Simultaneous Multiple Extradural Hematomas

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Abstract

Objective Simultaneous multiple epidural hematomas (EDHs) are very rare and are associated with high mortality. The purpose of this study is to identify the clinical features, varying mechanisms that may be responsible for production of these hematomas, location of hematomas, and outcome of simultaneous multiple EDHs.

Methods Our study consisted of 528 patients who were admitted in our emergency department with diagnosis of traumatic brain injury (TBI) over a period of 14 months from September 2012 to October 2013 and retrospective analysis of all cases with EDH, particularly those with simultaneous multiple EDHs was done. All the patients were carefully examined clinically, Glasgow Coma Scale (GCS) was noted, plain computed tomographic scan (CT scan) was done and managed accordingly.

Results We came across six cases of multiple EDHs which accounted to 1.13% of all TBI. All of the cases except one were diagnosed within the first 6 hours. The GCS was used for neurological evaluations on admission and during hospital stay. A CT scan was done in all cases. Five patients underwent surgical intervention and one was managed conservatively. Two patients expired due to pre- and postoperative complications.

Conclusion EDHs are serious manifestation of TBI, of which multiple EDHs are even worse. These are life-threatening conditions. Early recognition and treatment can save a precious life. Widespread use of CT scan leads to early diagnosis before deterioration of the neurological status and affects the outcome of surgery.

Keywords

- simultaneous multiple extradural hematomas
- traumatic brain injury
- managed conservatively

Introduction

Traumatic brain injuries (TBIs) are one of the major public health problems, leading to a high mortality and morbidity rate around the globe.[1] And pose a major social and economic burden on the society.[2]

Epidural hematomas (EDHs) are one of the consequences of head injury accounting to 1 to 2% case of TBI.[3] The simultaneous presence of EDHs at two or more sites is even rarer. Multiple EDHs may be unilateral or bilateral.

Detection of simultaneous multiple EDHs before the era of computed tomographic scan (CT scan) was very difficult and mostly diagnosed on autopsy. The first case of bilateral EDH was reported by Roy in 1884.[4]

Even with help of CT scan incidence of simultaneous multiple EDHs ranges from 2 to 25% of all EDHs in different series.[5]

Here, we report six such cases of multiple EDHs with their clinical profile and outcome.

Patients and Methods

Our study consisted of patients who were admitted in our emergency department with diagnosis of head injury over a period of 14 months from September 2012 to October 2013 and retrospective analysis of all cases with EDH, particularly those with simultaneous multiple EDHs was done. All the patients were carefully examined clinically, Glasgow Coma

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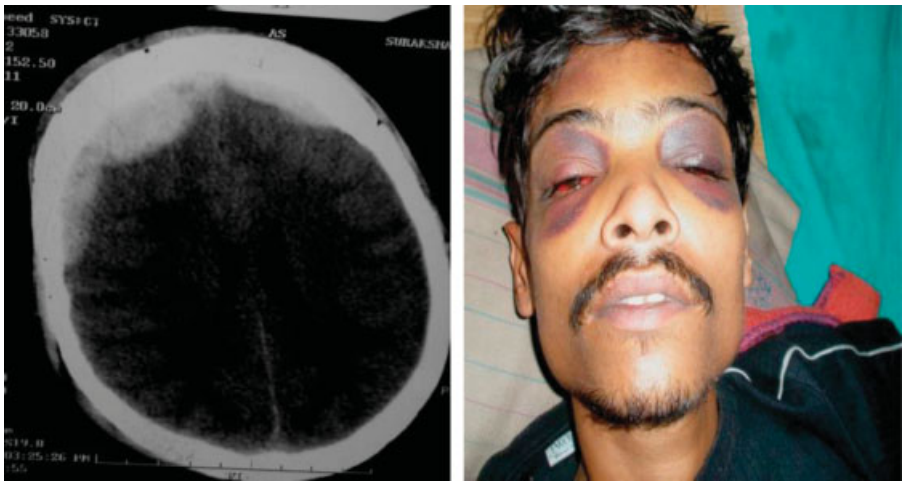

Fig. 1 Bilateral frontal and left parietal epidural hematomas managed conservatively (Patient no. 1 in ►**Table 1**).

