

Conservative Plan for Post Traumatic Extradural Hematoma: Risk Factors Favouring Conversion to Surgery

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Abstract

Introduction: Extradural hematoma (EDH) is considered one of the most serious and recognized secondary insults of traumatic brain injury (TBI). We will analyse the data of cases required conversion from a conservative to a surgical management and identify the possible patient and disease related risk factors in such cases. **Patients and Methods:** This prospective study included 90 patients with traumatic EDH, admitted to the Neurotrauma department in Cairo University hospitals from March 2014 to August 2016. Their CT scans reveal EDH alone or with associated cerebral lesions initially fitting the criteria of conservative management. **Results:** The commonest site is frontal in 21 patients (23.3%), followed by parieto-temporal in 18 patients (20%). While Posterior fossa hematomas occurred in 3 cases, which was the least common site (3.3%). The mean size of the EDH was 17.02 ml, with a standard deviation of 6.29 ml. The minimum size was 2 ml and a maximum of 28 ml. The cut off value of the size of the hematoma requiring conversion to a surgical management was 19 ml. **Conclusion:** Clear indications of EDH evacuation have been well known, however studying which risk factors are more liable to convert conservative management plan to evacuation is important. Increased caution and closer monitoring are required when the size of the hematoma is >19 ml or the hematoma is overlying a venous sinus. Unlike coagulopathy which was found to be a potential risk factor, but larger number study is needed.

Keywords

Traumatic Brain Injury, Extradural, Hematoma, Conservative, Conversion, Surgery

1. Introduction

Extradural hematoma (EDH) is considered one of the most serious and recognized secondary insults of traumatic brain injury (TBI) [1].

EDH is mainly due to trauma causing bleeding between the skull and outer layer of the dura. The source of bleeding could be an injured vessel, commonly the middle meningeal artery, or venous sinus. It is more common in young age than elderly people due to adherence of dura in aging skull [2]. Rapid accumulation of blood causes compression on the brain, causing various neurological deficits according to the site of the bleeding [3].

With up to 10% - 20% of patients with head injuries being estimated to have EDH and the mortality rate of operated cases of EDH ranges from 12% to 30% [4] [5] [6], management costs of EDH are significant [7].

EDH is classically considered to be an acute complication of TBI developing immediately after trauma [1]. However, recent studies show that it can also develop over several hours following trauma, possibly requiring a change in management plan from conservative to a surgical one [8] [9].

The possible risk factors for such conversion are several, thus proper study of such risk factors and the objective assessment of the statistical significance of their contribution to do surgery is essential in providing best care for patients in such critical conditions.

To the best of our knowledge, there are some studies favoring certain sites of conservative EDH to be converted to surgical ones especially in the temporal region but in our study, we investigated more factors including coagulopathy, whether the hematoma lies over sinus or not and volume of hematoma.

We will analyze the data of cases required conversion from a conservative to a surgical management and identify the possible patient and disease related risk factors in such cases.

2. Patients and Methods

This prospective study included 90 patients with traumatic EDH, admitted to the Neurosurgery Trauma department in Cairo University hospitals from March 2014 to August 2016.

The study included post-traumatic patients with CT scan revealing EDH alone or with associated cerebral lesions, provided that the EDH was the main lesion.

All cases initially fitted the criteria of conservative management as of the guidelines of the brain trauma foundation in 2006 [3]. The volume of extradural hematoma being less than 30 ml, as calculated by the ellipsoid equation. The thickness of the hematoma being less than 15 mm, midline shift being less than 5 mm and the Glasgow Coma Score (GCS) being more than 8.

A thorough history was taken for all cases including the mode of trauma, the time since the onset of the trauma, the presence of post traumatic convulsions, loss of consciousness and symptoms of increased intracranial tension.

Full neurological examination was done for all cases including level of con-

sciousness (GCS).

