Original research article

Outcome of surgically treated traumatic extradural hematoma

ABSTRACT

Summary

Extradural hematoma (EDH) has been seen as a neurosurgical emergency since eighteenth century. Efforts have been on since then to reduce the mortality associated with this entity. The mortality has dropped from around 80% in late nineteenth and early twentieth centuries to below 20% in many centers now. Improving quality of care and, constant assessment of outcome and factors affecting outcome are the driving forces leading to reduction in mortality.

Objectives

To determine the functional outcome and the effect of level of consciousness on traumatic extradural hematoma patients who had surgery in our centers.

Patients and methods

It was a prospective observational study carried out on forty three patients with traumatic extradural hematoma who had surgical evacuation of the hematomas in our centers over a five year period. Data were collected using structured proforma in accident and emergency, theater, intensive care unit, wards and in outpatient clinic. The data were analyzed using Environmental Performance Index (EPI) info 2007 software.

Results

Forty three patients had surgery for traumatic extradural hematoma during the five year period. There were thirty eight males (88.37%) and five females (11.63%). Road traffic accident was the most common aetiology. The functional outcome was 83.72% and mortality was 13.95%. Glasgow Coma Score prior to surgery significantly affected the outcome *P* = .002.

Conclusion

The favorable functional outcome from our study (83.72%) was within the current range in the world. Level of consciousness prior to surgery and age significantly affected outcome.

KEYWORDS: trauma, extradural hematoma, consciousness, surgery, outcome

1 INTRODUCTION

Extradural hematoma occurs as a result of bleeding between the inner table of the skull and the outer layer of the dura mater. It constitutes 1-3% [1, 2] of all head injured patients and 9% of those who are comatose. [3] In eighty five per cent (85%) of patients, the source of bleeding is the middle meningeal artery while in the rest, it is from middle meningeal sinus and dural sinuses. [4, 5]

Extradural hematoma is usually diagnosed with the aid of a Computerized Tomography (CT) scan. It appears as a biconvex extra-axial lesion. It is usually hyperdense in acute stage, isodense in sub-acute stage and hypodense in chronic stage.

Extradural hematoma is a neurosurgical emergency. Its immediate threat to life was reported as early as eighteenth centuries.[6, 7] The outcome of treatment was so poor at that time that Callender [8] wrote that all treatment of epidural hemorrhage were so hopeless that he advised against futile trephination of the skull. However, from the experience of Gross [9] during the battle of Shiloh, he advised immediate evacuation of extradural hematoma by trephination. With current application of emergency medical services and critical care methodologies, the outcome of head injured patients requiring surgical intervention has improved. [10] The introduction of Computerized Tomography Scan in 1972[11] led to early diagnosis and reduction of intervention time. Better neuroanaesthetic agents, early intubation and the use of ventilators and better monitoring equipment, have all helped to improve care, reduce the intervention time and have consequently translated into reduced morbidity and mortality in these patients. The trend globally has been steady decline in mortality as care improves. 12].With this trend in mind, we prospectively studied the outcome of surgically treated traumatic extradural hematoma we managed in our centers.

2 PATIENTS AND METHODS

It was a prospective cross-sectional study of the outcome of patients with computerized tomography scan diagnosed traumatic extradural hematoma who had surgical evacuation of the hematoma from 1st October 2008 to 30th September 2009 in the first center and from 1st August 2010 to 31st July 2014 in the second center. (Gap due to time taken by first author to write fellowship examinations and to relocate to center 2 that appointed him consultant on passing his fellowship examinations. He was actively involved in surgical care of the patients and data collection. He continued the research in center 2.)

2.1 Inclusion criteria:

All patients with cranial CT scan diagnosed traumatic extradural hematoma who had surgical evacuation of the hematoma were included in the study.

2.2 Exclusion criteria

All patients with cranial CT scan diagnosed traumatic extradural hematoma that were managed non-operatively were excluded from study. Patients who had traumatic extradural hematoma discovered and evacuated during surgery for open depressed skull fractures in patients who did not do cranial CT scan were also excluded from the study.

