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Check the Necessity of Performing CT Scan of the Brain in Patients with Mild Trauma

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Abstract: Introduction: CT scan of the skull in patients with head trauma play an important role in identifying patients' injuries; In moderate to severe brain injury; CT scans are arguably the best way to get information about the intracranial complications of a head injury. Researchers have cited a number of reasons for why doctors are increasingly asking for CT scans of patients. In this study; pathological findings in CT scan of patients with mild cranial trauma and level of consciousness 13-15 are examined. **Method:** In this study, the treatment process of 445 patients who had referred to the emergency department due to skull trauma was examined as research units; and samples were taken by simple random sampling among patients for whom CT scan of the brain was requested. In this study; the reasons for requesting a CT scan of the skull from the requesting physician were questioned through an interview at the time of request. **Results:** According to the tables; it can be seen that most of the patients referred to the hospital due to skull trauma for CT scan were men and were discharged in less than the first 24 hours. The age group of 21 to 30 years had the highest and the age group over 70 years had the lowest frequency and the highest percentage of request for CT scan was by doctor and the biggest injury that caused patients with mild cranial trauma to go to hospital was fall. **Conclusion:** Based on the findings of this study, cranial trauma is one of the life-threatening factors that can cause minor or severe injuries Its range varies from superficial injuries to hematoma and intracranial hemorrhage, which is a reason to perform CT scans of patients with skull trauma. In order to carefully examine the extent of the damage to the patient and to avoid possible risks and to take the necessary measures for treatment. On the other hand, the lack of clear protocols as well as the lack of clarity and certainty of physicians in their diagnoses to perform graphs of qualified people has increased the number of unnecessary CT scans.

Keywords: CT scan; trauma; necessity; hospital; Brian

Introduction

Computed tomography scans show tissues with high accuracy; It is therefore used as a valuable tool for detecting abnormalities in the brain or spinal cord [1]. In general, tomography scans help doctors for diagnose brain tumors, strokes, sinusitis, aortic artery dilatation, chest infections, and diseases of organs such as the liver, kidneys, and lymph nodes. Also with this method, injuries and internal bleeding are quickly identified This early diagnosis on CT scan allows the doctor to start treatment as soon as possible [2]. CT scan of the skull in patients with head trauma play an important role in identifying injury; In moderate to severe brain injury, CT scan is arguably the best way to get information about the intracranial complications of a head injury [3]. Researchers have cited a number of reasons why doctor are increasingly asking for CT scans of patients. Some researchers attribute this to the lack of clarity and clarity of the existing instructions or the lack of information

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and concern of some physicians about the requirements for performing a CT scan of the head. Which will ultimately lead to more physicians using diagnostic tests such as CT scans to ensure their behavior and documenting to deal with any possible legal problems [4]. The emergency department is one of the most important and essential organs of any hospital in response to disasters and accidents [5]. The emergency department plays a critical role in providing immediate medical care to patients and prompt medical interventions at all times of the day and all days of the year. Its performance can have a great impact on other departments and patient satisfaction. And out of the same patients referred to the emergency department, only a few are admitted to different wards of the hospital. Therefore, how to provide services in the emergency is a symbol of the general state of hospital services [6]. The effectiveness of the emergency department is evaluated according to the waiting time. The speed of providing services in medical centers, especially emergency, is of special importance in order to provide services, reduce mortality and disabilities.

In a medical emergency, seconds and minutes are important to the patient, and these times may determine the distance between life and death. The waiting time of patients to provide care and treatment services is one of the important and influential factors on the satisfaction of emergency patients. Prolonged waiting time and stay of patients in the emergency room can lead to a negative attitude of the community towards the hospital and care providers [7]. Also, according to the Global Brain Injury Guidelines, all patients referred to a trauma emergency center should be examined in less than 15 minutes. And CT scan of the head should be done less than an hour after requesting a CT scan [8]. Since the request for unnecessary CT scan increases the waiting time of patients in addition, the need for the nurse to accompany the patient to perform a CT scan, completion of the patient file by the nurse and documentation has increased the workload of emergency department nurses. Also, increasing the employment rate of beds in this sector prevents the provision of services to clients in order of priority [9]. This delays the diagnosis of brain damage. This issue can cause irreversible and life threatening effects on this group of patients. On the other hand; CT scan has disadvantages such as high cost for the patients and hospital; the risk of radiation and patient dissatisfaction [10]. Therefor; due the importance of the issue in trauma patient; the researchers decided to investigate the frequency and cause of CT scan to avoid doing this diagnostic unnecessarily in cases where it is not necessary to do it and prevent from possible damage and financial burden for the patients and hospital.

