



## Assessment of Unjustified Brain Ct Requests in The Emergency Room of The Public Health Care System in Palestine Case Study: Hebron Governmental Hospital

Khaled Sabarna<sup>✉\*1</sup>, Mysara Rumman<sup>ORCID✉\*\*1</sup>, Aroub Salah Aldin<sup>1</sup> Suhaib Tamim<sup>1</sup> Batoul Alayan<sup>1</sup>  
<sup>1</sup> Department of Medical Imaging, Faculty of Allied Medical Sciences, Palestine Ahliya University (Palestine).

\* ✉ [k.sabarna@paluniv.edu.ps](mailto:k.sabarna@paluniv.edu.ps)

\*\* ✉ [Mysara@paluniv.edu.ps](mailto:Mysara@paluniv.edu.ps)

Received:20/02/2023

Accepted:24/03/2023

Published: 01/04/2023

### Abstract:

Computed tomography (CT), which gives doctors a precise cross-sectional image that clearly shows the features of the organs, is one of the most crucial pieces of medical imaging equipment. In contrast to other equipment, the CT scan may expose the patient to a very high dose of radiation. As a result of the hazards associated with imaging patients, the use of CT images must be restricted, especially when imaging the head. The aim of the study is to the evaluation of the percentage of unjustified brain CT requests at the emergency rooms of the governmental health sector in Palestine. The 1957-built Hebron Governmental Hospital (HGH) was chosen as a research study case with a clinical capacity of 237 beds and 596 staff members; it is one of the key Palestinian government hospitals currently operating in the Hebron Governorate of the West Bank-Palestine. Samples were taken from the hospital's emergency room between the first of the year and the end of the year in 2021. 6152 or so brain CT images were gathered. Following that, 500 instances were picked for the investigation. Radiologists were asked to assess 100 of these 500 cases to determine whether the patient needed a scan or not. According to the study, 78% of brain tomography images were for unjustifiable reasons. Additionally, it was revealed by the study's results that unnecessary head CT scans were more common than those from retrospective investigations. In particular, non-specialized doctors who request cross-sectional brain imaging for no apparent reason are to blame for this because of their lack of knowledge.

**Keywords:** Brain CT; Unjustified examinations; Computed tomography; Cross-sectional brain imaging; Ionizing radiation; Emergency rooms; and Standardized guidelines.

**Abbreviations:** CT: Computed Tomography; CEC: Clinical Excellence Commission; DRLs: Diagnostic reference levels; HGH: Hebron Governmental Hospital; ER: emergency Room.

## تقييم الطلبات غير المُبررة لتصوير الدماغ بالأشعة المقطعية لمرضى غرفة الطوارئ البالغين في مستشفى الخليل الحكومي

خالد صبارنة<sup>1\*</sup>، ميسرة رمان<sup>1\*\*</sup>، عربوب صلاح الدين<sup>1</sup>، صهيب تميم<sup>1</sup>، بتول عليان<sup>1</sup>  
<sup>1</sup> قسم التصوير الطبي، كلية العلوم الطبية المساندة، جامعة فلسطين الأهلية (فلسطين).

\*✉ [k.sabarna@paluniv.edu.ps](mailto:k.sabarna@paluniv.edu.ps)

\*\*✉ [Mysara@paluniv.edu.ps](mailto:Mysara@paluniv.edu.ps)

