ORIGINAL ARTICLE

Midline Depressed Fractures of the Skull

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ABSTRACT

Objective: *To evaluate the results of management of middle depressed fracture skull.*

Depressed skull fracture is a common neuro-traumatic emergency. The commonest causes in our society are fall from height and road traffic accident. The frequency of depressed fractures is that it occurs in 75% in fronto-parietal region, 10%[1] in temporal region, while in occipital is 5% and in others is 10%. In time surgical management gives excellent results and leads to minimize the sequel of this condition. Most of the causes can be prevented just by adopting preventive measures. The condition can be treated in periphery hospital as well, if trained personals are available. Midline depress fracture are rare. Depressed fracture over venous sinuses requires special handling. Surgical elevation involves massive blood loss. Most of them are treated conservatively.

Material and Methods: *We conducted a 4 years study in the department of Neurosurgery, Lahore General Hospital from 2009 to 2013.*

Results: *We included 30 patients of mid line depressed fractures in which 20 were treated by surgical elevation and 10 by conservative management. Follow of 3 months to 1 year. In a total of 3750 patients who presented in the emergency department, 540 (14.4%) patients were operated for depressed skull fractures in which midline depressed fractures were 20 (4%). There were 20 patients in whom the anterior 1/3rd of superior sagittal sinus was involved, in 6 patients the middle 1/3rd of superior sagittal sinus was involved while in only 4 patients the posterior 1/3rd of superior sagittal sinus was involved. We paid special attention to these midline fractures involving the venous sinuses. In 4 of our patient we encountered severe blood loss as the depressed fragment was being plugged in sinus tear. In 12 patients we carefully elevated the depressed fractures and gained control over the venous sinus as soon as possible with the help of spongiston and packing technique. In 8 patients the fracture site was not contaminated with foreign material, there was no cosmetic issue and no focal deficit found, they were managed by scalp debridement along thorough irrigation and primary closure. Out of operated 20 patients only two patients presented with mild wound infection but it settled down with proper antibiotic therapy. In the conservative group out of 10 patients 2 patients developed epileptic seizure after 3 months and 7 months of trauma and they were managed by giving antiepileptic drugs.*

Conclusion: *In our study we concluded that elevation of depressed fracture over SSS can be attempted whenever patients clinical condition warrant. Elevation of the bone along with debridement of the wound resulted in rapid and dramatic resolution of signs and symptoms of raised ICP and venous hypertension. The study also showed an improvement in the cosmesis and reduction in the overall wound infection rate.*

Keywords: *Midline depressed fracture, occipital, superior sagittal sinus.*

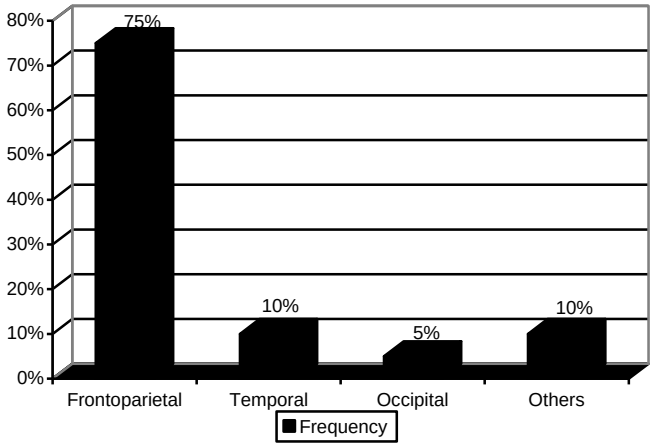
Abbreviations: *CVT: Cerebral Sinovenous Thrombosis, SSS: superior sagittal sinus*

INTRODUCTION

Traumatic brain injury is the major cause of death between 14 – 45 yrs and overall 3rd leading cause of death after cerebral vascular accidents and neoplasms. A skull fracture is breach or a gap in the cranial vault which can be because of direct or indirect blow to the

head. Edwin Smith's papyrus, the oldest known surgical paper described the depressed skull fracture in the context of head injuries. Treatment options for compound depressed skull fractures include debridement and closure of all scalp wounds reducing the risk of intracranial infection.

In selected situations, conservative approach may be safe. Depressed skull fractures account for 7 – 10% of children. Each year, approximately 1.7 million people sustain head injuries in the United States (US) alone, with 1.3 million undergoing emergency evaluation.[1] Depressed skull fracture is a common neuro-traumatic disorder. The commonest causes in our society are fall from height and road traffic accident. Depressed fractures occur mostly in frontoparietal region which accounts for about 75%, in temporal 10%, in occipital 5% and in others is 10%.



