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Surgical Treatment and Results of Depressed Skull Fracture

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ABSTRACT

Aim: Surgery for depressed skull fractures (DSF) is usually performed as an emergency. This entity is responsible for significant morbidity and mortality as it complicates head trauma. The study was designed to investigate the factors accompanying DSF in patients undergoing surgery and their relationship with the results. **Material and Methods:** This current cross-sectional study was performed in 70 patients with DSF requiring surgical treatment. The study was conducted in the Neurosurgery Department of the General Hospital, Lahore. Demographic data, type and time of injury, seizures, vomiting, ear, nose and throat bleeding, loss of consciousness, location and type of fracture were documented. Outcome was measured using the Glasgow Coma Scale (GCS). Postoperative complications were observed. All patients were followed up on the fifth postoperative day. **Results:** A total of 70 patients, 48 men and 22 women, were operated on for DSF. The age ranges from 10 to 55, and the average age is 33.90 ± 14.60. 15 (21.4%) patients were in the 10-18 age group, followed by 15 (21.4%) in the 19-30 age group, 25 (35.7%) in the 31-45 age group, and 15 (21.4%) in the 46-55 age group. It was determined that 48 (68.6%) patients had compound or open fractures, 22 (31.4%) patients had simple or closed fractures. **Conclusion:** DSF is a very common neurosurgical emergency. Surgery is an excellent option and should therefore be performed whenever indicated, as results are favorable in most cases.

Keywords: Depressed skull fractures; Neurosurgery; Glasgow Coma Scale; Head trauma.

INTRODUCTION

The skull provides good protection for the brain and fractures may occur in head injuries. However, a violent blow or blow to the head can result in fracture or fracture of the skull.[1,2] It may be accompanied by a concussion or other traumatic brain injury.[3,4] Collapsed skull fractures, one of the most serious forms of trauma occurring in 11% of severe head injuries, are comminuted fractures that displace fractured bones internally. This type of fracture has a high risk of increasing brain pressure by breaking delicate tissue. Complex depressive fractures are those that break the dura. DSF may require surgery if they put pressure on the brain to lift the bones. Therefore, head trauma makes an important contribution to mortality and morbidity in trauma patients.[5,6] The well-established practice in the Pakistan Public is driving without a helmet on two-wheelers, despite many laws and restrictions, which contributes to one of the main causes of head injuries.[7,8]

Skull fracture can be classified as closed, open, flattened and basal. Closed type fracture is also known as a simple fracture, may or may not be skin

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In DSF, the bone / skull bleeds or extends into the of the brain. A basal fracture occurs at the base of the skull, such as areas around the eyes, ears, nose, or upper neck along the spine.[9,10] There are a number of injuries associated with DSF such as brain contusion, subarachnoid hemorrhage, subdural hematoma, extradural hematoma (EDH), cerebrospinal fluid (CSF) leak, pneumocephalus.[11] The type, extent, and location of depression can be determined by radiographic examination of the skull. Non-augmented computed tomography (CT) with a bone window is the preferred method because it shows not only the depression fracture but also the intracranial injury.[12]

Advances in CT and magnetic resonance imaging (MRI) help to understand brain injuries in detail and to better plan surgical techniques. In addition, after the initiation of advanced trauma life support training, the management of head trauma patients has undergone significant changes. However, there have been some notable studies examining overall results and linking early complications to skull fractures. In this study, we tried to see the incidence patterns of DSF and to evaluate the impact attributable to the surgical outcome of DSF.

MATERIAL AND METHODS

The current cross-sectional study was conducted in the Neurosurgery Department of the General Hospital, Lahore for one-year duration from March 2019 to March 2020. Before starting the study, approval was obtained from the hospital ethics committee. All 70 patients who presented with a

collapsed skull fracture and were treated surgically participated in this study. Written permissions were made for all patients. Patients who did not want to undergo surgery were excluded from the study. Operation decision was made according to the standard indication published in books and articles.

