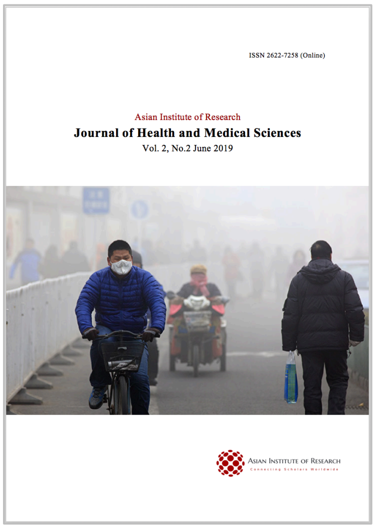

Journal of Health and
Medical Sciences

Hannan, Muhammad Abdul, Rafiq, Arzisha, Nazir, Mudassir, Malik, Sajid Shaheen, Farooq, S. Muhammad Yousaf, Murtaza, Ghulam, Jabbar, Hamza, and Gilani, Aima. (2019), Correlation of Glasgow Coma Scale (GCS) with Computed Tomography (CT) in Patients of Intra-Cranial Injuries. In: *Journal of Health and Medical Sciences*, Vol.2, No.2, 142-152.

ISSN 2622-7258

DOI: 10.31014/aior.1994.02.02.31

The online version of this article can be found at:
https://www.asianinstituteofresearch.org/

Published by:
The Asian Institute of Research

Asian Institute of Research
Connecting Scholars Worldwide

The Asian Institute of Research
Journal of Health and Medical Sciences
Vol.2, No.2, 2019: 142-152
ISSN 2622-7258

DOI: 10.31014/aior.1994.02.02.31

Correlation of Glasgow Coma Scale (GCS) with Computed Tomography (CT) in Patients of Intra-Cranial Injuries

Muhammad Abdul Hannan[1], Arzisha Rafiq[2], Mudassir Nazir[3], Dr. Sajid Shaheen Malik[4], S. Muhammad Yousaf Farooq[5], Ghulam Murtaza[6], Hamza Jabbar[7], Aima Gilani[8]

[1] Student of MID, The University of Lahore, www.uol.edu.pk. Contact number: 0300-7169499. E-mail ID: hannan.naeem95@gmail.com
[2] Student of MID, The University of Lahore, www.uol.edu.pk
[3] Student of MID, The University of Lahore, www.uol.edu.pk
[4] MBBS, DMRD, The University of Lahore, www.uol.edu.pk
[5] M.Phil. MSc Ultrasound, The University of Lahore, www.uol.edu.pk. E-mail ID: yousafgelani@gmail.com. Contact number: 00923444514256
[6] Student of MID, The University of Lahore, www.uol.edu.pk
[7] Student of MID, The University of Lahore, www.uol.edu.pk
[8] Student of M.B.B.S, Combined Military Hospital

Corresponding Author: S. Muhammad Yousaf Farooq. E-mail ID: yousafgelani@gmail.com. Contact number: 00923444514256

Abstract

Objective: To determine the correlation of Glasgow coma scale with Computed Tomography (CT) in patients of intra-cranial injuries. Material and methods: This study is a cross-sectional analytical study with a sample size of 138 patients. Sampling techniques were non-probability convenient sampling. The study was performed in the Department of Radiology in Lahore General Hospital. The study was finished in 3 months after approval of synopsis. Ultrasound was performed with a convex transducer of 3.5 - 5MHz frequency. Outcome variables are Prostate volume and post-micturition residual (PMR). The data collection sheet was used to record observed data, and individual patient personal data will not be published. Sections were taken parallel to the canthomeatal. CT machine: Toshiba Scanner Aquilion 16 SLICE, model no: TSX-101A, model no: CGGT-018A, slice thickness: 5-7mm, gap b/w slices: 5mm, window width: 1600, window length: +350, kV: 120, mA: 200, pitch: 5. Result: Total 138 patients were enrolled in the study, in which 54 (39.1%) were females, and 84(69.9%) were males with a mean age of 37 years with a range of 4-85 ± 16.28 years. The present study was conducted for a period of two years in the Department of radiology with association from Department of Emergency medicine and included 138 patients with a history of intra-cranial injuries. The cases were referred from the Emergency unit after clinical and neurological systemic examination and calculating the GCS score. The score was blinded for the radiologist examining the case for avoiding bias in reporting. Conclusion: To conclude from our study, patients with low GCS score were considered as a severity risk factor in association with more intra-cranial injuries CT findings. Patients with low GCS score are affected by severe morbidity and devastating effects as observed from other studies.

