

CLINICAL UTILITY OF COMPUTED TOMOGRAPHY IN MINOR TRAUMATIC BRAIN INJURY

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ABSTRACT

Objectives:

Mild traumatic brain injury is a major public health issue. Mild traumatic brain injuries account for more than 80% of all traumatic brain injuries. Computed tomography (CT) scan is an essential imaging modality for diagnosing traumatic brain injury. The rationale for brain CT however, still lacks a broad acceptance. This study evaluated the incidence of abnormal CT head findings and the clinical utility of CT scan head in patients with minor traumatic brain injury.

Materials and Methods: Hundred minor traumatic brain injury cases admitted in emergency department that underwent routine head CT scan after clinical assessment, who satisfy the inclusion criteria were analyzed prospectively.

Results: out of 100 patients, majority of patients (69%) had normal CT scan results and only 31 cases (31%) had abnormal CT results. Majority (76%) of the patients with Glasgow coma scale (GCS) score 15 and 40% of patients with GCS<15 had normal CT results. Abnormal CT findings were further classified into significant and insignificant CT findings. Of 31 patients with abnormal CT results only 14 cases (45%) had significant CT findings and 22 cases (71%) had insignificant CT findings. 28.5% and 21.5% cases with significant CT findings had GCS <15 and age over >60yrs respectively.

Conclusion: CT head is beneficial in patients with age over 60 years and GCS <15, especially when associated with other risk factors. CT head is not routinely indicated in patients with GCS 15 unless otherwise associated with other risk factors.

Keywords: CT scan, GCS, minor traumatic brain injury.

INTRODUCTION

Traumatic brain injury (TBI) is a major reason for health loss and disability worldwide. About 80% of the traumatic brain injuries that occur each year are mild traumatic brain injuries[1]. Motor vehicle accidents and falls are the most frequent causes of head trauma. One of the significant risk factors for injury is alcohol.(2)

The American Congress of Rehabilitation Medicine's committee on mild traumatic brain injury (TBI), as revised by WHO, defined mild TBI as having a Glasgow coma scale score between 13 and 15 at 30 min post injury, and one or more of the following symptoms: <30 minutes loss of consciousness; not less than 24 h post traumatic amnesia (PTA); impaired mental state at the time of accident (confusion, disorientation); and/or transient neurological deficit.[3]

Any abrupt, external, physical attack that damages the brain results in a traumatic brain injury (TBI). The variables for NCCT head indication have been the subject of numerous investigations. The indication for CT head, however, is still devoid of a broad consensus.

current evidence suggests that patients aged 65 or above presenting to the emergency department with minor head injury after a fall should receive a CT scan of head.[4] Patients with a GCS of 14 or 15 associated with a skull fracture and/or neurological loss are categorized as having a high-risk minor head injury by the world federation of neuro surgical societies' (WFNS) Neuro-traumatology Committee.[5,6]

AIMS AND OBJECTIVES**MATERIALS AND METHODS**

Hundred patients with head injury admitted in the emergency department of Government Medical College and Hospital, GNDH, Amritsar, who satisfy the inclusion criteria were analysed prospectively.

INCLUSION CRITERIA:

1. GCS score 13-15.
2. Loss of consciousness <30 min.
3. Not less than 24 h post traumatic amnesia.
4. Impaired mental state at the time of accident.
5. Transient neurological deficit will be included in the study.

EXCLUSION CRITERIA:

1. Patients with GCS score <13.
2. Age <16 y were not be included in the study.

After the initial clinical assessment, patients were evaluated by CT scan of head using CT scan 64 Slice Philips machine. CT windows used in the study were bone window, soft tissue window and volume reconstruction windows.

Selected clinical parameters including loss of consciousness, impaired mental state, vomiting, ENT bleed, headache, dizziness, amnesia, GCS score were recorded.

The presence of any of the following was considered as significant CT finding: subdural hematoma (SDH), extradural hematoma (EDH), subarachnoid hemorrhage (SAH), cerebral contusion, depressed skull fracture, basal skull fracture. Other findings which include soft tissue swelling, linear skull fractures, maxillofacial fractures were considered as insignificant CT findings.

