

Research Paper

Analysis of Cases of Giant Epidural Hemorrhage Evacuated in a Rural Hospital



Sajag Kumar Gupta^{1*} , Mohd Faheem¹ 

1. Department of Neurosurgery, Uttar Pradesh University of Medical Sciences, Saifai, India



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ABSTRACT

Background and Aim: We assessed surgical cases with giant epidural hemorrhages that have a significant influence on therapeutic as well as clinical prognosis.

Methods and Materials/Patients: A total of 112 cases underwent surgery for epidural hemorrhage in an Emergency Neurosurgical Department of the Uttar Pradesh University of Medical Sciences, Saifai, Etawah, India (a rural hospital), between January 1, 2022, and March 31, 2023. We defined giant epidural hemorrhage as a quantity of more than 80 cc. The therapeutic and prognostic features of 15 people with giant epidural hemorrhage with a hematoma volume of 80 cc were studied further.

Results: The most prevalent age group was between 20 and 40 years (53.33%). M2 response (60%) represented the most frequent motor movement among giant epidural hemorrhage victims who underwent surgery. The majority of them (86.66%) suffered from serious brain damage. The Glasgow coma scale (GCS) score on admission, pupil alterations, and motor movement were all associated with the prognosis of giant epidural hemorrhage surgery.

Conclusion: Giant epidural hemorrhage >80 cc performs badly. The GCS on admission, pupil alterations, and motor movement are all markers of the operative prognosis of a large epidural hemorrhage.

* Corresponding Author:

Sajag Kumar Gupta, Assistant Professor.

Address: Department of Neurosurgery, Uttar Pradesh University of Medical Sciences, Saifai, India

Tel: +98 (919) 924992598

E-mail: Sajag.Gupta@yahoo.com



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Highlights

- Epidural hemorrhage is a hematoma accumulation between the dura and bone.
- We considered >80 cc giant epidural haemorrhage.
- A giant epidural hemorrhage volume more than >80 cc causes instantaneous midline shift, brain herniation, and pressure over the brainstem result in a higher proportion of death.

Plain Language Summary

Epidural hemorrhage is commonly found in the region of a skull fracture. Epidural hemorrhage is usually rapid within a few hours, although it may have a delayed period that is recognized several days later. Giant epidural hemorrhage, also known as massive epidural hemorrhage (EDH), is an epidural collection large enough to induce sudden midline displacement, brain herniation, and pressure over the brainstem, ultimately resulting in death. This is an emergency that necessitates the immediate evacuation of the epidural hemorrhage and stabilization of the patient. We considered >80 cc giant epidural haemorrhage. A giant epidural hemorrhage >80 cc causes instantaneous midline shift, brain herniation, and pressure over the brainstem, resulting in a higher proportion of death.

1. Introduction

Epidural hemorrhage is a hematoma accumulation between the dura and bone. It is commonly caused by a rupture of the middle meningeal artery, but it can also be caused by a rupture of the dural venous sinuses, veins in the meningeal layer, diploic vein, and fracture line.

Trauma is almost always the etiology of epidural hemorrhage and it is generally linked to a skull fracture [1]. Epidural hemorrhages are responsible for 5%-15% of dangerous brain traumas [2]. The head computed tomography (CT) scan is the preferred examination for detecting brain damage following trauma [3]. Head CT scan also detects other factors that influence the surgical outcome, such as midline shift (MLS), traumatic subarachnoid hemorrhage, obliterated basal cisterns, hematoma size, the volume of the clot, contusion, and skull bone fracture.

Local ischemia from massive trauma, direct head injury, or venous return obstruction is most responsible for the associated brain disorders. Ischemic brain injury is a significant prognostic indicator for the pathophysiology of epidural hemorrhage and may be caused by the hematoma's mass effects and elevated intracerebral pressures (ICP), resulting in impaired cerebral perfusion pressures (CPP). Apart from epidural hemorrhage, the underlying brain damage is responsible for impaired neurological function following trauma.

