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RELATIONSHIP BETWEEN BRAIN CT SCAN FINDINGS WITH EPIDEMIOLOGY OF TRAUMATIC INTRACRANIAL HEMORRHAGE, CHANGES IN BLOOD COAGULATION FACTORS, SURGICAL FINDINGS, LEVEL OF CONSCIOUSNESS AND FATE OF PATIENTS WITH TRAUMATIC INTRACRANIAL HEMORRHAGE

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Abstract:

Trauma is leading cause of death among the young, adults and children, and traumatic brain injuries account for over 50%of deaths caused by trauma. Patients with traumatic brain injury should be treated based on our knowledge on the incidence rate of brain injuries caused by trauma and the symptoms after traumatic brain injury. The study population included the patients with traumatic brain injury and brain hemorrhage, which were clearly detectable and measurable in CT scan stereotypes. The study samples were selected using convenience sampling method. The collected data were encoded and inserted to the computer, then were analyzed using descriptive statistics (mean, standard deviation and confidence interval), chis-quare test and correlation coefficient test. The used software was SPSS 18. 343 out of 1835 head trauma patients admitted to Khatam-Al-Anbia Hospital, in which68cases had traumatic intracranial hemorrhage and all patients underwent surgery. In contrast to CT scan findings and based on surgical findings, the hematoma was epidural in15cases, subdural in 16cases, intraparenchymal in 13 cases, intraventricular in 15 cases and subarachnoid in 9 cases. There was a significant inverse relationship between hematoma volume and level of consciousness on admission, so that the larger sizes of the hematoma caused further drop in the level of consciousness on admission. In addition, the fate of patients with traumatic brain injury depends on the level of consciousness and hematoma volume on the CT scan is inversely related to the consciousness level of patients. According to the dependence of hematoma volume on the CT scan and consciousness level of patients, we can suggest the use of these parameters in CT scan aiming to predict the fate of these patients beside the other common parameters.

Key words: *CT scan, Epidemiology, Trauma, Intracranial Hemorrhage.*

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INTRODUCTION:

Trauma is leading cause of death among the young, adults and children, and traumatic brain injuries account for over 50% of deaths caused by trauma [1]. Patients with traumatic brain injury should be treated based on our knowledge on the incidence rate of brain injuries caused by trauma and the symptoms after traumatic brain injury [2]. To provide appropriate plan for the prevention of these injuries, epidemiological assessment must be performed initially. The results of epidemiological studies are affected by demographic and geographic factors as well as socio-economic status. The CT scan is a tool that not only could be carried out under emergency conditions, but also can almost detect the exact site of the hematoma, hematoma volume and pressure on a part of the brain (shifts), which is very helpful to determine the procedure of treatment [3]. Peterson and Epperson criteria are used for the diagnosis of hematoma volume, which is obtained by multiplying the length, width and height of the hematoma in 0.5 [4]. The most important tool to diagnose the severity of injuries and the patient's condition is the use of G.C.S system for determining the level of consciousness of patients; almost all specialists agree on this [5]. GCS scoring system has been developed to determine the level of consciousness of patients with acute cerebral problems and its lowest score is 3 and highest score is 15 [6]. Patient's response and clinical conditions of the patients are scored in this system. The most important part of this system is the patient's motor response [7]. General factors or systemic changes such as variations in coagulation factors and systems are some of the parameters that are worsening the prognosis in patients with multiple trauma and head injuries [8]. Due to the unavailability of any systematic study on the Iranian patients and the importance of changes in blood factors as a prognostic factor in patients with traumatic brain injury and intracranial hemorrhage, investigation of these changes appears to be necessary. According to the mentioned points, we decided to conduct the present study on the patients with intracranial hemorrhage hospitalized in Khatam- Al- Anbia Hospital in Zahedan, Iran, as the most important center for admission of trauma patients.

MATERIALS AND METHODS:

