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The Role of Multi-detector Computed Tomography (MDCT) in Medico-legal Evaluation of Non-Fatal Firearm Head Injuries in Sohag University Hospitals

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Abstract

Background: Multi-detector computed tomography (MDCT) has emerged as a critical noninvasive tool for investigating firearm injuries due to its three-dimensional (3D) imaging capabilities. This study evaluated the role of MDCT with advanced post-processing techniques for medico-legal assessment of non-fatal firearm injuries in the head among patients admitted to Sohag University Hospitals.
Methods: This prospective study included 45 male patients aged 11–60 years who sustained non-fatal firearm injuries in the head between September 2023 and September 2024. Forensic examinations were conducted before MDCT imaging.
Results: 53.3% of patients sustained non-permanent infirmity injuries, while 46.7% experienced permanent infirmity. Patients <18 years were more likely to have permanent injuries (38.1%), whereas those aged 31–40 years were more likely to have non-permanent injuries (37.5%). Residence played a significant role, with patients from Dar El Salam, Gehina, and Tahta being more associated with permanent infirmities. MDCT findings revealed significant differences in injury patterns. Permanent infirmity was associated with multiple wounds (60%), closer firing distances (<15 meters in 35% of cases), and specific injury sites (right temporal region). Non-permanent injuries were linked to single wounds and firing distances exceeding 15 meters. Retained bullets requiring surgical intervention were found in all cases, and shotgun injuries accounted for 80% of cases without significant differences between injury outcomes.
Conclusions: MDCT is crucial in the forensic evaluation of non-fatal firearm injuries to the head, providing exceptional imaging capabilities that aid in accurate medico-legal interpretations.

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Key words Multidetector computed tomography, Forensic, Firearm, Head, Medico-legal evaluation.

Introduction

Gunshot wounds are traumatic injuries that are frequently seen in forensic practice and are characterized by their complexity and violence. These injuries are the result of the ignition of gunpowder, which causes projectiles to be propelled from a barrel and penetrate the body. Wound ballistics is also the term used to describe the examination of these injuries (Tahir et al., 2023).

Similar to any other type of damage, forensic pathologists examining a gunshot wound must document the shape, size, site, and location. Additionally, they need to take into account the wound's severity, the fire's location and trajectory, the way in which it entered and left the building, and the characteristics of the entrance and exit (Kiran et al., 2023). Gunshot wounds may lead to fatality via bleeding, organ trauma, and infection of the wound. This information is crucial in ascertaining the nature of the injury, particularly in fatal cases, to aid medico-legal and criminal investigations in identifying whether the harm was self-inflicted or inflicted by someone (Baum et al., 2022)

As regard mechanism of the projectile's injuries, it causes damage to both the permanent cavity and the temporary cavity. The former is the damaged tissue along the projectile's path, while the latter is the tissue surrounding the former and is subject to forces like compression, shear, radial acceleration, and stretch. Although temporary cavities are caused by forces that operate for a brief duration, the consequences may be long-lasting (Kaur et al., 2024).

Obstruction of the bowels, failure to thrive, paralysis caused by neurogenic bladder, recurrent cardiorespiratory distress, hypoxic brain injury (hyperalgesia) leading to early dementia, amputations, hyperalgesia, chronic pain, pulmonary embolism, pulmonary vein thrombosis, edema and debility of the limbs, lead poisoning, and post-traumatic stress disorder (PTSD) are among the long-term adverse events that can occur (Ranney et al., 2014). Before management can commence, it is imperative to confirm the safety of the area. Subsequently, the airway, respiration, and circulation should be assessed and supported. Major haemorrhage should be ceased (Fremery et al., 2024).

Multi Detector Computed Tomography (MDCT) has been the imaging technique of choice for forensic investigators. It enables the visualization of all soft tissues, bones, and internal organs. It may generate a substantial volume of high-resolution isotropic voxel data, providing maximum intensity projection, surface-shaded display, or volume rendering techniques and quality. Additionally, it is a realistic method of imaging in three dimensions using sagittal, coronal, and oblique planes (Ting et al., 2024).

Reconstructions may be conducted, a capability particularly advantageous for correlating injury patterns with numerous contextual circumstances at the crime scene (Ting et al., 2024).

The present study aimed to demonstrate the importance of utilizing MDCT in conjunction with a variety of post-processing multi-planar reformatted and volume-rendered 3D modeling techniques for the medico-legal evaluation of non-fatal firearm injuries to the head in patients who were admitted to Sohag University Hospitals.

Patients and Methods

This prospective study included 45 male patients aged 11–60 years, admitted to Sohag University Hospitals due to non-fatal firearm head injuries. The research was conducted between September 2023 to September 2024, following the approval from Sohag University Hospital's ethical committee (approval Soh-Med-23-07-05PD). In all cases informed consent from conscious patients and their Guardians to use these data in the present study and the confidentiality of data were reserved.

The exclusion criteria for this study were injuries rather than firearm, firearm injuries not present in the head or fatal firearm injuries.

A Medico-legal forensic examination included the site of inlet and exit, the number of wounds, and the shape of the wound to determine the direction of firing. Medical history was taken prior to the blinded MDCT examination. The results of the MDCT were analyzed along with the clinical assessments performed by the diagnostic radiology and forensic medicine teams on each wounded patient. Multislice computed tomography (MDCT) was performed using a 16-row multi-detector CT (Toshiba alexion 16 multislice CT).

The scanning technique included 1.25 mm collimation, a reconstruction interval of 0.625 mm, a tube voltage of 120 kV, a tube current of 180-230 mA, and 16 slices every half second. The acquired images were subsequently rebuilt at the CT machine console to a section thickness of 0.625 mm before being transmitted to the post-processing workstation (Synapse 3D, Fujifilm Medical, Tokyo, Japan).

The power of the sample size:

The power of the study was about 85% calculated by G power program version 3.1.9.7 using correlation power calculation of z test based on the difference of the 2 independent groups, degree of freedom was 4, type one error was <0.05 and sample size 45.

Statistical analysis

SPSS v26 (IBM©, Armonk, NY, USA) was employed to conduct the statistical analysis. Qualitative variables were expressed as frequency and percentage and examined with the Chi-square test or Fisher's exact test if applicable. A two-tailed P value of less than 0.05 was deemed statistically significant. (Di Leo and Sardanelli, 2020).

