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Original Research Article

Co-Relation between Canadian CT Head Rule & CT Scan Findings in Traumatic Head Injury at Tertiary Care Hospital

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Abstract:

Introduction: Traumatic Brain Injury (TBI) means an acquired injury to the brain caused by an external physical force, resulting in total or partial functional disability or psycho-social impairment, or both. To overcome the side-effects & unnecessary cost of CT Scan, The Canadian CT Head Rule was introduced. The Canadian CT Head Rule guidelines help identify patients with GCS scores of 13-15 and consist of five high-risk factors.

Material & Methods: 50 cases of mild traumatic head injury patients, GCS (13-15,) admitted in M.Y. Hospital Indore. In all cases we studied following methods were employed to carried out the present study. Complete detailed history, general examination, systemic examination, local examination, relation with Glasgow coma scale, CT scan head plain, Canadian CT head rule, investigations.

Observation: Total 50 cases were studied out of them 37 were male and 13 were female. Total 35 patients (70%) were of 16-35 years of age, 13(26%) were 36-55 years of age. 02 patients were more than 65 years of age. Clinical features as vomiting, LOC, ENT bleed, convulsion found in 13,14, 05 and 01 patient respectively**.** Positive Ct Finding seen as ACUTE SDH 25 %, EDH 22%, Contusion 27%, brain edema17%, linear fracture 27%, depressed fracture 05%, SAA 08% and ICH 05%.

Keywords: Traumatic Brain Injury, Canadian CT Head Rule, GCS score etc.

Introduction

Traumatic Brain Injury (TBI) means an acquired injury to the brain caused by an external physical force, resulting in total or partial functional disability or psycho-social impairment, or both, that adversely affects a child's educational performance [1]".

The term applies to open or closed head injuries resulting in impairments in one or more areas, such as cognition; language; memory; attention; reasoning; abstract thinking; judgment; problem solving; sensory; perceptual and motor abilities; psycho-social behaviour; physical functions; information processing; and speech. The term does not apply to brain injuries that are congenital or degenerative, or brain injuries induced by birth trauma [2].

Head trauma may be responsible for primary and secondary brain damage. Primary brain injury results from a direct mechanical damage at the time of injury, whereas secondary injury is caused by further cellular damage that develops hours or days post injury [3]. TBI is also referred to in literature as a head injury, TBI, acquired brain injury, 3 brain damage or injury, or may be referred to according to the severity of the injury (mild TBI, moderate TBI, or severe TBI) [4].

Three broad grades of severity are used to categorize brain injury; mild, moderate and severe. However, universally accepted definitions for the severity of brain injury do not exist (Petchprapai & Winkelman, 2007). Consequently, different sources often use contrasting inclusion criteria to determine severity, especially when using combined measures [5].

Generally, a mild brain injury is generally defined by a GCS score of 13–15 [6], LOC of less than 30 minutes [7] and/or PTA of less than an hour [8]. A GCS score of 9–12, LOC of 30 minutes to 24 hours and/or PTA of one to 24 hours is classified as a moderate brain injury. Those with a severe brain injury have a GCS score less than 8, LOC of more than 24 hours and/or PTA of more than 24 hours.

Mild brain injuries represent the majority of brain injury cases. Estimates for the proportion of brain injury diagnoses classed as mild have ranged from 75% to 95% [8]. The seriousness of mild brain injuries should not be underestimated. Such injuries can result in long-term problems that affect daily functioning [9].

The neurobehavioral deficits of mild brain injury may include: headaches, dizziness, attention difficulties, memory lapses, sleep disturbances, fatigue, irritability, depression, anxiety, low motivation, poor planning, visual problems and heightened sensitivity to stimuli [10].

To overcome the side-effects & unnecessary cost of CT scan, The Canadian CT Head Rule was introduced, which comprises of –

High risk (for neurological intervention)

- GCS score <15 at 2 h after injury
- Suspected open or depressed skull fracture
- Any sign of basal skull fracture (haemotympanum, 'racoon' eyes, cerebrospinal fluid otorrhoea/rhinorrhoea, Battle's sign)
- Vomiting ≥ 2 episodes
- Age - ≥ 65 years

Medium risk (for brain injury on CT)

- Amnesia before impact >30 min
- Dangerous mechanism (pedestrian struck by motor vehicle, occupant ejected from motor vehicle, fall from height >3 feet or five stairs).

The Canadian CT Head Rule

Stiell et al. (2001) developed clinical guidelines, the Canadian CT Head Rules, to establish when to use CT for milder injuries (i.e., to identify patients at risk for intracranial lesions) [11].

These guidelines are 98.4% (95% CI 96-99%) accurate when identifying patients at risk for developing intracranial lesions. The Canadian CT Head Rule guidelines help identify patients with GCS scores of 13-15 and consists of five high-risk factors [Glasgow Coma Scale score lower than 15 at 2 hours after injury; suspected open or depressed skull fracture; any sign of a basal skull fracture; vomiting ≥ two episodes; age ≥ 65 years] and two additional medium-risk factors [retrograde amnesia > 30 min; and injury cause by especially-dangerous mechanisms (a pedestrian struck by a motor vehicle, an occupant ejected from a motor vehicle, or a fall from a height > 3 feet or five stairs)].