Graph 1: Frequency of depressed fracture

Classification

Skull fractures are classified by 3 ways.

By Pattern

It can be linear, diastatic, comminuted or depressed.

By Anatomical Location

It can be convexity or base.

By Type

It can be open or closed.

Cerebral venous thrombosis (CVT) is a state where thrombosis of the cortical or deep cerebral veins or venous sinuses results in blockage of venous outflow. It may be because of many reasons. The causes of CVT are dehydration, infection inside the cranial vault, hyper coagulable states, cyanotic heart disease, pregnancy, oral contraceptive pills usage, malignancies and rarely trauma.[1-3]

Cerebral sinovenous thrombosis (CVT) after head injury is a rare entity which accounts about 4% of CVT cases and is oftenly observed after penetrating head injury.[4] Compression of the sinus by adjoining structures with progressive thrombosis or direct trauma to the endothelium of the sinus is suggested as its mechanism. There is however reports showing that a mild closed head injury, in the absence of skull fracture passing over the sinus, can cause CVT.[5]

Depressed skull fractures are classified as closed (simple fracture) or open (compound fracture). Closed depressed skull fractures require surgical therapy according to the depth of deformity. A particularly type of newborn fracture is "ping – pong" fracture. It is usually encountered in parietal bone and requires surgery. Surgery for depressed fracture, closed or compound, situated over the superior sagittal sinus (SSS), is made after performing a CT scan with coronal and sagittal reconstruction or an angiography with venous phase, in order to evaluate the caliber and patency of the sinus beneath the impacted bone.

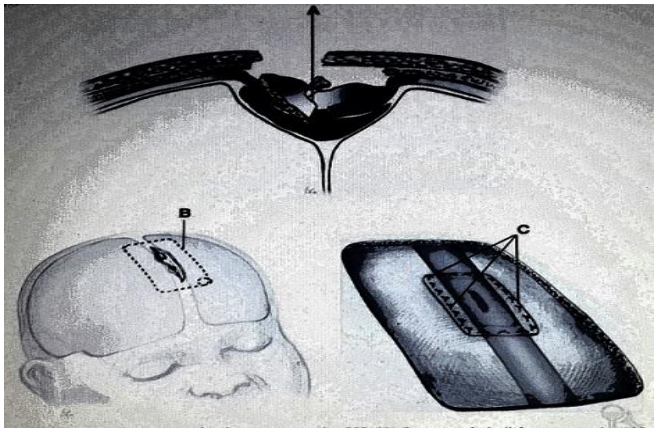


Fig. 1: *Diagrammatic representation of elevation of midline depressed fracture over SSS adapted from cranial trauma in children, practical handbook of neurosurgery 7th edition.*

MATERIAL AND METHODS

We included 30 cases midline depressed fracture skull treated during a period of 4 years from 2009 to 2013. All cases were admitted through emergency in the

Department of Neurosurgery Unit 2, PGMI, Lahore General Hospital, Lahore.

Surgical Technique for Fractures over the SSS:

Medial, rectangular free bone flap, centered over the SSS; elevation of the bone flap, with careful removal of bone fragments; repairing of the SSS. Tachocomb is used to cover the rent within the sinus. A surgicel strip is packed over, and periosteal graft is brought into the field and sewed over the surgicel strip and over the sinus. Closure with periosteum or aponeurotic galea, in surget manner, in narrow step, after dural closure, covering with Tachocomb and surgicel; dural repairing of SSS must be performed carefully, in order to not lose blood (in children there is a bigger risk for developing hemorrhagic shock); bone placement and wire fixation; wound closure; possible external drainage.

Compound fracture, containing bony fragments depressed or not with dural laceration represents an emergency for surgery. Also CT scan can show associated hemorrhagic subdural collection that needs mandatory surgical evacuation. Bone fragments must be elevated carefully, and lacerations of the dura will be treated by dural graft. Cortical laceration must be solved because it is an epileptic focus. Also, careful haemostasis must be performed. Cranioplasty with methylmethacrylate is performed if bone fragments could not be replaced.

RESULTS

We included 30 patients of mid line depressed fractures in which 20 were treated by surgical elevation and 10 by conservative management. Follow of 3 months to 1 year. In a total of 3750 patients who presented in the emergency department, 540 (14.4%) patients were operated for depressed skull fractures in which midline depressed fractures were 20 (4%).

