EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 9
Issue: 5
247-253
Year: 2022

IMPORTANCE OF COMPUTED TOMOGRAPHY SCAN IN TRAUMATICBRAIN INJURY DURING ROAD TRAFFIC ACCIDENT (RTA)

S. Kr Sah*, Liu Sibin, Lei Wei and Chen Lina

Department of Radiology, Central Hospital, Jingzhou, Hubei.

***Corresponding Author: Dr. S. Kr Sah**
Department of Radiology, Central Hospital, Jingzhou, Hubei.

Article Received on 27/02/2022 **Article Revised on 17/03/2022** **Article Accepted on 07/04/2022**

ABSTRACT

Background: Population and vehicle users are increasing day by day and RTA is also increasing day by day parallel way. Head trauma followed by brain injury is becoming the most common problem, especially in middle-aged people. It has taken second place next to cancer as a leading cause of death. Due to advance and developed radiology, computed tomography has become the prime choice in the initial assessment of head injury in patients as it is easily available, faster and highly accurate in detecting skull fractures of the skull and acute intracranial bleeding. **Aim**: To demonstrate the importance of Ct-scanning in the initial management planning, follow up and long term management of patients with traumatic head injury of varying severity in Patients. **Methods:** A prospective study has been carried out of 200 patients with road traffic accident with acute head trauma with positive CT scanning referred to central hospital, Jingzhou, Hubei, China between 2017 April to 2019 May (2-year prospective study). The affected age group was between (1-90) years and the great majority of them were males. **Result:** The affected age group was between (1-90) years and the great majority of them were males.77 % of all the 200 cases were males and 23% were females. Most of affected age group belongs to 61-70 years of age group. Their age ranged from 1 to 90 years, with a mean age of 51.88 years (±18.26) (mean±standard deviation). The median and modal age was 54 and 47 years, respectively. Most of the cases which were studied showed skull fractures, which indicates that there has been significant trauma and in a single case with more than one pathology, related to cranium has been seen. The most common post traumatic consequences found in the study of middle aged are subarachnoid hemorrhage, while other sequel such as contusion, subdural hematomas and extradural hematomas are encountered more. Diffuse and focal cerebral edema was being the most common pathology following trauma in children. **Conclusion:** CT scanning is the primary modality of choice in the diagnostic work up of patients with acute head trauma for identifying the various intracranial consequences following head injury especially within 48 hours which helps in the initial assessment, treatment planning, follow up and long term management of patients.

KEYWORDS: Computed Tomography, Head Injury, Intracranial Hemorrhage, Fracture and Diagnosis.

INTRODUCTION

Traumatic brain injury (TBI) after a head injury is associated with significant mortality and long-term morbidity in young adult, worldwide.[1,2,3,4] TBI affects 10 million people worldwide among them 1.7 million people are from the USA annually (2002).[4,5,6,7,8]

The most common clinical indicators used to assess acute brain injury severity include the length of loss of consciousness (LOC) and post-traumatic amnesia (PTA), and the most widely used tool for measuring the level of consciousness is the Glasgow Coma Scale (GCS).

Traumatic axonal injuries contribute to at least 35% of the mortality and morbidity of TBI cases without space-occupying lesions, and TAI is an important cause of severe disability in head injury survivors.[11]

Objectives

The general aim was to clarify the role of computer tomography (CT-scan) imaging in the detection of traumatic brain injury during road traffic accident (RTA) and investigate how to improve the radiological diagnostics of traumatic brain injury patients which could be lifesaving.

MATERIALS AND METHODS

The study was done using, GE Healthcare Discovery CT750, a 64 slice scanner. Computer tomography of head was performed with patients in supine position and scanning baseline was perpendicular to the longitudinal axis of patient body. Scanning voltage of 120 kV and a current of 110 mA were being used. Imaging parameters were as follows: 100–120 kV, 16 × 1.25 mm collimation, speed 27.5 mm/rot, rotation time

0.5 s, pitch value of 1.375:1.

Study design

A prospective study will be conducted over a period of two years (November 2017 to April 2019) on 200 patients with traumatic brain injury presented in the Department of Radio diagnosis at Central Hospital Jingzhou Affiliated to Medical School of Yangtze University. They will be evaluated with Computed Tomography- scan.

