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Evaluation of Head Trauma and to Determine Incidental Findings On Multidetector Computed Tomography

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Abstract

Background: Head Truama is an important factor in morbidity and death worldwide and our country Pakistan, with a million cases reported every year. Evaluation of head trauma is one of the most crucial applications of computed tomography (CT) scans. But CT scans frequently show incidental findings not related to the primary injury. **Objective:** The main aim of our study is to find out the frequency of head traumatic patients. The second objective is to characterize incidental findings in the traumatically traumatized patient on multidetector computed tomography. **Method:** A descriptive cross sectional study enrolled brain CT of 188 consecutive patients in four months (August 2024 to November 2024) to determine frequency of head trauma findings as well as incidental findings from the study population proceeded at Rahman medical institute and Hayatabad medical complex which is the main referral hospital in Peshawar Pakistan. In this pavable 128 slices multidetector CT scanner aque siion pirme Toshiba company. **Results:** A total of 188 head trauma patient who referred for head trauma CT were evaluated. The effected age group was 15 to 30. Among 188 the mean age of the patient was (4.17). Male (87.8%), female (12.2%). Head trauma Injury was commonly caused by RTA (75.0%), HOF (17.6%), and LOC (3.7%), FAI (2.7%). The common CT finding was Skull Fracture include multiple skull fracture 26.1%, followed by frontal fracture 9.6% and temporal fracture 8%. Brain contusion (18.6%), subdural hematoma (18.1%) Epidural hematoma (8.5%) both (8.0%) other hematoma (44.1%). Epidural hemorrhage (1.1%) subdural hemorrhage (1.6%) and subarachnoid hemorrhage (12.8%) intracerebral and subarachnoid hemorrhage (12.8%) subarachnoid and subdural hemorrhage (4.8%) intracerebral and subdural hemorrhage (3.8%) and other hemorrhage (16.0%). According to our research RTA is the common cause of head injury followed by HOF. In this study we found that the most common IF was maxillary sinusitis 10.10%, infarction 5.85%, tumor 5.3%, Brain atrophy 3.72%, and Ventricular abnormality 3. 19%, cyst 2.65%, Vascular related abnormality 2.12%, and calcification 2.12%, Skull abnormality 0.5%.

Conclusion: This study concludes that young male adults in Peshawar, Pakistan, suffer from head trauma, particularly as a result of RTAs. It highlights that in order to lower the number of RTAs, better road safety regulations and focused initiatives are required. The research also shows how useful head CT is for identifying traumatic brain injuries, such as fractures of the skull and different kinds of bleeding. Since various underlying disorders may affect the patient's therapeutic therapy, the incidental findings reported in this study again emphasize the significance of carefully interpreting CT scans. To further understand

the long-term effects of head trauma and the impact of pre-existing conditions in patient outcomes, more research is required, preferably with bigger sample sizes and longitudinal follow-up.

Keywords: Computed tomography, head trauma, incidental findings.

