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Original Research Article

FACTORS AFFECTING THE SURGICAL OUTCOME OF PATIENTS WITH CEREBRAL CONTUSIONS

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ABSTRACT

Background: The aim is to study about the key factors influencing the outcome ofsurgical management in cerebral contusion.

Materials and Methods: It was a observational prospective study. The study was conducted period from May 2022-December 2023 (18 months). It was conducted at one of Tertiary care hospital - Rangaraya Medical College, Kakinada. All the patients who come to casualty with cerebral contusions diagnosed with CT scan having age > 18 years in whom surgery is indicated with other associated intracranial injuries also.

Results: In the Majority of the patients admitted were due to road traffic accidents (72%). Majority of the population were observed with clinical presentation of headache. Pupillary abnormality was present among 64% of the patients. 52% of the patients had high GCS score(13-15). 94% of the patients were with only 1 contusion. Size of contusion was observed less than or equal to 25 ml among 78%. Among 36% of the patients location of contusion was frontal, followed by temporal (28%), parietal (16%), Temporoparietal (12%) and Fronto Temporal. 48% of the patients presented to the hospital in less than 6 hours, followed by 7-12 hours and > 12 hours after incident. 72% of the patients had midline shift > 5mm. 24% of the patients were with associated subdural hematoma and subarachnoid Haemorrhage. Majority, 22% of the patients were found with hypertension and both hypertension. 78% of the population had hospital stay less than or equal to 12 days. Among 36% of the patients, antiplatelet and Anticoagulant therapy usage was observed. 74% had good recovery after surgery, followed by moderate recovery (14%), among 8% of the patients death were observed and 4% of the patients were observed with severe disability.

Conclusion: The present study suggested that, CT suggested that the midline shift was a significant factor indicating poor clinical prognosis. The most predictive factors for mortality in severe TBI are low GCS on presentation and associated SDH on CT scan. Timing of hospitalization and duration of hospital stay were the significantly associated factors with morbidity and/or mortality.

Keywords: Cerebral contusion, Fronto femporal, SDH, CT scan, GCS.

INTRODUCTION

Traumatic brain injuries (TBIs) are a significant public health concern worldwide, often resulting in substantial morbidity and mortality. Among the various forms of TBIs, cerebral contusions are particularly critical due to their potential to cause severe neurological deficits and complications. A cerebral contusion, a type of intracerebral haemorrhage, involves bruising of the brain tissue and is commonly associated with trauma from accidents, falls, or violent impacts. The management

of patients with cerebral contusions is complex and necessitates a multidisciplinary approach, often involving surgical intervention.[1]

The outcome of surgical treatment for cerebral contusions can be highly variable, influenced by a myriad of factors. These factors range from patient-specific characteristics such as age, pre-existing medical conditions, and the severity of the initial injury, to treatment-related aspects like the timing of surgery, surgical techniques employed, and perioperative care. Understanding these factors is crucial for optimizing patient outcomes, improving surgical strategies, and informing clinical decision-making.[2]

Despite advancements in neurosurgical techniques and critical care, predicting the outcomes of surgical interventions for cerebral contusions remains challenging. Variability in patient recovery underscores the need for a comprehensive analysis of the determinants that impact surgical success. This study aims to investigate the key factors affecting surgical outcomes in patients with cerebral contusions, drawing on clinical data, patient demographics, and treatment modalities to identify patterns and predictors of recovery.

By elucidating the factors that contribute to better or worse surgical outcomes, this research seeks to provide valuable insights for clinicians, guiding more effective treatment plans and potentially improving prognoses for patients suffering from cerebral contusions. Ultimately, this study strives to enhance the understanding of the interplay between clinical variables and surgical success, paving the way for more tailored and effective interventions in the management of cerebral contusions.

Aim: To study about the key factors influencing the outcome of surgical management in cerebral contusion.

