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Original article

Relationship between Intracranial Lesions in Blunt Head Injuries and Different Parameters: A Six-Month Prospective Study at Ain Shams University Hospitals

Dalia Mohamed Nabil Zaki, Emad Ahmed El Sayed Mostafa

Department of Forensic Medicine and Clinical Toxicology, Faculty of Medicine, Ain Shams University, Egypt

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Abstract

Background: Head injuries (HIs) are a major threat to public health; they are significant risk factors for mortality in all age groups of population around the world and considered one of the major causes of road traffic accidents (RTAs) fatality. In Egypt, Policymaking to enhance community understanding of preventive and curative trauma programs is critical for reducing the impact of injuries. **Aim:** To assess the incidence, manner, cause, types, and outcome of blunt head injuries (BHI) in Ain Shams University Hospitals, and also, to study the correlation between the different types of intracranial lesions which were detected by computed tomography (CT) scan and these parameters. **Methods and results:** This study was conducted on 83 cases during a period of six months. There were 26 females and 57 males ranging from 2 years to 73 years. The most common cause was RTAs (67.5%) followed by falls (16.9%) and lastly blows (15.7%). The manner was mostly accidental, and the time of inflection was mostly at night. The most common types of skull fractures were combined fractures (48.2%), followed by fissure vault (21.7%) then localized depressed fractures (14.5%), then comminuted (6%), and lastly fracture base and no fracture with the same percentage (4.8%).The most common types of intracranial lesions were combined (36.1%) followed by extradural hemorrhage (EDH) (19.3%) then brain laceration (13.3%), contusion, and subdural hemorrhage (SDH) (9.6%), intracerebral hemorrhage (ICH) (8.4%), and lastly subarachnoid hemorrhage (SAH) (3.6%). Non-survivors represented 57.8% while survivors were 42.2%. **Conclusion:** Certain parameters such as age, sex, time etc, may contribute to catastrophic BHI and the relationship these parameters and intracranial lesions in blunt head injuries was studied. Combined fractures were the most prevalent type. Additionally, combined intracranial lesions were the most common type and the results indicated that the majority of the admitted cases were non-survivors.

I. Background

Head injuries (HIs) pose a serious concern to public health and are associated with a high risk of death across all age groups worldwide (Wang et al., 2018). By 2030, it's expected that traumatic injuries would rank among the top twenty global causes of mortality (Mahran et al., 2016).

Any injury that causes harm to the scalp, skull, or brain is classified as a HIs. These injuries can be caused by falls, sports injuries, road traffic accidents (RTAs), or gunshot wounds. RTAs are thought to be one of the leading causes of fatalities from traumatic head injuries (THIs) The severity of HIs varied from mild to severe; with the potential to induce alterations in the structure and function

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*Corresponding author: Dalia Mohamed Nabil
Email address: drdalia@med.asu.edu.eg

of cells, as well as tissue damage such as contusion, bleeding, and widespread axonal injury (Matthew et al., 2017). Around 57 million people worldwide suffer from a neurological disease brought on by THIs, with 10 million of them requiring lengthy medical care. HIs account for nearly 50% of all injuries and are now one of the main issues encountered by these individuals. In the United State (US), the median prevalence of TBIs was 73.5/100,000 (Alnaami et al., 2019).

Despite the fact that underreporting and incorrect diagnoses have resulted in several times more injuries in Egypt than are officially recorded, injuries nevertheless represent a significant burden in the country as they were the fifth most common cause of death in 2004 (Abdelgeleel et al., 2019; Mahran et al.,2016).

In Egypt, trauma is a major health concern that has to be addressed immediately. Reducing the effect of injuries requires creating policies that enhance community awareness and readiness for the preventative and curative trauma program, as well as creating a trauma network (Mahran et al., 2016).

The aim is to assess the incidence, patients' demographics, cause, manner, time of inflection, outcome of BHI, and types of skull fractures and intracranial lesions in Ain Shams University Hospitals, and also, to study the correlation between the different types of intracranial lesions which were detected by computed tomography (CT) scan and these parameters.

II. Subjects and Methods:

This is a prospective cohort study that was conducted on the available cases of BHI (83 cases) with a primary medico legal report admitted to Ain Shams University Hospitals over a period of six months from the beginning of November 2023 to the end of April 2024 and who met the inclusion and exclusion criteria.

Data about the incidence, patients' demographics, cause, manner, time of inflection, and outcome of BHI, types of skull fractures and intracranial lesions were gathered. Also, the Correlation between different types of intracranial lesions which were detected by CT scan and these parameters was assessed.

Ethical Considerations: It was approved by Ain Shams University- Faculty of Medicine's Ethical Committee, Federal Wide Assurance Number FWA 000017585, and approval number FMASU R287/2023. Each case had a primary medico legal report that was created and completed, along with a valid permission.

Inclusion criteria: Patients who were hospitalized to Ain Shams University Hospitals with THIs for more than 24 hours over a period of six months from the beginning of November 2023 to the end of April 2024.

Exclusion criteria: Patients who declined to sign the permission form, patients who were readmitted to the hospital for treatment of problems or rehabilitation, or cases who were discharged from the hospital before a full assessment of their clinical state at their request.

Statistical analysis: Data about the incidence of BHI, patients' demographics, cause, manner, time of inflection, and outcome of blunt head injuries (BHI), types of skull fractures and intracranial lesions according to the result of radiological findings in non contrast computed tomography of brain were gathered. Also, the relationship between the different parameters and the intracranial lesions in these cases was assessed. The Statistical Package of Social Science (SPSS) Version 20 was used on a personal computer to tabulate and analyze the acquired data statistically. The necessary statistics were employed, including the chi-square test ($\chi 2$ test) for analytic statistics, number, and percentage for descriptive statistics. Statistical insignificance is declared when the p-value is greater than 0.05. A statistically significant p-value is one that is less than 0.05. A p-value is deemed statistically highly significant if it is equal to or less than 0.001 (Dawson and Trapp, 2004).

III. Results:

This prospective cohort study was conducted on 83 cases of BHI admitted to Ain Shams University Hospitals and had a primary medico legal report over a period of six months from the beginning of November 2023 to the end of April 2024.

The incidence of BHI: The number of BHI cases represented 13.5% of the total number of patients who were admitted in the same period to Ain Shams University Hospitals.

Age and sex distribution of BHI: Table (1) shows that the age of cases was classified into four groups as follows: ≤10 years, >10-30 years, >30-60 years and >60 years .The group with ages from more than 10 to 30 represented the highest incidence of all cases of BHI (54.2%). Also, the table shows that male cases of BHI (68.7%) were more than females (31.3%).

Causes of acute injuries: Table (2) shows that BHI cases represented 13.5% of all causes of acute injuries in relation to sharp HIs with percentage (3.7%) and other causes of injuries with the highest incidence (82.8%). There was a significant difference in distribution between the different causes of acute injuries.

Distribution of different age groups of BHI according to sex: Table (3) shows that females represented the highest percentage in the age group of >10-30 years with a percentage of (15.7%) where males were higher in number in the age group of >10-30 years (38.6%) than any other age groups. There was a significant difference between males and females in the age group of ≤10 years. No significant difference was found between them in other age groups (>10-30 years,>30-60 years, >60 years).

Different causes of BHI: Table (4) shows that RTAs represented the most common cause of BHI (67.5%) followed by falls (16.9%) then blunt blows (15.7%). As regards RTAs, pedestrians were the most affected groups (21.7%) followed by drivers (18.1%) whereas the least incidence was among motorcyclists (12%).

Manner of BHI: Table (5) shows the majority of BHI were inflicted by accidental manner (81.9%) followed by homicidal manner (15.7%) then suicidal manner (2.4%).

Time of infliction of BHI: Table (6) shows the majority of BHI were inflicted at the period from 12:00 am to 8:00 am (43.4%) followed by the period from 4:00 pm to 12:00 am (31.3%) then the least were at the period from 8:00 am to 4:00 pm (25.3%). There was a significant difference between the different periods of the day and the number of BHI cases.

Distribution of different age groups of BHI in relation to its causes: Table (7) shows that there was a significant difference between the different age groups in relation to causes as falls, RTAs driver, RTAs motor cyclist and other different causes of BHI.

Incidence of types of skull fractures: Table (8) shows that the most common types of skull fractures were combined fractures with a percentage of (48.2%) followed by fissure vault fractures (21.7%) then localized depressed fractures (14.5%), then comminuted fractures (6%), and lastly fracture base of the skull and no fracture with the same percentage (4.8%). In case of combined fractures, fissure vault and fracture base had the highest incidence (47.5%) but localized depressed and fissure vault with the lowest incidence (7.5%).