Methods

This study is a cross- sectional clinical trial study in which 445 patients referred to the emergency department of Taleghani hospital in Kermanshah city; who had referred to the emergency department due to trauma and head injury were studied as research units. Confirmation of the patient's trauma by the doctor and requesting a CT scan of the skull was a condition for admission to the study and not requesting a CT scan was a condition for exclusion from the study. Sampling in this study was done by simple random method among trauma patients who were asked for a CT scan of the brain. In this study; the reason for requesting a CT scan of the skull from the requesting physician were ask through an interview when requesting this procedure. In this part of study variables were described by using descriptive statistics including frequency; mean percentage and standard deviation. Then the research hypotheses and in other words; the relationships between the variable of hospitalization time and other study variables were examined using independent t-test and Chi-square. Fisher exact test was used in conditions where Chi-square assumptions were not met. The date collection tool was a two- part questionnaire that the first included demographic information and the second part included clinical information of the research units. Data were collected based on interview with the treating physician and treatment process documentation and patient information was recorded in the prepared checklist and then analyzed by SPSS software.

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Results

Description of the studied variable:

Demographic variables and other variables were described using descriptive statistics including average; standard deviation; frequency and percentage.

1)Level of consciousness

Table 1. Frequency distribution of consciousness level variables.

Level of consciousness	Frequency	Percent
13	126	28/3
14	1	2/0
15	318	71/5
Total	445	100

According to the table; the level of consciousness for patients in level 13 were %28/3 and %71/5 of them were at level 15.

2) Reason for referral

Table 2. Frequency distribution of patients by reason of referral.

Reason for referral	Frequency	Percent
Fall	134	30/1
Car accident	163	36/6
Slip	16	3/6
Epilepsy	3	0/7
Conflict	45	10/1
collision with hard object	84	18/9
Total	445	100

According to this table; out of 445 patients; 36/6% referred to the emergency department due to car accident and 0/7% due to epilepsy.

3) Age

Table 3. Frequency distribution of age group of patients.

Age group	Frequency	Percent
1-10	42	9/4
11-20	54	12/1
21-30	110	24/7
31-40	89	20/0
41-50	63	14/2
51-60	39	8/8
61-70	25	5/6
>70	23	5/2
Total	445	100

According to the table; the age group of 12-30 years had the highest frequency and the age group over 70 years had the lowest frequency.

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4) Sex

Table 4. Frequency distribution of patients by sex.

Sex	Frequency	Percent
Male	257	57/8
Female	188	42/2
Total	445	100

According to table; 445 patients were studied that 257 of them were male and 188 were female. Therefore; the percentage of male clients is more than woman.

5) Pathological symptoms

Table 5. frequency distribution of the studied samples by pathological symptoms.

Pathological symptoms	Frequency	Percent
No symptoms	393	88/3
Injury	22	4/9
Mild symptoms	20	4/5
General symptoms	6	1/3
Meningitis	4	0/9
Total	445	100

According to the table; 88/3% of the patients referred were asymptomatic and only 0/9% of them presented with meningitis symptoms.

6) Clinical symptoms

Table 6. Frequency distribution of samples by clinical signs.

Clinical symptom	Frequency	Percent
Nausea; vomiting; Headache; hematoma; Loss of consciousness and dizziness	76	17/1
Headache; Nausea and dizziness	159	35/7
Coma	5	1/1
Headache	205	46/1
Total	445	100

According to the table, the highest frequency of clinical symptoms was related to headache and 36% were presented with symptoms such as headache; nausea and dizziness.

7) Reason for requesting a CT scan

Table 7. Frequency distribution of samples by CT scan applicant.

Applicant for CT scan.	Frequency	Percent
Doctor	443	99/6
Patient	2	0/4
Total	445	100

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According to the table, 99/6% of the requests for CT scan were from the doctor and only 2 out of 445 people (4.0%) had performed CT scan at their own request.

8) Reason for discharge.

Table 8. Frequency distribution of the studied samples according to the cause of discharge.

Reason for discharge	Frequency	Percent
Doctor	313	73/1
Patient	111	25/9
Escape	4	0/9
Total	428*	100

*17 data were missed.

According to the table, about 73% of the patients were discharged with request of the doctor and 0.9% of the patients were escaped.

9) Underlying disease

Table 9. Frequency distribution of samples by underlying disease.

Underlying disease	Frequency	Percent
Blood pressure	45	10/1
History of surgery	14	3/2
Epilepsy	9	2/0
NO disease	371	83/6
Asthma	5	1/1
Total	444*	100

*one data was missed.

