ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at: www.ijmacr.com

Volume – 5, Issue – 6, November – December - 2022, Page No. : 68 - 74

Correlation of NCCT brain findings with Glasgow coma scale in patients with acute traumatic brain injury

[1]Dr. Arun Babu, Junior Resident, Department of Radiology, Raja Rajeswari Medical College and Hospital, Kambipura, Karnataka, India.

[2]Dr. Gautam M, Professor and HOD, Department of Radiology, Raja Rajeswari Medical College and Hospital, Kambipura, Karnataka, India.

[3]Dr. Rohith, Junior Resident, Department of Radiology, Raja Rajeswari Medical College and Hospital, Kambipura, Karnataka, India.

Corresponding Author: Dr. Arun Babu, Junior Resident-3, Department of Radiology, Raja Rajeswari Medical College and Hospital, Kambipura, Karnataka, India.

How to citation this article: Dr. Arun Babu, Dr. Gautam M, Dr. Rohith, "Correlation of NCCT brain findings with Glasgow coma scale in patients with acute traumatic brain injury", IJMACR- November – December - 2022, Vol – 5, Issue - 6, P. No. 68 – 74.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: India has the rather unenviable distinction of having the highest rate of Traumatic brain injury (TBI) in the world. It is estimated that nearly 1.5 to 2 million persons are injured and 1 million succumb to death every year in India.

Initial assessment of consciousness level in any TBI case is done by Glasgow Coma Scale (GCS) which varies with severity of injury. Immediate Computed Tomography (CT) scan after a TBI case plays a crucial role in the management. This study is undertaken to assess the relationship between CT findings and GCS score.

Objective: To assess correlation between Computed Tomography (CT) findings and Glasgow Coma Scale (GCS) in patients with acute traumatic brain injury attending casualty of Raja Rajeshwari Medical college and Hospital.

Methodology: The study was conducted among patients with acute traumatic brain injury attending casualty of Raja Rajeswari Medical College and Hospital.

Inclusion criteria: Patients coming with head trauma to casualty with derangement in GCS

Exclusion criteria: Neuropsychiatry patients

A cross-sectional study was conducted among 50 patients of acute (less than24 hours) cases of head trauma over a period of four months. The patient's level of consciousness (GCS) was determined and a brain CT scan without contrast media was performed.

Results: Study included 50 Acute TBI cases. Head injuries were predominant among males (56%) and 31-40 years age group (38%). RTA was the most common

mode of injury (56%). Severity of TBI and CT findings were in accordance with each other and with GCS score. Mean GCS score was significantly lower in subjects showing CT finding as multiple lesions along with midline shift compared to those with single lesion and mixed lesion without midline shift (P<0.05).

Among 28 mild TBI cases 13 (46%) presented with craniofacial fractures and the remaining were non-fractured cases. Among 16 moderate TBI cases, 7 (44%) showed craniofacial fractures.

Among 6 severe TBI cases, 50% presented with craniofacial and 50% presented with basilar skull fractures. GSC score was significantly lower for subjects with fractures compared to non-fractured cases.

Conclusion: The presence of mixed lesions and midline shift regardless of the underlying lesion on CT scan showed significantly lower GCS. Patients having single lesion had significantly higher GCS level than mixed lesions and mid line shift type of injury. In this study, GCS score was useful for assessing consciousness level and CT scan helped in immediate management of acute TBI cases.

Keywords: Traumatic brain injury, Road traffic accident, Glasgow coma scale, midline shift.

Introduction

Traumatic brain injury (TBI) is considered as a silent epidemic contributing to worldwide death and disability more than any other traumatic insult[1]. It is estimated that 69 million individuals worldwide sustain a TBI each year. Road traffic collisions was found to be the leading cause of TBI's in Southeast Asia (56%) in a systemic review conducted by Dewan etal.,[1].

India has the rather unenviable distinction of having the highest rate of head injury in the world. It is estimated that nearly 1.5 to 2 million persons are injured and 1 million succumb to death every year in India. Road traffic injuries are the leading cause (60%) of TBIs followed by falls (20%-25%) and violence (10%).[2]

Head injury has been defined as a morbid state resulting from gross or subtle structural changes in the scalp, skull or contents of the skull produced by mechanical forces.[3]

Initially described by Teasdale and Jennet in 1974, Glasgow Coma Scale (GCS) is used for assessing the consciousness level of any head injury case[4].