Objectives:

1. To analyse the factors affecting the surgical outcome of patients with cerebral contusion
2. Analysis of mortality and morbidity in surgically managed patients with cerebral contusion due to various factors. Analyze the factors which culminate in morbidity and mortality

MATERIALS AND METHODS

Study Design: This study is Observational prospective study

Source of data: Patients with cerebral contusion, Department of Neurosurgery, Rangaraya Medical CollegeKakinada

Study Duration and Place of Study: The study was conducted period from May 2022-December 2023 (18 months). It was conducted at one of Tertiary care hospital - Rangaraya Medical College, Kakinada.

Inclusion and Exclusion Criteria

Inclusion Criteria

All the patients who come to casualty with cerebral contusions diagnosed with CT scan having age > 18 years in whom surgery is indicated with other associated intracranial injuries also

Exclusion Criteria

1. Paediatric Head injuries (age < 18 years)
2. Associated other extra cranial injuries (Polytrauma)

Method

Standard preoperative steps-sop

Every patient received preventive antibiotics and anticonvulsants. For those with clean wounds, ceftriaxone was administered at a dose of 1 g every 12 hours. while for those with open wounds, the dose was increased to 2 g every 12 hours. Basic care included IV fluid hydration, wound cleaning, and dressing.

Investigations

- **Blood investigations**

Standard biochemical tests were conducted, which included hemoglobin levels, complete blood counts, serum electrolytes, liver function tests, renal function tests, random blood sugar,virals, blood grouping and cross-matching, as well as arterial blood gas analysis.

- **Imaging Data**

Head CT on admission, at least four head CT imaging data, mainly investigated indicators are as follows. Number of cerebral contusion (single or multiple), size of contusion, midline shift, compression of basal cistern.

- Operative Procedure (Decompressive craniectomy and contusectomy)
- Other Investigation: variety of clinical/ imaging data were collected and analysed with respect to.

1. Incidence among various age groups
2. Sex distribution
3. Mode of injury
4. Pre-operative Glasgow coma scale
5. Pupillary Abnormality
6. Location and size of contusion
7. Findings on CT scan
8. Timing of surgery
9. Associated Intracranial injuries
10. Outcome of the patient at discharge & follow up at 1,3 and 6 months

The Mortality and morbidity was analysed with respect to Age, Sex, Mode of injury, pupillary signs, midline shift and associated intra cranial injuries.

Statistical Analysis: Collected data entered in the Microsoft Excel 2016 as a basis for statistical analysis. Data analyzed with the help of software SPSS version 25. Categorical data was expressed in terms of frequency and proportion. While quantitative data was expressed in terms of mean and standard deviation. Association between the variables was done with the help of chi-square test. P-value less than 0.05 was considered as statistically significant.

RESULTS

Table 1: Age Distribution among study population

Age	No.of Cases	Percentage
< 20 Years	3	6
21 - 30 Years	17	34
31 - 40 Years	12	24
41 - 50 Years	9	18
51 - 60 Years	7	14
> 60 Years	2	4
Total	50	100

Among study population it was observed that, 58% of the population were form the age groups 21 – 40 years of age followed by 41 - 50 years, 51 – 60 years, < 20 years and > 60 Years as shown in above table.

Table 2: Gender Distribution among study population

Gender	Frequency	Percentage
Male	38	76
Female	12	24
Total	50	100

It was observed majority of the patients were male (76%) compared to female who were 24% as shown in above table.

Table 3: Distribution of mode of injury among study population

Mode of Injury	Frequency	Percentage
Fall	10	20
Assault	4	8
Road Traffic Accident	36	72
Total	50	100

Majority of the patients admitted were due to road traffic accident (72%) followed by due to fall, and assault as shown in above table.

Table 4: Distribution of clinical presentation among study population

Clinical Presentation	Frequency	Percentage
Vomiting	12	24
Headache	16	32
ENT Bleed	11	22
Seizures	4	8
Loss of Consciousness	10	20

32% of the population were observed with clinical presentation of headache, followed by vomitting (24%), ENT bleed with 22%, 20% of the patients with loss of consciousness and 8% of the patients were found with siezures.

