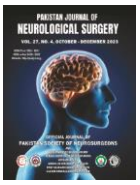

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Original Research

Depressed Skull Fracture Surgical Management and Outcome among Head Injury Patients: Experience at Tertiary Care Hospital

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ABSTRACT

Objective: To evaluate outcomes in patients with managed depressed skull fractures operatively having head injuries.

Methods: This study was conducted at Liaquat University of Medical and Health Sciences, Jamshoro. We analyzed 76 patients who underwent operative management for skull fractures. Patient selection included both children and adults with skull fractures evident on CT brain scans using bone windows.

Results: Our study included 76 patients, with 48 males and 28 females, and a mean age of 28.68 ± 10.33 years. Among them, 45 (59.21%) were under 30 years old, and the highest incidence of depressed skull fractures occurred in the 21 – 30 age group. Road traffic accidents were the leading cause, accounting for 42 (55.25%) cases, while falls from heights contributed to 24 (31.57%) cases, and 7 (9.21%) resulted from objects falling on the patients.

Conclusion: Patients with head injuries can be fatal if not managed promptly. Neglecting the management of a depressed fracture can also impact the outcome in these cases and lead to a series of complications.

Keywords: Skull depressed fracture, injury head trauma, Glasgow Outcome Scale, Compound depressed fractures.

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INTRODUCTION

Brain injuries are responsible for 25 – 50% of head trauma-related fatalities in the United States, leading to about 56,000 deaths annually. Depressed skull fractures, a severe subtype of head injuries, occur in approximately 11% of these cases. About 25% of all skull fractures are compound and necessitate immediate medical attention.[1,2]

A depressed fracture is diagnosed when a visible deformity in the skull creates a gap

between the inner and outer bone plates, potentially affecting the dura.[3]

A depressed fracture can be classified as either closed or open. In the closed type, there may or may not be a skin laceration, but the dura remains intact. In contrast, the open or compound type involves direct communication between a scalp laceration and the cerebral surface due to dural tearing.[4]

Depressed fractures can result from road accidents, falls, sports injuries, or blunt impacts. When individuals with extradural hematomas, subdural hematomas, or contusions experience a skull fracture, it can result in loss of consciousness, which is a critical indicator for determining the necessity of surgical intervention.[5,6]

Regarding investigations, an X-ray of the skull is the initial primary examination to detect fractures. Following this, a Computed Tomography (CT) scan is the preferred diagnostic method for identifying skull fractures. A plain CT scan of the brain can diagnose the type of fractures, such as linear or depressed, and assess any associated cerebral injuries.[7]

As for the extent of trauma, fractures involving the superior sagittal sinus (SSS) occur in approximately 1.5% to 5% of cases, which is common and can lead to factors such as morbidity and mortality plus the effect of dural sinus injuries present in all head injury cases.[8]

Management has undergone comprehensive evaluation in recent decades. The chosen approach depends on various factors, including fracture type, signs, symptoms, neurological concerns, dural integrity, and whether the fracture is compound or simple. Swift and precise diagnosis and management of skull fractures not only decrease morbidity and mortality but also support the attainment of optimal functional and aesthetic rehabilitation outcomes.[9]

Open depressed fractures represent surgical emergencies, demanding swift intervention to forestall potential complications like cerebral abscess, meningitis, epilepsy, osteomyelitis, neurological deficits, and mood swings. Timely diagnosis and treatment of skull fractures are pivotal in diminishing both morbidity and mortality, while also promoting optimal functional and aesthetic recovery.[10]

This study aims to evaluate the clinical outcomes of skull fractures, with a specific focus on Sindh. While existing literature has presented a wide range of outcomes for children with skull fractures, there is a notable absence of local data. Our study seeks to address this gap by reporting data from a tertiary care hospital in the region.

MATERIAL & METHODS

Study Design and Study Setting

The study was conducted in the neurosurgical department of Liaquat University of Medical and Health Sciences in Jamshoro from March 2021 to February 2023, following ethical approval from the Institutional Board committee and with the consent of patients' guardians and families.

Inclusion Criteria

Those who had mild to moderate Glasgow Coma Scale scores were included in the study.[11] and included cases of polytrauma.

Exclusion Criteria

Patients with a history of significant trauma, head injuries with multiple systemic diseases like diabetes or bleeding issues, and those who presented late with wound infections were excluded from the study. Relevant information was recorded in a proforma.

Data Collection

X-ray skull and CT scans were performed to confirm the precise location of the skull fracture. All patients in the study received operative management, which included elevating both

closed and open depressed fractures, repairing Dural tears, and draining extradural or subdural hematomas. The assessment of surgical outcomes was based on wound healing, neurological improvement, and Glasgow Coma Score. Patients were discharged within 5 to 15 days, determined by the severity of the head injury. A follow-up period of two to three months was conducted for all patients to evaluate surgical outcomes and complications.