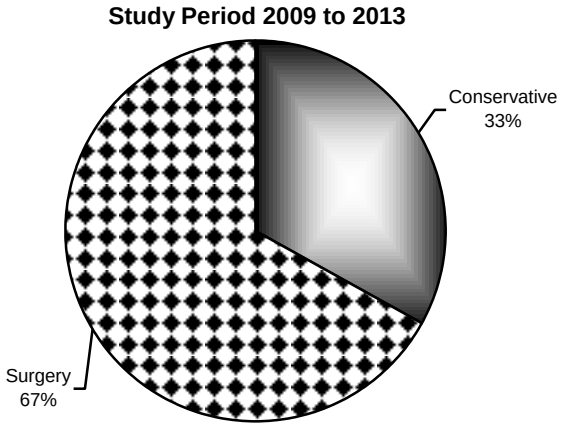
Table 1: *Frequency of depressed fracture in our set-up.*

Total No. of Cases presented	32500	
Total No. of Emergency Operations	3750	
Mid line Depressed Fractures	20	4%
Operated Depressed Fractures	540	14.4%

Table 2: *Involvement of superior sagittal sinus.*

Mid Line Depressed Fractures		
Anterior 1/3rd of SSS	20	66.6%
Middle 1/3rd of SSS	6	20%
Posterior 1/3rd of SSS	4	33.3%

There were 20 patients in whom the anterior 1/3rd of superior sagittal sinus was involved, in 6 patients the middle 1/3rd of superior sagittal sinus was involved while in only 4 patients the posterior 1/3rd of superior sagittal sinus was involved. All the patients remained well. There was no mortality. Out of operated 20 patients only 2 patients presented with mild wound infection but it settled down with proper antibiotic therapy. One of the patients has a closed depressed fracture that was planned to manage by conservative therapy but he developed hemiparesis along with dysphasia. He was urgently operated by elevating the depressed fragment of bone. Post operatively the patient speech and hemiparesis markedly improved. In the conservative group out of 10 patients 2 patients developed epileptic seizure after 3 months and 7 months of trauma and they were managed by giving antiepileptic drugs.



Graph 2: *Comparison of conservative and surgical management.*

In our study we included 30 patients who had depressed fractures in the mid line. The treatment strategy was that patients in whom there were closed fractures and neurologically intact they were managed

Fig. 2: *X-Ray Skull showing midline depressed fracture.*

Fig. 3: *C.T Scan Brain showing midline depressed fracture.*

conservatively. Debridement without elevation was done in patients with open depressed fractures but patent venous sinuses. Neurologically unstable patients either received or who developed deficit, urgent exploration were performed both in closed and open depressed fractures.

20 of our patients underwent surgery while 10 of the patients had a conservative treatment. There were 20 patients in whom the anterior 1/3rd of superior sagittal sinus was involved, in 6 patients the middle 1/3rd of superior sagittal sinus was involved while in only 4 patients the posterior 1/3rd of superior sagittal sinus was involved.