Results

In this study, 45 patients were admitted to Sohag University Hospitals due to non- fatal firearm injuries. MDCT was done on all patients in the study, and the outcome of the patients was evaluated according to MDCT and clinically. Twenty-four patients (53.3%) ended with non-permanent infirmity injuries which are injuries that healed in less than 21 days without leaving any deformity, while twenty-one (46.7%) ended with permanent infirmity as follow (24.4% presented with fissure fracture, 8.9% with cerebral haemorrhage and right hemiparesis, 6.7% presented with CDF (compound depressed fracture) and rupture globe and 6.7% ended with rupture globe) (Table 2 and photos1-4)

As regard to sociodemograghic data, the mean age of the patients was 27±12.5 years. There was a statistically significant difference between the distribution of age groups between permanent and non-permanent injuries. Patients below 18 years were more associated with permanent infirmity injuries (38.1%) then age group between 19-30 years (28.6%), while, patients of age group 19-30 years, 50% of cases showed non-permanent infirmity injuries then age group of 31-40 years (37.5%). All cases were males. About 31% of cases were from Dar El Salam. There was a statistically significant difference between permanent and non-permanent injuries in patients' residence distribution. Patients from Dar El Salam, Gehina, and Tahta were more associated with permanent injuries 23.8%, 19% and 19% respectively. Forty-four percent of patients were students without significant occupation differences between permanent infirmity and non-permanent infirmity injuries (Table 1).

Analyzing the items of inlet, exit, and injury sites according to MDCT evaluation were illustrated in (Table 3 and figures 1and 2). In twenty percent of patients, the inlet sites were not shown in MDCT, but all cases had retained bullets that needed surgical intervention. There was a statistically significant difference between permanent and non-permanent injuries in the injury and inlet sites. More than fifty percent of the cases associated with permanent infirmity injuries, the inlet injury sites were in Rt temporal & RT temporal with the frontal area. Projectiles were retained in all cases with no exit. All cases which had injury from Rt temporal, Rt temporal and frontal, Lt eye and multiple injuries had resulted in permanent infirmity.

There was a statistically significant difference between permanent and non-permanent infirmity injuries regarding the number of wounds. More than 60% of permanent infirmity patients were associated with more than one wound, while more than 60% of non-permanent infirmity patients were associated with only one wound. Most of the cases had rounded wounds with insignificant differences between permanent and non-permanent injuries regarding the shape of the wound.

There was a statistically significant difference between permanent and non-permanent infirmity injuries regarding the distance and the direction of firings. About 35% of permanent infirmity patients were associated with a distance of firings less than 15 meters. In contrast, all cases of non-permanent infirmity injuries were related to the distance of firings more than 15 meters. Regarding direction of firing the most common direction was from the right direction represented 37.8% totally and 52.4% in the permanent infirmity group. the Most cases had bullets from the shotgun (85.7%), with insignificant differences between permanent and non-permanent infirmity injuries regarding the type of the weapon. (Table 4, figures 3 and 4)

Table (1): Relation between socio-demographic data and fate of the studied cases. N=45

		Total (N=45)	The fate of the patients		P value
			Permanent infirmity (N=21)	None infirmity (N=24)	
Age	≤18 years	11 (24.4%)	8 (38.1%)	3 (12.5%)	<0.001**
	19-30 years	18 (40.0%)	6 (28.6%)	12(50%)	
	31-40 years	9 (20.0%)	0 (0%)	9 (37.5%)	
	41-50 years	4 (8.9%)	4 (19%)	0 (0%)	
	51-60 years	3 (6.7%)	3 (14.3%)	0 (0%)	
	27.4±12.5				-
Sex	Males Females	45 (100%) 0(0%)	21 (100%) 0(0%)	24 (100%) 0(0%)	----
Residence	El-Maragha	3 (6.7%)	3 (14.3%)	0 (0%)	<0.001**
	El-Monshah	3 (6.7%)	3 (14.3%)	0 (0%)	
	Dar El Salam	14 (31.1%)	5 (23.8%)	9 (37.5%)	
	Gehina	4 (8.9%)	4 (19%)	0 (0%)	
	Girga	3 (6.7%)	0(0%)	3 (12.5%)	
	Sohag	8 (17.8%)	0(0%)	8 (33.3%)	
	Tahta	4 (8.9%)	4 (19%)	0 (0%)	
	Tema	6 (13.3%)	2 (9.5%)	4 (16.7%)	
Occupation	Farmer	16 (35.6%)	7 (33.3%)	9 (37.5%)	0.3 NS
	Student	20 (44.4%)	11 (52.4%)	9 (37.5%)	
	Teacher	3 (6.7%)	0 (0%)	3 (12.5%)	
	Worker	6 (13.3%)	3 (14.3%)	3 (12.5%)	

N= number Data is presented as frequency (%) or mean ± SD. P value by chi-square if *<0.05 is significant **<0.01 highly significant NS: non significant if >0.05

Table (2): The frequency distribution of the fate of the studied cases according to MDCT. N=45

Outcome of patients	Number (%)
None	24 (53.3%)
Fissure fracture	11 (24.4%)
Intracerebral hemorrhage with right hemiparesis	4 (8.9%)
CDF and Rupture globe	3 (6.7%)
Rupture globe	3 (6.7%)
Total	45 (100%)

CDF compound depressed fracture

Table (3): Relation between findings of Multidetector computed tomography (MDCT) analysis and the fate of patients. N=45

		Total (N=45)	The fate of the patient		P value
			Permanent infirmity (N=21)	None infirmity (N=24)	
Inlet site	None	9 (20%)	0 (0%)	9 (37.5%)	<0.001**
	Below mandible	3 (6.7%)	0(0%)	3 (12.5%)	
	Frontal	3 (6.7%)	0(0%)	3 (12.5%)	
	High parietal	3 (6.7%)	0(0%)	3 (12.5%)	
	Left frontal	3 (6.7%)	0(0%)	3 (12.5%)	
	Left eye	3 (6.7%)	3(14.3%)	0 (0%)	
	Occipto-parietal	3 (6.7%)	0(0%)	3 (12.5%)	
	Right frontal and temporal	4 (8.9%)	4 (19%)	0 (0%)	
	Right temporal	7 (15.6%)	7(33.3%)	0 (0%)	
	Supraorbital	4 (8.9%)	4 (19%)	0 (0%)	
	Multiple	3 (6.7%)	3 (14.3%)	0 (0%)	
Exit site	Retained	45 (100%)			-
Site of injury	Scalp	12 (26.7%)	0 (0%)	12 (50%)	<0.001**
	Cervical	3 (6.7%)	0(0%)	3 (12.5%)	
	Left Occipto-parietal	4 (8.9%)	4 (19%)	0 (0%)	
	Right parietal	3 (6.7%)	0(0%)	3 (12.5%)	
	Right frontal	6 (13.3%)	0(0%)	6 (25%)	
	Left eye	3 (6.7%)	3(14.3%)	0 (0%)	
	Right temporal	7 (15.6%)	7(33.3%)	0 (0%)	
	Right frontal and temporal	4 (8.9%)	4 (19%)	0 (0%)	
	Multiple	3 (6.7%)	3 (14.3%)	0 (0%)	
Number of wounds	>10	6 (13.3%)	3 (14.3%)	3 (12.5%)	0.001**
	1	22 (48.9%)	7 (33.3%)	15 (62.5%)	
	2	7 (15.6%)	7 (33.3%)	0 (0%)	
	3	4 (8.9%)	4(19%)	0 (0%)	
	5	6 (13.3%)	0 (0%)	6 (25%)	
Shape of wound	Irregular	10 (22.2%)	7 (33.3%)	3 (12.5%)	0.09 NS
	Rounded	35 (77.8%)	14 (66.7%)	21 (87.5%)	