2.3 Methods:

Patients who had traumatic brain injury were resuscitated in accident and emergency using Advanced Trauma Life Support protocols. We used Normal saline for adult and 4.3%Dextrose in1/5Saline for children to ensure euvolemia and normotension. We gave Paracetamol 15mg/kg 8 hourly to ensure good analgesia. Ceftriaxone 1gm once daily for adult and 100mg/kg once daily for children, was given to those with open wounds. We gave Oxygen via face mask or nasal catheter at 4-7litres/minute aiming at ≥95% saturation. Cranial computerised tomography scan was done for those who could afford it (most of the CTs were done in private centers as center 2 did not have functional CT and the CT in center 1 was functionally epileptic. No universal insurance coverage in our country). Other investigations such as full blood count, urinalysis, chest x-ray, serum electrolyte/urea/creatinine were done. On CT scan acute extradural hematoma appears as hyperdense biconvex extra-axial collection bounded by dural attachment to suture lines. Fracture across suture line may alter the shape into somehow crescentic, mimicking acute subdural hematoma. Traumatic extradural hematoma in children ≥5mm or ≥10mm in adult were operated. Those associated with depressed skull fractures qualified for surgery. We used craniotomy to evacuate the hematoma. However, minicraniectomy (extended burr hole) was used in patients that could not withstand craniotomy and for faster decompression in deteriorating patients. After surgery, the patients were admitted in the wards. They were given fluids, antibiotics and analgesics for 12-48 hours depending on the state of the patients. For conscious patients, we discontinued fluids after 12 hours and commenced oral feeding. The antibiotics and analgesics were changed to orals. For unconscious patients we continued infusions, intravenous antibiotics and intramuscular analgesic for 48 hours. We commenced nasogastric feeding using our high energy/high protein diet on the third day. The diet is constituted thus: 500ml pap, two tablespoonful powdered milk, two tablespoonful soya bean powder, one tablespoonful red oil, and one tablespoonful cray fish powder. The daily fluid requirements of the patients were factored in the diet. They were given five to six times a day. Antibiotics and analgesic were then given via the nasogastric tubes. On discharge, the patients were followed up in outpatient clinic.

Data were collected using structured profroma which was component of compound research that was approved by research and ethics committee in center 1. It was a component of prospective data bank that was approved by research and ethic committee in center 2. The biodata, etiology, Glasgow Coma Score after resuscitation, symptoms and signs, CT findings and other investigations were documented in accident and emergency (A&E), Glasgow Coma Score prior to induction, interval between injury and surgery, the procedure used, and findings at operation were documented in theater. The progress of the patients till discharged were documented in the wards.

The Glasgow Outcome Scale (GOS) was the principal tool used in determining the outcome of patients. It assesses the functional state of the patient after treatment. It classifies them into five categories: 1 dead, 2 vegetative state, 3 severe disability, 4 moderate disability, and 5 good recovery. [13] The functional outcome was assessed at three months post-injury as it had been found that the outcome at three months was the best predictor in long term. [14] The Scores at three months were obtained in the outpatient clinic for patients that survived.

Patients were regarded as having good functional outcome if they had moderate disability or good recovery.

The data were analysed with EPI info 7 software. We used the ‘add analysis gadget, of the Visual Dashboard to analyse the data. We used frequency component to find frequency of some variables such as gender. We used the mean component to find mean of continuous variables such as age. We recoded age into groups using ‘defined variable’ component. Univariate variables were analysed using MXN/2X2 components. Its advanced components were used for multivariate variables. At 95% confidence interval, P <.05 was considered significant.

3 RESULTS

Forty three patients with traumatic extradural hematoma were operated within the period. Twenty four patients (55.81%) were referred to our centers from other health facilities, while nineteen patients (44.19%) came direct to us from the trauma scenes. There were thirty eight males (88.37%) and five females (11.63%). The age ranged from two years to seventy two years with a mean of 30.28 years. The majority of patients were 20 – 40years (55.82%), table1.

Table 1: Age group frequency

Age group	Number	Percent (%)
0 - >10	3	6.98

10 - >20	6	13.95
20 - >30	14	32.56
30 - >40	10	23.26
40 - >50	6	13.95
50 - >60	1	2.33
60 - >70	2	4.65
70 - >80	1	2.33
Total	43	100