Introduction

Traumatic brain injury (TBI) is a non-degenerative, non-congenital insult to the brain from an external mechanical force, possibly leading to permanent or temporary impairment of cognitive, physical, and psychosocial functions, with an associated diminished or altered state of consciousness[1]. Intracranial bleeding (IB) is a common and serious consequence of traumatic brain injury (TBI). Intracranial bleeding can be classified according to the location into: epidural hemorrhage (EDH) subdural hemorrhage (SDH) intra-cerebral hemorrhage (ICH) and subarachnoid hemorrhage (SAH)[2].

According to the Centers for Disease Control and Preventions (CDC), the leading causes of TBI include falls, road traffic accidents, being struck by or colliding with an object. Other causes include domestic violence and work-related and industrial accidents. The global incidence of TBI per 100,000 people was greatest in North America (1299 cases, 95% CI 650-1947) and Europe (1012 cases, 95% CI 911-1113) and least in Africa (801 cases, 95% CI 732-871) and the Eastern Mediterranean (897 cases, 95% CI 771-1023). Sixty-nine million (95% CI 64-74 million) individuals are estimated to suffer TBI from all causes each year, with the Southeast Asian and Western Pacific regions experiencing the greatest overall burden of disease. Head injury following road traffic collision is more common in low and middle-income countries (LMICs), and the proportion of TBIs secondary to road traffic collision is likewise greatest in this countries[3].

Pakistan is a low-income country with over 180 million populations, with a high rate of TBIs. A large road traffic injury surveillance study (n>100,000) in Pakistan showed that nearly a third of patients had a TBI, and of them, about 10% percent had moderate to severe TBI[4]. The management of patients with head trauma is clinically based on the Glasgow Coma Scale (GCS) that can present a comprehensive framework for assessing the three clinical aspects of verbal, visual, and motor responsiveness leading proper stratifying neural impairment and head injury severity[5,6].

It is essential to determine the cause of the trauma, the intensity, presence of neurological symptoms, convulsion, and particularly document any report on the loss of consciousness[7]. The GCS has been the most valuable and frequently used scoring system for assessing the severity of neurologic injury after head trauma. According to the GCS, traumatic brain injuries are classified as mild (GCS score 13–15), moderate (GCS score 9–12) or severe (GCS score equal to or <8) and is currently the most widely used parameter for assessment of consciousness level[8]. It comprises a set of very simple and easy-to-perform physical examinations, high inter-observer reliability and generally good prognostic capabilities. Radiography was the main imaging method recommended in emergency evaluations. The protocols were then modified to include CT, GCS and the presence of cranial fracture a risk factor. Currently, the imaging method of choice for the diagnosis and prognosis of Traumatic Brain Injury (TBI) is Computed Tomography (CT). Besides the clinical management of head trauma patients, intracranial lesions in patients can be detected by imaging methods even before clinical manifestations[9].

CT is indicated in all patients with moderate and severe head injury (GCS ≤12). Low threshold for taking CT is advisable in elderly and alcohol-intoxicated patients. In mild head injury, CT has indicated if any one of the following risk factors is present: loss of consciousness (LOC >5 min), history of vomiting, history of seizures, history of ear bleed, and history of nosebleed[10].

With the advent of computed tomography (CT), the diagnostic radiology has revolutionized[11]. The aim of this study is to find an association between CT findings and GCS categorization and to test the possibility of predicting intracranial lesions by determining GCS score on admission. If a good correlation between the CT scan appearance and GCS scoring can be found, then the use of follow-up CT scans would only be recommended in patients with clinical deterioration unexplained by intracranial pressure changes alone. Thus, substantially, lowering the radiation dose and also reducing the cost by preventing unwanted CT scans[12].
At present, there is no updated study regarding the correlation of the Glasgow Coma Scale (GCS) and intracranial injuries. Different hospitals follow different protocols. By this study, if we find a good correlation, the patient can be saved from the irrelevant CT radiation exposure. The accurate assessment of the GCS scoring can prove to be very helpful for the differential diagnosis of intracranial injury.