Table 5: Distribution of Pupillary abnormality among study population

Pupillary Abnormality	Frequency	Percentage
Present	32	64
Absent	18	36
Total	50	100

Among study population pupillary abnormality were present among 64% of the patients, while among 36% of the patient it was absent as shown in above.

Table 6: Distribution of Glasgow comma scale among study population

Glasgow Comma Scale	Frequency	Percentage
Mild (13 - 15)	26	52
Moderate (9 -12)	18	36
Severe (3 - 8)	6	12
Total	50	100

Glasgow comma scale showed that, 52% of the patients had mild GCS score, followed by moderate score and severe score as shown above table.

CT Findings

Table 7: Distribution of number of contusion among study population

Number of Cerebral Contusion	Frequency	Percentage
1	47	94
2	3	6
Total	50	100

In our study there were 94% of the patients had only 1 contusion observed and 6% of the patients were there with 2 contusion shown in above table.

Table 8: Distribution of size of contusion among study population

Size of Contusion	Frequency	Percentage
> 25 ml	11	22
≤ 25 ml	39	78
Total	50	100

Size of contusion was observe less than or equal to 25 ml among 78% of the patients where 22% of the patients had size more than 25 ml as shown in above table.

Table 9: Distribution of Location of contusion among study population

Location of Contusion	Frequency	Percentage
Frontal	18	36
Temporal	14	28
Parietal	8	16
Temporo parietal	6	12
Fronto temporal	4	8
Total	50	100

It was observed that, among 36% of the patients location of contusion was frontal, followed by temporal (28%), parietal (16%), Temporoparietal (12%) and Fronto femporal shown in above table.

Table 10: Distribution of timing of presentation among study population

Timing of Presentation	Frequency	Percentage
< 6 Hours	24	48
7 - 12 Hours	18	36
> 12 Hours	8	16
Total	50	100

It was observed that 48% of the patients were presented in the hospital in less than 6 hours, whereas 36% of the patients were in 7-12 hours of incidence happened while 16% of the of the patients were presented after 12 hours of incidence as shown in above table.

Table 11: Distribution of Midline shift >5 cm among study population

Midline Shift > 5 mm	Frequency	Percentage
Present	36	72
Absent	14	28
Total	50	100

Among population, 72% of the patients had milline shift was> 5cm present while it was not shifted more than 5 cm among 28% of the patients as shown in above table.

Table 12: Distribution of duration of surgery among study population

Duration of Surgery	Frequency	Percentage
> 3 Hours	12	24
< 3 Hours	38	76
Total	50	100

It was observed that, among 76% of the patients duration of surgery was less than 3 hours and among 24% of the patients duration of surgery was more than hours as shown in above table.

Table 13: Distribution of CT Findings among study population

CT Findings	Frequency	Percentage
Subdural Hematoma	12	24
Subarachnoid Haemorrhage	12	24
Epidural Haemorrhage	5	10
Intraventricular Haemorrhage	3	6

Cranial Fractures	6	12

We have observed In the CT findings that, there were each of 24% of the patients were with subdural hematoma and subarachnoid Haemorrhage, followed by cranial fracture (12%), epidural haemorrhage (10%), and intraventricular haemorrhage (6%)

Table 14: Distribution of comorbid condition among study population

Comorbid Conditions	Frequency	Percentage
Diabetes	7	14
Hypertension	11	22
DM & HTN	11	22
Anaemia	6	12
Seizure Disorder	2	4

We have observed that there each of 22% of the patients were found with hypertension and both hypertension and diabetes followed by 14% of the patients were with diabetes, 12% with anaemia and 4% with seizure disorder as shown in above table.

