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ORIGINAL ARTICLE

The most optimum imaging modality for diagnosis of shajjah hurt in medicolegal cases of head injuries.

Muhammad Qasim Memon[1], Rabail Altaf[2], Pardeep Kumar[3], Abrar Ul Hasnain Memon[4], Haya Afzal Memon[5], Sultan Rajper[6]

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ABSTRACT… Objective: To compare the optimum imaging modality to assess the various kinds of Shajjah hurt in MLE cases of head injuries. **Study Design:** Cross-sectional study. **Setting:** Department of Forensic Medicine and Toxicology at Gambat Medical College at Pir Abdul Qadir Shah Jeelani Institute of Medical Sciences, GAMBAT. **Period:** March 2021 to February 2022. **Material & Methods:** Medicolegal cases of head injuries of all age groups (infant to old) and of either gender presented to the Emergency department for treatment and medicolegal certification were included. 164 medicolegal cases of moderate to severe head injuries were included based on Glasgow Coma Scale (GCS) score of 12 or less. Injuries were categorized according to age, gender, kinds of Shajjah and modality with which the type of Shajjah hurt was diagnosed. **Results:** X-Rays failed to detect Shajjah hurt in at least one-fourth of the cases. X-Rays misdiagnosed 5 cases of Munaqillah, 48 cases of Ammah, and 21 cases of Damighah as Shajjah e Hashimah. X-rays also misdiagnosed the 16 cases of Shajjah e Ammah and 7 cases of Shajjah e Damighah as Shajjah e Munaqillah (fracture with dislocation). CT scan accurately diagnosed 16 (9.76%) cases as Shajjah hashimah, 20 (12.2%) as Shajjah Munaqillah, 79 (48.17%) as Shajjah Ammah, and 49 (29.88%) as Shajjah Damighah. **Conclusion:** In comparison to X-ray, CT scan had superior performance in correctly assigning the type of Shajjah hurt.

Key words: Computed Tomography, Injury, Medicolegal, Shajjah Hurt, X-ray.

INTRODUCTION

In Pakistan, injuries to the head have a mortality rate of 15%.[1] Annually, the calculated rate of head injuries is 81 per 100,000.[1] Globally, head injury is a prominent cause of morbidity and disability. Within the United States for example, the estimated annual rate is 200 per 100,000.[2-3] In comparison to Pakistan these numbers are worse but the mortality rate in the US is better; 13 to 14 per 100,000.[1]

Medicolegal examination of head injuries within Pakistan has not yet reached the standard of practice. As such, though X-rays of the skull are an indispensable tool within medicolegal examination for various reasons like for determining location of skull fractures, they are not the only radiographic investigation recommended for the assessment of such injuries. Medicolegal examinations in Pakistan often rely solely on X-rays as a screening tool even though CT Scans (Computed Tomography) are the gold standard and the only radiographic investigation recommended as per internationally accepted protocol for head injuries of all forms and provide much more insight into the anatomy to the head.[4,5]

The peculiarity of Pakistani Islamized law requires precise description of lesion that affected head area for medicolegal certification and there is no standard guideline / protocol for the evaluation of medicolegal head injuries (Shajjah hurt) in contrast to established guideline for selective neuroimaging in medical or neurosurgical cases.[6,7]

Shajjah or injuries/hurt of the head and face, according to the most recent act are categorized

1. MBBS, DMJ, Associate Professor Forensic Medicine, Suleman Roshan Medical College, Tando Adam.
2. MBBS, DMJ, Assistant Professor Forensic Medicine and Toxicology, Gambat Medical College, PSAQSJIMS, Gambat.
3. MBBS, DMJ, Associate Professor Forensic Medicine and Toxicology, PUMHS, Nawabshah.
4. MBBS, DMJ, Lecturer Forensic Medicine and Toxicology, Liaquat University of Medicine and Health Sciences, Jamshoro.
5. MBBS, DMJ, Assistant Professor, Indus Medical College, Tando Muhammad Khan.
6. MBBS, DMJ, Assistant Professor Forensic Medicine and Toxicology, PUMHS, Nawabshah.

