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Computed Tomography Scan Head Findings in Patients With Various Glasgow Coma Scales Presenting with Head Injury in Emergency of a Tertiary Care Hospital

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ABSTRACT

Objective: To associate the findings of CT scan with the Glasgow coma scale (GCS) of cases presenting with head trauma in the Emergency Department.

Study Design: Cross-sectional study.

Place and Duration of Study: Emergency Department, Combined Military Hospital, Rawalpindi Pakistan, from Jul to Dec 2021.

Methodology: Ninty head injury cases of either gender, aged 12-60 years were included using non-probability consecutive sampling. The severity of the head injury was determined via GCS. CT scan findings were noted.

Results: The mean age was 22.21±11.10 years. The highest frequency of patients was noted in the age group of (13-29 years). The most common cause of head injury in men was road traffic accidents n=39/58(67.24%). As per GCS scoring, 63.3% of patients had mild brain injury. A strong association was observed between GCS and CT scan findings in cases with brain oedema (p=0.002), skull fracture (0.018) and no findings on CT scan (p-value≤0.001). No association between findings on CT scan and GCS scoring was noted in cases with epidural, subdural hematoma, cerebral contusions, intracranial and subarachnoid haemorrhage.

Conclusions: There is a lack of association between brain injury based on GCS scoring and CT scan findings. Using GCS scoring only for assessing the degree of brain injury is insufficient.

Keywords: Computed tomography (CT) scan, Glasgow coma scales (GDS), Head injury.

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INTRODUCTION

There are many neurological disabilities caused by head injury. Many studies indicate that head injury is a common cause of death in young adults and is also associated with physical and psychological disabilities in these individuals.[1] According to many studies, 93% of adults and 96% of children who attend clinical settings because of head injuries have mild head injuries, and 5% of children and 6% of adults have moderate.[2] In contrast, only 1% of adults and 0.5% of children had severe brain injuries.[3] In the United States, about 1.6 million head injuries occur yearly, resulting in about 50,000 deaths and over 70,000 neurological deficits.[4]

Computerized tomography (CT) and Glasgow Coma Scale (GCS) are used to evaluate a patient presenting with head injury. This is important to determine the source of the injury, the severity of the impact, whether neurological symptoms are present, the presence of convulsions, and to document any reports of loss of consciousness, vomiting, or seizures.[5] GCS is the most widely used method of assessing consciousness level because it includes a simple and easy way of physical examinations.[6,7] An adequate assessment of neural impairment and head injury severity is based on the GCS, which measures verbal, visual, and motor responsiveness.[8]

GCS alone is not recommended to assess brain injury severity and forecast coma and outcomes.[9] Furthermore, imaging methods can detect intracranial lesions in head injury patients before clinical manifestations appear.[10] For early detection, computed tomography (CT) scan is the gold standard and an ideal tool for evaluating patients.

Although CT scanning has several advantages, especially in detecting brain lesions, it may not be available in some settings. Furthermore, although current CT scans are essential to follow lesion development at the start of and after treatment and surgical interventions in these patients, utilizing a suitable and reliable clinical alternative can discourage clinicians from obtaining unnecessary serial scans and radiation exposures. The current study evaluated the relation-

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ship between CT scan findings and GCS scores to introduce GCS scores as an acceptable alternative for CT scans in patients with head injuries.

METHODOLOGY

The cross-sectional study was conducted at the Emergency Department, Combined Military Hospital, Rawalpindi Pakistan, from July to December 2021. We obtained ethical approval from the Institutional Review Board (Reference ltr no. 271). The sample size was calculated using a WHO calculator, keeping the prevalence of head injuries at 5%.[11]

Inclusion Criteria: Patients of either gender aged 12-60 years having head injury, both blunt and penetrating, referred for CT scan were included in the study.

Exclusion Criteria: Patients with multiple injuries, other neurological or psychological illnesses, and other app-arent causes for altered GCS were excluded from the study. Patients with coagulopathy, comorbid like hyp-ertension, diabetes, and a history of raised intra-cranial pressure (ICP) were also excluded. Patients already on treatment were also excluded from the study.

