

Original Research Article

A study of correlation of degree of midline shift on computed tomography scan and Glasgow coma scale in patients of acute traumatic head injury

A. K. Chaurasia, Lalit Dhurve*, Rajneesh Gaur, Rajpal Kori, Avais K. Ahmad

Department of Surgery, Gandhi Medical College, Bhopal, Madhya Pradesh, India

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*Correspondence:

Dr. Lalit Dhurve,

E-mail: yash.dhurve@gmail.com

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ABSTRACT

Background: Traumatic brain injury is one of most common cause of death in road traffic accident. Most of these classified as mild injury, with approximately 20% classified as moderate to severe. Approximate 50% of the 150,000 trauma deaths every year are caused by head injury.

Methods: A prospective cross-sectional study was conducted on 150 patients with a head injury admitted in the Hamidia hospital, Bhopal. The assessment of the severity of head injury using Glasgow coma scale (GCS) at the time of admission, follow up on 5 days and 15 days respectively. The collected data were transformed into variables, coded and entered in Microsoft excel. Data were analyzed and statistically evaluated using statistical package for the social sciences (SPSS)-PC-21 version.

Results: Out of 150, a total of 115 patients had no midline shift while 35 patients were having midline shift. Severe head injury patients (GCS 3-8) were having more morbidity and mortality. Moderate head injury (GCS 9-13) was associated with good prognosis and low mortality. A greater degree of midline shift of (more than 5 mm) is indicated severe head injury and is significantly associated with morbid outcome and higher mortality.

Conclusions: In our study, road traffic accidents is the most common cause of head injury, with males being affected more than females. The degree of midline shift on computed tomography (CT) scan head in patients with head injuries was found to be significantly associated with high mortality and morbidity.

Keywords: Extradural hemorrhage, Subdural hemorrhage, Midline shift, Glasgow coma scale

INTRODUCTION

Traumatic brain injury is one of most common cause of death in road traffic accident. Most of these classified as mild injury, with approximately 20% classified as moderate to severe. Approximate 50% of the 150,000 trauma deaths every year are caused by head injury.¹

Glasgow coma scale (GCS) score more widely used parameter to assessment of traumatic brain injury. The relationship between different type of findings in

computed tomography (CT) scan and prognosis describe by several authors in there literature.²

Lower GCS score and different types of CT findings including subarachnoid hemorrhage (SAH), hemorrhagic contusion, subdural hemorrhage (SDH), are poor prognostic indicators of severe head injury.³

The larger the degree of midline shift on CT scan the poorer will be the outcome of traumatic brain injury.

When the CT findings were related to increased intracranial pressure (ICP). The most common findings of the CT scan midline shift, compression or obliteration of basal cisterns, and the presence of subarachnoid hemorrhage, and subdural hemorrhage.

In many studies reported that presence of midline shift resulting ICP and poor prognosis.⁴

Many injuries have variable degree of brain swelling but about 1% will developed a significant intracranial clot, extradural or intracerebral, the early removal of which will reduce morbidity and may prevent mortality.⁵

Following injury, the primary damage will produce secondary brain swelling, either focal or generalized, and as there is a limit to the intracranial capacity, the increase in brain or blood volume will soon cause an increase in intracranial pressure causing cellular hypoxia, intracranial volume and inadequate or irregular respirations due to brain stem injury or brain stem compression.⁶

Head injury is leading cause of mortality and morbidity in developed and developing country.

Brain injury from trauma results from two type of injury.

Primary brain injury

It occurs at time of trauma (cortical contusions, lacerations, bone fragmentation, diffuse axonal injury, and brainstem contusion).⁷

Secondary injury

It develops subsequent to the initial injury. Includes injuries from intracranial hematomas, edema, hypoxemia, ischemia (primarily due to elevated ICP and/or shock), and vasospasm.⁸

Role of surgery is mainly required in this groups of the patients.

