



## Role of Multi-Detector Computed Tomography in Evaluating Traumatic Brain Injuries in Taif City, Kingdom of Saudi Arabia

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Traumatic brain injury (TBI) represents a major percentage of admissions to hospital due to frequent trauma to this region and is considered a life-threatening situation because of that, MDCT is necessary to provide rapid diagnosis and best management that leads to successful treatment. Multi-detector Computed Tomography (MDCT) has a critical and significant role for early evaluation and patient triage. This study aimed to evaluate the findings that occur due to head injuries using MDCT. An analytical retrospective study of 200 patients with head injuries were examined by MDCT, the study extended from January 2023 to December 2023. 128 slices MDCT system (Siemens Medical system) were applied to investigate patients with head trauma at King Abdul-Aziz Specialist Hospital (KAASH) in Taif City, Saudi Arabia. A total of 200 head trauma 136 (68%) males and 64(32%) females, were examined via head MDCT presented with various types of head trauma. The findings have noticed that brain injuries were significantly higher in the male population (68%) than in the female population (32%). Based on age groups, the incidence percentage of TBI was 34%, occurring in the age group 18-27 years. The most common cause of injury in patients presenting with head trauma was road traffic accidents (RTA), comprising 63% of cases. The isolated skull fracture was most frequently seen at 35%. Our study reveals that Subdural hematoma (52%) was the most frequent lesion noted in traumatic patients. On-enhanced computed tomography (NECT) is considered the gold standard and the most informative diagnostic modality in the evaluation of Traumatic brain injuries and it is essentially to triage patients to observation, surgical or medical management.

**Keywords:** Traumatic brain injury (TBI), Trauma, Multi-detector Computed tomography (MDCT), Fractures, Head injury, Road Traffic Accident (RTA).

### INTRODUCTION

Multi-detector Computed Tomography (MDCT) is a crucial modality that provides detailed and accurate information regarding normal and abnormal that may occur in the human being which help in the diagnostic field and guide the physician team to plan and decide the best patient's treatment in a fast and easy way. MDCT is considered a significant and proper modality that is used in the case of traumatic patients because of the less time it takes to scan the patient especially those who are considered as lifesaving (Riegor et al. 2002).

This study aimed to evaluate the findings that occur due to head injuries using MDCT, by the way to determine the main causes of brain injuries.

In head injury, Computed Tomography is the single most informative diagnostic modality in the evaluation of

head trauma. Besides facilitating rapid implementation, it can demonstrate significant primary traumatic injuries. Additionally, the Contribution of CT is crucial to complete injury assessment and forms the basis of patient management (Riegor et al. 2002). Early recognition of treatable injuries is critical to reduce mortality and CT of the head is the keystone for rapid diagnosis (Servadei et al. 2000).

Traumatic brain injury (TBI) represents a major percentage of admissions to hospital due to frequent trauma to this region and is considered a life-threatening situation because of that, MDCT is necessary to provide rapid diagnosis and best management that leads to successful treatment (Ahmad. et al. 2014).

Road traffic accident is one of the common cause that lead to brain injury has been reported by the World

Health Organization (WHO) that road traffic crashes make up to 25% of all injuries and is one of the major contributors to mortality and morbidity, accounting for more than 1.27 million deaths internationally (Naeem 2010 & Ansari et al. 2000).

In the Kingdom of Saudi Arabia (KSA), RTAs contribute to 81% of deaths in hospitalized patients (Currie. et al. 2016). Furthermore, a study revealed that brain injuries account for 30% of all injuries, contributing to 26% of deaths in KSA (Bokhari et al. 2015).

Currently, MDCT is the optimal procedure over MRI because it is faster and more readily available and it more easily accommodates emergency equipment and can easily enable, the recognition of blood during the acute period (Stein et al. 2008). Head CT is a significant method to assess the extent of cerebral injury and it is an essentially aid to triage patients to observation, surgical, or medical management. Furthermore, MDCT reveals the pattern and severity of structural brain damage after head injury. For this, the study intended to evaluate TBI by using MDCT in Taif City, KSA, and determine the common causes of these traumas (Stein et al. 2008).

Traumatic brain injury (TBI) represents a major percentage of admissions to hospital due to frequent trauma to this region and is considered a life-threatening situation because of that, MDCT is necessary to provide rapid diagnosis and best management that leads to successful treatment (Newberg and Alavi 2003).

Road traffic accident (RTA) One of the common causes that leads to brain injury has been reported by the World Health Organization (WHO) that road traffic crashes make up to 25% of all injuries and are one of the major contributors to mortality and morbidity, accounting for more than 1.27 million deaths internationally (Naeem 2010 & Ansari et al. 2000).

In the Kingdom of Saudi Arabia (KSA), RTAs contribute to 81% of deaths of hospitalized patients (Currie. et al. 2016). Furthermore, a study revealed that brain injuries account for 30% of all injuries, contributing to 26% of deaths in KSA (Hassan et al. 2005).

