MEDICAL SCIENCE

To Cite:
Ali AHA, Serhan OO, Alqahtani MS, Alghofaili Z, Alobaidi IM, Alsultan BSS, Alharbi TA, Ababtain A, Alotaibi BM, Alenazi AH, Alanazi FM, Althubiti TA. Knowledge of CT scan indication for traumatic brain injury among emergency medical professionals. *Medical Science* 2023; 27: e295ms3108.
doi: https://doi.org/10.54905/disssi/v27i137/e295ms3108

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Peer-Review History
Received: 16 May 2023
Reviewed & Revised: 20/May/2023 to 04/July/2023
Accepted: 08 July 2023
Published: 18 July 2023

Peer-review Method
External peer-review was done through double-blind method.

Medical Science
pISSN 2321–7359; eISSN 2321–7367

Knowledge of CT scan indication for traumatic brain injury among emergency medical professionals

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ABSTRACT

One of the most frequent reasons for trauma hospitalizations is a minor head injury, but how best to handle them is still up for debate. Although clinically severe traumatic brain injury is uncommon in this group, it could be fatal if a clinically important condition is overlooked. This study aims to assess emergency physicians' knowledge of and adherence to these head CT guidelines. We questioned our participants about their knowledge of the regulations and how they applied to their professional lives. A survey was issued at random to EPs from King Khaled Hospital in Al-Kharj. Among the 74 emergency room doctors who replied, the utilization rates and awareness of clinical decision rules were respectively 55.5% and 43.3%. The working atmosphere and higher likelihood of lawsuits, which were 54.6% and 59.6% respectively, were the hurdles to using such policies. 89.9% of those doctors said they would like direction on how to put these standards into effect on a daily basis. Despite the large incidence of head traumas, there is confusion over what constitutes a minor head injury that led to requests for more CT scans. The healthcare system will be burdened, and there will be an increase in radiation exposure. A better use of our resources and a decrease in radiation risks will come from more education about head CT regulations.

Keywords: Emergency, CT scan, Knowledge, Head Injury.

1. INTRODUCTION

The emergency department (ED) frequently uses CT as a diagnostic imaging tool. The advantages of CT are obvious—a wide range of life-threatening illnesses can be identified or ruled out in a matter of minutes (Zwank et al., 2014). The harm to the general public's health posed by radiation from

medical imaging, however, is becoming more widely recognized. In the USA, CT scans and other medical imaging procedures currently account for more than half of the country's annual per-person radiation exposure. Physicians and other healthcare professionals are becoming more aware of these difficulties as this subject is given increasing attention in the medical literature (Hricak et al., 2011).

It is critical to gauge patients' awareness of CT hazards and, perhaps more crucially, their willingness for information. The requirement for doctors to communicate CT hazards in order to support patient autonomy may be determined by this. The frequency and necessity for CT scans have recently increased. Although a CT scan offers a more accurate diagnosis, it also exposes the patient to high radiation doses, which raises the risk of biological effects like cataract, skin damage, and cancer. Patients with a history of unconsciousness, forgetfulness, or disorientation and GCS (Glasgow Coma Scale) score of 13 to 15 are considered to have traumatic brain injury (Thomas, 2011).

Most individuals with minor head injuries who don't have the aforementioned symptoms hardly ever need to be admitted to the hospital and can be sent home after treatment (Stiell et al., 2001). However, only 1% of those individuals will require neurosurgical intervention, and 10% of those patients will experience a worsening of their illnesses due to a cerebral hematoma (Galbraith, 1976). Therefore, it is crucial and significant to make an early diagnosis of cerebral hematoma using computed tomography and to start treating such individuals' right once. Due to its accessibility and highly reliable diagnostic method, CT scans are a crucial diagnostic tool in emergency rooms.

Furthermore, a CT scan is a crucial component of the triage and management of patients with traumatic brain injury as the sequelae of omitting a clinically significant issue could be fetal. Therefore, more than any other department, emergency physicians (ERs) are requesting an astoundingly high number of CT scans. Even though ninety percent of scans are negative for clinically significant brain injury, this scanning leads in increased radiation exposure and significant health care costs (Huang et al., 2013). Additionally, studies and publications that aggressively advocated for CT scans to be performed on all patients with small head injuries would eventually result in more than 300% rise in the use of CT scans for patients in Canada and Europe who had minor head injuries (Stiell et al., 2001).