*Data is presented as frequency (%). P value by chi-square if *<0.05 is significant **<0.01 highly significant*
NS: non significant if >0.05. MDCT (Multidetector computed tomography). N =number

Table (4): Relation between distance, direction, and type of weapon distribution and the fate of patients. N=45

		Total (N=45)	The fate of the patient		P value
			Permanent infirmity (21)	None infirmity (24)	
Distance of firing	<10 m	3 (6.7%)	3 (14.3%)	0(0%)	0.004**
	15 m	4 (8.9%)	4 (19%)	0 (0%)	
	20 m	12 (26.7%)	3(14.3%)	9 (37.5%)	
	30 m	10 (22.2%)	7(33.3%)	3 (12.5%)	
	40 m	3 (6.7%)	0(0%)	3 (12.5%)	
	50 m	7 (15.6%)	4(19%)	3 (12.5%)	
	90 m	3 (6.7%)	0(0%)	3 (12.5%)	
	100 m	3 (6.7%)	0 (0%)	3 (12.5%)	
Direction of firing	Above	3 (6.7%)	0 (0%)	3 (12.5%)	0.001**
	From front	6 (13.3%)	6(28.6%)	0 (0%)	
	From left	6 (13.3%)	0 (0%)	6 (25%)	
	From right	17 (37.8%)	11(52.4%)	6 (25%)	
	Right frontal	3 (6.7%)	0 (0%)	3 (12.5%)	
	Frontal	7 (15.6%)	4(19%)	3 (12.5%)	
	Occipital & cervical area	3 (6.7%)	0 (0%)	3 (12.5%)	
Type of weapon	Handgun	3 (6.7%)	0(0%)	3 (12.5%)	0.24 NS
	Rifle	6 (13.3%)	3 (14.3%)	3 (12.5%)	
	Shotgun	36 (80%)	18 (85.7%)	18 (75%)	

*Data is presented as frequency (%). P value by chi-square if *<0.05 is significant **<0.01 highly significant*
NS: non significant if > 0.05, N=number. m=meter

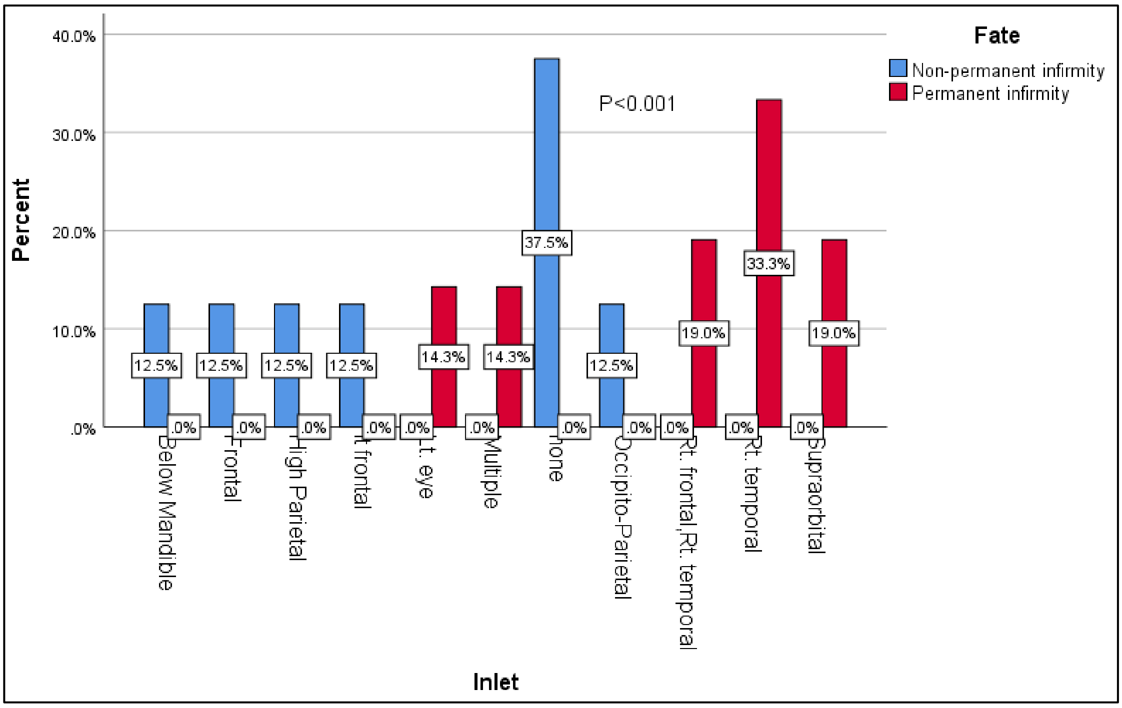

Figure (1) Bar chart showing distribution of the site of injury in relation to the fate of the patients