## MATERIALS AND METHODS

A retrospective study, done in 200 Patients who are suffering from brain injury including both genders (male and female) with their ages ranging from 18 to 67 years old. The aim of this study is to describe and determine the role of MDCT in the evaluation of TBI in Ta'if City, KSA. This study will be conducted on the Radiology department of King Abdul-Aziz Specialist Hospital (KAASH) in Ta'if City, KSA. The duration of this study is from 1 January 2023 to 31 December 2023. The equipment used is any CT machines installed in selected hospitals that will include (General Electric (GE) healthcare light speed, Philips medical system, and Siemens) of 128 slices. Preparation of the patient and technique or protocols, no specific preparation is needed

because data will be obtained from the Picture Archiving and Communication System (PACS) of the selected Hospital. The techniques for the head brain CT include AP and lateral scout are taken then the axial or helical scan from the vertex down to the skull base after that gantry will be angled parallel to the supraorbital meatal line (avoid lens of eyes) and these algorithms are applied (Standard Window settings: 140 WW/40 WL, posterior fossa; 90 WW/35 WL, Bone 4000 WW/400 WL).

The data will be analyzed professionally by using an excel version 16.Program and statistical program Statistical Package for the Social Sciences (SPSS) version 23.And presented in the form of a table and suitable charts. This research will be done effectively and scientifically then the final results will be published for sharing benefit information. Consent and acceptance are taken before data collection.

### Inclusion criteria:

Traumatic patients with brain injuries. The patient's age ranges from 18 years to 67 years old.

### Exclusion criteria:

Normal patients and patients with a history of trauma or who had an operation before. Patients that are unstable and require emergency treatment.

Enhanced image with contrast media.

## RESULTS

The result of a retrospective study conducted in KAASH hospital in Taif City, KSA, on a total of 200 patients who were referred to the radiology department for traumatic brain injury and requested do CT brain between 01 January 2023 to 31 December 2023.

### Study sample classification according to age and gender.

In this retrospective study, a total of 200 head trauma 136 (68%) males and 64(32%) females, were examined via head CT and presented with various types of trauma. The findings have noticed that brain injuries were significantly higher in the male population (68%) than in the female population (32%). Based on age groups, the incidence percentage of TBI was 34%, 17%, 16%, 22.5% and 9.5% for age ranges 18-27 years, 28-37 years, 38-47 years, 48-57years and 58 -67 years, respectively with a mean age of 40. (see table1)

**Table 1: Distribution of the study sample according to gender and age**

| Variable          | Frequency | Percent % |
|-------------------|-----------|-----------|
| Gender            |           |           |
| Male              | 136       | 68 %      |
| Female            | 64        | 32 %      |
| Age range (years) |           |           |
| 18-27 y           | 70        | 34 %      |
| 28-37 y           | 34        | 17 %      |

|                         |      |        |
|-------------------------|------|--------|
| 38-47 y                 | 32   | 16 %   |
| 48 -57y                 | 45   | 22.5 % |
| 58 -67y                 | 19   | 9.5 %  |
| Mean age                | 40   | 20 %   |
| Standard deviation (SD) | ± 17 |        |

**Distribution of the study sample according to the mode of head injury**

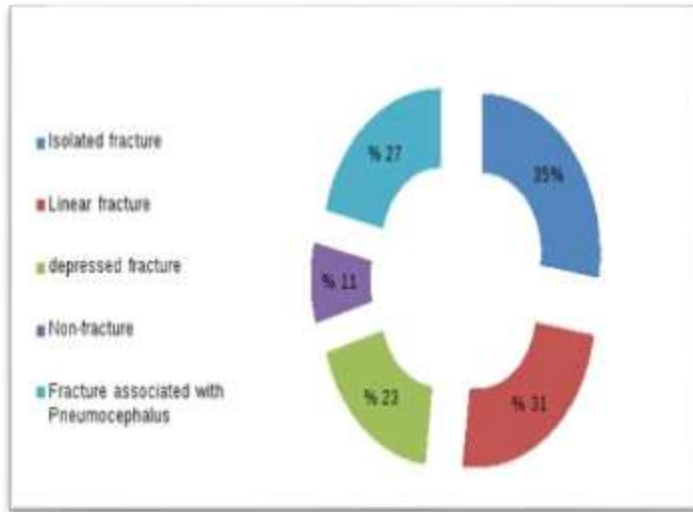
According to statistical analysis, RTA was found to be the frequent mode of head injury with an incidence of 126 (63%) followed by other modes of injury such as falls with an incidence of 36patients (18%), assaults 26 (13%) and miscellaneous 12 patients (6%). (see table2)

**Table 2: Incidence of Different Modes of Injury**

| Type of Injury | No. of Cases | Percentage |
|----------------|--------------|------------|
| RTA            | 126          | 63%        |
| Fall down      | 36           | 18%        |
| Assault        | 26           | 13%        |
| Other          | 12           | 6%         |

