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STUDY ON THE ASSOCIATION BETWEEN EXTRADURAL HEMATOMA (EDH) AND SKULL FRACTURE IN HEAD INJURY

Neurosurgery

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ABSTRACT

Extradural hematomas occur in 2% of all head injuries and up to 15% of fatal head injuries. Males are more frequently injured than females. Furthermore, teens and young adults are more likely to be affected. The average ages of patients are 20 to 30 years, and it is uncommon after the age of 50 to 60 years.

The present prospective study was conducted with an aim to find out the incidence and outcome of extradural hematoma (EDH) and skull fracture in head injury and to study clinical profile of patient and surgical vs medical result in such patient. The primary objectives were to find out the association between extradural hematoma (EDH) and skull fracture in head injury and to explain the need for a well integrated inter-professional team approach to improve care for patients with EDH. All patients diagnosed with EDH on CT-Scan who were hospitalized in Department of General Surgery, MLN Medical College, Prayagraj, UP, India. Study included 70 patients who were diagnosed with EDH on CT scan under Neurosurgery Unit after using exclusion criteria. A total of 70 consecutive patients who satisfied our criteria were selected for the study and statistically analyzed. Eligible patients were enrolled in the study after obtaining informed written consent to participate in the same.

Various parameters were tabulated and results were statistically analyzed and concluded that traumatic head injury commonly affects young adults (age range 15-30 yr). Most common site of Extradural hematoma is in temporal region and males are most commonly affected (Male:Female 6:1). RTA is the most common mode of injury which constitutes 74.3% in our study. EDH is usually associated with fracture of skull, linear skull fracture are seen most commonly in our study. The outcome of EDH is affected by GCS score, pupillary abnormality, hematoma volume and midline shift. In smaller hematoma and higher GCS score, outcome is better compared to patient with large hematoma and lower GCS score. EDH with higher volume required surgery whereas EDH with lower volume improved with medical management.

KEYWORDS

Head Injury, Extradural Hematoma (EDH), Glasgo Coma Scale (GCS), Skull Fracture, Road Traffic Accidents

INTRODUCTION

The incidence of Traumatic brain injury is quite high and estimated 20 per 1,00,000 people per year.[1] Traumatic brain injury (TBI) also known as intra-cranial injury, is injury to the brain due to impact by an external force. Traumatic brain injury can be characterized based on its severity (varying from mild to moderate to severe), mechanism (closed or penetrating head injury), or other characteristics (e.g. occurring in specific location or over a widespread area).

Extradural hematoma (EDH) is accumulation of blood in the potential space between inner table of skull and outer endosteal layer of durameter.[2] It is bounded by the lateral sutures (particularly the coronal sutures) into which the dura inserts. It is a potentially fatal condition which requires emergency treatment and can result in considerable morbidity and mortality if left untreated.

The most common source of EDH is arterial bleeding from middle meningeal artery and can also results from injury to the diploic veins, fracture hematoma or the venous sinuses.[3] Extradural hematoma mostly located in the temporoparietal region in approximately 70–80% of patients. Extensions to adjacent frontal and occipital areas are common.[4] Incidence of skull fracture in patients with EDH has been reported between 63-85%.[5] It occurs in approximately 1 – 3% of patients with head injuries and about 5 – 15% of patients with severe head injuries.[6,7]

Traumatic EDH is a neurosurgical emergency and timely surgical intervention for significant EDH is the gold standard.[8] EDH most frequently occurs as result of road traffic accidents, followed by fall from height, direct blow to skull, and assault. Sport injuries also contribute to the development of EDH.[9] Among these factors, the direct blow to skull is highly associated with skull fracture.[10] Mostly patients with an acute extradural hematoma become symptomatic in less than 24 hours, with 60–75% under 12 hours of trauma.[11] Rapid diagnosis and evacuation of hematoma are critical for a good outcome.

MATERIALS AND METHODS

The present Comparative Prospective study was conducted at Neurosurgery Unit, P.G. Department of General Surgery, M. L. N. MEDICAL COLLEGE & Swaroop Rani Nehru Hospital PRAYAGRAJ, U.P. India. Our study includes all patients diagnosed with EDH on CT-Scan who were hospitalized for a period of 14 months (September 2021-October 2022).

AIMS:

To find out the incidence and outcome of extradural hematoma (EDH) and skull fracture in head injuries and to study clinical profile of patient and surgical vs. medical results in such patient.

OBJECTIVES:

To find out the association between extradural hematoma (EDH) and skull fractures in head injury and to explain the need for a well integrated inter-professional team approach to improve care for patients with EDH.