Introduction

A wide range of injuries to the scalp, skull, brain, and the underlying tissue and blood vessels of the brain are together referred to as "head injuries." Head injuries are sometimes referred to as brain damage or traumatic brain injury (TBI)(1). TBI can happen when an object pierces the brain, when the head is struck by an external force, or when the head and brain move quickly back and forth. Not all head traumas result in traumatic brain injury (TBI). Concussions, the most prevalent kind of TBI, can result in short-term or temporary issues with a person's thinking, understanding, movement, speech, and behavior. More severe TBI can be lethal, and severe persistent TBI can result into even permanent disability(2). There are three levels of severity for traumatic brain injury, which is a major cause of death and morbidity: According to the Glasgow Coma Scale, these injuries can be categorized as mild, moderate, or severe based on the development of post-traumatic amnesia and loss of consciousness (3). Penetrating and nonpenetrating injuries are among the various and diverse causes of TBI, and each one varies in terms of overall severity and ensuing morbidity as determined by a scale limited by the GCS score(4). Traumatic brain injury (TBI) is one of the main causes of death and disability in people under 45 worldwide. The World Health Organization (WHO) estimates that 69 million people worldwide experience a traumatic brain injury (TBI) each year. Because TBI causes both immediate and long-term issues. A brain damage that results from neurodegenerative diseases is not the same as acquired brain injury. In general, acquired brain injuries can be divided into two categories: traumatic brain damage brought on by an external incident and non-traumatic brain injury brought on by an internal or external event(5). Head injuries, which are separated into primary and secondary injuries, are one of the causes of death after traumatic brain damage. Primary injury occurs soon after a head injury The secondary injury, which affects normally unharmed cells, is the body's physiological reaction to the first injury and happens over the course of the following minutes, months, or even years(6). Traumatic brain injury typically causes lifelong disruptions, and over 3 million Americans suffer from chronic disability as a result of TBI (7). It has been acknowledged that in order to prevent the secondary manifestation of serious brain injury, the amount of time between injury and operation must be minimized(8). IFs are unanticipated anomalies that appear on a diagnostic imaging study but are unrelated to the research's objectives. The frequency of IFs There is an increasing number of imaging modalities conducted on each patient. Any imaging method can detect IFs from various bodily parts, and how they are treated depends on the kind and seriousness of the discovery. Computed tomography (CT) scans are frequently performed in emergency departments (EDs) for head trauma, which may also be linked to no traumatic intracranial hemorrhages(9). Incidental findings are unintended knowledge discovered when looking for information one wants. With the great majority of results being indeterminate and frequently not intended for a test that would detect it, this incidental information can either save lives or have no significance. Increased patient stress, further diagnostic testing, and higher expenses can result from incidental findings, regardless of whether they turn out to be clinically significant(10). However, because the resolution of the latest scanners is constantly improving, incidental findings other than trauma are often observed. It is crucial to identify and notify the referring physician of these incidental findings since they may have an impact on how otherwise stressful situations are managed(11). Compared to magnetic resonance imaging (MRI), computed tomography (CT) is less sensitive for the early detection of some diseases. But because of things like patient mobility, lengthier imaging times, or higher costs than CT, CT is now prioritized for ruling out certain illnesses Compared to magnetic resonance imaging (MRI), computed tomography (CT) is less sensitive for the early detection of some diseases. But because of things like patient mobility, lengthier imaging times, or higher costs than CT, CT is now prioritized for ruling out certain illnesses(12).

