Original article

Evaluation of incidence various types of brain injuries in patients with head trauma with the help of computed tomography" a prospective study

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ABSTRACT:

Trauma constitutes one of the most important causes of morbidity & mortality in modern world. Concerted efforts must be made to improve the clinical outcome of each individual patient with head injury. This can only be accomplished if we can define more accurately the true extent of initial brain injury, achieve a better understanding of different types of traumatic lesions and develop more focused and effective means of treatment and rehabilitation. Immediate and instantaneous death following cranial trauma occurs due to unpreventable primary brain injuries. However, death occurring within 24 hours of cranio-cerebral trauma can be averted by timely institution of diagnostic and therapeutic measures. CT is the single most informative diagnostic modality in the evaluation of a patient with a head injury. With modern scanners CT brain can be accomplished in about 7 to 8 seconds. Besides facilitating rapid implementation it can demonstrate significant primary traumatic injuries including extra-dural, Subdural, intra-cerebral hematomas, subarachnoid and intra-ventricular hemorrhages, skull fractures, cerebral edema, contusions and cerebral herniations . This study highlights the role of CT in early diagnosis & localizing various brain injuries in patients with head injury.

INTRODUCTION

Trauma constitutes one of the most important causes of morbidity & mortality in modern world. Concerted efforts must be made to improve the clinical outcome of each individual patient with head injury. This can only be accomplished if we can define more accurately the true extent of initial brain injury, achieve a better understanding of different types of traumatic lesions and develop more focused and effective means of treatment and rehabilitation.

Immediate and instantaneous death following cranial trauma occurs due to unpreventable primary brain injuries. However, death occurring within 24 hours of cranio-cerebral trauma can be averted by timely institution of diagnostic and therapeutic measures. In addition it could help in preventing secondary brain insults. Prompt recognition of treatable injuries is critical to reduce mortality and CT of the head is the cornerstone for rapid diagnosis[1]. CT is the single most informative diagnostic modality in the evaluation of a patient with a head injury. With modern scanners CT brain can be accomplished in about 7 to 8 seconds. Besides facilitating rapid implementation it can demonstrate significant primary traumatic injuries including extra-dural, Subdural, intra-cerebral hematomas, subarachnoid and intra-ventricular hemorrhages, skull fractures, cerebral edema, contusions and cerebral herniations[2].

This study highlights the role of CT in early diagnosis & localizing various brain injuries in patients with head injury.

Methodology:

Source of Data

The present study was carried out on patients with head injury referred to Department of Radio-diagnosis during a period from February 2013 to August 2014.

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Sample Size

The study comprised a total of one hundred and fifty patients with head injury who were admitted in Sassoon General Hospital.

Inclusion Criteria

1. Patients of all age groups with traumatic intracranial hemorrhage.
2. Intracranial hemorrhage that has occurred within 24 hours.
3. Glasgow coma scale <14.
4. Patients with intracranial hemorrhage treated as in-patients.

Exclusion Criteria

1. Patients with clinical suspicion of intracranial hemorrhage but with no positive CT findings
2. Cranial trauma during childbirth.
3. Glasgow coma scale >14.
4. Patients with non traumatic intracranial bleed.
5. Patients who could not be followed up

A complete clinical history of the patients was noted on a proforma, which included, age sex, type of injury, principal presenting complaints. The type of trauma was further classified into Road traffic accidents, falls, assaults, industrial accidents and miscellaneous.

After initial resuscitation, severity of the intracranial hemorrhage was graded with the help of "Glasgow Coma Scale" (GCS).

Eye opening

Spontaneous 4
To sound 3
To pain 2
Never 1

Verbal Response:

Oriented 5
Confused Speech 4
Inappropriate Words 3
In comprehensible sounds 2
Never 1

Motor response

Obeys commands 6
Localizes pain 5
Normal flexion (withdrawal) 4
Abnormal flexion 3
Extension 2
Nil 1

Rating:

Mild head injury ....GCS of 13-15
Moderate head injury ....GCS of 9-12
Severe head injury ....GCS of 8

The patients were scanned on 64 rows 128 slice CT scanner Somatom Definition AS + Configure.
Matrix size-512, Slice thickness - 10 mm, 5 V-80 to l30. MAS - 50 to 270

CT PROTOCOL

The patient was instructed to lie on the CT table in supine position with arms resting along the body. The patient's head was correctly placed in the head holder and support was provided for the legs.

TOPOGRAM: Lateral, 256 mm.