The use of a CT scan for a minor head injury should be acceptable in certain conditions. The use of clinical decision criteria appears to have a significant promise for enhancing the effectiveness of addressing minor head injuries. A clinical decision rule is a method for making decisions that incorporates three or more factors from the history, physical examination, or simple tests. It is derived from unique research (Stiell et al., 2005). This study uses a specially prepared questionnaire with a brief clinical scenario to assess emergency physicians' knowledge of indications for CT scanning in Traumatic Brain Injury in accordance with Canadian CT Head Rule.

2. METHODS

We followed the Animal Research Guideline for the Use and Care of Animals in Research, which was approved by the PSA University Ethical Committee, Al-Kharj (SCBR-103-2023). From August 2022 to April 2023, this cross-sectional study was carried out at the King Khalid Hospital, Ministry of Health, in Al-Kharj, Saudi Arabia. The previously stated hospital, which offers cutting-edge emergency care, is the main emergency care facility in Al Kharj. The researchers looked for the literature for validated items and designed a self-reported questionnaire using advice from colleagues and emergency medical experts. Prior to being finalized, the questionnaire was pretested on 5 individuals.

Three components made up the questionnaire. First, it listed the candidate's demographic information, such as age, gender, specialization, and the number of shifts per month. Secondly, the questions were designed to examine the doctor's knowledge of the management of TBI and the indications for head CT scans based on their level of expertise. The last one is a clinical scenario involving a patient who has had a mild head injury evaluates the clinical expertise of the targeted doctors, with a focus on the rationale for a head CT scan in particular.

Our participants were given a case study on a minor head injury in which a 23-year-old man playing football was hit in the temporal region during play. He lost consciousness for only five to ten seconds after falling to the ground, and other players helped him stand back up. He could not recollect the incident of injury and denied any neck pain, yet he was complaining of dizziness, a headache, and nausea. He was sent to the emergency room for evaluation. The initial survey was entirely normal. The patient could not remember the incident despite being awake, oriented, and GCS 15-level. 88 ED physicians from the hospitals mentioned above participated in the study.

Participants were chosen at random using an alphabetical simple numerical technique. The statistical package for social sciences (SPSS) version 21 was used to enter the data. All relevant variables' proportions were determined, and the chi-square test was applied. Throughout the investigation, a p-value of <0.05 was regarded as statistically significant.

3. RESULTS

Seventy-four emergency department physicians made up the study's entire sample. 56 doctors who ranged in age from 26 to 51 were male, making up 75.67% of the group. About 39.18 percent of the participants were of Saudi nationality. In terms of experience, 24 percent of survey participants had less than two years' worth of experience, while 32.4%, 20.2%, and 22.9%, respectively, have three to five, six to ten, and more than ten years' worth of experience. Our data also revealed that 58.1% of the participants were residents, compared to 31.08% for specialists and 10.81% for consultants.

In terms of educational level, 58% of participants were residents, and 31% of participants were emergency room specialists. Only eight consultants, or 10% of the total, took part in the study. The expectation was that doctors working more shifts would be better familiar with the benefits of a head CT scan for TBI. A total of 21% of participants used to work more than 25 shifts per month, while 17 individuals worked between 21 and 25 shifts. Previously, 55% of participants worked fewer than 21 shifts per month.

About 73% of the participants in our survey said the case involved a minor head injury, 18% said it involved a moderate head injury, 7% said it involved a serious head injury, and 2% said it involved an enormous brain injury. Regarding the patient's management, 67% of our participants would order a head CT scan, while 22% would admit the patient for observation. Finally, 7% would discharge the patient with instructions after consulting a neurosurgeon around 6% of the time. Regarding exposure to trauma patients, 75% of our participants are accustomed to seeing fewer than nine patients with head injuries each month, 14% are accustomed to seeing between 11 and 14 cases, and 40% are accustomed to seeing 13 or more cases each month.

The following responses were given in response to the question, "How frequently would you request a head CT scan in cases of trauma patients": 6.4% of them will always ask for a head CT scan for trauma patients, 21% will generally ask, 16.9% will occasionally ask, and 5.1% will rarely ask. Every time a participant suspects a head injury, almost half of the participants will ask for a head CT scan.

We questioned our EPs on their knowledge of clinical decision guidelines for minor head trauma. 45.5% of respondents said "yes," while 46.3% said "no". Those who indicated yes were also questioned about the clinical decision rule they use. Examples of cases were mentioned in (Figures 2, 3). Canadian CT Head Rule was the most often employed standard in more than 42% of cases. Surprisingly, roughly 20% say they are drawing on personal experience. Our survey evaluated the use of any clinical decision rules, and the results showed that 44% of our participants always and 45% of the time employ clinical decision rules in their practice. When we evaluated knowledge and practice, the majority (51% and 63%, respectively) was weak (Table 1) (Figure 1).