Aims and objectives

Aims and objectives were: to study of correlation of degree of midline shift on CT scan and GCS in patient of acute traumatic head injury; to analyse the clinical presentation of acute traumatic head injury; to predict the survival rate with midline shift 5 mm to 12 mm; and correlation of the midline shift and mortality.

METHODS

Study design

A prospective cross-sectional study was conducted on 150 patients admitted with a head injury in the department of general surgery, Hamidia hospital, Bhopal from June 2018 to September 2020.

Inclusion criteria

All traumatic head injury patient more than 12 years of age admitted in department of general surgery, Hamidia hospital, Bhopal were included in the study.

Exclusion criteria

All traumatic head injury patients less than 12 years of age, with pregnancy, history of neurological deficit without trauma, and patients who are non-willing to take part in the study were excluded from the study.

In this prospective study patients with clinically diagnosed traumatic head injury admitted in Hamidia hospital, Bhopal taken into consideration. The detailed information about each patient including name, age, sex, address, presenting complaints, duration of traumatic injury, general examination, local examination, stating site, size and other characteristics of head injury were retrieved from records and noted in a prescribed proforma. Patients were subjected to regular clinical examination, local examination, assessment of unconscious patient, GCS, CT scan finding.

The severity of head injury classified based on GCS 14-15, 9-13, <3-8 mild, moderate, severe head injury respectively. The correlation between degree of midline shift on CT scan and severity of head injury using GCS. Based on the clinical assessment and CT head findings we planned surgical or conservative management and risk assessment.

Data collection and statistical analysis

The collected data were transformed into variables, coded and entered in Microsoft excel. Data were analyzed and statistically evaluated using statistical package for the social sciences (SPSS)-PC-21 version.

Quantitative data was expressed in mean±standard deviation. Qualitative data were expressed in percentage and statistical differences between the proportions were tested by Chi square test or Fisher's exact test. Spearmann correlation coefficient was used to see the correlation between GCS score and midline shift size. P value less than 0.05 was considered statistically significant.

RESULTS

Patients presented with traumatic head injury are predominantly males, out of 150 patients, 104 were males and 46 were female patients.

The most common CT finding in our study was hemorrhagic contusion accounting for 56% of the cases. It was followed by subdural hematoma (SDH), subarachnoid hemorrhage, extradural hemorrhage (EDH) and generalized cerebral edema accounting for 24%, 14%, 12% and 12% respectively. Few of the cases were

observed to have intracerebral hematoma (7%) and intraventricular hemorrhage (5%).

When associating GCS score with outcome it was observed that 43% of the patients with severe head injury (GCS score 3-8) had moderate disability while 22% patients in a vegetative state and 35% ultimately died.

87% patients with a moderate head injury (GCS score 9-13) had good recovery while 5% had moderate recovery and 3% had severe disability and 5% patients died. None of the patients with mild head injury (GCS 14-15) died. All 65 patients (100%) of the patients had good recovery.

Table 1: Age and gender wise distribution of study subjects (n=150).

Age group (years)	Male (n=104)	Female (n=46)	Total (n=150)
	N (%)	N (%)	N (%)
13-20	12 (11.6)	06 (13)	18 (12)
21-30	30 (28.8)	12 (26)	42 (30)
31-40	24 (23)	10 (21.7)	34 (22)
41-50	20 (19.2)	08 (17.3)	28 (18)
51-60	10 (9.6)	06 (13)	16 (10)
>60	08 (7.6)	04 (8.7)	12 (8)

Table 2: Mode of injury of study subjects (n=150).

Mode of injury	Number	%
Road traffic accident	106	70
Fall from height	26	17
Assault	18	12

Table 3: CT Findings of study subjects in different GCS category (n=150).

