

## RESEARCH PAPER

# The adherence of doctors to brain ct referral criteria: a service evaluation survey from basrah teaching hospital

Elaf S. Mohammed<sup>1</sup>, Hassan A. Farid<sup>2</sup>, Ahmed S. <sup>3</sup>, Ali R. Hashim<sup>4</sup>

1. Hematology Resident Doctor, Basrah Teaching Hospital, Basrah, Iraq.
2. Neurology Clinical Teaching Fellow / Honorary Clinical Lecturer, St. George's University of London and Hospital, London, United Kingdom.
3. Radiology Specialist Doctor, Basrah Teaching Hospital, Basrah, Iraq.
4. Professor of Medicine and Neurology / Consultant Physician, College of Medicine, University of Basrah, Basrah, Iraq.

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### Abstract

**Background:** CT scans are increasingly utilised in outpatient and emergency departments due to their ability to facilitate swift diagnosis and treatment planning. However, inappropriate use of CT scans, particularly CT scans of the brain, can have negative consequences.

**Objectives:** This study aims to evaluate the adherence of Basrah Teaching Hospital doctors to the international referral criteria for brain CT scans.

**Methods:** A retrospective review of medical records was conducted to investigate the utilisation of brain CT scans in the radiology departments of Basrah Teaching Hospital for two months and involved 108 referrals. The medical records were thoroughly reviewed to extract relevant information related to the indications of referral, referring doctor, referring place, brain CT results, and assessing the request form completions. The standard referral criteria were extracted from the United Kingdom and European brain CT referral guidelines.

**Results:** Most of the referrals (75.9%) met the referral criteria, and most of the doctors, regardless of their levels, met the referral criteria; however, the highest rate was among the junior doctors (88.9%), followed by specialists and senior resident doctors. Moreover, most of the units adhered to the referral criteria, but the highest adherence rate was among those referrals from inpatient wards (91.7%). Furthermore, the majority of the doctors and most of the referring wards completed their request forms; however, the highest completion was in specialty and consultant doctors' groups (77.8%). The results also showed that about half of positive brain CT results are due to neurological causes (46%), followed by head trauma referral (34.6%).

**Conclusions:** The majority of the doctors at Basrah Teaching Hospital met the international standards for brain CT referrals, and most of the referral wards followed these guidelines.

**Key words:** Brain CT scan, Head trauma, headache, Stroke, Neurology, Radiology

**Corresponding author:** Hassan A. Farid, Neurology Clinical Teaching Fellow / Honorary Clinical Lecturer, St. George's University of London and Hospital, London, United Kingdom

✉ E-mail: [Hfaired@sgul.ac.uk](mailto:Hfaired@sgul.ac.uk)

### Introduction

The utilisation of computed tomography (CT) scans has become increasingly prevalent in both outpatient and emergency departments due to their ability to provide rapid diagnosis and treatment planning. However, the inappropriate use of CT scans, particularly in the case of brain

CT scans, can have detrimental consequences, such as unnecessary exposure to ionising radiation and increased healthcare costs.<sup>1</sup> The majority of indications for these scans are related to traumatic brain injuries resulting from road traffic accidents, which are considered an emerging public health priority and require urgent attention.<sup>2</sup> The evaluation of provided services holds paramount importance in establishing localised criteria for the appropriate utilisation of brain CT scans. Given the increasing significance of diagnostic imaging techniques like brain CT scans, it is crucial to assess the quality and effectiveness of these services. This evaluation serves as a vital step towards establishing local guidelines and criteria, facilitating informed decision-making, and optimising the use of brain CT scans in clinical practice.<sup>3</sup>

This study aims to evaluate the utilisation of brain CT scans provided by Basrah Teaching Hospital to patients from the emergency department, inpatients, and outpatients.

## Methods

A retrospective review of medical records was conducted to investigate the utilisation of brain CT scans in the radiology departments of Basrah Teaching Hospital. The study period for data collection spanned from January 2023 to March 2023.

**Sampling:** A random selection of medical records was performed to ensure a representative sample. The sample size for this study was determined to be 108 records.

**Data Collection:** The selected medical records were thoroughly reviewed to extract relevant

information. The following variables were collected:

- Indications for CT scans: The documented reasons for ordering the brain CT scans were recorded. The indications were classified into four main groups based:

1. *Headache*
2. *Traumatic brain injury*
3. *Stroke, weakness, and seizure*
4. *Others.*

- CT scan results: The outcomes and findings from the brain CT scans were noted.
- Grade of requesting doctors: The professional rank or grade of the doctors who ordered the CT scans was documented (junior residents, senior residents, speciality doctors).
- Place of request: The location where the brain CT scan was requested was recorded, including the emergency department, in-patients wards, or outpatient departments.
- Demographic information: Patient data such as age and gender were collected to provide a demographic overview.