METHODOLOGY

Study Design is Cross-sectional analytical study. This study was conducted in the Department of Radiology in Lahore General Hospital. Three months study Duration after the approval of synopsis. Sampling Technique was non-probability convenient sampling and sample size 138.

The patient is given the consent to read and to sign after he/she agrees for the procedure. The patient is placed on the CT table in a supine position. Head first into the gantry also placed within the head holder. Centre the table height such that the external auditory meatus is at the center of the gantry. Sections were taken parallel to the canthomeatal. CT machine: Toshiba Scanner Aquilion 16 SLICE, model no: TSX-101A, model no: CGGT-018A, slice thickness: 5-7mm, gap b/w slices: 5mm, window width: 1600, window length: +350, kV: 120, mA: 200, pitch: 5.

Results

Total 138 patients were enrolled in the study, in which 54 (39.1%) were females, and 84(69.9%) were males with a mean age of 37 years with a range of 4-85 ± 16.28 years. The present study was conducted for a period of two years in the Department of radiology with association from Department of Emergency medicine and included 138 patients with a history of intra-cranial injuries. The cases were referred from the Emergency unit after clinical and neurological systemic examination and calculating the GCS score. The score was blinded for the radiologist examining the case for avoiding bias in reporting.

Total 138 patients were enrolled in the study, in which 54 (39.1%) were females, and 84 (60.9%) were males (table # I). This table is showing different blood pressure level frequencies table # II. Types of injuries on CT frequency epidural hemorrhage was 49 (35.5), Intra-cerebral hemorrhage 1 (.7), Intra-ventricular hemorrhage 10 (7.2), Subarachnoid hemorrhage 2 (1.4) and Subdural hemorrhage 25 (18.1) table # IV. The mean age of the patients was 37 years with a range of 4-85 ± 16.28 years (table # V). Glasgow coma scale, types of injury on CT cross-tabulation table # VI.

Table-I: Frequency of gender

	Frequency	Percentage
Female	54	39.1
Male	84	60.9
Total	138	100.0

Graph-I: Frequency of gender

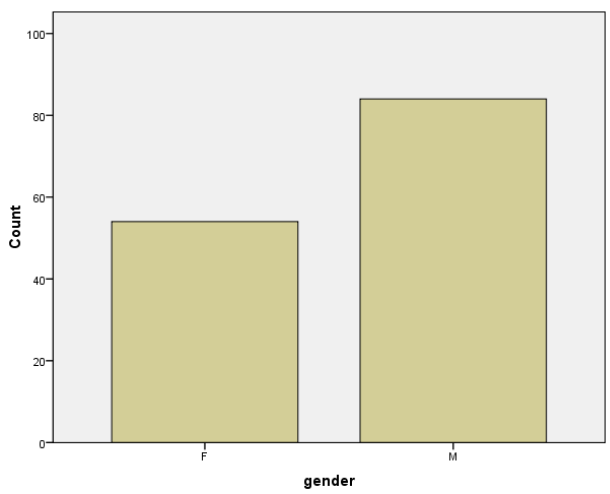

Table-II: Frequency of blood pressure

	Frequency	Percentage
100/70	2	1.4
100/80	1	.7
110/70	10	7.2
110/80	7	5.1
110/90	6	4.3
120/10	1	.7
120/11	1	.7
120/70	1	.7
120/80	9	6.5
120/90	5	3.6
130/10	5	3.6
130/80	14	10.1
130/90	16	11.6
140/10	1	.7
140/80	3	2.2
140/90	14	10.1
150/10	1	.7
150/11	2	1.4
150/90	2	1.4
160/10	6	4.3
160/11	4	2.9
160/90	4	2.9
170/10	9	6.5
170/11	2	1.4
170/80	2	1.4
170/90	3	2.2
180/10	4	2.9
180/11	1	.7
200/11	1	.7
200/14	1	.7
Total	138	100.0