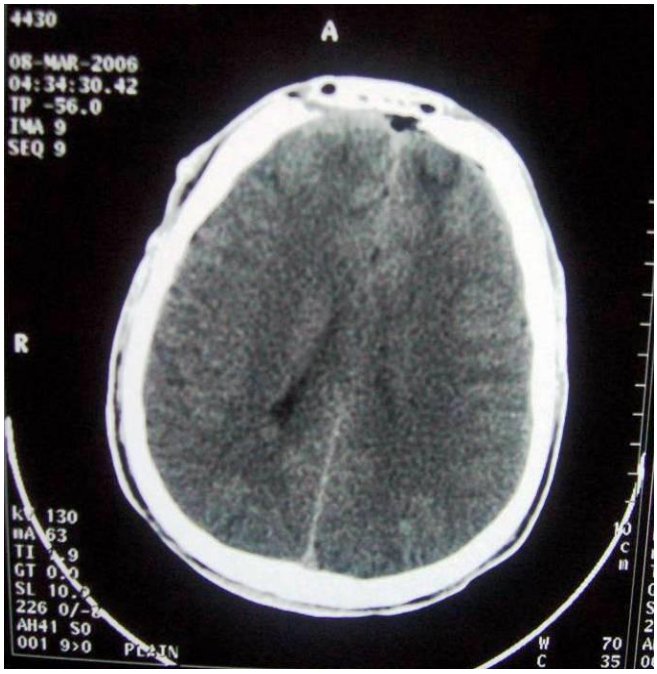


Fig. 4: *Post-operative C.T Scan showing elevated depressed fracture.*

DISCUSSION

The incidence of head injury is increasing everyday so it is imperative that knowledge of this subject must increase rapidly both in its preventive and practical aspects as well as its scientific aspects because many of these cases are either preventable or curable. Thangaraj M[14] in a study of cranio-cerebral injuries by blunt force observed that most of his cases were due to fall from height (34%) and vehicular accidents (32%). In the present study we also accounted for 70% of cases due to fall from height. Gradwohl and Camps and Purchase[15] have mentioned that external injuries may or may not be present in all cases of head injury. Simpson[16] is of the view that wounds of the scalp due to blunt force must be looked upon as potentially serious no matter how they are produced. The results of these studies hold well in our study as well. In 22% of direct or indirect trauma to the head there were no external injuries on the head but these had severe intra-