SAMPLING

Sample Size: Study included 70 patients who were diagnosed with EDH on CT scan under Neurosurgery Unit after using exclusion criteria. Sample size is calculated on the basis of proportion of skull fracture among EDH cases using the formula :

$$n = \frac{z_\alpha^2 pq}{L^2}$$

Where p = 72.5% expected proportion of skull fracture among EDH cases

q = 100 – p ,

Type I error α=5 %, for the significance level of 95%.

Allowable error L = 15% of p for detecting the results with 80% power of study,

Data loss factor = 10%

The minimum sample size required comes out to be n = 70

All patients having EDH due to head injury were included in the study. Those patients who are on anticoagulants and who were not willing to participate were excluded from the study.

A total of 70 consecutive patients who satisfied our inclusion criteria were selected for the study and statistically analyzed. Eligible patients were enrolled in the study after obtaining informed written consent to participate in the study. The clinical variables included were Age of patient, gender, mode of injury, GCS score and pupillary abnormalities. The CT variables included were site of hematoma, volume of EDH, associated skull fracture and midline shift. Management variables were surgical and medical treatment. Various parameters were tabulated and results were statistically analyzed.

Statistical Analysis

The results were analyzed using descriptive statistics and making comparisons among various groups. Categorical data were summarized as in proportions and percentages (%) while discrete as mean ± SD. The Chi Square Test, Arithmetic Mean, Standard deviation, ANOVA, Unpaired t Test and Paired t Test were calculated in the present analysis.

OBSERVATIONS AND RESULTS

"Study on the association between Extradural Hematoma (EDH) and Skull Fracture in Head Injury" was undertaken at our tertiary care hospital to find out the incidence and outcome of extradural hematoma (EDH). The study found that maximum cases belonged to the age range 15 – 29 yr (37.1%) followed by the age group 45 – 59 yr (22.9%). There were 17.1% cases below 15 years of age while 2.9% cases were aged more than 60 years. Male/Female proportion in the study was 6:1. Majority of the cases were due to RTA (74.3%), assault was the mode in 10 (14.3%) cases and fall in 8 (11.4%) cases.

In our study, anisocoric but reactive pupil was observed in 24 (34.3%) cases while reactive in 46 (65.7%) cases. Temporal site was involved in maximum 38.6% cases followed by the frontal site which was involved in 27.1% cases. Other sites were frontoparietal (1.4%), occipital (7.1%), parietal (14.3%) and temporoparietal (11.4%). The depressed, compound and linear fractures were observed in 4 (5.7%), 8 (11.4%) and 14 (20.0%) cases respectively. Surgeries were done in majority 49 (70%) cases while remaining 21 (30%) cases managed medically. At the time of admission, the GCS score was maximum (14.47±0.53) for EDH volume ranges 10-40 ml and minimum (7.11±4.11) for the EDH volume ranges >=120ml. At Discharge, the GCS score was maximum (14.71±0.29) for EDH volume ranges 10-40 ml and minimum (9.25±4.57) for the EDH volume ranges >=120 ml.

The mean GOS score at discharge was maximum (4.95) for EDH volume ranges 10-40 ml and minimum (2.75) for the EDH volume ranges >=120 ml. The significant difference was found in GOS score among various EDH volume ranges (p<0.001).

In the surgical treatment group majority of the cases had EDH volume between 40-80 ml (65.3%) while in medical treatment group majority had EDH volume between 10-40 ml. The significant difference was found in proportion of EDH volume between surgical and medical groups (p<0.001)

Volume	Surgical		Medical		chi sq	p-value
	N	%	N	%		
10 - 40 ml	2	4.1%	20	95.2%	57.77	<0.001
40 - 80 ml	32	65.3%	0	0.0%		
80 - 120 ml	12	24.5%	0	0.0%		
>= 120 ml	3	6.1%	1	4.8%		

At the discharge, in the surgical treatment group, mean GOS score was 4.37 while in the medical treatment group mean GOS score was 4.90. The significant difference was found in mean GOS score between surgical and medical groups (p=0.008)

Treatment	GOS at Discharge		unpaired t test	
	Mean	SD	t-value	p-value
Surgical	4.37	1.20	-2.74	.008
Medical	4.90	0.44		

DISCUSSION

Extradural hematoma (EDH) is a disease characterized by intracranial bleeding collected between the skull and the dura mater. Usually, the bleeding is unilateral and commonly caused by rupture of the middle meningeal artery.[12] The causes of intracranial haemorrhages, particularly EDH are commonly attributed to traumatic brain injuries, accompanied by a mortality rate of upto 30%.[13,14] Bilateral EDH are quite rare conditions that account for only less than 5% of all cases of EDH.[13,15] Bilateral EDH can be attributed to skull fracture, generally linear fracture, crossing the midline and causing EDH on both sides of the skull, usually due to superior sagittal sinus injury.[12]

