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Original Article

Depressed Skull Fracture : Outcome of Surgical Treatment

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Abstract

Elevation and repair of an open depressed skull fracture is often thought of as an emergency procedure. Common indications for emergency elevation of a depressed skull fracture have been dural tear, seizure, gross contamination or mass effect from bone or a sizable underlying intracerebral hematoma. Over a 18 months period 93 patients with depressed skull fracture were admitted in the Neurosurgery ward of Rajshahi Medical College Hospital (RMCH) from July 2007 to December 2008 among which 67 patients needed surgical treatment. In 7 patients fracture crossed the midline over the superior sagittal sinus. Pre-operative GCS (Glasgow Coma Scale) score ranged from 5-15. Focal neurological deficit were present in 28 cases. Operations done were elevation of depressed fragments, repair of dural tear and hemostasis of sinus injury by gel-foam. No sinus injury required repair. Complete neurological recovery occurred in 21 cases. No death was recorded. One patient developed postoperative meningitis and controlled by parenteral antibiotics. One patient developed major wound infection including osteomyelitis but not intracranial infection. This patient had skin loss which was later closed by rotation flap of scalp operation. Seven patients had minor wound infection. One patient developed pseudo-meningocele.

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Introduction

Depressed skull fractures, a very serious type of trauma occurring in 11% of severe head injuries, are comminuted fractures in which broken bones are displaced inward.[1] This type of fracture carries a high risk of increasing pressure on the brain, crushing the delicate tissue. Complex depressed fractures are those in which the dura mater is torn. Depressed skull fractures may require surgery to lift the bones off the brain if they are causing pressure on it.[2]

Approximately 25% of patients with depressed skull fracture do not report loss of consciousness, and another 25% loose consciousness for less than an hour. The presentation may vary depending on other associated intracranial injuries such as epidural hematoma, dural tears, and seizures [4].

Treatment of depressed skull fracture depends upon the degree of depression, communication with the exterior and neurological deficit. Indications of surgery in depressed skull fracture are a) compound depressed fracture b) focal neurological sign c) CSF (Cedebrospinal fluid) leak d) depression more than the inner table of non-depressed bone e) associated other lesion like EDH (Extradural hematoma) and f) cosmetic purpose e.g. over the forehead.

Surgical treatment comprises 1) Elevation of the fracture fragment 2) Evacuation of hematoma 3) Repair of dural tear 4) Repair of venous sinus or hemostasis by gelfoam

Materials and method

This study was conducted in the Department of Neurosurgery, Rajshahi Medical College Hospital. All the patients were admitted with depressed skull fracture and underwent operative treatment, were included in this study. Decision of operation was taken following standard indication published in textbooks and journals.

Surgical procedures done -

- Elevation of depressed bone fragment
- Removal of in driven bone fragment
- Repair of dural tear
- Evacuation of hematoma
- Hemostasis (Hemostasis of bleeding from SSS could be acheived by digital pressure and application of gelfoam only, no one required repair of the sinus).
- Debridement of wound margin and primary repair

All the patients were given prophylactic antibiotics and anticonvulsants.

All the patients were followed up at least up to 7th postoperative day and all the patients were advised to report to Neurosurgery OPD for follow up after one month.

Results

93 patients with depressed skull fracture were admitted during the period of 18 months (July '07 – Dec. '08). In this study 67 patients were included who underwent operative treatment for depressed skull fracture. Of these 67 patients, 43 cases were compound and 24 cases were close depressed fracture.

	No. of patients	**Percentage (%)**
Simple (close) type	24	36
Compound (open) type	43	64

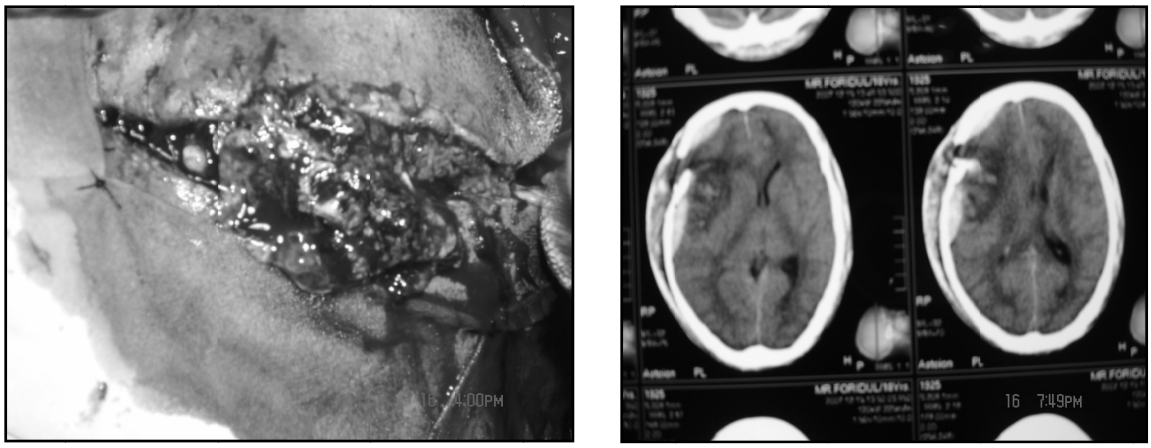

Fig: Compound depressed fracture with cerebral contusion with evisceration of brain matter

In 7 cases depressed fragment crossed the midline over the Sup. Sagittal sinus (SSS) and in all the cases SSS were injured. Rest 60 cases remain in one side of midline.

