The relationship between Traumatic brain injury and intracranial lesions : A cross sectional study

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Abstract

Background: Head injury is an abuse to the brain, not resulting from a deteriorating nature or Congenital anomaly, but obtained by external physical force that leads to impairment of cognitive Abilities or physical functioning because produces a negative or altered level of consciousness. Head injury is a major cause of disability and death in adults. Road traffic accidents (RTA) are the Leading cause of mortality and disability nationally and internationally . The computerized Tomography (CT) imaging is a standard part of head trauma evaluation. The intracranial hemorrhage Is a common and serious consequence of head trauma .

Objective: this study aims to evaluate the pattern of head injuries in patients with intracranial lesions and to study their relationship , aiming to evolution with the clinical course during neurointensive care and long-term outcome after traumatic brain injury patients with a head injury who are admitted to Al_hilla general teaching hospital in Babylon province.

Method:

This was a cross-section study of head injury patients in the department of neurosurgery at Al-Hilla General teaching hospital through a structured interview during during two months from February to March 2024. A total of 60 patients were included in the study. The data Collected included Various clinical-epidemiological parameters, patient demographic information (age and gender), injury mechanism, and clinical computerized tomography (CT) finding. We used GCS scores to identify the severity of head injury patients code 3 and above. The SPSS version 25 Was used for the analysis of data.

Results:

A total of 60 patients were studied. The mean age of data was 27.05 years with a maximum of 76 And a minimum of 1. The most commonly affected age group was 20-39 years. Most of the study Patients(68%) were men. The majority (66.7%) of the sample was admitted to intensive care units (ICU). The most common mechanism of head injury was due to road traffic accident (RTA) (58,33%),

Followed by falls related injury in 25% of patients, 11,67% (7) was due to penetrating trauma, and 5 %(3) were due Bulett injury. The most common CT scan Head injury-related findings were: Intracranial hemorrhage (93.3%), skull fractures (46 %), and hemorrhage contusion (5%).The Subdural hemorrhage (SDH) (40%(24)) and subarachnoid hemorrhage (SAH) (36.7%(22)) presented As the first and second most frequently encountered intracranial hemorrhages, respectively.The Epidural hemorrhage (EDH) was found in 18,3 %(11) , intraventricular hemorrhage (IVH) was found In 10%(6). In total, 63.3% of cases were managed conservatively whereas surgical intervention was conducted in 36.7% of cases .

Conclusion:

Our study showed road traffic accidents(RTA) are the main mechanism of head injury in the Babylon Province. The intracranial hemorrhage was the most common computerized tomography (CT) Finding abnormal in this study.

Keywords: head injury,computerized tomography (CT) finding. Skull fracture, Intracranial Hemorrhage, road Traffic accidents(RTA).

Abbreviations:

RTA:road Traffic accidents

CT: computer tomography

SDH:subdural hemorrhage

SAH: subarachnoid haemorrhage

EDH:epidural hemorrhage

IVH: Intraventricular hemorrhage

GCS: Glasgow Coma Scale

ICU:intensive care unit

ICH: intracranial hemorrhage

Introduction :

Traumatic brain injury (TBI) is defined as a sudden insult to the brain caused by an external mechanical force that is non-degenerative and non-congenital and may result in an impairment of cognitive, physical, and psychosocial function and an altered state of consciousness.(1,2) Trauma remains one of the leading causes of death and disability globally accounting to 9% of total mortality in Nepal.(3,4)

Prompt recognition of treatable injuries is critical to reducing mortality. In the acute setting, non-contrast computed tomography (CT) is the cornerstone for rapid diagnosis as it quickly and accurately identifies intracranial haemorrhage that warrants neurosurgical evacuation. Follow-up assessment using a CT scan is frequently necessary to detect the progression and stability of the lesion and evidence of delayed complications and sequels of cerebral injury, which can determine whether surgical intervention is necessary.(5) However, patients who initially presented with head trauma often receive repeat CT scans in order to rule out the progression of their head injury.(6)

Failure of cerebral autoregulation has been linked to unfavorable outcome after traumatic brain injury (TBI). Preliminary evidence from a small, retrospective, single-center analysis suggests that autoregulatory dysfunction may be associated with traumatic lesion expansion, particularly for pericontusional edema(7)