Material & Methods

The study was carried out on 50 cases of mild traumatic head injury patients, GCS (13-15,) admitted in M.Y. Hospital Indore. The present study is carried out on cases of head injuries admitted in Surgery Department, MGM Medical College & M.Y. Hospital, and Indore MP. Study was carried out from May 2018 to Aug 2019.

Inclusion Criteria

- Age 16yrs and above with traumatic brain injury admitted in M.Y. Hospital Indore.
- GCS :- 13 - 15

Exclusion Criteria

- Non-trauma cases, GCS <13, Age <16 years, Coumadin or bleeding disorder, Obvious open skull fracture.

In all cases we studied following methods were employed to carried out the present study-Complete detailed history, general examination, Systemic examination, Local examination, Relation with Glasgow coma scale, CT scan Head plain, Canadian CT head rule, Investigations.

Examination of central nervous system –
Patient's attitude, orientation, level of responsiveness noted in all cases according to Glasgow coma scale and examined repeatedly on the subsequent days and changes if any, were noted. Whenever possible cranial nerve were examined but in cases which were unconscious, examination of cranial nerves and other dates pertaining to C.N.S. was done to the extent as far as possible. Examination of sensory system, motor system, tone, power, reflexes was done whenever possible. Superficial reflexes such as corneal, planter, abdominal sensation such as pain, touch were tested whenever possible and recorded.

Canadian CT Head Rule

	Present	Absent
High Risk -		
GCS Score <15 At 2hrs After Injury		
Suspected Open/Depressed Skull Fracture		
Any Signs Of Basal Skull Fracture*		
Vomiting ≥ 2 Episodes		
Age ≥ 65 Years		
Medium Risk -		
Amnesia Before Impact ≥ 30 Min		
Dangerous Mechanism**		

Observations: Total 50 cases were studied out of them 37 were male and 13 were female. Total 35 patients (70%) were of 16-35 years of age, 13(26%) were 36-55 years of age. 02 patients were more than 65 years of age.

Table 1: Table Showing Mode of Injury

Mode of injury	Positive Cases N (%)	With In Normal Limit N (%)	Total N (%)
RTA	22 (70.9%)	9 (29.03%)	31 (62%)
Fall From Height	12 (92.3)	1 (7.69%)	13 (26%)
Playground	2 (40%)	3 (60%)	5 (10%)
Others (Assault)	0	1 (100%)	1 (02%)
Chi Square Value	7.86		
P Value	0.049(S)		

Table 2: Table Showing Clinical Features In Head Injury Cases

Clinical Features	Positive Cases N (%)	With In Normal Limit N (%)	Total N (%)
Vomiting	11 (84.6)	2 (15.3)	13 (26)
LOC	13 (92.8)	1 (7.1)	14 (28)
ENT Bleed	4 (80)	1 (20)	5 (10)
Convulsion	1 (100)	0	1 (2)
Chi Square Value	0.885		
P VALUE	0.829(NS)		

Table 3: Table Showing GCS Score Of Head Injury

GCS Score	Positive Cases N (%)	With In Normal Limit N (%)	Total N (%)
13	14 (100)	0 (0)	14 (28)
14	12 (100)	0 (0)	12 (24)
15	10 (41.6)	14 (58.3)	24 (48)
Chi Square Value	21.1		
P Value	0.001(HS)		

Table 4: Table Showing Type of Positive Ct Finding

Lesions	Number of cases	%
Acute SDH	9	25%
EDH	8	22.2%
Contusion	10	27.7%
Brain Edema	6	16.6%
Linear Fracture	10	27.7%
Depressed Fracture	2	5.5%
SAH	3	8.3%
ICH	2	5.5%

Table 5: Table Showing Association Of Canadian Ct Head Rule With Ct Findings

Canadian CT Head Rule	No. of Cases.	Positive Cases N (%)	With In Normal Limit N (%)
Present	38	36(94.7)	2(5.2)
A. High Risk	32	32(100)	0(0)
B. Medium Risk	6	4(66.6)	2(33.3)
Absent	12	0	12
Chi Square Value	15.3		
P Value	0.001(Hs)		

Discussion

Traumatic brain injury is a significant cause of death and disability, particularly amongst people below the age of 35 years [12]. International mortality statistics show that accidents are accountable for 3% to 10% of all deaths for all causes, and the problem takes on greater magnitude considering that most of these deaths occur in young patients. Mild brain injuries represent the majority of traumatic brain injury cases ranging from 75% to 95% [6,7,8].

Most of patients with minor head injury can be discharged without sequel after a period of observation but a small portion may deteriorate and require neurosurgical intervention for intracranial hematoma [13,14].To manage such patients an early diagnosis of intracranial injuries using computed tomography (CT) followed by early craniotomy is required [15,16,17].

Substantial potential for improving the efficiency of minor head injury management appears possible through the application of clinical decision rule like Canadian CT Head Rule.