Incidence of types of intracranial lesions: Table (9) shows that the most common types of intracranial lesions were combined intracranial lesions (36.1%) followed by EDH (19.3%) then brain laceration (13.3%), contusion and SDH with the same percentage (9.6%), ICH (8.4%) and lastly SAH with a percentage of (3.6%). In case of combined intracranial lesions, brain laceration and SAH had the highest incidence (33.3%) but brain laceration and SDH with the lowest incidence (3.3%).

Outcome of BHI: Table (10) shows that non-survivors of BHI cases represented the highest percentage (57.8%) while survivors had a percentage of (42.2%).

Correlation between different types of intracranial lesions of BHI and different age groups: Table (11) shows statistical analysis of different types of intracranial lesions of BHI with different age groups where brain laceration, combined intracranial lesions of BHI, contusion, EDH, ICH, SAH and SDH were more common in the age group of >10-30 years than others with a percentage of (36.4%, 46.7%,75%,50%,57.1%,100% and 75%) respectively. There was a significant difference between different types of intracranial lesions of BHI with age groups of >30-60 years and >60 years.

Correlation between different types of intracranial lesions of BHI and sex: Table (12) shows statistical analysis of different types of intracranial lesions with sex where brain laceration, contusion, EDH, ICH, SAH and SDH were more common in males with a percentage of (81.8%, 75%, 87.5%,71.4%,100% and 75%) respectively but combined intracranial lesions of BHI were more common in females (53.3%).There was no statistically significant difference between different types of intracranial lesions with either males or females

Correlation between different types of intracranial lesions of BHI and causes of BHI: Table (13) shows a statistical analysis of different types of intracranial lesions with different causes of BHI in this study where brain lacerations and EDH were more common in cases of RTAs passengers and pedestrians with a percentage of (27.3%) and (25%) respectively but combined intracranial lesions were more common in RTAs pedestrians with a percentage of (26.7%). RTAs motorcyclists had the highest incidence of contusion (50%). The incidence of ICH was higher in cases of blunt blow injuries (57.1%) than any other type of

BHI. SAH occurred with (100%) in cases of RTAs drivers. Whereas cases of falls type of BHI were represented commonly by SDH with a percentage of (50%). There was no significant difference between different types of intracranial lesions of BHI with different causes of BHI.

Correlation between different types of intracranial lesions of BHI and its manner: Table (14) shows a statistical analysis of different types of intracranial lesions with its manner where brain laceration, combined intracranial lesions of BHI, contusion, EDH, SAH and SDH were more common in cases of BHI with accidental manner with a percentage of (81.8%, 86.7%,75%,87.5%,100% and 87.5%) respectively, but ICH were more common in cases with homicidal manner with a percentage of (57.1%). There was a significant difference between different types of intracranial lesions of BHI with a homicidal manner.

Correlation between different types of intracranial lesions of BHI and types of skull fractures: Table (15) shows a statistical analysis of different types of intracranial lesions with different types of skull fractures where brain lacerations, combined intracranial lesions of BHI and ICH were more common in cases of combined skull fractures with a percentage of (81.8%, 50% and 85.7%) respectively, but the incidence of EDH were higher in cases of fissure vault fractures than any other type of skull fractures (56.3%). Cases without fractures were more commonly associated with SDH (50%) but cases of comminuted skull fractures were represented commonly by SAH with a percentage of (66.7%). All cases with Fissure vault fractures, fracture base, localized depressed and combined fractures had the highest incidence of contusion with the same percentage (25%). There was a significant difference between different types of intracranial lesions of BHI and cases of BHI without fractures, comminuted skull fractures, fissure vault fractures and combined skull fractures.

Correlation between different types of intracranial lesions of BHI and time of occurrence of BHI: Table (16) shows a statistical analysis of different types of intracranial lesions with time of its occurrence where brain laceration, combined intracranial lesions of BHI, EDH, SAH and SDH were more common at the period from 12 am to 8:00 am of the day with a percentage of (45.5%, 43.3%, 56.3%, 100% and 50%) respectively but contusions were more common in occurrence at the period from 4:00 pm to 12:00 am (75%). The period from 4:00 pm to 12:00 am showed the highest incidence of ICH (71.4%). There was no significant difference between different types of intracranial lesions with different periods all over the day.

Correlation between different types of intracranial lesions of BHI and the outcome: Table (17) shows a statistical analysis of different types of intracranial lesions with the outcome where brain laceration, combined intracranial lesions of BHI, contusion, ICH and SAH were more common in non survivor cases with a percentage of (81.8%, 76.7%, 100%, 85.7% and 66.7%) respectively, but EDH and SDH were more common in survivor cases with the same percentage (100%). There was a highly significant difference between different types of intracranial lesions of BHI with the outcome.

Table (1): Distribution of Blunt head injuries in cases admitted to Ain Shams University Hospitals as regards to age and sex throughout the period of study

Blunt head injuries	Number	Percentage (%)
Age (years)		
≤10 years	10	12.0%
>10-30 years	45	54.2%
>30-60 years	15	18.1%
>60 years	13	15.7%
Sex		
Female	26	31.3%
Male	57	68.7%

Table (2): Causes of acute injuries in cases admitted to Ain Shams University Hospitals during the period of study

Causes of acute injuries	Number	Percentage (%)	χ2	p-value
Blunt head injuries	83	13.5%	688.700	<0.001*
Sharp head injuries	23	3.7%		
Others (firearm injuries)	511	82.8%		

*: Statistically significant at p-value ≤ 0.05, χ2: Chi-square test

Table (3): Chi-square (χ2) analysis of distribution of different age groups according to sex in all cases of blunt head injuries admitted to Ain Shams University Hospitals throughout the period of study

Age (years)	Sex				Total		χ2	p-value
	Female		Male					
	N	%	N	%	N	%		
≤10 years	2	2.4%	8	9.6%	10	12.0%	12.104	<0.001**
>10-30 years	13	15.7%	32	38.6%	45	54.2%	0.264	0.607
>30-60 years	7	8.4%	8	9.6%	15	18.1%	1.985	0.159
>60 years	4	4.8%	9	10.8%	13	15.7%	1.985	0.159
Total	26	31.3%	57	68.7%	83	100.0%	0.002	0.963

N: number of cases, %: percentage, **: Statistically highly significant at p-value ≤ 0.001, χ2: Chi-square test, ≤: less than and equal to, >: more than

Table (4): Distribution of different causes of blunt head injuries in cases admitted to Ain Shams University Hospitals throughout the period of study

Causes of Blunt head injuries	Number	Percentage %
Falls	14	16.9%
Blunt blow	13	15.7%
Road traffic accidents	56	67.5%
Pedestrian	18	21.7%
Driver	15	18.1%
Passenger	13	15.7%
Motor cyclist	10	12.0%

Table (5): Distribution of manner of blunt head injuries in cases admitted to Ain Shams University Hospitals throughout the period of study

Manner of Blunt head injuries	Number	Percentage %
Accidental	68	81.9%
Homicidal	13	15.7%
Suicidal	2	2.4%
Total	83	100%

Table (6): Chi-Square (χ2) analysis of different periods of the day in relation to number of BHI cases admitted to Ain Shams University Hospitals throughout the period of study

Time of infliction of Blunt head injuries	Number	Percentage %	χ2	p-value
From 8:00 am to 4:00 pm	21	25.3%	5.993	0.014*
From 4:00 pm to 12:00 am	26	31.3%		
From 12:00 am to 8:00 am	36	43.4%		
Total	83	100.0%		

*: Statistically significant at p-value ≤ 0.05, am: ante meridiem, pm: post meridiem, χ2: Chi-square test

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Table (7): Chi-Square (χ2) analysis of different age groups of blunt head injured cases in relation to causes

Cause of Blunt head injuries	Age groups of Blunt head injuries cases								Total		χ2	p-value
	≤10 years		>10-30 years		>30-60 years		>60 years					
	N	%	N	%	N	%	N	%	N	%		
Falls	4	40.0%	3	6.7%	5	33.3%	2	15.4%	14	16.9%	10.076	0.018*
Blunt blow	2	20.0%	5	11.1%	4	26.7%	2	15.4%	13	15.7%	2.224	0.528
RTAs driver	0	0.0%	14	31.1%	0	0.0%	1	7.7%	15	18.1%	11.628	0.009*
RTAs motor cyclist	0	0.0%	10	22.2%	0	0.0%	0	0.0%	10	12.0%	9.601	0.022*
RTAs passenger	2	20.0%	5	11.1%	2	13.3%	4	30.8%	13	15.7%	3.156	0.368
RTAs pedestrian	2	20.0%	8	17.8%	4	26.7%	4	30.8%	18	21.7%	1.272	0.736
Total	10	100.0%	45	100.0%	15	100.0%	13	100.0%	83	100.0%	32.594	<0.001*