**Distribution of the study sample according to the Association of Fractures in patients of traumatic head injury**

In our series, we had 70 isolated skull fractures, 62 linear, 47 depressed fractures, and 54 fractures associated with Pneumocephalus



**Figure 1: Distribution of the study sample according to the Association of Fractures in patients of traumatic head injury.**

**Distribution of the study sample according to the Incidence of various hemorrhages in traumatic patients**

According to the present study, Subdural hematoma (52%) was the most common lesion noted in traumatic patients, followed by Subarachnoid hemorrhage (32 %). Epidural hemorrhage (8.5%) was the least common

lesion noted in these patients

**Table 3: Incidence of various hemorrhages in patients**

| Type of hemorrhages       | No. of Cases | Percentage |
|---------------------------|--------------|------------|
| Epidural hematoma         | 17           | 8.5 %      |
| intracerebral hematoma    | 39           | 19.5 %     |
| Intraventricular hematoma | 26           | 13 %       |
| Subdural hematoma         | 104          | 52 %       |
| Subarachnoid hemorrhage   | 64           | 32 %       |

**DISCUSSION**

Traumatic brain injury (TBI) represents a major percentage of admissions to hospitals due to frequent trauma to this region and is considered a life-threatening situation because of that, MDCT is necessary to provide rapid diagnosis and best management that leads to successful treatment (Ismail & Azez. 2018). Moreover, MDCT plays a significant role in the Diagnosis and management of TBI subsequently patient outcomes will improve add to that it's the optimum tool for fast and accurate revealing of hemorrhage in the early stage. Furthermore, MDCT is recognized as the investigation of choice since it precisely recognizes intracranial hemorrhage including extra-axial hemorrhage (epidural, subdural, and subarachnoid hemorrhage) as well as intra-axial hemorrhage (contusion, intra-parenchymal hematoma, and shear injury). It also identifies the evolution of hemorrhage and signs of secondary injury. Due to its quick results, easy availability, and sensitivity to hemorrhage (Stein et al. 2008). Hence, the Impact and contribution of CT are crucial to complete injury assessment and form the basis of patient management that will help to get Early recognition of treatable injuries consequently that will reduce sequels and mortality (Riegler et al. 2002& Servadei et al. 2000).

Road traffic accident One of the common causes that lead to brain injury has been reported by the World Health Organization (WHO) that road traffic crashes make up to 25% of all injuries and is one of the major contributors to mortality and morbidity, accounting for more than 1.27 million deaths internationally (Naem 2010 & Ansari et al. 2000).

In the Kingdom of Saudi Arabia (KSA), RTAs contribute to 81% of deaths of hospitalized patients (Stein et al. 2008). Furthermore, a study revealed that brain injuries account for 30% of all injuries, contributing to 26% of deaths in KSA (Currie. et al. 2016). However, TBI may be caused by interpersonal trauma, fall and workplace accident, and sports injury.

In the present study a total of 200 patients were referred with head trauma and injuries were found to be more common in the male population about 136 (68%) of cases compared to females 64 (32%) with a male: female ratio of 2.1 and common mode of injury was RTA

This result was in agreement with Suryapratap Singh Tomar et al. and the incidence of TBIs in our study was common among 18 – 27 years (34%) age group followed by 48 -57 years age group (22.5 %) and less common in 58-67 years age group (9.5%). Our study reveals that subdural hematoma (52%) was the most frequent lesion noted in traumatic patients, followed by Sub arachnoid hemorrhage (32 %) while Epidural hemorrhage (8.5%) was the least common lesion noted in these patients. Our findings were consistent with similar studies (Ann et al 2011), whereas Ashley et al. found intracerebral hematoma as the most intracranial bleed (Ogunsheyinde et al 1999).

According to the present study, the common fracture was observed an isolated skull fracture which represents 35%, followed by linear and depressed fractures which represent 31% and 22 % retrospectively. Whereas fractures associated with Pneumocephalus represented 27% which is consistent with studies conducted by Nithesh.

## CONCLUSIONS

Non-enhanced computed tomography (NECT) in TBI is considered as gold standard and the most informative diagnostic modality in the evaluation of these injuries. Besides facilitating rapid implementation, it can demonstrate significant primary traumatic injuries. Furthermore, MDCT is essentially to triage patients to observation, surgical or medical management. add to that MDCT reveals the pattern and severity of structural brain damage after head injury.

## Author contributions

Author 1, 2, and 3 collect the data by data collection sheets. Author 4, 5 and 6 analyze the data. Author 7, 8 and 9 achieve the discussion part of this article. All authors contribute in the final revision of this article.

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## Informed Consent Statement

Not applicable.

## Data Availability Statement

All of the data is included in the article.

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## Conflict of interest

The authors declared that present study was performed in absence of any conflict of interest.

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