Table 1 Percentage of knowledge and practices among participants

Features		No.	Percentage
Knowledge	Weak	38	51.35%
	Average	23	31.08%
	Good	13	17.56%
Practices	Weak	47	63.51%
	Average	15	20.27%
	Good	12	16.21%

There were statistically significant variations between knowledge, practice and sex, country, years of experience, duty load, field of interest, and highest academic credentials when employing the Chi-square t-test (Table 2). In our study, 55% of ER doctors were aware of clinical decision rules and 45% used them, while 47% of ER doctors were not aware of any clinical decision guidelines at all. However, 90% of those doctors said they would welcome advice on how to find out more about one of these recommendations. Our scenario backs up what we found.

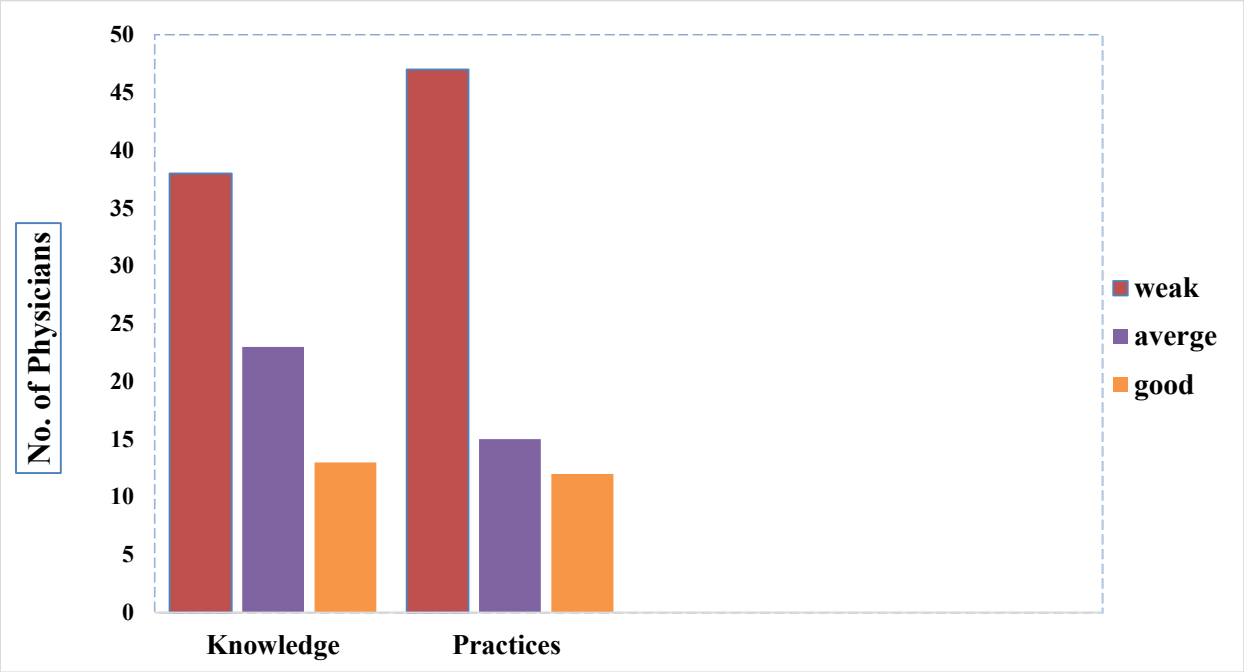

Figure 1 Percentage of knowledge and practices among participants

Table 2 Illustrative statistical comparison of study characteristics to practice and knowledge

Features		No.	Knowledge	Practices	P value
Gender	Male	56	4.213	28.212	0.004
	Female	18	3.944	24.456	
Nationality	Saudi	29	4.640	27.321	0.011
	Non-Saudi	45	3.977	24.437	
Experience as emergency physicians in years	One to two	18	4.123	20.232	0.021
	Three to five	24	3.893	24.657	
	Six to ten	15	4.678	27.787	
	More than ten	17	4.779	22.234	
Monthly shifts	< 12	18	4.323	22.876	0.0012
	12-20	23	3.234	23.232	
	21-25	17	5.321	29.676	
	> 25	16	4.432	29.121	
Specialty expertise	Medical	33	5.333	33.433	0.00044
	Surgical	18	3.321	30.451	
	Trauma	23	4.434	23.222	
Greatest level of study	Resident	43	4.676	22.434	0.0022
	Specialist	23	5.562	30.001	
	Consultant	8	5.432	37.765	