Materials and methods

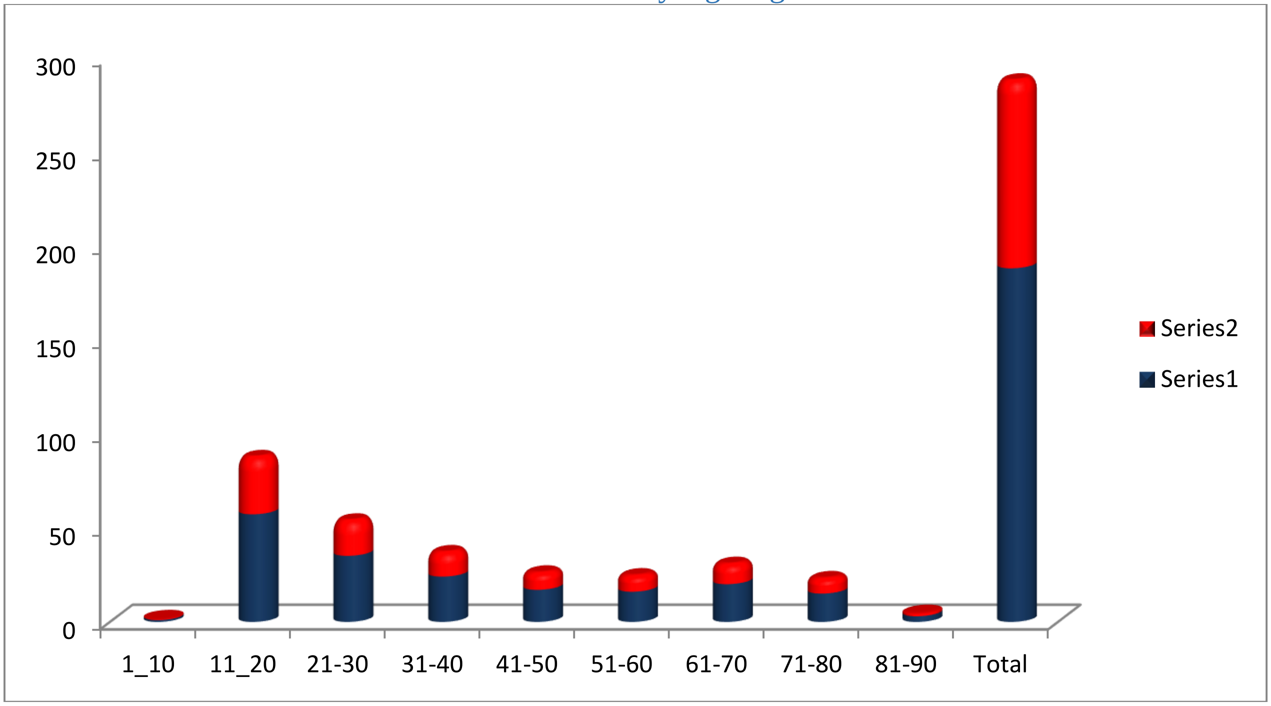
Ethical approval for our study was obtained from the Hospital Research and Ethical Committee (IREB) – REHMAN MEDICAL INSTITUTE AND HAYATABAD MEDICAL COMPLEX - PAKISTAN after the proposal was approved, and we received authorization for data collection from Rehman Medical Institute and Hayatabad Medical Complex. The study included 188 participants who visited department, both oral and written consent were obtained from each participant. The calculated sample size of 188 was based on a 14.4% prevalence, and a convenience sampling technique was used. Participant were included all patients of head trauma who referred for head MDCT with irrespective of age and genders. Those who have post-operative and post trauma were excluded from the study. Participants were informed about the study's goals, provided oral consent, and completed a semi structure Performa that assessed, demographics, CT assessment and Incidental findings. The semi structure Performa, which included, collected information on age, gender, reason of head trauma and computed tomography results, such as skull fractures, hematomas, hemorrhage and incidental findings. Statistical analysis was done by using IBM SPSS Statistics version 20.

Result

In this descriptive cross sectional study total of n=188 participants from age 10-90 of all patient referred for head Computed tomography that completed our inclusion criteria were retain from Rahman medical institute and Hayatabad medical complex Peshawar KPK Pakistan. Participant with age 1-10 years were n=1(0.5%), 11–20-year participants were n=57(30.3%), 21-30 year participants were n=35(18.6%), 31-40 years' participants were n=24(12.8%), 41-50 years' participants were n= 17(9.0%), 51-60years participants were n=16(8.5%), 61-70 years' participants were n=20(10.6%), 71-80 years' participants were n=15(8.0%), 81-90years participants were n=3(1.6%). **Shown in Figure 1.1**.

A total of 188 head trauma patient who referred for head trauma CT were evaluated. The effected age group was 15 to 30. Among 188 the mean age of the patient was (4.17) Male (87.8%) female (12.2%) **shown in Figure 1.2.** Head trauma Injury was commonly caused by RTA (75.0%), HOF (17.6%), and LOC (3.7%), FAI (2.7%) **Show in Table 1.3.** The common CT finding was Skull Fractures including multiple fractures 26,1% followed by frontal 9.6% and temporal fractures 8% **as shown in Figure 1.4 and 1.5** Brain contusion (18.6%), subdural hematoma (18.1%) Epidural hematoma (8.5%) both (8.0%) other hematoma (44.1%) **Show in Table 1.6 and 1.7.** Epidural hemorrhage (1.1%) subdural hemorrhage (1.6%) and subarachnoid hemorrhage (12.8%) intracerebral and subarachnoid hemorrhage (12.8%) subarachnoid and subdural hemorrhage (4.8%) intracerebral and subdural hemorrhage (3.8%) and other hemorrhage (16.0%) **Show in Table 1.8 and 1.9.** According to our research RTA is the common cause of head injury followed by HOF. In this study we found that the most common IF was maxillary sinusitis 10.10%, followed by infarction 5.85%, tumor 5.3%, Brain atrophy 3.72%, Ventricular abnormality 3.19, cyst 2.65%, calcification 2.12%, Vascular related abnormality 2.12%, Skull abnormality 0.5%. **as shown in Figure 2.0.**