RESULTS

Of the 100 minor traumatic brain injury patients, 69 patients (69%) were men and 31 patients (31%) were women. Most commonly (57%) affected age group was 21-40 y with mean age of 38.9 y. Road traffic accidents (RTA) was the mechanism of injury in 64% of cases,

followed by history of fall in 21% cases, history of assault in 11% cases and history of injury due to falling objects in 4% cases.

Table 1: Distribution of the study population according to the gender

Gender	Frequency	Percentage
Male	69	69
Female	31	31
Total	100	100

Table 2: Distribution of the study population according to the age group

Age group(y)	Frequency	Percentage
>16-20	6	6
21-30	33	33

31-40	24	24
41-50	16	16
51-60	8	8
>60	13	13
Total	100	100

Fig 1: Distribution of study population according to the cause of minor traumatic braininjury

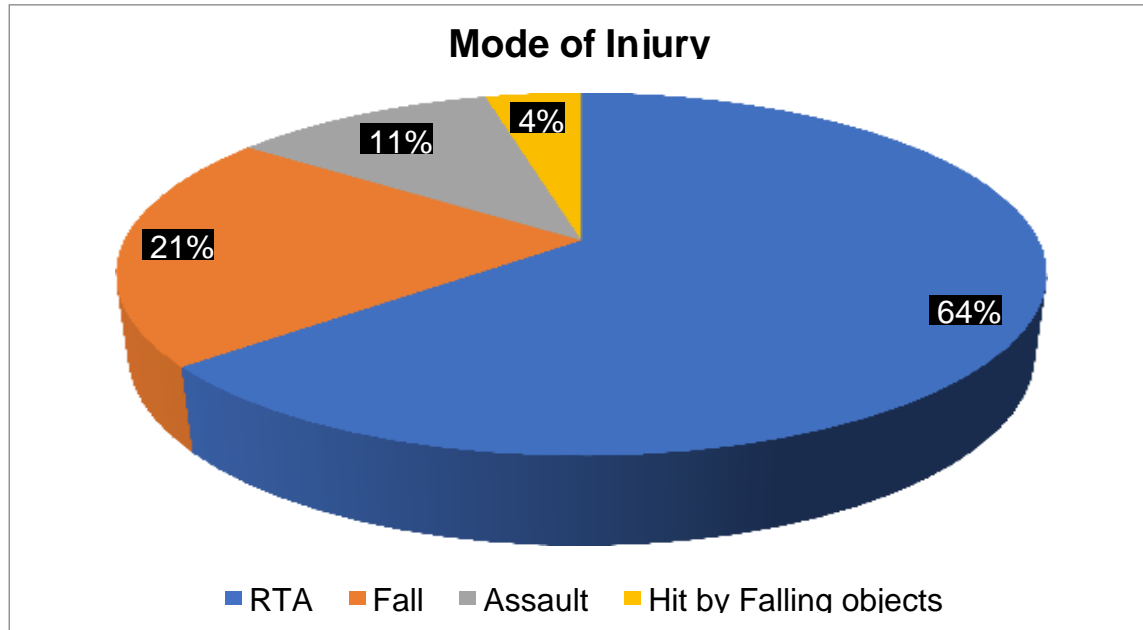


Table 3: Distribution of study population according to Glasgow coma score

GCS	Frequency	Percentage
15	80	80
14	16	16
13	4	4
Total	100	100

Out of 100 patients,80 patients (80%) had a GCS score of 15 at the time of presentation.16 patients (16%) had a GCS score of 14 and 4 patients (4%) presented with a GCS score of 13. The majority of the patients (69%) in the study population had normal CT scan results and 31cases (31%) had abnormal CT results. 76% (70cases) of the GCS 15 patients and 40% of GCS <15 patients had normal CT results.

