



PROGNOSTIC FACTORS AFFECTING SURGICAL OUTCOME IN DEPRESSED SKULL FRACTURE PATIENTS AT A TERTIARY CARE CENTRE IN NORTH INDIA

Neurosurgery

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ABSTRACT

BACKGROUND: Head injury is an important public health problem today and a major worldwide health and social issue. There has been a substantial increase in the number of cases with head injuries in the past few decades especially in congested cities which has simultaneously led to increase in the annual rate of depressed skull fractures

AIM AND OBJECTIVES: Identify the prognostic factors which affect surgical outcome in depressed skull fracture patients.

MATERIAL AND METHODS: study was conducted in P.G. Department of surgery, S.R.N. Hospital associated with M.L.N Medical College, Prayagraj for a period of 12 months. Approval from the ethical committee and written and informed consent either from patient or their legal heirs was obtained before starting the study. Outcome was measured using Glasgow outcome scale score at discharge and divided into two groups good outcomes (GOS4,5) and poor outcomes (GOS1,2,3)

RESULTS: total of 97 patients underwent surgical intervention during the study period. A total of 80 patients, i.e., 82.47% of study participants had a favorable Glasgow outcome scale score while 17 patients (17.53%) had an unfavorable Glasgow outcome score. GCS score at admission: Around 48.45% of the study participants had a GCS of 13–15, and 38.15% had a GCS score of 9–12 and 13.4% had a GCS score ≤ 8 at admission. Better GCS score at admission with minimal pre-hospital delay was found to be correlated statistically with better outcome ($p < 0.05$). Patients with non reactive pupil and anisocoric pupil at admission had more unfavorable outcome as 10.31% and 5.16% respectively while patient with responsive pupil at admission had better surgical outcome with 2.06% as unfavourable outcome. There was significant statistical association between pupillary response and surgical outcome. There was positive statistical association between pre-hospital delay and surgical outcome of patient.

KEYWORDS

INTRODUCTION

Head injury is an important public health problem today and a major worldwide health and social issue. There has been a substantial increase in the number of cases with head injuries in the past few decades especially in congested cities which has simultaneously led to increase in the annual rate of depressed skull fractures [1] which are associated with considerable morbidity and mortality of patients and add an unavoidable financial burden on the family members. The assessment of patient at admission for GCS is necessary as-

Glasgow Coma Scale-

Eye opening	Best verbal response	Best motor response
	5: oriented	6: obeys command
4: spontaneous	4: confused but converse	5: localize pain
3: to speech	3: inappropriate words	4: withdraws
2: to pain	2: incomprehensible sounds	3: abnormal flexion
1: none	1: none	2: extension
		1: none
Total GCS score : 3 – 15		

A skull fracture is considered depressed when a portion of the outer table of the fracture line lies below the normal anatomical position of the inner table.[2].

Depressed skull fractures typically occur when objects with a large amount of kinetic makes contact with the skull over a fairly small area.[3]. Depressed fractures can also be very serious because small pieces of bone can press inwards against the brain. Open fractures are often more serious because there's a higher risk of bacterial infection if the skin is broken.

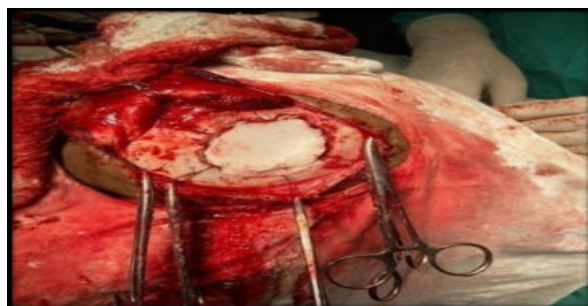
Depressed skull fractures (DSF), one of the types of compound cranial fractures, usually resulting from blunt injuries, occur when the extent of bone displacement is greater than the full thickness of the adjacent calvarium.

Compound depressed fractures are fractures with an overlying scalp

laceration and galeal disruption and are surgical emergencies which should be treated promptly. Early definitive diagnosis and management of skull fracture decreases morbidity and mortality.

Frontal Depressed Skull Fracture exhibits some peculiar features with involvement of the inner table of the frontal bone can lead to particular complications such as central nervous system (CNS) infections in up to 15% to 30% of the patients (e.g., meningitis and brain abscess), mucocele cyst, chronic sinusitis, cerebrospinal fluid (CSF) leakage, late post-traumatic epilepsy (LPE), and smell and taste disturbances (STD)^[4]

Image : Left Parietal Depressed Fracture.



AIMS & OBJECTIVES

Identify the prognostic factors which affect surgical outcome in depressed skull fracture patients.

