INVESTIGATION OF ROAD TRAFFIC ACCIDENT TRAUMA CASES: OCCURRENCE AND DIAGNOSIS IN JEDDAH

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ABSTRACT

Objectives: Road traffic accidents (RTAs) are a leading cause of emergency department admissions, and Jeddah City is no exception. In this study, we conducted a comparative analysis of male and female patients who sustained injuries in RTAs, considering factors such as age, site of injury, and the optimal diagnostic modality, Computed tomography (CT) or X-ray radiography (XR), depending on the nature of the injury.

Methods: Data was collected retrospectively from the Picture Archiving and Communication System (PACS) at the Radiology Department of King Fahad General Hospital (KFGH). Collected data included patient demographics, injury locations, initial diagnostic modality employed and its findings, and any subsequent diagnostic modality used, if necessary. We investigated the appropriateness of the initial diagnostic modality for each type of injury by comparing the diagnoses obtained from the first modality with those of the second modality.

Results: Data from 200 patients (83.5%: males; 16.5%: females) was collected. Patients were categorized into four age groups: 16–23, 24–30, 31–60, and > 60 year old groups accounting for 28.5%, 32%, 36% and 3.5% of patients, respectively. The most common site of injury was polytrauma with 101 cases (50.5%), followed by head and spine injuries in 64 (32%) and 17 cases (8.5%), respectively. Notably, CT was the most commonly used first diagnostic modality, employed in 88.5% of cases; all cases of polytrauma injuries and the majority of head (93.8%) spinal (56.3%) and facial (71.4 %) injuries. Whereas radiography was primarily used for chest, lower, and upper limb injuries.

Conclusions: Based on our findings, we recommend CT as the initial diagnostic modality for patients with polytrauma, spinal injuries, and head injuries resulting from RTAs. However, radiography remains a valuable diagnostic tool when transporting patients to a radiology department or for follow-up purposes.

OPEN ACCESS

1. INTRODUCTION

Jeddah City, situated between the Holy Cities of Makkah and Madinah, is one of the primary urban centres in the Kingdom of Saudi Arabia. Unfortunately, as in many regions worldwide, road traffic accidents (RTAs) present a significant public health concern, resulting in substantial loss of life, injuries, and property damage. RTAs are the second major health concern in the Kingdom of Saudi Arabia. [1]

One striking consequence of RTAs is their significant contribution to the influx of patients into the emergency department (ED), with X-rya radiography (XR) imaging as a primary diagnostic tool. The number of imaging planes required depends on the patient's specific condition, such as the area of interest. However, obtaining additional images can be challenging, particularly in individuals with severe injuries. Computed tomography (CT) has emerged as a standard imaging method for assessing RTA trauma after initial XR imaging. Nonetheless, CT scanning is typically reserved for specific cases due to its high cost and associated exposure to radiation [2].

Therefore, this study aimed to conduct a comparative analysis of male and female patients with RTA trauma. This comparison considers variables such as age, injury site, and the most appropriate diagnostic modality, such as CT or radiography, based on the nature and location of the injuries.

1.1 X-ray and computed tomography in different RTA trauma

1.1.1 Chest trauma

Macri et al., conducted a study involving 160 patients with minor blunt thoracic trauma, initially assessed with chest radiography, followed by chest CT. They aimed to evaluate the diagnostic performance of CT compared to chest radiography for minor blunt thoracic trauma and found that CT detection of injuries (187 lesions) in 104 patients had 100% sensitivity and specificity. In contrast, chest radiography revealed abnormalities in 82 (79% of the total population) patients. Thus, CT is more accurate for the evaluation of minor blunt thoracic trauma [3]. In another study by Trau et al., 141 patients with severe blunt thoracic trauma underwent chest CT and radiography. This study sought to identify the clinical features associated with the additional diagnostic information provided by

CT scans compared with regular chest X-rays. CT scans were substantially more accurate than routine chest radiography in detecting lung contusions, pneumothorax, mediastinal hematomas, and fractures [4] . Similarly, Yazka et al. conducted a study on 83 patients with blunt chest trauma who underwent both chest radiography and CT. The primary objective of this study was to examine the diagnostic accuracy of rib fractures for blunt chest trauma. The results showed that chest CT is highly sensitive in identifying rib fractures and should be the preferred initial assessment method, whereas chest radiography may be suitable for follow-up evaluations [5].