تاريخ النشر: 01/04/2023

تاريخ القبول: 24/03/2023

تاريخ الاستلام: 20/02/2023

### ملخص:

يُعد التصوير المقطعي (CT)، الذي يمنح الأطباء صورة مقطعية دقيقة تُظهر بوضوح ميزات الأعضاء، التي تُعد أحد أهم معدات التصوير الطبي على عكس المعدات الأخرى، التي قد تُعرض المريض لجرعة عالية جدًا من الإشعاع؛ ونتيجة للمخاطر المصاحبة لمرضى التصوير، يتطلب تقييد استخدام الصور المقطعية، خاصة عند تصوير الرأس، وعليه تهدف الدراسة إلى تقييم النسبة المئوية لطلبات التصوير المقطعي المحوسب الدماغية غير المُبررة في غرف الطوارئ في القطاع الصحي الحكومي في فلسطين، وتم اختيار مستشفى الخليل الحكومي (HGH) الذي تم بناؤه عام 1957م كحالة دراسة بحثية بسعة إكلينيكية تبلغ (237) سريرًا و(596) موظفًا، وهو أحد المستشفيات الحكومية الفلسطينية الرئيسية العاملة حاليًا في محافظة الخليل بالضفة الغربية-فلسطين، وتم أخذ العينات من غرفة الطوارئ بالمستشفى بين الأول من العام 2021 ونهايته، وتم جمع (6152) أو نحو ذلك من صور التصوير المقطعي المحوسب للدماغ، وبعد ذلك، تم اختيار (500) حالة للتحقيق، إذ طُلب من أطباء الأشعة تقييم (100) حالة من بين (500) حالة لتحديد ما إذا كان المريض بحاجة إلى فحص أم لا، ووفقًا للدراسة، فإن (78%) من صور التصوير المقطعي للدماغ كانت لأسباب غير مُبررة، بالإضافة إلى ذلك، كشفت نتائج الدراسة أن عمليات التصوير المقطعي المحوسب للرأس غير الضرورية كانت أكثر شيوعًا من تلك المُبررة والناجمة عن التحقيقات بأثر رجعي، وعلى وجه الخصوص، يقع اللوم على الأطباء غير المتخصصين الذين يطلبون التصوير المقطعي للدماغ دون سبب واضح بسبب افتقارهم إلى المعرفة الطبية ومضاعفات الحالات الواردة إلى غرف الطوارئ لنظام الرعاية الصحية العامة في فلسطين.

**الكلمات المفتاحية:** التصوير المقطعي للدماغ، الفحوصات غير المُبررة، التصوير المقطعي، التصوير المقطعي

للدماغ، الإشعاع المؤين، غرف الطوارئ، المبادئ التوجيهية الموحدة.

## 1. Introduction

A computed tomography scan is a medical imaging procedure used in radiology (X-ray) to generate in-depth internal images of the body non-invasively for diagnostic reasons. It was formerly known as axial computed tomography. Radiologists and other medical professionals can recognize inside structures and assess their shape, size, and density thanks to CT imaging. This thorough information can be utilized to identify whether a medical issue is present, pinpoint the degree and precise location of the issue, and provide other significant details that can assist the doctor in selecting the most appropriate course of action. Patients in an emergency room can be swiftly scanned so that medical professionals can evaluate their status. It can be required to perform emergency surgery to halt internal bleeding. Surgery can be performed precisely thanks to CT imaging. Surgery's chances of being successful are seriously hampered without this knowledge.

Benefits of CT include better cancer detection and treatment, imaging a small area of the body or the complete body at the same examination, minimizing the need for exploratory surgeries, and more effective medical management by deciding when surgeries are necessary (radiologyinfo.org, 2022). For a variety of conditions, including identifying tumors, blood clots, excess fluid, and infections, doctors may order CT scans. These conditions include complex bone fractures, malignancies, and other joint and bone issues. Ionizing radiation is produced by the X-rays used in CT scans. According to research, this type of radiation may harm your DNA and cause cancer. As a result of a CT scan, you have a one in 2,000 chance of acquiring cancer, therefore your risk grows with each additional scan (WebMD, 2017). A brain CT scan is a non-invasive diagnostic imaging procedure that creates horizontal or axial images (commonly referred to as slices) of the brain using precise X-ray measurements. Compared to conventional head X-rays, brain CT scans can offer more precise details about the brain's tissue and structures, revealing more information about any injuries or disorders to the brain (Johns Hopkins Medicine, n.d).

Sepsis is a life-threatening condition that can occur when the body fights an infection while they are in the ED's waiting room. Clinicians are trained to identify sepsis, but it can be difficult because sepsis can be masked behind minor visible symptoms.

### 1.1 Problem Statement

Ionizing radiation exposure has been shown to have risks for both patients and medical professionals. Radiation use in medicine should therefore be justified. Unnecessary tests expose patients to radiation without a need, which raises their chance of developing cancer or genetic problems. Although a CT scanner is an important imaging technique, particularly for critically ill patients, the radiation dosage for patients is also relatively significant when compared to traditional radiography. Therefore, greater limits should be put in place to cut down on unneeded inspection and thus, unnecessary radiation. Typically, doctors who should be knowledgeable about radiation's hazardous effects write CT requests. However, numerous studies have revealed that general practitioners (GPs) frequently order unnecessary tests because they are unaware of the dangers of radiation. Therefore, it is necessary to constantly undertake continuing education programs to boost knowledge and awareness to reduce the number of unnecessary examinations and thereby improve the quality.