Distribution by Age Figure 1.1



Distribution by Gender Figure 1.2

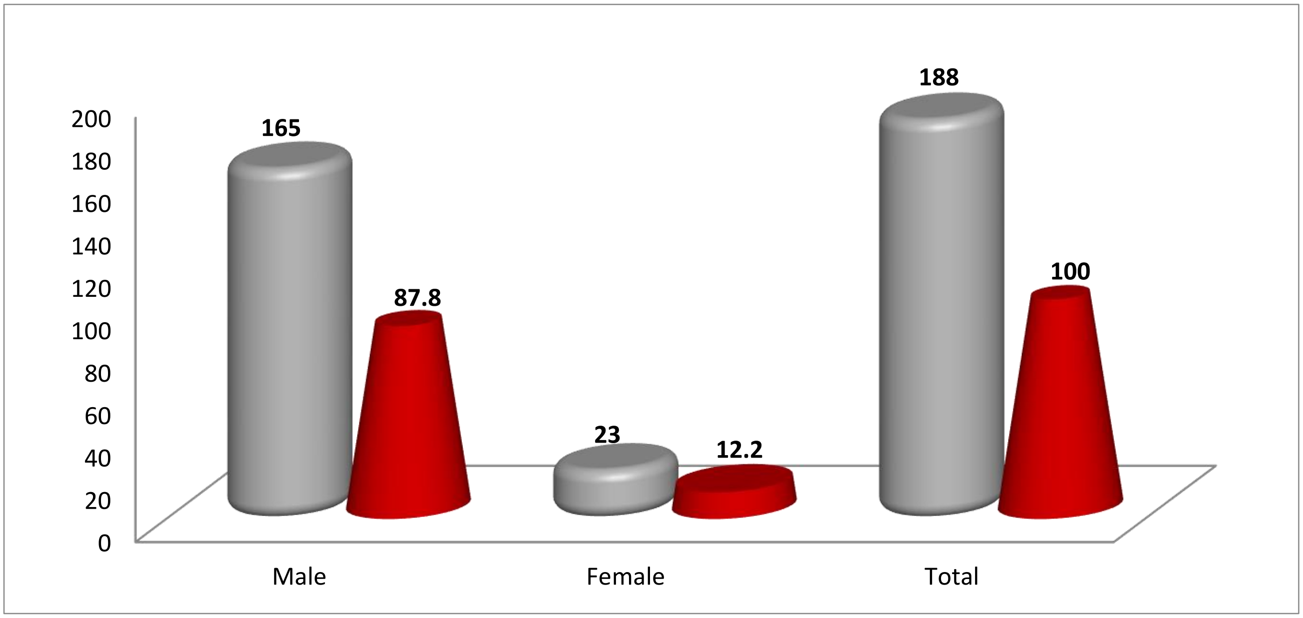


Table 1.3: Reason of the head trauma					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	RTA	141	75.0	75.0	75.0
	HOF	33	17.6	17.6	92.6
	LOC	7	3.7	3.7	96.3
	ES	1	.5	.5	96.8
	FAI	5	2.7	2.7	99.5
	HF	1	.5	.5	100.0
	Total	188	100.0	100.0	