Failure of cerebral autoregulation and progression of intracranial lesion have both been shown to contribute to poor outcome in patients with acute traumatic brain injury (TBI), but the interplay between the two phenomena has not been investigated. Preliminary evidence leads us to hypothesize that brain tissue adjacent to primary injury foci may be more vulnerable to large fluctuations in blood flow in the absence of intact autoregulatory mechanisms(8,9)

Method:

Study design and study sample:

This is a cross-sectional study that was carried out on patients admitted with a head injury who presented to medical wards and intensive care unit(ICU) at Al_ Hilla general teaching hospital in Babylon during two months from February to March 2024 . A total of 60 patients were included in this study. Data are collected on patients who arrive at the hospital alive, death from injury at any point during admission, patients who require intensive or high dependency care, patients with “isolated head injury” or “multi-system trauma with a head injury” and patients with abnormal CT findings such as fractures or intracranial hemorrhage were included in the study. Patients with trivial head trauma mechanisms, patients with preexisting neurologic disorders including brain tumors, ventricular shunts, bleeding disorders, and no head computed tomography (CT) scan examination provided were excluded.

Data collection tools:

The data were collected by using a paper interviewer administered questionnaire through face-to- face interviews with patients or assisted by medical staff in intensive care unit(ICU) , If the condition of the injured patient did not permit the conversation, the close relatives were interviewed. Self- evaluation forms were used in interviews with the patients to collect personal information, The information about the mechanism of injury was primarily determined from the medical history provided by the caregiver to a physician and patient assessment. The CT findings and GCS of the patients were obtained from their medical records. When the GCS score was not specifically recorded in the medical record, it was calculated from the neurological examination .The mean

amount of time required for collecting data from patients was 10 minutes. Informed consent was provided by all patients.

Study variables:

The parameter of Patients demographic, clinical, and neuroimaging data, including age, sex, mechanism of injury, level of consciousness, endotracheal intubation, ICU admission, the head computed tomography(CT)scan finding, the type of ICH, the skull fractures, severity of the head injury, management, time of injury, Neurological status was assessed using the Glasgow Coma Scale (GCS), the outcome after follow up . the head computed tomography(CT)scan finding was classified into intracranial hemorrhage or skull fracture, The time of injury is divided into four months unit (August, September, October, and December). The Glasgow Coma Scale (GCS) was defined as units from 3 to 15, GCS score usually was sedation in patients in an intensive care unit (ICU) and was assumed to equal three, and the verbal domain of GCS score in patients with endotracheal intubation was assumed to equal one . The severity of the head injury was classified into three categories based on GCS score such as mild (GCS score 13_15), moderate (GCS score 9_12), and severe (GCS score 3_8). The outcomes after follow up were either in-hospital mortality and alive, the patients were followed until discharge, facility transfer, death, or one week in the hospital.

The statistics data:

Data were analyzed by The SPSS version 25. Baseline characteristics were summarised using means and standard deviations for continuous variables and counts and percentages

for categorical variables. To summarize our data, various descriptive statistics like frequencies and proportions were calculated. The correlation between patient characteristics (sex, age, severity of head injury , intracranial hemorrhage ,Skull fracture location) and mechanism of injury was analyzed using binary logistics. The chi-square test was used to measure the statistical significance of study results at P <

.05. The Chi-square test were used as a test for association between variables. All statistical tests were performed at a 95% level of significance and were two-sided; a P value, of .05 indicated statistical significance.

Results:

	Frequency	Percent %	Valid Percent	Cumulative Percent
below 20	25	41.7	41.7	41.7
20_29	16	26.7	26.7	68.3
30_39	8	13.3	13.3	81.7
40_49	3	5.0	5.0	86.7
50_59	1	1.7	1.7	88.3
above 59	7	11.7	11.7	100.0
Total	60	100.0	100.0	

Table 1 presents the distribution of age. The patients' age was divided into six groups, group I (below 20), groupII (21_29),groupIII(30_39), group IV (40_49), group V (50_59), and Group VI (above 59). Note that 81.7 % (41 of 60) of patients were between 1 and 39 years with a peak incidence Below 20 years, 6.7 %(4 of 60) of patients were between 40 and 59 and 11.7 %(7 of 60) of patients Were above 59.