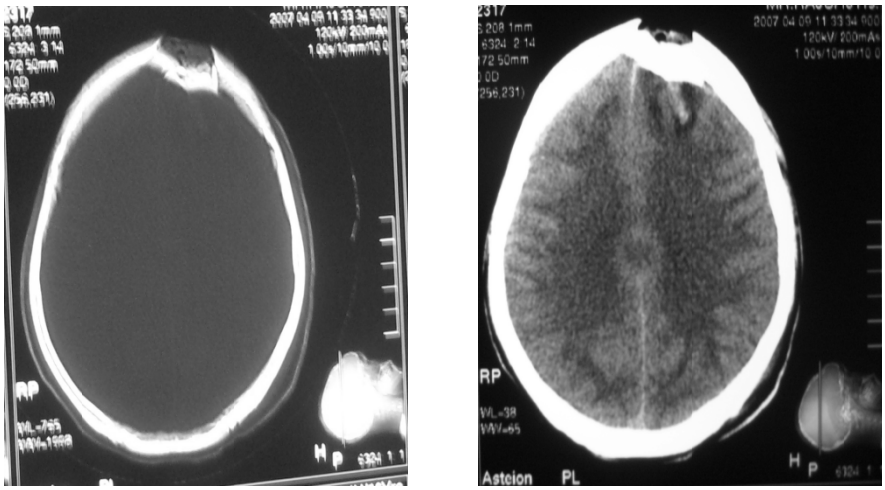

Fig: DF crossing the midline with SSS injury

Etiology:

Cause	No. of patients	Percentage (%)
Assault (striking by bamboo, lathi, spade, hammer)	32	48
RTA	29	43
Others (Fall of heavy object on head like coconut, wood, brick etc. fall from height.)	06	09

Associated injuries:

Lesion	No.	Percentage (%)
EDH	15	22
Dural Tear	17	25
Brain contusion	21	31
In driven bone fragment	09	13

Fig: Depressed fracture with EDH

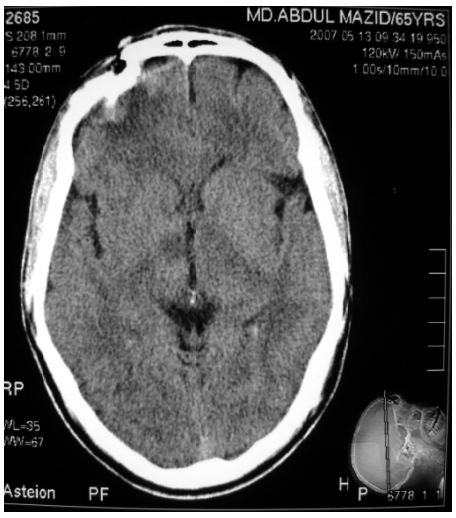

Fig: DF with dural tear

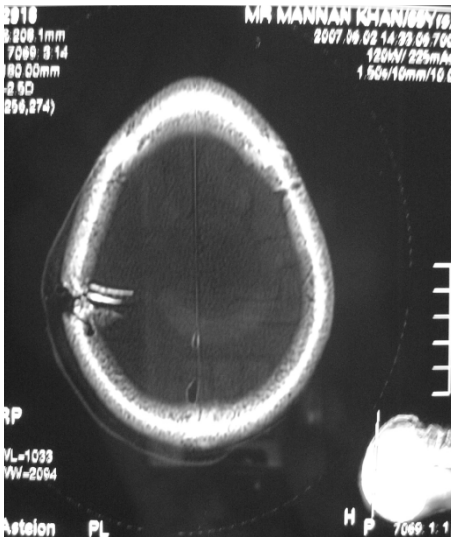

Fig: DF with cerebral contusion and in driven bone fragment

Preoperative GCS

Category	No. of patients	Percentage (%)
3-8	13	19
9-12	21	31
13-15	33	50

Postoperative GCS

Category	1st POD	7th POD
3-8	03	00
9-12	17	7
13-15	47	60

Fig: Preoperative poor GCS

Fig: Postoperative recovery

Preoperative focal Neurological deficit present in 28 cases

Improvement of Neurological deficit

- Complete recovery - 18
- Incomplete recovery - 10
- No recovery - 00

Total- 28

Postoperative complications:

Complication	No.
Infection –	
Major wound infection	01
Minor wound infection	07
Meningitis	01
Osteomyelitis	01
Cerebral abscess	00
Postop. Seizure	00
Pseudomeningocele	01

One patient had skin loss, that patient developed osteomyelitis. After control of infection by parenteral antibiotics wound was closed rotation flap of scalp.

Postoperative Benign intracranial hypertension was not reported.