Inclusion criteria

- Patients of any age and sex
- Patients who give written informed consent for the study.
- Patient brought to Emergency and Radiology department with head trauma byRTA.

Exclusion criteria

- Patients except head injury are excluded.

OBSERVATION AND RESULTS

Demography

A total of 200 CT scan images of patients that sustained head injury were analyzed.

Table 1: Age distribution of study subjects in relation to causes of head injury.

Age (years)	Cause of trauma (RTA). no. of patient	Percentage
0-10	10	5%
11-20	05	2.5%
21-30	15	7.5%
31-40	08	4%
41-50	37	18.5%
51-60	45	22.5%
61-70	46	23%
71-80	19	9.5
81-90	15	7.5%
Total	200	100%

Table 2: Sex distribution of study subjects in relation to causes of head injury.

Sex	Frequency	Perentage
Male	154	77%
Female	46	23%

Table 3: Epidemiological prognostic factor in severe head injury.

Age	No. of patient	Glasgow outcome score					Percentage age of unfavorable outcome (%)
		I	II	III	IV	V	
0-10	10	1	0	0	5	4	10%
11-20	05	0	0	1	3	1	20%
21-30	15	0	0	3	4	8	20%
31-40	08	1	0	1	5	1	25%
41-50	37	1	2	6	21	7	24%
51-60	45	1	13	1	29	20	57%
61-70	46	2	0	20	4	20	47%
71-80	19	1	5	0	8	4	31%
81-90	15	1	2	8	1	3	73%

Table 4: CT scan findings in the study subjects.

Findings	Frequency (no. patient)	Percentage
Fractures		
Linear	79	39.5%
Depressed	29	14.5%
Basilar	14	7%
Intracranial bleeds		
Cerebral contusion	84	42%
Epidural hematoma	55	27.5%
subdural hematoma	77	38.5%
Intracerebral		

Subarachnoid	116	58%
Intraventricular	36	18%
Pneumocephalus	27	13.5%
Haemosinus	11	5.5%
Edema and brain swelling	30	15%
Diffuse axonal injury	09	4.5%
Soft tissue swelling	50	25%
Foreign body	5	2.5%
Subgaleal hematoma	12	6%

77% of the study subjects were male while 23% were female, with a male to female ratio of 3.3:1. Their age ranged from 1 to 90 years, with a mean age of 51.88 years (mean±standard deviation). The median and modal age was 54 and 47 years, respectively.

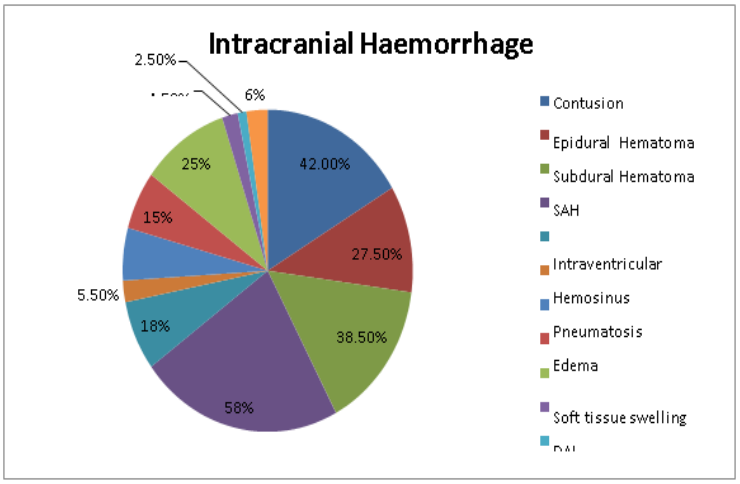

Figure 1: Pie chart showing different types of intra cranial bleed associated with RTA.

Looking at the site of injury among RTA patients, It is seen that most common among them was SAH with 58%, 2nd most common followed by SAH was contusion with 42% followed by subdural hematoma with 38.5%, than epidural with 27.5% and soft tissue swelling with 25%, Intraventricular bleed with 18%, edema with 15% so as pneumocephalus by 13.5%, Subgaleal hematoma with 6%, hemosinus with 5.5%, DAI with 4.5% and foreign body with 2.5% respectively.