Sampling was done using the non-probability consecutive sampling technique. Before enrolling all patients, we obtained their written consent, and the confidentiality of the patients was ensured at all levels. Detailed history and complete physical examination were made.

A head injury was defined as an event that resulted in a blow to the head, a scalp wound, or altered consciousness. A GCS score was measured at the time of admission in all patients, and levels of consciousness were classified as mild (9–12) head injuries, moderate (13–15) head injuries, and severe (<8) head injuries based on the score.[12] A radiologist blinded to the patient's GCS score evaluated the CT scan documents and recorded reports, and determined the types of lesions.

Statistical Package for Social Sciences (SPSS) version 23.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test was applied to explore the inferential statistics. The p-value of ≤0.05 was set as the cut-off value for significance.

RESULTS

A total of 90 patients, 32(35.6%) were females, and 58(64.4%) were males. The mean age of patients was 22.21±11.097 years. Head injury occurred most frequently (61.1%) in the age group 13-29 years, then in the age groups 6-12 years (21.1%), and the age group 30-60 years (17.8%). According to the statistics, road traffic accidents accounted for the highest percentage of head injuries in men n=39/58(67.24%), followed by falling 16/58(25.86%) and hitting objects on the head 4/58 (6.89%). In addition, accidents 15/32(46.87%), falls 8/32(25%), hits to the head 5/32(15.62%), and assault 4/32(12.5%) were the most common causes of head injuries in women. Accidents 12/19(63.15%), hitting objects to the head 4/19(21.05%), and falling 3/19 (15.79%) were the most common causes of injury in children. Consequently, causes were distributed differently by age and gender, as shown in Table-I.

Table-I: Gender and Age Distribution according to the Cause of Head Injury in Patientss (n=90)

Groups	Causes of Head Injury			
	Road Traffic Accident	Fall	Hitting Object to the Head	Assault
Gender				
Male	39(43.3%)	15(16.6%)	4(4.44%)	-
Female	15(16.6%)	8(8.8%)	5(5.5%)	4(4.44%)
Age (Years)				
6-12	12(13.3%)	3(3.33%)	4(4.44%)	-
13-29	29(32.2%)	17(18.8%)	5(5.55%)	4(4.44%)
31-60	13(14.4%)	3(3.33%)	-	-

The severity of head injuries according to the GCS score indicates that the majority of patients had a mild injury (63.3%) followed by moderate injury (22.2%) and then severe type injury (914.4%), as shown in Table-II.

Table-II: Distribution of Patients according to Severity of Head Injuries based on GCS score (n=90)

The Severity of Head Injuries	GCS Score	n(%)
Mild	13–15	57(63.3%)
Moderate	12-9	20(22.2%)
Severe	<8	13(14.4%)

Of 90 patients, 49(54.4%) had no findings on CT scans. In comparison, cerebral contusion was found in 17(18.9%) patients, Intracranial Hemorrhage 7(7.9%), Acute Subdural Hematoma 4(4.4%), Subara-chnoid Hemorrhage 5(5.6%), Epidural Hematoma 3(3.3%), Skull Fracture 3(3.3%), and Brain Edema 2(2.2%). The association of CT scan findings with GCS score was observed using the chi-square test, as shown in Table-III.

Table-III: Association of CT Scan findings with GCS Score (n=90)