SCAN MODE: Sequential

Scan Parameters

Scan mode	Sequence
kV	120
mAs	380
Rotation time (s)	1.0
Detector Configuration (Acquisition/ Collimation) (mm)	24 x 1.2
Dose modulation (CareDose)	no
Scan length (mm)	138
Scan time (s)	1.0
CTDI-vol (mGy)	53.0
Reconstruction	
Kernel	H31s
Slice (mm)	4.8
Position increment (mm)	--

Figure.1: Scan parameters

Gantry tilt was done after the examination of the cervical spine ruled out any evidence of injury. The gantry tilt was given in the range of ± 0-20 degrees, so as to parallel the scan plane to the orbito-meatal line.

Bone algorithms & wide window settings were studied to visualize the various intracranial hemorrhages.

Statistical methods

Rates, ratios and percentages of different diagnosis and outcome made by Computed tomography were computed and compiled. Chi square test was used for comparison of CT findings of different variables and P value was calculated.

Results

A total of one hundred and fifty patients of head injury who had intracranial hemorrhage on CT scan were included in the present study.

In the present study, the peak incidence of head injury in males occurred in the age group of 21-30 i.e. 40 patients (32.26%).Incidence in other age groups being 14 patients (11.29%) in 0-10, 15 (12.09%) in 11-20, 28 (22.58%) in 31-40, 13 (10.48%) in 41-50, 10 (8.07%) in 51-60 and 04 in (03.23%) patients aged above 61.

Even in females the peak incidence occurred in 21-30 age group i.e. 10 patients (38.46%).The other age groups being 04 (15.39%) in 0-10, 02(7.69%) in 11-20,04 (15.39%) in 31-40 , 02 (7.69%) in 41-50, 51-60 and also in patients above 61 years

According to statistical analysis, RTA was found to be the commonest mode of head injury with an incidence of 98 patients (65.34%) followed by other modes of injury such as falls with an incidence of 40 patients (26.67%), assaults 06 (4.%) and miscellaneous 06 patients

(4.%).According to the study, commonest type of fractures associated with head injury were linear fractures accounting for 67(72.04%), followed by depressed fractures 18(19.35%) and skull base fractures 8(8.61%). In the present study cortical contusions of brain were the commonest intracranial lesion noted in 66 patients (44.00%) and fractures were the commonest of all lesions accounting for 93 cases (61%). Other lesions which were seen on CT scan are Cerebral edema 65 (43.30%), Midline shift 59 (39.9%), Subdural hematoma 58 (38.6%), Extradural hematoma 43 (29%), Intracerebral hematoma 28 (19.3%), and Intraventricular hemorrhage 06 (4%) and pneumocephalus 27 (18%).

Discussion

A total of 150 patients with head injury with positive findings on CT scan were included in the study.

Table-1: Comparative studies of sex distribution

Authors	**Male (%)**	**Female (%)**
Masih Saboori et al (2007)	78.20	21.80
James F Holmes et al (2006)	65.00	35.00
Kalsbeck et al	59.00	41.00
Zimmerman RA	79.00	21.00
Present study	82.60	17.30

Males were found to be more predominant than females in the present study. Incidence reported in other studies were Kalsbeck[3] 59%, Zimmermann et al[4] 79%, James F Holmes et al[5] 65%, Masih Saboori et al[6] 78.2%. This male preponderance can be attributed to the increased outdoor activity and travel by males. In the present study patients in the age group of 21-30 yrs formed the bulk of the study. Study by Ogunseyinde AO et al[7] also stated that head injury was common in patients younger than 35 yrs. Fary Khan et al[8] (2003) in their study mentioned that peak incidence of traumatic brain injuries were between 15-35 years age group and Masih Saboori et al[6] (2007) reported a mean age of 29yrs for patients of head injury. By the studies it is noted that head injury is seen commonly in socially and economically productive age group of the population and hence has an impact on the financial aspect of the family.

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Table-2: Comparative studies of Road Traffic Accidents

Author	Road Traffic Accident (%)
Igun GO et al	72.00
Masih Saboori et al	88.20
Zimmermann	39.00
Present study	65.34

Road traffic accidents were found to be the commonest mode of injury in the present study accounting for 65.34%. Zimmermann et al[4] also reported RTA as the major cause albeit at a lesser population (39%). Igun G O[9] in his study reported vehicular accidents as the major mode of head injury with an incidence of 72% and Masih Saboori et al[6] reported incidence of 88.2%. This increased incidence due to RTA can be attributed to the increased vehicular movement in cohesion with the population explosion. The findings of our study are comparable to that of other workers.