Radiological evaluation using CT brain was done for all the patients at the time of admission. A follow up CT was scheduled within 12 hours from the initial one for cases having their initial CT done within 6 hours of the onset of trauma. For patients having their initial CT later than 6 hours from the onset of trauma, the first follow up was done within 24 hours. A second and a third follow up CT scans were scheduled 24 and 48 hours after the first follow up as well as in case of any neurological deterioration. A final follow up CT scan was done one week after the patient was discharged.

Patients were divided into two groups:

Group (A) patients who were managed with conservative treatment and follow up.

Group (B) patients who required surgical intervention after failed conservative treatment.

Risk factors were categorized into patient related risk factors e.g. extremes of age and bleeding disorders and disease related risk factors e.g. the site of EDH and the presence of associated fissure fractures.

All the patients were initially treated conservatively. Continuous neurological assessment and follow up CT scans were done as scheduled.

Surgical evacuation was done immediately in case of clinical deterioration or a radiological increase of the hematoma size more than 30ml, thickness > 1.5 cm or midline shift > 0.5 cm.

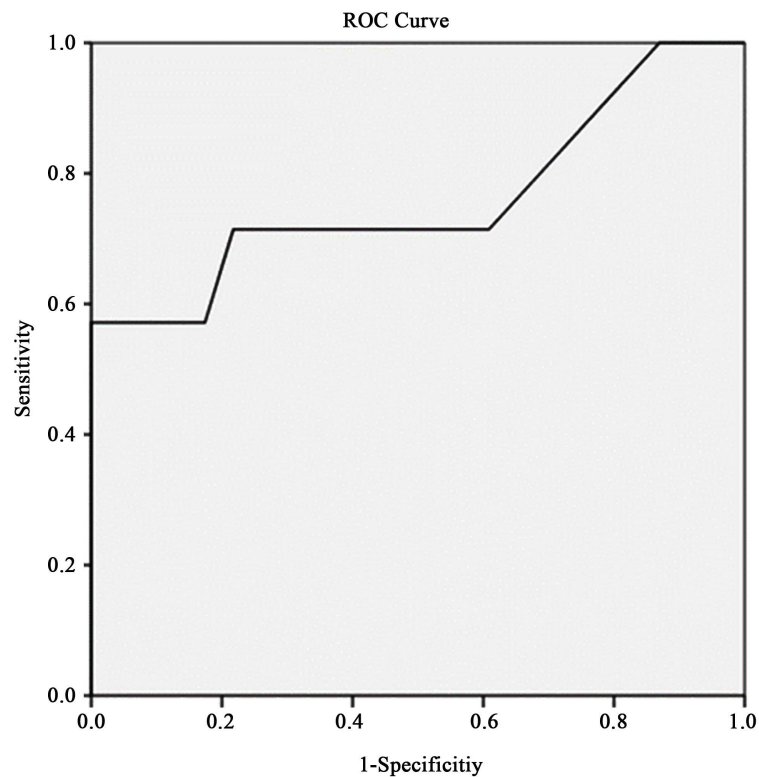
Glasgow outcome score (GOS) by Jennett and Bonds was used to evaluate the outcome which include death, persistent vegetative state, severe disability, moderate disability and good recovery [10].

Good outcome includes good recovery and moderate disability while cases ending in death, persistent vegetative state or severe disability were considered as a poor outcome.

Data was summarized using mean, standard deviation, median, minimum and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. Comparisons between quantitative variables were done using the non-parametric Mann-Whitney test [11]. For comparing categorical data, Chi square (χ^2) test was performed. Exact test was used instead when the expected frequency is less than 5 [12]. Logistic regression was done to detect independent predictors of conversion to surgery [13]. Receiver operating characteristic (ROC) curve was constructed with area under curve analysis performed to detect the best cutoff value of the total volume of hematoma for detection of need of surgery. P values less than 0.05 were considered as statistically significant (Figure 1).

3. Results

A total of 90 patients were admitted with post traumatic EDH, to whom conservative management was initially started.



Diagonal segments are produced by ties.

Figure 1. ROC curve for detection of cases that need surgery using total volume.

Table 1 shows a comparison of between the surgical and the non-surgical groups.