Table 4: Distribution of study population based on the CT findings

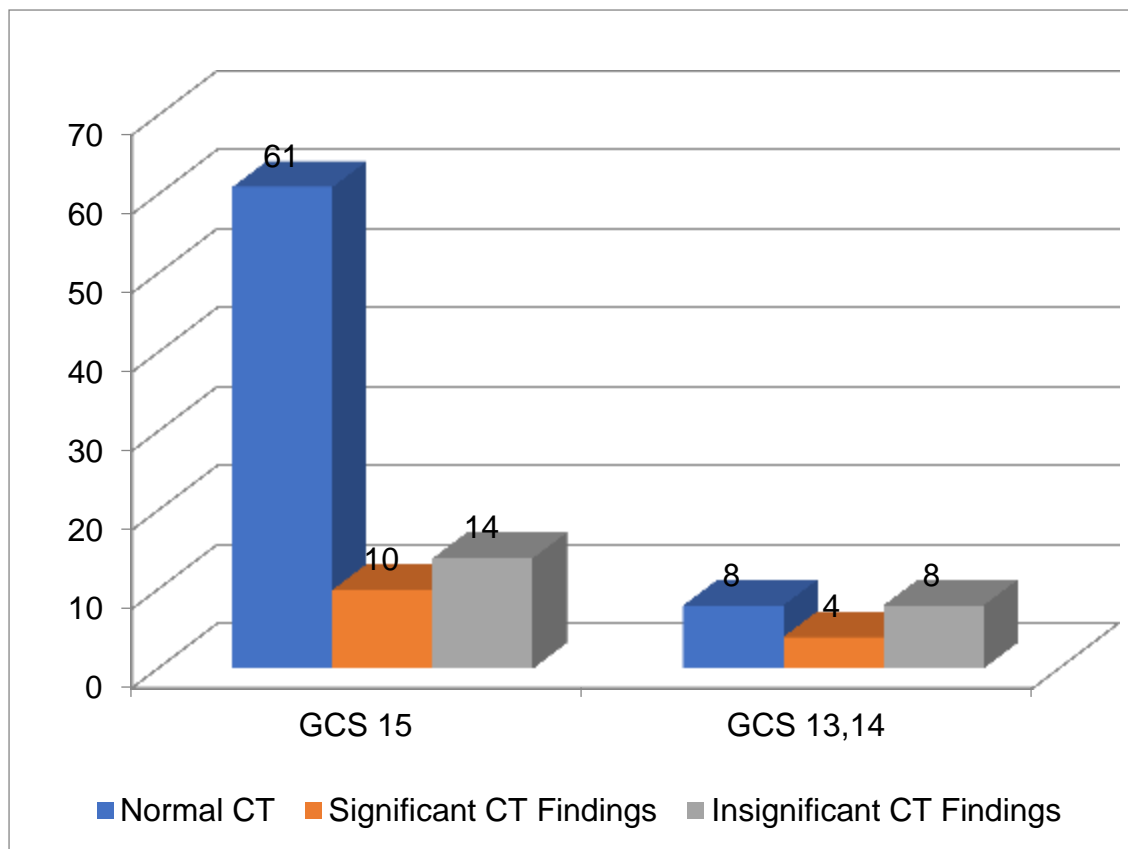
CT	Frequency	Percentage
Normal CT	69	69
Abnormal CT	31	31

Total	100	100
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Table 5: Distribution of study population based on the significant and non-significant CT findings

GCS score	Frequency	Normal CT	Significant CT findings	Insignificant CT findings
15	80	61	10	14
13, 14	20	8	4	8
Total	100	69	14	22

Fig 2: Distribution of study population based on the significant and non-significant CT findings



Significant CT findings were present in 14% of total study group and 22 patients (22%) had insignificant CT findings. Most common CT findings were soft tissue swelling and linear skull fracture accounting for 10% each. Craniofacial fracture and depressed skull fractures were the next frequent CT findings with 10% and 9% incidence respectively. contusion occurred in 5 patients (5%) while basal skull fracture, subdural and extradural hematomas were documented in 2% of cases each. subarachnoid hemorrhage was least common finding, seen in only one case (1%).

