Original Article

Relationship of Glasgow Coma Scale and CT Scan Brain findings in Head Trauma Patients of Different Age groups

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ABSTRACT

Objective: To determine the relationship between GCS score and CT scan brain findings in head trauma patients of different age groups.

Methodology: This was a cross-sectional descriptive epidemiological study. It included 45 head injury patients who presented to the Emergency Department of Sharif Medical City Hospital, Lahore, Pakistan and underwent a CT scan. The Glasgow Coma Scale (GCS) score of the patients at the time of presentation to the Emergency Department was calculated and the data was filled in the questionnaire.

Results: Most of the patients were adults i.e they belonged to the age group 19-60 years (68.9%). Out of the 45 patients, 66.7% had a mild, 24.4% had a moderate and only 8.9% had a severe GCS score. The most common CT scan finding in patients with head trauma was a linear fracture (40%) with contusions being the second most common finding (17.8%). Our results showed that 20% of the patients with a severe GCS score had multiple findings on their CT scan reports whereas only 4.5% of the patients with severe GCS had a single CT scan finding. There is a strong association between the GCS score of the patients and the number of findings on their CT bran scan reports. Most of the patients with severe head injury had the subarachnoid hemorrhage.

Conclusion: This study showed that there is a strong relationship between the GCS score of the patients with head injury and the likelihood of multiple findings on their CT scan reports.

Keywords: *Glasgow Coma Scale (GCS). CT Scan Brain. Head Trauma.*

INTRODUCTION

Head injury is a common and potentially devastating clinical problem. Within 48 hours of head injury, clinical intervention should be done for the proper management of head trauma. For the patients with head injury, computed tomography (CT) scan of the brain can perform an important role in the diagnostic workup. In the initial stages, neuroimaging is very significant to find out the existence and the extent of the injury and determine the surgery or minimally invasive interventions. Computed tomography (CT) scan is the best imaging modality to be performed in head injury patients in emergency and trauma setup due to its easy availability, low cost and less time required to perform it. The use of CT scan brain in head injury patients has become increasingly common. Because of separate CT scan windows for brain and bone, it not only gives details of intracranial pathologies but also gives excellent clue about cranial, skull base and facial bones fractures.[1] Glasgow Coma Scale (GCS) is a quantitative measure of the conscious level of the patient. It is the best assessment tool for the patients with head injury.

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Glasgow Coma Scale was first presented by Teasdale and Jennett in 1974 and is scored from 3-15 (15 being the fully conscious patient and 3 being the one showing no response to pain.[2] According to GCS, head injury patients can be divided into three groups; mild, moderate and severe. Patients with mild head injury have GCS between 13-15, moderate have GCS between 9-12 and in severe head injury GCS is 3-8. Glasgow Coma Scale is shown in table 1. Head injury is a common problem seen in poly-trauma patients.[3,4] It is an alarming health problem worldwide with an increasingly high incidence and suggesting a dominant and prime cause of death and disability in all age groups i.e. adolescent, adult and geriatric. It is also a major cause of morbidity and mortality in Pakistan.[5] Radiological evaluation of head injury patients includes an x-ray of the skull and CT scan brain. Selection of patients for CT scan is done on the basis of Glasgow Coma Scale, signs of raised intracranial pressure and presence of skull fracture.[6-10] Head injury is very common in Pakistan. So, this study was planned to evaluate the relationship between GCS score and CT scan brain findings in head trauma patients of different age groups.

METHODOLOGY

This was a cross-sectional descriptive epidemiological study. It included head injury patients who presented to

the Emergency Department of Sharif Medical City Hospital, Lahore, and underwent a CT scan. A non-probability sampling technique was used. Forty five patients were included in this study. It was carried out between September 2016 - January 2017 after approval from ethical committee. Written informed consent was taken from the patients and data was collected using a questionnaire. The Glasgow Coma Scale (GCS) score of the patients at the time of presentation to the Emergency Department was calculated and the score together with the findings of their CT scan reports was filled in the questionnaire. Study subjects were divided into three groups according to age. Group 1 with the age <18 years, group 2 has patients of age 19-16 years and group 3 included patients with age > 60 years.

This division is based upon the premise that the mechanisms of injury in group 1 (play related falls, over speeding, one-wheeling) are generally significantly different from those in group 2 (accidental trauma, work-related injuries). The second division is based upon both the different mechanisms as well as the existence of co-morbidities in patients of group 3 (brain atrophy, atherosclerosis).

STATISTICAL ANALYSIS

The data collected through the questionnaires was entered into the computer using the SPSS (Statistical Package for Social Sciences) software 23.0. The categorical variables were analyzed and presented as frequencies and percentages. Their association with the patient GCS score was analyzed using chi-square test. A p-value of < 0.05 was considered statistically significant.