Sex Distribution: In the present study, 74% (37/50) of the patients were male (p value <0.05; statistically significant). Murray et al. stated in, The Europian Brain Injury Consortium, that 74% of reported cases were men. More number of cases of males in head injury may be attributed to higher exposure of male to outdoor activities & other risk factor.

Age Distribution: In the present study showed the maximum percent of head injury cases were seen in age group of 16-35 yr-70%(35/50) of cases, followed by age group of 36-55 - 26% (13/50) of cases , 56-above yrs – 4% (02/50) of cases). More recent UK prevalence and epidemiology studies have reported similar findings [18].

Mechanism of Injury: In this study, Road Traffic Accidents are the most common cause of head injury with incidence of 62% (31/50) of cases, followed by fall from height 26% (13/50), playground injuries 10% (05/50) & other causes 2% (01/50). The above findings were found to be statistically significant (p value <0.05) and consistent with the studies conducted by Tiret et al & Teasdale et al [6].

Clinical Features: In the present study, the most common clinical feature was loss of consciousness 28% (14/50) of cases out of which 13 cases had positive finding on CT scan ; followed by vomiting 26% (13/50) out of which 11 cases had positive finding on CT scan; ENT Bleed 10% (05/50) & convulsions 2% (01/50) of cases. These findings were supported by findings of Fischer et al as Loss of consciousness was most common finding (60%) followed by vomiting (19%) in cases of head injury. Although, a prospective study of 152 patients found that vomiting was associated with positive CT findings in 40–45% of cases [19].

The precise mechanism of post-traumatic vomiting is unknown but it is likely that contact forces (impact) are less important than inertial forces (impulse) in its etiology. Whereas symptoms such as loss of consciousness and post-traumatic vomiting are induced by head motion, skull fracture depends on contact forces. In most injuries the two phenomena occurs together.

Glasgow coma score: In this study we studied the cases of mild head injury (GCS 13-15) and divided into 3 groups –

- GCS score : 13
- GCS score: 14
- GCS score: 15

Most of the cases of mild head injury had GCS score 15 i.e. 48% (24/50), followed by GCS score 13 i.e. 28% (14/50) & GCS score 14 i.e.24% (12/50) of all cases. In the present study, the CT scan findings were correlated with the GCS Score. Out of 50 mild head injury cases 36(72%) had positive CT scan findings. All cases with GCS score 13 and 14 had positive CT scan findings (100%) while those with GCS score 15 out of 24 cases only 10(41.6%) had positive CT scan findings while 14(58.3%) cases had normal CT scan findings. (P value=0.001).

CT scan Findings: Most common type of lesion with positive CT scan findings was Contusion 27.7% (10/36) and linear fracture 27.7% (10/36), followed by SDH 25% (9/36) & EDH 22.2% (8/36). Brain edema was present in 16.6% (06/36) of cases, SAH was present in 8.3% (3/36) of cases, and depressed fracture & ICH were present in 5.5% (02/36) of cases. Findings were similar to study conducted by smits et al. [20] who documented skull fractures in 59.6% patients, followed by Haemorrhagic contusions in 37.8% patients, subarachnoid haemorrhage in 27.6%.

Canadian CT Head Rule with CT findings: In the present study, Canadian CT head rule was applied to all the cases. Out of 50 cases 38 cases were found to have either one or more High risk or medium risk factors and out of these 38 cases 36(94.7 %) cases had positive CT scan findings, while 12 cases were found to have no risk factors and all 12 cases had no positive findings on CT scan.

Out of 38 cases, 32 cases had one or more high risk factors and all 32(100%) cases had positive ct scan findings, while 6 cases had one or more medium risk factors and out of them 4(66.6%) cases had positive ct scan findings and in 2(33.3%) cases CT scan findings were within normal limit.

Mode of treatment

In the present study, 98% (49/50) patients was managed conservatively. In the present study, we found that 2% (01/50) of patients needed neurosurgical intervention. Multiple studies have shown that these neurosurgically significant lesions are relatively uncommon with incidences of 0.1-3.2% for GCS 15 and 0.5-6.5% for GCS 14 with most of the larger studies finding that acute neurosurgical intervention is required in less than 1% of mild head injury patients. The patient who underwent surgical management had depressed fracture with ICH.

Morbidity & Mortality: In this study, all patients were discharged, and no death was recorded.

Conclusions

Canadian CT Head Rule is a highly sensitive decision rule for use of CT and has the potential to significantly standardize and improve the emergency management of patients with minor head injury. Secondly, this rule would reduce or eliminate the likelihood of patients being discharged from the emergency department with an undiagnosed intracranial haematoma. Moreover, physicians working in smaller hospitals without CT scanners would have clear directions about patient management. We can conclude that Canadian CT Head Rule is a good indicator in minor head injury and CT scan can be omitted in patients with GCS score of 13-15 who does not have any risk factors mentioned in Canadian CT Head rule.

With the proper use of Canadian CT Head Rule and neurological examination, unnecessary use of CT scan can be avoided, rationalization of use of resources & avoiding radiation hazard in minor head injury patient.

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