### 1.2 Justification

The use of this modality must be supervised to allow only the justifiable requests because CT scanners expose patients to significantly more radiation, increasing the risks of health damage. This study aims to assess unjustifiable requests and identify the factors that contribute to an increase in these requests.

### **1.3 Purpose/ Objective of Study**

As a research case for the Palestinian public health sector, this study attempts to quantify the percentage of unapproved brain CT requests at the emergency room of the Hebron Governmental Hospital.

### **1.4 Research Questions**

- What percentage of brain CT scans are unwarranted is the study's key inquiry?
- What is the rationale for the doctor's request for a brain CT?
- What is the most requested tomography of the brain by the doctor?
- What percentage of CT brain images include a medical report?
- When were the CT scans of the head most frequently requested and why?

## **2. Literature Reviews**

A study about the reasons for cerebral CT scans in patients with minimal trauma was done by Zahabi et al. (2020). They examined 550 people who had minor brain injuries. Age, sex, trauma type, trauma severity, CT scan-associated symptoms based on NEXUS II, CCHR, and NOC criteria, and underlying disorders were among the characteristics included in the questionnaire used to gather data. They discovered that patients were 62 % male and had an average age of 32.5 years. The hospital receives self-referrals from 67% of patients. Car accidents falling from great heights, and war were the main causes of trauma in 29 %, 19 %, and 16.5 % of patients, respectively. 30.5 % of patients had scalp lesions, 4.9 % had hematomas, 4.9 % experienced dizziness, 8.9 % had a history of comorbidities, 5.8 % had an episode of vomiting less than twice, 1.1 % had an episode of vomiting twice or more, 5.8 % had a headache that scored a 7 or higher, 23.1 % had a headache that scored a 7 or higher, 0.2% had raccoon eyes, and 0.2 % had nose bleeding. In 0.2% of patients, the CT examination results were abnormal. They concluded that most patients who suffered minor head trauma had normal brain CT scans and could be discharged without the requirement for neurosurgery counseling. Therefore, it would be necessary to lessen the frequency of brain CT scans performed on patients who had just minor head injuries.

Saleim (2019) conducted a study in (Apr-Jun2019) on the percentage of justifiable and unnecessary CT scans carried out on young persons under the age of 35 by the NICE criteria. Two reviewers retrospectively applied the NICE recommendations to all computed tomography brain scans conducted on young individuals 35 years of age during the period to determine the percentage of justified and unjustified head CT scans. According to the NICE standards, they discovered that 183 (64 %) of the 287 head CT scans were justified and 104 (36 %) were not. They concluded that there were more unjustified scans from the emergency department than from the non-emergency department. This variation (chi-square statistic = 7.959; p=0.005) was important.

In August 2017, Beram et al. (2017) conducted a study on the rational use of brain CT scans at Al-Shifa Hospital in the Gaza Strip: a review of medical data. In the Gaza Strip, an area that is still under Israeli occupation, CT scan usage has significantly increased. Although this method has boosted diagnostic accuracy, it has also exposed more patients to radiation and driven up prices. They sought to determine if patients at Al-Shifa Hospital in the Gaza Strip needed neurological CT scans to reduce radiation exposure for patients and the budgetary burden of CT scans on the Palestinian Ministry of Health, (2018). They discovered that 4132 CT scans were done during the study period, of which 1578 (38%) were brain CT scans. We found and examined 1129 scan requests (72%): 616 (55%) of them were urgent, 420 (37%) of them involved kids under the age of 20, and 642 (57%) involved male patients. Referring doctors neglected to mention whether the patient had previously

been evaluated in 1023 (91%) requests. The medical history was given for 501 (44%) of the scans, no clinical assessment was given for 348 (31%) of the CT scans, and no provisional diagnosis was given for 536 (47%) of the scan requests. 660 brain CT scans, or 58 %, showed no abnormalities (260 [42 %] of urgent examinations and 400 [78 %] of elective examinations, 356 [56 %] of male examinations, and 304 [62 %] of female examinations). The difference in results between male and female examinations ( $\chi^2=152$  and  $p=0.10$ ) and the differences between urgent and elective examinations was significant ( $\chi^2=9706$  and  $p=0.0001$ ). They conclude that doctors commonly request a brain CT scan without noting the patients' prior tests, clinical examinations, or medical histories. In Gaza's public hospitals, more than 58 % of brain CT scans come back normal. Since the Palestinian Ministry of Health has limited resources, requests for CTs from patients ought to be adequately supported.