OBJECTIVES:-

The objective of the study was to evaluate the:-

- Affect of duration and time lapse to admission before surgery.
- Depressed fracture associated NCCT head finding.
- GCS Score at time of presentation.
- Post-op complications- meningitis, osteomyelitis, epilepsy, surgical site infection, neurological deficits.

- Type and site of fracture. Affecting the surgical outcome in depressed skull fracture patients.

MATERIAL AND METHODS

The study was conducted in P.G. Department of surgery, S.R.N. Hospital associated with M.L.N Medical College, Prayagraj for a period of 12 months. Approval from the ethical committee and written and informed consent either from patient or their legal heirs was obtained before starting the study.

Inclusion Criteria:

- All head injury patients with depressed skull fractures
- Patients with associated intracranial lesions (SAH, SDH, EDH, CONTUSION etc).
- Patient's guardian must be able to understand and give consent for the study.

Exclusion Criteria:

- Patients with severe co-morbid injuries involving other organs (POLYTRAUMA).
- Patients with severe co-morbid medical disorders.
- Inability to understand and give consent.
- Participants who might not be able to comply with the study procedures till the end of the study.
- Firearm Injury.
- Mortality in preoperative period which were being managed conservatively.

Outcome-

Outcome was measured using Glasgow outcome scale score at discharge and divided into two groups good outcomes (GOS4,5) and poor outcomes (GOS1,2,3)

Glasgow Outcome Scale:

Good recovery (able to return to work or school)	5
Moderate disability (able to live independently, unable to work or school)	4
Severe disability (able to follow commands / unable to live independently)	3
Vegetative state	2
Death	1

Observation And Results

Total 97 patients of head injury admitted in trauma centre SRN Hospital, MLN Medical College, Prayagraj were included. In this study, multiple parameters were compared and their relation with outcomes was observed.

Table-1 Outcome of patients according to age group (N=97)

		OUTCOME		Total	*p-value
		Favourable	Un -Favourable		
AGE yrs	≤20	(27)27.84%	(5)5.15%	(32)32.99%	0.59
	20-40	(30)30.93%	(5)5.15%	(35)36.08%	
	>40	(23)23.71%	(7)7.22%	(30)30.93%	
Total		(80)82.48%	(17)17.52%	(97)100.0%	

*p>0.05, so considered statistically not significant

In this study, most favorable outcome was in age group 20-40 years (30.93% of patients had GOS 5&4) followed by age group ≤20yrs (27.84% of patients had GOS 5&4). Most unfavorable outcome was in age group >40 years -7(7.22% of patients had GOS 3-1) though was statistically insignificant to impact the surgical outcome of patient.

Table -2: Outcome of patients according to Gender

		GENDER * OUTCOME			
		% of Total			
		OUTCOME		Total	*p-value
		FAVOURABLE	UN -FAVOURABLE		
GENDER	MALE	(47)48.45%	(9)9.28%	(56)57.73%	0.78
	FEMALE	(33)34.02%	(8)8.25%	(41)42.27%	
Total		(80)82.47%	(17)17.53%	(97)100.0%	

*p>0.05, so considered statistically not significant.

In this study, 47(48.45%) male patients had favorable outcome (GOS 5&4) and 33(34.02%) female patients had favorable outcome (GOS 5&4) though was statistically insignificant to impact the surgical outcome of patient.

Table-3: Outcome of Patients according to GCS

		GCS AT ADMISSION * OUTCOME			
		% of Total			
		OUTCOME		Total	* pvalue
		FAVOURABLE	UN -FAVOURABLE		
GCS AT ADMISSION	13-15	(44)45.36%	(3)3.09%	(47)48.45%	<.0001
	9-12	(31)31.96%	(6)6.19%	(37)38.15%	
	≤8	(5)5.15%	(8)8.25%	(13)13.40%	
Total		(80)82.47%	(17)17.53%	(97)100.0%	

*p<0.05, so considered statistically significant

In this study, 44 (45.36%) patients with GCS 13-15 had favorable outcome while among patients with GCS 9-12, 31(31.96%) patients had favorable outcome and among patients with GCS ≤8, only 5(5.15%) had favorable outcome while maximum among this group - 8(8.25%) had unfavorable outcome which was statistically significant and proves patient with poorer GCS at admission had more unfavorable outcome.