Table 15: Distribution of hospital stay among study population

Hospital Stay	Frequency	Percentage
< 12 days	39	78
>12 Days	11	22
Total	50	100

Among population, 78% of the population had hospital stay less than or equal to 12 days and 22% of the patients had hospital stay more than 12 days as shown in above table.

Table 16: Antiplatelet and Anticoagulant therapy among study population

Antiplatelet & Anti Coagulant Therapy	Frequency	Percentage
Yes	18	36
No	32	64
Total	50	100

Above table showed that, among 36% of the patients, antiplatelet and coagulant therapy were observed.

Table 17: Distribution of outcomes among study population

Outcome	Frequency	Percentage
Good Recovery	37	74
Moderate Recovery	7	14
Severe Disability	2	4
Death	4	8
Total	50	100

It was observed that, among population 74% had good recovery after surgery, followed by moderate recovery (14%), among 8% of the patients death were observed and 4% of the patients were observed with severe disability as shown in above table.

Table 18: Association between age group and outcome among population.

Age	Outcome		Chi-squre	p-value
	Good	Poor		
< 20 Years	3(6.8%)	0(0%)	7.15	0.027
21 - 30 Years	17(38.6%)	0(0%)		
31 - 40 Years	11(25%)	1(16.7%)		
41 - 50 Years	7(15.9%)	2(33.3%)		
51 - 60 Years	6(13.6%)	1(16.7%)		
> 60 Years	0(0%)	2(33.3%)		
Total	44(100%)	6(100%)		

It was observed that, poor outcome (GOS<3) was observed, in the age groups between 31 – 40 years to > 60 years, and this association between age groups and outcome was statistically significant as shown in above table.

Table 19: Association between gender and outcome among population.

Gender	Outcome		Chi- square	p-value
	Good	Poor		
Male	33(75%)	5(83.3%)		

Female	11(25%)	1(16.7%)	0.201	0.653
Total	44(100%)	6(100%)		

Due to the majority of male population in the study, poor outcome also observed among male and in only in one patient poor outcome was observed, and this association between gender and outcome was statistically not significant.

Table 20: Association between mode of injury and outcome

Mode of Injury	Outcome		Chi- squre	p-value
	Good	Poor		
Fall	9(20.5%)	1(16.7%)	0.43	0.509
Assault	4(9.1%)	0(0%)		
Road Traffic Accident	31(70.5%)	5(83.3%)		
Total	44(100%)	6(100%)		

Poor outcome was observed due to fall in one patients and among 5 patients were duet of road traffic accidents, and this association between mode of injury and outcome was statistically not significant.

Table 21: Association between Glasgow coma scale and outcome

Glasgow Coma Scale	Outcome		Chi- square	p-value
	Good	Poor		
Mild (13 - 15)	26(59.1%)	0(0%)	19.29	0.000011
Moderate (9 -12)	16(36.4%)	2(33.3%)		
Severe (3 - 8)	2(4.5%)	4(66.7%)		
Total	44(100%)	6(100%)		

It was observed that there were more poor outcome observed among the patients had severe GCS score followed by moderate GCS score and this association between Glasgow coma scale and outcome was statistically highly significant as shown in above table.

Table 22: Association between Size of contusion and outcome

Size of Contusion	Outcome		Chi- square	p-value
	Good	Poor		
> 25 ml	7(15.9%)	4(66.7%)	7.92	0.004
≤ 25 ml	37(84.1%)	2(33.3%)		
Total	44(100%)	6(100%)		

Among the patients with poor outcome, 66.7% of the patients had size of contusion more than 5 cm and 33.3% of the patients had size of contusion was less than or equal to 5 cm and this association between size of contusion and outcome was statistically highly significant as shown in above table.