A study conducted by Shobeirian et al. (2021) about the Overuse of brain CT scans to assess mild traumatic brain injuries in adults. Brain CT scans were performed in our Emergency Department (ED) for the evaluation of mild head trauma not indicated by four standardized guidelines analysis contributing factors. This was a descriptive prospective study. We included randomly selected adult patients under 75 years of age with minor head trauma evaluated by a brain CT scan. They checked off items on a checklist for each patient, including demographic information, the mechanism of the trauma, the doctor who made the request, and whether the patient complied with the requirements of the brain CT guidelines. Brain CT scans conducted on patients without meeting any of the established criteria were deemed to be overusing the technology. 170 people were assessed in the study. The average age of the patients was 38.38 and 19.73. The most typical trauma mechanism was falling (37.6 %). 15.3 % of brain CT scans were used excessively overall. Younger patients underwent the majority of the overused scans, and overuse was inversely connected with patient age. Based on the mechanism of the trauma and the doctor's specialty, there was no discernible difference.

Al-Tell A. (2019) conducted a study in December 2019 on the reason for urgently required Brain CT Scan treatments. Researchers took into account two facets of the problem. At Al-Makkased Hospital, a sizable hospital in Palestine, they first looked into the records of the urgent CT scan requests for a sample of 339 patients. Second, a survey was conducted to gauge the level of knowledge about radiation dangers among a sample of 42 referral doctors from the same hospital. They discovered that of the 339 urgent requests for brain CT scans, 69.6% were justifiable and 30.4 percent were not. Statistically, these findings indicate that at least 25% of the CT requests at this facility are not warranted, with a p-value of 0.011. They concluded that the hospital needs to decrease the number of brain CT examinations and that their justification needs to be improved. They found that 42% of respondents knew the effective dose of a brain CT scan, 24% knew the radiation risks, and 14% knew about radiation protection.

Zarb and Xerxen (2009) conducted a study in 2009 about the justification of CT brain scans in accidents and emergencies. This study examines referrals for CT brain scans at a nearby general hospital's Accident & Emergency unit. The major goal of this study was to ascertain if the requests for CT brain scans were legitimate in light of the stated referral standards. The findings demonstrated that the majority of CT brain scans that are classified as Accident and Emergency were acceptable by European standards. Cases were selected as unjustified mostly due to imprecise and insufficient clinical indications recorded by the referring physician. The referral clinician may be more selective when sending patients for a CT scan examination if the referral criteria outlined in "Radiation Protection 118" had to be adhered to. People may become more knowledgeable about when a CT is required or not as a result of increased public awareness and education on the matter. As a result, the

public will receive a lower dose, the CT waiting list will be shorter, and the stress levels of the staff members that make up the CT team will also naturally decline. The European Union produced "Radiation Protection 118" which contains the referral recommendations that were adopted for this investigation. These referral guidelines are made primarily to help referral doctors send patients for CT scans in a more selected manner. As a result, there might be fewer unnecessary CT scans, which would help cut down on the number of radiation people inadvertently receive. For ethical reasons, the identities of the radiologists and patients were not disclosed. Methodology: This study used quantitative analysis to gather the clinical indications listed on the referral forms of a few randomly chosen individuals. Later, the participating radiologists looked at these. This was provided in the form of a checklist to determine whether each specific instance met the "Radiation 118" referral requirements and was therefore warranted or not. The clinical indications were then divided into categories and assessed as a whole.

