Original Research Article

Factors affecting outcomes in compound depressed frontal bone fractures: Institutional study

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Abstract

Introduction: Compound depressed frontal bone fractures exhibits some peculiarities such as frequent involvement of frontal sinus and olfactory nerve and tract, which lie on the floor of the anterior cranial fossa. The primary aim of our study is analyzing factors influencing the outcomes in compound depressed fractures of frontal bone .This will help in improving outcomes and management of compound depressed frontal bone fracture.

Material and methods: Study was conducted at tertiary care institute by collecting data of 40 patients operated surgically from August 2018 to July 2019. The study included patients who were diagnosed with compound depressed frontal bone fracture and underwent surgical management at our institute. Follow-up was performed at least 3 months after the trauma. The variables evaluated were mortality, GOS, occurrence of rhinorrhea, meningitis, late post-traumatic epilepsy and smell disturbances.

Results: Most of our patient with GCS 13-15 was discharged with good clinical outcome and no complication on follow-up. Patient with low GCS and delayed presentation are at risk and adds up morbidity and mortality.

Conclusion: Early surgical intervention in patients with GCS 13-15 is associated with good outcomes and low complication rate associated with meningitis or CSF leak.

Key words

Frontal bone fractures, Skull fractures, Depressed fractures, Pneumocephalus.

Introduction

The presence of skull fracture in patients sustaining traumatic brain injury (TBI) is very common finding on CT scan. Important risk factors for poor outcome are – CSF rhinorrhea associated intracranial hematomas, contusions, pneumocephalus and have unfavorable outcome and death [1-3].

Cranial fractures can be classified as depressed and linear. Linear fractures have a single trait and no displacement between the bone edges [1]. Depressed skull fractures usually resulting from blunt injuries, occur when the extent of bone displacement is greater than the full thickness of the adjacent calvarium. Compound depressed frontal bone fractures are fractures with an overlying scalp laceration and galeal disruption. Compound depressed frontal bone fractures exhibits some peculiarities such as frequent involvement of frontal sinus and olfactory nerve and tract, which lie on the floor of the anterior cranial fossa. Frontal DSF with involvement of the inner table of the frontal bone can lead to particular complications such as central nervous system (CNS) infections (e.g., meningitis and brain abscess), cerebrospinal fluid (CSF) leakage, late posttraumatic epilepsy (LPE), visual problems and smell disturbances. It is worth emphasizing that CNS infections are associated with unfavorable outcomes [4-5].

Objectives

The primary aim of our study was analyzing factors influencing the outcomes in compound depressed fractures of frontal bone.

Materials and methods

Study was conducted at tertiary care institute by collecting data of 40 patients from August 2018 to July 2019. This was a retrospective observational study.

Inclusion criteria

- All compound frontal depressed fractures requiring surgical intervention.
- Age more than 12 years

Exclusion criteria

- Patients with closed depressed fracture
- Linear and undepressed fractures
- Polytrauma and associated medical comorbidities
- Pediatric patients (less than 12 years)

All the cases which fulfill the inclusion criterion, were evaluated in casualty, assessed for fitness and undertaken for surgery. The results were analyzed.

On admission, a detailed history was taken, and thorough clinical examination of all patients was carried out. Assessment of pupillary size/reactivity and level of consciousness (as per Glasgow Coma Scale - GCS) was carried out. Associated maxillofacial injuries were recorded .The neurological reassessment was carried out frequently to identify any neurological deterioration. The local wound was inspected for external evidence of fracture and contamination.

The head computed tomography (CT) scan was imaging modality of choice. Plain CT scan brain with bone window cuts with 3D reconstruction was taken. Radiographic data, including the presence of underlying contusions, extradural hematoma (EDH), subdural hematoma (SDH), traumatic subarachnoid hemorrhage (SAH), pneumocephalus and other associated lesions were noted.