It has three domains: Eye opening, Verbal response and Motor response. GCS scoring is used to grade head injury as mild, moderate and severe head injury.[5]

In this new era of radiology, CT scanning has become the primary method of assessing head injury since its inception[6]. Any head injury requires a CT scan immediately after a trauma. CT scan is now widely available and it plays a crucial role in immediate management of the case without time lapse. Non contrast CT is highly sensitive in detecting acute hematomas (EDH, SDH, SAH, IVH, Brain contusions etc.) and depressed fractures that require emergency surgery.[5]

CT findings vary according to the severity of TBI which is in accordance with the GCS score.[7,8] Lower GCS and special CT scan findings including SAH, midline shift of more than 3 mm, and multiple Haemorrhagic contusions are poor prognostic indicators after closed head injury.[9]

This study was conducted to assess relationship between CT findings in TBI and GCS score.

Methods

The study was conducted at Raja Rajeswari Medical College and Hospital for a period of four months i.e., from June 2022 to September 2022.

Study design and subjects

A cross-sectional study was conducted among 50 patients of acute (less than24 hours) cases of head trauma with derangement of GCS and attending the casualty of Raja Rajeswari Medical College and Hospital. Neuropsychiatry patients were excluded from the study.

Manoeuvre

A cross-sectional study was conducted among 50 patients of acute (less than24 hours) cases of head trauma with derangement of GCS. Demographic details were collected from the patient's attendants and all the patients included in the study were subjected to general examination, clinical examination, examination of the site of injury, GCS scoring and CT Scanning.

GCS scoring was done to determine patient's level of consciousness and a brain CT scan without contrast media was performed. A sixth generation General Siemens perspective 128 slice CT scan was utilized and 5mm and 10mm sections were obtained for infratentorial and supratentorial parts respectively.

GCS score and severity of head injury[10]

GCS score	Severity
14-15	Mild
9-13	Moderate
<3-8	Severe

Ethical Statement

Ethical approval for the study was sought and obtained from the health research and ethics committee of Raja Rajeswari Medical College and Hospital. The data obtained was treated with utmost confidentiality. Written informed consent was obtained from Patient's attendants.

Statistical analysis

Data collected was compiled, entered into Microsoft excel sheet and was analyzed using SPSS software version 26. Quantitative data was expressed in mean and standard deviation, Qualitative data was expressed in frequency and percentages. ANOVA (for more than two groups) and Unpaired't' (for two groups) test were used to compare the groups, $P<0.05$ was considered significant.

Results

Total 50 subjects were included in the study.

Figure 1: Gender distribution among study subjects

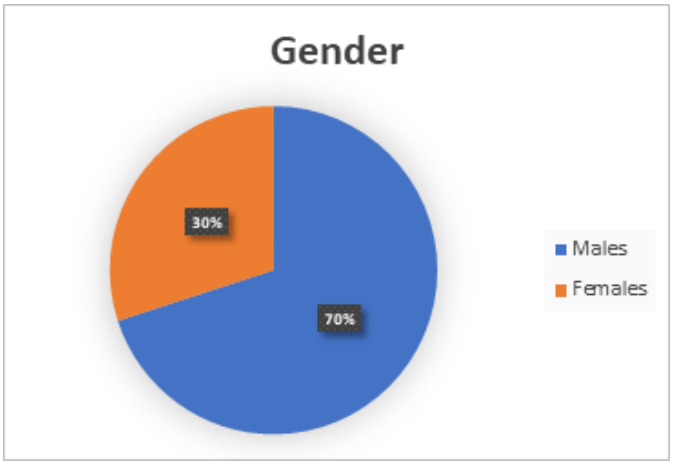


Table 1: Age and gender wise distribution of study subjects

Age in years	Male n (%)	Female n (%)	Total
11 - 20	2 (5.7)	3 (20.0)	5 (10.0)
21 - 30	6 (17.1)	2 (13.3)	8 (16.0)
31 - 40	7 (20.0)	3 (20.0)	10 (20.0)
41 - 50	6 (17.1)	3 (20.0)	9 (18.0)
51 - 60	7 (20.0)	1 (6.6)	8 (16.0)
61 - 70	6 (17.1)	2 (13.3)	8 (16.0)
71 - 80	1 (3.0)	1 (6.7)	2 (4.0)

Table 2: Mode of injury among study subjects

Mode of injury	Number (%)
Road traffic accident	28 (56.0)
Fall	11 (22.0)
Assault	11 (22.0)