1.1.2 Knee trauma

Avci and Kozaci conducted a study on patients with knee trauma who underwent XR imaging and CT. They assessed the accuracy of XR imaging compared with computed tomography (CT) in detecting knee bone fractures and characterizing the type of fracture. Their findings indicate that XR imaging has low sensitivity for characterizing knee fractures and fracture types. Consequently, CT is recommended for cases in which XR imaging cannot adequately identify the fracture characteristics of knee injuries [2].

1.1.3 Wrist trauma

In a study by Etli et al., involving 274 patients with wrist trauma, both XR imaging and CT scans were used to compare the accuracy in diagnosing fractures. XR imaging detected 66% (180 274) of injuries, whereas CT identified 72% (196 274). Therefore, XR is the primary modality for evaluating wrist injuries. However, if the fracture involves the joint space, CT imaging is recommended [6].

1.1.4 Head trauma

A study by Bibek, Khadka and Deka analyzed 80 patients with head injuries in the emergency room. The study found that early and accurate detection of lesions by CT significantly affected appropriate treatment, timely surgical intervention, and prognosis. Moreover, RTAs were the leading cause of head injuries, accounting for 65% of all cases [7].

1.1.5 Spinal trauma

Mehmood, Muhammad Sajid, et al. study, covering the period from 20 September 2014 to 20 March 2015 included 315 patients with various types and levels of spinal trauma. Falls were the most common causes of spinal injury (50%), followed by RTAs (41%). Radio-

graphs were used for the initial evaluation, however, CT scans provided a 360-degree view of the spine, vertebrae, and internal organs, offering valuable diagnostic insights [8].

1.1.6 Injury of the brachial plexus

Kaiser et al. found that patients impacted in vehicle crashes had a higher percentage of upper avulsions, and that male patients in traffic accidents were more common than female patients. This suggests a higher prevalence of brachial plexus injuries in traffic accident fatalities than in survivors [9].

2. MATERIALS AND METHODS

2.1 Study Design

This retrospective study aimed to assess the choice of diagnostic modality (CT or radiography) according to the specific area of injury in patients involved in RTAs. Prior to commencing this investigation, ethical approval was obtained from the Ministry of Health, which allowed us to gather essential data from King Fahad General Hospital (KFGH). KFGH was selected as the study site due to its status as the primary trauma centre in Jeddah.

2.2 Data Collection

A structured questionnaire was developed for data collection. Data were retrieved from the Picture Archiving and Communication System (PACS) at KFGH, between 14 October 2020 and 1 April 2021. The following information was gathered: patient demographics (site of injury, categorized as chest, spine, lower limb, or upper limb), initial diagnostic modality and corresponding results and any instances in which an alternative diagnostic modality was deemed necessary. Age category was divided upon life cycle grouping, starting from the age of driving permits. 18- 24; youth, 25 -60; adults and above 60; seniors. However the age group of adults was divided into two age categories according to the life dynamic of citizens. Those who are above 30 are usually married and more stable in driving.

2.3 Evaluation of Diagnostic Modality

To determine the most suitable diagnostic modality for each injury type, we recorded the diagnosis obtained using the initial modality and compared it with the diagnosis obtained using any secondary modality.

3. RESULTS

Data were collected from 200 individuals, including 33 (16.5%) females and 167 (83.5%) males. The age distribution revealed that 57 (28.5%) were in the 16–23 age group, 64 (32%) in the 24–30 age group, and 72 (36%) in the 31–60 age group. Only seven (3.5%) individuals were > 60 years (Table 1).