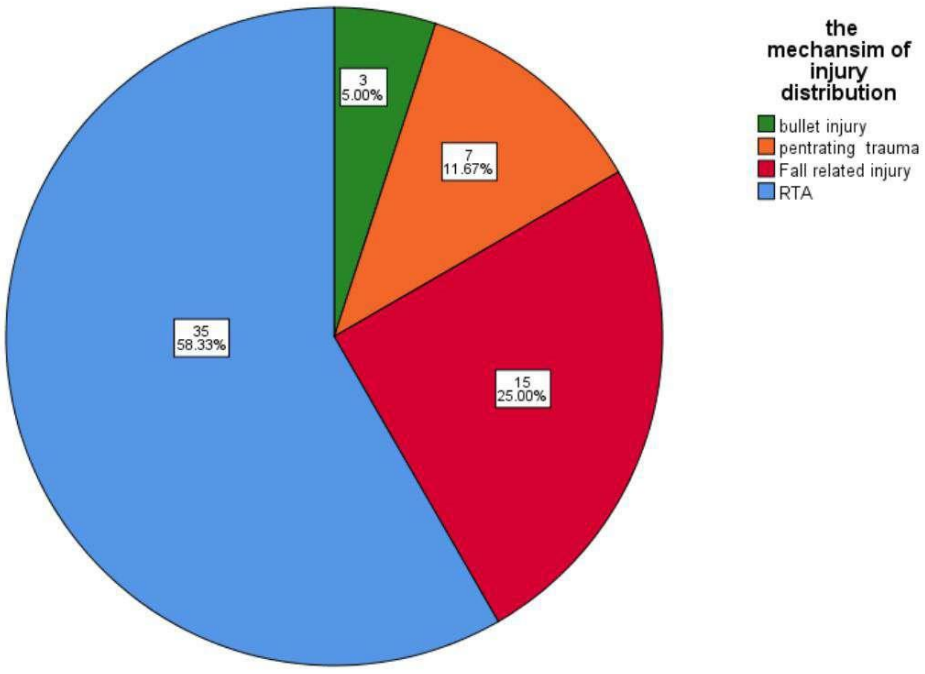

Figure 1: Describe the distribution of the mechanism of injury, The most common mechanism of Head injury was due to road traffic accident (RTA) (58,33%), followed by falls related injury 25% of Patients, 11,67% (7) due to penetrating trauma, and 5 %(3) were due Bulett injury.

		the mechansim of injury				Total
		RTA	Fall related injury	bullet injury	pentrating trauma	
Age Groups	below 20	13	8	1	3	25
	20_29	12	2	1	1	16
	30_39	6	2	0	0	8
	40_49	2	0	0	1	3
	50_59	0	1	0	0	1
	Above 59	2	2	1	2	7
Total		35	15	3	7	60

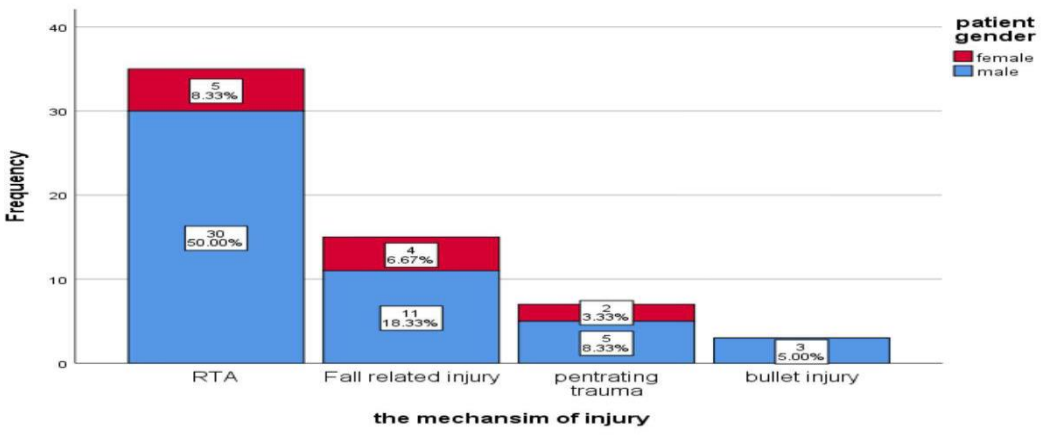

Table 2 and Figure 2 presented differences in the distribution of the mechanism of injury according To age and gender. Note that There was not a significant difference in the distribution of the Mechanism of injury according to age and gender (p valve > 0.05). The male was a greater Percentage of patients among all mechanisms of injury except bullet injury, all patients with Bulett Injury were male. The mean and standard deviation age for each group of mechanisms of injury Varied from (24 to 35 years), (15 to 26), respectively .road traffic accidents (RTA) were the most Common mechanism of head injury in the age group of below 40 years (n=31,51.7%). A fall-related Injury like falling to the ground, falling from a bed, and falling from high was the commonest cause Of head injury in those below 20 years(13.3%). Penetrating injury and bullet injury accounted for (6.7%)and(3.4%) of patients, respectively.