Table-4: Outcome on the basis of Pupillary response

Pupillary Response At Admission * Outcome

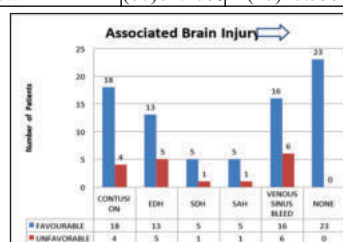
		OUTCOME		Total	*p value
		FAVOURABLE	UN -FAVOURABLE		
PUPIL LARY RESPONSE AT ADMISSION	RESPONSIVE	(52)53.61%	(2)2.06%	(54)55.67%	.0001*
	ANISOCORIC	(23)23.71%	(5)5.16%	(28)28.87%	
	NON RESPONSIVE	(5)5.15%	(10)10.31%	(15)15.46%	
	Total	(80)82.47%	(17)17.53%	(97)100.0%	

*p<0.05, so considered statistically significant

In this study, 52 patients with responsive pupil had favorable outcome while 23 patients with anisocoric pupil had favorable outcome and most patients with non responsive pupil 10 among the 15 who had non reactive pupil had unfavorable outcome which was statistically significant to outcome parameter as patients with non - reactive pupil at admission or over the time before surgery had more unfavorable outcome.

Table-5 Outcome of Patients according to CT scan Findings 9

		ASSOCIATED BRAIN INJURY * OUTCOME			
		% of Total			
		OUTCOME		Total	
		FAVOURABLE	UN -FAVOURABLE		
ASSOCIATED BRAIN INJURY	CONTUSION	(18)18.56%	(4)4.12%	(22)22.68%	
	EDH	(13)13.4%	(5)5.16%	(18)18.56%	
	SDH	(5)5.155%	(1)1.03%	(6)6.185%	
	SAH	(5)5.155%	(1)1.03%	(6)6.185%	
	VENOUS SINUS BLEED	(16)16.49%	(6)6.19%	(22)22.68%	
	NONE	(23)23.71%	0	(23)23.71%	
Total		(80)82.47%	(17)17.53%	(97)100.0%	



Graph-1 Distribution of Patients according to CT-Scan Findings

In this study, most unfavorable outcome was present in patients of depressed fracture with associated venous bleed 6(6.19%) while patients with associated EDH with depressed skull fracture on CT scan had 5(5.16%) unfavorable outcome and patients with contusion had 4(4.12%) unfavorable outcome. 1 unfavorable outcome was present in SAH and SDH suggesting patients with associated brain injuries had poorer outcome.

Table 6: Outcome of Patients according to Pre Hospital delay

	OUTCOME		Total	*p value
	FAVOURABLE	UN-FAVOURABLE		
PREHOSPITAL	(45)46.39%	(3)3.09%	(48)49.48%	0.0063
≤2hrs	(35)36.08%	(14)14.44%	(49)50.52%	
DELAY >2 hrs	(80)82.47%	(17)17.53%	(97)100.0%	

*p<0.05, so considered statistically significant

In this study, patient who were attended and operated in ≤2h of injury had less unfavorable outcome 3(3.09%). While patients who had contact with tertiary hospital of ours at >2h, 14(14.44%) had unfavorable outcome which was statistically significant proving early elective approach had a better outcome.

Table 7: Distribution of Patients according to GOS at discharge

	Number of Patients	Percentage (%)
GOS AT DISCHARGE	5	63
	4	17
	3	8
	2	3
	1	6
Total	97	100%

Out of the 97 patients admitted and operated, Outcome assessed using Glasgow outcome scale score at discharge and divided into two groups- good outcomes (GOS4,5) and poor outcomes (GOS1,2,3). Among the 97 patients, 63(64.95%) had GOS of 5 while 17(17.52%) patients had moderate disability with GOS of 4 and total of 6 patients succumbed post GOS of 1.

DISCUSSION

In our study, the mean age of presentation was 23.50 ± 7.7years. Maximum number of patients (36.08%) belonged to the age group of 20-40 years who were at special risk of road traffic accidents, fall from heights and assaults as this age group is more involved in outdoor activities like sports, day to day outdoor activities due to jobs. The unfavorable outcome increased and became worse with increase in age from 5.15% in age group of 20yrs and 20-40 years to 7.22% in group of >40 years. These findings are similar to study done by C. C. Hung et al.[5] Ritesh S. Satardey et al[6] found in their study group that as age increased, outcome worsened as age group of 20-40 years had the most number of patients with good outcome (81.2%)

Gender

In our study, 56 (57.7%) cases out of 97 were males and 41 (42.3%) were females. Among admitted patients Male: Female ratio was 1.4:1. In a similar study done by Mumtaz et al.,[3] 35.71% cases were females and 64.28% were males.[3]. Ritesh S. Satardey et al[6] found in their study majority of patients were males (78%), and they also had poorer outcomes as compared to females. This can be explained by their involvement in more severe trauma. Anand Prakash et al.[7] studied there was a predominance of the male cases (6.94:1) as compared to females. The male: female ratio in Glasgow, Brisbane, Rotterdam, and Liverpool series was 4.99:1, 4.04:1, 6.14:1, and 9:1, respectively,[8,9,10,11] although they were observational without surgical intervention done among these patients.