According to the table, about 84% of patients had no underlying disease and 1/1% had Asthma.

11) Addiction or allergies

Table 11. Frequency distribution of samples according to the presence or absence of addiction or sensitivity.

Addiction or sensitivity	Frequency	Percent
Negative	409	92/1
Positive	35	7/9
Total	444*	100

*one data was missed.

According to the table, about 92% of patients were not addicted or allergic and about 8% of the samples answered positively.

12) Duration of hospitalization

Table 12. Frequency distribution of patients according to length of hospital stay.

Duration of hospitalization	Frequency	Percent
Maximum 24 hours	315	73/4
More than 24 hours	114	26/6
Total	429	100

*16 data were missed.

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According to the table, 73/4% of patients were discharged from the hospital within 24 hours and only 26/6% of patients were hospitalized for more than 24 hours.

13) Hospitalization in other wards of the hospital

Table 13. Frequency distribution of patients according to hospitalization in other wards of the hospital.

Hospital sections	Frequency	Percent
Emergency	328	74/0
ICU 1	23	5/2
ICU 2	41	9/3
Neurology	51	11/5
Total	443	100

*Tow data were missed.

According to the table, 74% of patients were hospitalization to the outpatient emergency department of the hospital and 5/2% were admitted to the ICU 1 ward.

Investigation of research hypotheses

In this part of the study, the relationship between duration of hospitalization and other variables was examined using independent t-test, Chi-square. It should be noted that wherever the Chi-square test default was not met, Fisher's exact test was used.

Investigating the relationship between level of consciousness and duration of hospitalization.

Table 1. Investigating the relationship between level of consciousness and duration of hospitalization using Fisher's exact test.

		Duration of hospitalization		Total	Fisher's exact test result
		24 hours	More than 24 hours		
Level of consciousness	00/13	47	75	122	Value< 001/0 P-
	00/14	0	1	1	
	00/15	268	38	306	
Total		315	114	429	

According to the table from 122 patients, that were at the level of consciousness 13, 75 persons were hospitalized for more than 24 hours. While from 306 patients with a level of consciousness 15, only 38 were hospitalized for more than 24 hours.

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2) Investigating relationship between the reason for referral and duration of hospitalization

Table 2. Investigating the relationship between reason for referral and length of hospital stay using Fisher's exact test.

		Duration of hospitalization		Total	Fisher's exact test result
		24 hours	More than 24 hours		
Reason for referral	Fall	90	40	130	Value< 001/0P
	Car accident	114	43	157	
	Slip	12	3	15	
	Epilepsy	1	2	3	
	Conflict	25	18	43	
	collision with hard object	73	8	81	
Total		315	114	429	

According to the table, there was a statistically significant relationship between the reason for referral and duration of hospitalization stay at the level of 0.05. For example, out of 43 patients referred because of conflict, 18 persons (approximately 42%) were hospitalized for more than 24 hours. Of the 81 patients who presented because of collision with hard object, only 8 (approximately 10%) were hospitalized for more than 24 hours.

3) Investigating the relationship between age and duration of hospitalization

Table 3. Investigating the relationship between age and duration of hospitalization stay using independent t-test.

Duration of hospitalization	Sample size	Average	The standard error	T statistics	P-value
Maximum 24 hours	315	66/34	10/1	26/0	793/0
More than 24 hours	114	21/35	68/1		

According to the average age table, patients who were hospitalized for more than 24 hours are more than patients who were hospitalized for a maximum of 24 hours. But this mean difference was not statistically significant at the level of 0.05.

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4) Investigating the relationship between gender and duration of hospitalization

Table 4. Investigating the relationship between gender and duration of hospitalization using Chi-square test.

		Duration of hospitalization		Total	Chi-square test result
		24 hours	More than 24 hours		
Sex	Male	180	66	246	019/0Chi-square=889/0P-value=
	Female	135	48	183	
Total	315	114		429	

According to the table, there is no statistically significant relationship between gender and duration of hospitalization

5) Investigating the relationship between pathological symptoms and duration of hospitalization

Table 5. Evaluation of the relationship between pathological symptoms and duration of hospitalization using Fisher's exact test.

		Duration of hospitalization		Total	The result of Fisher's exact test
		24 hours	More than 24 hours		
Reason for referral	No symptoms	296	85	381	001/0P-value<
	Injury	12	8	20	
	Mild symptoms	3	15	18	
	general symptoms	4	2	6	
	Meningitis	0	4	4	
Total		315		114	

According to the table, the result of Fisher's exact test was significant at the level of 0.05. That is, there is a statistically significant relationship between the reason for referral and the length of hospital stay. For example; 18 persons with mild symptoms were hospitalized for 24 hours. while from the 20 injured 8 persons were hospitalization for more than 24 hours.