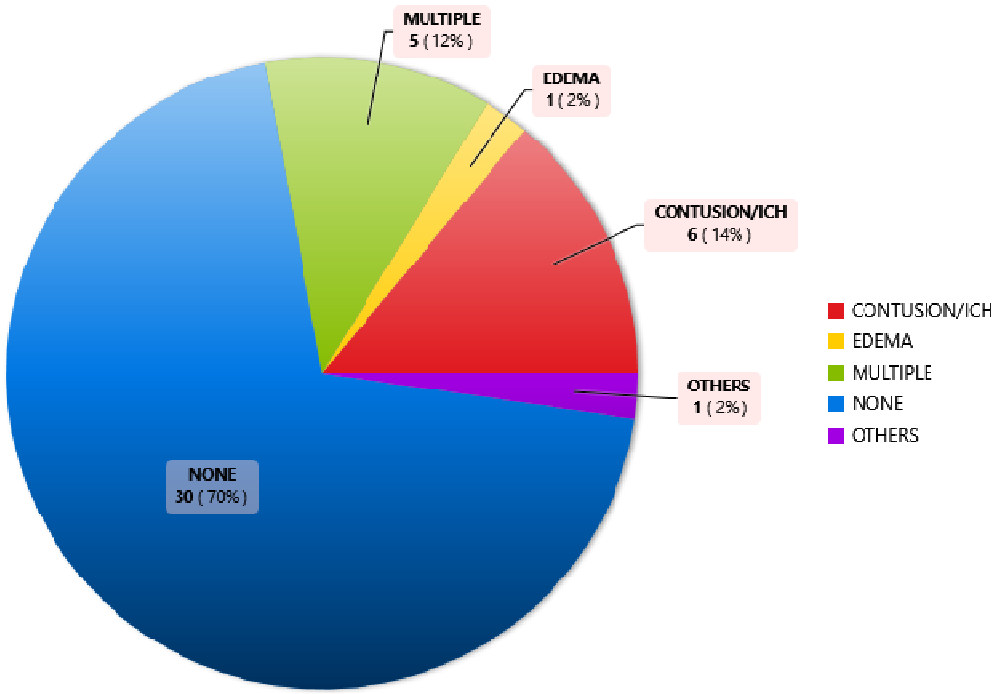
The most common etiology was road traffic accident (RTA), table 2.

Table 2: Etiology frequency

Etiology	Number	Percent (%)
Assault	7	16.28
Fall	4	9.30
Others	2	4.65
RTA	29	67.44
Sports	1	2.33
Total	43	100

The most common associated intradural lesion was contusion/intracerebral haemorrhage (ICH), 14% fig 1.

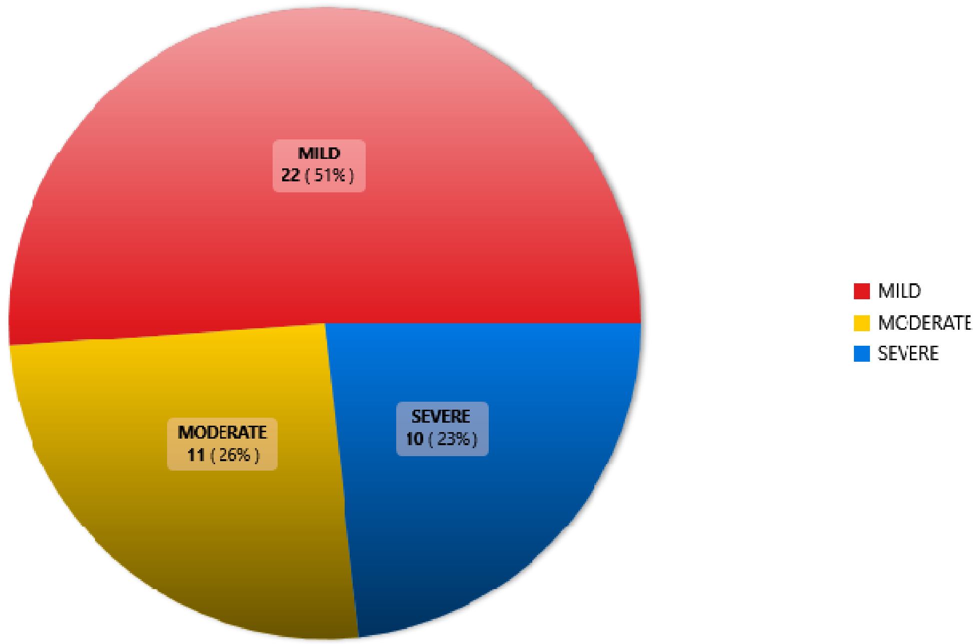
Fig 1: Intradural lesions



Etiology had no significant relationship with intradural lesions, *P* = .997. Nineteen patients (44.19%) had associated skull fractures while 24 patients (55.81%) did not have associated fractures. Among those with fractures, only one patient died, while five patients died in those without fractures.

Based on GCS prior to surgery, mild traumatic brain injury (GCS 13-15) had highest frequency 22 (51%), fig 2.

FIG 2 GCS prior to surgery



Thirty seen patients (86.05%) had craniotomy, while six (13.95%) had minicraniectomy. Nine patients had surgery the first day, thirteen the second day, nine the third day, and the rest (12) after three days. Two patients died on the first day, two on the second day, one on the fifth day, and the last after one week.

The favourable functional outcome (≥4) was 83.72% with mortality rate of 13.95%. The GCS prior to surgery significantly affected the outcome, *P* = .002 table 3.

