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Head Injury and Intracranial Hemorrhages: A CT imaging study of trauma patients

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ABSTRACT

Objective: To determine how frequently patients who have experienced head trauma have intracranial bleeding on computed tomography imaging.

Materials and Methods: The study comprised 165 individuals with a history of trauma, all of whom had computed tomography. The brain was imaged using axial plane computed tomography without contrast, with slices 10mm thick from the foramen magnum to the vertex. SPSS version 22 was used for data analysis. All numerical values, including age, were given a mean and standard deviation. All qualitative variables, including gender, head injury, injury type, and cerebral hemorrhage, were calculated using frequencies and percentages.

Results: 25 (15.3%) of the 165 head injury patients had traumatic intracranial bleeding visible on a computed tomography scan. In the 25 patients, there were 9 (36%) subdural hemorrhages, 5 (20%) subarachnoid hemorrhages, 7 (28%) epidural hemorrhages, and 4 (16%) intraparenchymal hemorrhages. The 165 patients had 71 (43.1%) road traffic accidents, 39 (23.6%) history of falls, and 55 (33.33%) other types of traumatic injuries. It was found that the age range of 16 to 30 years had the highest frequency of cerebral bleeding. Intracranial hemorrhage was more common in men (72%) than women.

Conclusion: According to this study, a CT scan revealed intracranial hemorrhages in 15.3% of head injury patients. The most frequent type of hemorrhage in this study was subdural. Compared to other traumatic injuries, the presence of cerebral bleeding was most frequently related to traffic accidents.

Keywords: Intracranial hemorrhage, computed tomography, subdural hematoma, extradural hematoma, subarachnoid hematoma.

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INTRODUCTION

One of the significant issue with public health is head injuries. The main factor causing neurological impairment is traumatic head injuries (1). Each year, roughly 2 million traumatic brain injuries happen (2). 65% of trauma patients have a head injury (3). There are two general categories of head injuries: closed and penetrating. In contrast to a penetrating injury, which leaves the skull fractured and open, a closed injury does not involve a fracture of the skull (1). In neuroradiology, cranial computed tomography has proven to be a reliable diagnostic tool. It offers a precise noninvasive diagnosis of fractures, intracranial hemorrhages, and other head injury symptoms such as cerebral edema (3). The most often utilized intracranial evaluation method following trauma is computed tomography (CT), which allows an objective evaluation of structural brain damage (4).

Axial non-contrast computed tomography is the gold standard for trauma patients (1). CT results frequently imply prognosis (5). Patients with acute cerebral trauma to the cranium may present with CT findings of hemorrhagic contusion, intra, and extracranial hemorrhage, generalized and localized cerebral edema, and shear injury of the cerebral white matter (3). On a CT scan, intracranial hemorrhages, abnormal brain parenchymal densities, mass effect, and midline shift indicate intracranial injury (6).

According to the National Energy Utilization Radiography Study, the incidence of cerebral damage is 8.3% (7). Intracranial hemorrhage is the most frequent outcome of all traumatic brain injuries (8). The rate of intracranial hemorrhage is between 4.2% (9). Intracranial hemorrhage frequently occurs (56%) and is almost always caused by blunt head trauma (95%), and 5% due to firearm wounds (10).

Typically, a computed tomography (CT) scan of the head is part of the initial assessment of patients who have suffered catastrophic head injuries (9). It has been studied how to categorize patients with mild traumatic brain injury (TBI), which accounts for most TBIs, into those who ought to and should not to undergo CTH evaluation (11). In the majority of studies, 0.5-1% of patients with mild TBI who receive CTH have traumatic intracranial findings, and 5-10% of these patients also require neurosurgery (11). However, mild TBI is a hazy condition that the Glasgow Coma Scale can variously classify (GCS) 13-15, GCS 14-15, or GCS 15, and it can happen with or without loss of consciousness or retrograde amnesia, which has complicated research on it in the context of diagnostic evaluation (12).

Radiation exposure and cost are two frequent justifications for limiting the use of CT after mild TBI. Although these are significant factors, they shouldn't be overemphasized because a single CTH has significantly less radiation exposure than most other computed tomography scans (13). Additionally, unrecognized intracranial hematoma continues to have significant clinical and legal ramifications for emergency medicine practitioners (12). This last factor is likely responsible for the growing use of CTH because no decision tool has ever demonstrated 100% sensitivity across a population tested (14).

Rationale: The major purpose of this study is to assess the prevalence of intracranial bleeding in head traumas. The objective of the study was to assess whether it was safe to release head trauma patients or if it was safe to run a CT scan on them. This study also looked into the frequency of various ICH types in patients with GCS.

MATERIALS AND METHODS

Study design and setting: A cross-sectional study was conducted in Faisal Hospital, Faisalabad, Pakistan for a duration of four months.