Table 1 Characteristics of the study population	
	n (N %)
Gender	
Female	33 (16.5)
Male	167 (83.5)
Age	
16-23	57 (28.5)
24-30	64 (32.0)
31-60	72 (36.0)
Above 60	7 (3.5)

The most common site of injury was polytrauma, accounting for 101 cases (50.5%), followed by head injuries in 64 cases (32%) and spine injuries in 17 cases (8.5%) (Table 2).

Table 2 Frequency of injury sites and 1st diagnostic modality		
		N (n%)
	Polytrauma	101 (50.5)
	Head	64 (32)
	Spine	17 (8.5)
Site of Injury	Chest	7 (3.5)
	Facial	7 (3.5)
	Lower limb	3 (1.5)
	Upper limb	1 (0.5)
1st **Diagnostic modality**	CT	177 (88.5)
	X-ray	23 (11.5)

The first diagnostic modality varied depending on the type of injury. CT was the most commonly used first diagnostic modality, employed in 88.5% of cases. Notably, all cases of polytrauma injuries and the majority of head (93.8%) and facial (71.4 %) injuries employed CT scans as the first diagnostic modality. Additionally, CT scans were used as the first diagnostic modality in 58.8% cases of spinal injury , whereas radiography was primarily used for chest, lower, and upper limb injuries, with CT scans in only 14.3% of chest injuries (Table 3).

In most cases (96%), CT was the first diagnostic modality and no second diagnostic modality was required. However, in 100% of cases where radiography was the first diag-

Table 3 Frequency of first diagnostic modalities for each site of injury

Site of injury	1st Diagnostic modality	
	CT	X-ray
Polytrauma (n=101)	101 (100%)	0 (0%)
Head (n=64)	60 (93.8%)	4 (6.3%)
Facial (n=7)	5 (71.4%)	2 (28.6%)
Spine (n=17)	10 (58.8%)	7 (41.2%)
Chest (n=7)	1 (14.3%)	6 (85.7%)
Lower limb (n=3)	0 (0%)	3 (100%)
Upper limb (n=1)	0 (0%)	1 (100%)

nostic modality, a second diagnostic modality in the form of CT was necessary (Table 4).

Table 4 Frequency of 2nd diagnostic modality for each 1st diagnostic modality

	2nd Diagnostic modality		
1st Diagnostic modality	No 2nd Diagnostic modality	CT	X-ray
CT	170 (96%)	1 (0.6%)	6 (3.4%)
X-ray	0 (0%)	23 (100%)	0 (0%)

4. DISCUSSION

Our study considered the proportion of male and female drivers in Makkah Province based on Statista's 2020 estimate [10, 11], which suggests that approximately 33.4% of drivers are female, whereas 66.6%If are male. Notably, the data from our study indicated that female drivers had a lower incidence of RTA trauma (16.5%) than male drivers (83.5%). This suggests that similar to cultural expectations, female drivers appear to be involved in fewer accidents.

Saudi societal structure and cultural context may partially explain these findings. Traditionally, external responsibilities and driving duties often fall more heavily on males, which could account for the lower accident rates among females in Saudi society. Consistent with, our research findings highlight that the majority of RTA trauma cases (83.5%) involve males, irrespective of the type of injury.

Participants were categorized into four groups based on age:16–23 years, 24–30 years, 31–60 years, and > 60 years. The highest percentage of RTA trauma cases (40.0%) was found in the 31–60 age group as expected because it encompasses a broader range of years. Notably, the younger age group (16–23 years) also had a relatively high percentage (28.5%),

which can be attributed to its narrow age range (seven years). In contrast, the oldest age group (> 60 years) had the lowest percentage (3.5%).