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6) Evaluation of the relationship between clinical symptoms and duration of hospitalization

Table 6. Evaluation of the relationship between clinical symptoms and duration of hospitalization.

		Duration of hospitalization		Total	The result of Fisher's exact test
		24 hours	More than 24 hours		
Reason of referral	Nausea; Vomiting; Headache; hematoma; loss of consciousness and dizziness	41	30	71	001/0P-value=
	Headache; Vomiting and dizziness	109	47	156	
	Coma	4	1	5	
	Headache	161	36	197	
Total		315	114	429	

According to the table, there was a statistically significant relationship between the reason for referral and the duration of hospitalization. As can be seen, the proportion of samples who were hospitalized for more than 24 hours is not homogeneous in different groups.

7) Investigating the relationship between duration of hospitalization stay and the person requesting a CT scan

Table 7. investigating the relationship between duration of hospitalization stay and the person requesting a CT scan.

		Duration of hospitalization		Total	The result of Fisher's exact test
		24 hours	More than 24 hours		
Request	Doctor	314	113	427	461/op-value=
	Patient	1	1	2	
Total		315	114	429	

According to the table, no significant relationship was observed between the length of hospital stay and the person requesting the CT scan.

8) Investigating the relationship between discharge cause and duration of hospitalization stay using Fisher's exact test

Table 8. investigating the relationship between discharge cause and duration of hospitalization stay using Fisher's exact test.

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		Duration of hospitalization		Total	Fisher's exact test
		24 hours	More than 24 hours		
	Doctor	226	86	312	838/0P-value=
	Patient	83	27	110	
	Scape	3	1	4	
Total		312	114	426	

According to the table, there was a significant relationship between the cause of the drawing and the duration of hospitalization.

9) Investigating the relationship between underlying disease and duration of hospitalization using Fisher test.

Table 9. investigating the relationship between underlying disease and duration of hospitalization stay using Fisher's exact test.

		Duration of hospitalization		Total	The result of Fisher's exact test
		24 hours	More than 24 hours		
Underlying disease	Blood pressure	32	12	44	970/0P-value
	History of surgery	10	4	14	
	Epilepsy	7	1	8	
	No disease	261	96	357	
	Asthma	4	1	5	
Total		314	114	428	

According to the table, there was no statistically significant relationship between the underlying disease and the duration of hospitalization.

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10) Investigating the relationship between duration of hospitalization and sensitivity or addiction

Table 10. investigating the relationship between duration of hospitalization and sensitivity or addiction using Chi-square test.

		Duration of hospitalization		Total	Chi-square test result
		24 hours	More than 24 hours		
Addiction and sensitivity	Negative	297	100	397	87/5Chi-square= 015/0-value=
	Positive	17	14	31	
Total		314	114	428	

According to the table, about a quarter of the samples who were not allergic or addicted were hospitalized for more than 24 hours and 14 of the 31 patients with allergies or addictions were hospitalized for more than 24 hours.

11) Investigating the relationship between hospitalization time and hospitalization in other wards

Table 11. investigating the relationship between duration of hospitalization and hospitalization in other wards.

		Duration of hospitalization		Total	Chi-square test result
		24 hours	More than 24 hours		
Hospitalized in other wards	Emergency	310	11	321	40/350 Chi-square= 001/0P-value<
	ICU 1	2	21	23	
	ICU2	1	36	37	
	Neurology	2	46	48	
Total		315	114	429	

According to the table, there is a statistically significant relationship between the variables duration of hospitalization and hospitalization in other wards

Discussion

The aim of this study was to evaluate abnormal findings in patients with mild cranial trauma referred to the hospital with a level of consciousness 13 to 15. In the present study, 445 patients with mild trauma were studied, that 126 persons (28.3%) were at the level of consciousness 13, 1 person (0.2%) at the level of consciousness 14 and 318 persons (5/5). 71%) were at level 15 of consciousness. According to a study conducted by Stiell in Canada, the average level of consciousness 15 in patients with mild trauma was 79% [11]. Studies show that road accidents with 36.6% have the highest rate of cranial damage in patients and zhu.H study shows this consistency in the findings. According to this study, the three factors of accident were 14/1%, fall 5.6% and blows 9.1% (collision of objects - conflict) were the most common reason for patients to refer to medical centers [12]. Findings of 445 patients with average age of 34.73 show that 57.8% of patients were male and 42.2% were female. Also, these statistics and the results of various researches show that the reason for referral is directly related to different cultural and geographical factors of the research place. Conflict is also one of the most important social issues in any society, the number of which is higher in men than women. Which depends on various cultural and social factors such as residence, employment, race, marital status, age and ethnicity, etc., and the results of the present study are consistent with the Miller study, in