Graph-II: Frequency of blood pressure

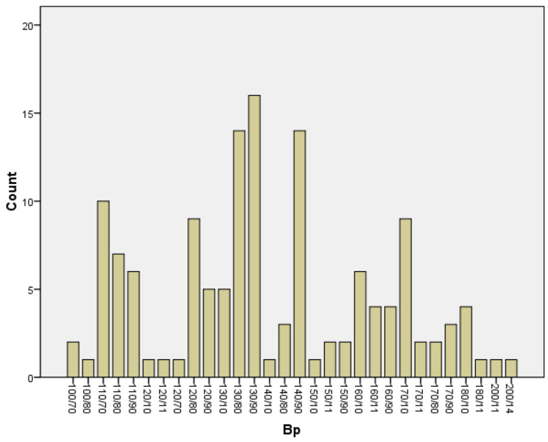

Table-III: Frequency of Glasgow coma scale.

	Frequency	Percentage
10/15	20	14.5
11/15	23	16.7
12/15	13	9.4
13/15	13	9.4
14/15	10	7.2
15/15	28	20.3
3/15	2	1.4
4/15	3	2.2
6/15	5	3.6
7/15	3	2.2
8/15	6	4.3
9/15	12	8.7
Total	138	100.0

Graph-III: Frequency of Glasgow coma scale.

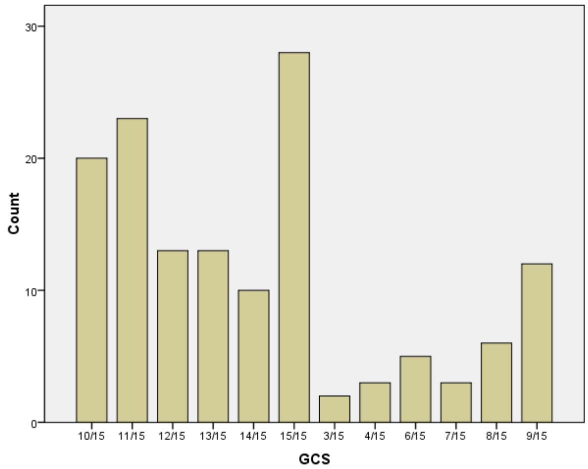

Table-IV: Types of injury on CT

	Frequency	Percentage
EDH	49	35.5
ICH	1	.7
IVH	10	7.2
SAH	2	1.4
SDH	25	18.1
Total	138	100.0

Graph-IV: Types of injury on CT

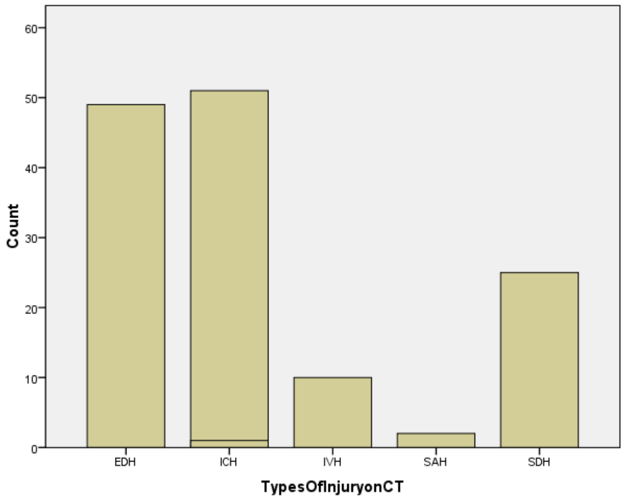

Table-V: Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	138	4.00	85.00	37.3696	17.63088
Valid N (list wise)	138				