A detailed history such as gender, age, occupation, location and location of fracture, type and time of injury, loss of consciousness, vomiting, seizures, nose and ear bleeding, and collapsed fracture type were recorded after admission. A general physical examination and a detailed neurological examination was performed. Outcome was studied using the GCS. Preoperative GCS was recorded on arrival and one hour before surgery. CT of the brain was performed in all patients. The patient was operated on showing associated intracranial lesions such as midline, displacement of a 10 mm or more depressive fragment, subdural hematoma, EDH, neurological deficit and contusion. Anticonvulsant and antibiotics were given to all patients as prophylactic. The surgery was performed under general anesthesia, under the elevation of collapsed bone fragments, removal of free and inwardly driven bone fragments, dural tear repair, and debridement of the wound margin and evacuation of the hematoma in all cases. Postoperative complications were reported for all patients and were followed up to at least the seventh postoperative day. All patients were recommended to return to hospital one month later for control. Data were analyzed using SPSS 22.0 and descriptive analysis was performed. Categorical data were analyzed as a percentage and presented in a tabular format.

RESULTS

During the study period, a total of 70 patients, 48 men and 22 women, were operated on for DSF. The age ranges from 10 to 55, and the average age is 33.90 ± 14.60. 15 (21.4%) patients were in the 10-18 age group, followed by 15 (21.4%) in the 19-30 age group, 25 (35.7%) in the 31-45 age group, and 15 (21.4%) in the 46-55 age group.

It was determined that 48 (68.6%) patients had compound or open fractures, 22 (31.4%) patients had simple or closed fractures. The most common etiology was traffic accident in 35 (50%) patients, followed by 15 (21.4%) assault, 12 (17.1%) has history of fall, and 8 (11.4%) cases as a head-on object. The common area affected was the parietal region in 29 (41.42%) patients and then the temporal region in 15 (21.4%) patients. 16 (22.85%) patients were affected in the frontal region and 10 (21.4%) patients in the occipital region. The most common associated injury was brain contusion in 25 (35.7%) patients, followed by dural tears in 20 (28.6%) patients. EDH and inward moving bone fragments were found in 15 (21.4%) and 10 (14.3%) patients, respectively. Preoperative GCS was performed and 35 (50%) patients had mild head trauma with a GCS score of 14-15, 22 (31.4%) patients had a GCS score of 9-13 showing moderate head trauma, and 13 (18.6%) patients had severe head injury with a GCS score of 3-8. None of the patients had a GCS below 7. Postoperative GCS was recorded on postoperative 1st and 5th days, and we found that GCS score improved on the 5th day after surgery. On postoperative day 1, 45 (64.3%) patients had a GCS score of 14-15 associated with mild to moderate head trauma, and 54 patients (77.1%) improved further on day 5. Wound infection developed in 6 patients (8.6%), 4 of them were treated with oral antibiotics, 2 required debridement and CSF drainage, 5 patients developed meningitis and 2 patients with chronic scalp infection developed skull osteomyelitis. Neurological deficits were seen in 3 patients and pseudomingocele in 2 patients. 51 (72.8%) patients achieved a very good result.

Table 1: Distribution of study population according to their clinical profile

Parameter		Frequency	Percentage
Age Groups	10 to 18	15	21.4%
	19 to 30	15	21.4%
	31 to 45	25	35.7%
	46 to 55	15	21.4%
Type of DSF	Simple Fracture	22	31.4%
	Compound Fracture	48	68.6%
Etiology	Road Traffic Accident (RTA)	35	50.0%
	Assault	15	21.4%
	Fall	12	17.1%
	Fall of object on Head	8	11.4%
Preoperative GCS	Mild (GCS 14-15)	35	50.0%
	Moderate (GCS 9-13)	22	31.4%
	Severe (GCS 3-8)	13	18.6%
1st day Postoperative GCS	Mild (GCS 14-15)	45	64.3%
	Moderate (GCS 9-13)	16	22.9%
	Severe (GCS 3-8)	9	12.9%
5th day Postoperative GCS	Mild (GCS 14-15)	54	77.1%
	Moderate (GCS 9-13)	16	22.9%
	Severe (GCS 3-8)	0	0.0%
Associated Injuries	EDH	15	21.4%
	Dural Tear	20	28.6%
	Brain Contusion	25	35.7%
	In driven Bone fragments	10	14.3%
Postoperative Complications	Wound infection	6	8.6%
	Meningitis	5	7.1%
	Osteomyelitis	2	2.9%
	Pseudomeningocele	2	2.9%
	Neurological deficit	3	4.3%
	Cerebral abscess	0	0.0%
	Postoperative seizures	0	0.0%