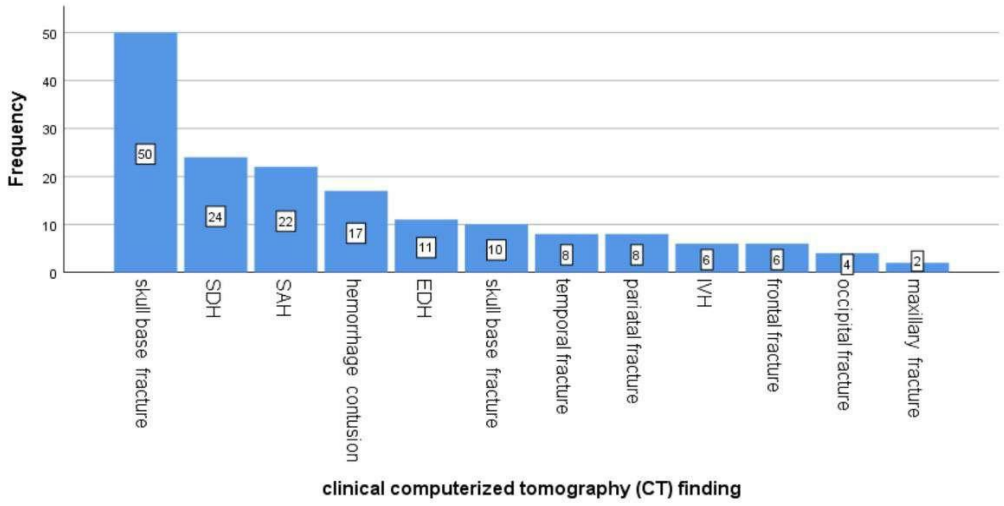

Figure 3 shows the distribution of clinical computerized tomography (CT) findings. Note that there Are a wide variety of computerized tomography (CT) findings abnormalities, where Intracranial hemorrhage was seen in 93.3%(56 of 60) of patients, among patients with intracranial Hemorrhage, the most common computed tomographic findings were subdural hemorrhage (SDH) Found in (40%; 24) of patients and subarachnoid hemorrhage (SAH) (36.7%; 22) presented as the First and second most frequently encountered intracranial hemorrhages, respectively. Epidural Hemorrhage (EDH) was found in 18,3 %(11), and intraventricular hemorrhage (IVH) was found in

10%(6). Hemorrhage contusion was seen in 28.3%(17). The skull fractures were seen in 48.3%(29) Of patients. Among patients with skull fractures, the most common fracture was base skull fracture (10 cases) followed by temporal fracture (8 cases), the parietal fracture was found in (8 cases), (6 Cases) had a frontal fracture, the four cases had an occipital fracture and only two cases had a Maxillary fracture.

		the mechansim of injury				Total
		RTA	Fall related injury	bullet injury	pentrating trauma	
CT finding	SDH	15	3	3	3	24
	SAH	16	3	0	3	22
	EDH	5	3	0	3	11
	IVH	5	1	0	0	6
	hemorrhage contusion	13	3	0	1	17
	skull base fracture	4	5	0	1	10
	temporal fracture	6	1	0	1	8
	pariatal fracture	3	2	1	2	8
	frontal fracture	5	1	0	0	6
	occipital fracture	2	1	1	0	4
	maxillary fracture	0	1	1	0	2
Total		35	15	3	7	60