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which 61% of the clients are men. Of this number of male and female patients, most of the clients are under 30 years old and in the second decade of their lives [13–15]. Researchers believe that the reason for such similarities in demographic findings is more male activity in socio-economic fields, high risk behaviors in men, and the activity of the under 40 age group compared to other age groups. Also, different social groupings can sometimes lead to conflict among the population and violence [16,17]. According to the results of the present study, 11.6% of the patients had abnormal CT scans, which showed different brain lesions. Which is related to the results of smits studies which show 9.9% of brain damage [18]. According to the results of Abdul Latip's study, lowering the Glasgow standard score from 15 to (14-13) increases the risk of brain damage in patients, that these people need more cranial tomography. Decreased level of consciousness is also directly related to the incidence of nausea and vomiting in patients, which can be an important factor for cranial X-ray in patients. However, since patients with GCS 15 do not have an urgent need for initial measures, it is recommended that brain scans of these patients be performed if there are symptoms such as loss of consciousness, nausea, vomiting, severe tenderness, etc. [19,20]. According to research by Roka et al., The most common symptoms in patients with cranial trauma were nausea and vomiting (57%) and headache (43%). Among 445 patients in this study, 52.8% of patients had nausea and vomiting and 46.1% had headaches that these people required CT scan due to specific clinical symptoms. But in other people the lack of specific symptoms causes ionizing radiation damage in these people. The results of the present study also show that people who did not have severe clinical symptoms did not have a problem with their tomography scan and did not need a CT scan and the doctor's order was only to document the patient's file [21]. Given that performing CT scan in the early hours after head trauma can lead to the diagnosis of life-threatening factors in the patient and is effective in reducing mortality due to cranial trauma but CT scans can be very costly for patients and their families. Also, ionizing radiation from CT scans can cause cancer in patients. Therefore, in addition to reducing the level of consciousness in these people, it is recommended to pay attention to other clinical symptoms such as nausea, vomiting, severe tenderness, etc. [22,23]. In this study, out of 445 patients studied, 99.6% of patients underwent CT scan according to the doctor's instructions. This is due to hospital protocols to ensure that doctors diagnose and protect themselves from the dangers of misdiagnosis and exposure to the law. In the study of Lindor et al., 60 legal cases were examined in which the reason for the complaint was the lack of a doctor's order to perform a CT scan, which shows the importance of documenting the cases of patients with skull trauma that performing CT scan increase physicians' ability to respond to such cases [24]. In a study by John.You et al., Participating physicians often cited fear of misdiagnosis and the resulting legal condemnation, often at the request of the patient or the patient's companions, as the most important reason for requesting a CT scan. Researchers have argued that people in the community have expressed unrealistic views about the ability of advanced medical equipment, Including CT scans for correct diagnosis [25]. Among the 445 patients in this study, 73.4%, equal to 315 of them, were discharged in the first 24 hours and did not need hospital services. Of these 315, 313, ie 73.1% of patients with The doctor's orders released. This indicates that CT scans were not needed in these patients. And the doctor has performed CT scans for various reasons, such as: fear of complaining, hospital instructions, confirmation or rejection of brain lesions, as well as the speed of diagnosis [26]. Research has shown that the risk of underlying disease increases the risk of injury in patients with cranial trauma. Also in the present study, 10.1% of patients had underlying hypertension, 2% had epilepsy and 1.1% had asthma [27]. Among the patients who were examined, 26.6% of them were hospitalized for more than 24 hours, that this issue depends on various factors such as the patient's symptoms, her consent to attend or leave the hospital, the reason for referral and the severity of the injury. Also, this number of hospitalized patients shows that performing CT scans in hospitals is due to the completion of the case and the prevention of legal problems and its subsequent consequences. However, if there are strong and clear protocols according to which the doctor can diagnose the patient's condition based on the symptoms and request a CT scan if necessary and do not face legal problems, the number of unnecessary CT scans can be reduced and protected patients from the dangers of CT scans. Also, the presence of experienced physicians in the emergency department, due to their greater ability in early diagnosis

and familiarity with dangerous symptoms, helps to reduce the number of CT scans requested. [18,28–30].

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Conflicts of Interest: All authors declare that there is not conflict of interest in this study.

Ethical Statement: This study was approved by the Ethics Committee of Kermanshah University of Medical Sciences, Kermanshah, Iran Ethical code: IR ethics ID KUMS. REC(1398.1093).

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