Our results showed that maximum cases belonged to the age group 15 – 29 year (37.1%) followed by the age group 45 – 59 year (22.9%). Only 17.1% cases were less than 15 years of age while 2.9% cases were aged more than 60 years with male preponderance. However, Maurice-Williams RS et al, Jennett B et al observed that the effect of a head injury is disproportionately severe in the elderly.[16,17] Although the occurrence of post-traumatic intracranial haematoma in the elderly is common, the exception is an acute EDH, which is relatively rare (Amacher AL et al).[18] In our study the mode of injury was RTA in majority of the cases (74.3%). Assault was the mode in 10 (14.3%) cases and fall in 8 (11.4%) cases. Umerani MS et al also found that RTA was the most common cause (52.8%) followed by fall, assault, and sports injury.[19] Our results also found that anisocoric but reactive pupil was observed in 24 (34.3%) cases while equal and reactive in 46 (65.7%) cases. Incidence of pupillary changes is diversely reported (Chowdhury SM et al, Yurt I et al, Özkan Ü et al)[20,21,22]

In our study, temporal site was involved in maximum 38.6% cases followed by the frontal site which was in 27.1% cases. Other sites were fronto-parietal (1.4%), occipital (7.1%), parietal (14.3%) and temporo-parietal (11.4%). Gupta et al also found that most common location of EDH was temporal region (44.83%) followed by frontal and parietal area.[23] The results of our study also revealed that the linear, depressed and compound fracture types were observed in 14 (20.0%), 8 (11.4%) and 4 (5.7%) cases respectively. Muhammad Ammad-ul-Haq et al found that linear type of injury was observed in 65 (20.2%) cases, simple type in 62 (25.5%) cases, depressed type in 100 (31.1%) cases while the compound type of skull fracture in 75 (23.3%).[24] In our study, cases were managed by surgeries in majority 49 (70%) cases while remaining 21 (30%) cases managed medically. Bhau KS et al studied the role of conservative management and various reasons for conversion to surgical intervention in traumatic EDH and found that out of 120 patients admitted 67 were managed conservatively, 53 cases were operated upon.[25] At the time of discharge, condition of the pupil was also observed. Reactive condition was found in majority 61 (87.1%) cases, anisocoric but reactive was present in 4 (5.7%) cases and in remaining 5 (7.1%) cases dilated fixed was found with their GCS E1VTM1. In our study, Volume of EDH was found to be between 40-80 ml in majority 32 (45.7%) cases, among 22 (31.4%) the EDH volume was between 10-40 ml, in 12 (17.1%) cases, it was between 80-120 ml and in remaining 4 (5.7%) cases it was above 120 ml.

The decision to perform a surgery in a patient with a traumatic EDH is dependent on several factors (neurological status, size of hematoma, age of patients, CT findings) but also may depend on the judgment of the treating neurosurgeon. At the time of admission, the GCS score was found to decrease significantly with increase in EDH volume (p<0.001) and similar observations were found from day 1 to the day of discharge (day 8) with high statistical significance (p<0.001). It was observed that on post-op 1st day, a non-significant reduction in GCS score was observed (p=0.650) while a significant increase in GCS score was observed on post-op day 3rd, 7th and at the time of discharge (p<0.001). A similar study was performed by Khan MS et al illustrated that there was statistically significant positive correlation(p=0.001) between admission GCS Score with GCS Score on 1st , 3rd , 10th POD and following 1 month following surgery. There was also statistically significant positive correlation (p=0.001) between admission GCS Score and GOS Score during subsequent postoperative follow-up in this study.[26]

The mean age of surgical treatment group was 29.57±14.33 years with 43 (87.8%) males and 6 (12.2%) females. At discharge, in the surgical

treatment group and medical treatment group reactive pupil abnormalities were 83.7% and 95.2% respectively with no significant difference (p=0.337). Mean GCS score was 13.45±3.40 in surgical group while in the medical treatment group mean GCS score was 14.76±1.09 with significant difference (p=0.018).

When non-surgical management is attempted, the patient should be admitted in a neurosurgical center, under very close neurological observation, with serial CT scans, in order to act quickly on sudden deterioration. The first follow-up CT scan should be obtained within 6 to 8 hours after trauma (Bullock MR et al).[27]

LIMITATIONS

The study was limited to a small finite sample size,and it did not involved subjects with serious comorbidities.

CONCLUSION

Young male adults are more commonly affected by traumatic head injuries with road traffic accidents as most important cause. Extradural hematomas most commonly present in temporal regions, and are usually associated with skull fractures, commonly the linear skull fractures. The outcome of EDH is affected by GCS score, pupillary abnormalities, hematoma volume and midline shift. In smaller hematoma and higher GCS score, outcome is better compared to patient with large hematoma and lower GCS score. EDH with higher volume required surgery whereas EDH with lower volume improved with medical management only.

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