A study by Al-Nsoor and Mhearat (2010) was conducted in Amman, Jordan. Concerning brain computed tomography in syncope sufferers. 292 individuals having a history of brief loss of consciousness visited the emergency room at the King Hussein Medical Center in Amman, Jordan, between March 2006 and April 2008. All patients under investigation underwent a neurologist's examination, and brain scans were taken. According to the neurological examination results and the brain scan results, the patients were divided into 4 groups. 38 (13% of the 292) patients were excluded out of the total of 254 (86.1%) patients who underwent brain scans. The first group contained 203 individuals (79.9%), all of whom had normal neurological examination and brain scan results. The second group consisted of 10 [3.9 %] patients, all of whom had abnormal neurological examination results and abnormal brain CT scan findings connected to their syncope. Their syncopal episode and aberrant brain CT findings are responsible for the abnormal neurological findings. Depending on the results of their brain CT scan and their neurological assessment upon presentation, they were divided into 3 groups. The third group consisted of 39[15.3%] individuals with abnormal brain scan results that were unrelated to their syncope and either normal or abnormal neurological examination results that were unrelated to and could not be linked to the abnormal head CT findings and their syncopal episode. In the final group, two individuals (0.7%) had abnormal scan results but normal neurological examination results. The conclusion is that, unless there is a sign in the history or physical examination, using a brain scan as a regular diagnostic tool in patients with syncope is not justified.

A study carried out by Moradi et al. (2021) in Zanjan, Iran's Mousavi Hospital. To calculate the risk of radiation-induced brain cancer, this study sought to assess the frequency of requested brain CT scans in trauma patients. Methods and Materials: The study sample consisted of traumatic patients who had undergone a head CT scan within the two months from August 23 to October 22, 2018. Two radiologists reviewed every one of the patients individually to evaluate the rate of normal and abnormal cases. Dose length product (DLP) in milli grays was utilized to calculate the effective dose in millisieverts, resulting in assessing the risk of radiation-induced brain cancer using ICRP 103. Between 523 valid scans, 460 patients (88%) received normal reviews while only 47 patients (9%) had findings related to their current trauma. Subperiosteal hematoma was the most common pathology in abnormal subjects (4.8 %). The average effective dose was 1.05 0.36 mSv. According to calculations, there are 0.037 and 0.030 new cancer cases per 10,000 males and females, respectively, at risk of developing radiation-induced brain cancer. The final results showed that many patients having a CT scan are in good health. The excessive exposure brought on by this careless use of CT scans could significantly increase the incidence of cancer. Given that cancer is the third leading

cause of death in Iran, it is more important than ever to avoid using unnecessary CT scans and to minimize radiation exposure for all patients to an absolute minimum (ALARA).

From June to December 31, 2018, a study was conducted Mansoor et al. (2018) regarding the Evaluation of the Brain Plain on Computed Tomography in Headache Patients. Patients with a history of cranial surgery, head trauma, or malignant tumors were not included. Results from a CT scan of the brain were examined, and they were categorized into two groups: (I) no intracranial abnormalities and (II) with considerable intracranial abnormality. The study included a total of 34 girls and 26 males, ranging in age from 8 to 60 years, with a mean age of 31.35 and 11.30 years. 88.3 % of CT results revealed negative instances, whereas 11.7 % revealed positive cases. Patients with severe brain disease were less common than expected when referrals and the majority of patients for CT scans of the brain were kept simple with simply a history of headaches. Brain Low importance exists for CT Plain in patients with headaches and no other clinical symptoms. For referral and imaging selection, radiologists and physicians must collaborate. It is necessary to hold several workshops about the right selection and referral of neurological imaging in various levels and departments.