Figure 1.4

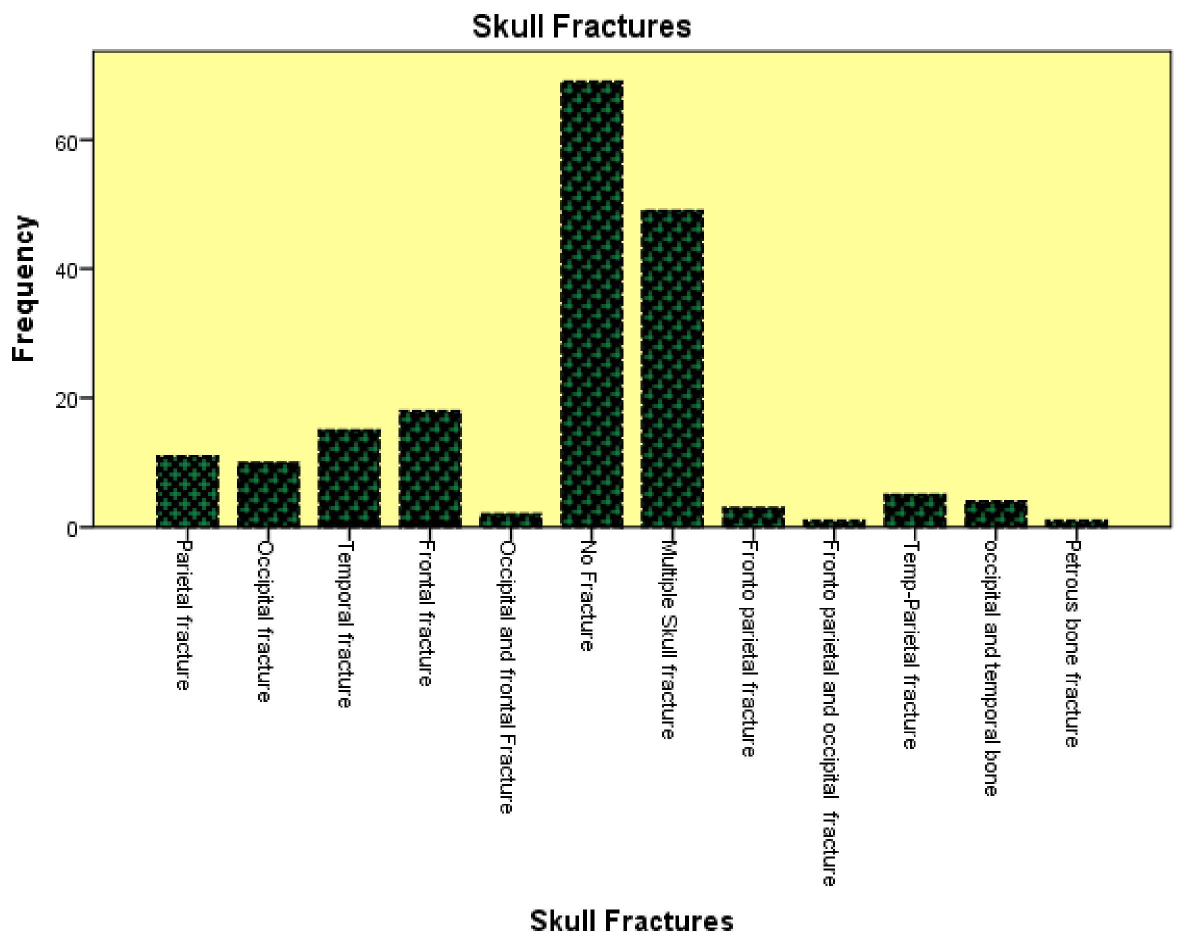


Table 1.5: Other Fracture					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	50	26.6	26.6	26.6
	No	138	73.4	73.4	100.0
	Total	188	100.0	100.0	

Table 1.6: Hematoma					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Epidural hematoma**	16	8.5	8.5	8.5
	Subdural hematoma	34	18.1	18.1	26.6
	No	123	65.4	65.4	92.0
	Epidural and subdural hematoma	15	8.0	8.0	100.0
	Total	188	100.0	100.0	

Table1.7: Other hematoma					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Yes**	83	44.1	44.1	44.1
	No	105	55.9	55.9	100.0
	Total	188	100.0	100.0	

Table 1.8: Hemorrhage					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Epidural hemorrhage**	2	1.1	1.1	1.1
	Subdural hemorrhage	3	1.6	1.6	2.7
	Subarachnoid hemorrhage	24	12.8	12.8	15.4
	No	84	44.7	44.7	60.1
	Intracerebral hemorrhage	35	18.6	18.6	78.7
	Intracerebralar & subarachnoid hemorrhage	24	12.8	12.8	91.5
	Subarachnoid and subdural hemorrhage	9	4.8	4.8	96.3
	Intracerebral and subdural hemorrhage	7	3.7	3.7	100.0
	Total	188	100.0	100.0	