Graph-V: Descriptive statistics

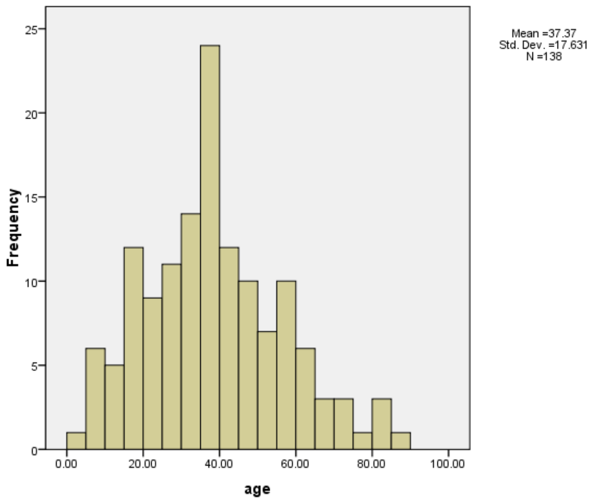

Table-VI: Glasgow coma scale, types of injury on CT cross-tabulation

		Types Of Injury on CT					
		EDH	ICH	IVH	SAH	SDH	Total
GCS	10/15	6	0	2	1	6	20
	11/15	5	0	5	0	0	23
	12/15	4	0	1	0	2	13
	13/15	4	0	0	0	4	13
	14/15	6	0	0	0	2	10

	15/15	20	0	1	0	4	28
	3/15	0	0	0	0	1	2
	4/15	1	1	0	0	0	3
	6/15	0	0	0	0	2	5
	7/15	1	0	0	0	0	3
	8/15	1	0	0	0	2	6
	9/15	1	0	1	1	2	12
Total		49	1	10	2	25	138