Table 1 Clinical and CT findings, management, and outcome

Patient no.	Age (y)	Mode of injury	GCS on admission	CT scan site of EDHs	Management	GCS on discharge
1	26	RTA	15	B/L frontal and Rt parietal (►**Fig. 1**)	Conservative	15
2	25	RTA	8	B/L parietal and Lt frontal (►**Fig. 2**)	Sx	Expired
3	45	RTA	8	B/L frontal (►**Fig. 3**)	Sx	Expired
4	18	RTA	14	B/L frontal (►**Fig. 4**)	Sx	15
5	35	RTA	14	B/L occipital (►**Fig. 5**)	Sx	15
6	30	Assault	12	Lt frontal and occipital (►**Fig. 6**)	Sx	12

Abbreviations: B/L, bilateral; CT, computed tomographic; GCS, Glasgow Coma Scale; Lt, left; Rt, right; RTA, road traffic accident; Sx, surgery.

Scale (GCS) was noted, plain CT scan was done and managed accordingly.

Results

A total of 528 patients were admitted with head injury during our study period, of which 68 patients had EDH. Among these only six patients were diagnosed with bilateral/multiple EDHs which accounted for only 1.1% cases of head injury and 8.8% cases of EDH.

All the patients with simultaneous multiple EDHs were males. Overall, five patients were adults younger than 35 years age and only one patient was of 45 years. Road traffic accident (RTA) was the cause in most cases, whereas one was due to physical assault.

All cases presented within 6 hours of their injuries except a young adult who was referred to us 24 hours after RTA with a GCS of 15 and having raccoon eyes. CT scan was done which showed multiple EDHs with calvarial fracture (►**Fig. 1**). He was managed conservatively as family members did not give consent for surgery, and was discharged with GCS of 15 after 21 days when repeated CT scan revealed resorption of hematomas.

Two patients were admitted with a GCS of 8 and both did not survive after surgical evacuation. One of them succumbed to his injuries (rib fracture with hemothorax and fracture shaft left femur) (►**Fig. 2**). The other patient died of septicemia after being on ventilator for 8 days (►**Fig. 3**).

The other three having GCS of 14, 14, and 12 were discharged following surgery with GCS of 15, 15, and 12,

Fig. 2 Bilateral parietal and left frontal epidural hematomas (Patient no. 2 in ►**Table 1**).

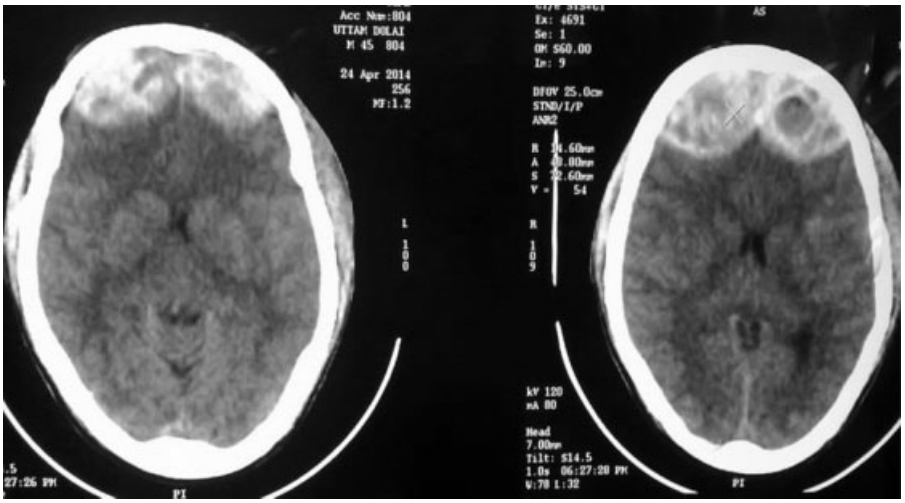

Fig. 3 Bilateral frontal epidural hematomas (Patient no. 3 in ►**Table 1**).

respectively (►**Table 1**) (►**Figs. 4–6**). Giving an impression that patients with better GCS have good surgical outcome.