Table 1.9: Other Hemorrhage					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**yes**	31	16.5	16.5	16.5
	No	157	83.5	83.5	100.0
	Total	188	100.0	100.0	

Table 2.0

	Incidental findings	Frequency	Percentage
Tumors	Frontal meningioma	2	1.06%
	Temporal glioma	2	1.06%
	Chlesteatoma	1	0.50%
	Other tumor	5	2.65%
Cyst	Arachnoid cyst	1	0.50%
	Thyroglossal duct cyst	1	0.50%
	Cavum verger cyst	1	0.50%
	Cerebral hydatid cyst	1	0.50%
	Other cyst	1	0.50%
Skull abnormality	Encephelocele	1	0.50%
Ventricular abnormality	Hydrocephalus	5	2.65%
	Cavum septum pellucid	1	0.50%
Vascular related abnormality	Single Virchow robin	1	0.50%
	Calcified vascular stenosis	1	0.50%
	Small Pseudo aneurism of ECA	1	0.50%
	Small aneurism of ICA	1	0.50%
Calcification	Basal ganglia	3	1.59%
	Frontal scalp and soft tissue	1	0.50%
Infarction	Temporal lobe	3	1.59%
	Peri-locular region	1	0.50%
	Basal ganglia	2	1.06%
	Right thalamus	1	0.50%
	MCA infarct	1	0.50%
	Left parietal lobe	2	1.06%
	Parenchyma	1	0.50%
Brain atrophy	Generalize atrophy	3	1.59%
	Cerebral atrophy	4	2.12%
Ear, nose, throat	Maxillary sinusitis	12	6.38%
	Sphenoidal sinusitis	2	1.06%
	Ethamoid sinusitis	1	0.50%
	Mastoiditis	3	1.59%
	Adenoid Hypertrophy	1	0.50%

Table 2.1

			Correlation B/W Gender Reason of the head trauma						Total
			RTA	HOF	LOC	ES	FAI	HF	
Gender of the participant	Male	Count	131	24	3	1	5	1	165
		Expected Count	123.8	29.0	6.1	.9	4.4	.9	165.0
		% within Gender of the participant	79.4%	14.5%	1.8%	0.6%	3.0%	0.6%	100.0 %
	Female	Count	10	9	4	0	0	0	23
		Expected Count	17.3	4.0	.9	.1	.6	.1	23.0
		% within Gender of the participant	43.5%	39.1%	17.4%	0.0%	0.0%	0.0%	100.0 %
Total		Count	141	33	7	1	5	1	188
		Expected Count	141.0	33.0	7.0	1.0	5.0	1.0	188.0
		% within Gender of the participant	75.0%	17.6%	3.7%	0.5%	2.7%	0.5%	100.0 %