Table 6: Distribution of study population according to the positive CT findings.

S.no	CT finding	Frequency	Percentage
1	Soft tissue swelling	10	10
2	Linear Skull fractures	10	10
3	Craniofacial fractures	9	9
4	Depressed skull fractures	6	6
5	Brain contusion	5	5
6	Basal skull fractures	2	2
7	Subdural hematoma	2	2
8	Extradural hematoma	2	2
9	Subarachnoid hemorrhage	1	1

The most frequent clinical parameters were loss of consciousness < 30 min and impaired mental status (at the time of accident) found in 64% and 46% of cases respectively. The next most commonly presenting clinical features were headache and vomiting, which were present in 38% and 20% cases of total study population respectively. Other clinical features which include dizziness seen in 17% cases, ENT bleed in 10% of the cases and amnesia in 5% cases. Among the study, 23% of patients with age >60 y and only 12.6% of patients with age <60 y have significant CT findings respectively.

Table 7: Distribution of study population based on the clinical findings

S.no	Clinical findings	Frequency	Percentage
1	LOC	64	64
2	Impaired mental status at time of accident	46	46
3	Headache	38	38
4	Vomiting	20	20
5	Dizziness	17	17
6	ENT bleed	10	10
7	Amnesia	5	5

Table 8: Distribution of significant CT findings in the patients with age over 60 years and below 60 years.

Age(y)	Total CT scans	Significant CT findings	Percentage
<60	87	11	12.6
>60	13	3	23

Twenty eight percent and twenty one percent cases with significant CT findings had GCS <15 and age over >60 y respectively. All patients with significant CT findings were associated with at least one of the following risk factors: vomiting, LOC, Amnesia and age over 60 years.

DISCUSSION

Most of the patients with minor traumatic brain injury in the present study were in between the age group of 21-40 y with a mean age of 38.9 y and Men (69%) were most commonly affected than women (31%). Similar reports were documented in previous studies.[7] Road traffic accident was most frequent cause accounting for 64% of cases, followed by falls (21%). Only few cases were caused by injury due to assault and hit by falling objects. Similar findings were published in previous literature[2]. 80 patients (80%) with minor head injury had a Glasgow coma scale (GCS) score of 15, 16 percent had a GCS 14, and 4 percent had a GCS 13. Similar distribution was observed in the previous studies.[8]

The majority of the patients (69%) in the study population had normal CT scan results and 31 cases (31%) had abnormal CT results, particularly those with GCS 15; they also had trouble-free hospital discharges. 76% of the GCS 15 patients and 40% of GCS <15 patients had normal CT results. Abnormal CT findings were further classified as significant and insignificant CT findings. Of 31 cases of abnormal CT scans, 14 cases (14%) had significant CT findings and 22% of cases had insignificant CT findings like in previous studies.[9] Linear skull fractures and soft tissue swelling were the most common CT findings documented in 10 patients (10%) each, while depressed fractures and brain contusion were the next most frequent CT findings found in 6 cases (6%) and 5 cases (5%) respectively. Similar distribution was seen in previous studies.[9] Among the significant CT findings, most frequent abnormalities were depressed fractures and brain contusion. 30% of the significant CT findings were found in patients with GCS 13 or 14. Clinical findings like vomiting, LOC, GCS <15, headache, Impaired mental status at the time of injury had significant correlation with positive CT findings. Similar results were found in previous studies.[9]

Patients with GCS score 13 or 14 should be categorized as high risk minor head injury, especially when associated with other risk factors like loss of consciousness, vomiting, headache, skull fractures, impaired mental state, amnesia and ENT bleed. Presence of skull fracture regardless of GCS score or other significant findings will also be categorized under high risk minor head injury as recommended by WFNS neuro traumatology committee. High risk minor head injury group patients require urgent CT scan and neurological consultation.[5,6]

Only 10% of the total research population with GCS 15 exhibited significant CT findings, in our study. Number of previous studies have shown similar findings.[9] And all these patients have at least one of the following risk factors: vomiting, Loss of consciousness, amnesia and age over 60 years. Many previous studies also recommend not to use CT scan routinely in all minor traumatic brain injury patients with GCS 15.[10,11]