RTAs: road traffic accidents, **≤:** less than and equal to, >: more than, N: number of cases, %: percentage, *: Statistically significant at p-value ≤ 0.05, χ2: Chi-square test

Table (8): Incidence of types of skull fractures in blunt head injuries in cases admitted to Ain Shams University Hospitals throughout the period of study

Types of skull fractures	Number	Percentage %
Fissure vault fracture	18	21.7%
Localized depressed fracture	12	14.5%
Comminuted fracture	5	6.0%
Fracture base	4	4.8%
No fracture	4	4.8%
Combined	40	48.2%
Fissure vault and Fracture base	19	47.5%
Comminuted and Fracture base	13	32.5%
Comminuted and Fissure vault	5	12.5%
Localized depressed and Fissure vault	3	7.5%

Table (9): Incidence of types of intracranial lesions in blunt head injured cases admitted to Ain Shams University Hospitals throughout the period of study

Types of Intracranial lesions	Number	Percentage %
Extradural hemorrhage	16	19.3%
Brain laceration	11	13.3%
Contusion	8	9.6%
Subarachnoid Hemorrhage	8	9.6%
Intracranial Hemorrhage	7	8.4%
Subarachnoid Hemorrhage	3	3.6%
Combined	30	36.1%
Brain Laceration and Subarachnoid Hemorrhage	10	33.3%
Subarachnoid Hemorrhage and Contusion	9	30.0%
Extradural And Subdural Hemorrhage	6	20.0%
Brain Laceration and Extradural Hemorrhage	4	13.3%
Brain Laceration and Subdural Hemorrhage	1	3.3%

Table (10): The Outcome of blunt head injured cases admitted to Ain Shams University Hospitals throughout the period of study

Outcome of Blunt head injuries	Number	Percentage %
Non-survivors	48	57.8%
Survivors	35	42.2%
Total	83	100%

Table (11): Chi-square statistical analysis (χ2) of different types of intracranial lesions in cases with different age groups

Age groups		Intracranial lesions of Blunt head injuries							Total (N=83)	χ2	p-value
		Brain laceration (N=11)	Combined (N=30)	Contusion (N=8)	EDH (N=16)	ICH (N=7)	SAH (N=3)	SDH (N=8)			
≤10 years	N	2	4	2	0	0	0	2	10	5.705	0.336
	%	18.2%	13.3%	25.0%	0.0%	0.0%	0.0%	25.0%	12.0%		
>10-30 years	N	4	14	6	8	4	3	6	45	5.984	0.308
	%	36.4%	46.7%	75.0%	50.0%	57.1%	100.0%	75.0%	54.2%		
>30-60 years	N	0	11	0	2	2	0	0	15	13.406	0.020*
	%	0.0%	36.7%	0.0%	12.5%	28.6%	0.0%	0.0%	18.1%		
>60 years	N	5	1	0	6	1	0	0	13	19.005	0.002*
	%	45.5%	3.3%	0.0%	37.5%	14.3%	0.0%	0.0%	15.7%		

≤: less than and equal to, **>**: more than, **N**: number of cases, %: percentage, *: Statistically significant at p-value ≤ 0.05, χ2: Chi-square test, EDH: Extradural Hemorrhage, SDH: Subarachnoid Hemorrhage, SAH: Subarachnoid Hemorrhage, ICH: Intracranial Hemorrhage,

Table (12): Chi-square statistical analysis (χ2) of different types of intracranial lesions of blunt head injuries with sex

Sex		Intracranial lesions of Blunt head injuries							Total (N=83)	χ2	p-value
		Brain laceration (N=11)	**Combined (N=30)**	**Contusion (N=8)**	**EDH (N=16)**	**ICH (N=7)**	**SAH (N=3)**	**SDH (N=8)**			
Female	N	2	16	2	2	2	0	2	26	11.964	0.063
	%	18.2%	53.3%	25.0%	12.5%	28.6%	0.0%	25.0%	31.3%		
Male	N	9	14	6	14	5	3	6	57		
	%	81.8%	46.7%	75.0%	87.5%	71.4%	100.0%	75.0%	68.7%		

N: number of cases, %: percentage, χ2: Chi-square test, EDH: Extradural Hemorrhage, SDH: Subdural Hemorrhage, SAH: Subarachnoid Hemorrhage, ICH: Intracranial Hemorrhage, **=:** equal to

Table (13): Chi-square statistical analysis (χ2) of different types of intracranial lesions with causes of blunt head injuries

Causes of Blunt head injuries		**Intracranial lesions of Blunt head injuries**							Total (N=83)	χ2	p-value
		Brain laceration (N=11)	**Combined (N=30)**	**Contusion (N=8)**	**EDH (N=16)**	**ICH (N=7)**	**SAH (N=3)**	**SDH (N=8)**			
Blunt blow	**N**	**2**	**3**	**2**	**1**	**4**	**0**	**1**	13	6.551	0.256
	%	**18.2%**	**10.0%**	**25.0%**	**6.3%**	**57.1%**	**0.0%**	**12.5%**	15.7%		
Falls	**N**	**0**	**7**	**0**	**3**	**0**	**0**	**4**	14	5.987	0.307
	%	**0.0%**	**23.3%**	**0.0%**	**18.8%**	**0.0%**	**0.0%**	**50.0%**	16.9%		
RTAs Driver	**N**	**1**	**6**	**0**	**2**	**2**	**3**	**1**	15	2.609	0.760
	%	**9.1%**	**20.0%**	**0.0%**	**12.5%**	**28.6%**	**100.0%**	**12.5%**	18.1%		
RTAs Motor cyclist	**N**	**2**	**2**	**4**	**2**	**0**	**0**	**0**	10	8.880	0.114
	%	**18.2%**	**6.7%**	**50.0%**	**12.5%**	**0.0%**	**0.0%**	**0.0%**	12.0%		
RTAs Passenger	**N**	**3**	**4**	**2**	**4**	**0**	**0**	**0**	13	4.127	0.531
	%	**27.3%**	**13.3%**	**25.0%**	**25.0%**	**0.0%**	**0.0%**	**0.0%**	15.7%		
RTAs pedestrian	**N**	**3**	**8**	**0**	**4**	**1**	**0**	**2**	18	2.307	0.805
	%	27.3%	26.7%	0.0%	25.0%	14.3%	0.0%	25.0%	21.7%		

RTAs: road traffic accidents, N: number of cases, %: percentage, χ2: Chi-square test, EDH: Extradural Hemorrhage, SDH: Subdural Hemorrhage, SAH: Subarachnoid Hemorrhage, ICH: Intracranial Hemorrhage, **=:** equal to

Table (14): Chi-square statistical analysis (χ2) of different types of intracranial lesions of blunt head injuries with its manner

Manner		Intracranial lesions of Blunt head injuries							Total (N=83)	χ2	p-value
		Brain laceration (N=11)	Combined (N=30)	Contusion (N=8)	EDH (N=16)	ICH (N=7)	SAH (N=3)	SDH (N=8)			
Accidental	N	9	26	6	14	3	3	7	68	8.174	0.147
	%	81.8%	86.7%	75.0%	87.5%	42.9%	100.0%	87.5%	81.9%		
Homicidal	N	2	3	2	1	4	0	1	13	11.201	0.048*
	%	18.2%	10.0%	25.0%	6.3%	57.1%	0.0%	12.5%	15.7%		
Suicidal	N	0	1	0	1	0	0	0	2	1.880	0.865
	%	0.0%	3.3%	0.0%	6.3%	0.0%	0.0%	0.0%	2.4%		

N: number of cases, %: percentage, χ2: Chi-square test, EDH: Extradural Hemorrhage, SDH: Subdural Hemorrhage, SAH: Subarachnoid Hemorrhage, ICH: Intracranial Hemorrhage, **=:** equal to, *: Statistically significant at $p \leq 0.05$

Table (15): Chi-square statistical analysis (χ2) of different types of intracranial lesions in blunt head injuries with the types of skull fractures