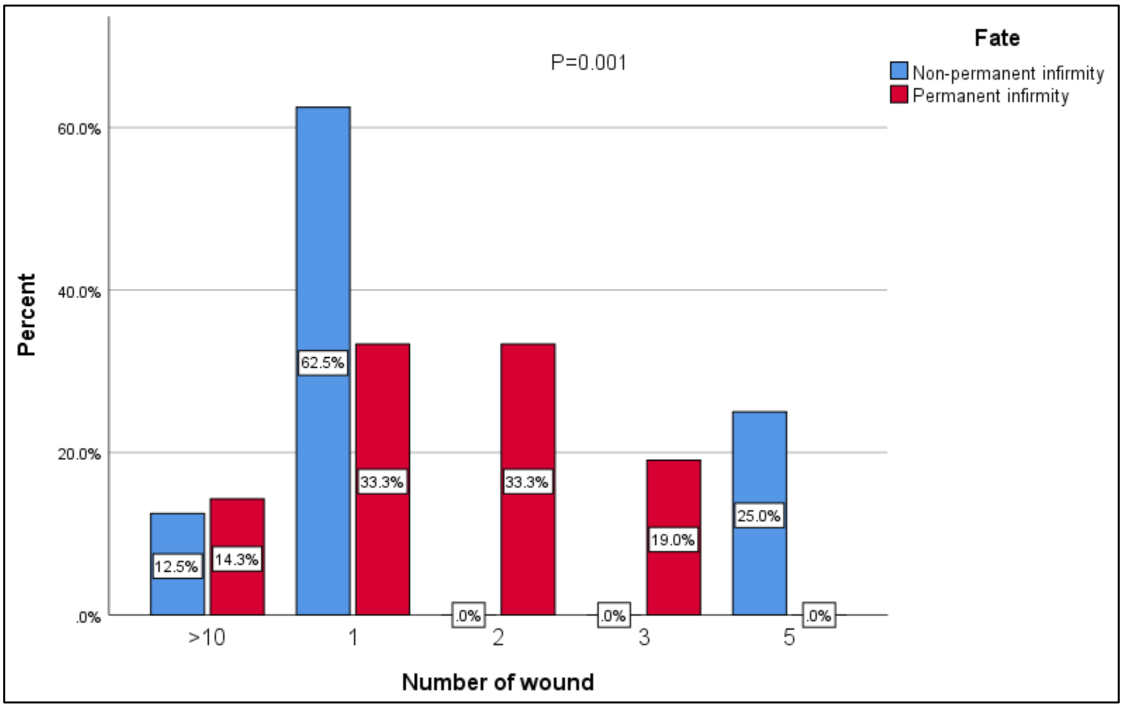

Figure (2) Bar chart showing distribution of the number of the wounds in relation to the fate of the patients

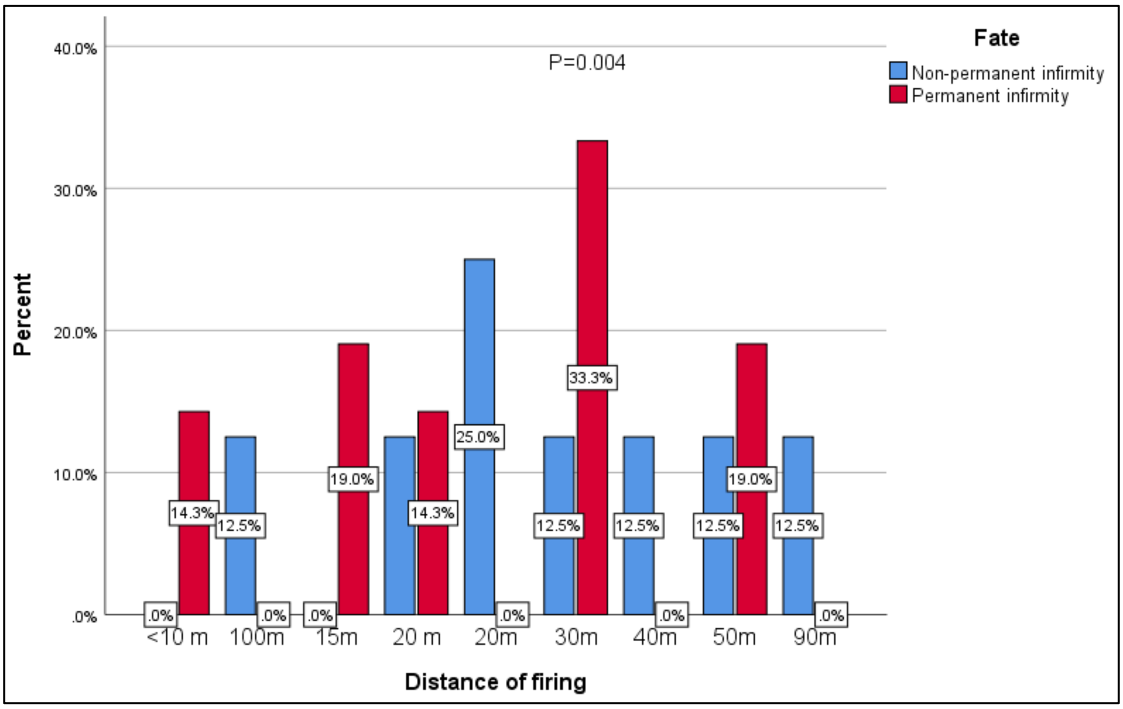

Figure (3) Bar chart showing distribution of the distance of firing in relation to the fate of the patients

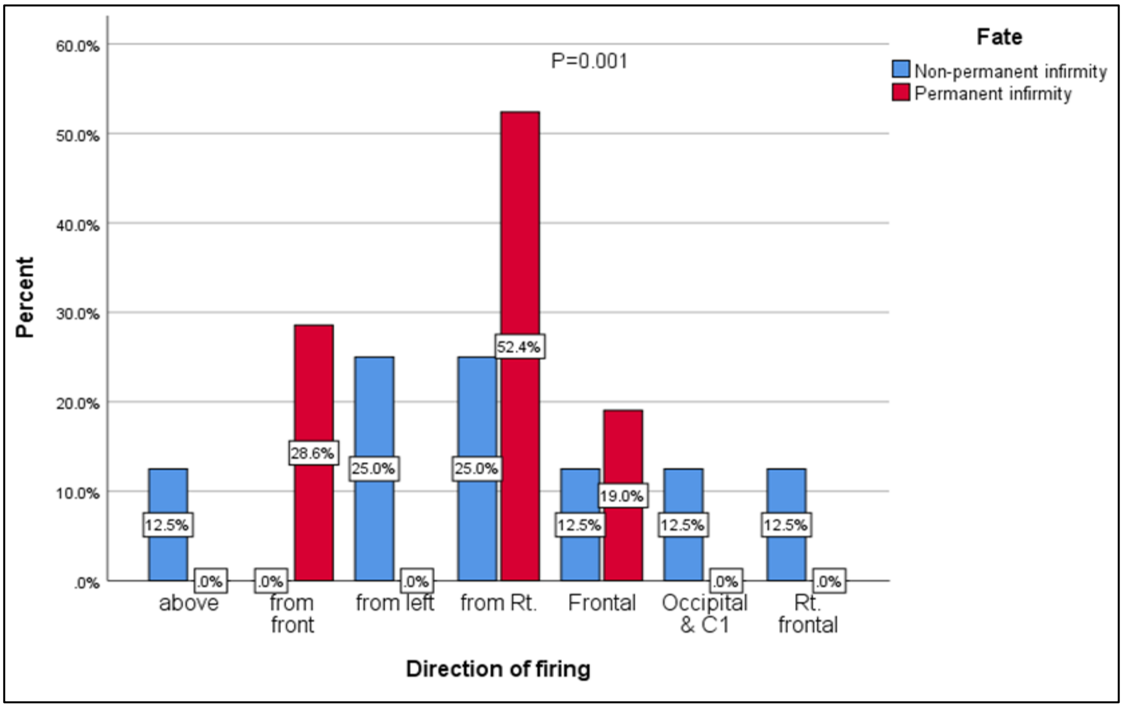

Figure (4) Bar chart showing distribution of the direction of firing in relation to the fate of the patients