The study population included the patients with traumatic brain injury and brain hemorrhage, which were clearly detectable and measurable in CT scan stereotypes. The present study was conducted at Zahedan Medical and Educational Center of Khatam-Al-Anbia in 2016. The study samples were selected using convenience sampling method. Given the 3% prevalence of hematoma among patients admitted due to traumatic brain injury and considering 95% confidence interval and 80% power, the minimum required sample size was obtained 40 using the software. Patients with fractures in other body parts and other problems requiring surgical intervention such as internal bleeding, rupture of visceral, severe chest trauma and hematoma in several anatomical sites (mix) were excluded from the study. In this stage, in addition to the necessary primary activities, the patient's medical history was simultaneously obtained and detailed examinations were carried out as well. The patient's level of consciousness on admission and at intervals of 6-24 hours were measured and recorded based on GCS criteria by neurosurgery team. The patients were transferred to the radiology ward with the routine measures to perform brain CT scan. In this step, the patients who had no traumatic brain injury were excluded. For patients who were eligible to remain in the study, the hemorrhage site was determined and its volume was measured and recorded using the Peterson and Epperson criteria. All the CT scans were performed at the same center with Toshiba CT scanner equipment (Spiral Singleslice). An experienced radiologist using specified criteria interpreted all CT scans. Overall, the severity of lesion was classified based on the GCS scale, as follows: 1- severe for GCS score less than 9, 2- moderate for GCS score between 9-12 and 3- mild for GCS score equal or more than 13. The fate of patients was defined in five categories: 1- death, 2- persistent vegetative state (PVS), 3- severe disability, 4- partial loss and 5- normal. The fate of patients was determined by neurosurgeon at the hospital discharge time. All data related to the surgery were collected by the neurosurgeon. The collected data were encoded and inserted to the computer, then were analyzed using descriptive statistics (mean, standard deviation and confidence interval), chi-square test and correlation coefficient test. The used software was SPSS version 18 [9-11].

RESULTS:

In 2015, 343 out of 1835 head trauma patients admitted to Khatam-Al-Anbia Hospital, in which 68 cases had traumatic intracranial hemorrhage and all patients underwent surgery. The mean age of patients was 26±19 years with an age range of 2-64 years. Out of the 68 patients, the number of men was significantly higher compare to women (46 men (67%), 22 women (33%), P=0.001). In contrast to CT scan findings and based on surgical findings, the hematoma was epidural in 15 cases, subdural in 16 cases, intraparenchymal in 13 cases, intraventricular in 15 cases and subarachnoid in 9 cases. There was a significant inverse relationship between hematoma volume and level of consciousness on admission, so that the larger sizes of the hematoma caused further drop in the level of consciousness on admission. In the present study, the parameter of DIC-score was defined as the sum of scores of coagulation experiments of the patients that confirms the general status of coagulation system of the patients. This variable, based on its definition, could be scored between zero to nine, and scores of zero and one are considered as normal, scores of 2 to 4 indicates the changes are minor, scores of 5 to 7 and above are respectively show moderate and severe abnormal findings. In the studied patients, 55 cases had normal DIC-score (between 0-1). The prevalence of mild, moderate and severe abnormal findings was respectively 5, 5 and 3. According to the definition, coagulopathy disorder refers to the score over 4, including groups of moderate and severe disorders; people with scores below 4 had no disorders (Table 4). Chi-square test was used to investigate the relationship between the level of consciousness and the fate of patients. There was a relationship between the levels of consciousness on admission, before surgery, 24 hours before surgery and discharge with the fate of patients (Table 6). In order to determine the predictive model of fate of the patients based on the regression model, the fate of the patients was considered as the response variable, as well as CT scan findings, surgery and the level of consciousness were regarded as the predictor variables. The effect of hematoma site and hematoma volume on CT scan is significant (p=5%) on the operated patients. Therefore, the hematoma site and hematoma volume could be appropriate predictor variables for the fate of patients underwent surgery.

Table 1: Frequency distribution of different types of brain hemorrhage is given based on their gender; accordingly, it could be found that all types of brain hemorrhage were higher in men.

CT Scan findings	Males (%)	Females (%)	Total
Epidural hematoma	10 (16%)	4 (06%)	(%20)14
Subdural hematoma	12 (18%)	5 (07%)	(%25)17
Subarachnoid hematoma	11 (16%)	6 (09%)	(%25)17
Intraventricular hemorrhage	5 (07%)	3 (05%)	(%12)8
Intraparenchymal hematoma	8(12%)	4(06%)	(%18)12
Total	46(67%)	22(33%)	(%100)68

Table 2: Descriptive characteristics of hematoma volume on the CT scan and surgery

Variables	Mean	Median	Standard deviation	Minimum	Maximum
Hematoma volume (cc) on CT scan	42/15	19	51/12	2/5	198
Hematoma volume (cc) in surgery	63/15	38	54/53	4	205

Table 3: Relationship between hematoma volume and level of consciousness based on GCS criteria

Time	Correlation coefficient	P Value
Admission	-0/58	0/01
Before surgery	-0/398	0/08
24 hours after surgery	-0/302	0/22
Discharge	-0/300	0/24
24 hours after admission	0/018	0/64
Discharge	0/16	0/45