Figure-1: Subdural hemorrhage

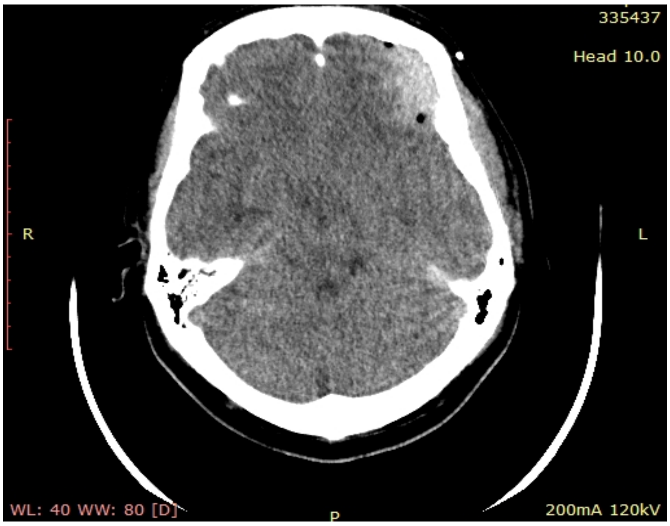

Figure-2: Intra-cerebral hemorrhage

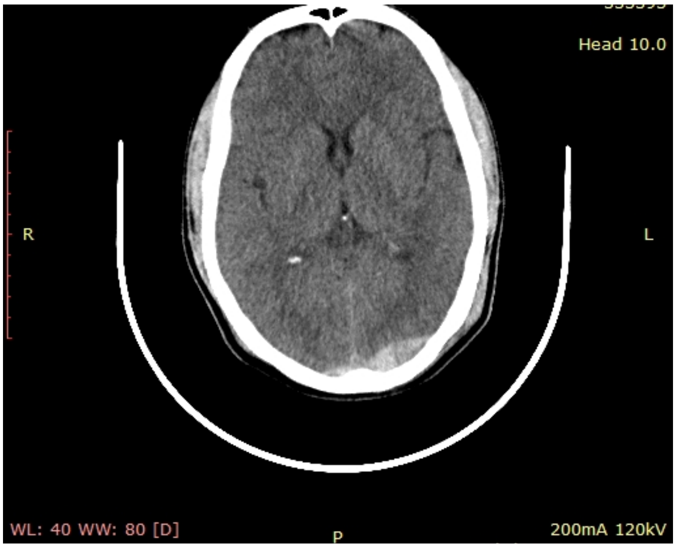

Figure-3: Epidural hemorrhage

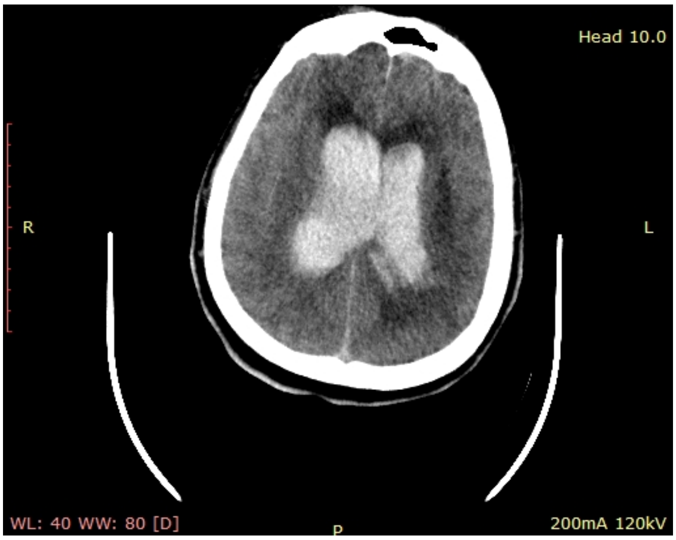

Figure-4: Intra-ventricular hemorrhage

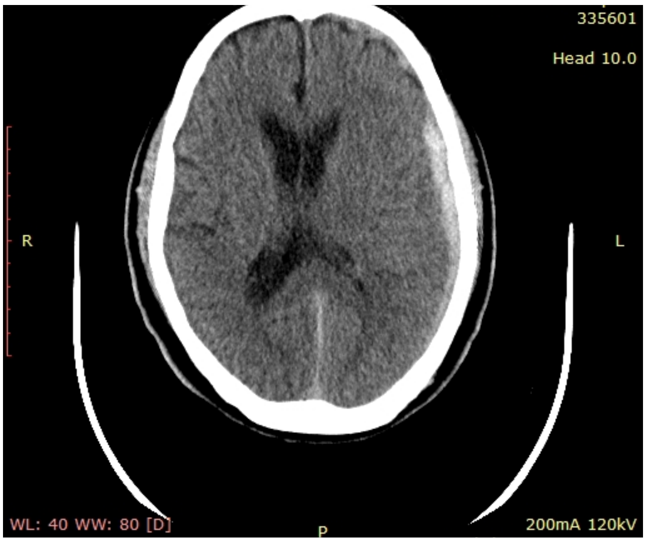

Figure-5: Subdural hemorrhage

Figure-6: Epidural hemorrhage

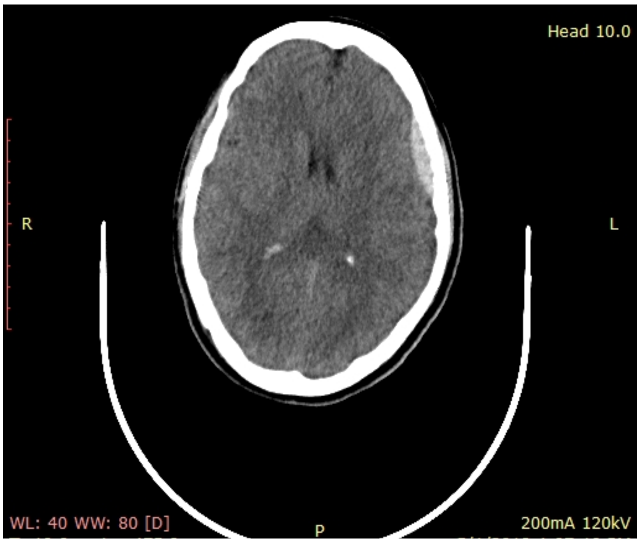

Figure-7: Epidural hemorrhage

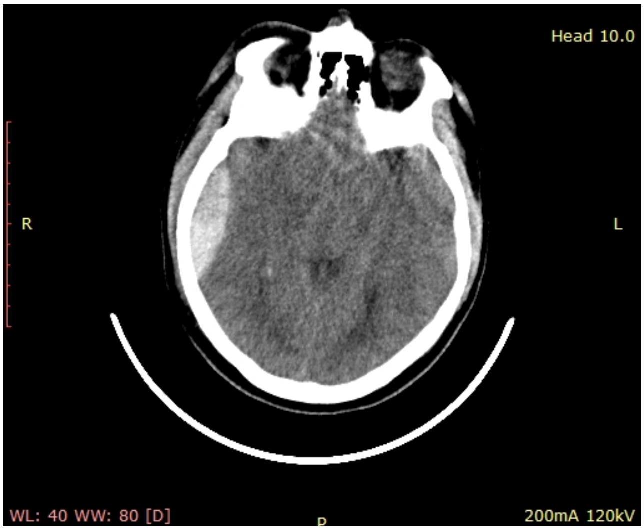

Figure-8: Epidural hemorrhage

Discussion

In the present study, 138 patients were enrolled in the study, in which 54 (39.1%) were females, and 84(69.9%) were males with a mean age of 37 years with a range of 4-85 ± 16.28 years. The present study was conducted for a period of two years in the Department of radiology with association from Department of Emergency medicine and included 138 patients with a history of intra-cranial injuries. The cases were referred from the Emergency unit after clinical and neurological systemic examination and calculating the GCS score. The score was blinded for the radiologist examining the case for avoiding bias in reporting.

Association between the severity of brain lesion assessed by the level of consciousness on GCS scoring system and the presence or absence of brain lesions in CT scan is now considered as a new subject to minimize unnecessary CT following in patients with intra-cranial injuries. This subject can be very important in children, as well as in those with complete or partial contraindications of CT scanning. Our study attempted to determine the association between CT findings and GCS categorization to test the possibility of predicting brain lesions by determining GCS score on admission. In our observation and among those with positive CT findings on brain abnormality, 77.1 patients had a mild brain injury, 11.0% had a moderate brain injury, and 11.9% had a severe brain injury. On the other hand, a notable number of patients with abnormal CT findings may have only mild injuries leading to mild consciousness impairment while about one-fourth of patients with CT findings may have moderate to severe consciousness impairment. In fact, the presence of CT finding may not be an indicator for the level of consciousness impairment assessed by GCS score. A few recent studies assessed the correlation between GCS score and CT scan to assess brain lesions.