The outcome of epidural hemorrhage is mostly determined by the Glasgow coma scale (GCS) score on admission and neurological state [4]. A massive epidural hemorrhage (Figure 1) is an epidural collection large enough to produce an abrupt MLS, brain herniation, and pressure over the brainstem, resulting in patient death. It is an emergency that necessitates the immediate removal of epidural hemorrhage and stabilization of the patient. Many comorbidities, concurrent brain impairment, ischemic brain, antiplatelet, anticoagulant medication, and old age influence the surgical prognosis of epidural hemorrhage. It is critical to correctly identify outcome-predicting markers in order to provide appropriate surgical treatment. We assessed the effect of massive or huge epidural hemorrhage, which is significant acute deterioration of neurological status and negative prognosis. We also examined people with huge epidural hemorrhage who underwent surgery from a therapeutic and prognosis standpoint.

2. Methods and Materials/Patients

This retrospective study was done on 112 people who underwent surgery for an epidural hemorrhage in an Emergency Neurosurgical Department of the Uttar Pradesh University of Medical Sciences (UPUMS), Saifai, Etawah, India, a rural hospital between January 1, 2022, and 31 March 2023. They were evaluated for giant epidural hemorrhage target amount and we considered >80 cc giant epidural haemorrhage. Accordingly, 15 people with giant epidural hemorrhage with hema-