Data Analysis

The data was analyzed with SPSS version 24 and presented as a percentage (%), observational study.

RESULTS

Gender Incidence

In our study, we included 76 patients with depressed skull fractures who met the criteria. Among these patients, 48 (63.14%) were male, and 28 (36.8%) were female.

Table 1: Characteristics of Patients.

	Variables	No. of Patient	Percentage
Age Mean: 28.68±10.33 years	10 – 20	16	21.05%
	21 – 30	29	38.15%
	31 to 40	19	25.0%
	41 to 50	8	10.52%
	51 to 60	3	3.90%
Gender	Male	48	63.15%
	Female	28	36.86%
Injury mode	Road traffic accident	42	55.26%
	Fall from Altitude	24	31.57%
	Fall of any object	7	9.21%
Neurological Sign Symptoms	unconsciousness	41	53.9%
	vomiting	54	71.05%
	headache	56	73.68%
	Seizures	12	15.78%

Age Distribution

With 28.68 ± 10.33 years as the mean age. In the study among 76 patients, 45 (59.21%) were below the age of 30 years. The highest percentage was seen in the 21 – 30 age group with skull fractures.

Distribution by Mechanism of Trauma

The common reason for these fractures was road traffic accidents, accounting for 42 (55.25%) cases, while 24 (31.57%) resulted from falls from heights, and 7 (9.21%) were due to objects falling onto the patient. The patients typically presented with compound fractures accompanied by symptoms such as headaches and multiple episodes of vomiting. Characteristics are defined in **Table 1.**

Effect of Clinical Variables on Outcome

The frontal bone was the most affected site by fracture site, observed in 36 cases (47.36%), as is dissipated in **Table 2.** Compound skull fractures were observed in 55 (72.36%) patients, while simple fractures were noted in 21 cases (27.63%). Additionally, associated brain injuries were documented, including extradural hematomas in ten patients 23 30.26%, subdural hematomas in 15 patients (19.73%), involvement of venous sinuses in five cases (5.6%), and brain contusions in 18 cases (23.68%) as seen in Table 3. The outcome compared to regional parietal and occipital was better, with early discharge and good GCS, while the frontal was associated with frontal sinus injury which delayed the patient recovery and the temporal lobe had an association with dural injury (46.5%) followed by frontal region and brain contusion 9 (50%).

All patients underwent operative procedures for a depressed fracture

Table 2: Location (site) of Skull Fracture.

	Characteristics	No. of Patient	Percentage
Fracture Site	Frontal	36	47.36%
	Parietal	27	35.52%
	Temporal	05	6.57%
	Occipital	8	10.52%
Facture Type	Open	55	72.36%
	Close	21	27.63%
Dural	Dural injury	43	56.57%
	Intact Dural	34	44.73%

elevation surgery and were kept on antiepileptics and antibiotics. Postoperatively, outcomes were assessed using the Glasgow Outcome Score, as depicted. Complications were observed in 16 (21%) patients, including 6 (7.89%) with neurological deficits, 18 (23.68%) with wound infections, 4 (5.5%) with CSF leaks, and 3 (3.96%) who unfortunately did not survive.

DISCUSSION

This study has seventy-six patients with a skull fracture, managed over 3 years, this also reflects the load on dept of neurosurgery, that was received from different parts of Sindh and its districts and they are given treatment as per protocol, with assault is also the major contributors, young age are major contributors to the group and also the patient dominates along with associated injury to the brain parenchyma.

In our study, males are found to be the dominant contributors due to their higher mobility and increased susceptibility to accidents, flights, and assaults. Conversely, in countries like India, females tend to be more involved in household activities, resulting in less exposure to

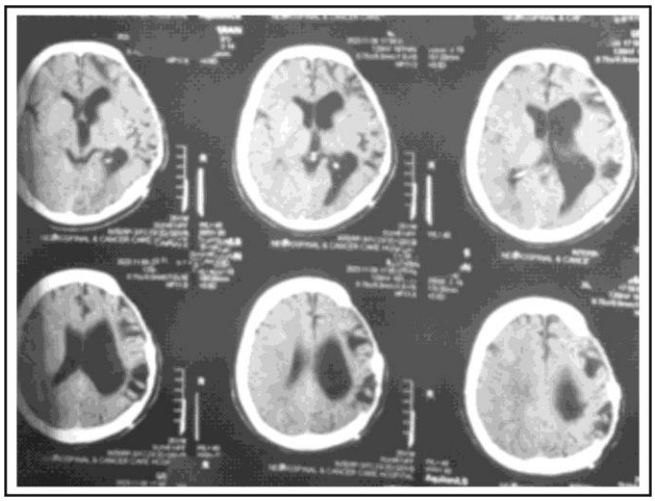

Figure 1: Pre-operative MRI showing the bony defect(scan included with permission of the patient).