In our study, 23% of patients with age >60 y and 12.6% of patients with age <60 y have significant CT findings respectively. So, in patients with age over 60 years. CT scan is recommended routinely. patients with age over >60 y tend to have more significant intracranial injuries than young patients.[6,12 – 15] Because there is a 6–10% chance of developing an intracranial hematoma that necessitates surgical intervention, patients who are older than 60 y are considered to be high risk head injury cases and require urgent CT scans.[5]

CONCLUSION

Head CT scan is beneficial in all minor traumatic brain injury patients with age over 60 y and GCS <15 especially when associated with other risk factors, as majority of significant CT findings were found in this subgroup of patients. CT head is not routinely indicated in patients with GCS 15 unless otherwise associated with other risk factors.

BIBLIOGRAPHY

1. Kurtzke JF and Jurland LT. "The epidemiology of neurologic disease," in *Clinical Neurology*, R. J. Joynt, Ed., JB Lippincott, Philadelphia, Pa, USA. 1993.
2. G.Gururaj , Das BS, kalia perumal VG et al,Epidemiology of traumatic braininjuries: Indian scenario. *Neurol Res* 2002; 24: 24-28
3. Lefevre-Dognin C, Cogné M, Perdrieau V, Granger A, Heslot C, Azouvi P. Definition and epidemiology of mild traumatic brain injury. *Neuro Chirurgie*.2020;p.1-4.
4. Sharif-Alhoseini M, Khodadadi H, Chardoli M, Rahimi-Movaghar V. Indicationsfor brain computed tomography scan after minor head injury. *J Emerg, Trauma and Shock*. 2011;4(4):472-6.
5. Servadei F, Teasdale G, Merry G. Defining acute mild head injury in adults: a proposal based on prognostic factors, diagnosis, and management. *J Neurotrauma*2001;18(7):657- 664.
6. Gomez PA, Lobato RD, Ortega JM, Cruz JDL. Mild head injury:differences in prognosis among patients with Glasgow coma score of 13 to 15 and analysis of factors associated with abnormal CT findings. *Br J Neurosurg* 1996; 10: 453–460.
7. Kazem Jamali1,Amir Hasan Asadi2 et al,Evaluation of ct scan results in patients with minor head trauma based its indication and final clinical results in patients referred to emergency department of Namazi hospital. *Int J Med Invest* 2018; vol7; num 1; 49-55.
8. Marion smits, Diederik W.J et al, External Validation of the Canadian CT Head Rule and the New Orleans Criteria for CT Scanning in Patients With Minor HeadInjury ; *JAMA*. 2005;294:1519-152
9. Robab sadegh,Ehsan Karmialavijeh et al, Head CT scan in Iranian minor head injury patients: evaluating current decision rules ,*springer Emer.Radiol*(2016)23:9-16
10. Miller E, Holmes J, Derlet R. Utilizing clinical factors to reduce head CT scanordering for minor head trauma patients. *J Emerg Med* 1997;15(4):453-457.
11. Stein S, Ross S. The value of computed tomographic scans in patients with low-risk head injuries. *Neurosurgery* 1990;26(4):638-640
12. Stiell IG, Wells GA, Vandemheen K, Clement C, Lesiuk H, Laupacis A et al. TheCanadian CT Head Rule for patients with minor head injury. *The Lancet*. 2001;357(9266):1391-96.
13. Borczuk P. Mild head trauma. *Emerg Med Clin North Am* 1997; 15: 563–579.
14. Jeret JS, Mandell M, Anziska B, et al. Clinical predictors of abnormality disclosedby computed tomography after mild head trauma. *Neurosurgery* 1993; 32: 9–16.
15. Schynoll W, Overton D, Krome R, et al. A prospective study to identify high-yieldcriteria associated with acute intracranial computed tomography findings in head- injured patients. *Am J Emerg Med* 1993; 11: 321–326.