RESULTS

Most of the patients belonged to the age group 19-60 years (68.9%), 71.1% of the patients were male whereas only 28.9% of the patients were females (Figure 1).

Our results showed that most of the patients (68.9%) suffered from the head injury due to a fall from height and 14 (31.1%) patients presented after road traffic accident. Out of the 45 patients, 66.7% had a mild, 24.4% had a moderate and only 8.9% had a severe GCS score. The most common CT scan finding in patients with head trauma was a linear fracture (40%) with contusions being the second most common finding (17.8%). There was an equal incident of subdural hematoma (SDH) and extradural hematoma (EDH) in the patients (11.1%) with a slightly higher incidence of subarachnoid hemorrhage (SAH) (15.6%) (Table 2).

Our results depicts that 58.3% of the patients in the age

Table:1 Glasgow Coma Scale

Parameter	Response	Score
Eye-opening	Spontaneous	4
	To command	3
	To pain	2
	No response	1
Motor response	Obeys	6
	Localizes	5
	Withdrawal	4
	Flexor	3
	Extensor	2
	No response	1
Verbal response	Oriented	5
	Confused conversation	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1

Table 2: Frequency distribution of patients according to their CT scan findings

CT Scan Findings	Percentage
Linear Fractures	40
Partially Displaced Fractures	4.4
Depressed Fractures	2.2
Comminuted Fractures	0
Midline Shift	2.2
Contusions	17.8
Diffuse Cerebral Edema	6.7
Soft Tissue Swelling	11.1
Intracranial Hemorrhage (ICH)	0
Pneumocephalus	2.2
Subdural Hematoma (SDH)	11.1
Subarachnoid Hemorrhage (SAH)	15.6
Extradural Hematoma (EDH)	11.1
Incidental Findings	2.2
Unremarkable scan	15.6

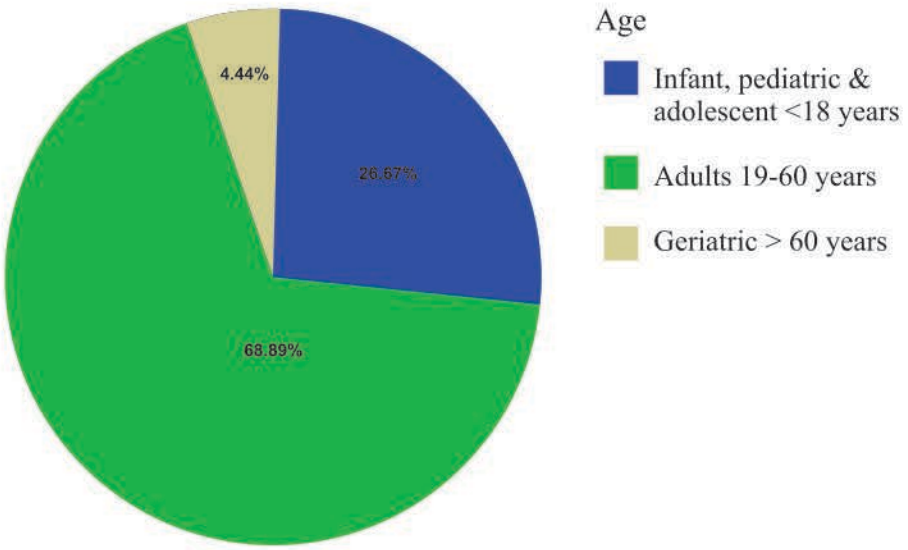

Figure 1: Age distribution of the patients

group <18 years and 67.7% of the patients in the age group 19-60 years had a mild head injury. However, there is no statistical significance between the patients GCS scores and their age ($p > 0.05$).

In our study, 20% of the patients with a severe GCS score had multiple findings on their CT scan reports whereas only 4.5% of the patients with severe GCS had a single CT scan finding. There is a strong association between the GCS scores of the patients and the number of findings on their CT scan reports ($p < 0.05$).

Our results showed that 42.9% of the patients with severe head injury had SAH according to their CT scan reports. There is a strong statistical association between the GCS score of head injury patients and the presence of SAH on their CT scan reports ($p < 0.01$ which means results are highly significant).