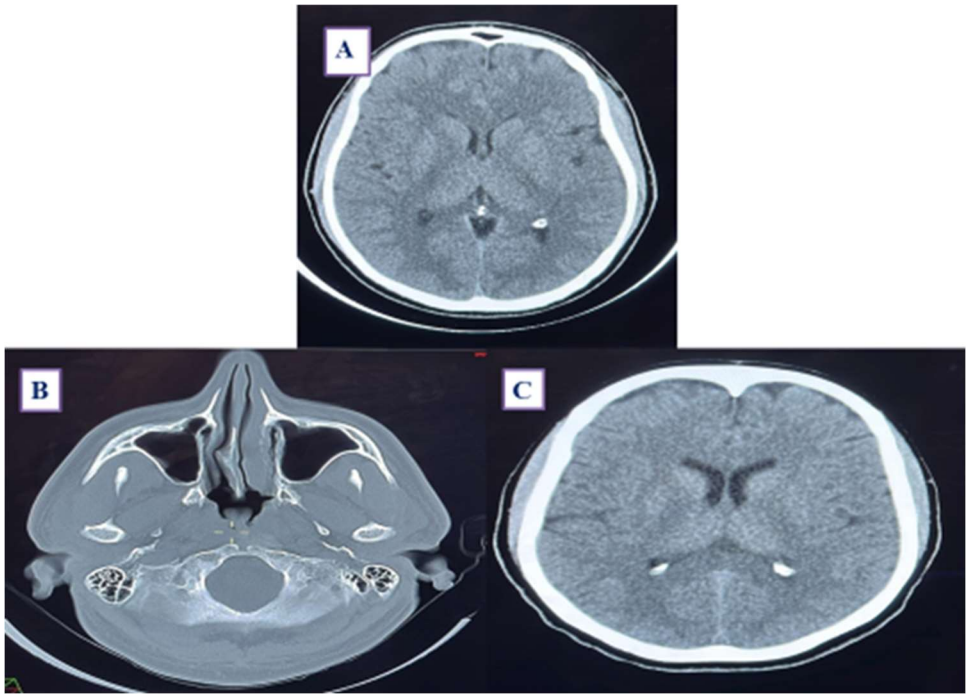

Figure 2 Normal CT of different patients came to ER Trauma, fall, assault, then scan and imaging finding was A) Normal axial brain CT scan. B) Normal axial Brain CT Scan. Nasal septum deviation as incidental findings. C) Normal axial Brain CT Scan of patient fall down. No skull vault fracture

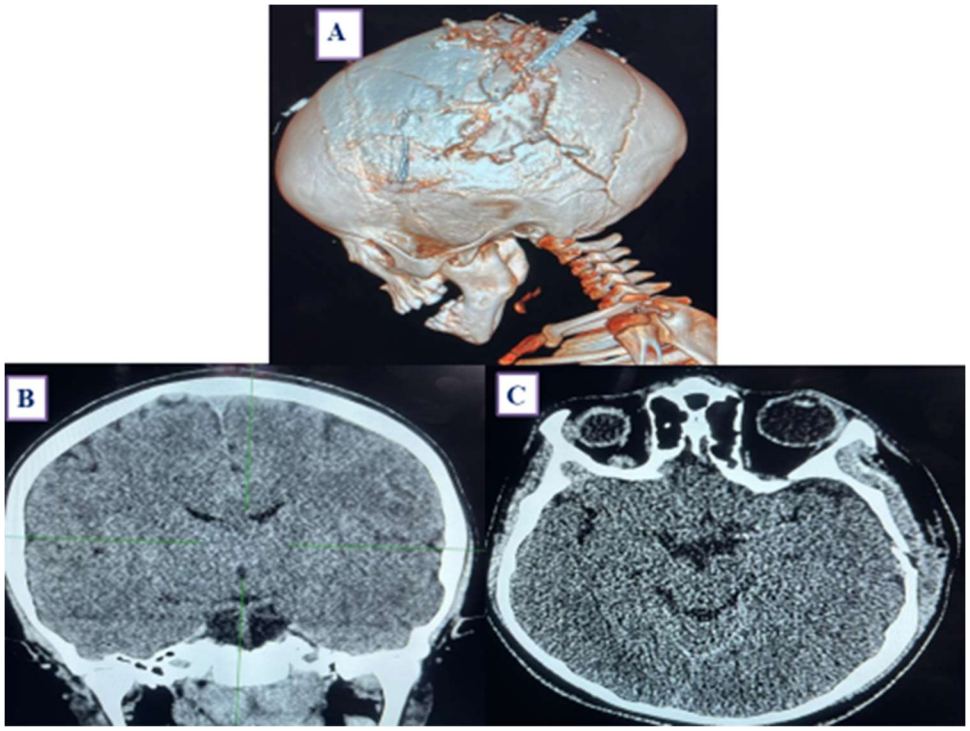

Figure 3 Abnormal CT of different patients. A) CT 3D skull image with multiple skull vault sever fractures. B) MPR Coronal Brain CT scan with left Temporal-parietal fractures. C) MPR Axial Brain CT scan with same findings