Table 23: Association between time of presentation and outcome

Timing of Presentation	Outcome		Chi- square	p-value
	Good	Poor		
< 6 Hours	24(54.5%)	0(0%)	13.02	0.0003
7 - 12 Hours	16(36.4%)	2(33.3%)		
> 12 Hours	4(9.1%)	4(66.7%)		
Total	44(100%)	6(100%)		

Patients presented in the hospital after more than 12 hours observed poor outcome among 66.7% of the patients and 33.7% of the patients observed with poor outcome reached in the hospital between 7 – 8 hours, there were no poor outcome among the patients who reached in the hospital less than 6 hours of incidence and this association between timing of presentation and outcome was statistically highly significant as shown in above table.

Table 24: Association between midline sift > 5 mm and outcome

Midline shift > 5 mm	Outcome		Chi-squre	p- value
	Good	Poor		
Present	31(70.5%)	5(83.3%)	0.43	0.509
Absent	13(29.5%)	1(16.7%)		
Total	44(100%)	6(100%)		

Majority of patients with poor outcome observed with midline shift > 5 mm and only one patient observed with poor outcome in which midline shift > 5mm was absent and this association between midline shift and outcome was statistically not significant as shown in above table.

Table 25: Association between Hospital stay and outcome

Hospital Stay(Days)	Outcome		Chi- squre	p-value
	Good	Poor		
< 12 days	37(84.1%)	2(33.3%)	7.92	0.004
>12 Days	7(15.9%)	4(66.7%)		
Total	44(100%)	6(100%)		

Among poor outcome, 4 patients had hospital stay more than 12 days, also 2 patients with poor outcome had hospital stay less than 12 days, and this association between hospital stay and outcome was statistically highly significant.

DISCUSSION

Trauma poses a significant issue in both developing and developed nations. Head injuries significantly contribute to the mortality and morbidity rates among trauma patients. The frequency of head injuries is consistently rising, prompting heightened concerns about management and efforts to enhance outcomes.
Cerebral contusion is a relatively common type of craniocerebral injury. Unlike younger patients, in elderly individuals those who have cerebral atrophy, As a result, they do not show a significant increase in intracranial pressure from the same amount of cerebral contusion and exhibit relatively mild clinical symptoms. Additionally, elderly patients with cerebral contusion are often affected by advanced age and a range of chronic diseases such as hypertension, diabetes, and heart disease. In clinical practice, patients and their families frequently hesitate to pursue surgical treatment.
The elderly have naturally weak protection and defense abilities, along with a low adaptive protection function, which increases their vulnerability to trauma. Their brain tissue tends to degenerate, causing the subarachnoid space to enlarge and the brain tissue's mobility to increase during trauma. Additionally, poor elasticity due to cerebral arteriosclerosis makes it easy for the brain to sustain damage and bleed, with these symptoms being difficult to stop on their own. As a result, cerebral contusion and laceration combined with intracranial hematoma, especially intracerebral hematoma and subdural hematoma, are more common. Even minor head trauma can result in significant injuries. Due to the elderly's poor compensatory ability, their recovery is very slow, and they are more likely to experience long-term coma, dementia, and various neurological disorders as sequelae.
Additionally, elderly individuals often have various pre-existing conditions, making complications more likely after an injury. When complications arise, they hinder brain recovery and create a vicious cycle, contributing to the poor prognosis and high mortality rate of brain contusions in the elderly.
In the present study we have studied 50 patients, with cerebral contusions diagnosed with CT scan having age > 18 years for whom surgery was indicated. In the study by Kawamata et al. in Japan involving 182 patients with cerebral contusions and demonstrated that surgical excision effectively controls the progressive increase in ICP and clinical deterioration in many cases.[3] Similarly, Becker et al. recommended early evacuation of traumatic contusions to prevent secondary complications.[4]
Outcomes: In the present study, among population 74% had good recovery after surgery, followed by moderate recovery (14%), among 8% of the patients death was observed and 4% of the patients were observed with severe disability, in the study we made good recovery and moderate recovery as good outcome and patients with severe disability and death as poor outcome. Study by Zainab Sarwar, et al,[5] observed that, of the total patients, 25 (67.6%) patients survived 30 days while 12 (32.4%) patients didn't survive for 30 days. Some other previous studies showed that, showed that the range of favourable outcomes among patients with severe traumatic braininjuries ranges from 28.2–60%,[6,7] According to the study conducted by Akyam LR et al.[8] Overall mortality in their study was 21.6%. In the same study favorable outcome was 78.7%, and unfavorable outcome was 21.2%, one more study by Lobato RD et al in their study found a mortality of 28.1%.[8] which was more compared to our study.
Age: In the present study, 58% of the population was from the age groups 21 – 40 years of age followed by 41 - 50 years, 51 – 60 years, < 20 years and > 60 Years. In present study we didn't find any significant association between age and outcomes. According to the study done by Wahyuningsih, Islamiati, Ubaidillah, Pratiwi et al.[9]
Gender: In the present study majority of the patients were male (76%) compared to female who were 24%. Our study showed that, almost 61.6% of the women had good outcome compared to males (86.84%). Study conducted by Abhilash Pawar et al,[10] male: female ratio was 3.25:1). It is due to more outdoor activities, increasing use of motor vehicles, alcohol addiction and less self-awareness. One more study by Satardey, et al,[11] 39 (78%) cases out of 50 were males and 11 (22%) were females.
Mode of injury: In our study majority of the patients admitted were due to road traffic accident (72%) followed by due to fall, and assault. And also poor outcome was observed due to fall in one patient and among 5 patients were due to road traffic accidents, and this association between mode of injury and outcome was statistically not significant. Study by Abhilash Pawar et al, found most common cause was found to be road traffic accidents (62.5%).
Clinical Presentation: In the present study, 32% of the population were observed with clinical presentation of headache, followed by vomitting