Table 3: GCS VS GOS

GCS	GOS					
	1(%)	3 (%)	4 (%)	5 (%)	≥4 (%)	Total (%)
Mild	0 (0.00)	0 (0.00)	1 (4.55)	21 (95.45)	22 (100)	22 (100)
Moderate	1 (9.09)	1 (9.09)	2 (18.18)	7 (63.64)	9 (81.82)	11 (100)
Severe	5 (50)	0 (0.00)	0 (0.00)	5 (50)	5 (50)	10 (100)
Total	6 (13.95)	1 (2.333)	3 (6.98)	33 (76.74)	36 (83.72)	43 (100)
P = .002						

The age group significantly affected the outcome, *P* = .00 table 4.

Table 4: Age vs GOS

AGE	GOS					
	1 (%)	3 (%)	4 (%)	5 (%)	≥4 (%)	Total (%)
1 - <10	1 (33.33)	0 (0.00)	0 (0.00)	2 (66.67)	2(66.67)	3 (100)
10 - <20	0 (0.00)	0 (0.00)	0 (0.00)	6 (100)	6 (100)	6 (100)
20 - >30	1 (7.14)	0 (0.00)	3 (21.43)	10 (7143)	13 (92.86)	14 (100)
30 - >40	1 (10)	0 (0.00)	0 (0.00)	9 (90)	9 (90)	10 (100)
40 - >50	1 (16.67)	0 (0.00)	0 (0.00)	5 (83.33)	5 (83.33)	6 (100)
50 - >60	0 (0.00)	1 (100)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100)
60 - >70	1 (50)	0 (0.00)	0 (0.00)	1 (50)	1 (50)	2 (100)
70 - >80	1 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100)
Total	6 (13.95)	1 (2.33)	3 (6.98)	33 (76.74)	36 (83.72)	43 (100)
P = 0.00						

Time to surgery did not have significant effect on the outcome, *P* = .760. Mode of presentation (direct or referred) did not affect the outcome, *P* = .675. The favourable outcome among patients with associated fractures was 94.74% with mortality rate of 5.26%. The favourable outcome in those without associated fractures was 75% with mortality rate of 20.83%. Although the presence of fracture did not significantly affect the outcome, P = .092, the trend was there. Three patients (6.98%) had post-traumatic seizure. Two had early, while one had late post-traumatic seizures.

4 DISCUSSIONS

Majority of our patients, 24 (55.81%) were referred from other health facilities. The high percentage of referred patients in our neurosurgical centers was due to high population coverage by our centers. The first center covers one state with about 15 million people, while the second center covers two states and parts of three adjoining states totalling about 7 million people [15] Emejulu et al. [16] In Nnewi, South East, Nigeria, found that referred patients constituted 42.4% in their study. Adeleye and Okonkwo [17] in South West, Nigeria, found that 75% of their patients were referred from other health facilities. The high volume of referred patients to neurosurgical centers in our country depicts not only the dearth of neurosurgical centers but also lack of trauma system and universal insurance coverage unlike what is obtained in developed countries. [18, 19]

Our study showed more males than females. The relatively higher ratio of males in our study was due to occupation. More males are involved in technical works in our environment and they form the largest occupation group involved. Males in our environment are involved in commercial vehicle and motorcycle driving which many youths have resorted to due to high unemployment rate in our country. Our result was within the range of many studies showing higher proportion of male to female ratios, 2:1 to 8:1.[20,21,22] The most common cause of extradural hematoma was road traffic accident with motorcycle accident being the highest subgroup. The emergence of motorcycles as the commonest cause of road traffic accident in Nigeria had been documented in the literature. [23] Younger age group was mostly affected in our study. These are people who are in their prime working actively to make ends meet. The affectation of this younger age group which form the work force of the society had been documented by other authors. [24] The most common intradural lesion was contusion/ICH. The presence of intradural lesion depicts the extent of force impacted on the cranium. As noted by many authors, focal brain injury is produced by collision forces acting on the skull, resulting in local tissue compression beneath the site of impact.[25] Such injuries are commonly characterized by laceration, contusion, and hematoma occurring in either the presence or absence of a skull fracture.[26] Nineteen (44.19%) of our patients had skull fractures. In Chowdhury et al. [22] study, 74.09% had associated fractures. Khan et al. [27] in their study found that 79.2% of their patients had associated skull fractures. Local impact on skull causes deformation of skull that results on fracture and stripping dura off the inner surface of the skull. Yavuz et al. [28] found that the degree of deformation of skull and type of fracture produced depended on the striking force. Ford et al. [29] found that localized impact strips off the dura from the inner table of the skull with resultant extradural hematoma formation, and the higher the force of the impact, the higher the stripping off, and the larger the volume of the hematoma formed. It had been found that oozing from fractured ends of the skull leads to extradural hematoma formation in about one third of cases.[30] On the other hand, skull fracture in relation to EDH serves as decompression outlet thereby reducing intracranial pressure.[31] That might have accounted for low mortality among those with fractures in our study. The fracture may also serve another purpose. Because EDH strips the dura off the inner table of skull, the hematoma becomes covered in inside by dura and on outside by bare skull bone. Because no soft tissue grows on bare bone, chronicity of EDH becomes rare. However in those with fracture, the cartilage cells from pericranium migrate through the fracture opening during repairing of the fracture. The external part of the hematoma abutting the fracture site may get involved in the calcifying process and the outer part gets calcified, or the entire hematoma gets calcified. This unique chronicity was first recognized and removed 6 years following injury; it was invested by a calcified membrane.[32] Cases of calcified EDH causing seizures months or years after the original trauma had been reported. [33, 34]