**Referral criteria:** The indications for brain CT referral were extracted from the United Kingdom and European Guidelines, which were followed by the National Institute of Health (NHS) in England, as shown in (Table-1) below.<sup>4</sup>

Table 1. The summary of brain CT referral guidelines

Category	Indications
<b>Head Trauma</b>	<p><b><i>CT scan of the brain within one hour in:</i></b></p> <ol style="list-style-type: none"> <li>1. Glasgow Coma Scale (GCS) &lt;13 when first assessed or GCS &lt;15 two hours after injury</li> <li>2. Suspected open or depressed skull fracture</li> <li>3. Signs of the base of skull fracture</li> <li>4. Post-traumatic seizure</li> <li>5. Focal neurological deficit</li> <li>6. &gt;1 episode of vomiting</li> </ol> <p>All patients with a coagulopathy or on oral anticoagulants should have a CT brain scan within eight hours of the injury, provided there are no other identified risk factors, as listed above.</p>
<b>Headache</b>	<ul style="list-style-type: none"> <li>- CT is indicated in acute headache with focal neurological signs, nausea, vomiting or GCS &lt;14 (e.g., acute subarachnoid haemorrhage).</li> <li>- Chronic headache: CT or MRI are not usually useful if there are no focal neurological signs but are more likely to detect an abnormality if there is: <ol style="list-style-type: none"> <li>1. Recent onset and a progressive worsening of symptoms and frequency or a change in their pattern.</li> <li>2. Association with the onset of epilepsy (especially focal epilepsy).</li> <li>3. Personality change.</li> <li>4. Associated dizziness, lack of coordination, tingling or numbness.</li> <li>5. History of recent head injury or falls (to exclude subdural haemorrhage).</li> <li>6. Features suggestive of raised intracranial pressure.</li> </ol> </li> </ul>
<b>Focal neurological deficit and Seizure</b>	<ul style="list-style-type: none"> <li>- Acute stroke:</li> </ul> <p><b><i>Immediate CT scan should be performed in the following:</i></b></p> <ol style="list-style-type: none"> <li>1. Those who might benefit from acute thrombolysis.</li> <li>2. Anyone with a bleeding tendency or on anticoagulants.</li> <li>3. Glasgow Coma Score (GCS) &lt;13.</li> <li>4. Progressive or changing symptoms.</li> <li>5. Severe headache.</li> <li>6. Any features suggestive of meningoencephalitis - e.g., papilledema, neck stiffness.</li> </ol> <p>Those who do not have any of the features above should have a scan within 24 hours.</p> <ul style="list-style-type: none"> <li>- Space occupying lesions: suspected tumour or mass - e.g., cerebral abscess.</li> <li>- New onset seizure with focal neurological deficit or status epilepticus.</li> </ul>
<b>Others</b>	<ol style="list-style-type: none"> <li>1. Suspected hydrocephalus or shunt revision</li> <li>2. CNS infections</li> <li>3. Evaluation of patients with psychiatric disorders and brain herniation</li> <li>4. Middle or inner ear symptoms, including vertigo.</li> </ol>

**Data Analysis:** The collected data were analysed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were employed to summarise the characteristics of the sample, including frequencies, percentages, and associations. A P-value below  $< 0.05$  is considered statistically significant.

**Ethical Considerations:** The study adhered to strict ethical guidelines, ensuring patient confidentiality and privacy. All data were anonymized and only used for research purposes.

## Results

The current survey involved 108 patients referrals. Their mean age was around 44 years, equally distributed by gender (50% for each gender) (Table-2).

**Table 2.** The demographic characteristics of the patients

Characteristics		Number
Age	Mean $\pm$ SD	44.88 $\pm$ 24.32
	Median	48.00
	Range	1 - 89
Gender	Male	54 (50%)
	Female	54 (50%)

Most of the referrals (75.9%) met the referral criteria that were organised by the unit, and about half of these referrals (46.3%) were due to neurology-related causes, including stroke and abnormal body movement. Moreover, the majority of these referrals (58.3%) were requested by senior resident doctors and mainly (72.2%) from the emergency department. Furthermore, the evaluation of the competency of the request form revealed that the majority of these requests (67.6%) were written in a proper way (Table-3).