Table 3: CT findings and range of GCS score among the subjects

CT finding	GCS score range	Number (%)
Single lesion	12-14	28 (56.0)
Multiple lesion	8-11	16 (32.0)
Single lesion + Multiple lesion + Midline shift	3-6	6 (12.0)

Table 4: Severity of TBI among study subjects

Grading	GCS score range	Number (%)
Mild	12-14	28 (56.0)
Moderate	8-11	16 (32.0)
Severe	3-6	6 (12.0)

Table 5: Comparison of mean GCS score between the lesions

CT finding	Mean GCS score (mean ± SD)	P value
Single lesion v/s Multiple lesion	13.1±0.8 v/s 9.6±0.9	<0.0001*
Single lesion v/s Single lesion + Multiple lesion + Midline shift	13.1+0.8 v/s 4.5±1.2	<0.0001*
Multiple lesion v/s single lesion + Multiple lesion + Midline shift	9.6+0.9 v/s 4.5+1.2	<0.0001*

*-significant

Table 6: Comparison of mean GCS scores and severity of TBI among the fractured cases v/s non-fractured cases

Type of Fracture	Mean GCS score as per severity of TBI			P value
	Mild TBI	Moderate TBI	Severe TBI	
Craniofacial fracture (n=17)	13.57±0.5 (n=7)	9.5±0.9 (n=7)	4.6±1.5 (n=3)	<0.0001*
Basilar Skull fracture (n=3)	0	0	4.6+1.5 (n=3)	-
Non fractured TBI (n=30)	12.9±0.8 (n=21)	9.6+1.0 (n=9)	0	<0.0001*
P value	0.049*	0.839	-	-

Among 50 subjects, majority were males (35,70%) compared to females (15, 30%) as shown in figure-1. Mean age in the study was 9.6±0.9 years. Majority i.e., 10 (20%) belonged to 31-40 years age group followed by 9 (18%) subjects who belonged to 41-50 years age group. Among 35 males, 7 (20%) belonged to 31-40- and 51-60-years age group. Among 15 subjects, 3 (20%) belonged to 11-20, 31-40- and 41-50-years age group (table -2). The most common mode of injury in the study was road traffic accident seen in 28 (56%) of the subjects (table-3).

GCS score was less among subjects with single lesion+ multiple lesion+ midline shift compared to those with single lesion and multiple lesion without midline shift. 28 (56%) subjects showed singe lesion on CT scan, 16 (32%) showed multiple lesion and 6 (12%) showed Single lesion + Multiple lesion + Midline shift on CT scan. 28 (56%) subjects showed mild severity, 16 (32%)

showed moderate severity and 6 (12%) showed severe severity of TBI and the severity was in accordance with the GCS score.

GCS score was more for subjects with single lesion on CT, compared to those with multiple lesion and it was lowest for single lesion + Multiple lesion + Midline shift. This difference in the GCS score between the lesions was found to be highly significant.

Among 50, 20 (40%) subjects had fractures and among these 20, 17 (85%) were craniofacial fractures and 3 (15%) were basilar skull fractures.

All the 3 cases with basilar skull fractures had severe TBI with mean GCS score of 4.6±1.5. Basilar fractures were seen in three subjects and of them had severe TBI. 17 subjects had craniofacial fractures, among which 14%, 14% and 6% had mild, moderate and severe TBI respectively. Among 30 non-fractured cases, 56% had mild and 32% had moderate TBI and none had severe TBI.

Mean GCS score showed significant difference between the grading of severity among subjects with craniofacial fractures and among non-fractured cases ($P<0.05$). Mean GCS score of mild TBI was significantly different between fractured and non-fractured cases ($P<0.05$) whereas for moderate TBI it was almost same (Table-6).

Discussion

CT scan is the preferred method for the evaluation of any acute traumatic brain injury. It is available in almost every health facility. Early diagnosis and treatment of a head injury case plays a crucial role for the survival of the patient, which is possible now with CT scan. The rapidity with which CT findings are obtained helps in immediate management of such cases. Glasgow Coma Scale score is used for the initial assessment of consciousness level of TBI case. Studies have shown that Severe TBI cases are accompanied with lower GCS score and poor outcome.[11]

In this study, it was noted that head injury was common among males compared to females (70% v/s 30%). This was similar to a study conducted by Chaurasia etal.,[12] and Agarwal etal.,[5] in which male predominance was 70% and 74% respectively.

This may be due to working habits among males and also may be due to influence of alcohol while driving. Age group commonly involved in this study was 31-50 years (38%). This may be because this age group involves working people who travel daily. In a study by Agarwal etal. Head injury was common in 11-40 years age group.