Types of skulls fracture		Intracranial lesions of Blunt head injuries							Total (N=83)	χ2	p-value
		Brain laceration (N=11)	Combined (N=30)	Contusion (N=8)	EDH (N=16)	ICH (N=7)	SAH (N=3)	SDH (N=8)			
No fracture	N	0	0	0	0	0	0	4	4	37.895	<0.001**
	%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	4.8%		
Comminuted	N	0	3	0	0	0	2	0	5	21.223	<0.001**
	%	0.0%	10.0%	0.0%	0.0%	0.0%	66.7%	0.0%	6.0%		
Fissure fracture of vault	N	0	4	2	9	1	1	1	18	16.440	0.006*
	%	0.0%	13.3%	25.0%	56.3%	14.3%	33.3%	12.5%	21.7%		
Fracture base	N	0	2	2	0	0	0	0	4	9.123	0.104
	%	0.0%	6.7%	25.0%	0.0%	0.0%	0.0%	0.0%	4.8%		
Localized depressed fracture	N	2	6	2	1	0	0	1	12	3.538	0.618
	%	18.2%	20.0%	25.0%	6.3%	0.0%	0.0%	12.5%	14.5%		
Combined	N	9	15	2	6	6	0	2	40	13.026	0.023*
	%	81.8%	50.0%	25.0%	37.5%	85.7%	0.0%	25.0%	48.2%		

N: number of cases, %: percentage, χ2: Chi-square test, EDH: Extradural Hemorrhage, SDH: Subdural Hemorrhage, SAH: Subarachnoid Hemorrhage, ICH: Intracranial Hemorrhage, **=:** equal to, *: Statistically significant at $p \leq 0.05$, **: Statistically highly significant at p-value ≤ 0.001

Table (16): Chi-square statistical analysis (χ2) of different types of intracranial lesions in blunt head injured cases in relation to the time of occurrence

Time of occurrence of BHI		Intracranial lesions of Blunt head injuries							Total (N=83)	χ2	p-value
		Brain laceration (N=11)	Combined (N=30)	Contusion (N=8)	EDH (N=16)	ICH (N=7)	SAH (N=3)	SDH (N=8)			
From 8:00am-4:00pm	N	3	8	0	3	5	0	2	21	10.708	0.058
	%	27.3%	26.7%	0.0%	18.8%	71.4%	0.0%	25.0%	25.3%		
From 4:00p-12:00am	N	3	9	6	4	2	0	2	26	7.474	0.188
	%	27.3%	30.0%	75.0%	25.0%	28.6%	0.0%	25.0%	31.3%		
From 12:00 am to 8:00am	N	5	13	2	9	0	3	4	36	3.070	0.689
	%	45.5%	43.3%	25.0%	56.3%	0.0%	100.0%	50.0%	43.4%		

N: number of cases, %: percentage, χ2: Chi-square test, EDH: Extradural Hemorrhage, SDH: Subdural Hemorrhage, SAH: Subarachnoid Hemorrhage, ICH: Intracranial Hemorrhage, **=:** equal to, am ante meridiem, pm: post meridiem

Table (17): Chi-square statistical analysis (χ2) of different types of intracranial lesions of blunt head injuries with the outcome

Outcome		Intracranial lesions of Blunt head injuries							Total (N=83)	χ2	p-value
		Brain laceration (N=11)	Combined (N=30)	Contusion (N=8)	EDH (N=16)	ICH (N=7)	SAH (N=3)	SDH (N=8)			
Non-survivors	N	9	23	8	0	6	2	0	48	48.035	<0.001**
	%	81.8%	76.7%	100.0%	0.0%	85.7%	66.7%	0.0%	57.8%		
Survivors	N	2	7	0	16	1	1	8	35		
	%	18.2%	23.3%	0.0%	100.0%	14.3%	33.3%	100.0%	42.2%		

N: number of cases, %: percentage, χ2: Chi-square test, EDH: Extradural Hemorrhage, SDH: Subdural Hemorrhage, SAH: Subarachnoid Hemorrhage, ICH: Intracranial Hemorrhage, **=:** equal to, **: Statistically highly significant at p-value ≤ 0.001

IV. Discussion

The current study is a prospective cohort study aimed to assess the incidence, patients' demographics, cause, manner, time of inflection, outcome of BHI, and types of skull fractures and intracranial injuries on 83 cases who were admitted to Ain Shams University Hospitals. According to our data, the proportion of BHI cases accounts for 13.5% of all patients admitted to hospitals within the same time period from the beginning of November 2023 to the end of April 2024. (Taha and Barakat (2016) revealed in a survey carried out in Zagazig, Egypt, that 2124 patients admitted to their neurosurgical trauma unit had TBIs out of 9458 patients admitted for other reasons.Also, our finding is in line with those of Refaat et al. (2019), who reported that (39.7%) of all cases admitted to the neurosurgery department of Banha University Hospital during the study period had THIs.

In the current study, the group with ages from more than 10 to 30 years old was the most affected one in comparison to others with the least affected group of age more than 60 years old followed by those less than 10 years old. Also, males and females represented the highest percentage in the age group of >10-30 years with percentage of (38.6% and 15.7%) respectively. This may be explained by the fact that young adults are the primary breadwinners in the family and spend the majority of the day outside, as well as the fact that the age range of more than 10 to 30 is the most active. Additionally, youth tend to engage in more aggressive activities by nature. Individuals who are at the extremes of age typically stay indoors, while youngsters are restricted to domestic spaces. The similar conclusion was reported by Emejulu et al. (2010). The bulk of Khanabhai et al. (2012) patients fell within the 20–29 age group, according to their study. These data highlight the economic effects of HIs since they are more common among those who are employed. (Kumar et al. (2014) demonstrated that the age group of 21 to 30 years old accounted for the greatest percentage of casualties (45%). According to Yusuf et al. (2014), the majority of the patients in Ilorin, Nigeria, were between the ages of 15 and 44. Also, this finding is consistent with that of Tandean et al. (2019), who revealed that the productive age group, which is 18 to 35 years old, had the greatest prevalence of THIs. This might be brought on by the fact that people in this productive age group engage in more everyday tasks that put them at risk for HIs, such operating a vehicle and working at heights. Bangirana et al. (2019); Bedry and Tadele (2020) stated the same findings. However, Yates et al. (2006) showed a very high rate of moderate to severe HIs in the age group less than 5 years old for both males and females in urban areas. This may be attributable, in part, to such factors as greater density of population, traffic flow, and, potentially, crime rates. Halldorsson et al. (2007), who carried out a prospective study in Iceland, documented that there was an increased risk for THIs in the age group from (0-4 year). Omar et al. (2018) demonstrated that children were the most frequently affected age group, followed by adolescents, and that the elderly over 50 were the least frequently affected. Additionally, the mean age was 60 years (median; range 0–104 years), according to Maegele et al. (2019). The findings from Kloss et al. (2008) did not align with the results presented here, as they did not discover any significant correlation between HIs and age. Contrary to this, Gupta et al. (2002) highlighted that individuals in their third decade were the most vulnerable age group, constituting 48.13% of cases, followed by those in their fourth decade at

24.06%. Meanwhile, children tended to experience incidents within the vicinity of their homes.

The current study showed that males were more affected than females and there was a significant difference between males and females in the age group of ≤10 years. This higher male to female ratio finding is in agreement with Sah et al. (2020) and Metwalli et al. (2022). Men may participate in outdoor activities at a higher rate than women. According to Amini et al. (2020), the reason for the male preponderance is because men are exposed to the outside environment more than females. According to Gupta et al. (2002) and Yadav et al. (2008), young men are also more likely to participate in high-risk or contact sports like football, karate, boxing, etc., fight with weapons and firearms, and work in jobs that can be dangerous in the workplace, frequently involving heavy machinery. Boys (41, 59%) were the most prevalent gender group to have HIs in the study conducted by Atwa et al. (2017), with a male to female ratio of 1.4: 1. Children under the age of five had the highest frequency of HIs (53, 75.7%), with the age range of two to five years old having the highest percentage of HIs (33, 47%).

In order to identify intracranial injuries, Haydel et al. (2000) scanned and assessed individuals with moderate HIs who were in the ED. Of the patients, 21% were female and 78.2% were male. Male preponderance was shown across all age categories, according to Patil and Vaz (2011) study, which is consistent with other studies' earlier findings as Yavuz et al. (2003) and Adeleye et al. (2009).

In this study, BHI cases represent 13.5% of all causes of acute injuries in relation to sharp HIs with a percentage of 3.7% and other causes w ch has the highest incidence (82.8%). This is in accordance with Saleh et al. (2022) who showed that blunt instruments were the commonest cause of HIs (94%) followed by sharp instruments (6%). According to Mohanty et al. (2005), firearm trauma was the least prevalent type of trauma in India, whereas blunt trauma was the most common type. Blunt weapons are widely used because they are affordable, easily obtained, and, in the event that they are discovered later, can be claimed to be household items. Patil et al. (2016) also revealed that blunt injury was the most common agent causing the skull fracture in 95.74 % and the least was sharp in 4.25 %. The findings contradicted those of Omar et al. (2018), who demonstrated the widespread use of firearms and their efficacy as murder weapons.