Cervical spine clearance was done both clinically and radiologically. Progress was done during stay in hospital and Follow-up. Follow up performed at 1 month and 3 months after the discharge. The parameters studied were - Glasgow Outcome Scale (GOS), neurological deficits, rhinorrhea, meningitis, late post

traumatic epilepsy (LPE), and smell disturbances, behavioral changes.

All the patients were given prophylactic antibiotics and anticonvulsants. The antibiotic given was ceftriaxone 2 g 12 hourly and antiepileptic phenytoin loading dose given at time of admission. Primary care such as cleaning of wound with thorough saline wash with approximation of skin with stay sutures and dressing of wound was carried out in casualty department.

Routine biochemical investigations as a part of fitness for surgery were carried out. Radiological investigations included X-ray cervical spine, and X-ray chest were done in all patients.

Standard surgical procedures with elevation of depressed bone fragment, removal of bone fragments if comminuted and small fragments. Repair of dural tear/evacuation of hematoma done wherever necessary. Wound debridement and toilet done. Debridement of wound margin and primary repair was carried out to give primary covering (**Figure – 1**).

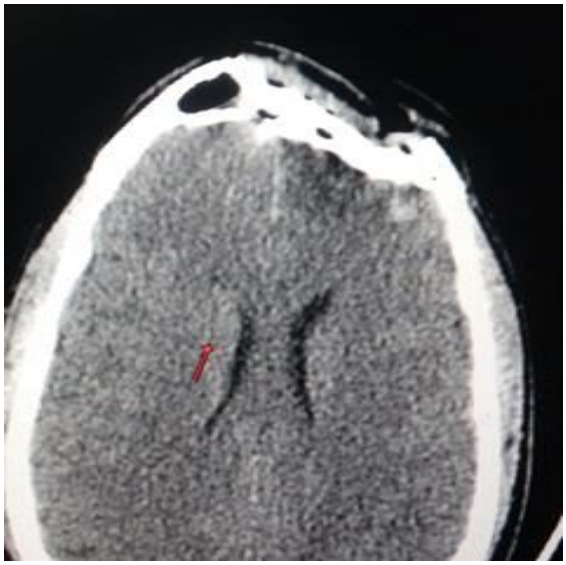

Figure - 1: Illustrative images of operated case of depressed frontal bone fracture. (a) 3D Image, (b) axial cut of non contrast CT brain showing depressed segment, (c) post operative image of same patient.

Results

In our study from August 2018 to July 2019 total 40 cases underwent surgical management and all were analyzed. We observed that majority of patients in our series presented with eye swelling (35%) and vomiting (30%). Eight patients had history of loss of consciousness (20%) for more than 10 minutes. Most of the patients who were having eye swelling were also irritable (64%). Associated Maxillofacial injuries were present in 6 patients (15%) (**Table – 1**).

Twenty nine patients (72.5%) were in the 20-40 age groups, eleven patients (27.5%) were in 40-60 years group and one patient (2.5%) more than 60 years group. Mostly patients are male (95%)

and young age group (72.5%) this reflects that trauma mostly affects young age and affects male. 87.5% of our patients had road traffic accident (RTA) as most common mode of injury followed by physical assault and fall.

Table - 1: Distribution of clinical presentation in our study.

Clinical presentation	No. of cases (%)
Loss of consciousness	08 (20)
Nasal bleed	06 (15)
Irritable	09 (22.5)
Vomiting	12 (30)
Seizures	01 (2.5)
Eye swelling	14 (35)
Maxillofacial injuries	06 (15)

Table - 2: Clinico-demographic variables of our study.

Variables	No. of cases
Age group (years)	
20-40	29
40-60	11
>60	01
Sex	
Male	38
Female	02
Mode of injury	
Road traffic accident	35
Physical assault	03
Fall	02
Alcohol consumption	
Yes	08
No	32
GCS score on admission	
13-15	30
9-12	08
<8	02
Pre-hospital management	
control of bleeding	20
airway protection	03
Pre-hospital delay(hours)	
<4	18
4-8	12
>8	10
Additional CT findings	
Pneumocephalus	10
Underlying contusion	08
SAH	04
EDH	06
Dural tear	11
Normal	22
Eye swelling	14
Associated maxillofacial injuries	06

Table – 3: Outcomes of patients in our study.

