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Extradural Hematoma in Patients Presenting with Linear Skull Fracture after Head Injury

Syeda Ruba Irfan[1], Usamah-Bin-Waheed[2], Shahida Saeed[3], Waqas Mughis[4], Sana Silvia[5]

1 ***Consultant Neurosurgeon, Department of Neurosurgery, Civil Hospital, Karachi Pakistan***
Substantial contribution to the conception and design of the work, Data acquisition, Analysis, Interpretation of data for the work, Drafting the work, Revising critically for intellectual content, Final approval of the version to be published, Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated

2 ***Senior Registrar, Department of Neurosurgery, Liaqat College of Medicine, Karachi Pakistan***
Substantial contribution to the conception and design of the work, Data acquisition, Analysis, Interpretation of data for the work, Drafting the work, Revising critically for intellectual content, Final approval of the version to be published, Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated

3 ***Consultant Neurosurgeon, Department of Neurosurgery, Civil Hospital, Karachi Pakistan***
Substantial contribution to the conception and design of the work, Data acquisition, Analysis, Interpretation of data for the work, Drafting the work, Revising critically for intellectual content, Final approval of the version to be published, Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated

4 ***Senior Registrar, Department of Neurosurgery, Jinnah Medical & Dental College, Karachi Pakistan***
Substantial contribution to the conception and design of the work, Data acquisition, Analysis, Interpretation of data for the work, Drafting the work, Revising critically for intellectual content, Final approval of the version to be published, Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated

5 ***Post Graduate Resident, Department of Neurosurgery, Dr. Ruth K. M. Pfau, Civil Hospital, Karachi Pakistan***
Substantial contribution to the conception and design of the work, Data acquisition, Analysis, Interpretation of data for the work, Drafting the work, Revising critically for intellectual content, Final approval of the version to be published, Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated

CORRESPONDING AUTHOR
Dr. Syeda Ruba Irfan
Consultant Neurosurgeon, Department of Neurosurgery, Civil Hospital, Karachi Pakistan
Email: srubairfan@gmail.com

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ABSTRACT

Background: Head trauma is a major cause of morbidity and mortality worldwide, with skull fractures serving as key indicators of possible intracranial injury. Linear skull fractures are among the most common fracture types and are frequently associated with extradural hematoma (EDH), a life-threatening condition requiring timely diagnosis. Determining the frequency and relationship between linear skull fractures and EDH can improve early detection and management, especially in tertiary care settings. **Objective:** To determine the frequency of extradural hematoma in patients with linear skull fractures presenting to a tertiary care hospital. **Study Design:** Cross-sectional study. **Settings:** Department of Neurosurgery, Dr. Ruth K.M. Pfau Civil Hospital, Karachi, Pakistan. **Duration:** May 30, 2020, to May 29, 2021. **Methods:** All patients meeting inclusion criteria were enrolled after informed consent. Each underwent a head CT scan for assessment of linear skull fracture and the presence of EDH. Fractures were confirmed radiologically, and data were collected by an independent observer not directly involved in the research. All information was documented on a structured proforma and analyzed statistically. **Results:** The mean age of participants was 31.77 ± 12.63 years. Of 224 patients, 198 (88.4%) were male and 26 (11.6%) were female. Extradural hematoma was present in 76 (33.9%) patients. The frontal bone was the most frequently fractured site (34.3%) and also the location most commonly associated with EDH (9.8%). **Conclusion:** Linear skull fracture shows a strong association with extradural hematoma. Patients presenting with linear fractures should undergo CT evaluation for EDH to ensure early diagnosis and appropriate management.

Keywords: *Extradural hematoma, Skull fracture, Head injury, Tertiary care hospital.*

INTRODUCTION

Traumatic brain injury is a significant public health problem globally. Annually, an estimated 10 million people suffer from traumatic brain injury worldwide [1] percent (1%) of all deaths are due to head injury.[2] It is the leading cause of morbidity and mortality among individuals younger than 45 years of age.[3] Moreover, 25% of acute trauma victims suffer immediate death secondary to head injury.[4]

It is important to be well-educated in the pathophysiology of traumatic brain injury to provide optimal patient management, as it may have physical, cognitive, behavioral, and emotional implications that may last the entire lifetime of the patient.[5]

Common vital causes of head injury include falls from height, road traffic accidents, being struck by or against an object, and assault. Blasts and firearm injuries are common among individuals in war zones. Furthermore, sports and recreation activities are also a chief cause of traumatic brain injury.[5,6]