Table 5: Causes of head Trauma and Indications for CT scan with its percentage of positive ctfindings.

Causes	No. of patient	Positive CT-finding percentage %
Road traffic accident	200	100%
Indications		
Unconsciousness after RTA	59	29%
Headache after RTA	76	58%
Head injury after RTA	55	61%
Change in clinical condition	10	4%
Total	200	100%

Table 6: Type of hemorrhage associated with fracture with percentage%.

Type of hemorrhage	No of patient	Patient with fracture	Percentage
Epidural	55	46	83.6%
Subdural	77	49	63.6%
Intraventricular	36	15	41.6%
Subarachnoid	116	76	65.5%
Subgaleal	12	6	50%

Table 7: Type of fracture and % associated with haemosinus.

Type of fracture	No. of patient	Patients with haemosinus	Percentage
Linear vault	80	6	7.5%

Depressed vault	26	3	11.5%
Base of skull	14	1	7.1%

Table 8: Type of fracture and % associated with pneumocephalus.

Type of fracture	No. of patient	Patients with pneumocephalus	Percentage
Linear vault	80	12	15%
Depressed vault	26	4	15.3%
Base of skull	14	1	35.7%

Table 9 Site of fracture in 164 patients.

Site	no. of patient	percentage
Parietal bone	45	22.5%
Frontal bone	38	19.1%
Temporal bone	36	18%
Occipital bone	37	37%
Base of skull	08	8%
Total	164	82% of total patient (200)

Table 10: Clinical prognostic factor in traumatic brain injury during RTA.

Prognostic	No. of	Glasgow outcome score					Percentage of
Factor	Patient.	I	II	III	IV	V	Unfavorable outcome (%)
HypotensionPresent	79	2	0	17	31	29	24%
Absent Hypoxia	121	6	0	19	42	54	20%
Present	83	5	0	16	15	47	28%
Absent	117	3	0	13	18	83	13%
TreatmentOperative	179	7	0	63	67	42	39%
Non- operative	21	1	0	2	14	24	14%

The demographic characteristics such as age were divided into groups. The first group ranged between 0 - 10 years, second group ranged between 11 to 20 years, third group ranged between 21 to 30 years, fourth group ranged between 31 to 40 years, fifth group ranged between 41 to 50 years, sixth group ranged between 51 to 60 years, seventh group ranged between 61 to 70 years, eighth group ranged between 71 to 80 and last group aged between 81-90. Considering road traffic accident the most common affected age group ranged between 61 to 70 years (23%) followed by 51 to 60 years (22.5%) whereas the least common age group affected by road traffic accident ranged between 11 to 20 years (2.5%). The different range of age group is shown in table 1. Among 200 patients males were 154 (77%) affected more than female 46 (23%).

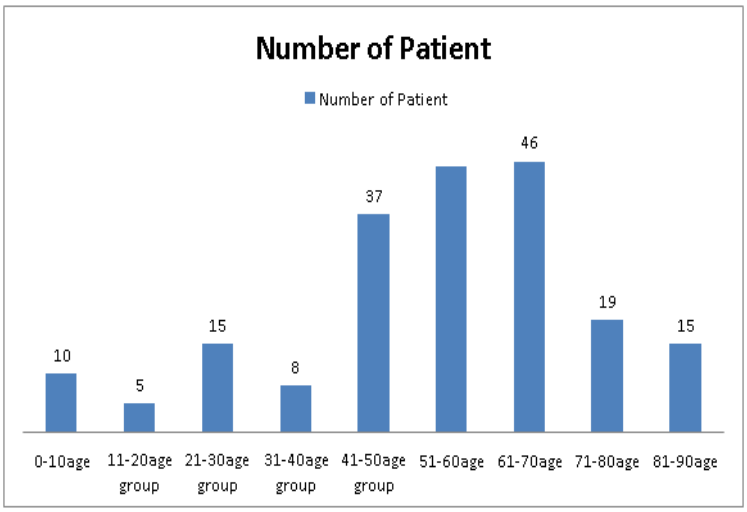

Figure 2: Bar diagram showing age group affected by RTA.