Patients with GCS 13-15 formed the majority. That might have been due to localized impact with less effect on reticular formation and other areas involved in maintaining consciousness. Most of the patients from assault had localized impact from plank, stick, iron road, motorcycle exhaust pipe, besides stone. Rehman et al. [1] found that patients with GCS 13-15 formed 56.67% in their study. Mezue et al. [21] found highest rate among patients with GCS 13-15 in their own study. Conversely, Khan et al. [27] had highest incidence (50%) among patients with GCS 3-8. The most common etiology in their study was fall, followed by RTA unlike ours where RTA was most common followed by assault, thus making fall more likely to have caused more severe injuries. Thirty seven patients had craniotomy which is the standard surgery for EDH. Six patients had minicraniectomy (extended burr hole). It was used when patient was deteriorating for faster decompression or when they could not withstand craniotomy. It was placed where craniotomy line would pass in case there was need for craniotomy. In most cases the bleeding vessels were seen and coagulated. Mezue et al. [21] in Enugu, Nigeria used minicraniectomy in eight of their patients. In deteriorating patient, minicraniectomy is faster way for decompression of extradural hematoma, especially in developing countries where Gigli saw is still used to raise bone flap.

Favourable functional outcome was 83.72% and the mortality was 13.95%. In Khan et al. [27] study the favourable outcome was 79.2% with a mortality of 12.5%. Rehman et al. [1] in their study found favourable outcome in 83.33% and mortality of 10%. These are almost similar to our results. Many authors reported mortality between 10% and 20%; [35-38] others reported less than 10% mortality. [20, 39] The outcome was significantly related to GCS prior to surgery. Khan et al. [27] also found significant relationship between GCS at presentation and outcome. Other authors found that admission GCS was the most significant factor affecting outcome. [22] Our result showed that those operated in coma had higher mortality. The poor outcome in comatose patients had been reported by many authors with varying functional outcome.[40, 41] The high mortality may be due to the severity of associated injury to brain parenchyma or severe compressive effect of the haematoma overwhelming the compensatory mechanisms of intracranial contents. The age of patients significantly affected the outcome. There was high mortality in patients above 60 years. That was likely due to aging affecting the protein turn over, and aging of their systems affecting their ability to withstand stress. Many authors reported the significant relationship of age with outcome. [27, 30, 42, 43].

. The seizure rate in our study was 6.98%. Seizure is a marker of parenchymal injury. Mezue et al. [21] found seizure rate of 23.7% in their study. Their patients with GCS 3-8 (34%) were more than our patients with GCS 3-8 (22%), showing that their study had patients with severe injuries more than ours. Many authors reported that patients with lower GCS at presentation had higher incidence of intradural damage with EDH. [44, 45]

5 CONCLUSION

Traumatic extradural haematoma remains a major indication for neurosurgical intervention in our centre. The favourable outcome in our study was 83.72% with mortality of 13.95%. The GCS and age significantly affected the outcome. The challenge is how to improve the care of these patients as many other centres are currently achieving below 10% mortality rate. The need to review our care systems with provision of trauma system and universal health insurance coverage to keep pace with the trend in the world cannot be overemphasized.

5.1 Caution!

We have to be cautious in hyping intervention time in extradural hematoma especially in those with associated skull fractures decompressing the pressure effect. These patients when conscious can be monitored clinically and radiologically as days go by. Many may not require surgery. In the course of this study we saw two patients with subacute extradural hematomas with associated overlying skull fractures. Patients were conscious. We monitored them for two weeks. We did repeat CT. Both hematomas had resolved.

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