In a study by Lee *et al*., the change in CT scans was compared with the GCS the day of the scan showed a positive correlation between the two modalities. In this regard, in patients with unchanged or improved GCS, 73.1% had improved or the same CT appearance, while in those with a worse GCS, the CT was worse in 77.9%. Finally, the authors concluded that due to good correlation between the CT scan appearance and the clinical status, the use of follow-up CT scans was recommended only in patients with clinical deterioration unexplained by intracranial pressure changes alone[13].

Farshchian *et al*.[14] Showed that only three lesions of extra-axial hematoma, subarachnoid hemorrhage, and hemorrhagic contusion might be associated with low GCS scores. In a study by Joseph *et al*.,[15] a mild GCS score (GCS 13–15) in patients with an intracranial injury does not preclude progression on repeat head CT and the need for neurosurgical intervention. Melo *et al*.[16] also indicated that of patients with mild brain injury, neurosurgery was performed in 6.7% and 9.2% had neurological disabilities. In fact, mild brain injury based on GCS score may be associated with significant abnormalities in CT scan, require neurosurgical procedure and Intensive Care Unit admission. Moreover, Chieregato *et al.* [17]showed that the GCS scoring system was not enough for assessing brain injury, and, therefore, it should be combined with other systems such as traumatic brain injury classification.

Leonidas Grigorakos conducted a study in 2016 on the topic of Predictors of Outcome in Patients with Severe Traumatic Brain Injury. The study was performed Neurosurgery Department, Tzaneio General Hospital of Pireus, Greece. This article has been published in the Journal of Neuroscience & Clinical Research. A retrospective study was carried on patients (n=621) with a severe head injury, defined as Glasgow Coma Scale (GCS) ≤ 8 who were admitted to the general ICU over a 15-year period (1999-2013). Most important variables that could be correlated with outcome (demographics, cause of injury, GCS, clinical variables and computed tomography–CT scan) were analyzed. The conclusion they gave for this study was that severe TBI has high mortality and morbidity in Greek society as it has a high negative impact on young people, especially men. The age of the patient, GCS at admission and the CT scanning are significant predictors of outcome[18].

Conclusion

In summary, because of disagreement between intra-cranial injuries assessed by GCS score and findings brain abnormalities in CT scan, the use of GCS score for assessing the level of injury may not be sufficient and thus considering CT findings as the gold standard, the combination of this scoring system and other applicable scoring systems such as intra-cranial injuries classification and also considering clinical signs like depressed fracture may be more applicable to stratify brain injury level.

