Score was maintained at thirty-minute intervals.

X-rays of the skull and CT scan were done whenever possible. The volume of EDH was calculated using the Peterson and Epperson equation $a \times b \times c \times$

0.5, where a, b, and c represent diameter of the hematoma in the sagittal, axial and coronal planes respectively. When a diagnosis of EDH was established, the patient was shifted to the theatre for surgical evacuation of the hematoma. Details of the operative findings with special reference to the size and site of the hematoma, source of bleeding, accompanying intradural pathology and state of the underlying brain were recorded. During the post-operative period, the clinical observation of the classical signs, the vital signs and the Glasgow Coma Score were maintained till the time of discharge. At the time of discharge, the morbidity in terms of neurological deficit was recorded. All patients were followed up for six months. The correlation between the sizes of extradural hematoma (EDH), Glasgow Coma Score (GCS) and its effect on the outcome were analyzed using SPSS 12.0.

Results

Total fourteen hundred patients were admitted with head injury from January 2004 to January 2005 in the Department of Neurosurgery, PIMS Islamabad. There were 38 patients of extradural hematoma, managed surgically at PIMS during this period. Therefore, the total frequency of extradural hematoma in patients admitted for head injury was 2.71%. Extradural hematoma is an affliction of youth. The greatest representation was found in the 21 to 30 years age groups (19 patients), closely followed by the 12 to 20 years (10 patients) and the 31 to 40 years age groups (4 patients) and the 41 to 60 years age groups (5 patients). In older age groups, a steady decline in the frequency was noted. In the fourth and fifth decades, the number of patients was 4 and 5 respectively. The oldest patient was a gentleman of 60 years.

There were 35 males and 3 females, with Male to female ratio of 11.7:1. Road traffic accidents (RTA) were responsible for 25 cases. Assaults resulted in 8 cases, while 5 patients had fall from heights. It was seen that half of the patients reached the hospital in less than six hours of injury. Thirteen patients reached within 6 to 12 hours, while 3 patients arrived later than 12 hours but before 24 hours. Four patients reached after a delay of more than one day.

The patients were divided into five groups according to the behavior of their conscious level from the time of injury to the time of operation as conscious throughout (7), unconscious throughout (9) Initially conscious, subsequently unconscious (10), unconscious to lucid to unconscious (5) and unconscious to lucid (8). Ipsilateral pupil dilatation is a very important clinical sign. In this series, a difference in the pupil size was noted in 12 cases. In the remaining 26 patients, the pupils were equal and reacting to light at the time of admission. A relative hemiparesis of varying degrees was observed in 7(18%) patients. In addition to the

above mentioned signs, patients of extradural hematomas presented with other signs as well. Vomiting was the commonest finding and was present in 76% of the patients. A bleeding from the ear, nose and mouth was observed in 26 %. Fits were seen in 13%. Headache as the sole presenting complaint was seen in 13%.

After sustaining a mild head injury, the patient loses consciousness suddenly, but gradually improves and becomes lucid for a variable period of time and thereafter starts to deteriorate again. On examination one pupil is seen to be bigger than the other and the side contra lateral to the papillary dilatation is weak. It was observed that all of these three signs were present in only 16%. Thirty nine percent of these patients displayed only two of the above features, while 21% had only one of these signs. The most important group however, was the one that did not demonstrate any of these signs and a substantial number i.e. 24% belonged to this group.

The patients were divided into three groups according to GCS as mild moderate and severe head injuries. A linear fracture was seen on plain X-rays in 25 patients. A pre-operative C.T scan was done in 37 patients. We could not get a CT. Scan in a young gentleman, who was brought after a RTA and he was deteriorating very quickly. So exploratory burr holes helped to diagnose EDH and salvage this patient. Most of the hematomas were seen to occur in the temporoparietal region i.e. 12. Four were located in the frontal region, four in the parietal and five in the parietoccipital areas. Six hematomas confined themselves to the temporal fossa. Three hematomas were located in the frontoparietal region while the posterior fossa was the seat of two hematomas. Bilateral hematomas occurred in two patients. One was

in the frontal region, crossing the superior sagittal sinus and in one patient the hematoma lying in the temporoparietal and contralateral frontal region.

Surgery was done in all patients. In 35 patients, craniotomy was performed, while in the remaining 3 patients the evacuation of the hematoma was done through a craniectomy of sufficient size to expose the clot and the bleeding sites adequately. However, it was seen that the exposure was better and surgery was easier when a craniotomy was performed. The posterior fossa hematoma was removed by performing a craniectomy. The source of bleeding was identified in all cases. The middle meningeal vessels were the main culprits, responsible for bleeding in 22 (58%) cases. Bleeding was from the fracture site or diploic veins in 7 (18%) cases. The superior sagittal sinus was bleeding in 3 (8%) cases, while the transverse sinus was the source in 2 (5.3%) cases. There was a generalized oozing from the dura in 3 (8%) cases, while no active bleeder was found in 1 (2.6%) patient.