Five of the six patients with multiple EDHs underwent surgery of which only three survived. Only one patient who presented late was managed conservatively. This shows a higher mortality rate of 33.3% (2 out of 6) compared to 22.6% (14 out of 62) of single EDH (►**Table 2**).

Discussion

Most common causes of TBI are fall from height, motor vehicle accidents, struck by/against events, and assaults.[6] Although, in developed countries, the incidence of fall-related TBI is high.[2] In the developing countries, the incidence of motorbikes-related TBIs is significantly increasing as compared to other causes.[7]

In our series, five of six cases were due to RTA and one was victim of assault.

Extradural hematomas are one of the various manifestations of head injuries. These are generally unilateral and result from middle meningial vessel bleed. On the basis of the vessel of origin, there are two types of EDH. In cases with venous bleed, EDHs occur as a delayed phenomenon, whereas in the other type the bleeding is arterial and present acutely.[8] About 10 to 40% of EDHs are result of venous bleed, as the result of tearing of dural sinuses, emissary veins, or venous leak from dura matter.[9]

Bilateral EDHs consists of 2 to 10% of all acute EDHs in adults.[10] In our study, it was 8.8% of all EDHs.

To produce bilateral EDHs, the dura mater must be detached in two locations by a singly directed force. A lateral force can strip the dura mater at the site of impact by the inward and outward bending of the skull, as described by Bell.[11] On the opposite side, dural stripping may occur because of motion of the skull further aggravated by the negative intracranial pressure found at the antipode of the compression forces of the skull.[12] The decrease in intracranial pressure found when nonspherical skulls were experimentally compressed along the long axis could supplement the force of deformation of the skull in producing bilateral dural detachment.[12] In adults and infants, separation of bone and dura mater causes mixed arterial and venous bleeding from the bone bed as a result of disruption of emissary veins, sinuses, and venous lakes.[13]

Vertex bilateral EDH can be due to extension of linear fracture across the sagittal suture leading to bilateral EDH under fracture line, as a result of superior sagittal sinus injury.[11]

Many if not most of these bilateral hematomas are of venous origin and are bifrontal in location.[14] It has been thought that force of impact to head leading to bilateral hematomas tends to be anteroposterior rather than lateral direction. This may be the reason for more cases in frontal region.[11]

In our series, bilateral frontal followed by frontoparietal EDHs appear to be common combinations, and for the

Fig. 4 BL frontal EDH (Patient no. 4 in ►**Table 1**).

Fig. 5 Bilateral occipital epidural hematomas (Patient no. 5 in ►**Table 1**).

suspicion of sinus injury, two units of blood were kept in hand to prevent catastrophes (►**Table 1**).

Bilateral EDH are associated with high mortality,[15,16] as the patients with double EDHs have a lower GCS, lateralization is frequently absent, and deteriorate more often than individuals with unilateral hematomas.[11,14,17,18]

The delay in development of symptoms may either be because of a difference in the rate of growth of the hematomas, or because of the ability of the brain to compensate for an enlarging intracranial mass. Several factors, including buffering by cerebrospinal fluid, and elasticity of cerebral tissues, contribute to the brain's ability to compensate for an intracranial mass. Thus, management has to be individualized based on GCS, volume of EDH and site.