**Table 3.** The description of the referrals

Characteristics		Frequency (%)
Meeting referral criteria	Yes	82 (75.9)
	No	26 (24.1)
Cause of referral	Head Trauma	26 (24.1)
	Headache	27 (25.0)
	Focal Neurological deficit / Seizure	50 (46.3)
	Others	5 (4.6)
Referring doctor	Junior resident doctor	18 (16.7)
	Senior resident doctor	63 (58.3)
	Specialty doctor / Consultant	26 (25.0)
Place of referral	Emergency department	78 (72.2)
	In-patient wards	12 (11.1)
	Out-patients clinic	18 (16.7)
Findings of brain CT	Negative	75 (69.4)
	Positive	33 (30.6)
Request form completion	Complete	73 (67.6)
	Incomplete	35 (32.4)

The current survey found that most of the doctors, regardless of their levels, met the referral criteria; however, the highest rate was among the junior doctors (88.9%), followed by specialists and senior resident doctors ( $P > 0.05$ ). Regarding the site of referral, again, most of the units adhered to the referral criteria, but the highest adherence rate was among those referrals from inpatient wards (91.7%), followed by emergency departments (76.9%). The outpatient department referral got the lowest level of adherence (61.1%) ( $P > 0.05$ ) (Tables 4,5).

**Table 4.** The association between meeting referral criteria and referring doctor

Criteria Vs. referring doctor	Referral criteria met	Referral criteria were not meet	P-Value
	No. (%)	No. (%)	
Junior resident doctor	16 (88.9)	2 (11.1)	0.334
Senior resident doctor	46 (73.0)	17 (27.0)	
Specialty doctor / Consultant	20 (74.1)	7 (25.9)	

**Table 5.** The association between meeting referral criteria and place of referral

Criteria Vs. referring place	Referral criteria met	Referral criteria were not meet	P-Value
	No. (%)	No. (%)	
Emergency department	60 (76.9)	18 (23.1)	0.152
In-patient wards	11 (91.7)	1 (8.3)	
Out-patients clinic	11 (61.1)	7 (38.9)	

The radiology request form's completion was also assessed in this survey. The results found that most of the doctors and most of the referring wards completed their request forms. However, the highest completion was in speciality and consultant doctors' groups (77.8%) ( $P > 0.05$ ) and from the in-patient ward (91.7%) ( $P > 0.05$ ) (Tables 6,7).

**Table 6.** The association between request form completion and referring doctor

Criteria Vs. referring doctor	Request form completed	Request form was not completed	P-Value
	No.(%)	No. (%)	
Junior resident doctor	13 (72.2)	5 (27.8)	0.320
Senior resident doctor	39 (61.9)	24 (38.1)	
Specialty doctor / Consultant	21 (77.8)	6 (22.2)	

**Table 7.** The association between request form completion and place of referral

Criteria Vs. referring place	Request form completed	Request form was not completed	P-Value
	No. (%)	No. (%)	
Emergency department	49 (62.8)	29 (37.2)	0.108
In-patient wards	11 (91.7)	1 (8.3)	
Out-patients clinic	13 (72.2)	5 (27.8)	

Finally, the causes of referral were assessed in this study, and their association with the brain CT results was also evaluated. The results found that most referrals resulted in negative brain CT scans. The results also showed that about half of positive brain CT results are due to neurological causes (46%), followed by head trauma referral (34.6%) ( $P < 0.05$ ) (Table-8).

**Table 8.** The association between the findings of brain CT and the cause of referral

Criteria Vs. referring doctor	Negative Brain CT	Positive Brain CT	P-Value
	No. (%)	No. (%)	
Head Trauma	17 (65.4)	9 (34.6)	0.001
Headache	26 (96.3)	1 (3.7)	
Focal Neurological deficit / Seizure	27 (54.0)	23 (46.0)	
Other causes	5 (100.0)	0 (0.00)	