Outcome	Number of patients
Dead	2
Disability	2
Good	36

Table – 4: Follow up complications.

Variables	No of patients
CSF leak(rhinorrhea)	1
Anosmia	5
Seizure	1

Alcohol consumption was noted in 20% patients. Pre hospital management for bleeding from scalp and facial laceration was controlled by compression or suturing in 50% of our patients and airway was secured in three patients (7.5%) with low GCS.

None of the patients required airway protection at our institute pre operatively.

Eighteen patients reached the hospital within 4 hours of injury and twelve within 4-8 hours and ten more than 8 hours and no positive correlation could be observed. The most common associated finding apart from depressed frontal fracture on CT scan was found to be pneumocephalus and underlying contusion and most of the patients were not having any parenchymal injury or hematoma except for depressed fracture.

Ten patients (25%) had pneumocephalus, six patients (15%) had EDH, four patients (10%) had SAH, eight patients (20%) had underlying contusion (**Table – 2**).

Patients with contusions and SAH had poor outcomes and increased morbidity and mortality

[6]. Three of our patients developed meningitis in postoperative period which was treated with antibiotics out of which only 2 patients recovered and one expired. One patient died because his GCS on admission was less than 8 and had multiple parenchymal injuries**.** It was observed that patients with GCS13-15 had good outcome with no morbidity and mortality (**Table – 3**).

During follow up, we had five patients presented with anosmia, one patient had seizure for which anti-epileptic was added and one patient had CSF rhinorrhea which was treated with endoscopic repair (**Table – 4**).

Discussion

Trauma is a huge problem in both developing and developed countries. Head injury largely contributes to the mortality and morbidity of trauma patients. The incidence of head injuries is steadily increasing, which has led to increased concerns on management and to improve outcome. In depressed frontal bone fractures the outer table of one or more of the fracture edges lies below the normal anatomical level of the inner table as determined by the surrounding intact skull [8, 9]. Patients with history of trauma presenting with depressed frontal bone fractures depression over the skull can have varied clinical presentation ranging from neurological signs, seizure, CSF leak [10].

In our study, the mean age of presentation was 32.6 years. Maximum number of patients (72.5%) belonged to the middle age group of 20–40years who were at special risk of road traffic accident followed by physical assaults These findings are similar to multiple studies done earlier [11].

Jaggar, et al. evaluating compound depressed fractures found that the road traffic accident was the most frequent mechanism of injury [11, 12]. The patients with GCS score of 13 or more fared well with better long term outcome as against those with GCS score below it. In a similar study by Hossain, et al., patients with preoperative GCS in the range of 13–15 were 50%, 9–12 were 31%, and those who presented with GCS of 8 or lower were 19% [6].

Conclusion

Frontal depressed fracture patients with GCS 13-15, if managed timely and with proper management plan have good clinical outcomes. Secondary insult associated with rhinorrhea, meningitis, seizures can be prevented .Our study could find a few significant factors which influence the outcome of depressed fractures.

Young patients (20–40 years), patients with GCS 13 or more, had more chances of having uncomplicated course of treatment and uneventful recovery. Associated frontal contusions with mass effect, Dural tear and CSF rhinorrhoea have impact on long term outcome of the patient and warrant urgent surgical intervention. Even after surgical intervention, these factors have adverse effect on the recovery of patient - by increased stay in hospital, increased morbidity and mortality. Thus, our observation suggests that patients brought to hospital with minimal delay, with GCS score between 13 and 15, with simple depressed fracture and normal brain parenchyma without dural tear have the best outcome [7].

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