We had only one mortality out of 38 patients, which is (2.6%). Table I shows the outcome in relation to the size of hematoma in the study population

In the present study nine were in GCS below 8. Only two patients had normal outcome, one expired, one was in vegetative state and three had severe disability while in fifteen patients the GCS was 13 to 15/15. Only one patient had mild disability while the remaining fourteen patients had excellent recovery. This shows a very important relationship between outcome and pre operative GCS as shown in table II.

Table I: Hematoma Size and Outcome

Hematoma size	Outcome					Total
	Death	Vegetative	Severe Disability	Mild Disability	Normal	
<30ml	0	0	1	0	3	4
30-50ml	0	0	1	0	15	16
51-80ml	0	0	0	2	7	9
80-20ml	0	0	0	3	3	6
>120ml	1	1	1	0	0	3
Total	1	1	3	5	28	38

Table II: Pre-Operative GCS and Outcome

Pre operative GCS	Outcome					Total
	Death	Vegetative	Severe Disability	Mild Disability	Normal	
3-8	1	1	3	2	2	9
9-12	0	0	0	2	12	14
13-15	0	0	0	1	14	15
Total	1	1	3	5	28	38

Discussion

The incidence of extradural hematoma in patients admitted with head injury in our department was 2.71% which corresponds to the findings of most other studies as 3% by McKissock et al.³ and 1.6% by Jamieson and Yelland.⁶ Extradural hematoma is prevalent in young adult males with a male to female ratio of 4:1 as shown by Oertel M et al.⁷ But there was a significantly high incidence in our study as male to female ratio was 13:1, which may be due to the traditional way of life in Pakistan, where women usually restrain from outdoor life. The greater exposure of males to all kind of trauma undoubtedly explains these results.

Road traffic accidents were the commonest (63%) cause of extradural hematoma in the present study as also indicated in the study of Servadei F et al.⁸, to be 70%. The incidence of assaults is relatively less common in various international studies but in the present study, assault was responsible for a good bulk i.e. 21%. It was followed by head injuries due to falls (16%). The observation of classical signs like deterioration in conscious level, hemiparesis and pupils difference, were found to be extremely important from the diagnostic point of view. However, most cases were not seen to behave in the classical way. Only two patients presented with these three signs together. Jamieson and Yelland also found this picture in 2.4% of their patients.⁶ The description of deterioration in conscious level i.e. concussion, lucidly to unconsciousness is usually thought of as the only classical sign of extradural hematoma in a significant number of patients as shown by McKissock et al.³ to be as high as 26% and Jamieson and Yelland showed it to be 12%.^{3,6} But it was observed in only 3 (8%) patients in our study. So the description of lucid interval as the only sign for extradural hematoma seems to be overemphasized.

In one series, it was seen that up to 40% patients of extradural hematoma did not present with localizing signs or deterioration in conscious level.⁹ In the present study as well, 9 (24%) patients were fully conscious and oriented with no focal signs. Therefore, it is important to realize the facts pointed out by Teasdale et al.¹⁰, that it is essential to breakaway from the tradition that a traumatic intracranial hematoma is diagnosed only after there has been progressive deterioration.

The frequency of fracture of skull in this series was 71%. Most studies describe the incidence between 75 to 85%.^{11,12} In the series of Phonprasert et al.¹³, the incidence was 63%. So X-ray skull is very helpful as it guides us to get a CT scan and diagnose an extradural hematoma. However its value in the diagnosis of extradural hematoma could not be established as 29% of the patients did not have fractures on skull X-rays.

Similar view have been expressed by Cook et al.¹⁴, who say that X-ray skull is of no use in the diagnosis of extradural hematoma as 35% of X-rays are reported normal. However, the value of X-ray skull in the assessment of patients of head injury cannot be questioned. In alert patients, X-ray skull is sometimes the only parameter available to ascertain the severity of the trauma and to decide whether a patient of head injury should be admitted or not. Similar views have been expressed by Mendelow et al.¹⁵, while discussing the benefits and costs of admitting patients after a mild head injury.