In the present study, patients classified as severe head injury with a GCS score of <8 formed the bulk of the study accounting for 41.3 followed by 32% of patients with mild head injury with GCS score of 13-14. This increase in incidence of severe head injury seen is probably due to exclusion of patients with normal CT findings in the present study conducted.Many studies were conducted to predict the usefulness of CT scan in a patient with minor head injury. In this respect DrProflan G Steill et al[10] came up with the Canadian CT head rule which consists of five high risk factors which are

(1) failure to reach GCS of 15 within 2 hours, (2) suspected open skull fracture, (3) any sign of basal skull fracture,(4) vomiting 2 episodes, (5) age 65 years) and two additional medium-risk factors (amnesia before impact >30 min and dangerous mechanism of injury). The high-risk factors were 100% sensitive and medium-risk factors were 98.4% sensitive for predicting clinically important brain injury.

Contusion was found to be the commonest lesion detected on CT accounting for 44% in the present study. Dublin[11] also reported similar observation (40%).

Table-3: Comparative studies of Incidence of Subdural Hematoma

Author	SDH (%)
Masih Saboori et al	34.70
Igun GO et al	60.00
Ogunseyinde AO	28.70
Present study	38.60

Subdural hematoma was found in 38.6% in the present study. Incidence reported in other studies were Masih Saboori et al[6] (34.7%), Igun GO (60%), Ogunseyinde AO et al[7] (28.7%). Intra cerebral bleed accounted for 14.3% of lesions in the present study, whereas a slightly higher incidence of 26.3% was noted in the study conducted by Ogunseyinde AO et al[7]. Intra-ventricular hemorrhage was the least common lesion noted with an incidence of 4% in the present study. Le Roux PD et al[12] (1992) and Lee J.P et al[13](1991) in their studies had stated that IVH is noted in 1% to 5% of all patients with head injury. Traumatic IVH is thus relatively uncommon and usually reflects severe injury.

Extra-dural hematoma was found to be associated with an overlying fracture in 93.02% of cases in the present study. Igun GO[9] reported 100% association of EDH with an overlying fracture. A blow to the calvarium resulting in fracture of the adjacent bone causes displacement of dura away from the inner table of skull resulting in damage to underlying vessel thus causing extra-dural hematoma. The commonest hemorrhage found in patients who expired was intracerebral with an incidence of 58%. This can be attributed to the more severe impact of trauma to cause the hemorrhage and also the significant midline shift noted in these patients leading to a grave prognosis. Subdural hematoma was seen in 46% of patients who expired. Cooper et al[14] in his study stated that mortality due to subdural hematoma was between 35% to 50%. SDH is also associated with worse outcome because it generally is caused by high velocity injuries resulting in more primary brain injury. Our study showed similar results. EDH was seen in only 7.5% of patients who expired. Bricolo A.P et al[15] and Smith HK et al[16] in their studies stated that mortality with EDH is approximately 5%. Since EDH is usually associated with low velocity injury, it results in little primary injury to brain and causes poor outcome only if the expanding hematoma is allowed to compress the brain. Here also the findings of our study were similar to that of other workers.

Discussion:

Head injury causes more deaths and disability than any other neurologic condition before age 50 and occurs in >70% of accidents, which are the leading cause of death in men <35 year old. Neuro imaging techniques provide some of the most important diagnostic, prognostic, and pathophysiological information in the management of brain injury. Beside the correct diagnosis itself, the time

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to establish a diagnosis above all has a crucial impact on successful management and good outcome of these patients. Remarkable advances have occurred in the last few decades in the management of patients with head injury. CT has spearheaded these advances by providing a rapid method for detecting most treatable forms of head injury because Computed tomography is a simple, inexpensive, highly effective and safe imaging modality and provides the ability to rapidly evaluate patients with acute head injuries. CT aids in surgical planning, prognosticating outcome and recovery time. It can demonstrate significant primary traumatic injuries including extradural, subdural, intracerebral hematomas, subarachnoid and intra-ventricular hemorrhages, skull fractures, cerebral edema, contusions and cerebral herniations. CT is one of the most comprehensive diagnostic modality for accurate localization of the site of injury in trauma to head. One of the greatest advantages of CT is that modern CT scanners can assess a head injury patient in minutes, allowing prompt diagnosis of expanding intracranial hematomas and thereby facilitating early surgical intervention. This fast examination time, wide availability, lack of contraindications, and high accuracy for detecting hemorrhage have made CT the diagnostic study of choice for initial evaluation of head injury patients . This is likely to be true for the immediate future, especially for the patient with multiple-organ trauma.The disadvantage of CT is that it may miss a significant number of findings. This is where MR, however, is beginning to contend for this role. Factors that limit the more widespread use of MR as the primary diagnostic study for evaluation of trauma patients are greater cost, lesser availability, slightly longer examination time, greater difficulty of patient monitoring, lower accuracy for detecting fractures, and physician unfamiliarity with the MR appearance of traumatic lesions .