Fracture associated with RTA

Bone fracture was divided into three different type namely linear fracture, depressed fracture and basilar fracture. The most common fracture was linear fracture which was present among 79 patients (39.5%) followed by depressed fracture which was seen among 29 patients (14.5%). The least common fracture was basilar which was present among 14 patients (7%). The frequency of

fracture among two hundred road traffic accidents is shown Figure 2.

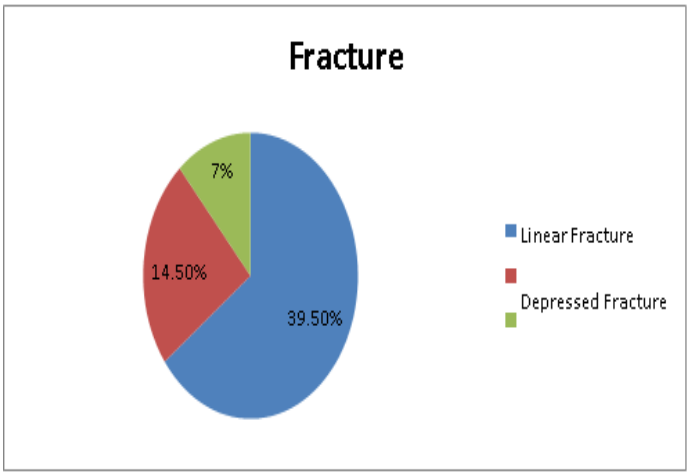

Figure 3: Pie chart showing different types of fracture associated with RTA.

Looking at the site of fracture among RTA patients, it is seen that frontal bone fracture is the most common fracture which was seen in 45(22.5%) of patients. The second affected bone fracture was parietal bone which was seen in 38 (19%) patients followed by occipital fracture which was seen in 37(18.5%) patients and temporal fracture which was seen in 36(18%). The least common fractures were base of skull bone which was 8(4%).

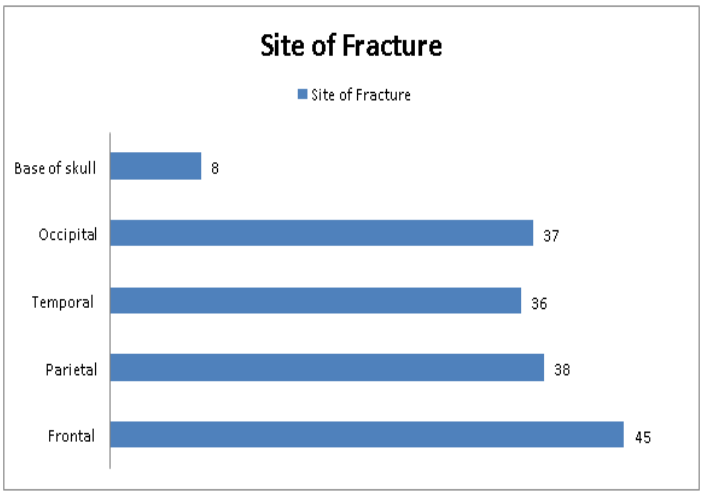

Figure 4: Bar graph showing site of fracture.

Table-11: showing site of fracture where x-axis shows the number of patients whereas y-axis shows the site of fracture associated with RTA. While comparing these fractures with different types of hemorrhage it is found that among 55 patients with epidural hemorrhage 46 (83.6%) patients were affected with fracture. Among 77 patients with subdural hematoma 49 (63.6%) were affected with fracture, among 116 patients with subarachnoid hemorrhage 76 (65.5%), among 36 patients with Intraventricular hemorrhage 15 (41.6%) were affected with fracture and among 12 patients with Subgaleal hemorrhage 6 (50%) were affected with fracture/

Table11: Showing fracture association with type of hemorrhage found in CT scanning of the patients following RTA.