Table 3 describes the correlation between the mechanism of injury and clinical computerized Tomography (CT) scan of the head. The clinical CT finding was categorized into three groups: Intracranial hemorrhage, hemorrhage contusion, and skull fracture. Intracranial hemorrhage is Classified into four categories including Subdural hemorrhage(SDH), epidural hemorrhage(EDH), Subarachnoid hemorrhage(SAH), and intraventricular hemorrhage(IVH). Most

of the patients with Road traffic accidents (RTA) had SDH, SAH, and hemorrhage contusion,(15, 16, 13 cases) Respectively, all patients with bullet injury had SDH only. The patients injured by an RTA had Hemorrhage contusion (n=13) more than patients with other mechanisms. The skull fractures were Classified based on the location such as base skull fracture, temporal fracture, parietal fracture, Occipital fracture, and maxillary fracture. Most patients with RTA had a temporal fracture (six cases) Followed by a frontal fracture (five cases) .most patients injured by fall-related accidents had skull Base fractures (five cases). Most patients with penetrating trauma had a parietal fracture. The Maxillary fracture is seen only in patients injured by bullet injury and fall-related injury.

		mangement		Total
		surgical intervention	conservative mangement	
CT finding	SDH	13	11	24
	SAH	6	16	22
	EDH	5	6	11
	IVH	1	5	6
	hemorrhage contusion	5	12	17
	skull base fracture	2	8	10
	temporal fracture	4	4	8
	pariatal fracture	3	5	8
	frontal fracture	1	5	6
	occipital fracture	2	2	4
	maxillary fracture	2	0	2
Total		22	38	60

Table 4 The correlation between computerized tomography (CT) finding and the management of the Patients. The Patient management was either surgical intervention or conservative management Based on the clinical condition, Conservative management consisted of close observation in either Intensive care unit (ICU) with vital signs monitoring in addition to frequent neurological clinical Examinations and repeat head CT scans, the conservative was more common management than Surgical intervention, surgical intervention was most common with SDH, EDH, and SAH . the Conservative management was most common with SAH, SDH and hemorrhage contusion.

Discussion:

TBI were found to be more commonly seen in the age group below 20 (41.7%) with the main etiological factor being RTA (58.33%) and majority were male . This finding is worrying, as the groups of individuals who are exposed to these brain injuries are young patients, whom face permanent lifelong neurological disabilities resulting in long-term hospital care which will bring negative psychological effects to caregivers. Besides that, these permanent disabilities will lead to long-term costly medical treatments causing significant financial strains on families as well as national healthcare systems. There is a need for more enforcement of road traffic safety especially speed monitoring as well as educating and increasing requirements on providing driving licenses to this young group of citizens . The importance of this finding is it highlights the need for safety improvements in the automobile industry especially for motorcyclist. There is a need for increased research and development into helmet designs to include full protection and the use of a more resilient material to make helmets. Besides that, enforcement of compulsory usage of rear seatbelts and increasing airbag protection in vehicle should be endorsed as this has been shown to significantly reduce the risk of intracranial lesions . The main aim of these protective methods is to reduce the transfer of forces to facial bones that will indirectly reduce the force transferred to the skull therefore protecting the brain. There is a need for clinicians to provide patients with the necessary preventive and safety

precautions advice which include avoidance of any contact sports as well as any physical activities that may have risk of exposing the cranium to any form of impact to prevent further injuries . Quick diagnosis early intervention is fundamental to prevention of morbidity as well as mortality especially with regards to prevention of TBI as even a short duration of hypoxia and edema will lead to significant permanent neurological deficits. The study show Most of

The patients with Road traffic accidents (RTA) had SDH, SAH, and

Hemorrhage contusion,(15, 16, 13 cases) Respectively, all patients

With bullet injury had SDH only and approximately half of them required surgical intervention. There are some limitations of this study that should be discussed. Firstly the size of the sample population was small which could affect the results of this study. Besides that, the study only involved one trauma centre and the study only retrospectively assessed cases which reduces the generalization of our results. However, it must emphasize that our results were consistent with results from larger multicentre cohorts and were statistically significant. Future research would require a more exhaustive multicentre study involving larger samples and a bigger time frame of assessment to specifically assess additional parameters in order to get definitive conclusions to improve preventive

Measures and prevent significant morbidity and mortality among patients. This study showed road traffic injury was the commonest cause of traumatic brain injury which affected young age groups. TBI patients with any of risk factors may need close continues monitoring, early ICU admission and CT SCAN, and some other special extra care in ED

Conclusion :

In conclusion, our study showed road traffic accidents are the main mechanism of head injury in The Babylon province. The fall-related injury also played an important role in head injury. The Intracranial hemorrhage was the most common computerized tomography (CT) finding abnormal in This study. The prevalence of abnormal CT-scan findings did not significantly change according to The head injury. There was no significant association between the mechanism of injury and age and Also with gender.

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