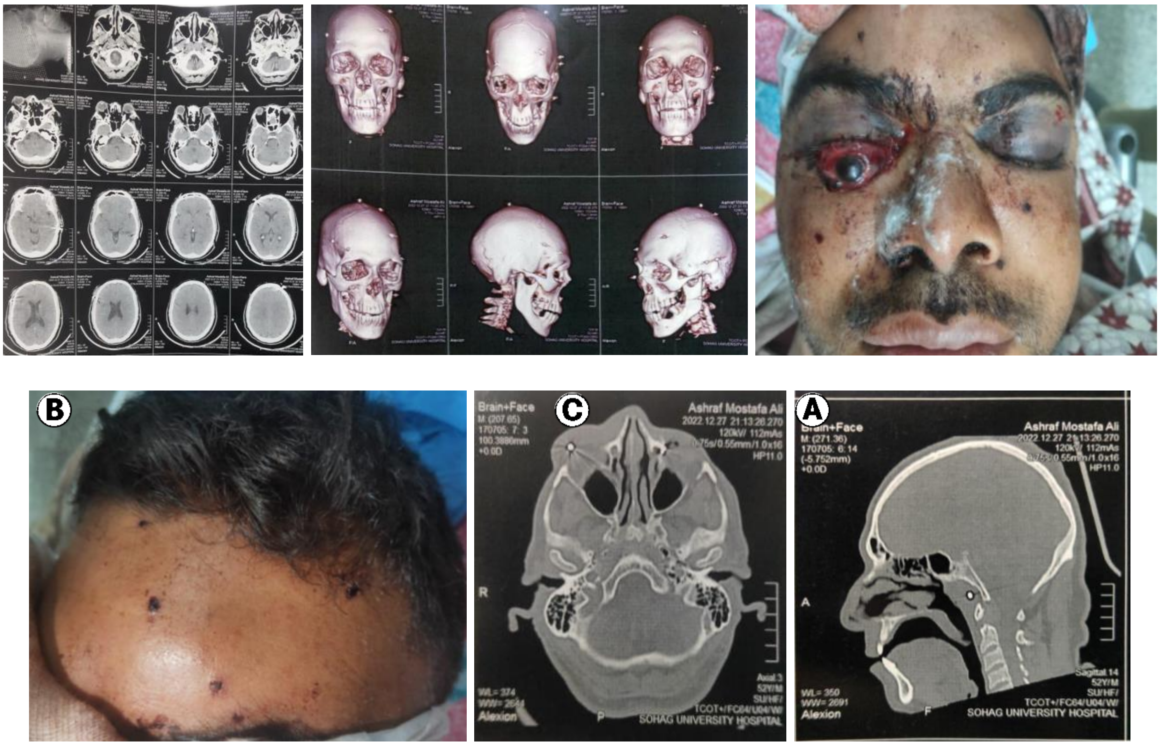

Photo (1): Firearm injury from front, patient image showing periorbital haematoma with sites of bullet inlets. Multislice CT of the skull and orbit (A). Axial cuts, bone window showing the bullet at periorbital region and another one impacted at the base of the skull (B). Multislice Axial cuts of soft tissue brain window displaying Rt frontal and orbital fractures with periorbital and subgaleal haematoma (C). 3D Reformatted image exhibits the bullets their metallic artifacts through their pathways and underlying bony fractures.