Correspondence Address:
Dr. Rabail Altaf
Department of Forensic Medicine and Toxicology,
Gambat Medical College, PSAQSJIMS, Gambat.
rabailmuslim@gmail.com

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as per law into six types.[8] These six categories are in an order of increasing severity and seriousness. The depth of the wound and the structures involved determine these categories. The first type being superficial head and face injuries of the soft tissue without exposure of the bone, then exposure of the bone but without fractures, then fractures of the skull or facial bones without dislocation of the bone, then fractures with dislocations, then wounds deep enough to reach the membranes of the brain, and lastly fractures deep enough to rupture the membranes and result in intracranial hemorrhage.[9]

Head trauma is amongst the most common presentations in the emergency department.[3] As stated earlier it is a prominent cause of morbidity and mortality and the economic costs of accurate diagnosis and management are a substantial drain on society. According to the Qisas and Diyat act accurate certificates need to be issued by Medicologal Officers for judicial proceedings.[10]

A standardized evidence-based protocol for radiographic investigation for the various types of Shajjah hurt is necessary in identifying the correct type. Research discussing the effectiveness of the various radiographic investigations in terms of identifying the specific type of injury as per the local laws of Shajjah hurt are invaluable[11], however data on the matter is very scarce.

This prospective study aims to produce a guideline which may facilitate medico legal officers in defining injuries in context of our local laws correctly for legal matters. The aim of this study was to determine the burden of various kinds of medicolegal head injuries (Shajjah hurt) and the imaging modality most optimum for their diagnosis, so that we may know the burden of each as well as assess how they are being diagnosed and the offenders be punished as per kind of hurt.

MATERIAL & METHODS

A cross-sectional study was undertaken at the Department of Forensic Medicine and Toxicology at GAMBAT Medical College at Pir Abdul Qadir Shah Jeelani Institute of Medical Sciences, GAMBAT between March 2021 to February 2022 after obtaining ethical approval from the institute Ref.No/FM/GMC.109. This study was carried out at the medicolegal section of the hospital. Medicolegal cases of head injuries of all age groups (infant to old) and of either gender is referred by the police or brought by relatives, friends or volunteers at the Emergency department of the hospital, for treatment and medicolegal certification were included. Non-medico-legal cases of head injuries including fall and trauma resulting in diffuse axonal injury and contrecoup injury of the brain were excluded.

This was done at the medicolegal section that works under Police Surgeon Karachi of Health Department, Government of Sindh. One hundred and sixty-four medicolegal cases of moderate to severe head injuries were included based on Glasgow Coma Scale (GCS) score of 12 or less. A non-probability convenience sampling technique was conducted to recruit patients. All patients who were advised for X-ray skull and CT scanning that were conducted at the Radiology department of GAMBAT by an experienced technician who remained blinded to the study objectives to reduce bias.

X-ray skull anterior posterior and lateral views and CT scanning of skull and brain of all the selected injured were performed at the radiology department of GAMBAT. Reporting was performed by an experienced consultant who was well versed with medico legal procedures. A predesigned proforma was used to document the patient information after taking informed consent from the injured or attendant. Injuries were categorized according to age, gender, kinds of Shajjah and modality with which the type of Shajjah hurt was diagnosed. Results were compiled according to objectives, using SPSS version 23.

At the end of study period the relevant information was retrieved from the proformas of the injured and results were deduced and compiled as mean and standard deviation for the age of the injured, percentage and the ratio of the gender, frequency of different kinds of Shajjah and modality of diagnosis was assessed for the kind of Shajjah

hurt i.e., X-rays, CT scanning.

RESULTS

Out of the total 164 cases, the majority were between the ages of 18 and 40 years. About 80 percent of the patients were male. According to the study, the most common type of Shajjah hurt was Shajjah-i-Ammah (exposure of meninges) followed by Damighah (rupture of meninges) (Table-I). This analysis showed that the young population was the main target of victimization.