In the present study, the most common mode of injury was RTA which was seen in 56% of the subjects followed by fall from height (22%) and assault (22%). This may be due to rapid urbanization of the study area. This was similar to a study by Chaurasia etal.,[12] in which most common mode of injury is RTA 70%, followed by fall from height 17% and assaults 12%, and also to a study by Agrawal et al.[5] in which 65% patients had RTA, 25% had fall from height.

Majority i.e., 56% of the subjects in this study showed single lesion on CT scan and all these subjects had mild severity as per GCS score.

The decrease in mean GCS score from single to multiple lesions, from multiple to single lesion+ multiple lesion+ midline shift was found to be highly significant ($P<0.0001$). This was similar to a study by Agarwal etal.,[5] and Chaurasia etal., [12] in which 55% showed single lesion on CT scan and the difference in the GCS score between the lesions was highly significant. In a study by Paudel etal.,[12]

GSC score significantly decreased with multiple lesions and midline shift similar to this study. Similar findings were observed in study by Sah etal.[13]

In this study, 28 (56%) subjects showed mild severity, 16 (32%) showed moderate severity and 6 (12%) showed severe severity of TBI and the severity was in accordance with the GSC score.

These findings were consistent with a study by Chaurasia etal.,[12] in which mild head injury (43%) was most common, followed by moderate (38.0%) and severe head injury (19%). Agrawal et al[5] revealed that 55% cases were mild, 25% were moderate and 20% were severe head injuries which was similar to this study.

In this study, mild, moderate and severe cases had GCS score of 12-14, 8-11 and 3-6 respectively. This was in accordance to a study by Agarwal etal.,[5] in which GCS score for Mild, moderate and severe TBI was 12 to 14, 8 to 11 and < 8 respectively.

Fractured and non-fractured in this study were 85% and 15% respectively. Basilar skull fractures constituted about 6%, craniofacial fractures about 34% which was similar to a study by Morgado etal.,[14] in which craniofacial fractures accounted to 34.3% and basilar skull fractures to 7.8%.

Among 28 mild TBI cases 13 (46%) presented with craniofacial fractures and the remaining were non-fractured cases. In a study by Morgado etal.,[14], out of 84 mild TBI cases, 24 (16.6%) presented with craniofacial fractures which was less compared to this study and two with basilar skull fractures whereas in this study none of the mild TBI cases presented with basilar fractures.

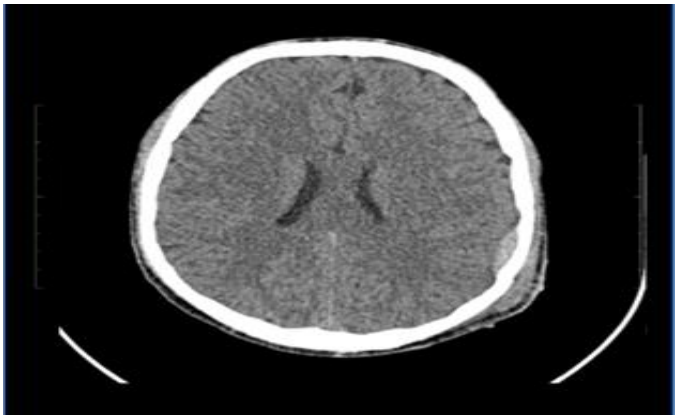
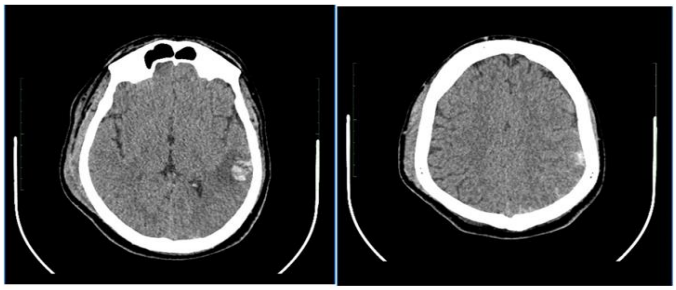
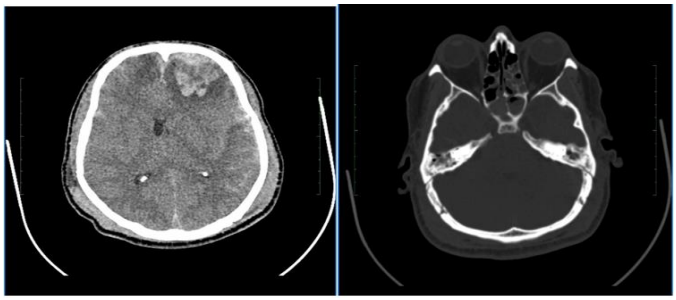


Figure 1: CT image showing Mild TBI from self-fall showing single lesion A). extradural hemorrhage in left parietal convexity.