In this study, RTAs represent the most common cause of BHI with percentage of 67.5% followed by falls (16.9%) then lastly blunt blows (15.7%). As regards RTAs, pedestrians were the most affected groups (21.7%) then drivers (18.1%) whereas the least incidence was among motorcyclists (12%). This result comes in agreement with Bindu et al. (2017) where RTAs responsible for (68%) of injuries.

According to Kumar et al. (2012), HIs resulting in a fractured skull were linked to rear-end collisions (78; 92.8%), falls from a height (3; 3.6%), assaults (2; 2.4%), and railway accidents (1; 1.2%). Out of the 78 instances of Rear-End Accidents, (51.3%) involved individuals riding two wheels, and (82.5%) involved the drivers. Pedestrians (37.2%) and bicycle riders (6.6%) made up the next largest casualty category. Out of all motorized two-wheeler riders, just 3 (7.5%) were found to be wearing a helmet.

In line with previous study by Peeters et al. (2015) and Kafle et al. (2019) reported that RTAs (76%) was the most common mode of HIs, followed by falls injury (18%) and physical assault (4%).

In a study by Patil and Vaz (2011), 57.7% of motor vehicles and RTAs involved pedestrians. This is due to the fact that pedestrians use the roads more frequently than other users and that hawkers monopolize the sidewalks designated for their use, forcing pedestrians onto the roadways, and that cars ignore traffic signals, lane boundaries, and speed limits. According to Kumar et al. (2014), 59.60% of victims are from (RTAs), which were followed by falls from heights (20.20%), then assaults (4.20%) and finally occupational HIs (15.80%). Other causes, such as gunshots, comprised (0.2%) of the total. According to Patil et al. (2016), blunt force trauma is frequently linked to rear-end collisions (RTAs). Two-wheeler riders contributed to 70% of these instances, making them the primary victims of fractured skulls, with passengers accounting for the least amount of these cases (7.79%). Also, the majority of motorcycle accidents in Africa and underdeveloped nations, according to Boniface et al. (2017), were caused by these accidents. In contrast to the current investigation, Saleh et al. (2022) reported that falls were the most common cause of HIs and that assault-related injuries were the least common. Linnau et al. (2013) demonstrated that falls from height (31.5%) were the

leading cause of death in the US, followed by car crashes and assaults. THIs was most frequently caused by falls from a low height (38.7%), as stated by (Maegele et al. 2019).

This current study showed that the majority of BHI were inflicted by accidental manner representing (81.9%) followed by homicidal manner (15.7%) then suicidal manner (2.4%).This finding is in agreement with the results of Yadav et al. (2008) in India, who found that there were (92.4%) victims of accidents, (6.7%) of homicides and just (0.9%) were suicides. According to Patil et al. (2016), accidental death accounts for (81.94%) of deaths, homicidal accounts for (12.7%), and suicidal accounts for (5.3%) of cases. Also, Saleh et al. (2022) showed that accidental infliction was the most common manner (64%), while suicidal injury was the least.

In this current study, the majority of BHI were inflicted in the period from 12:00am to 8:00am (43.4%) followed by from 4:00pm to 12:00am (31.3%) then in the period from 8:00 am to 4:00 pm (25.3%) with a significant difference between different periods of the day and number of BHI cases. This finding was in contrast with Kumar et al. (2012) who found that maximum number of RTAs occurred between 3:00 pm- 5:00 pm (23.8%), 9:00 am-12:00 pm (22.5%), 12:00 pm- 3:00 pm (13.7%) and 12:00 am-3:00 am (11.3%) hours. According to Patil and Vaz (2011), the greatest number of deaths (29.6%) happened between the hours of 6:00 am and 12:00 pm., when most of victims were heading to work or engaging in outdoor activities. This was followed by a slightly lower peak of (28.6%) between the hours of 6:00 pm and 12:00 am when people were heading home.

This study proved that there was a significant difference between different age groups of BHI cases in relation to causes such as falls, RTAs driver, RTAs motor cyclist and also all different types of BHI. The highest percentage of falls, blunt blow, RTAs driver and motorcyclist, RTAs pedestrian and passenger were found in age group of ≤10 years,>30-60 years, >10-30 years, and >60 years respectively. This finding comes in agreement with Bangirana et al. (2019) stated that falls were also reported as the most common cause of TBIs in the elderly population. A study by Atwa et al. (2017) found that TBIs from sporting activities and other causes account for the least in most age groups.

According to Levant et al. (2016), falls were the most frequent cause of TBIs for all age groups except those between the ages of 15- 24 and 25- 34. Accidents involving falling objects, objects colliding with people, or both accounted for 26.8% of the causes for individuals aged 15 - 24, while motor vehicle injuries (27.3%) accounted for the majority of causes for adults aged 25-34. This is consistent with the findings of Pandey et al. (2016), who demonstrated that youngsters accounted for the majority of patients experiencing falls from height. This is a result of kids not showing up for school and kids playing outside or flying kites on open roofs.

In this current study, the most common types of skull fractures in BHI cases were combined fractures (48.2%) followed by fissure vault fractures (21.7%) then localized depressed fractures (14.5%), comminuted fractures (6%), and lastly fracture base of the skull and no fracture with the same percentage (4.8%). In case of combined fractures, fissure vault and fracture base have the highest incidence (47.5%) but localized depressed and fissure vault with the lowest incidence (7.5%).

In comparison, base skull fractures alone were reported to be (44%), followed by base fractures with vault (31%), by Kumar et al. (2012). According to Saleh et al. (2022), fissure fractures are the most common type of skull fractures, followed by depressed fractures. These findings are consistent with those of Menku et al., (2004), who found that fissure fractures were the most common type of fractures, and they also align with the findings of a study conducted by Mohanty et al. (2005). Also, Thube et al. (2015) and Soni et al. (2016), reported that the most frequent type of skull fracture was a linear fracture. In a study by Sah et al. (2020), (62.8%) of the participants experienced a linear form of fracture, with depressed and comminuted kinds occurring in (29.4%) and (7.8%) of instances, respectively. Chattopadhyay and Tripathi (2010) reported that of the cases that resulted in death, nearly half (49.3%) had comminuted fractures of the skull and only (58.9%) had a fracture of the base of the skull. Additionally, over three quarters (76.7%) of the cases had multiple cranial bone fractures, while fissure fractures were the most common type of fracture (55.5%) and found that the majority of the survivors (55.5%) had single cranial bone fractures.

According to a study by Omar et al. (2018), the most common type of fatal skull fracture among deaths was a comminuted fracture. Because of the concomitant brain laceration, every case of comminuted fracture ended abruptly. This is consistent with the findings of Henry et al. (2009), who showed that depressed fractures, particularly those with temporal and parietal fractures, all cases with skull fractures and/or serious brain injury were regarded as fatal injuries.

This study showed that the most common types of intracranial lesions in BHI cases were combined intracranial lesions with a percentage of 36.1% followed by EDH (19.3%) then brain laceration (13.3%), contusion and SDH with the same percentage (9.6%), ICH (8.4%) and lastly SAH with a percentage of 3.6%. In the case of combined intracranial lesions, brain laceration and SAH have the highest incidence (33.3%) but Brain laceration and SDH with the lowest incidence (3.3%). Contrary to Metwalli et al. (2022) findings, which indicated that the percentage of contusions was (32%), the percentage of EDH was (21.5%), and the least was SAH (10.7%), and none of the participants experienced SDH or intracranial hematomas.

According to Geijerstam and Britton (2003) meta-analysis study, the most common CT findings were: SDH (1.3%), EDH (1.0%), SAH (1.0%), skull fracture (3.2%), intracranial hemorrhage or contusion (2.8%), and SDH (1.3%). This finding contradicted the findings of a study by Saleh et al. (2022), which showed that isolated SDH accounted for (45.7%) of cases, with solitary epidural hemorrhage accounting for (15.7%) of cases. The incidence of combination SDH and SAH was matched by the (2.9%) of patients that showed a combination of epidural, SDH, and intracranial hemorrhages. In one case (1.4%), a single SAH was discovered. According to Dhagat et al. (2018), contusions account for 11.4% of all radiological findings and were discovered in (15.2%) of male and (3.1%) of female patients with statistically significant results. (SAH) was discovered in (11.3%) of instances, with (2.3%) of male patients having SAH along with an accompanying intraventricular hemorrhage (IVH) and (4.9%) of female cases just having SAH.

Patil and Vaz (2011) observed that cerebral hemorrhages were detected in 30.68% of instances when they were isolated, but in 83.6% of cases when they were identified in combination. The most prevalent type of hemorrhage was a mix of SDH and SAH (59.8%). Sixty-nine cases had cerebral contusions, 42% had profound brain hemorrhages, and 26% had lacerations.