DISCUSSION

Head trauma is the main factor contributing to mortality and morbidity in trauma patients. DSF is a common head injury and is considered a very serious brain injury with a very poor prognosis. But the truth is that it gets serious when it involves the brain directly or indirectly. In the case of compound DSF, treatment should begin as quickly and efficiently as possible because it not only affects brain function but also leads to epileptogenic focus and nerve failure. It is a gold standard procedure to prevent complications such as depressive elevation of bone fragments, meningitis, CSF leak, infection, and posttraumatic seizures.[11,12]

In our study, the mean age of DSF was 33.90 ± 14.60 years. The maximum number of patients (50.0%) was in the 31-45 age group. Different from our study, it was reported that students attending school between the ages of 2-15 were presented as DSF in the study conducted by Al-Haddad and Kirollos and Mehdi et al. Similar to our study, Al-Haddad also claimed that there was a 9:1 male majority and that the most common cause of DSF was traffic accidents.[13] RTA is one of the biggest contributors to DSF in most patients. This study likewise reported that the patients' maximum DSF was associated with RTA. Heary et al. reported that assault and RTA-related injuries were the same.

A submerged skull fracture is either a simple type (closed) or a compound type (open). An open break can cause cutting of the skin over the fracture or through the sinuses and middle ear structures, resulting in communication between the external environment and the cranial cavity.[13,14] Open fractures may be clean or contaminated/soiled. Thus, compound DSF are surgical emergencies and can have serious morbidity and mortality unless treated promptly and adequately.[15,16] Hossain did a similar study showing 64% compound, 36% simple DSF. Also, the study of Al-Derazi et al. found that 72% of patients had composite DSF. In this study, the most frequently affected area from DSF was the parietal region (46%) and then the temporal region (24%). The frontal area was affected in 18% of the cases, and the occipital area in 12% of the cases. Ali did a similar study in which the parietal region (36.1%) was most involved, followed by the frontal (31.3%) and temporal (17.64%) regions.[17,18]

GCS scores were studied 1 hour before surgery and at discharge, this may affect the outcome of patients with DSF. A higher GCS score of 14-15 indicates that the patient has a mild head injury. A GCS score of 9-13 represents moderate head injury, while a GCS score of 3 to 8 represents severe head injury. Therefore, when DSF is treated surgically, the GCS score needs to be improved so that a good outcome of the study can be achieved.[19,20] In this study, GCS was followed before surgery and on the 1st and 5th postoperative days. The improvement in GCS score was 50% from preoperative to 88% up to the fifth postoperative day. In a similar study by Hossain et al., patients with preoperative GCS in the 13-15 range were 50%, 9-12 31% and 19% GCS 8 or less. Concomitant brain injuries are an important additional factor in predicting outcome in patients with DSF.[21,22] Also, in a study by Hossain et al., the most common associated injury was brain contusion (31%) followed by dural tear (25%), EDH (22%) and 13% had a bone fragment made, this study is completely similar, dura mater rupture, EDH and made bone fragment were seen in 40%, 30%, 20% and 10%, respectively.[23,24]

CONCLUSION

DSF is a very common neurosurgical emergency that can lead to death and morbidity unless early diagnosis and prompt treatment are provided. The use of prophylactic antibiotics reduces the risk of postoperative / posttraumatic infections and the perioperative use of anticonvulsants effectively reduces the likelihood of posttraumatic seizures. When the patient is discharged, the GCS score represents the good result of this study. Surgery is an excellent option and therefore should be done when recommended as in most cases the results are positive.

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