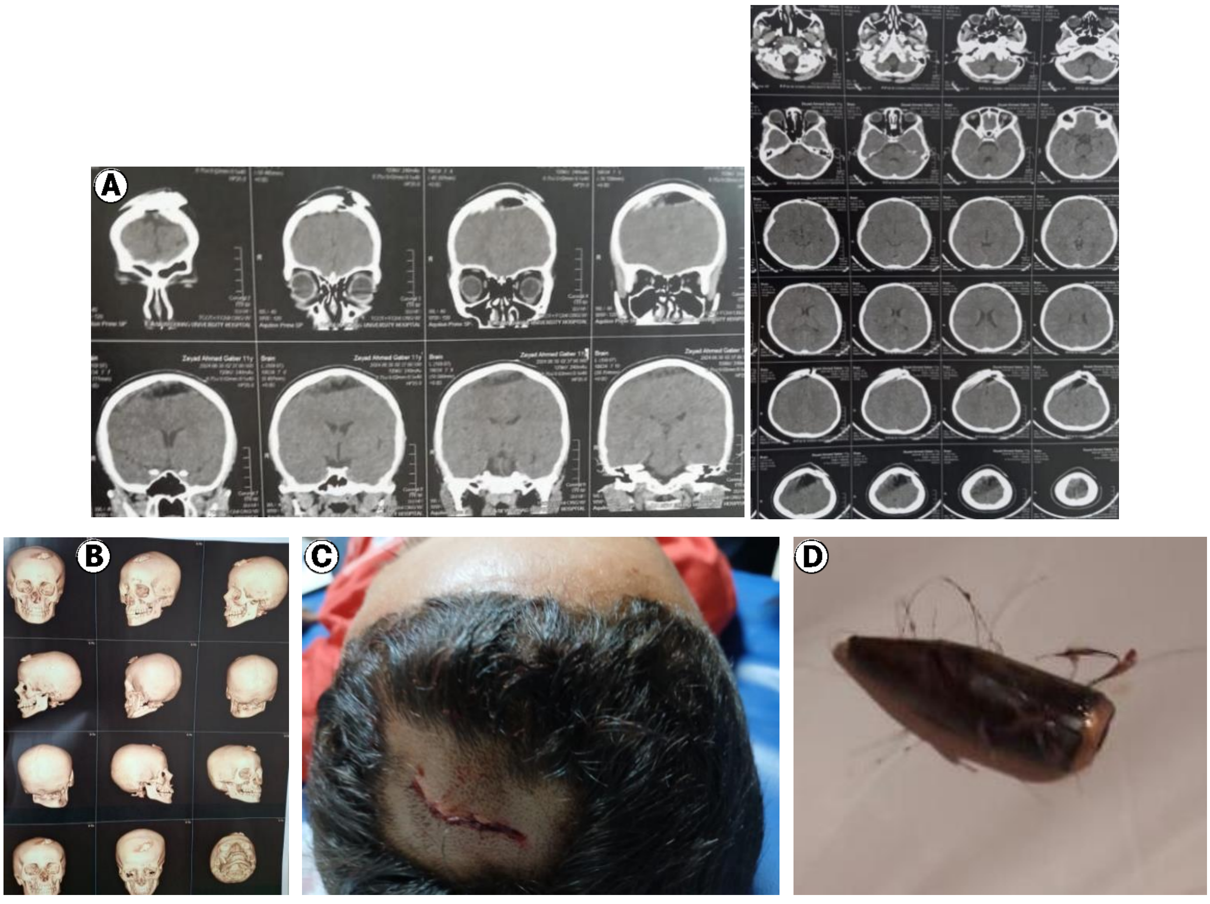

Photo (2): (A) Multislice CT Brain with axial cuts, (B) reformatted coronal and 3D images showing Lt frontal bullet injury with underlying Lt frontal comminuted fracture with retained (D) bullet at the same site then it was extracted surgically (C) Picture of scalp showing external wound in frontal bone

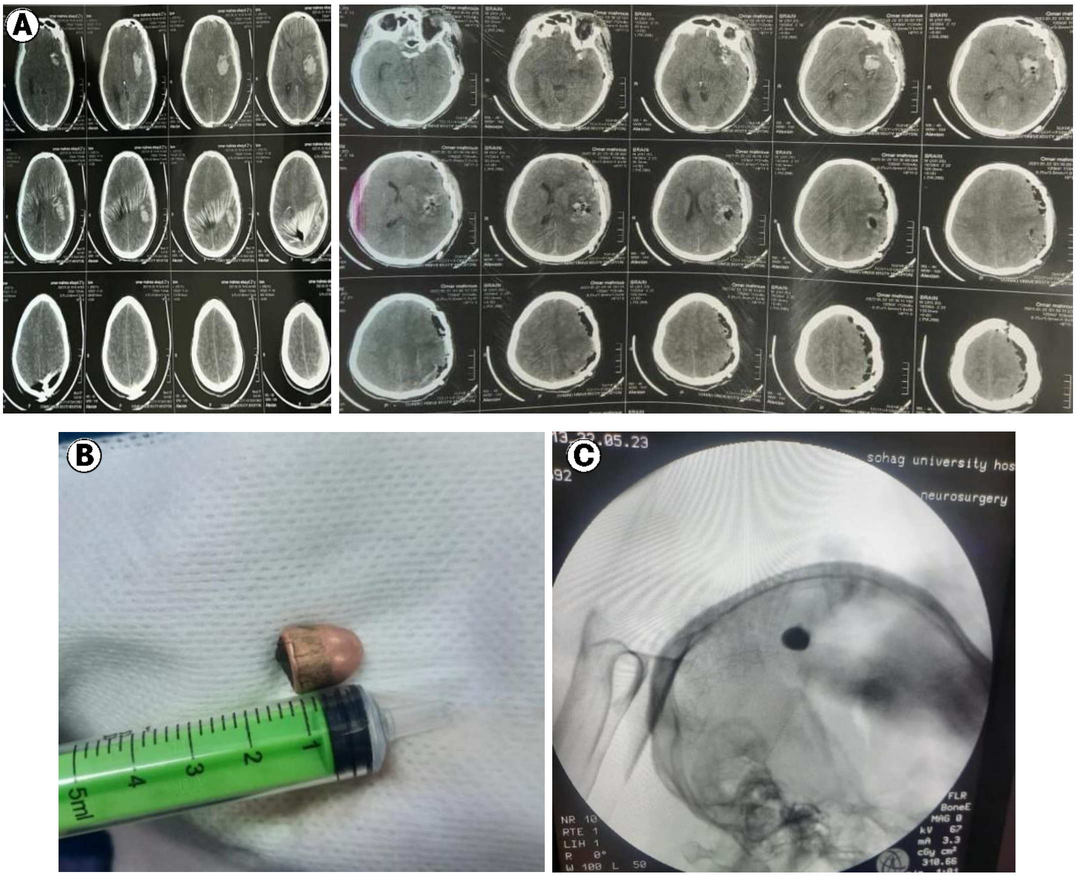

Photo (3): (A&B) Multislice CT scan of the orbit and brain axial cuts displaying bullet injury its inlet though lt orbit leading to rupture globe with marked lt sided intracranial intra and extra axial haemtomas with pneumocephalus, retained bullet at high parietal region which is extracted surgically (C)