Study group and sampling technique: 165 patients (108 males and 57 females) of all age groups with head trauma were selected via a convenient sampling technique for a computed tomography scan from the emergency room and neurosurgical outpatient departments.

However, patients with bleeding disorders and patients on anticoagulant therapy were excluded from the study.

Equipment: A 64-slice helical CT machine was used for imaging purposes.

Data collection and analysis: Data was collected using closed-ended self-modified performa after obtaining the consent and analyzed using a statistical package of social science (SPSS) version 22.

Ethical issues: This study had no ethical issues because the client was not put on the experiment, and no medication was given during the study. Consent was obtained from the patient and attendant. Moreover, the study was duly approved by the ethical committee of Faisal Hospital, Faisalabad.

RESULTS

Of the 165 patients, 51 (30.9%) had an age range of 1-15 years, 58 (35.2%) 16–30 years, 32 (19.4%) 31–45, and 24 (14.5%) over 46 years (**Table 1**).

Regarding gender distribution, 108 (65.4%) were male and 57 (34.6%) female with a traumatic head injury of 165 patients (**Figure 1**).

Table 1: Age distribution of patients

Age (Years)	Number of Patients	Percentage %
1-15	51	30.9
16-30	58	35.2
31-45	32	19.4
46-onward	24	14.5
Total	**165**	**100**

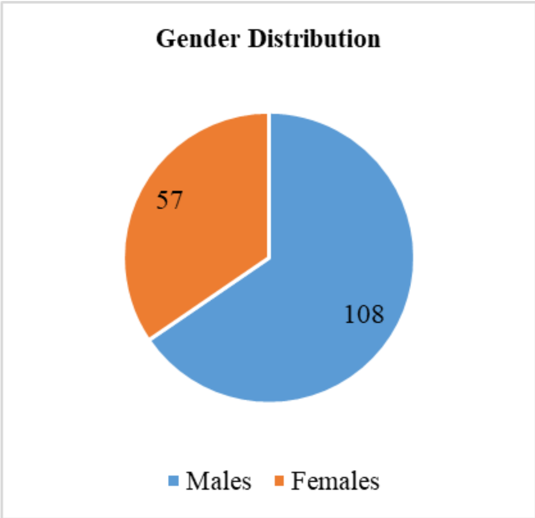

Figure 1: Gender Distribution of patients

Based on medical history, out of 165 patients, 71 (43.1%) had a road traffic accident (RTA), 39 (23.6%) had a H/o fall, and 55 (33.3%) had various types of traumatic injuries, i.e. firearm, blunt trauma, domestic violence (**Table 2**).

Table 2: Mode of Injury

Mode of Injury	Frequency	Percentage %
RTA	71	43.1
H/O Fall	39	23.6
Other modes of trauma	55	33.3
Total	**165**	**100**

Regarding the frequency of ICH on CT of 165 patients with a head injury, 25 (15.3%) had traumatic intracranial bleeding on CT. Of the 25 patients, 09 (36%) had subdural hemorrhage (SDH), 05 (20%) had subarachnoid hemorrhage (SAH), 07 (28%) had epidural hemorrhage (EDH), and 04 (16%) had intraparenchymal hemorrhage (IPH) (**Table 3**).

Table 3: Frequency of traumatic intracranial hemorrhage on CT scan

CT scan findings	Patients No	Frequency %
Subdural Hemorrhage	09	36
Subarachnoid Hemorrhage	05	20
Epidural Hemorrhage	07	28
Intraparenchymal Hemorrhage	04	16
Total	**25**	**100**

Of the 165 patients, 29 (17.6%) patients had a skull bone fracture without ICH, while 111 (67.3%) patients were free of any fracture. Men showed a higher incidence of intracranial bleeding (72%) than women (**Table 4**).

Table 4: Gender distribution in patients with Intracranial Hemorrhage

Gender	Patients with intracranial hemorrhage	Frequency %
Males	18	72
Females	7	28

Among different age groups, it was observed that the highest frequency of intracranial hemorrhage was in the age range of 16-30 years, which is in 13 out of 25 patients.

DISCUSSION

Head injury is the leading cause of morbidity worldwide (15). In Pakistan, there are 81 head injuries per 100,000 people annually, with a death rate of 15% (16). A frequent and deadly result of head injury is intracranial bleeding. Computed tomography is the most used intracranial examination technology following trauma, which allows an unbiased evaluation of structural brain damage (1).

According to a study by Yousafani et al. in 2010, brain injuries are more common (53%) in people between the ages of 18-30 years (16). The results well correlated with the given study, the age range of 16 to 30 years comprised the majority (35%) of the 165 individuals with head injuries. Most individuals in this age range are either students, young professionals, or bus drivers.