The mean age of the patients was 22.07 years with a standard deviation of 11.54 years. Motor car accidents (MCA) were the most common cause (46.7%) representing 42 cases. While thirty cases were fallen from height (33.3%)

The most common hematoma site was frontal in 21 patients (23.3%), followed by parieto-temporal in 18 patients (20%). While Posterior fossa hematomas occurred in 3 cases which was the least common site (3.3%).

The mean size of the EDH was 17.02 ml, with a standard deviation of 6.29 ml. The minimum size was 2 ml and a maximum of 28 ml.

Thirty-six patients had skull fracture on their intimal CT brain (40%) and most of cases (75 cases) were not associated with intra parenchymal lesions (83.3%) while associated brain contusions were found in fifteen cases (16.7%).

Nine cases (10%) had their EDH over superior sagittal sinus (SSS) and transverse sinus while initial CT of 81 patients (90%) didn't reveal that hematomas overlying a venous sinus.

Six cases of the surgically converted group (28.6%) had their hematoma over venous sinus (disease related factor) while only three patients continued conservative plan although they had their hematoma over sinus.

Fifteen patients (16.7%) presented with one attack of post traumatic fits. 16.7% of cases had a previous history of head trauma.

Only three cases of those who require surgery had coagulopathy (14.3%) while in the non-operative group; no one had coagulopathy as patient related factor.

Twenty-one patients (23.3%) were converted from conservative to surgical management, following deterioration of the neurological condition with follow up CT brain showing increased size of the hematoma.

Nine patients (42.8%) required conversion to surgical management had a temporal component in the hematoma.

Six patients (28.6 %) were converted to surgery and had the hematoma overlying a venous sinus which constituted 66.7% of all cases with hematomas overlying a sinus.

The cutoff value of the size of the hematoma requiring conversion to a surgical management was 19 ml (**Figure 2**).

Figure 2 shows CT brain with right fronto parietal extradural hematoma of male patient presented with motor car accident who was managed conservatively (one of three cases of coagulopathy who didn't need evacuation).

There were no mortalities in our study. A good outcome was achieved in 98.2%, with a poor outcome in only 2 cases. Both cases had associated chest injuries which may be the cause of their poor outcome.

4. Discussion

EDH is one of the most commonly encountered complications of TBI [7].

Large EDH can cause severe neurological deficits including rapid deterioration of the level of consciousness that could be rapidly fatal. However, prompt and efficient management of EDH by surgical evacuation can drastically change the outcome [1].

Classically, conservative management of EDH is indicated in an EDH less than 30 ml in volume, with a thickness less than 15 mm and with a midline shift

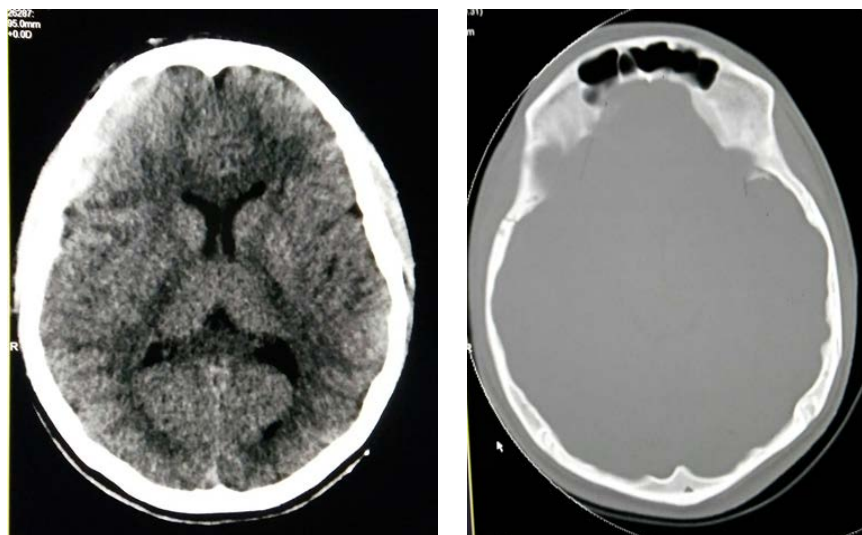


Figure 2. Right fronto parietal small extradural hematoma. (Soft tissue and bone window).

less than a 5 mm in patients with a GCS score greater than 8 without focal neurological deficits. With serial CT scanning and close neurological observation in a neurosurgical center [3].