Computed tomography (CT) is linked to a risk of developing cancer, according to a study by Tan et al. (2021) published on September 22, 2021. Different centers employ different methods to lower radiation dosage. They assessed the proportion of brain CT examinations conducted within the reference range the International Commission on Radiological Protection advised by comparing radiation exposures in pediatric and general emergency departments (EDs) (ICRP). In a healthcare network with three general hospitals EDs and one pediatric ED, a retrospective review was done. Children under the age of 16 who had CT brain scans performed between January 1, 2015, and December 31, 2018, were included. We gathered data on the patient's demographics, diagnosis, volume-averaged CT dose index, and dose length product (DLP). Using conversion factors, known as k-coefficients, which were obtained using a 16 cm brain CT dose phantom, the effective dose was then determined from DLP. They discovered that 379 (79.1 percent) of the 479 brain CT tests that were performed were done at the pediatric ED. The top three ED diagnoses were disturbed mental status (44, 9.2 percent), head injury (147, 30.7 %), and seizure (149, 31.1 %). The median effective dose estimates were higher overall than pediatric EDs, especially for those older than 3 to 6 years old (1.57 mSv (IQR 1.42-1.79) versus 1.93 mSv (IQR 1.51-2.28),  $p = 0.047$ , and older than 6 to 10 years (1.43 mSv (IQR 1.27-1.67) versus 1.94 mSv (IQR 1.61-2.59),  $p = 0.002$ , and older than 10 years. In all, 233 research (48.6%) and 13 studies (2.7%) were within the reference levels suggested by ICRP 60 and 103, respectively. They draw the following conclusions: Less than half of the tests were conducted within the reference values advised by the ICRP, and radiation doses for brain CT examinations were much greater at general E.Ds. Radiation dangers in the juvenile population can be decreased with the adoption of diagnostic reference levels (DRLs) as a standard and clinical reason for undertaking CT examinations.

Ugwuanyi et al. (2020) conducted a study 2020 on August 1 on the diagnosis process for patients presenting with head trauma, stroke, brain tumors, and epilepsy, computed tomography (CT) is a vital imaging tool. To prevent patients from being exposed to radiation needlessly, the goal of this study was to describe the most common intracranial diseases that CT scans in our environment revealed. They discovered that the study comprised the radiological data from 300 individuals' brain CT scans. The majority of the patients were between the ages of 31 and 40, with a mean age of 41.25 16.5 years (30.67 %). Out of 300 instances, 117 (39 %) had normal findings, while 1 had intracranial physiological calcification (0.33 %). The most frequent clinical sign, which accounts for 53 (17.67%) of cases, is headache, while unstable gait, accounts for 3 (1 %). According to the Chi-square test (X<sup>2</sup>

= 285.60,  $p = 0.002$ ), there was a statistically significant correlation between the results of the brain CT and the clinical justifications for the studies. conclude the study showed that more males than females undergo brain CT scans with headache being the most common presenting complaint. The majority of findings of the brain CT scans in this study are normal despite, myriads of complaints nieces conclude the study revealed that headache is the most frequent presenting symptom for brain CT scans, with more men than women undergoing the procedure. Despite a wide range of complaints requiring investigations, the majority of the brain CT scan results in this study are normal. The study also found a strong correlation between CT findings and clinical indicators. The study also revealed a significant association between clinical indications and CT findings.

### **3. Methodology of Research**

Computed tomography (CT) of the brain is perhaps one of the greatest ways to diagnose brain illnesses for patients, but it is also one of the most frequently requested procedures by physicians. In this part, we will discuss whether or not doctors are justified in ordering a CT of the brain. We'll review cases from the Hebron Governmental Hospital as part of our study.

#### **3.1 Study Design**

An observational, retrospective, cross-sectional strategy was used to assess the need for a brain CT. The researcher simultaneously assesses the participants' exposures and outcomes in a cross-sectional study.

#### **3.2 Research Settings**

One of the main Palestinian government hospitals operating in the Hebron Governorate of the West Bank is known as "Hebron Governmental Hospital." It was constructed in 1957. It has a clinical capacity of 237 beds and a staff of 596 people, including medical professionals like doctors, nurses, pharmacists, physiotherapists, and radiologists (Ministry of Health, 2018).

#### **3.3 Population and Sampling**

The radiology department at Hebron Government Hospital used hospital systems to gather the samples. The emergency department's samples were deliberately chosen for the brain CT scan, yielding 10239 CT images, of which 6152 were brain CT images. Following a survey of 6,000 cases, 500 cases were chosen to be examined to determine the factors and justifications that led the doctors to recommend imaging. From the 500 cases, 100 were then chosen to be presented to the radiologists to determine whether the patient required scanning.

##### **3.3.1 Inclusion Criteria**

Patients from Hebron Governmental Hospital's emergency room who are older than 18 are present.

##### **3.3.2 Exclusion Criteria**

All divisions aside from the emergency room and patients younger than 18 years old.