A study by Onwuchekwa and Alazigha in 2017 revealed that the majority (67%) of head trauma was due to road traffic accidents (11). The research by Zimmerman et al. revealed that motor vehicle accidents were the most frequent cause of brain injuries. 113 (39%) of the 286 individuals suffered head injuries as a result of road traffic/motor vehicle accidents (5). This was comparable to the given study that revealed 43.1% of head trauma occurred due to road traffic accidents.

A study by Pablo P. in 2009 examined more than 13,000 patients with traumatic brain injury. Men comprised 65.4% of all head injury (ICH) cases while women comprised 34.6%. This might be because men spend the majority of the day traveling for employment or other reasons (17). The results of this study well correlated with the given study, men had the most (72%) intracranial hemorrhages as compared to women.

According to a study by Bordignon and Arruda, in 2002 in head trauma patients, 21 cases (4.1%) out of 1306 presented intracerebral hematoma (8). Jeret et al. found 10.4% of intracranial bleeding in his study with head trauma and a GCS score of 15 (18). As compared to the results of the current study, 25 out of 165 head trauma patients had intracranial hemorrhage with a frequency of 15.3%

A study by Stein and Ross found 131 (8.5%) cases of head trauma out of 1538 with a skull fracture (19). A study by Onwuchekwa and Alazigha in 2017 revealed that 85 (37.7%) cases out of 225 had skull fractures (11). However, in our study, there were 29 (17.5%) patients with a skull fracture out of 165 patients.

A study conducted by Stein and Ross found 6.8% of epidural hemorrhage (EH), 5.7% of subarachnoid hemorrhage (SAH), and 4.5% of subdural hemorrhage (SH) (19).

A study by Bordignon and Arruda in 2002 showed similar numbers of intracranial hemorrhage; 6.6% of SAH, 6.4% of SH, and 1.4% of EH (8). A study by Roghani and Ali showed 3% SAH, 10% SH, and 10% EH (10). A study conducted by Bonney et al. in 2020 showed that the most common findings of intracranial hemorrhages were 4.7% for subdural hemorrhage, 4.5% for traumatic subarachnoid hemorrhage, and 3.8% for intraparenchymal hemorrhage (14). However, the current study revealed that subdural hemorrhage accounted for 36% of all intracranial hemorrhages, followed by epidural hemorrhages (28%), subarachnoid hemorrhages (20%), and intraparenchymal hemorrhages (16%).

When suggesting surgical evacuation, the severity of the bleeding was taken into consideration (20). Only substantial cerebral bleeding was found to be related to a worse result, regardless of the site (EDH, SDH, or IPH). A large hemorrhage was associated with an increased chance of death compared to a small-volume intracranial hemorrhage (20). The estimated risk of cerebral bleeding in the given study is highly precise, mainly to the inclusion of 165 patients with traumatic brain injury in the investigation.

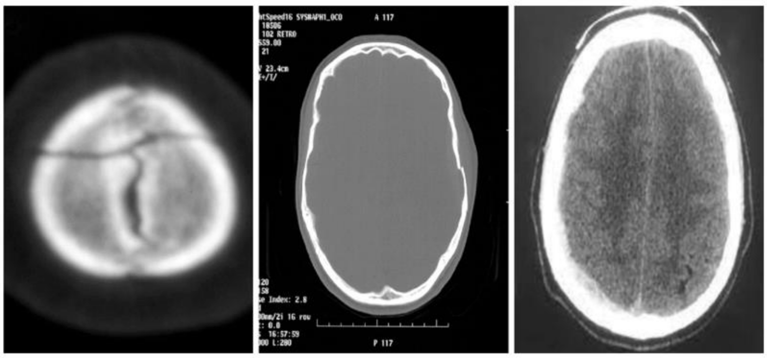

Figure 2: (a) CT image showing a linear oblique fracture involving the bilateral parietal bones. **(b)** Fracture of overlying bone visualized on the bone window. **(c)** CT scan brain shows a small hyperdense subdural hematoma along the right cerebral convexity.

CONCLUSION

It was concluded that 15.3% of head trauma patients had intracranial bleeding. The most frequent form of intracranial hemorrhage in this investigation was subdural hemorrhage accounting for 36%. Compared to other traumatic injuries, the presence of intracranial cerebral bleeding was most frequently due to road traffic accidents. The highest frequency of intracranial hemorrhage was in the age range of 16-30 years as compared to others. However, men showed a higher incidence of intracranial bleeding than women.

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Ethical approval: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and/or with the Helsinki Declaration of 1964 and later versions. Informed consent or substitute for it was obtained from all patients for being included in the study. Written consent was obtained from each patient to use their hospital data.

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