Table 4: Scoring of coagulation tests

Variables	Prothrombin time (second)	Thromboplastin time (second)	Platelet count (cubic mL)
Zero (0)	Below 13.5	Between 30 - 44	Over 150 thousands
One (1)	Between 13.5 - 14	Over 44 and below 49	Between 100-150 thousands
Two (2)	Between 14 - 17	Over 48	More than 50 thousands
Three (3)	Over 17	Over 50	Below 50 thousands

Table 5: Relationship between CT scan findings in terms of hematoma volume and coagulopathy

Coagulopathy	Hematoma below 25 cubic centimeters	Hematoma over 25 cubic centimeters
Hematoma volume >4	4	5
Total number	32	16

Table 6: Relationship between the fate of patients and the level of consciousness based on GCS criteria

Time	Statistics test	P Value
Admission	24/48	0/001
Before surgery	23/24	0/001
24 hours after surgery	18/12	0/008
24 hours after admission	14/18	0/07
Discharge	34/36	0/001

Table 7: Regression analysis of the variables predicting the fate of patients underwent surgery

Variables	Regression coefficient	Statistic value	P value
Age	0/017	1/15	0/22
Level of consciousness on admission	0/15	1/54	0/15
Level of consciousness before surgery	0/001	0/06	0/65
Level of consciousness 24 hours after surgery	-0/20	-1/45	0/08
Level of consciousness at discharge time	-0/058	-0/74	0/54
Hematoma site on CT scan	0/92	2/35	0/01
Hematoma volume on CT scan	0/024	2/12	0/02
Amount of midline shift on CT scan	-0/125	-1/36	0/15

DISCUSSION:

In our study, the most frequency of head trauma leading to intracranial hemorrhage was in the age range of 20-35 years and the peak age of around 25 years. The highest age range of patients with traumatic intracranial hemorrhage was in the patients of active groups of society. The results have indicated that the most common traumatic brain injury in developing countries is related to the third decade of life [12, 13]. This could be due to the most high-risk behaviors in this age group. Our findings demonstrated that the number of men with traumatic brain injury leading to intracranial hemorrhage was twice more than in women [14]. In a study in western Sweden, 59% of the patients were men. In another study, the number of men with traumatic brain injury was 2.6 times more than in women [6, 7, and 15]. In the studies of other regions of our country, the number of men was 3-5 times more than in women. This is partly justified by the greater involvement of men in the outdoor environments, especially because traffic accidents are considered as the major cause of the injury. In this study, there was an inverse relationship between hematoma volumes in general and the level of consciousness on admission and before surgery, which is similar to the study results of Rayhan et al. in Bangladesh and Huang et al. Therefore, the more hemorrhage volume will lead to reduction in patient's level of consciousness. In addition, in this study, there was an inverse relationship between the GCS and the severity of coagulopathy. These findings can be explained by the role of activated coagulation factors caused by trauma, stress, traumatic brain injuries, the severity of trauma and also external hemorrhage and level of complications. The presence of complications was stated as a risk factor for incidence of coagulation disorders by other researchers such as Kumara et al. and Olson et al., which is quite comparable with our investigation. Therefore, coagulation disorders can be presented as a prognostic factor in patients with traumatic brain injury. In this study, there was a significant correlation between the hematoma site based on CT scan method and the fate of patients, so that the majority of cases leading to death were caused by subdural hematoma. It is noteworthy that if the subdural hematoma is not treated immediately by surgical decompression, it will have the highest mortality. It should be noted that the hematoma volume was significantly associated with the fate of patients, so that the fate of patients with the hematoma volume less than 30 cc was death for many of the patients. However, in the study of Joey et al., hematoma volume over 800 ml led to the fate of death in 90% of the patients. Therefore, the probability that a person's destiny lead to death will be higher by increasing the hemorrhage volume. In addition, the results of this study indicated that the variables of hematoma site and hematoma volume in the patients underwent surgery had the ability to predict the fate of patients. Therefore, since the CT scan can determine both of these variables, which have the ability to predict, the fate of the patients, understanding these two variables could be helpful and beneficial. However, it is controversial because variables of level of consciousness cannot predict the fate of patients. One of the limitations of the present study was the small sample size, so it is necessary to repeat this study with a larger sample.

CONCLUSION:

It seems that normal coagulation tests such as prothrombin time, thromboplastin time, platelet count and the tests of products derived from fibrin for the patients with traumatic brain injuries leading to moderate and severe intracranial hemorrhage could be helpful in terms of diagnosis and therapy. According to the dependence of hematoma volume on the CT scan and consciousness level of patients, we can suggest the use of these parameters in CT scan aiming to predict the fate of these patients beside the other common parameters. It is recommended to pay more attention to coagulation factors in patients with lesions and improve them if it is necessary.

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