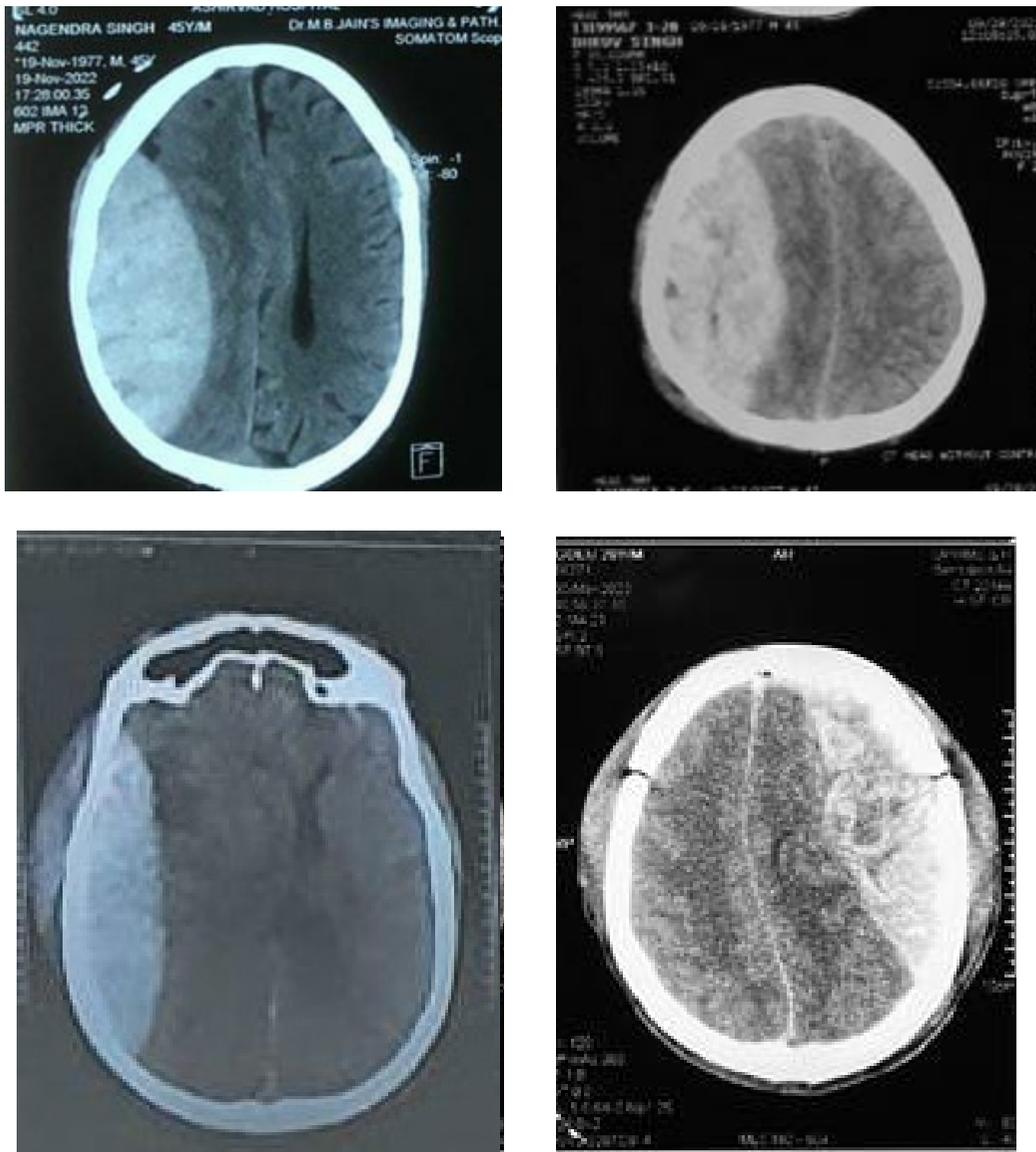


Figure 1. A) The right-sided giant epidural hemorrhage of a 45-year-old man, B) The right-sided giant epidural hemorrhage of a 26-year-old man, C) The right-sided giant epidural hemorrhage of a 29-year-old man, D) The left-sided giant epidural hemorrhage of a 36-year-old man

toma >80 cc were evaluated clinically, surgically, and for outcome according to age group, gender, mode of trauma, motor response, the severity of the injury, location of hemorrhage, presentation, CT findings, amount of clot evacuated, source of bleeding, and prognosis at discharge/death. All cases admitted to the Neurosurgical Department at UPUMS, met the criteria of inclusion. Patients with epidural hemorrhage >80 CC who received surgery within the first two hours after arriving at the trauma center were included in the research. The exclusion criteria were insufficient data for the research variables, conservatively treated epidural hemorrhage patients, and giving no consent to surgery. Craniotomy with epidural hemorrhage evacuation was the surgical

procedure employed. Craniectomy was performed for temporal epidural hemorrhage or comminuted skull fracture. Fresh frozen plasma was utilized to correct the international normalized ratio (INR) in anticoagulation medication patients, while pools of platelets were used in antiplatelet medication patients based on the neurosurgeon's choice. ICU care was offered following surgery. All performed procedures were informed after receiving permission from victims or their relatives (in cases where the patient was not able to consent, namely, those with a low GCS score).

Statistical tests were done using GraphPad Prism software, version 8.3. A $P < 0.05$ was considered significant. The null hypothesis of no significant difference in the mean and the alternative hypothesis of a significant difference between the means were considered. Outcome analysis of giant epidural hemorrhage was done using Pearson's correlation coefficient, chi-square test, and one-way ANOVA. The Peterson and Espersen equation was used to compute the amount of the epidural hemorrhage [5] (Equation 1):

$$1. \text{Epidural hemorrhage volume} = XYZ/0.5.$$

Where X, Y, and Z denoted the hematoma's sizes in the sagittal, axial, and coronal planes, respectively.

3. Results

In this research, most patients who underwent evacuation for giant epidural hemorrhage were in the age group of 20–40 years ($n=8$, 53.33%) followed by the age group of 40–60 years ($n=3$, 20%) (Table 1).

In this research, most patients who underwent surgery for giant epidural hemorrhage were male ($n=14$, 93.33%). The male-to-female (F:M) ratio was 14:1 (Table 1). Road traffic accidents (RTAs) ($n=10$, 66.66%) followed by assault ($n=4$, 26.66%) and fall from height ($n=1$, 6.66%) were the common modes of injury. M status was mostly M2 ($n=9$, 60 %) followed by M3 ($n=4$, 26.66 %) and M4 ($n=2$, 13.33%). Those with giant epidural hemorrhage had moderate (GCS score: 9–13; $n=2$, 13.33%) and severe head injury (GCS score: ≤ 8 , $n=13$, 86.66 %). No patient had a mild head injury (GCS score: 14–15). Pupil alteration (bilateral) in eight patients (53.33%), pupil alteration (unilateral) in five patients (33.33%), and bradycardia in seven patients (46.66%) were reported. In this research, the most common site of giant epidural hemorrhage was frontotemporoparietal ($n=10$, 66.66%) followed by frontoparietal ($n=4$, 26.66%) and parietal ($n=1$, 6.66%) (Table 2).