Polytrauma injuries were the most common and observed in the majority of cases. In the younger age group, males were predominantly affected by polytrauma injuries, with RTAs being the leading cause. [12] The data revealed that CT was the primary diagnostic modality in most cases (88.5%), with radiography accounting for a lower percentage (11.5%). This finding was consistent with the nature of the injuries. CT scans are highly effective for diagnosing polytrauma and head trauma because these injuries often involve multiple body parts, making it challenging to obtain accurate X-ray images. Moreover, CT scans are more adept at detecting complications associated with head injuries such as subdural, epidural, and subarachnoid hemorrhages.

Spinal trauma cases, representing 8.5% of the total sample, underwent CT scans as the initial diagnostic modality in most cases (58.8%). This aligns with previous research findings, indicating that CT is a more efficient tool for the accurate diagnosis of spinal trauma [8]. Lower limb injuries, which represented a small proportion (1.5%) of the sample, were exclusively diagnosed using radiography. This is consistent with other studies, which suggested that radiography is adequate for evaluating lower limb fractures when plain film radiography can accurately identify the fracture. Upper limb injuries were present in only one case (0.5%), which was diagnosed via radiography. Due to the limited sample size, this case does not provide a critical basis for distinguishing between CT and radiography for upper limb trauma.

Chest injuries, constituting 3.5% of the total sample, predominantly involved radiography as the first diagnostic modality (85.7%), contradicting the findings of previous studies [5]. X-rays are advantageous for chest injuries owing to their rapid acquisition, availability, and minimal radiation exposure. In cases where plain film radiography is inconclusive, further investigation using CT is required.

The choice between CT and radiography as secondary diagnostic modalities depends on the initial modality. When CT was the initial diagnostic modality, most cases (96%) did not require a second diagnostic modality, whereas cases in which radiography was the primary modality required a follow-up CT scan. The primary advantage of CT scans over conventional X-rays is their increased sensitivity and accuracy in imaging small density variations.

5. CONCLUSION

This study aimed to conduct a comparative analysis of male and female patients with RTA trauma. This comparison considers variables such as age, injury site, and the most appro-

priate diagnostic modality, such as CT or XR, based on the nature and location of the injuries. Our findings underscore the preference for CT scanners over X-rays due to their ability to provide more detailed information. This is particularly crucial in cases involving RTAs, where patients may have specific conditions such as internal bleeding and polytrauma. Hence, our study suggests that CT scans should be employed selectively, primarily for critical patients suspected of having these conditions, whereas most injuries can be managed through observation.

Another significant advantage of CT is its ability to rapidly assess spinal injuries. Therefore, many hospitals have adopted CT as the standard initial examination tool for spinal injuries, favoring it over plain film radiography.

Although plain film radiography has a lower sensitivity than CT, it remains a valuable tool for evaluating extremity injuries. However, CT scanning should be performed when fractures are complex and challenging to detect using radiography. Nevertheless, further research in this area is warranted because of the limited available data.

Chest radiography offers several advantages for chest injuries, including flexibility for use in mobile radiography in intensive care units without the need to move injured patients and quick image acquisition. However, CT scans are essential for identifying injuries that may be invisible on X-rays.

6. RECOMMENDATIONS

Based on our findings, we recommend the following. First, CT should be the primary diagnostic modality for patients with polytrauma and spine and head injuries resulting from RTAs. These cases benefit from the enhanced detail and accuracy of CT scans, which are vital for diagnosing complex injuries and conditions such as internal bleeding. Second, in situations where it is challenging to transfer the patient to the radiology department, radiography can serve as a helpful alternative, particularly for follow-up examinations.

By adhering to these recommendations, healthcare providers can improve the accuracy and efficiency of diagnosing and treating patients with RTAs, ultimately leading to better patient care and outcomes.

7. ETHICS STATEMENT

Ethical approval was acquired from Research and studies department, Jeddah Health Affairs, Ministry of health. IRB registration number with KACST, KSA: H-02-J-002, Date: 08/03/2020, Research number: 01189.

8. FUNDING STATEMENT

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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