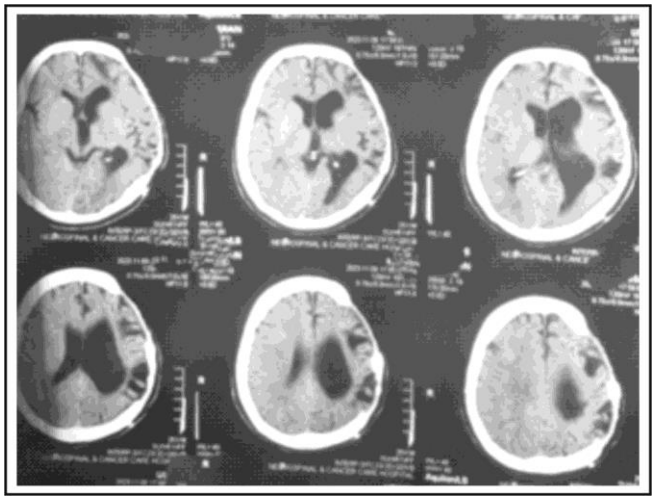

Figure 2: Post-operative scan showing the defect is covered with bone cement (scan included with permission of the patient).

Table 3: Associated Brain Injury.

Injury	No. of Patient	Frontal	Temporal	Parietal	Occipital
Extradural hematoma	23	2 (8.6%)	9 (39.1%)	6 (26%)	6 (26%)
Subdural hematoma	15	-	7(46.6%)	8 (53.33%)	-
Contusion	18	4 (22.22%)	9 (50%)	5 (27.77%)	-
Sinus involvement	05	4 (80%)	-	-	1 (20%)

factors that could lead to head injuries. This higher prevalence of head injuries in males may be attributed to their thicker and stronger skulls, which can better absorb impact forces. As a result, males are more likely to experience depressed fractures, whereas females are more prone to linear fractures.[12]

In our study, headaches, vomiting/nausea, and seizures were observed as patients presented with bone and dural injuries, which were the primary factors causing pain. In contrast, other studies reported different primary symptoms among participants. In these studies, vomiting was the most frequent symptom, occurring in 55% of all cases, followed by unconsciousness (20%), convulsions (20%), and shock (5%). It's important to note that the experience of symptoms is subjective, and patients may describe their sensations differently when awake, leading to variations in reported complaints.[13]

In a separate study, the incidence of extradural hematoma in cases of linear occipital skull fractures among head injury patients was reported as 11%, whereas our study found it to be slightly higher at 11.7% for linear skull fractures.[14] Similarly, a relative study, demonstrated that the incidence of extradural hematoma in cases of linear parietal skull fractures is 61%, closely aligning with our study's finding of 50%. 15 In our study, extradural hematoma was followed by subdural hematoma and contusion. Extra-dural hematoma is common due to the easily ruptured vessels on the dura, leading to associated dural injury. In this study, 72.36% of cases were compound fractures, a percentage similar to the study by Al-Derazi et al, where 72% of patients had compound fractures.[16]

To explore this issue further, consider investigating patients with progressive vision loss, especially those with post-traumatic depressed skull fractures in the anterior cranial fossa and concurrent hydrocephalus. This case strongly supports the need for early neurosurgical intervention in frontobasal fractures.[17] Early surgery of depressing fracture and early cranioplasty have shown promising results.[18] In recent advances the role of 3-D prints for their accuracy to cover the defect and cosmetic issues are used in many centers across.[19]

LIMITATIONS

Some patients experience a loss of follow-up, while longer-term follow-up is required to assess late presentations due to patients in peripheral areas contributing to delayed surgery. This delay may increase the rates of infection and epilepsy. The advancement of 3D printing has revolutionized cranioplasty, which is currently not available at our center.

CONCLUSION

Patients with head injuries can have a series of fatal complications, if not managed promptly. Neglecting the management of a depressed fracture can also impact the outcome in these cases and lead to a series of complications. Therefore, performing surgery for a depressed fracture is crucial, as early diagnosis and proper management can significantly reduce morbidity and mortality in such patients.

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Additional Information

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Human Subjects: Consent was obtained by all patients/participants in this study.
Conflicts of Interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following:
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AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Aurangzeb Kalhoro	1. Study design and methodology.
2.	Muhammad Hamid Ali	2. Paper writing.
3.	Vashdev Khimani	3. Data collection and calculations.
4.	Mubarak Hussain	4. Analysis of data and interpretation of results.
5.	Riaz Ahmed Raja	5. Literature review and referencing.
6.	Mahesh Kumar Luhano	6. Editing and quality insurer.