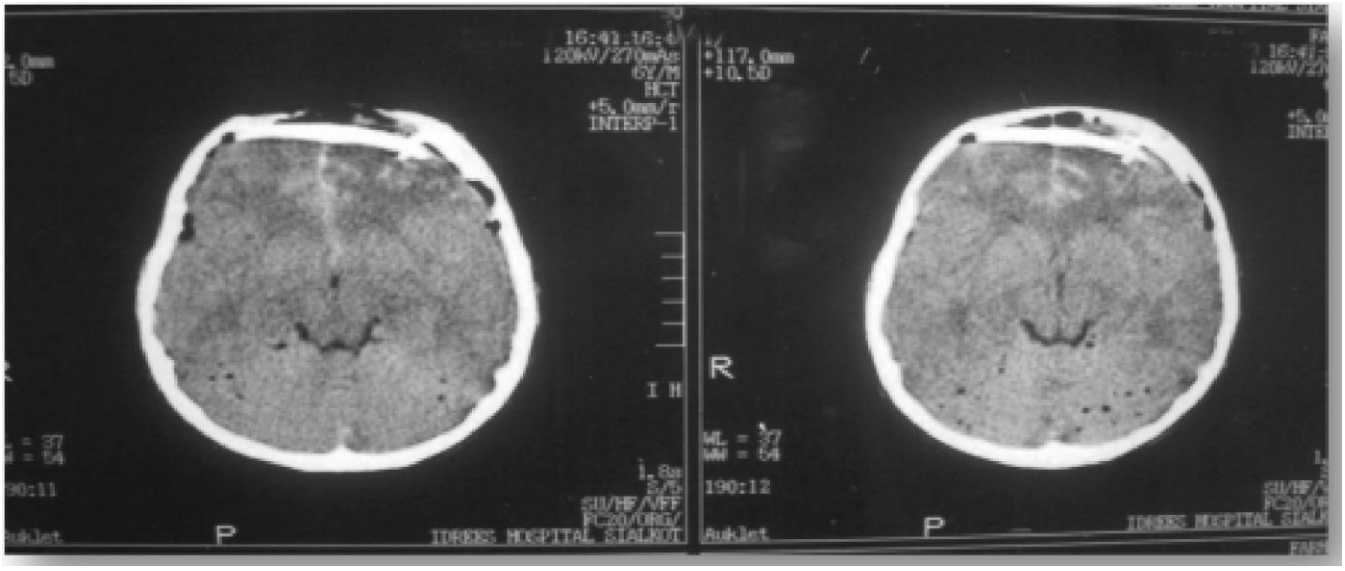


Fig. 5: *Pre-operative CT scan showing midline depressed fracture.*

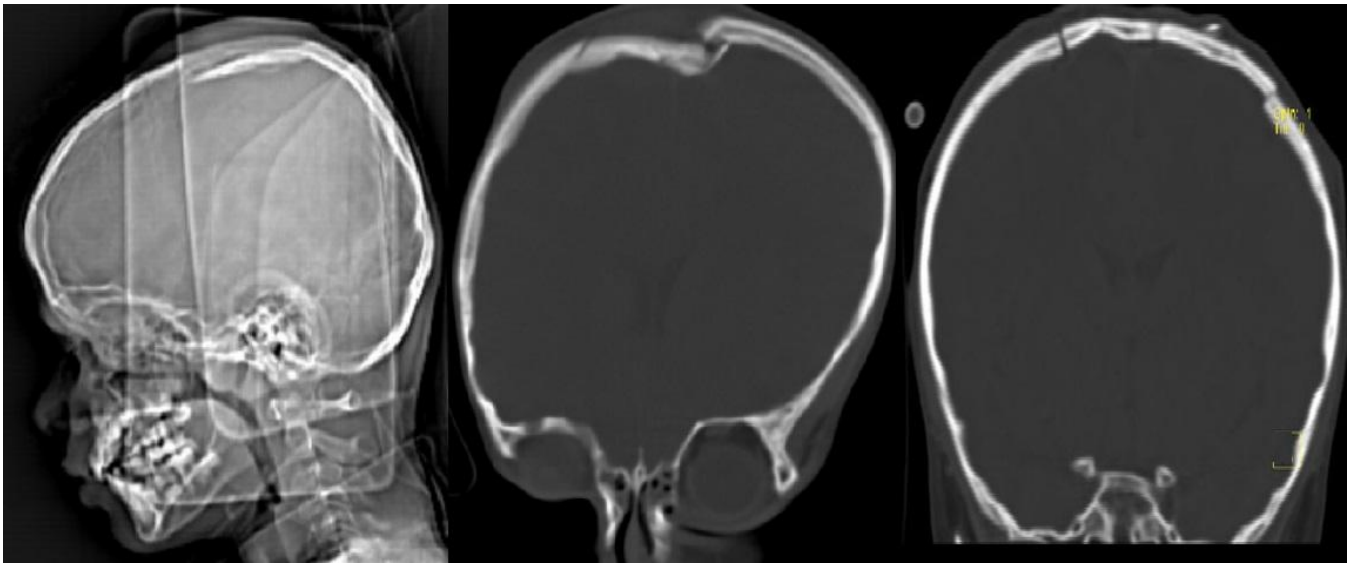
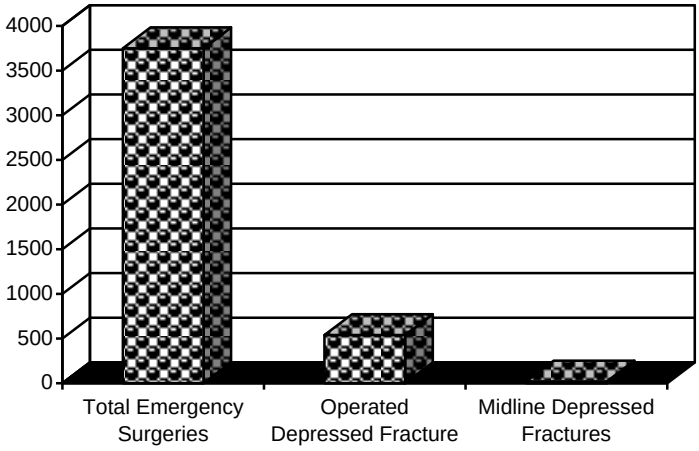


Fig. 6: *Preoperative and post operative X-Ray skull Showing depressed fracture and its elevation.*

cranial lesions. The dominant type of skull fracture found was linear (fissured) fracture in 43.04% cases followed by basilar fracture in 17.73%, comminuted fracture in 7.6% and midline depressed fracture in 3.78% cases in a study by Pathak A[17] which is near to this study. Manish k et al[18] from Davangere, in his study showed that linear fracture (38.8%) was the commonest fracture followed by Comminuted fracture (27.7%) and depressed fracture (11.1%). In another study by Mukesh K Goyal et al[19] out of 140 cases 16% doesn't have bone injury while 84% presented with fractures of skull. Fracture of skull were detected in 118 (84%) cases fractures of skull of various types i.e. linear (77) cases, depressed (13) cases, comminuted (7) cases and base of skull 21 cases. Ravindra S Honnungar et al[20] study showed that out of 403 head injury cases, 313 cases (77.7%) had a fatal skull fracture. The bones involved were Temporal (40.3%), Occipital (36.4%), Parietal (46.9%), Frontal (56.2%), Sphenoid (14.1%) and base of skull (22.1%). Our findings are consistent with these studies. In a study by Ranjit M. Tandle et al[21] out of 113 cases skull fracture was found

in 95 cases. Among them linear fracture of skull with basal fracture was commonest (24.21%) followed by linear fracture (16.84%), basal fracture (15.79%) and depressed fracture (14.74%). Skull vault fracture was seen in 80 cases with linear fracture as the commonest one. Location wise Temporo-parietal region (20%) was followed by Fronto-parieto-temporal region (17.50%).



Graph 3: *Operated Midline Depressed Fractures in Emergency.*

CONCLUSION

In our study we concluded that elevation of depressed fracture over SSS can be attempted whenever patients clinical condition warrant. Elevation of the bone along with debridement of the wound resulted in rapid and dramatic resolution of signs and symptoms of raised ICP and venous hypertension. The study also showed an improvement in the cosmesis and reduction in the overall wound infection rate.

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