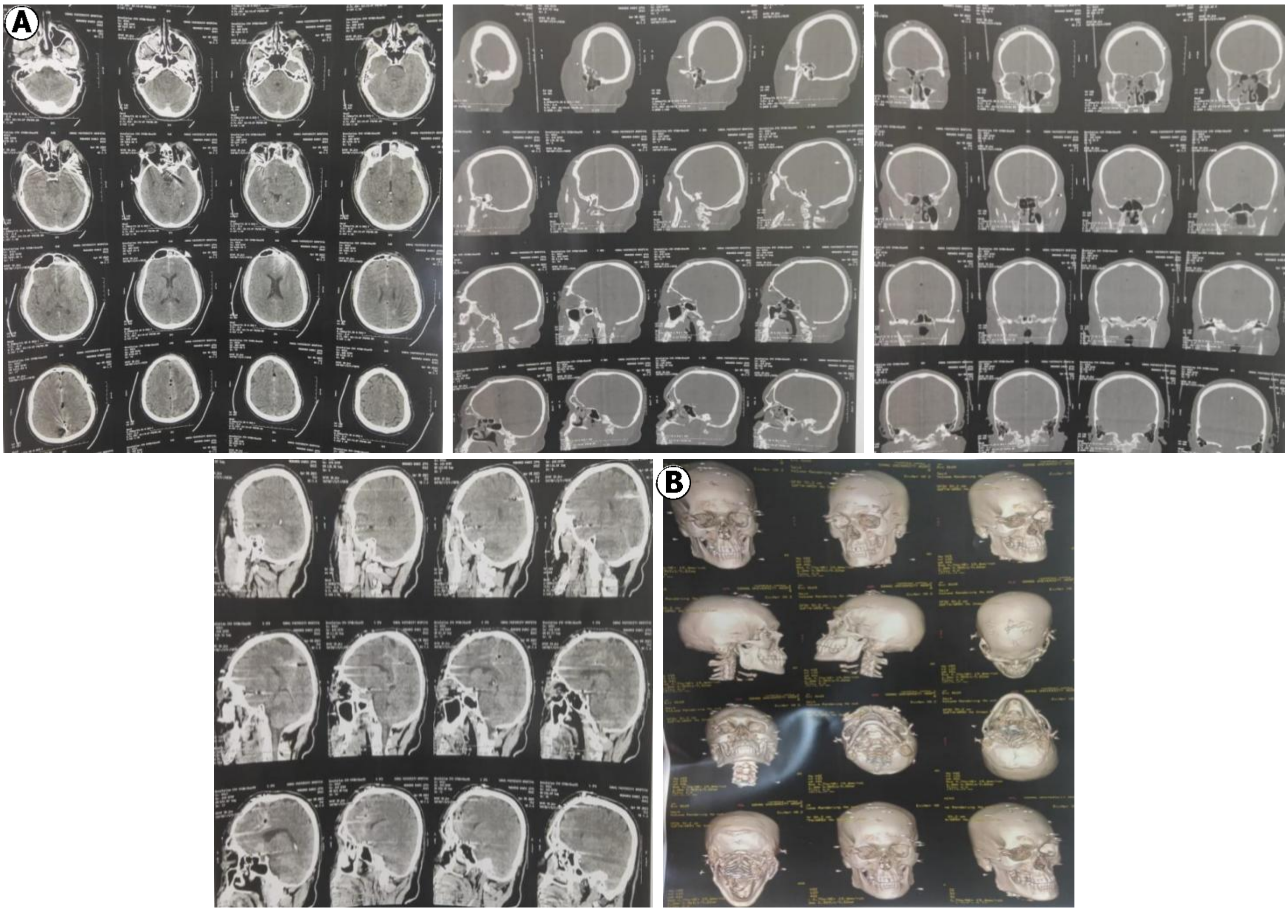

Photo (4): (A) Multislice CT Brain and skull with axial cuts and sagittal bony and soft tissue reformatted images with 3D reconstructed images (B) displaying multiple shots injury with lt fronto-parietal fractures, some shots reained at subgaleal region others seen intrcranial at falx level. No gross haematomas

Discussion

Multi-detector computed tomography (MDCT) demonstrated its capacity to accurately evaluate the nature and extent of firearm injuries in the head. Its high-resolution imaging enabled precise localization of bullets and assessment of injury sites, as noted in the study where MDCT identified retained bullets in all cases, which required surgical intervention. This is particularly significant in forensic medicine, where detailed documentation of injury patterns is critical for legal and medical conclusions. The use of advanced post-processing techniques, including multi-planar reformatted and 3D volume-rendered modeling, further enhanced the capability to analyze complex injuries, a factor emphasized in prior studies on medico-legal imaging (Abdel Aal et al., 2015).

This study finding indicated that 53.3% had non-permanent infirmity injuries as scalp injuries due to bullet not penetrating skull, while 46.7% suffered permanent infirmities as rupture globe, compound depressed fracture and intracerebral hemorrhage with paresis de. It revealed a significant difference in the distribution of age groups between the two types of injuries. Patients under 18 years were more likely to experience permanent injuries (38.1%), while those between 19 and 30 years old were more associated with non-permanent injuries (50%). In terms of residency, a statistically significant difference was observed, with patients from Dar El Salam, Gehina, and Tahta being more likely to sustain permanent injuries. Around 31% of the cases came from Dar El Salam, this may be due to high incidence of occurrence of firearm injuries in term of revenge with intention of killing the victim or causing severe permanent infirmity. Regarding occupation, 44% of the patients were students, with no significant differences in occupation between those with permanent and non-permanent injuries. All victims in our population were males. This may be attributed to the fact that males are more likely to be involved in quarrels and assaults, as well as being more mobile and violent (Maklad et al., 2004).

According to Hilal et al. (2024) the study of traumatic head injuries revealed that children under six years old were the most frequently affected age group, followed by adults aged 18-40 years, and then children aged 6-12 years and adolescents aged 12-18 years. Also, the majority of their population were males and rural residence (70.4%). Non-working children were the most affected (53.2%), followed by students (12.9%), workers (10.8%), and non-working adults (9%), while drivers, farmers, employees, and others made up less than 15%.

Mohammed et al. (2013) assessed the patterns of gunshot injuries (both fatal and nonfatal) in Qena governorate, Egypt, between the years 2010 and 2011. In 2010 and 2011, nonfatal cases constituted 94.7% and 81.9% of the total cases, respectively. Permanent disability occurred in 7.1% and 8.7% of nonfatal cases in 2010 and 2011, respectively. They indicated that the bulk of the population is aged between 21 and 30 years. The data demonstrated markedly substantial disparities in gunshot injury cases across all areas of Qena Governorate. Nonetheless, a comparison of case numbers within the same region during these two years revealed no significant variations. The Deshna rural area routinely reported the greatest proportion of gunshot injuries, succeeded by Qena city.

Asmar et al. (2021) investigated firearm-related injuries (FRI) at the sole Level I trauma facility in Southern Arizona. A total of 1012 FRI patients were identified. The predominant demographic of patients consisted of teens (32%) and young adults (30%), with 88% being male. The predominant aim behind injuries was assault, accounting for 75% of cases.

Hafez et al. (2020) evaluate the patterns and methodologies employed in the diagnosis and monitoring of permanent disability cases sent to the Cairo Department of Forensic Medicine, Ministry of Justice, Egypt. The study indicated that the prevalence of confirmed permanent disability cases was 7.2% (150 cases). The majority of cases included males aged 21 to 40 years, primarily manual laborers.

Samad et al. (2023) evaluated the incidence of gunshot injuries by gender and age at a tertiary care hospital in Nawabshah, Sindh, Pakistan. It was determined that one hundred sixty-one (74.5%) were male, and forty-two (19.44%) patients were aged 20 to 25 years. Ninety-eight individuals (45.37%) sustained brain injuries.

Additionally, Dutta et al. (2020) illustrated that firearm crime had a burden of 0.49 percent (115 cases). Majority of victims were in the age group of the second and third decades. Incidence of rural communities was higher.