Traumatic brain injury can be categorized as diffuse or focal brain damage. Diffuse brain damage is due to acceleration/deceleration injury resulting in diffuse axonal injury or brain swelling, whereas focal brain damage is due to contact injury resulting in contusions, lacerations, or intracranial hematomas. [6]

Delay in diagnosis and treatment of intracranial hematomas is a leading cause of preventable death secondary to head trauma; extradural hematomas are of utmost importance as they are lethal yet benign lesions that are relatively simple to diagnose and treat.[7] Extradural hematoma (EDH) can be defined as the bleeding between the dura mater and the skull, where a potential space exists. Skull deformation or fracture caused by the initial impact results in separating the dura from the inner skull table, often accompanied by vascular insult. Blood begins to accumulate within the extradural space. A hydraulic water pressure effect is created by an arterial bleed, which progressively strips the dura from the skull and widens the perimeter for collection.[8] If an arterial wall ruptures, it will result in rapid expansion of hematoma along with neurological deterioration. The most common artery to bleed is the middle meningeal artery or one of its branches, as the overlying peritoneal bone is weak and prone to injury. On the other hand, bleeding from a vein or diploic channels has slower development and progression of EDH. In about one-third of the patients, the source of extradural bleeding is oozing from fractured bone.[9]

A skull fracture is a break in the continuity of the skull bone. It can be classified by pattern (linear, comminuted, depressed, diastatic), location (vault, convexity, base), and overlying skin integrity (open, closed)". Low-energy blunt trauma to a wide surface area of the skull results in linear fracture and involves the entire thickness of the skull bone. If the fracture line crosses a vascular channel, venous sinus groove or suture, an extradural hematoma may develop. The clinical management of patients with skull fractures varies between institutions and individuals. Although many clinicians routinely admit children with linear skull fractures for observation, others suggest that isolated linear skull fractures can be safely discharged home directly from the emergency department.[9,10]

X-rays of the skull (AP and lateral views) and CT scans of the brain (including bone window) are both used in the evaluation of patients with head trauma. However, due to accuracy, reliability, safety, and widespread availability, CT-scan has become the investigation modality of choice. Considering the burden of head trauma and the gravity of EDH, its timely diagnosis and management are imperative. In a recent study, the frequency of EDH in the presence of linear skull fracture was 21%.[9] Where as another study reported it to be 17.2%.[10]

METHODS

This cross-sectional study was conducted in the Department of Neurosurgery (Letter Ref. NSG-2018-183-589) Trauma Center / Dr. Ruth K.M. Paul Civil Hospital, Karachi. It was completed in one year, from May 30, 2020, to May 29, 2021. The sample size was calculated using Open Epi Software version 3, taking the frequency of EDH in patients with linear skull fracture (29.8%)6, (anticipated population proportion) at the margin of error of 6% with a confidence interval of 95%. calculated sample size = 224.

The sampling technique was non-probability, consecutive sampling.

Head trauma patients presented to the Department of Neurosurgery, SMBB Trauma Center/ Dr. RKMP Civil Hospital Karachi, patients of age between13 years to 60 years and patients with presence of linear skull fracture on CT scan were included in the study.

Previous history of head trauma or surgery and patients with bleeding disorders or on anti-coagulants or anti-platelets were excluded form the study.

All patients who presented in the emergency department during the study period and who met on inclusion criteria were studied. Data was collected on a predesigned performa. Patient demographics, including age, gender, and hospital registration number, were recorded. All patients underwent a head CT scan and were evaluated based on the findings. The major parameter to be assessed in this study was the presence of linear skull fracture. The following additional factors were assessed in this study: mechanism of trauma and GCS of the patients at the time of admission. To reduce bias, CT scan brain findings were confirmed and reported by a radiologist with at least 5 years post-fellowship experience. Data was filled by an independent observer not directly involved in the research process.

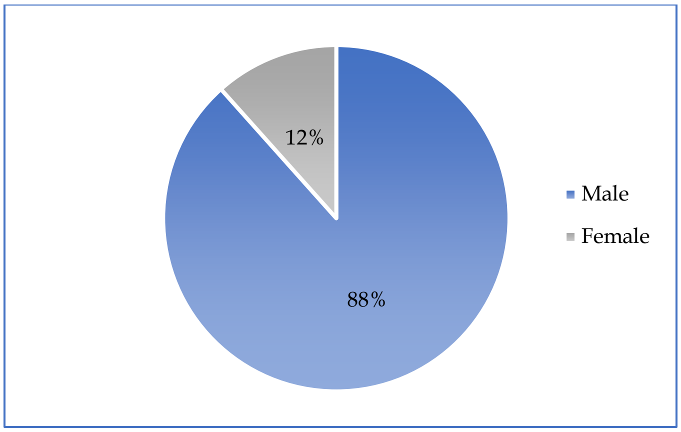
SPSS 20 was used for statistical analysis. Quantitative variables included GCS and age, so means and standard deviations were determined for them. Qualitative variables included gender, mode of injury, location, and presence of EDH, so frequency and percentages were determined for them. Stratification of the variables was done, like age, gender, mode of injury, location of the linear fracture, and GCS at presentation, to see the impact of these on the outcome variable. The chi-square test was applied after stratification. Consider P value <0.05 as significant.