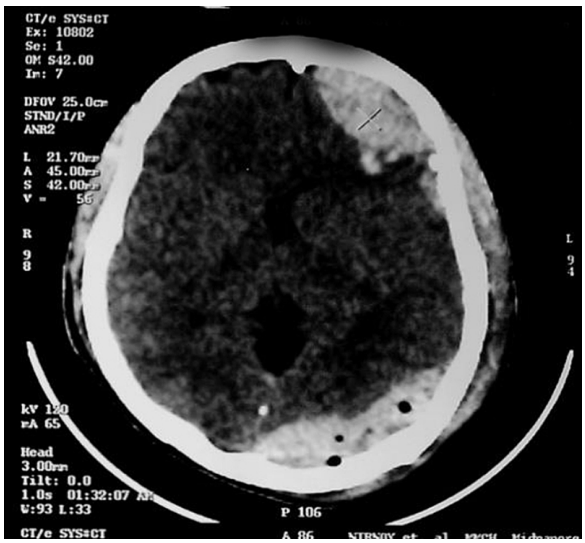

Fig. 6 Left frontal and occipital epidural hematomas (Patient no. 6 in ►**Table 1**).

Table 2 Outcome

		Survived	Expired
Single EDH	Surgery	39	9
	Conservative1	9	5
Multiple EDH	Surgery	3	2
	Conservative	1	0

EDH with volume more than 30 mL is considered an indication for surgery regardless of patient's GCS by some authors. Some consider fall in GCS as indication. Cases with EDH in inferotemporal lobe, have a lower threshold for surgery, as increased chance of herniation.[19] Emergency and rapid decompression of brain may be needed in these cases. If necessary, bilateral simultaneous craniotomies by two neurosurgeon groups, should be performed to evacuate temporal EDHs.[17] This will reduce the operating time and improve result.[17]

However, having two operating neurosurgeons may not always be possible, like in our set up. And hematomas have to be evacuated one after another.

Barlow and Kohi reported that in the case of bilateral EDH with different volumes, the side with a larger volume of hemorrhage has to be evacuated primarily, followed by the opposite side. When the volumes of the hematomas are equal, the dominant-sided hematoma is first evacuated.[20]

Similar principle was also followed by us during bilateral craniotomies. Nonoperative treatment of EDHs has also been argued.[21,22] With increased access to CT for the screening of patients after injury, more hematomas which appear suitable for surgical evacuation may be discovered, but the clinical progress of the patients may not always indicate the need for such treatment.

Various theories for spontaneous resolution of extradural hematomas have been proposed. The formation of a fibrovascular neomembrane lining the dural side acts as an absorbing structure for the blood clot. The angioblasts form sinusoids that gradually connect with the marginal dural vessels, so blood and blood products can return to the systemic circulation via the permeable membrane of these sinusoids.[23,24] However, such hematoma resolution is

reported as longer than 3 weeks.[23] Medical treatment, repeated CT scan, and close neurological follow-up are essential in the conservative management.[23,24]

Some authors emphasized the potential communication between the intra- and epicranial spaces through a fracture as mechanism for spontaneous resolution of EDHs.[22] Increasing ICP creates a pressure gradient between the EDH and epicranial soft tissues, such that the EDH is forced out of the epidural space through the fracture.[23,24]

Though the majority of extradural hematomas require urgent surgical evacuation, the detection of an extradural hematoma in a patient showing clinical improvement, particularly if diagnosed late after the injury, should not necessarily be an indication for evacuation.[25]

Thus, it may be possible to manage patients conservatively in anticipation of absorption of the hematoma, like the patients described here with CT scan monitoring the progress.

High mortality rates (15.7—20%) have been reported in various series on bilateral EDHs.[11] The mortality rate was 33.3% in our series.

Conclusion

EDHs are serious manifestation of head injury of which multiple EDHs are even worse. These are life-threatening conditions. Early recognition and treatment can save a precious life. Although conservative management has also been argued by some, it should be weighed against surgical intervention, considering factors like patients GCS, time of presentation, site, and volume of lesion. Further studies with larger number of cases are needed to establish a definite protocol. For the time being, surgery stands as the prime modality of treatment. Good results can be achieved with careful planning, adequate exposure, judicious surgical approach, and timely management.

Conflicts of Interest
The authors have nothing to declare.

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