Table 1. Age and sex distribution of the participants

Variables		No. (%)
Age (y)	<20	2(13.33)
	20-40	8(53.33)
	40-60	3(20)
	>60	2(13.33)
Sex	Male	14(93.33)
	Female	1(6.66)



Table 2. Site and side of giant epidural hemorrhage

Location of Giant Epidural Hemorrhage	No. (%)
Bilateral	2(13.33)
Right	7(46.66)
Left	6(40)
Front temporoparietal	10(66.66)
Frontoparietal	4(26.66)
Parietal	1(6.66)



Table 3. Source of bleeding in giant epidural hemorrhage

Source of Bleeding	No. (%)
Dural venous sinus bleeding	12(80)
Middle meningeal arterial bleeding	3(20)



The right-sided giant epidural haemorrhage was present in seven victims (46.66%), left-sided was found in six victims (40%), and bilateral giant epidural hemorrhage was seen in two victims (13.33%).

The source of bleeding was dural venous sinus bleeding in 12 patients (80%), followed by middle meningeal arterial bleeding in three patients (20%) (Table 3). The amount of hematoma drained during the operation was >140 cc in seven patients (46.66%), 120–140 cc in five patients (33.33%), 100–120 cc in two patients (13.33%), and 80–90 cc in one patient (6.66%). In all patients, MLS and brain herniation were present. The Glasgow outcome scale (GOS) score of one was observed in eight patients (53.33%), the score of two was seen in three patients (20%), the score of three was seen in two patients (13.33%), the score of four was seen in one patient (6.66%), and the GOS score of five was seen in one patient (6.66%). In this study, the GCS score on admission, pupil alteration, and motor response were significantly associated with the outcome following sur-

gery for a giant epidural hemorrhage. In contrast, age, gender, and severity of injury were not associated with outcomes following surgery (Table 4).

4. Discussion

Hemorrhage is commonly found in the region of a skull fracture. Epidural hemorrhage is usually rapid within a few hours, although it may have a delayed period that is recognized several days later [6]. A giant epidural hemorrhage, also known as a massive epidural hemorrhage, is an epidural collection large enough to induce sudden midline displacement, brain herniation, and pressure over the brainstem, ultimately resulting in the victim's death. This is an emergency that necessitates the immediate evacuation of the epidural hemorrhage and stabilization of the patient. The age of victims who had massive epidural hemorrhage surgery ranges from 6 to 75 years. The 20-40 year age group (n=8, 53.33%) had the largest number of casualties, followed by the 40 to 60-year age group (n=3, 20%). There is a paucity

Table 4. Variables of operated giant epidural hemorrhage cases GOS score

Characteristics	GOS: 1 (n=8)	GOS: 2 (n=3)	GOS: 3 (n=2)	GOS: 4 (n=1)	GOS: 5 (n=1)	P
Age (y)	43.1	31	31.2	34	20	0.4217
Gender (%)	Male	8	2	2	1	0.3955
	Female	0	1	0	0	
Mode of injury	RTA=10	6	2	1	0	0.5777
	FFH=1	1	0	0	0	
	Assault=4	1	1	1	1	
Motor response	1.8	2.8	3.5	4	5	<0.0001
Pupil changes	8	3	2	0	0	0.0021
Severity of trauma	Mild	0	0	0	0	0.8242
	Moderate	0	0	0	1	
	Severe	8	3	2	0	
GCS score on admission	3.8	4.5	5.7	11	13	<0.0001



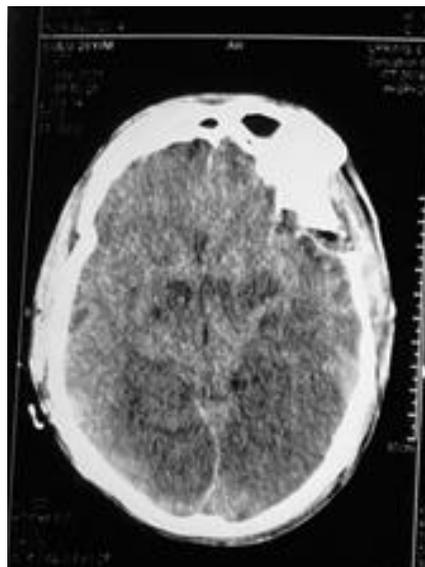


Figure 2. Post-operative head CT showing infarction



of data sets in scientific evidence on the age distribution patterns of giant epidural hemorrhage. However, in the published studies that included all epidural hemorrhages, most of the epidural hemorrhages were in the second decade of patients' lives, and the mean age of victims with epidural hemorrhage was between 20 to 30 years [7, 8]. Patients suffering giant epidural hemorrhage have a similar trend of age distribution. The male/female ratio of 14:1 in the current research reflects our social milieu, where most women were not exposed to outdoor careers. In individuals with giant epidural hemorrhage, we discovered male predominance (n=14, 93.33%) over female victims (n=1, 6.66%). Research is scarce on sex predominance in patients with giant epidural hemorrhage. Male predominance over females is identified in the documented series of all epidural hemorrhage cases [9]. We found a similar type of male predominance in our giant epidural hemorrhage patients.