CT findings	Severe (3-8)	Moderate (9-13)	Mild (14-15)	Total
	N (%)	N (%)	N (%)	
Subdural hematoma	15 (53.6)	12 (18.5)	9 (15.8)	36
Extradural hematoma	1 (3.6)	12 (18.5)	5 (8.8)	18
Intracerebral hematoma	7 (25.0)	3 (4.6)	0	10
Subarachnoid hemorrhage	4 (14.3)	12 (18.5)	5 (8.8)	21
Intraventricular hemorrhage	1 (3.6)	6 (9.2)	0	07
Hemorrhagic contusion	14 (50.0)	47 (72.3)	33 (57.9)	94
Generalized cerebral edema	10 (35.7)	7 (10.8)	1 (1.8)	18
Associated spinal injury	1 (3.6)	3 (4.6)	1 (1.8)	05
Multiple findings	28 (18)	13 (8.6)	5 (3.3)	46

Table 4: Association of midline shift with GCS score at admission.

GCS score	Midline shift-nt (n=115)	Midline shift+nt (n=35)	P value
	N (%)	N (%)	
3-8, n=28	7 (25)	21 (75)	<0.001
9-13, n=57	43 (75)	14 (25)	
14-15, n=65	65 (100)	0	

Table 5: Association of degree of midline shift with GCS score and mortality.

GCS score at admission	No midline shift N (%)	Midline shift <5 mm (n=6) N (%)	Mortality	Midline shift ≥5 mm (n=29) N (%)	Mortality N (%)
3-8 (n=28)	07 (22)	02 (8)	0	19 (70)	05 (17)
9-13 (n=57)	43 (75)	04 (7)	0	10 (18)	03 (5)
14-15 (n=65)	65	0	0	0	0

Table 6: Association of degree of midline shift with GCS score at day 1 and day 5.

GCS score	Midline shift <5 mm (n=6)		Midline shift ≥5 mm (n=29)	
	Day 1	Day 5	Day 1	Day 5
3-8	02	10	19	04
9-13	04	17	10	02
14-15	0	02	0	0

Table 7: Association of GCS with outcome.

GCS	Good recovery	Moderate disability	Severe disability	Vegetative state	Death
	N (%)	N (%)	N (%)	N (%)	N (%)
3-8	00	12 (43)	00	6 (22)	10 (35)
9-13	50 (87)	03 (5)	01 (3)	0	3 (5)
14-15	65 (100)	00	00	0	0

DISCUSSION

Head injury is a major health problem worldwide and a significant cause of morbidity and mortality. Clinical assessment based on GCS score and non-contrast CT head, with or without midline shift, helps us to guide in initial emergency management and further management for a better outcome.

In our study the highest frequency of head injury was found in the age group of 21-30 years of age (29%) and second highest was from 31-40 years age group (23%). These statistical data were similar to a study conducted by Agrawal et al, where the frequency in the age group of 21-30 was 28%, and 18% in 31-40 years.⁹

In our study most of the patients were males (70% compared to a 30% in females). The male and female ratio was 2.5:1, which was found to be similar to the study by Emejulu et al in which male female ratio was 2.4:1.¹⁰ This is because it was seen that males had a higher prevalence of alcohol abuse and driving under the influence of alcohol than females. Males also had larger numbers working across cities with more intercity travel resulting in more highway accidents.

In our study the most common mode of injury is road traffic accident 70%, followed by fall from height 17% and assaults 12%, which is similar to the study by Agrawal et al.^{9,10} In their study, 65% patients had road traffic accidents, 25% had fall from height and rest of them had other modes.

The predominant type of head injury based on GCS score in our study is mild head injury (43%), followed by moderate (38.0%) and severe head injury (19%). This is in accordance with the study done by Agrawal et al in 2019 at Shree Narayan Hospital Raipur, where 55% cases were mild, 25% were moderate and 20% were severe head injuries.