References

1. Ghandour H, Kobeissy F, Abbas HA, El-Sayed M, Tamim H. Traumatic Brain Injury Review: Past Present and Future. Emerg Med Inves: EMIG-175. DOI. 2018;10:2475-5605.
2. Perel P, Roberts I, Bouamra O, Woodford M, Mooney J, Lecky F. Intracranial bleeding in patients with traumatic brain injury: a prognostic study. BMC Emergency Medicine. 2014; 9(1):15.
3. Dewan MC, Rattani A, Gupta S, Baticulon RE, Hung YC, Punchak M, Agrawal A, Adeleye AO, Shrime MG, Rubiano AM, Rosenfeld JV. Estimating the global incidence of traumatic brain injury. Journal of neurosurgery. 2018; 27:1-8.
4. Bhatti JA, Stevens K, Mir MU, Hyder AA, Razzak JA. Emergency care of traumatic brain injuries in Pakistan: a multicenter study. BMC emergency medicine. 2015;15(2):S12.
5. Teasdale G, Knill-Jones RO, van der Sande JA. Observer variability in assessing impaired consciousness and coma. Journal of Neurology, Neurosurgery & Psychiatry. 2015;1;41(7):603-10.
6. Braakman R, Gelpke GJ, Habbema JD, Maas AI, Minderhoud JM. Systematic selection of prognostic features in patients with a severe head injury. Neurosurgery. 2014;6(4):362-70.
7. Poddar U. Approach To Acute Recurrent Pancreatitis In Children. The Child and Newborn. 2016; 20(1-4):49.
8. Swann IJ, MacMillan R, Strong I. Head injuries at an inner city accident and emergency department. Injury. 2015; J 1;12(4):274-8.
9. Bricolo AP, Pasut LM. Extradural hematoma: toward zero mortality: A prospective study. Neurosurgery. 2014 1;14(1):8-12.
10. Waganekar A, Sadasivan J, Prabhu AS, Harichandra kumar KT. Computed Tomography Profile and its Utilization in Head Injury Patients in the Emergency Department: A Prospective Observational Study. Journal of emergencies, trauma, and shock. 2018;11(1):25.
11. Saba Mushtaq MI, Riasat UB, Malik SS, Yousaf SM, Farooq M. Saudi Journal of Biomedical Research (SJBR) ISSN 2518-3214 (Print).
12. Nayebaghayee H, Afsharian T. Correlation between Glasgow Coma Scale and brain computed tomography-scan findings in head trauma patients. Asian journal of neurosurgery. 2016 ;11(1):46
13. Lee TT, Aldana PR, Kirton OC, Green BA. Follow-up computerized tomography (CT) scans in moderate and severe head injuries: Correlation with Glasgow Coma Scores (GCS), and complication rate. Acta Neurochir (Wien) 2017;139:1042–7.
14. Farshchian N, Farshchian F, Rezaei M. Correlation between Glasgow Coma Scale and brain CT-scan findings in traumatic patients. J Inj Violence Res. 2016;4(3 Suppl 1) Paper No 44.
15. Joseph B, Pandit V, Aziz H, Kulvatunyou N, Zangbar B, Green DJ, et al. Mild traumatic brain injury defined by Glasgow Coma Scale: Is it really mild? Brain Inj. 2015;29:11–6.
16. Melo JR, Lemos-Júnior LP, Reis RC, Araújo AO, Menezes CW, Santos GP, et al. Do children with Glasgow 13/14 could be identified as mild traumatic brain injury? Arq Neuropsiquiatr. 2014;68:381–4.
17. Chieregato A, Martino C, Pransani V, Nori G, Russo E, Noto A, et al. Classification of a traumatic brain injury: The Glasgow Coma Scale is not enough. Acta Anaesthesiol Scand. 2016;54:696–702.
18. Grigorakos L, Alexopoulou A, Tzortzopoulou K, Stratouli S, Chroni D, Papadaki E, Alamanos I, Sakellaridis N. Predictors of outcome in patients with severe traumatic brain injury. Journal of Neuroscience & Clinical Research. 2017 30;2016.