RTAs were the most prevalent source of trauma in this research (n=10, 66.66%), followed by assault (n=4, 26.66%), resulting in the development of giant epidural hemorrhage. It is comparable to several other published datasets [8, 9] that cover all epidural hemorrhage patients. Compared to other places, epidural hemorrhage is more commonly seen in the temporoparietal and temporal regions in diverse reported series [10, 11]. There is a scarcity of material about the location of the giant epidural hemorrhage. According to our data, giant epidural hemorrhage was commonly found in the front temporoparietal area (n=10, 66.66%), followed by the frontoparietal (n=4, 26.66%) and parietal (n=1, 6.66%) regions. In the temporal area, epidural hemorrhage has

been linked to a high rate of death [11]. In this investigation, the M2 motor response was reported in nine patients (60%) followed by M3 (n=4, 26.66%) and M4 (n=2, 13.33%). Poor outcomes were seen in operated patients with low motor response status. In epidural hemorrhage patients, the best motor response on admission was a crucial determinant affecting the outcome [12, 13]. The majority of the head injury patients leading to giant epidural hemorrhage in our investigation were severe (n=13, 86.66%), followed by moderate (n=2, 13.33%) head injuries. Bilateral pupil alterations (n=8, 53.33%) along with unilateral pupil alteration (n=5, 33.33%) in victims of giant epidural hemorrhage suggest brain herniation as well as pressure over the brainstem caused by the giant epidural hemorrhage. Bradycardias were found in seven victims (46.66%) suggesting brainstem compressions. In our research, the most prevalent source of bleeding resulting from a large epidural hemorrhage was dural venous sinus bleeding (n=12, 80%), followed by middle meningeal artery bleeding (n=3, 20%). In recent research of 102 pediatric victims along with 387 adults with epidural hemorrhage, arterial bleeding was found as the cause of epidural hemorrhage in 36% of adults and 18% of children [11]. The low GCS score, concomitant cerebral lesions, pupil alteration, and elevated ICP are independent indicators of poor outcomes [3, 14]. The GCS score prior to surgery is a significant predictor of operative outcome [3, 14]. Age, hematoma size, and epidural hemorrhage location were all important variables in other studies. It was discovered that pupil alteration and a lower GCS score (9) were connected to bad prognosis [15]. In this research, the important clinical factors linked to poor

outcomes were GCS on admission, motor response, and pupil state. Age, sex, and the severity of damage were not substantially linked to treatment outcomes of giant epidural hemorrhage surgery.

The most important predictor of prognosis in patients with epidural hemorrhage receiving surgery is the GCS score on admission or the GCS score prior to surgery [16]. There were eight deaths (53.33%) in this trial, with a GCS score of one. These findings point to bad outcomes and increased death in victims with large epidural hemorrhage (>80 cc). Research is scarce on the expiration of post-operative giant epidural bleeding. One of the patients had a heart attack after surgery and died (Figure 2).

5. Conclusion

A giant epidural hemorrhage >80 cc causes instantaneous MLS, brain herniation, and pressure over the brainstem, resulting in a higher proportion of death. Early removal of a giant epidural hemorrhage is associated with a good result. In victims with giant epidural hemorrhage, poor GCS score on admission, poor motor response, and pupil alterations are related to bad outcomes. Some notable findings in the study include the predominance of men with an M:F ratio of 14:1 and the active age group of 20 to 40 years.

Ethical Considerations

Compliance with ethical guidelines

The study was approved by the Institutional Ethical Committee (Code: EC 23-008). Written informed consent was obtained from the patients.

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Authors' contributions

All stages of the study were performed by both authors.

Conflict of interest

The author declared no conflicts of interests.

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