In this study, factors related to the patients, mode of trauma and the characters of the resulting EDH were thoroughly studied aiming to identify the possible factors that would favor conversion of a conservatively managed extradural hematoma into surgical management.

The presence of these risk factors, which could be patient related, or disease related, would necessitate a closer follow up of the patient for any signs of neurological deterioration requiring urgent surgical intervention.

Several possible risk factors were assessed (Table 1). The presence of associated cerebral lesion that did not require initial surgery or the occurrence of fits at the time of trauma did not increase the incidence of later conversion to surgery.

Table 1. Comparison of between the surgical and the non-surgical groups.

		Surgical				P value
		Y		N		
		No.	%	No.	%	
Sex	F	3	14.3%	30	43.5%	0.015
	M	18	85.7%	39	56.5%	
Side of the hematoma	L	9	42.9%	33	47.8%	0.689
	R	12	57.1%	36	52.2%	
Overlying a venous sinus	Yes	6	28.6%	3	4.3%	0.004
	No	15	71.4%	66	95.7%	
Mode of trauma	FFH	6	28.6%	24	34.8%	0.005
	IHT	0	0%	18	26.1%	
	MCA	15	71.4%	27	39.1%	
Associated cerebral lesions	Contusion	6	28.6%	9	13.0%	0.106
	No	15	71.4%	60	87.0%	
Presence of fissures	Y	12	57.1%	24	34.8%	0.067
	N	9	42.9%	45	65.2%	
Fits at the time of trauma	Y	6	28.6%	9	13.0%	0.106
	N	15	71.4%	60	87.0%	
Previous head trauma	Y	3	14.3%	12	17.4%	1
	N	18	85.7%	57	82.6%	
Presence of coagulopathy	Y	3	14.3%	0	0%	0.011
	N	18	85.7%	69	100.0%	

Y: Yes, N: No, M: Male, F: Female, FFH: Fall From Height, MCA: Motor Car Accident, R: Right, L: Left.

Patients with an old history of trauma and those with history of coagulopathy did not have a higher incidence of conversion to surgery. However, the number of patients with coagulopathy in our study was not enough to provide statistically significant results.

The presence of fissures associated with the hematoma was also not a risk factor for conversion to surgery.

The two most statistically significant predictive factors for conversion to a surgical management were found to be the original size of hematoma at time of presentation and the hematoma being overlying a venous sinus with p values < 0.001 and 0.012 respectively.

A cutoff value of the initial size of the hematoma was found to be 19 ml, with larger hematomas being associated with a higher incidence of progression in size and clinical deterioration causing an increased incidence of conversion from a conservative to a surgical management. And this make our study different from other studies.

Thus, hematomas of such sizes, being still less than 30 ml and classically managed conservatively, should be closely observed and any sign of deterioration should be surgically managed.

Nine cases (10%) had hematomas related to a venous sinus, six of them were related to the superior sagittal sinus. These cases had a high incidence of requiring conversion to surgery (66.67%). Also requiring closer follow up and better observation.

Prompt and adequate management of extradural hematomas is usually associated with a good outcome; however, the presence of serious associated body injuries may worsen the prognosis.

Our study has some limitations; including small number of cases and being one center results and coagulopathy that need to be investigated separately in cases of extradural hematoma. Which should be considered in future studies.

5. Conclusions

Clear indications of EDH evacuation have been well known, however studying which risk factors are more liable to convert conservative management plan to evacuation is important.

EDH with a volume of 30 ml or less is managed conservatively, however, increased caution and closer monitoring are required when the size of the hematoma is >19 ml or the hematoma is overlying a venous sinus. Unlike coagulopathy which was found to be a potential risk factor, but larger number study is needed.

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