A CT scan revealed cerebral edema in 44% of patients, intracerebral hematoma in 22% of cases, subdural hematoma in 41% of cases, extradural hematoma in 32% of cases, IVH in 6% of cases, and pneumocephalus in 19% of cases, according to a study by Narang et al. (2019).

In this study, the majority of BHI cases are not survivors (57.8%), whereas the rate of survivors is (42.2%). According to Chattopadhyay and Tripathi (2010), (80.21%) of the cases turned out to be fatal, while 19.78% of them survived. Furthermore, Omar et al. (2018) discovered that out of the 206 instances they looked at, 96 cases had non-fatal HIs. In contrast, 110 cases had fatal HIs, which either occurred immediately after being admitted to the hospital or on the way there.

According to Raza et al. (2018), (19.4%) of patients died and (80.6%) of patients were released. As demonstrated by Kumar et al. (2014), (94.4%) of HIs patients survived in a tertiary care hospital, whereas (5.6%) of patients passed away there, as a result of their injuries.

This study revealed that brain laceration, combined intracranial lesions of BHI, contusion, EDH, ICH , SAH and SDH were more common in the age group of >10-30 years than others with a percentage of 36.4% ,46.7%,75%,50%,57.1%,100% and 75% respectively. There was a significant difference between different types of intracranial lesions of BHI with age groups of >30-60 years and >60 years. This was in agreement with Jawale et al. (2019), who found that EDH, SDH and SAH were most commonly seen in age group 21-40 years. ICH was found commonly in age groups 21-40, 41-60 and 61-80 years. IVH was found commonly in 21-40- and 61-80-years age groups.

In this study, brain laceration, contusion, EDH, ICH, SAH and SDH were more common in males with a percentage of (81.8%, 75%, 87.5%, 71.4%, 100% and 75%) respectively, but combined intracranial lesions of BHI were more common in females with a percentage of (53.3%).There was no significant difference between different types of intracranial lesions of BHI with either males or females. This finding goes hand in hand with Muhammad et al. (2020) study as regards SAH but on the contrary regarding EDH, ICH and SDH.

This study proved that brain lacerations and EDH were more common in cases of RTAs passengers and RTAs pedestrians with a percentage of (27.3%) and (25%) respectively but combined intracranial lesions of BHI were more common in RTAs pedestrians with a percentage of (26.7%). RTAs motorcyclists had the highest incidence of contusion (50%). The incidence of ICH was higher in cases of blunt blow injuries (57.1%) than any other type of BHI. SAH occurred with (100%) in cases of RTAs drivers. Whereas cases of falls type of BHI were represented commonly by SDH with a percentage of (50%). There was no significant difference between different types of intracranial lesions of BHI with different causes of BHI.

The findings of the present study showed that brain laceration, combined intracranial lesions of BHI, contusion, EDH, SAH and SDH were more common in cases of BHI with accidental manner with a percentage of 81.8%, 86.7%, 75%,87.5%,100% and 87.5% respectively but ICH were more common in cases of BHI with homicidal manner with a percentage of (57.1%). There was a significant difference between different types of intracranial lesions of BHI with a homicidal manner.

This study found that brain lacerations, combined intracranial lesions of BHI and ICH were more common in cases of combined skull fractures with a percentage of 81.8%, 50% and 85.7% respectively but the incidence of EDH was higher in cases of fissure vault fractures than any other type of skull fractures (56.3%). Cases without fractures were more commonly associated with SDH (50%) but cases of comminuted skull fractures were represented commonly by SAH with a percentage of 66.7%. All cases with fissure vault fractures, fracture base, localized depressed and combined fractures of BHI had the highest incidence of contusion with the same percentage (25%). There was a significant difference between different types of intracranial lesions of BHI and cases of BHI without fractures, comminuted skull fractures, fissure vault fractures and combined skull fractures. This was in contrast with Jawale et al. (2019) who found that fracture of skull was found in (7%) of cases of EDH, in (26%) cases of SDH, in (33%) cases of SAH, in (5%) cases of ICH and in (2%) of IVH.

In this current study, brain laceration, combined intracranial lesions of BHI, EDH, SAH and SDH were more common in occurrence at the period 4:00 pm to 12:00 am of the day with a percentage of (45.5%, 43.3%, 56.3%, 100% and 50%) respectively, but contusions were more common in occurrence at the period 4:00 pm to 12:00 am of the day with a percentage of (75%). From 8:00 am to 4:00 pm of the day showed the highest incidence of ICH (71.4%). There was no significant difference between different types of intracranial lesions of BHI with different periods of occurrence all over the day.

This study stated that brain laceration, combined intracranial lesions of BHI, brain contusion, ICH and SAH were more common in non survivor cases of BHI with a percentage of (81.8%, 76.7%, 100%, 85.7% and 66.7%) respectively, but EDH and SDH were more common in survivor cases of BHI with the same percentage of 100%. There was a highly significant difference between different types of intracranial lesions with the outcome. This finding goes with Raza et al. (2018) who showed that combined ICH was more common in non survivor cases followed by brain contusion, then SDH, ICH and lastly SAH and EDH but brain contusion was more common in survivor cases followed by combined ICH then SAH, EDH and lastly SDH. This was in line with the findings of Chattopadhyay and Tripathi (2010), who revealed that in (61.6%) of the fatal cases, SDH and SAH were found together, whereas in (22.23%) of the non-fatal cases, EDH and SAH were noted. This can be explained by the fact that in the majority of the cases, there was a blunt force impact over the parietal and temporal regions, which led to fissure fractures and tear in the blood vessels in the epidural space. Because of this, there was a greater force of impact, which reached the brain's deeper tissues and caused SDH, SAH, and intracranial hemorrhages. Thus, it follows that the likelihood of death increases with the depth of the brain hemorrhage.

Conclusion and Recommendation: Globally, BHI is a major contributor to chronic morbidity and mortality. Finding the conditions in which they occur and the variables such as age, sex, etiology, time of incidence, etc, that may be significant in either contributing to or predisposing to such catastrophic cranio-cerebral injuries is vital. Additionally, the relationship between these parameters and the various CT scan findings of cerebral lesions. According to the current study's findings, automobile accidents were the most frequent reason. The inflection generally occurred at night, and the technique was largely unintentional. Combination fractures were the most prevalent kind of skull fractures. Additionally, combined intracranial lesions were the most common type of brain lesion, and the results indicated that the majority of the admitted cases were non-survivors. It is recommended to conduct the development plans of the country in preventing and decreasing the incidence of BHI. First aid tools and well-trained emergency teams essential for pre-hospital care. Also, proper care and rehabilitation for injured victims should be organized in the hospitals.

List of Abbreviations

Am: ante meridiem
BHI: Blunt head injury
CT: Computed tomography
EDH: Extra dural hemorrhage
His: Head injuries
ICH: Intracerebral hemorrhage
IVH: Intraventricular hemorrhage
pm: post meridiem
RTAs: Road traffic accidents
SDH: Subdural hemorrhage
SAH: Subarachnoid hemorrhage
TBIs: Traumatic brain injuries
THIs: Traumatic head injuries
US: United States

V. References

Abdelgeleel, N. M., Salama K. M., Ali M. A. and Elsagher A. N (2019). Assessment of management of polytrauma patients in the emergency department in Suez Canal University hospital. International Surgery Journal, 6(6), 1844-1850. DOI: https://doi.org/10.18203/2349-2902.isj20192352

Adeleye, A.O., Olowookere, K.G. and Olayemi, O.O. (2009). Clinicoepidemiological profiles and outcomes during first hospital admission of head injury patients in Ikeja, Nigeria. Neuroepidemiology; 32: 136-41. DOI: 10.1159/000182821

Alnaami, I., Alshehri, S., Alghamdi, S., Ogran, M., Qasem, A., Medawi, A., Medawi, A., Alshahrani, S., Sarhan, L. (2019). Patterns, types, and outcomes of head injury in Aseer Region, Kingdom of Saudi Arabia. Neurosci J. 7; 2019:2782146. PMID: 30984774; PMCID: PMC6431466. DOI: 10.1155/2019/2782146

Amini, H., Isanejad, A., N. Chamani, N., Movahedi-Fard, F., Salimi, F., Moezi, M. and Habibi, S. (2020). Physical activity during covid-19 pandemic in the iranian population: A brief report. Heliyon 6, e05411. DOI: 10.1016/j.heliyon.2020.e05411

Atreya, A., Karmacharya, B., Nepal, S., Sathian, B. and Bharrarai, A. (2017). Head injuries in survivors of accident falls: A hospital-based study in Nepal. Journal of South India Medicolegal Association; 9(2):106-13. https://www.researchgate.net/publication/341927763_