(24%), ENT bleed with 22%, 20% of the patients with loss of consciousness and 8% of the patients were found with siezures. Abhilash Pawar et al observed that, Vomiting was the most common presenting symptom. It was present in 62.5% cases. 23% were having giddiness. 25% were having headache. 3% were having convulsions. 5.5% were having ENT bleeding. 13% were having drowsiness. 8.5% were having unconsciousness. 2% were having facial swelling. 0.5% were having black eye. 0.5% were having abnormal behavior. Another study by Zainab Sarwar, et al observed that, all patients had a loss of consciousness, vomiting, and deterioration in their consciousness levels. 29% had seizures and upgoing plantar. 18% had hemiparesis or hemiplegia. Light reflex was absent in 40.5% of patients. All 37 patients had a history of loss of consciousness. Seizures were present in 11 (29.7%) patients while 26 (70.3%) had no history of fits. There is a history of at least one episode of vomiting in 37 patients. All the patients had a history of deterioration of consciousness level.

Glasgow coma scale: In the present study Glasgow coma scale showed that, 52% of the patients had high GCS(1315) score, followed by moderate score (9-13) and low score (<8) also, there were more poor outcome observed among the patients who had low GCS score followed by moderate GCS score and this association between Glasgow coma scale and outcome was statistically highly significant(p-value<0.001). Study by Abhilash Pawar et al, GCS is a very important predictor of outcome. Outcome is good in patients with GCS more than 12, moderate in patients with GCS between 9- 12 and poor in patients with GCS below 9. Study by Zainab Sarwar, et al studied that, Preoperative GCS is directly related to the outcome i.e., the better the GCS on presentation better the outcome. The more the GCS at the presentation better are the chance for the patient post-operatively. Another study by Satardey, et al, the patients with GCS score of 13 or more (74%) fared well with better long-term outcome as against those with GCS score below it. Patients with 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%) which was concurrent with our study results. 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] AGM Groshi et al, found that at admission, 67% and 33% of patients had GCS 6–8 and 3–5 respectively. The role of GCS in deciding the outcome was studied in previous studies and noted that low GCS was correlated with poor outcomes.[13,14] This was also found to be statistically significant ($p < 0.05$), which was similar to our study. Study by H. Hendam, A. Taha et al,[15] found that, preoperative and at discharge GCS score were positively associated with favorable outcomes, which are reflected in previous studies.[16-18] found that GCS score on the first postoperative day was the single best predictor of good prognosis. In the same study poor outcome were associated with severe GCS score while good outcome were associated with moderated GCS and this difference were statistically significant (p-value<0.001) In one more study by SULTAN H., AZIZ A., et al,[2] concluded that, early evacuation of cerebral contusion due to traumatic brain injury in patients with mild to moderate GCS improves neurological status of the patient, decreases mortality.