Type of hemorrhage	Associated fracture
Epidural hemorrhage (n=55)	46(83.6%)
Subdural Hematoma (n=77)	49(63.6%)
Subarachnoid hemorrhage(n=116	76(65.5%)
Intraventricular hemorrhage(n=36)	15(41.6%)
Subgaleal (n=12)	6(50%)

Comparing different types of fracture association with different age group of the patients following RTA showed most of the patients affected with fracture are between the age of 51-60 and 61-70 years followed by age group 31 to 40. 32 (57.7%) patients from the age group 21-30 years were affected by linear fracture, 13 (23.2%) patients were from 10 to 20 years of age and 11 (19.6%) were from 31 to 40 years. Considering depressed fracture, 7 (26.9%) patients from age group 41 to 50 years were affected with depressed fracture, 6 (23.07%) from the age 61 to 70 years, 3 (11.5%) from the age 51 to 60 years and 3 (11.5%) patients were from 71 to 80, 2(7.7%) patient were from 31 to 40years and 1(3.8%) patient were from 0 to 10, 11 to 20 and 81 to 90 years of age group

DISCUSSION

Demographic characteristics Head injuries worldwide are an important public health problem due to the nature of injuries sustained and the long term morbidity and disability that subsequently results from the injuries. Majority of patients in the study were young adults with males outnumbering females. 77% of patients were male and 23% were female (male to female ratio- 3.3:1). These findings are comparable to previous studies which reported ratios of males to females to range from 76.6% (male) and (25.4%) as female,(male to female ratio was 3.01:1) reported in eastern china in 2004[19]. The high incidence in the males is due to the nature of the risks they take and the young population is due to the active nature of the work they do. This is an important public health issue as economic loss to the families and the country is enormous. The patients who were not brought to hospital (40 patient i.e. 20%) within first 8hrs of trauma were less than patient who were brought to the center within first 8hrs of trauma (160 patient i.e. 80%).20% of patient that was not brought within first 8 hrs of trauma may be due to the fact that the hospital is along a busy highway hence most accident victims would be brought there. The hospital also serves as a referral center and injuries that occurred far from the hospital. The referred patients were from various part of the city Jingzhou. Similar studies has been done in china before here is the chart from 1980-2005 of trends and increase in road traffic accident in china and also compared with different in which china has leading number of RTA and death occurred.

Radiologic patterns

The most common CT finding subarachnoid at 58%, of which 42%cerebral contusion, was the commonest followed by subdural hematoma at 38.5%, followed by epidural hematoma at 27.5 and Intraventricular at 18%. There were hematoma associated with fractures and contusion. This may be due to the nature of the cause of injury, the location of the trauma to the skull and/or secondary effects of the primary injury.

Linear skull fractures were the leading among the skull fractures at 39.5% followed by depressed skull fracture with 14.5% and basilar fracture in 7% of the patient. When a low energy blunt trauma affects a wide surface area of the skull it causes linear fracture. Linear skull fractures were seen comparatively higher in number.

Acute Sub-dural hematoma accounted for 38.5% of the study population and most were also found to be due to public vehicle injuries on highway. Most of the patients were in the age group 21-70yrs and this was likely due to their occupation and travelling activities among this age group.

A significant number of patients (15%) had cerebral edema and this resulted in increased intracranial pressure worsening the level of consciousness of the patients. This was observed from their Glasgow Coma Scale which was mainly below 8/15. This was similarly demonstrated by previous studies which showed that the findings of intracranial pathology were associated with the period of loss of consciousness mainly due to the cerebral edema, being worse the longer the period of loss of consciousness.

Historically imaging of the head-injured patient relied on skull radiographs but studies have shown that the use of skull radiographs in evaluation of patients with head injury may miss a significant number of intracranial lesions and thus CT Scanning has become the diagnostic study of choice.[12,13] In the present study, CT scan was utilized in demonstrating the intracranial lesions.