Atwa, H., Abdallah, NB., Abd, H. and Gawad, E. (2017). Pattern and outcome of paediatric head injuries in the Suez Canal region: A follow-up study. Journal Egypt Public Health Assoc; 92(1): 11-7. DOI: 10.21608/epx.2017.7004

Bangirana, P., Giordani, B., Kobusingye, O., Murungyi, L., Mock, C., John, CC., and Idro, R., et al. (2019). Patterns of traumatic brain injury and six-month neuropsychological outcomes in Uganda. BMC Neurology.; 19(1): 18. DOI: https://doi.org/10.1186/s12883-019-1246-1

Bedry, T. and Tadele, H. (2020). Pattern and outcome of pediatric traumatic brain injury at Hawassa University Comprehensive Specialized Hospital. Article ID 1965231. Emergency medicine international. DOI: 10.1155/2020/1965231

Bindu, TS., Vyas, S., Khandelwal, N., Bhatia, V., Dhandapani, S., Kumar, A. and Ahuja, C.K. (2017). Role of whole brain computed tomography perfusion in head injury patients to predict outcome. Indian Journal. Radiology. Imaging; 27:268–273. DOI: 10.4103/ijri.IJRI_454_16

Boniface, R., Lugazia, ER., Ntungi, AM. and Kiloloma, O. (2017). Management and outcome of traumatic brain injury patients at Muhimbili Orthopaedic Institute Dar es Salaam, Tanzania. Pandemic African Medicine Journal.; 26: 140. https://doi.org/10.11604/pamj.2017.26.140.10345

Büyükcam, F., Kaya, U., Karakılıç, ME., Cavuş, UY., TuranSönmez, F. and Odabaş, O. (2012). Predicting the outcome in children with head trauma: comparison of four score and Glasgow Com. Observational study, Ulus Travma Acil Cerrahi Derg; 18(6):469-73. Journal agent. DOI: 10.5505/tjtes.2012.23169

Chattopadhyay, S.P. and Tripathi, C. (2010). Skull fracture and hemorrhage pattern among fatal and nonfatal head injury assault victims – a critical analysis. Journal of Injury. Violence Res.; 2 (2): 99-103. DOI: 10.5249/jivr.v2i2.46

Dawson, B. and Trapp, R. G (2004): Basic and clinical biostatistics. Singapore, 2001, 141-142. https://books.google.com.eg/books/about/Basic_Clinical_Biostatistics_4_E_EBOOK.html?id=p6hu-qU2zpsC&redir_esc=y

Dhagat, PK., Dwivedi, A., Arora, S., Singh, SN., Singh, S. and Jain, M. (2018). Spectrum of radiological findings on non contrast computed tomography head in a Trauma center with cases of acute head injuries. Journal of Medical Academics ;1(1):26-34. https://www.jaypeedigital.com/doi/JOMA/pdf/10.5005/jp-journals-10070-0006

Emejulu, JKC., Isiguzo, CM., Agbasoga, CE. and Ogbuagu, C.N. (2010). Traumatic brain injury in the accident and emergency department of a tertiary hospital in Nigeria. East and Central African Journal of Surgery; 15(2):28-38. https://www.semanticscholar.org/paper/Traumatic-Brain-Injury-in-Accident-and-Emergency-of-Emejulu-Isiguzo/c32154c5b6a25d6bfb59c79c3a2109ca7e28b209

Geijerstam, JL. and Britton, M. (2003). Mild head injury--mortality and complication rate: meta-analysis of findings in a systematic literature review. Acta Neurochirgica (Wien); 145 (10): 843–850. https://doi.org/10.1007/s00701-003-0115-1

Gupta, A. (2002). Cranio-cerebral damage with special reference to circle of willis in fatal road traffic accidents. Anil Aggrawal's Internet Journal of Forensic Medicine and Toxicology; 3(2):75-6. https://www.anilaggrawal.com/ij/vol_003_no_002/main.html

Halldorsson, JG., Flekkoy, KM.,Gudmundsson, KR., Arnkelsson, G. and Arnarson, EO. (2007). Urban rural differences in pediatric traumatic head injuries: A prospective nationwide Study. Journal of Neuropsychiatric Disease and Treatment; 3(6):935-941. https://www.tandfonline.com/doi/full/10.2147/ndt.s2034

Haydel,MJ., Preston, CA., Mills, TJ., Luber, S., Blaudeau, E. and DeBlieux, PM. (2000). Indications for computed tomography in patients with minor head injury. N England Journal Medicine; 343(2):100-5. https://doi.org/10.1056/nejm200007133430204

Henry, J. (2009). Brain trauma in head injuries presenting with and without concurrent skull fractures. J Forensic Leg Medicine; 16: 115-120. DOI: 10.1016/j.jflm.2008.08.013

Jawale, SM., Bhise, SS., Hoval Prashant and Nanandkar, SD. (2019). Study of pattern of fatal intracranial hemorrhages. International Journal of Health Research Medico Leg Prae; 5(1):19-22. DOI:10.31741/ijhrmlp.v5.i1.2018.6

Kafle, P., Khanal, B., Yadav, DK., Poudel, D., Karki, T. and Cherian, I. (2019). Head injury in Nepal: An instuonal based prospecve study on clinical Profile, management and early outcome of traumac brain injury in Eastern Part of Nepal BJHS; 4 (2): 750 – 754. DOI: https://doi.org/10.3126/bjhs.v4i2.25459

Khanabhai, M. and Lutomia, M.B.L. (2012). Motorcycle accident injuries seen at Kakamega Provincial hospital in Kenya. East Central. African. Jouranl. surg; 17:43-46. https://www.semanticscholar.org/paper/Motorcycle-Accident-injuries-seen-at-Kakamega-in-Khanbhai-Lutomia/6979816e941bb1122ece8d0c733200ddb8dd7c97

Kloss, F., Laimer, K., Hohlrieder, M., Ulmer, H., Hackl, W., Benzer, A., Schmutzhard, E., & Gassner, R. (2008). Traumatic intracranial haemorrhage in conscious patients with facial fractures--a review of 1959 cases. Journal of cranio-maxillo-facial surgery : official publication of the European Association for Cranio-Maxillo-Facial Surgery, 36(7), 372–377. https://doi.org/10.1016/j.jcms.2007.12.002

Kumar, D., Bains, V., Sharma, BR. and Harish, D. (2012). Descriptive study of head injury and its associated factors at tertiary hospital, Northern India. Journalical of Community Med Health Educ; 2:141. DOI:10.4172/jcmhe.1000141

Kumar, L., Agarwal, S., Singh, T. and Garg, R. (2014). Patterns of head injury at tertiary care hospital. International Journal of Scientific Study; 1(5):5-8. https://www.ijss-sn.com/uploads/2/0/1/5/20153321/ijss_feb-02.pdf

Levant, S., Chari, K. and DeFrances, C. (2016). National hospital care survey demonstration projects: Traumatic brain injury. National Health Statistics Reports; 97:1-16. PMID: 27483022. https://pubmed.ncbi.nlm.nih.gov/27483022/

Linnau, K.F. (2013). Skull fractures. In: Harris & Harris' Radiology of Emergency Medicine, Pope T.L. and Harris J.H. (eds.), 5th Edition, Philadelphia, Pennsylvania, Lippincott Williams & Wilkins; p:1. https://searchworks.stanford.edu/view/L317535

Maegele, M., Lefering, R., Sakowitz, O., Kopp, MA., Schwab, JM., Steudel, WI., Unterberg, A., Hoffmann, R., Uhl, E. and Marzi, I. (2019). The incidence and management of moderate to severe head injury. Dtsch Arztebl Int.; 116(10):167-173. DOI: 10.3238/arztebl.2019.0167

Mahran, D. G., Farouk, O., Qayed, M. H., & Berraud, A. (2016). Pattern and trend of injuries among trauma unit attendants in Upper Egypt. *Trauma monthly*, *21*(2), e20967. https://doi.org/10.5812/traumamon.20967

Matthew, L. P., Ingrid, R. N.,Junji E.,Atsushi S., Sameer B. S. and Josh L. D (2017): Pathophysiology associated with traumatic brain injury: Current Treatments and Potential Novel Therapeutics. 37(4):571-585. DOI: 10.1007/s10571-016-0400-1

Menku, A., Koc, RK., Tucer, B., Durak, AC. and Akdemir, H. (2004). Clivus Fractures: Clinical presentations and courses. Neurosurgical Review; 27(3):194-198.https://doi.org/10.1007/s10143-004-0320-2