4. DISCUSSION

The diagnosis of post-traumatic cranial damage requires the use of CT head imaging. They may also be used to identify neurological disease brought on by minor head trauma that needs urgent attention. CT imaging has been incredibly overused because of the possible danger of misdiagnosing or altogether ignoring deadly findings. This technique raises the risk of cancer, exposes people to radiation they don't need to, and costs the healthcare industry money (Al-Omran et al., 2023).

It is debated and contentious whether routine CT scanning is useful for patients with mild head injuries, whether they are children or adults. Various clinical recommendations have been created to decide whether CT imaging is necessary. In our study, 73% of participants determined that the patient had suffered just minor head trauma, whereas the remaining 50% determined that the patient had suffered moderate to severe head trauma. As a result, several ER doctors do not agree on the criteria of minor head trauma. This implies that the majority of patients with minor head injuries will get unnecessary head CT scans.

Two significant studies that previously examined the same topic were published. ER doctors participated in the first one, Eagles et al., (2008), it aimed to assess clinicians' knowledge of and adherence to the Canadian computed tomography head rule across Canada, Australia, the United Kingdom, and the United States of America. In the second survey, Chinese emergency physicians were asked to assess their knowledge of and adherence to the Canadian computed tomography head rule for patients with moderate head injuries (Huang et al., 2013).

We discovered differences and variations between our survey's results and those of the aforementioned research when we compared them. In a study from China, "pressure from administration to order more examinations" and "lack of knowledge about the radiation risk of CT" came in second and third, with 29.5% and 27%, respectively, as the main barriers to the use of CCHR. 90% of those who responded think that following the regulations will result in better resource management and greater advantages for patients. Ordering CT scans for mild illnesses has become normal practice as the doctor-patient interaction becomes more challenging (Wong et al., 2011).

That would account for the rise in the need for head CT scans for mild head trauma in order to confront patients and prevent misconduct. Defensive medicine makes up one out of every five examinations in some settings (Swensen, 2012). The variations in clinical contexts, the availability of resources, and regional recommendations may all be contributing factors to the differences in the degree of CT overuse observed between studies. Another study by Cellina et al., (2018) found a 72% overuse of CT scans, which was limited to patients between the ages of 18 and 45. The referring doctor and the type of trauma may be to blame for this misuse in the community (Cellina et al., 2018).

Collectively, these findings highlight the significance of limiting excessive CT head imaging, particularly in young adults since early radiation exposure may give malignant neoplastic potential more time to develop. According to our findings, patients also had a greater rate of overuse of CT imaging. The study does have certain restrictions. The sample size was tiny and there weren't many consultants. For more accurate results, we think a countrywide a survey is necessary.

5. CONCLUSION

Our survey revealed that, despite brain injuries being one of the most frequent systems involved in trauma, there is confusion about what constitutes a minor head injury, which led to requests for more CT scans. The healthcare system will be burdened and there will be an increase in radiation exposure as a result. There certainly ought to be additional educational efforts made to increase resource usage, lower radiation risk, and should not harm participants.

Acknowledgments

This publication was supported by the Deanship of Scientific Research at Prince Sattam bin Abdulaziz University, Al-Kharj, Saudi Arabia. In addition, we thank those who participated and contributed to the study.

Authors' Contributions

All authors contributed to the research and/or preparation of the manuscript. Ali Hassan A Ali, Omar O. Serhan, Mohammed Saad Alqahtani and Ibrahim Mohammed Alobaidi participated in the study design and wrote the first draft of the manuscript. Bandar Suliman S Alsultan, Fahd M Alanazi and Talal A. Alharbi collected and processed the sample. Ali Ababtain, Bader M. Alotaibi, Ammar H. Alenazi, Ziyad Alghofaili, Yousef Fudhayl F Alanazi and Tareq A. Althubiti participated in the study design and performed the statistical analyses. All of the authors read and approved the final manuscript.

Ethics Approval

All series of steps that were implemented in this study that included animal models were in compliance with Ethics Committee of Prince Sattam bin Abdulaziz University Institutional Review Board (SCBR-103-2023).

Informed consent

Not applicable.

Funding

This study has not received any external funding.

Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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