RESULTS

224 patients were studied to assess the extradural hematoma in patients with linear skull fractures in a tertiary care hospital.

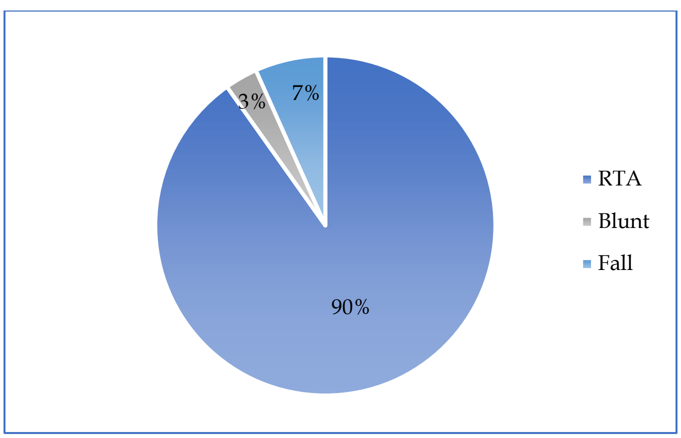
The mean age at presentation was, and the results were as31.77±12.63. Out of 224 patients, 198 (88.4%) were male, while 26 (11.6%) were female. (Figure 1)

Figure 1: Gender distribution



In the distribution of Mechanism of injury, 7 (3.1%) patients had blunt force trauma, 15 (6.7%) had fallen from height, while 202 (90.2%) had R.T. injury

Figure 2: Mechanism of Injury



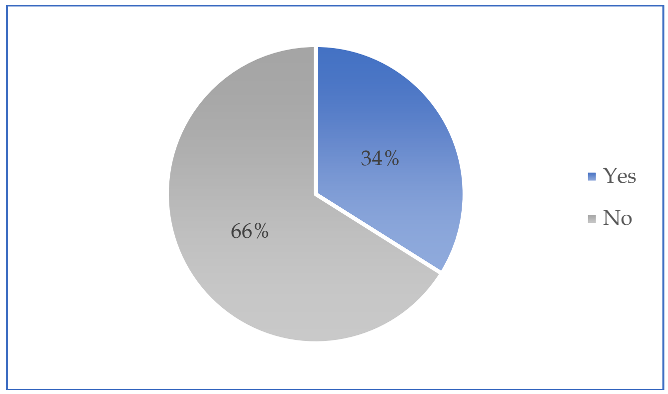
Out of 224 patients, 77 (34.4%) had a fracture on the frontal side, 37(16.5%) patients had an occipital fracture, 54 (24.1%) had parietal, 1(0.4%) had parietal + temporal fracture while 55 (24.6%) had a temporal fracture. Table 1

Table 1: Distribution of linear skull fractures according to location

Location	Frequency	Percentage %
Frontal	77	34.3
Occipital	27	16.5
Parietal	54	24.1
Parieto-Temporal	1	0.4
Temporal	55	24.6

Presence of extradural hematoma was found to be in 76 (33.9%) (Figure 3).

Figure 3: Presence of EDH



Stratification of linear fracture was done for the presence of extradural hematoma to assess the statistical difference (Table 2), which turned out to be statistically insignificant.

Table 2: Association between location of linear skull fracture and presence of epidural hematoma

Location of Linear Fracture	Presence of EDH		p-Value
	Yes	No	
Frontal	22 (9.8%)	55 (24.5%)	0.149
Occipital	8 (3.6%)	29 (13%)	
Parietal	25 (11.1%)	29 (13%)	
Temporo-parietal	0 (0.0%)	1 (0.4%)	
Temporal	21 (9.4%)	34 (15.2%)	

The frontal bone is the most commonly fractured bone after head injury (34.3%), and the EDH is also most commonly associated with linear frontal fracture (9.8%).