Metwalli, ASI., Taha, MM. and Elsharkawy, AME. (2022). Mild Head Injury Patients: Correlation between admission computed tomography brain scan and outcome. 28 (2): 174-180. https://doi.org/10.21608/zumj.2020.11140.1151

Mohanty, S., Mohanty, MK. and Panigrahi, MK. (2005). Fatal head injury in homicidal victims. Medicine, science, and the law; 45(3):244-8. https://doi.org/10.1258/rsmmsl.45.3.244

Muhammad, S., Chaudhry, SR., Kahlert, UD., Lehecka, M., Korja, M., Niemelä, M. and Hänggi, D. (2020). Targeting high mobility group box 1 in subarachnoid hemorrhage: A Systematic Review International. Journal. Mol. Sci., 21(8), 2709. https://doi.org/10.3390/ijms21082709

Narang, S., Bansal, P., Thukral, BB. and Mital M. (2019). Spectrum of computerized tomography (CT) findings in craniocerebral trauma- A clinicoradiological evaluation. Journal of Medical Science And Clinical Research (JMSCR). Volume 07 Issue ISSN (e)-2347-176x ISSN (p) 2455-0450. DOI:10.18535/jmscr/v7i12.100

Omar, AHM., Hanna, MM., Zaher, MAA., Ishak, GA. and Fahim, AL. (2018). Skull fracture and hemorrhage pattern among fatal and nonfatal head injury and primary reconstruction of depressed Fracture. Journal of Forensic Medicine 3: 122. https://www.hilarispublisher.com/open-access/skull-fracture-and-haemorrhage-pattern-among-fatal-and-nonfatal-headinjury-and-primary-reconstruction-of-depressed-fracture-2472-1026-1000122.pdf

Pandey, R., Kamal, V. and Agrawal, D. (2016). Epidemiology, clinical characteristics and outcomes of traumatic brain injury: Evidences from integrated level 1 trauma center in India. Journal of Neurosciences in Rural Practice; 7(4):515. DOI: 10.4103/0976-3147.188637

Patil, R.C., Arifulla, K.M. and Goudar, E.S. (2016). Scenario of pattern of skull fractures in the victims of unnatural deaths due to head injury autopsied at Al-Ameen Medical College Hospital and District Hospital Mortuary, Vijaypur, India.: International Journal of current Medical and Applied sciences; 10(2), 86-92. https://www.ijcmaas.com/images/archieve/IJCMAAS_APRIL_2016_VOL10_ISS2_11.pdf

Patil, AM. and Vaz, WF. (2011). Pattern of Fatal BHI: A Two-Year Retrospective / Prospective medico legal autopsy study. Journal of Indian Academy of Forensic Medicine; 32(2):144-149. https://www.researchgate.net/publication/277229521

Patil, SG., Patil, BS., Joshi, U., Allurkar, S., Japatti, S. and Munnangi, A., et al. (2016). The facial skeleton: Armor to the brain? Indian Journal Dent; 7:116-20. DOI: 10.4103/0975-962X.180318

Peeters, W., van den Brande, R., Polinder, S., Brazinova, A., Steyerberg, EW. and Lingsma, HF., et al. (2015). Epidemiology of traumatic brain injury in Europe. Acta Neurochirgica; 157(10):1683–96. DOI: 10.1007/s00701-015-2512-7

Raza, S., Shahzad, Y., Shafiq-ur-Rahman, Tassadaq, A. and Akhtar, N. (2018). Pattern of head injury and associated injuries in patients presenting to the Neurosurgical Emergency. Journal of Rawalpindi Medical College. 22(2): 120-3. https://www.researchgate.net/publication/351903191

Refaat, R., Haroun, MR., Sharaf Eldin, AAI., Hussein, AYA., and Abdelkader, A. (2019).Medico legal aspects of traumatic head injuries in Benha university hospital(prospective analytical study). The Egyptian Journal of Forensic Sciences and Applied Toxicology); 19 (4). DOI: 10.21608/EJFSAT.2019.20885.1119

Rupani R., Verma, A. and Rathore, S. (2013): Pattern of skull fractures in cases of head injury by blunt force. Journal of Indian Academy Forensic Med.; 35 (4): 336-8. https://www.researchgate.net/publication/290060604_Pattern_of_skull_fractures_in_cases_of_head_injury_by_blunt_force

Sadaka, F., Patel, D. and Lakshmanan, R. (2012). The four score predicts the outcome in patients after traumatic brain injury. Neurocrit Care; 16: 95-101. DOI: 10.1007/s12028-011-9617-5

Sah, SK., Neupane, BR., Atreya, A. and Karki, N. (2020). Pattern of head injuries in western Hilly region of Nepal. A Hospital-based Cross-sectional Study. Journal of Lumbini Medical College; 8(1): 6. DOI: https://doi.org/10.22502/jlmc.v8i1.297

Saleh, SM., Tayel, AM., Ibrahim, FA. and El Shehaby, DM. (2022). Outcome of Patients with Moderate and Severe Head Injuries in South Valley University Hospitals. SVU-International Journal of Medical Sciences. 5 (2): 274-288. DOI:10.21608/svuijm.2021.60128.1068

Soni, SK., Dadu, SK. and Singh, BK. (2016). Pattern of skull fracture in fatal road traffic accident victims: An autopsy based study. Scholars Journal of Applied Medical Sciences; 4(5F):1819-22. DOI: https://saspublishers.com/media/articles/SJAMS_45F_1819-1822.pdf

Soni, SK., Dadu, SK., Bajrang, K., Singh, BK. and Pandey, D. (2016). Pattern and distribution of head injuries in fatal road traffic accidents in Indore region of central India. Sch. Journal. Applied. Medicine. Science.; 4(5D):1711-1716. DOI: https://saspublishers.com/media/articles/SJAMS_45D_1711-1716.pdf

Taha, MM. and Barakat, MI. (2016): Demographic Characteristics of Ttraumatic brain injury in Egypt; hospital-based study of 2124 patients. Journal of Spain neuorosergery, 5:6. *doi:* https://www.scitechnol.com/peer-review/demographic-characteristics-of-traumatic-brain-injury-in-egypt-hospital-based-study-of-2124-patients-sW0P.php?article_id=5607

Tandean, S., Japardi, J., Kollins, F. and Loe, ML. (2019). Epidemiology of traumatic brain injury in neurosurgery department of tertiary referral hospital at North Sumatera, Indonesia. Medicinus; 7(5):146–149. DOI: https://doi.org/10.19166/med.v7i5.2471

Thube, HR., Pawale, DA., and Jagtap, NS. (2015). Study of Pattern of fatal experience from a tertiary care center in Pakistan. Turkish neurosurgery, 24(1), 19-24. https://www.mlam.in/pdf/currentissue/7.Harshal_Thube.pdf

Wang, J., Han, F., Zhao, Q., Xia, B., Jialin Dai, J and Wang, Q. et al. (2018): Clinicopathological characteristics of traumatic head injury in juvenile, middle-aged and elderly individuals. International Medical Journal of Experimental and Clinical Research, 18 May 2018, 24:3256-3264. DOI: 10.12659/MSM.908728

Yadav, A., Kohli, A. and Aggarwal, NK. (2008). Study of pattern of skull fractures in fatal accidents in Northeast Delhi. Indmedica - MedicoLegal Update; 8(2). https://www.indianjournals.com/ijor.aspx?target=ijor:mlu&volume=8&issue=2&article=011&type=pdf

Yates, PJ., Williams, WH., Harris, A., Round, A. and Jenkins, R. (2006). An epidemiological study of head injuries in a UK population attending an emergency department. Journal Neurol Neurosurg Psychiatry; 77: 699–701. DOI: 10.1136/jnnp.2005.081901

Yavuz, MS., Asirdizer, M., Cetin, G., Günay, BY. and Altinkok, M. (2003): The correlation between skull fractures and intracranial lesions due to traffic accidents. American Journal of Forensic Medicine and Pathology; 24(4):339- 345. DOI: 10.1097/01.paf.0000103011.14578.c3

Yusuf, AS., Odebode, TO., Adeniran, JO., Salaudeen, AG., Adeleke, NA. and Alimi, MF. (2014). Pattern and outcome of motorcyclists head injury in Ilorin, Nigeria. DOI:https://journals.lww.com/nbcs/fulltext/2014/11020/pattern_and_outcome_of_motorcyclists_head_injury.6.aspx

Zaki M, D., Elsayed A, E. (2025). Relationship between Intracranial Lesions in Blunt Head Injuries and Different Parameters: A Six-Month Prospective Study at Ain Shams University Hospitals. *Zagazig Journal of Forensic Medicine and Toxicology*, 23 (1): 47-63. doi: 10.21608/zjfm.2025.331193.1205