We noted that in 20% of patients, the inlet sites were not visible on the MDCT, but all cases had retained bullets requiring surgical intervention. A statistically significant difference was found between permanent infirmity and non-permanent infirmity injuries regarding both the inlet and injury sites. In half of the cases with permanent injuries, the inlet and injury sites were located in the right temporal area and the right temporal-frontal region. Additionally, there was a statistically significant difference in the number of wounds between the two groups. Over 60% of patients with permanent injuries had more than one wound, while more than 60% of non-permanent injury patients had only one wound. Most of the wounds were rounded, with no significant difference in wound shape between those with permanent and non-permanent injuries.

Hilal et al. (2024) study reported that the most common site of trauma was parietal region followed by frontal, occipital and temporal regions (40.6%, 31%, 16.7%, and 3.1% respectively). An additional 8.6%of cases reported more than one site of head trauma. 58.2% of cases had scalp wounds, 65.6%of patients reported symptoms of concussion. Radiological findings revealed that 43.9% of cases showed isolated skull fracture, 14.5% of cases showed intracranial hemorrhage, 0.7% of cases showed brain edema and 22% of cases showed mixed findings, while 18.9% of cases had free radiograph.

Mohammed et al. (2013) found that multiple inlet wounds were significantly more common than single inlet wounds in both years, with multiple inlets accounting for 57.6% of cases in 2010 and increasing to 66% in 2011. Exit wounds were absent in 13.3% of cases, while in 2011, only 11.8% of cases lacked exit wounds.

In our study, a statistically significant difference was observed between permanent and non-permanent injuries concerning the distance and direction of firings. About 81% of patients suffering permanent infirmity was fired from front an right side. About 35% of patients with permanent infirmity injuries were shot from a distance of less than 15 meters, whereas all patients with non-permanent injuries were shot from distances greater than 15 meters. Regarding the type of weapon, most cases (80%) involved shotgun injuries, with no significant differences between permanent and non-permanent injuries based on the weapon used.

Mohammed et al. (2013) stated that long rifled weapons were predominantly used, showing a significant increase from 87.4% in 2010 to 96.4% in 2011, while short rifled weapons significantly decreased from 11% to 2.7%, and non-rifled weapons remained the least common at 1.6% and 0.9% respectively. Regarding firing distance, distant firing was significantly more prevalent than near firing in both years, increasing notably from 84.5% in 2010 to 97.5% in 2011. As for firing direction, perpendicular firing was significantly more common than other angles (P value ≤0.01), representing 84.5% and 88% of cases in 2010 and 2011 respectively, while oblique firing decreased from 13.7% to 9% during the same period.

The study's limitations include its single-center design and a relatively small sample size, restricting generalizability. The exclusion of fatal injuries may have also biased the findings. Despite these limitations, the study reinforces the indispensable role of MDCT in the medicolegal evaluation of non-fatal firearm head injuries. The integration of MDCT into forensic protocols enhances the precision of injury assessments, supports accurate legal documentation, and aids in the objective determination of injury severity and causality.

Conclusion and Recommendations

MDCT is crucial tool in the forensic evaluation of non-fatal firearm injuries to the head, providing exceptional imaging capabilities that aid in accurate medicolegal interpretations.

The broader use of MDCT in forensic practice could improve the precision of injury assessments, leading to more accurate medical diagnoses and enhanced judicial outcomes. Future research should expand to multicenter studies with diverse populations to validate these results.

Conflict of Interest: The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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دور الأشعة المقطعية متعددة المقاطع في التقييم الطبي الشرعي لإصابات الأسلحة النارية غير المميتة في الراس بمستشفيات سوهاج الجامعية

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الملخص العربى

الخلفية: ظهرت تقنية التصوير المقطعي المحوسب متعدد الكواشف (MDCT) كأداة غير جراحية حاسمة للتحقيق في إصابات الأسلحة النارية نظرًا لقدراتها على التصوير ثلاثي الأبعاد .(3D) قامت هذه الدراسة بتقييم دور التصوير المقطعي المحوسب متعدد الكواشف مع تقنيات المعالجة اللاحقة المتقدمة للتقييم الطبي الشرعي لإصابات الأسلحة النارية غير المميتة في الرأس بين المرضى الذين تم قبولهم في مستشفيات جامعة سوهاج.

الهدف من البحث: تهدف الدراسة الحالية إلى توضيح أهمية استخدام الأشعة المقطعية ثلاثية الابعاد للتقييم الطبي الشرعي لإصابات الأسلحة النارية غير المميتة في الراس للحالات التي تم فحصها في مستشفيات جامعة سوهاج.

الطرق: شملت هذه الدراسة الاستشرافية ٤٥ مريضًا من الذكور تتراوح أعمارهم بين ١١ و ٦٠ عامًا والذين أصيبوا بإصابات غير مميتة في الرأس بسبب الأسلحة النارية بين سبتمبر ٢٠٢٣ وسبتمبر ٢٠٢٤. أجريت الفحوصات الشرعية قبل التصوير المقطعي المحوسب متعدد الكواشف.

النتائج: أصيب ٥٣.٣٪ من المرضى بإصابات لم تؤدي الي اعاقه دائمة، بينما عانى ٤٦.٧٪ من الإعاقة الدائمة. كان المرضى الذين تقل أعمارهم عن ١٨ عامًا أكثر عرضة للإصابة بإصابات دائمة (٣٨.١٪)، في حين كان أولئك الذين تتراوح أعمارهم بين ٣١ و ٤٠ عامًا أكثر عرضة للإصابة بإصابات غير دائمة (٣٧.٥٪). لعبت الإقامة دورًا مهمًا، حيث ارتبط المرضى من دار السلام، وجهينة، وطهطا بشكل أكبر اعاقه دائمه. كشفت نتائج التصوير المقطعي المحوسب عن اختلافات كبيرة في أنماط الإصابة. ارتبط العجز الدائم بالجروح المتعددة (٦٠٪)، ومسافات إطلاق النار الأقرب (<١٥ مترًا في ٣٥٪ من الحالات)، ومواقع إصابة محددة (المنطقة الصدغية اليمنى). ارتبطت الإصابات غير الدائمة بجروح مفردة ومسافات إطلاق ناريه تتجاوز ١٥ مترًا. تم العثور على رصاصات محتجزة تتطلب تدخلاً جراحيًا في جميع الحالات، وشكلت إصابات البندقية ٨٠٪ من الحالات دون اختلافات كبيرة بين نتائج الإصابة.

الاستنتاجات: التصوير المقطعي المحوسب أمر بالغ الأهمية في التقييم الجنائي لإصابات الأسلحة النارية غير المميتة في الرأس، حيث يوفر قدرات تصوير استثنائية تساعد في التفسيرات الطبية القانونية الدقيقة.

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