DISCUSSION

Incidence of skull fracture in patients with extradural hematoma has been reported between 63-85% in various series.[11-15] Level of consciousness is the most important prognostic factor, which deteriorates with delay in surgery[16-18] due to a delay in diagnosis and referral.[19] In rural areas, CT scans are not usually available, but X-rays are readily available for diagnosing skull fractures, which may guide for early referral to a neurosurgical facility.

In large-scale studies, the overall incidence of skull fracture ranged between 60-85% in RTA. 21% of cases with extradural hematoma with linear skull fractures were reported by Sunay *et al*[22] and 17.2% by Servadei *et al*,[23] while it was 33.9% in our study. Historically, screening for skull fractures has been performed in head-injured patients as a means of identifying patients at risk for intracranial injury. Older guidelines called for hospitalization and observation of any patient with a skull fracture resulting from head trauma.[24,25] As computed tomography (CT) has become widely available as a more definitive measure of intracranial injury, the significance of skull fractures in patients has been called into question.[26,27] Most authors consider the presence of an isolated skull fracture (ISF) in the absence of intracranial abnormalities on CT to have little effect on treatment or expected outcomes for older children or adults.[28-30] The findings of our study are comparable with different studies. A few of these are presented here. In our study, the mean age was noted as 31.77±12.63 years. Aurangzeb A *et al* reported a mean age of 18.23 ± 16.5.6. Another study noted the age as 26 years. Also, Rivas JJ *et al* reported the age as 27.6 years.[31,32] The study by Görgülü A *et al* noted the mean age as 34.2 years.[33] The mean GCS at presentation was found to be 12.36 ± 2.84.

Of 224 patients, 198 (88.4%) were male, while 26 (11.6%) were female in our study. There were 85 (74.5%) males and 29 (25.5%) females in the study of Aurangzeb A *et al*.[6] Baykaner K *et al* noted to have 70 (73.68%) male and 25 (26.32%) female patients,[31] Görgülü A, *et al* noted to have 15 (78.9%) male patients and 04 (21.1%) female patients,[32] while Harwood-Nash DC *et al* reported as 67.70% males and 32.30% females.[34] Furthermore, another study noted 130 (77.84%) males with 37 (22.16%) female cases.[35]

The present study noted the distribution of mode of injury as 07 (3.1%) patients had blunt force trauma, 15 (6.7%) had fallen from height, and 202 (90.2%) had RTA injury. Aurangzeb A *et al* further noted the mode of injury as fall from height as 65 (57%) and RTA as 39 (34.2%).[6] There were 33% of the cases of RTA in the study of Baykaner K *et al* with 40% cases of fall.[31] The findings of Rivas JJ *et al* stated that 69.23% of cases were due to RTA, and 30.77% of patients fell from height.[32] Another study noted a fall from height prevalence in 24% of cases, while cases of RTA were 31%.[33] Jamieson KG *et al* reported RTA cases as 45.5%.[34]

Moreover, our study also reported that 77 (34.4%) patients had a fracture on the frontal side, 37 (16.5%) patients had an occipital fracture, 54(24.1%) had parietal, 01 (0.4%) had parietal + temporal fracture while 55 (24.6%) had a temporal fracture. Aurangzeb A *et al* reported the prevalence of fractures on the frontal side, 28 (24.6%), occipital fracture, 24 (21.1%), parietal 49 (43%), and temporal 23 (20.2%). This study found EDH in 76 (33.9%) patients. Aurangzeb A *et al* reported EDH in 34 (29.8%) cases. Baykaner K *et al*[31] noted in 49.5% of patients.[6]

The presence of an EDH difference was noted in the age group (P=0.557), gender (P=0.422), mode of injury (P=0.360), and location of linear fracture (P=0.149), whereas a significant difference was found in GCS presentation (P=0.003).

CONCLUSION

It is to be concluded that linear skull fracture is pretty associated with extradural hematoma. Patients presented with linear skull fractures should be worked up for the presence of extradural hematoma to ensure adequate treatment. The sample population represents a single institutional experience; but the study sample can be generalized as the sample came from various areas of Pakistan.

LIMITATIONS

The increased number of study hospitals and cases can provide us with more generalized results. CT scan reporting was observer-dependent, so human error can be found in the results.

SUGGESTIONS / RECOMMENDATIONS

We recommend that patients with fractured skulls should be referred to a neurosurgical facility without delay, even if they do not have any other evidence of significant head injury. Those patients who do not have a fractured skull and who are conscious should be watched with a high index of suspicion for the development of an extradural hematoma.

CONFLICT OF INTEREST / DISCLOSURE

None.

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No.

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