CT scan was found to be an extremely useful diagnostic tool. It helped us to diagnose extradural hematoma in 37 patients, while exploratory burr holes were done in one patient. A few older studies show the role of angiography in diagnosing EDH.^{16,17} but with the invention and implementation of CT scan it has become the investigation of choice to diagnose the volume and location of EDH, associated injuries and midline shift etc. The mortality rate of 29 to 33% in pre CT scan era and 9 to 12% in post CT Scan era have been reported.^{16,17} Its availability round the clock is a great asset. Persistent headache and vomiting are also indications for a CT scan. In the present series 4 (9.5%) patients presented with intractable headache after trauma as the sole complaint. In the series by Cook et al.¹⁴, 40% of patients presented with only headache and vomiting. In the present study, 7 patients had no localizing signs or a history of deterioration. However, every patient with a history of unconsciousness or every patient with a fracture skull should be subjected to a C T scan.⁸ Post operative CT scan was done in 3 patients who were not showing predictable recovery and in one patient, who was deteriorating after surgery. In two cases small recurrence was recorded and in two cases brain edema was found but all patients were treated conservatively.

None of our patients required re-exploration although four patients did not show improvement but the residual collection was not significant and there was only oedema. In many large series deterioration or failure to improvement have been encountered in 1 to 2% of the patients, who required re-exploration.^{13,18} Our good surgical results are probably due to wide exposure, meticulous haemostasis and accurate anchorage of the dura to the pericranium in all cases. Patients comatose at operation usually show a more rapid clinical deterioration (a shorter trauma-to-operation interval) and tend to have a large hematoma volume, a higher incidence of mixed CT density clot (hyper acute bleeding), more marked shift of midline structures, more severe associated lesions, and higher postoperative intracranial pressure(ICP) levels.¹⁹

In the present study, there were 4 (9.5%) patients with rapid clinical deterioration and all of them

had EDH volume of 80 to 150ml, midline shift more than 0.5 centimeter and raised postoperative ICP level were noted. Among mildly head injured patients with 13-14 GCS have a significantly higher incidence of initial loss of consciousness, skull fracture, abnormal CT findings, need for hospital admission, delayed neurological deterioration and need for operation than patients with a GCS of 15/15.²⁰ Rivas et al also found an unfavorable outcome in deteriorating patients and a hematoma volume of more than 150 ml.¹⁹ Lobato, Lee and Servadei et al also reported the similar result.^{17, 20, 21} In contrast, Van den Brink et al²², found no correlation between EDH volume, GCS and outcome at 6 month, important to note that how if the above mentioned studies directly correlated GCS and volume of EDH. So the present study shows that if a patient has a good GCS, the hematoma volume is expected to be small and vice versa. Most of the studies found a significant correlation of hematoma volume and outcome.^{2, 17, 20} Our study also shows similar results. Dubey A et al²³, found a positive correlation at volume of only 30 ml above or below group but we found a positive correlation in all our groups and they measured the outcome in terms of favorable or unfavorable at 2 weeks but we measured the outcome in terms of Glasgow Outcome Score at 6 months. So we were able to compare various groups of outcome in a better way.

According to one study, volume of hematoma above 150 ml can be compatible with survival and low morbidity but our study shows that as the volume increases the mortality and morbidity increases progressively.²⁴ According to Bezircioglu et al²⁵, patients with EDH less than 30ml can be treated conservatively except when hematoma in temporal region. Our study also included three patients of temporal hematoma and all of them were more than 10ml in volume. Similarly our patient with posterior fossa EDH had a volume of 25 ml, so it was evacuated. Kudy et al²⁶, have reported that lower GCS correlates with an unfavorable outcome our study also confirmed the similar findings.

Our mortality of 2.6% seems quite low. However, when compared to Mortality rate of another study by Phonprasert C et al¹³, 16%, so 2.6% mortality seems to be very low. Therefore, I endorse the views of Hooper, which in a setting like ours a mortality rate of less than 10% would be a reasonable goal.¹⁸ It appears that Bricolo and Pasut's goal of zero mortality is yet a dream.¹⁶ To date there are very few reports in the literature with mortality rate less than 10%.

A detailed analysis of the factors affecting mortality from the literature and from the results of the present study reveals that primarily, there are two preventable reasons i.e. is delay in surgery and the other is mismanagement in the hospital. Delay can occur at various levels i.e. delay in referral, a delay in

reaching the hospital, a delay in diagnosis, and in some cases a delay in surgery even after a firm diagnosis. In what ever reason for the delay, it leads to a worse pre-operative conscious level and a Glasgow Coma Score, leading to a subsequently high mortality.

Mismanagement in the hospital includes misdiagnosis, inadequate exploration leading to missed extradural hematoma, inadequate or faulty surgery and poor post operative care. Every effort should therefore be made to minimize the impact of the various avoidable factors that lead to a high mortality.

Conclusion

There is a strong correlation of outcome in extradural hematoma with its size and GCS of the patient. : The outcome of extradural hematoma is affected by GCS and hematoma size. In small hematoma there was a good outcome but in large size hematoma the prognosis is poor. In higher GCS the outcome will be excellent but in low GCS the outcome is poor.

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