In our study, it was found that hemorrhagic contusion was the most common CT head finding (56%), which is similar to the study conducted by Isyaku and Saidu in 2006.¹¹

Second common findings in our study was subdural hematoma 24%. These findings were similar to a study conducted by Barooah et al which reported that in head injury patients, incidence of acute SDH is 21%.¹²

In contrast, Gautam et al found that, acute subdural hematoma is the most common type of head injury, accounting for 24% cases.¹³

In our study we found that 56% patients had hemorrhagic contusion, 24% had subdural hematoma, 14% had subarachnoid hematoma, and 12% bleeds were extradural in their initial CT scan. These findings are similar to a study reported by Eze et al in which, among the hemorrhages found, 37% were intracerebral, 25% were subdural, 16% were intraventricular, 15% were subarachnoid, and 7% were epidural.¹⁴

In our study, 35 patients had midline shift in their initial CT head findings, out of which severe head injury patients were 19 (54%) and moderate head injury patients 16 (45%), which is similar with the study by Chiewvit et al.¹⁵ 96 of 216 patients had midline shift, 53 of 96 (55%) patients had CT scan of midline shift less than 10 mm whereas 37 of 96 (38%) patients, greater than 10 mm.

In our study we also found that the presence of midline shift, despite other lesions was accompanied by a statistically significant reduction in GCS score, $p < 0.001$, similar to the study conducted by Chiewvit et al.¹⁵

In a study by Daverat in 166 cases, 50% cases had midline shift >5 mm with 76% mortality.¹⁶

The most consistent CT findings in severe head injury in our study was midline shift of greater than 5 mm which showed statistical significant relationship as the level of severity of head injury increases. In our study we found that as the severity of head injury increases, associated CT

findings of midline shift increased. This is similar to findings of Chiewvit et al.³⁸

We also studied the relation between midline shift and GCS score and its impact on mortality in patients of acute head injury. It was observed that a total of 115 patients had no midline shift while 35 patients were having midline shift. Patients were divided according to their GCS score on presentation. It was seen that there were 7 (25%) patients with a severe GCS score (3-8) who had no midline shift, and among those 4 (14%) patients died. Of these 4 patients 3 were operative and 1 was conservative. Similarly 43 (75%) patients with no midline shift had a moderate GCS score (9-13) were 65 (100%) of the patients with no midline shift had a mild GCS score (14-15) and none of them died. This indicated that patients with severe GCS score, even with no midline shift had higher mortality than other groups.¹⁷

In our study we found 35 patients (23%) had midline shift out of these 21 (75%) having severe GCS score and 14 (25%) having moderate GCS score. Out of these severe head injury patient with midline shift 6 patients died out of which 5 were operative and 1 was managed conservatively. Among the patients with moderate GCS who had midline shift, 2 (2%) patient's died. 1 of these patients was operative and 1 was managed conservatively.

In our study we observed that patients with GCS score of 3-8, there was a 35% mortality rate, and none of the patients had a good recovery, while 42% patients had moderate disability and 4% patients are in vegetative state. Patients with moderate head injury with GCS score 9-13 were associated with a 5% mortality and moderate disability, were 87% patients had good recovery.¹⁷

Patients with mild head injury a GCS score of 14-15 had a normal or good recovery. Results were found to be in contrast with the study by Agrawal et al in which out of 2068 cases, 45% had good recovery, 13% had severe disability, whereas 19 % had vegetative state.¹⁸

Additionally, it was found that the outcome was related to the GCS score at the time of admission and the association was found to be statistically significant ($p=0.001$).

In our study the all the patients with mild TBI (GCS 14-15) were found to have a good recovery. With moderate TBI (GCS 9-13) also a good recovery with minimal deficits, was found. In severe TBI (GCS 3-8), the prognosis was not good and most patients had severe disability and mortality, which was statistically significant ($p<0.01$).

Limitations

The limitation was that the number of patients in group were small from single centre.

CONCLUSION

Severe head injury patients with GCS 3-8 were having more morbidity and mortality whereas moderate head injury (GCS 9-13) was associated with good prognosis and low mortality. Therefore from our study we infer that the GCS score and a degree of midline shift in CT scan can be used to determine the severity of head injury and predict the outcome in cases of acute traumatic head injury. Lower GCS score and greater midline shift more than 5 mm is an indicator of severe head injury associated with high mortality and morbidity.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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