Table 3: Comparison of the patients GCS score in relation to their age groups

		Glasgow Coma Scale Scores			Total
		Mild (13-15)	Moderate (9-12)	Severe (3-8)	
Age	< 18 years	7	5	0	12
		58.3%	41.7%	0%	100%
	19-60 years	21	6	4	31
		67.7%	19.4%	12.9%	100%
	> 60 years	2	0	0	2
		100%	0%	0%	100%
Total		30	11	4	45
		66.7%	24.4%	8.9%	100%
Chi- square value = 4.544 with p value = 0.337					

Table 4: Comparison of the patients GCS score in relation to the number of findings on their CT scan

		Glasgow Coma Scale Scores			Total
		Mild (13-15)	Moderate (9-12)	Severe (3-8)	
Findings on CT scan	Unremarkable Scan	7	1	0	8
		87.5%	12.5%	0%	100%
	Single finding	18	3	1	22
		81.8%	13.6%	4.5%	100%
	Multiple findings	5	7	3	15
		33.3%	46.7%	20.0%	100%
Total		30	11	4	45
		66.7%	24.4%	8.9%	100%
Chi- square value = 11.588 with p value = 0.021					

Table 5: Comparison of the patients GCS score in relation to the presence of SAH on their CT scan report

		Glasgow Coma Scale Scores			Total
		Mild (13-15)	Moderate (9-12)	Severe (3-8)	
SAH	Present	2	2	3	7
		28.6%	28.6%	42.9%	100%
	Absent	28	9	1	38
		73.7%	23.7%	2.6%	100%
Total		30	11	4	45
		66.7%	24.4%	8.9%	100%
Chi- square value = 12.623 with p value = 0.002					

DISCUSSION

Head trauma is an important public health problem. There are many factors which can affect the severity of head injury and the likelihood of having positive findings on the CT scan, for example, the mechanism of injury (sharp & blunt, acceleration & deceleration factors) and types of injury. [11-13] In this study, 45 post head injury patients in three different age groups the pediatric population, the adult population and the geriatric population were observed. This division was based upon the premise that the mechanisms of injury were different for different age groups. Group 1 have injury due to play related falls, over speeding, one-wheeling whereas in group 2 accidental trauma and work-related injuries are common. In group 3 primarily falls because of age-related co-morbidities usually occur. Another, very valid reason behind this grouping was the age-related differences in the anatomy of the structures involved as well as the existence of co-morbidities. Younger patients have a higher structural compliance with trauma and as the age advances, this ability is lost. Additionally, other factors like brain atrophy and atherosclerosis play a role in the type of injury resulting from similar trauma.

Out of the 45 patients, 68.9% belonged to the age group 19-60 years and 71.1% of the patients were male. In a study by Nayebaghayee et al. similar results showing the majority of the patients in the adult group were observed.[4] This may be because 19-60 years age group forms the majority of the working population in our country and most of them are males so they are more prone to mishaps and accidents.

According to our study, 68.9% of the patients had a traumatic head injury due to a fall from height as compared to the 31.1% who suffered head injury due to a road traffic accident. However, a similar study carried out in Pakistan showed that 62.6% of the injuries were caused by road traffic accidents whereas 31.7% of the injuries were a result of a fall.[5] Both these studies show that RTA and falls are the major causes of head injury in Pakistan. This may be because of poor safety measures and the rash driving practices in Pakistan.

In our study, 66.7% of the patients had a mild head injury, 24.4% had a moderate head injury and 8.9% had a severe head injury according to the GCS score upon presentation in the Emergency Department. Farshchian et al. conducted a study in which 70.13% of the patients had a mild, 7.8% had a moderate and 22% had a severe head injury according to their GCS score.[3]

The most common CT scan finding in our patients with head trauma was linear fractures (40%) with contusions being the second most common finding (17.8%). There was an equal incident of SDH and EDH in the patients (11.1%) with a slightly higher incidence of SAH (15.6%). A similar study carried out in Iran demonstrated that the most common type of lesion on the CT scan was the epidural hematoma (38.5%), followed by cerebral contusion (29.4%) and pneumocephalus (17.4%).[4]

An important point highlighted in this study was that the patients with severe GCS score had multiple findings on their CT scan (20% of patients with a severe GCS had multiple findings). The results were statistically significant with a p-value < 0.05.

A study was conducted by Farshchian et al. to see the correlation between GCS and brain CT scan findings in head trauma patients. According to their study, most of the head trauma patients having low GCS score have 3 positive finding on CT scan showing extra-axial hematoma, subarachnoid hemorrhage and hemorrhage contusion.[3] A study conducted by Lee et al. also revealed the positive association between GCS score and CT scan findings.[1]

However, Nayebaghayee et al. observed opposite results in their study. According to their study, a weak correlation was revealed between the two modalities (CT findings and GCS severity scoring) to determine brain lesions ($p = 0.142$). Two hundred patients were included in this study. Out of 200 patients, 161 patients had GCS 13-15, 21 had GCS 9-12 and 18 had GCS <8. One hundred and nine patients had abnormal brain CT scan findings. Out of these 109 patients, 77.1% had the mild head injury, 11% had moderate head injury and 11.9% had the severe head injury.[4]

CONCLUSION

This study showed that there is a strong relationship between the GCS score of the patients with head injury and the likelihood of multiple findings on their CT scan reports. Patients with severe GCS also had a strong possibility of having subarachnoid hemorrhage (SAH). However, the relatively small number of patients included in this study necessitates further studies for a definitive conclusion to be made.

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