Number and size of Contusion: In our study there were 94% of the patients had only 1 contusion observed and 6% of the patients were there with 2 contusion and we have observed that there was significant difference in the outcome between them, patients with 2 contusion has expired. Size of contusion was observed less than or equal to 25 ml among 78% of the patients where 22% of the patients had size more than 25 ml study by SULTAN H., AZIZ A., et al. Cerebral contusions account for 25-30 % of severe head injuries and 8.5% of all traumatic brain injuries.

Location of Contusion: In the present study, It was observed that, among 36% of the patients location of contusion was frontal, followed by temporal(28%), parietal (16%), Temporoparietal (12%) and Fronto femporal. Zainab Sarwar, et al observed that, the majority of contusions (77%) were contracoup in nature, impacting the frontal and temporal lobes. Another study by Satardey, et al observed that, most common site for DSF in their study group was parietal region (48%), followed by frontal (34%) and temporal (10%). Those involving more than one area were 2% each in frontoparietal and occipitotemporal. The patients with involvement of two or more scalp bones or extensive neuroparenchymal damage had more morbidity and mortality. One more study by Al-Derazi et al., the sites for DSF were frontal (32%), parietal (44%), temporal (18%), and occipital (6%) which matches those of our study group. In the study conducted by SULTAN H., AZIZ A., et al.observed there were 50% of the patients were with location of frontal lobe (50%), followed by temporal lobe (47%) and parietal lobe (13%). According the study conducted by Nabeel A, et al,[19] observed in their study that, regarding the site of brain contusion, in Group A, the most frequent site was parietal (28.57%) followed by temporal (23.81%), frontal (19.05%), fronto-temporal and deep (9.52%), fronto-parietal and occipital (4.76%). In Group B, the most frequent sites were parietal, and temporo-parietal (28%) followed bytemporal (20%), and occipital and frontal (12%).

Midline Shift > 5 mm: In our study population, 72% of the patients had milline shift was> 5mm present while it was not shifted more than 5 mm among 28% of the patients, majority of patients with poor outcome observed with midline shift > 5 mm and only one patient observed with poor outcome in which midline shift > 5mm was absent and this association between midline shift and outcome was statistically not significant. In the study conducted by Zainab Sarwar, et al observed that, a shift of midline

for more than 5 mm are the predictors of mortality after surgery for cerebral contusions which was observed similar to our results. Akyam LR et al observed that, the incidence of mortality among patients with midline shift of more than 5 mm was 24.2% as compared to only 6.6% in patients with less than 5 mm. The risk of mortality was 4.4 times more among positive finding of the patients and statistically significant also ($p< 0.05$). Chiewvit P.et al., found that the increased midline shift in CT brain in patients with head trauma related to the severity of head injury and was significantly related to poor final clinical outcome.[20] This also in accordance with our findings where the more midline shift.