Discussion

A **skull fracture** is a break in one or more of the bones in the skull caused by a head injury. Though in public mind, fractures of the skull carry an impression of severe injury with grave prognosis, these are serious only in so far as they affect the brain directly or indirectly. A force severe enough to fracture the skull may expend itself in the skull or may spread to produce brain damage as well.[3] Broken fragments of skull can lacerate or bruise the brain or damage blood vessels[2].

Fractures of the skull can be comminuted, depressed, linear or diastatic[2].

Comminuted skull fractures, those in which a bone is shattered into many pieces, can result in bits of bone being driven into the brain, lacerating it[13].

Depressed skull fractures result from a high-energy direct blow to a small surface area of the skull with a blunt object. Comminution of fragments starts from the point of maximum impact and spreads centrifugally. Most of the depressed fractures are over the fronto-parietal region because the bone is thin and the specific location is prone to an assailant's attack[4].

A depressed fracture may be open or closed. Open fractures, by definition, have either a skin laceration over the fracture or the fracture runs

through the para-nasal sinuses and the middle ear structures, resulting in communication between the external environment and the cranial cavity. Open fractures may be clean or contaminated/dirty.[4]

Patients with depressed skull fractures present with history of trauma, depression over then skull, neurological signs, seizure, CSF leak, brain matter may come through the wound in compound depressed fracture. Plain X-ray skull will demonstrate the fracture, type, its location, its degree of depression. CT scan is helpful in the diagnosis of skull fracture and associated intracranial lesion. Generally CT is more useful in demonstrating depressed fractures except when they are at the vertex [14].

Compound depressed skull fractures are surgical emergencies, and unless treated promptly and properly, complications like meningitis, cerebral abscess, osteomyelitis or post-traumatic seizure may supervene[3].

If dura is torn, lacerated brain matter brain matter may present in the wound that should be sucked out, after proper hemostasis dural rear should be repaired in watertight fashion. If needed by using pericranial graft or fascia lata[3]. In our series we had to use pericranial graft in one case. In 03 cases we could not close the dura completely. In postoperative follow up no CSF leakage encountered. But one patient developed pseudomeningocele.

Al-Haddad SA, Kirollos R (2002) reported that there was a male preponderance of 9:1. Alleged assault was the most common cause of depressed skull fractures followed by road traffic accidents. Postoperative infection rate was 8.2%. More than 80% of patients received prophylactic antibiotics. Prevalence of early post-traumatic epilepsy was 12.3%. No patients received prophylactic anticonvulsants. There was no significant association between dural tear and prevalence of post-traumatic epilepsy. Mortality rate was 1.4%[9]. Ozer FD et al. reported in their series motor vehicle accident is the commonest cause of depressed skull fracture followed by assault[12]. In our series assault (33) is the commonest cause followed by RTA(29). Postoperative infection rate was 12%, among them most are minor wound infection. We used prophylactic antibiotics in all the cases.

We used prophylactic anticonvulsant in all the cases and encountered no postoperative seizure. We had no death in our series.

The use of surgical treatment for depressed skull fractures that are located over major venous sinuses is a matter of controversy. However, if clinical and radiological findings of sinus obliteration and related intracranial hypertension are present, surgical decompression is indicated[5].

Depressed skull fractures may not only interrupt the growth and function of the brain but also give rise to an epileptogenic focus or other signs of dysfunction. Therefore, early treatment is needed. The surgical elevation of depressed bone fragments is the standard treatment of depressed skull fractures in cases where the depression involves the full thickness of the normal adjacent skull [(6)].

Many cases of depressed skull fractures have been described as "ping-pong ball" fractures in newborns and infants [(7)]. Similar to the "greenstick fractures" of the long bones in children, the depressed skull fractures usually have the localized depressions of the skull without the loss of bone continuity[8]. Without surgery, a 'cup-shaped' depressed skull fracture in an infant was safely elevated by suction generator and the cup of breast pump with no neurological signs. This method is considered a simple, effective, safe, and alternative procedure in an infant with simple depressed skull fracture[6]. All children admitted into the Central Hospital of Yaounde between 1999 and 2004 with a cup-shaped simple depressed skull fracture and treated with the vacuum extractor were included. The cosmetic and radiographic results were satisfactory. The procedure was simple and without any complication[15].

Fuentes S et al. (2005) reported two cases of benign intracranial hypertension developed in patients with depressed skull fracture overlying the

SSS. Both the patients underwent surgical decompression[10]. A case of delayed signs of intracranial hypertension following closed head injury with a depressed cranial fracture and superior sagittal sinus thrombosis is reported. Conservative treatment of intracranial hypertension, including just repeated lumbar puncture and oral acetazolamide, was performed. Spontaneous re-canalization of the superior sagittal sinus was observed[11]. In our study no patient reported with features of BIH.

Conclusion

Surgical treatment is a good option for depressed skull fracture. Perioperative anticonvulsant use effectively reduces the chance of post traumatic seizure. Prophylactic antibiotic use reduces the risk postoperative / posttraumatic infection. Elevation of depressed fragment of bone over the sinus reduces the risk of benign intra-cranial hypertension.

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