Parameters	N (%)
Age Group	
< 18 years	39 (23.8%)
18-35 years	95 (57.9%)
> 35 years	30 (18.3%)
Gender	
Male	131 (79.9%)
Female	33 (20.1%)
Kinds of Shajjah hurt	
Shajjah-i-Ammah	79 (48.17%)
Shajjah-i-Damighah	49 (29.88%)
Shajjah-i-Munaqqilah	20 (12.2%)
Shajjah-i-Hashimah	16 (9.76%)

Table-I. Patient demographic characteristics

Plain radiographs i.e. X-Rays failed to detect Shajjah hurt in at least one-fourth of the cases. Out of these six were diagnosed as Shajjah hashimah, seven as Shajjah Munaqillah, fifteen as Shajjah Ammah, and six as Shajjah Damighah.

X-Rays misdiagnosed five cases of Munaqillah, 48 cases of Ammah, and 21 cases of Damighah as Shajjah e Hashimah (fracture without dislocation). X-rays also misdiagnosed the sixteen cases of Shajjah e Ammah and seven cases of Shajjah e Damighah as Shajjah e Munaqillah (fracture with dislocation). Further details are illustrated in Table-II.

In total, Computed Tomography (CT) scan accurately diagnosed 16 (9.76%) cases as Shajjah hashimah, 20 (12.2%) as Shajjah Munaqillah, 79 (48.17%) as Shajjah Ammah, and 49 (29.88%) as Shajjah Damighah (Table-II).

DISCUSSION

The present study revealed that the Shajjah hurt affects males overwhelmingly as compared to females. The male preponderance of Shajjah injury within our society is likely the result of sociocultural and behavioral differences between the two groups.[12,13] As per the norms of Pakistani society men are overall more likely to be involved in activities that present a higher risk of accidents and violence, from social, legal, ownership and interpersonal disputes to being victims of criminal battery and assault.[13] Men are also more likely to sustain injury due to occupational mishaps and indulge in dangerous practices such as irresponsible driving.

As a male dominated society they constitute the bulk of the working class.[14] The male preponderance (90%) corresponds with 90.7% noted by Sohail et al[15], and 88.44% noted by Tajammul and colleagues.[16] Western and Indian studies also describe male predominance though to a lesser extent that is about 74%[17] and 80%[18] respectively.

Based on the data it was revealed that young adults (ages 18 to 35 years) were the most susceptible to Shajjah hurt. This specific age bracket's increased vulnerability can be attributed to their behaviors and activities.

Modality	Diagnosis By CT Scan				
Diagnosis By X-Ray	**Shajjah-i-Hashimah**	**Shajjah-i-Munaqillah**	**Shajjah-i-Ammah**	**Shajjah-i-Damighah**	**Total**
No traumatic lesion	6 (3.7%)	7 (4.3%)	15 (9.15%)	6 (3.66%)	34 (20.73%)
Shajjah-i-Hashimah	10 (6.1%)	5 (3%)	48 (29.27%)	21 (12.8%)	84 (51.22%)
Shajjah-i-Munaqillah	0 (0%)	8 (4.9%)	16 (9.76%)	7 (4.27%)	31 (18.9%)
Shajjah-i-Damighah	0 (0%)	0 (0%)	0 (0%)	15 (9.15%)	15 (9.15%)
Total	16 (9.76%)	20 (12.2%)	79 (48.17%)	49 (29.88%)	164 (100%)

Table-II. Comparison of X-Ray versus CT scan with respect to diagnosis of Shajjah hurt

Adults aged 18 to 35 years often lead proactive and socially involved lives. They are more likely to find themselves in the midst of violent disputes, radical and extremist activities, and occupational and by-stander accidents. People of this age group also often participate in riskier recreational activities and reckless behaviors such as rash driving and provoking violence. As per Ahmed et al. this group comprised 50% of head trauma.[19]

In the present study, routine X-ray skull AP and lateral views and CT scanning were performed on all the medicolegal cases of moderate to severe head injuries in this study. The most common type of Shajjah hurts were Ammah followed by Damighah. Of all the cases under study conventional radiography failed to detect any traumatic lesion in approximately 1/4th of the cases and also could not detect majority of the cases with fracture of skull with extradural hemorrhage (Shajjah-i-Ammah) regardless of severity.