Discussion

The purpose of this study was to investigate the distribution of head trauma cases and related radiological findings in patients who were referred for head CT scans at Rahman Medical Institute and Hayatabad Medical Complex in Peshawar, Khyber Pakhtunkhwa (KPK), Pakistan. The analysis included 188 patients, ranging in age from 10 to 90 years. The study also aimed to determine the frequency of head trauma patients using CT as diagnostic tools and to identify incidental findings with risk factors. By examining these relationships, we hope to offer important information that will impact preventative and therapeutic strategies and improve treatment of the findings. The age distribution of the participants showed that most patients were younger, especially those between the ages of 11 and 20 (30.3%) and 21 and 30 (18.6%), with a notable concentration of head trauma cases in the 15–30 age range. Our research is backed by(13)(Kelly C. Bordignon et al.), demonstrating that young adults are more likely to sustain brain injuries as a result of their increased involvement in risky behaviors such as road traffic accidents (RTAs). As for the gender distribution, 87.8% of the patients were men, which is likewise in line with previous research. Because they are more likely to engage in high-risk activities like driving, athletics, and manual labor, men are typically more vulnerable to head injuries. The proportion of women in the population was much smaller (12.2%), as evidenced by(14) (Mebrahtu-Ghebrehiwet and et al.), which implies that the main risk factors for head trauma in this area may not be as commonly encountered by women. (Mebrahtu-Ghebrehiwet and et al) which suggests that women may be less frequently exposed to the major risk factors for head trauma in this particular region. Road Traffic Accidents (RTAs) were the leading cause of head injuries in this study, accounting for 75.0% of the cases. In both industrialized and developing nations, where RTAs are the primary cause of head injuries, this is consistent with the results of other research. High population density, traffic laws, and road infrastructure all contribute to the high frequency of RTAs in nations like Pakistan. According to his findings, angro Maxine Eva (Nairobi) (15). Additional causes of head injuries in this study include a history of loss of consciousness (LOC) (3.7%) and head-on falls (HOF) (17.6%). One of the main causes of head injuries, especially in older persons, is falls, which may be brought on by mishaps at work or in the home. Specifically, LOC may be a sign of more serious head injuries or underlying neurological disorders. The most frequent CT findings were skull fractures, which included multiple fractures (26.1%), frontal fractures (9%), and temporal fractures (8%). Brain contusions (18.6%) and subdural hematomas (18.1%) were the next most common findings. This result is common in head trauma, as skull fractures frequently result in underlying brain injuries such hematomas and contusions. Subdural hematomas were the most prevalent type, according to the study's hematoma distribution, which may reflect the type of traumatic forces at play (such as the acceleration-deceleration mechanisms observed in RTAs). A percentage of cases also had epidural hematomas (8.5%), which is in line with the mechanism of damage involving skull fractures that cause blood vessels between the dura mater and the skull to break. Our outcome is supported by (Arifa Mobeen and et al)(16). Subarachnoid hemorrhage (12.8%), intracerebral hemorrhage and subarachnoid hemorrhage (12.8%), and other combinations of these types were among the other hemorrhagic findings. The increasing frequency of intracerebral and subarachnoid hemorrhages points to more serious and perhaps fatal injuries, which could be linked to increased mortality or long-term morbidity. Some individuals have several hemorrhagic lesions, which highlights the intricacy of head trauma and the necessity of cautious treatment and observation. It's interesting to note that incidental findings (IF) were frequently observed in CT scans. The most common IF among these was maxillary sinusitis (10.1%), which reflects the high frequency of sinus-related problems in the population that may be caused by lifestyle or environmental causes.which is a little unexpected because serious head trauma is not usually associated with sinus issues. These results, however, may be accidental, unrelated to the trauma, and found during regular imaging because of the paranasal sinuses near closeness to the brain. Brain atrophy (3.72%), ventricular abnormalities (3.19%), tumors (5.3%), infarctions (5.85%), cysts (2.65%), vascular-related abnormality (2.12%), calcification (2.12%), and skull abnormality (0.5%) came next. These results emphasize how crucial it is to thoroughly assess CT scans for IF, which can have which can have significant clinical implications. The result of our study is supported by **(**Hadia Akhtar et al)(12),(Marzieh alinezhade and et al)(9). Our results are consistent with global research indicating that RTAs are the primary cause of TBI. Studies from comparable areas also show that young adults, especially men, have significant rates of head trauma. Additionally, as skull fractures, brain contusions, and hematomas are the most commonly seen incidental abnormalities in CT scans of patients with head trauma, the radiological findings in this study are similar with those seen in prior studies on TBI.

Conclusion

This study concludes that young male adults in Peshawar, Pakistan, suffer from head trauma, particularly as a result of RTAs. It highlights that in order to lower the number of RTAs, better road safety regulations and focused initiatives are required. The research also shows how useful head CT is for identifying traumatic brain injuries, such as fractures of the skull and different kinds of bleeding. Since various underlying disorders may affect the patient's therapeutic therapy, the incidental findings reported in this study again emphasize the significance of carefully interpreting CT scans. To further understand the long-term effects of head trauma and the impact of pre-existing conditions in patient outcomes, more research is required, preferably with bigger sample sizes and longitudinal follow-up

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Conflict of Interest:

The authors have declared no conflict of interest. All authors have seen and approved the final version of this article.

Data availability:

the data that support the findings of this study are available upon reasonable request to the corresponding author.

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