The level of severity among the patients who were in the extremes of age (very young and in the elderly) was noted to be worse compared to the middle aged patients and was found to be significant. This was comparable to previous studies which showed that the very elderly and very young patients when they get head injury, they have more severe head injuries with lower Glasgow coma scale. This may be attributed to the frailties of advanced age, pre-existing systemic disease, alterations in haemostatic mechanisms and change in viscoelastic properties of the brain among the[14] elderly and the developing brain in the very young which is delicate and sensitive to any insult on it giving more severe head injuries.[15]

No gender variation was seen as regards the level of severity in relation to the cause of head injury and this could be attributed to random occurrence of the injury. This was similarly shown in a study in Malaysia by Chan et al. The correlation between severity of head injury and the cause and CT findings showed a linear relationship and the more the intracranial CT Findings, the more the severity of the head injury. This may be because the more the intracranial findings detected on head CT, the more the structures involved and the worse the cerebral edema, and thus the more worse the severity of the head injury.

CONCLUSION

Head injury remains an important public health problem accounting for a substantial proportion of all trauma admissions at Central hospital, Jingzhou, China. RTA was the leading and significant cause of head injury.

The commonly affected were middle aged in their productive years with males more affected compared to females. The patients from age 41-70 were mostly affected among whom patient from age 61-70 were comparatively high. Various signs and symptoms like age of patient, Glasgow coma scale, vitals of patient and pupillary reaction were all shown to be significant predictors of patient condition and prognosis after head injury. Apart from this in the acute emergency situation, CT scan brain is a classical radiological modality to define status of head injury patient and very helpful to treat the head injury patients in golden hours without wasting more time. The most common CT scan finding in this series was SAH. Brain lesions occurred even if there was no visible fracture and lesions might be missed if CT scan was not done. Most patients with low GCS had bad prognosis as unfavorable outcome. CT scan depicts various findings and these vary depending on the nature of the injuries sustained. Preventive measures to reduce car and public vehicle accidents on highway are necessary to reduce the incidence of head injuries in this region. Increased public awareness and early imaging by CT aids in detection of the intracranial injuries early enough within golden period thus facilitating early treatment of the patients.

The high incidence of CT scan finding in head trauma justifies the use and importance of CT scan in traumatic brain injury during road traffic accident (RTA).

REFERENCE

1. Alfageeh M, Bahran M, Albargi S, et al. CT Scan importance in the first eight hours of head injury, 2018; 5(4): 766-771.
2. Davis PC, Imaging N, Criteria O. Appropriateness criteria, 2007; 1619-1621.
3. Coles JP. Imaging after brain injury, 2007; 99(1): 49-60. doi:10.1093/bja/aem141
4. Kim JJ, Gean AD. Imaging for the Diagnosis and Management of Traumatic Brain Injury, 2011; 8(January). doi:10.1007/s13311-010-0003-3
5. Rosen CB, Luy DD, Deane MR, Scalea TM, Stein DM. Routine repeat head CT may not be necessary for patients with mild TBI, 2018; 1-5. doi:10.1136/tsaco- 2017-000129
6. Mutch CA, Francisco S, Talbott JF, Francisco S, Gean A, Francisco S. HHS Public Access, 2017; 27(4): 409-439. doi:10.1016/j.nec.2016.05.011.Imaging
7. Wintermark M, Sanelli PC, Anzai Y. Imaging Evidence and Recommendations for Traumatic Brain Injury : Conventional Neuroimaging Techniques, 2015; (1): 1-14. doi:10.1016/j.jacr.2014.10.014
8. The IN, States U. Traumatic Brain Injury, 2006.
9. Brandstack N. Detection of pathologic changes followings traumatic brain using MRI *By*., 2013.
10. Scale GC. The New England Journal of Medicine Indications for CT in patients, 2000.
11. Article O, Ahmad S, Afzal A, Rehman L, Javed F. Impact of depressed skull fracture surgery on outcome of head injury patients, 2018; 34(1): 130-134.
12. Gan BK, Paed MM, Uk M, Lim JHG, Ng IHB, Edin F. Outcome of Moderate and Severe Traumatic Brain Injury Amongst the Elderly in Singapore, 2004; 33(1): 63-67.
13. Itanyi DU. Computerized Tomography Imaging Features of Head Injury in Abuja, Nigeria's Capital, 2017; 20(6): 1-9. doi:10.9734/BJMMR/2017/31880