This observation is in agreement with the study conducted by Khan and colleagues, who described that the role of skull X-ray in patients with head injury has been controversial and the yield of X-ray might not be helpful.[20] Their study showed strong association of skull fracture to extradural hematoma, and provided evidence of the futility of conventional radiographs in excluding extradural hematomas from the list of differentials. Extradural hematomas are classified as Shajjah-al-Ammah and the identification of this injury translates to significantly more severe and dire punishments in a court of law.[9] Missing such injuries or mislabeling them directly leads to incorrect legal sentencing.

Historically the management of such injuries was based on their identification on plain X-rays, for instance, the guidelines developed by the Working Party of Neurosurgeons (1984).[21] Since then plain skull X-rays have fallen out of favor as the primary diagnostic modality for head injuries. Updated protocols, like those presented by the National Institute of Clinical Excellence (NICE) and the New Orleans criteria have replaced X-rays with CT scans and GCS assessment.[22]

Taheri et al. also concluded that most evidence show that skull X-ray is less informative and is of limited value in head injuries.[23] The present study also confirmed the same findings and revealed that X-ray examination of skull alone fails to reveal medicolegal diagnosis for certification of an injured as per Qisas and Diyat Act, is unjust and cannot be relied upon.

In contrast the cross-sectional images provided by CT scans possess much more information regarding anatomical damage. These cross-sectional images of bone, vessels and soft tissue aid in the comprehensive detailing of head and face injuries. This leads to fewer missed injuries, and fewer false-positive and –negative results. Findings like extradural hematomas (EDH) are regularly missed by plain X-rays and are readily picked up on CT scans. All cases of extradural hematoma were diagnosed with CT scans. This success of CT scans at visualizing EDH was also apparent in earlier studies conducted by Zhang et al.[24] Thus the CT scan can also be adequately used to rule out specific injuries. This benefits medico Legal officers in adequately preparing evidence of the type of Shajjah hurt as per the Qisas and Diyat Act.

Recent recent also emphasized that in diagnosis of head injury the CT scanning is the investigation of choice, and it not only reveals bony injury but also the EDH, cerebral edema and ruptures of brain membranes.[25] This study has shown that CT scanning had a marked impact on forensic case workup for assigning the correct medicolegal kind of Shajjah hurt.

To adequately interpret and diagnose head and face injuries, Medicolegal officers handling these cases need to possess a strong foundational knowledge in CT scan and plain X-ray interpretation. They should be well-versed in the subtle and the profound changes occurring within CT scan images in the setting of trauma. Insight into the findings from an experienced radiologist should be acquired when feasible. The CT scan images should always be studied personally.

Despite the many strengths of the study, there

were a few limitations to this study. Due to a small undiversified sample size, the interference from the study findings is limited and generalizability is not possible. Therefore, a larger sample from multiple locations would have been more accurate.

CONCLUSION

In comparison to X-ray, CT scan had superior performance in correctly assigning the type of Shajjah hurt. It not only found almost all skeletal lesions but offered valuable information regarding intracranial damage like extradural hemorrhage and rupture of membranes which are associated with last two categories of Shajjah hurt i.e., Ammah and Damighah respectively.

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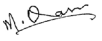
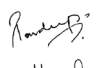
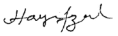
AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	M. Qasim Memon	Paper writing, referencing and data calculation.	
2	Rabail Altaf	Study design, Methodology.	
3	Pardeep Kumar	Analysis of data & Interpretation of results.	
4	Abrar Ul Hasnain Memon	Literature review & main script writing.	
5	Haya Afzal Memon	Analysis of data and writing.	
6	Sultan Rajper	Study design and methodology.