Conclusion:

These limitations have been greatly reduced during the last few years and now offer little impediment to the use of MR for evaluating head injury patients.

Table-4: Sex wise Distribution in intracranial hemorrhage

Sex	No. of Cases	Percentage
Male	124	82.60
Females	26	17.30
Total	**150**	**100.00**

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Figure-2: Sex wise Distribution in intracranial hemorrhage

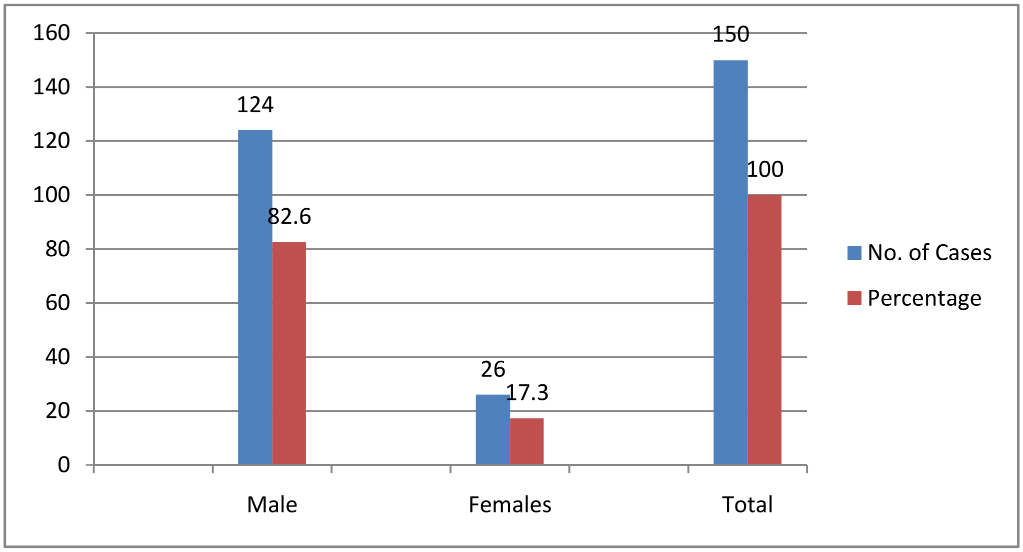

Table-5: Incidence of Different Modes of Injury

Type Of Injury	No. of Cases	Percentage
Road traffic accident	98	65.34
Fall	40	26.67
Assault	06	4.00
Others	06	4.00
Total	**150**	**100.00**

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Figure-3: Incidence of Different Modes of Injury

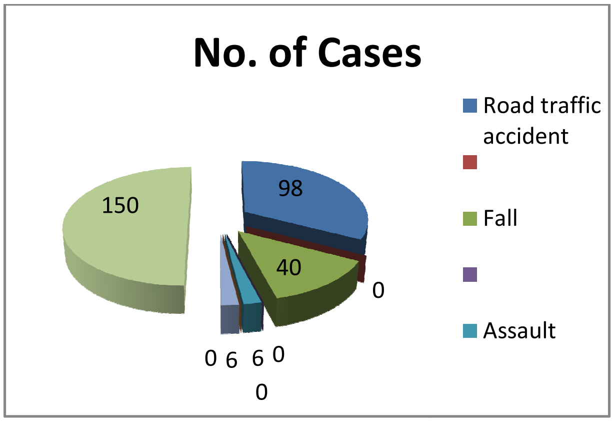

Figure-5: Hemorrhagic contusion in left temporal lobe

Figure-6: Large Subdural hematoma along left cerebral hemisphere with midline shift.

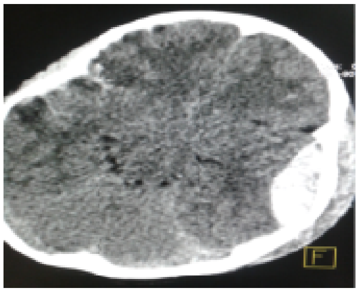

Figure-7 Large extradural hemorrhage in left parietal region with SAH along right sylvian fissure with extracranial soft tissue contusion in left parietal region

Figure-,8: Extensive peri-mesenchephalic Subarachnoid hemorrhage with intraventricular extension

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