GCS At Admission

The patients with GCS score of 13-15 (48.45%) at the time of admission responded to treatment well with better long-term outcome as against those with GCS score below it. There were 47 patients between 13- 15 GCS score and 44 of them had good outcome. 37 patients were noted in the 9-12 GCS group and 31 of them had good outcome. Thirteen patients fell in the below 9 GCS score group and 8 among them had unfavourable outcome. GOS score at discharge was also considered. Sixty three (64.95%) patients had GOS score of 5

while 17(17.52%) had GOS of 4 that means 82.47% patients had favourable outcome at discharge. There was a very strong correlation between GOS score at discharge and final outcome. Hence, it can be emphasized that GCS score both at admission and at discharge had a significant role in predicting the final outcome. 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%.[12]. In a study by Ritesh S. Satardey et al studied nearly 97.3% patients who presented with GCS between 13 and 15 had good outcome as against 16.7% patients who had GCS of 8 or below while patients had preoperative GCS in the range of 13-15 were 37 (74%), in the range of 9-12 were 7 (14%), and those below 8 were 6 (12%).[6]

ANAND PRAKASH et al[7] studied the incidence of severe head injury (GCS < or = 8) and moderate injury (GCS score 9-12) is 15% and 23% which are slightly higher than findings in Liverpool series[11]. This notable percentage of severe and moderate injury may be due to initial neglect of injury and lower or difficult access to medical facilities causing delay in seeking medical care in developing countries like ours, resulting in conversion of mild head injury into moderate head injury. This could be supported by the observation that there is simultaneous decrease in mild cases with GCS score 13-15 (62.47%) as compared to 72% in Liverpool series [11].

Associated Intracranial Lesion

Associated brain injuries are another important factor in predicting the outcome in patients with DSFs. In our study, 22.68% of cases had contusions, 18.56% - EDH, 6.18% - SDH, and 6.18% - SAH. Most of the cases having SDH and SAH had good outcome except one. Most cases with poor outcome had contusions, EDH and venous sinus bleed associated. Ritesh S. Satardey et al studied additional CT findings in their study group - EDH (62%), cerebral contusions (34%), and Dural tear (14%).[6]. These findings were similar to a study by Hossain et al., findings where EDH - 22%, brain contusions - 31%, Dural tear - 25%, and in-driven bone fragment - 13%.[12].

Glasgow Outcome Score

There were six cases which had a Glasgow outcome score of 1, i.e., death in our study and three had Glasgow outcome score of 2 having vegetative state while eight had a severe disability state with a GOS score of 3. Among these seventeen patients with unfavorable outcome, seven were from the age group of more than 40yrs and 11 out of seventeen had compound skull fractures.

Dural tear and type of fracture were related to outcomes in our study. This conclusion is line with Satardey et al.[6] which had more poorer outcomes in cases with Dural tear and a statistically significant relation with type of fracture (simple fractures had better outcomes in their study) as observed in our study.

Pre Hospital Delay

There was significant association between the pre-hospital delay to the hospital as among 49 patients who had first contact with medical care >2h, 14 had a poor outcome although there GCS at presentation were equally low. Ritesh S. Satardey et al studied that no significant statistical relationship existed between pre-hospital delay and outcome ($P < 0.38$), but observed that as the time to reach hospital increased, unfavorable outcome increased among study groups.[6]

CONCLUSION

- Among the 97 patients operated, 80(82.47%) had favorable outcome.
- Depressed fracture seen in age group >40yrs had more unfavorable outcome. Male are more commonly affected (M: F:: 1.4: 1) than females and the gender of patients has no statistical association with significant conclusion of poor prognostic effect on outcome of patients though male have hard skull and depressed fracture is common than females who have linear fracture more common as seen.
- GCS at admission is directly related to outcome of patients.
- Bilateral non-reactive pupil accounts for a poorer outcome and patient who had bilaterally reactive pupil made a better outcome.

The provision of advanced care to trauma patients is not readily available. Imaging modalities such as CT scans and MRI are also not easily accessible. The associated intracranial lesions and higher rate of infections could also be a significant cause of increased mortality which can guide our focus of management on them with strategic planning at individual as well as community level. Primary surgical

repair of depressed skull fractures is safe, feasible, and associated with good outcomes. Our study found that replacement of bone fragments in compound depressed skull fractures does not significantly increase the risk of infectious complications.

Unilateral pupillary dilatation and an admission GCS score of 8 or less are ominous signs in regard to morbidity and lately mortality.

The prognostic factors (predictors) of unfavorable outcome in surgical intervened patients were concluded as 1) increased patient age, 2) lower Glasgow Coma Scale score at first evaluation, 3) clinical deterioration in the first hours after trauma including pupillary changes and 4) onset or increase of midline shift on follow-up CT images.

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