## Discussion

This research was conducted to assess the utilisation of brain CT scans at Basrah Teaching Hospital, which serves as a board training centre for various medical and surgical specialities and is the sole medical neurology centre in Basrah City. This study provides valuable insights into the indications for brain CT scan use, highlighting the differences observed compared to previous research. Our study included a total of 108 patients who underwent brain CT scans. Among the patients included in our study, 72.2% of the brain CT scan requests originated from the emergency department, 16.7% were from the outpatient clinic, and the remaining 11.1% were from in-patient wards. These distribution patterns indicate that the majority of brain CT scan referrals were initiated in the emergency department, reflecting the acute and urgent nature of many cases that require immediate imaging evaluation. Our findings revealed that the primary indications for brain CT scan at Basrah Teaching Hospital were focal neurological deficits and seizures, accounting for 46.3% of referrals. Headache was also the second significant indication, representing 25% of referrals. Additionally, traumatic brain injury constituted 24% of referrals, with other causes accounting for 4.6%. These findings contrast with a study conducted by Ugwuanyi et al., which reported headache as the most common clinical indication for brain CT investigations in Hansa Clinic Enugu, Enugu State, Nigeria<sup>5</sup>, and contrast with a study of Taba Radiology Centre in Shiraz, Iran, that also shows headache as the primary indication in 60.8 per cent of requests<sup>6</sup>, as well as with Akhtaret Akhtar et al., who find headache the primary indication in 11.4 per cent of requests, which is lower than our findings.<sup>7</sup> The variation in indications between our study and previous research can be attributed to the unique position of Basrah Teaching Hospital as a training centre and the sole medical neurology centre in the city. These distinctive characteristics likely influence the referral patterns and clinical practices observed in our study. The findings of the survey demonstrate a noteworthy adherence rate of 75.9% to the brain CT referral

criteria among doctors. This indicates that a substantial proportion of healthcare providers are appropriately utilising brain CT scans in line with the established guidelines. The assessment of adherence was conducted by referencing the criteria outlined in Table 1. It is important to consider the potential factors that contribute to the observed high level of adherence among doctors. The results revealed a notable adherence rate of 88.9% among junior resident doctors, 74.1% among speciality/consultant doctors, and 73% among senior resident doctors. The high adherence rate among junior resident doctors may be attributed to their relatively recent training, during which they received comprehensive education on the importance of adhering to established guidelines. Additionally, the presence of experienced consultants and specialists may contribute to the adherence of more senior doctors, as their expertise and mentorship can reinforce the significance of following referral criteria. Additionally, the inpatient wards exhibited the highest adherence rate at 91.7%, indicating that doctors in this setting were more likely to follow the established guidelines when requesting brain CT scans. The emergency department had a slightly lower adherence rate of 76.9%; this may be explained by time constraints, and the need for quick decision-making in emergency departments may also influence doctors to request brain CT scans without strictly adhering to the referral criteria, while the outpatient clinic had the lowest adherence rate at 61.1%. The results of the CT scan revealed that 69% of the cases showed no abnormalities, while 30.6% yielded positive findings. This is similar to the result that was carried out by Ibrahim et al. to evaluate the use and possible misuse of the CT scan. Of 897 computerised tomographic (CT) scan examinations of the brain, over one-half were normal, and only 32.7% demonstrated a reportable abnormality.<sup>8</sup> This is also a similar result from Iran and Nigeria studies.<sup>5,6</sup> In the specific case of patients presenting with headaches, our study revealed that only 3.7% of the CT scans exhibited positive results, indicating a low likelihood of detecting abnormalities associated with this symptom. This finding aligns with a study conducted

by Akhtar et al.<sup>7</sup>, where among 73 patients with headaches, only 2.7% reported abnormal findings. These parallel results further support the notion that CT scans may have limited diagnostic utility in identifying underlying abnormalities in patients presenting with headaches. The rate of abnormalities detected in patients with focal neurological deficit/seizure in our study is 23% of the CT scans in patients with focal neurological deficit/seizure yielded abnormalities. While the negative result despite a clinical neurological deficit can be attributed to the fact that certain conditions, such as ischemic stroke, may present with subtle or negative findings in the early stages, making CT scans necessary to exclude haemorrhage as a potential cause, certain types of brain tumours may exhibit infiltration rather than a distinct mass lesion, and a negative scan will exclude a mass lesion but does not completely rule out an infiltrating tumour.<sup>9</sup> In our study, among the requests specifically related to head trauma, only 34.6% of the CT scans exhibited radiological findings, indicating the presence of trauma-related abnormalities. It is worth noting that different studies evaluating the use of brain CT scans in trauma classify injuries into severe, moderate, and mild categories. The severity of the injury is often associated with a higher likelihood of detecting positive abnormalities. For example, a study conducted by Mebrahtu-Ghebrehiwet et al. at Orotta Hospital in Asmara, Eritrea, aimed to evaluate the profile of CT scan findings in cases of severe head trauma. They reported that 54.5% of the CT scans showed positive findings, while 45.5% were normal.<sup>10</sup> On the other hand, CT scans often miss mild-to-moderate traumatic brain injuries, as highlighted by the research conducted by Haydel et al. In their study, only 5–10% of CT scans were abnormal in patients with documented mild traumatic brain injuries.<sup>6,11</sup> It is important to mention that our study did not classify the patients according to specific injury types; therefore, the findings lie within the range of the results from the aforementioned studies. Our study's observed rate of positive findings (34.6%) falls between the rates reported in the studies mentioned above, suggesting a