A **B**

Figure 2: CT image showing Moderate TBI from RTA showing multiple lesions, A). Hemorrhagic contusion in left temporal lobe B). Subarachnoid hemorrhage in sulcal spaces of left high parietal lobe.



A **B**

Figure 3: CT image showing Severe TBI from RTA showing multiple lesions with midline shift, A). Hemorrhagic contusion in left frontal lobe with midline shift towards right B) Linear undisplaced fracture of left parietal bone extending inferiorly involving the mastoid part of temporal bone with associated hemomastoid.

Conclusion

In this study, it was found that head injuries were predominant among males and 31-40 years age group. RTA was the most common mode of injury. Severity of TBI and CT findings were in accordance with each other and with GCS score. Mean GCS score was significantly lower in subjects showing CT finding as single lesion+multiple lesion+midline shift compared to those with single lesion and multiple lesion.

References

1. Dewan MC, Rattani A, Gupta S, Baticulon RE, Hung YC, Punchak M, Agrawal A, Adel eye AO, Shrime MG, Rubia no AM, Rosenfeld JV, Park KB. Estimating the global incidence of traumatic brain injury. J Neurosurg. 2018 Apr 1: 1-18. Doi: 10. 3171/ 2017.10. JNS17352.

2. Gururaj G. Epidemiology of traumatic brain injuries: Indian scenario. Neuro logical research. 2002 Jan 1; 24 (1): 24-8.

3. Munro D. Cranio-cerebral injuries. Oxford University Press, as quoted by Gordon I, Shapiro HA in-Forensic Medicine: A Guide to Principles, 3rd Ed, 1988: 252.

4. Teasdale G, Jennet B. Assessment of coma and impaired consciousness: a practical scale. Lancet. 1974; 304 (7872):81-4.

5. Agrawal B, Verma R. Correlation of Glasgow Coma Scale with Non-Contrast Computed Tomography findings in immediate post traumatic brain injury. International Journal of Research in Medical Sciences. 2019 7(4):1059.

6. Tomar SS, Bhargava A, Reddy N. Significance of computed tomography scans in head injury. Open Journal of Clinical Diagnostics. 2013 Sep 24;2013.

7. Giannarelli TA, Spielman GM, Langfitt TW, Gildenberg PL, Harrington T, Jane JA, et al. Influence of the type of intracranial lesion on outcome from severe head injury: a multicenter study using a new classification system. J Neurosurg. 1982; 56 (1): 26 - 32. 10.

8. Wardlaw JM, Easton VJ, Statham P. Which CT features help predict outcome after head injury? J Neurol Neurosurg Psychia. 2002; 72:188-92. 11.

9. Youmans J, eds. Neurological Surgery. 5th ed. Philadelphia: WB Saunders; 2004:5019-5273.

10. Chaurasia AK, Dhurve L, Gaur R, Kori R, Ahmad AK. A study of correlation of degree of midline shifts on computed tomography scan and Glasgow coma scale in patients of acute traumatic head injury. Int Surg J 2021; 8:3075-80.

11. Raj R, Siironen J, B. Skrifvars M, Herne Niemi J, Kivisaari R. Predicting outcome in traumatic brain injury: development of a novel computerized Tomo graphy classification system (Helsinki computerized tomography score). Neurosurg. 2014; 75 (6): 632 -47.

12. Paudel SS, Luiten R, Bista A, Baniya A, Panta DJ, Shrestha B, Singh A. Scenario of head injury patients in tertiary care hospital of Nepal. J Nepal Health Res Counc. 2020 Apr 20; 18:112-5.

13. Sah SK, Subedi ND, Poudel K, Mallik M. Correlation of Computed Tomography findings with Glasgow Coma Scale in patients with acute traumatic brain injury. Journal of College of Medical Sciences-Nepal. 2014;10(2):4-9.

14. Morgado FL, Rossi LA. Correlation between the Glasgow Coma Scale and computed tomography imaging findings in patients with traumatic brain injury. Radio logia Brasileira. 2011; 44:35-41.