CT Scan Findings	GCS Score 13–15 (n=57)	12-9 (n=20)	<8 (n=13)	*p*-value
Epidural Hematoma				
Present	1(1.8%)	1(5%)	1(7.7%)	0.502
Absent	56(98.2%)	19(95%)	12(92.3%)	
Cerebral Contusion				
Present	10(17.5%)	4(20%)	3(23%)	0.890
Absent	47(82.5%)	16(80%)	10(77%)	
Acute Subdural Hematoma				
Present	2(3.5%)	1(5%)	1(7.7%)	0.797
Absent	55(96.5%)	19(95%)	12(92.3%)	
Intracranial Hemorrhage				
Present	4(7%)	2(10%)	1(7.7%)	0.912
Absent	53(93%)	18(90%)	12(92.3%)	
Subarachnoid Hemorrhage				
Present	1(1.8%)	2(10%)	2(15.3%)	0.095
Absent	56(98.2%)	18(90%)	11(84.7%)	
Brain Edema				
Present	-	-	2(15.3%)	0.002
Absent	57(100%)	20(100%)	11(84.7%)	
Skull Fracture				
Present	0(0.0%)	1(5%)	2(15.3%)	0.018
Absent	57(100%)	19(95%)	11(84.7%)	
No Findings				
Present	39(68.4%)	9(45%)	1(7.7%)	<0.001
Absent	18(31.6%)	11(55%)	12(92.3%)	

DISCUSSION

Brain injury gradually increases, leading to long-term morbidity and mortality, especially among young adults. Brain injury can result from an accident, fall, hitting an object, or assault. It can occur in people of all age groups but is frequently observed in young adults.[12] In our study, the highest frequency (61.1%) of brain injury among males and females has been noted in the age group 13-29 years. A local study conducted in Kashmir observed the same age group distribution of brain injury. They observed a high number of cases from rural areas as compared to urban. Since our study was single city-based so we did not note such discrimina-tion among rural or urban areas.[13]

According to GCS scoring in our study, most cases had mild head injuries (63.3%) followed by moderate and severe injuries in decreasing frequency. GCS showing mild injury was noted in 5,483(60%) cases in a nationwide retrospective cohort study by Jochems *et al*.[14] Similar results were observed by Joan *et al*.[15]

Brain injury can worsen over time, so timely and accurate diagnosis is essential, which is usually done using CT scans.[16] We noticed a strong association between the GCS score and CT scan findings in cases with brain oedema (*p*=0.002), skull fracture (0.018), and no findings on CT scan (<0.001). Cases with no findings on CT scans presented mild brain injury (GCS 13-15). Nayebaghayee *et al*.[17] in a study to determine the significance of GCS scoring, documented that using GCS scoring to determine the level of injury may not be sufficient. These results are similar to that ours.

In a study conducted by Joseph *et al*.[18] mild brain injuries with a GCS score (13-15) do not rule out an intracranial injury on a CT scan and the requirement of surgical intervention. We also observed that cases with cerebral contusions, epidural, subdural hematoma, and intracranial haemorrhage presented more with mild brain injury as per GCS Scoring (13-15). So not doing a CT scan can probably miss cases with internal brain injuries. Melo *et al*.[19] also concluded that 6.7% of patients presenting with mild brain injury (GCS 13-15) needed neurosurgical intervention, and about 9.2% of cases had neurological disabilities later in life. They concluded that classifying brain injury as mild based on GCS scoring can be associated with clinically significant findings on CT scans requiring interventions, as noted in our study. Chieregato *et al*.[20] studies also showed that the GCS scores arse insufficient for determining brain injury and must be combined with other radiological investigations, including CT scans and scoring systems like traumatic brain injury classification.

LIMITAIONS OF STUDY

Our study was single-centred. We did not do serial CT scans with serial monitoring of GCS scoring. Moreover, small sample sizes and time limitations were also there in our study due to the type of study design. More studies, including large sample sizes, multi centres, and serial monitoring of patients using GCS scoring and CT scans, should be done for better generalization of results.

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CONCLUSION

There is a lack of association between brain injury determined based on GCS scoring and CT scan findings. A GCS score alone is insufficient for assessing the level and degree of brain injury, so it cannot replace a CT scan. A combination of GCS scoring and CT scanning should be used in emergency departments for determining the degree of brain injury and management of cases presenting with brain injury.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MH & AS: Data acquisition, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

MK & MASK: Study design, data interpretation, critical review, approval of the final version to be published.

SBKM & TP: Concept, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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