moderate level of abnormal CT scan results for head trauma cases. Finally, the completion rate of request forms for brain CT scans was found to be 67.6%, indicating that a significant portion of doctors completed the necessary forms. However, 32.4% of the request forms were not fully completed. When considering the degree of completion based on the type of doctor, it was observed that 77.8% of speciality doctors and consultants completed the request forms, followed by 72.2% of junior resident doctors and 61.9% of senior resident doctors. Furthermore, there was an association between the different referral places and the completion of request forms. Among the requests originating from the inpatient wards, the completion rate was the highest at 91.7%. For outpatient clinics, the completion rate was 72.2%, while the emergency department had the lowest completion rate at 61.9%. These findings suggest that there is room for improvement in ensuring the completion of request forms for brain CT scans. Efforts should be directed towards enhancing the understanding and awareness among doctors regarding the importance of completing these forms accurately and comprehensively. Additionally, targeted interventions and educational initiatives should be implemented to address the specific challenges observed in different referral settings, such as the emergency department, to promote higher completion rates and facilitate smoother communication between healthcare providers involved in the patient's care.

**Conclusion and recommendations**, the current study concludes that most of the doctors at Basrah Teaching Hospital met the international standards for brain CT referrals, and most of the referral wards followed these guidelines. We recommend increasing the level of awareness of these guidelines and probably establishing posters at different hospital wards that contain these guidelines to achieve a higher standard.

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**التزام الأطباء بمعايير الإحالة للتصوير المقطعي المحوسب للدماغ: مسح تقييم الخدمة من مستشفى البصرة التعليمي**

**المقدمة:** يتم استخدام التصوير المقطعي المحوسب بشكل متزايد في أقسام العيادات الخارجية والطوارئ نظرًا لقدرتها على تسهيل التشخيص السريع والتخطيط للعلاج. ومع ذلك، فإن الاستخدام غير المناسب للأشعة المقطعية، وخاصة التصوير المقطعي المحوسب للدماغ، يمكن أن يكون له عواقب سلبية.

**الأهداف:** تهدف هذه الدراسة إلى تقييم التزام أطباء مستشفى البصرة التعليمي بمعايير الإحالة الدولية للأشعة المقطعية للدماغ.

**منهجية البحث:** تم إجراء مراجعة بأثر رجعي للسجلات الطبية للتحقيق في استخدام التصوير المقطعي المحوسب للدماغ في أقسام الأشعة بمستشفى البصرة التعليمي لمدة شهرين وشمل ١٠٨ إحالة. تمت مراجعة السجلات الطبية بدقة لاستخراج المعلومات ذات الصلة المتعلقة بسبب الإحالة، ودرجة الطبيب المحيل، ومكان الإحالة، ونتائج التصوير المقطعي المحوسب للدماغ، وتقييم إكمال نموذج الطلب المرسل. تم الاعتماد على معايير الإحالة القياسية من إرشادات الإحالة بالأشعة المقطعية في المملكة المتحدة.

**النتائج:** استوفت معظم الإحالات (٧٥,٩٪) معايير الإحالة العالمية، واستوفى معظم الأطباء، بغض النظر عن مستوياتهم، معايير الإحالة؛ ومع ذلك، كان أعلى معدل بين الأطباء المقيمين الدورين (٨٨,٩٪)، يليهم الأخصائيون والأطباء المقيمين الأقدمين. علاوة على ذلك، التزمت معظم الوحدات بمعايير الإحالة، لكن أعلى معدل التزام كان من بين تلك الإحالات من ردهات المرضى الراقدين (٩١,٧٪). وعلاوة على ذلك، استوفى معظم الأطباء ومعظم الأقسام المحالة استمارات طلباتهم الشروط المطلوبة؛ ومع ذلك، كان أعلى إنجاز في مجموعات الأطباء المتخصصين والاستشاريين (٧٧,٨٪). أظهرت النتائج أيضًا أن حوالي نصف نتائج التصوير المقطعي المحوسب الإيجابي للدماغ ترجع إلى أسباب عصبية (٤٦٪)، تليها إحالة صدمة الرأس (34.6%).

**الاستنتاجات:** استوفى غالبية الأطباء في مستشفى البصرة التعليمي المعايير الدولية لإحالات التصوير المقطعي المحوسب للدماغ، واتبعت معظم الأقسام الإحالة هذه الإرشادات.

**الكلمات المفتاحية:** التصوير المقطعي المحوسب للدماغ، إصابات الدماغ، الصداع، السكتة الدماغية، طب الأعصاب، الأشعة.