Timing of Presentation to the Hospital: It was observed that 48% of the patients presented to the hospital in less than 6 hours, whereas 36% of the patients were in 7-12 hours of incident happened while 16% of the of the patients presented after 12 hours of incident. Patients presented in the hospital after more than 12 hours observed poor outcome among 66.7% of the patients and 33.7% of the patients observed with poor outcome reached in the hospital between 7 – 8 hours, there were no poor outcome among the patients who reached in the hospital less than 6 hours of incidence and this association between timing of presentation and outcome was statistically highly significant. Zainab Sarwar, et al observed that, 78% of the patients were presented less than 12 hours, followed by 16%, within 12-24 hours and 5.4% of the patients were reported within 24 – 48 hours. As we observed in the study that, deterioration of clinical symptoms may only indicate that the patients during a certain period of hospitalization may suffer from increased intracranial pressure or lesion itself caused by hematoma and other factors, and ultimately lead to neurological symptoms change, and most of these patients are given active surgical treatment.

Duration of Surgery: It was observed that, among 76% of the patients duration of surgery was less than 3 hours and among 24% of the patients duration of surgery was more than 3hours(associated intracranial injuries requiring surgery). Study conducted by H. Hendam, A. Taha et al. the operative time itself could be affected by many additional factors, however. Patients with more severe injuries would be expected to have longer operative time. The surgeon experience would also possibly affect the length of operative time. Similar to operative duration, a measure that has been broadlystudied is the time it takes for patients to be taken to the operating room, classicallyknown as injury- to-incision time.[21,22] found that subjects who underwent an early decompression with a mean injury-to-incision time of 4.5 hours had significantly favorable outcome than patients who underwent a delayed decompression.

CT Findings: We have observed In the CT that, there were associated subdural hematoma and subarachnoid Haemorrhage in 24% of the patients each, followed by cranial fracture (12%), epidural haemorrhage (10%), and intraventricular haemorrhage (6%). Study by Abhilash Pawar et al, Skull and facial bone fractures are the most common finding found on CT scan (24.5% patients were having skull and facial bone fracture in our study). Intracranial bleeding such as SDH, EDH, Contusions are found in relatively less patients. Another study by Satardey, et al. CT findings in our study group were EDH (62%), cerebral contusions (34%), and dural tear (14%). In the study by Hossain et al., findings were EDH (22%), brain contusions (31%), dural tear (25%), and in-driven bone fragment (13%).[23]

Hospital Stay: 78% of the present study population had hospital stay less than or equal to 12 days and 22% of the patients had hospital stay more than 12 days. Among poor outcome, 4 patients had hospital stay more than 12 days, also 2 patients with poor outcome had hospital stay less than 12 days, and this association between hospital stay and outcome was statistically highly significant. Hendam, A. Taha et al showedthat, there was significant statistically difference was observed between good recovery and poor outcome in terms of hospital stay, study observed that, duration of hospital stay was long in the patients with poor outcome compared to good outcomes.

Outcomes among study population: It was observed that, among present study population 74% had good recovery after surgery, followed by moderate recovery (14%), among 8% of the patients death was observed and 4% of the patients were observed with severe disability. Zainab Sarwar, et al observed that, out of the total patients, 25 (67.6%) patients survived 30 days while 12 (32.4%) patients didn't survive for 30 days. Most deaths occurred on the first postoperative day followed by the 3rd, 6th, and 13th postoperative days. Satardey, et al observed that there was good outcome among 80% of the patients after surgery, and eachi of 10% of the patients had moderate disability and expired. In the study by Akyam LR et al. the incidence of mortality in the study was found to be 21% which was quite more than our study. We had no mortality in our series of 110 patients all of whom had unilateral frontal craniotomy.

CONCLUSION

When compared with other studies, observation and results of present study conclude that, the lower the presenting GCS poorer was the outcome. Delays in surgery may have repercussions on the outcome of the patients regardless of traumatic insult, hence a quick intervention should be in order. Those who were young (20–40 years) had more chances of having uncomplicated course of treatment and uneventful recovery. CT suggested that the midline shift was a significant factor indicating poor clinical prognosis. The most predictive factors for mortality in severe TBI are low GCS on presentation and associated SDH on CT scan. Timing of hospitalization and duration of hospital stay were the

significantly associated factors with morbidity and/or mortality.

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