#### **3.4 Data Collection and Sample Size**

PACS of Hebron Government's and Avicenna HIS's radiology departments. The samples were taken from Hebron Governmental Hospital between January 1 and December 31, 2021. We concentrated on the Hospital Information System (AVISINNA), which turned up 10239 CT pictures, 6152 of which came from the emergency room. Following a survey of 6,000 cases, 500 cases were chosen to be examined to determine the factors and justifications that led the doctors to recommend imaging. From the 500 cases, 100 were then chosen to be presented to the radiologists to determine whether the patient required scanning.



### 3.5 Criteria of Study

The brain should be included from the base of the skull to the vertex of the skull in the anatomy demonstration. For patient positioning, the patient should be placed head first into the gantry with their head in the head-holder. The external auditory meatus (EAM) should be in the middle of the gantry when you center the table height.

Scout: AP And Lateral FROM C2 To Vertex.

Scan Extent C2 To Vertex.

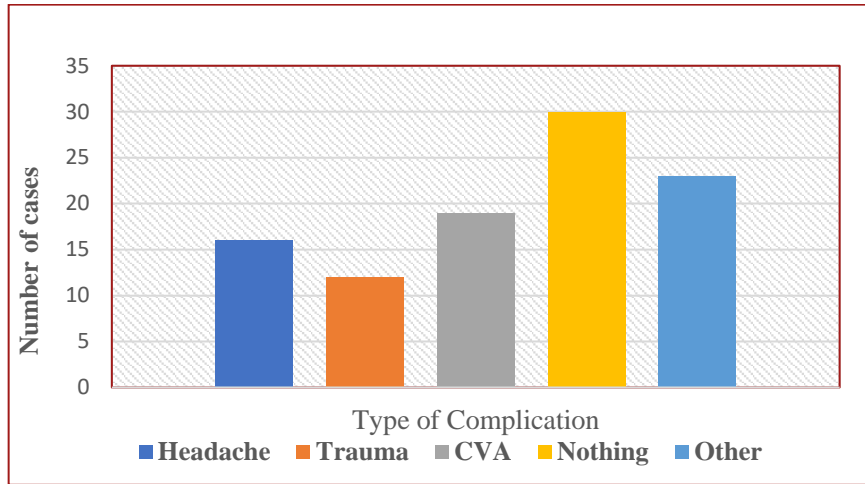
Scan Direction Caudocranial.

## 4. Results

Table 1 displays the documented outcomes for the 100 cases that were chosen. Thirty patients (30%) were not previously justified by doctors, twelve (12%) patients had trauma as the underlying reason, nine (9%) individuals had R/OCVA, and 23 patients (23%) were shown to have additional causes. It was found that whereas 82 causes (or 82%) were requested by a general practitioner, just 18 cases (or 18%) were requested by specialists (not a specialist). Also discovered was the radiologist's failure to report all head CT scans. The remaining 12 cases (12%) were finished during the night shift after 22 cases (22%) were scanned during the morning shift, 66 cases (66%) during the evening shift, and 22 cases (22%) during the night shift. Additionally, 78 out of 100 instances utilized unjustified photos, with the final 22 scans being done for justified images. The values were visually depicted in Figures 1 through Figure 4.

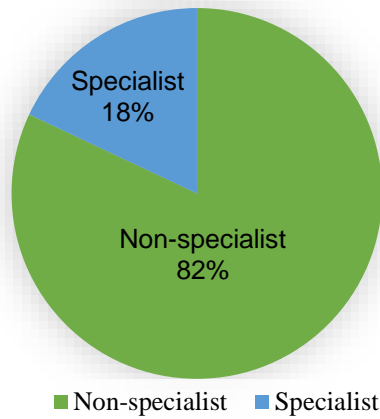
**Table 1:** Results of the last 100 instances were recorded. Based on four separate categories of complications, the physician who requested the image, the time (shift) at which the scan was requested, the total number of justified and non-justified images, the number of cases, and their corresponding percentages are displayed.

		# of Cases	%
Complication	Headache	16	16%
	Trauma	12	12%
	CVA	19	19%
	Nothing	30	30%
	Other	23	23%
	Total	100	100%
Physician	Non-Specialist	82	82%
	Specialist	18	18%
	Total	100	100%
Shift	Morning	22	22%
	Evening	66	66%
	Night	12	12%
	Total	100	100%
Justification	Unjustified	78	78%
	Justified	22	22%
	Total	100	100%

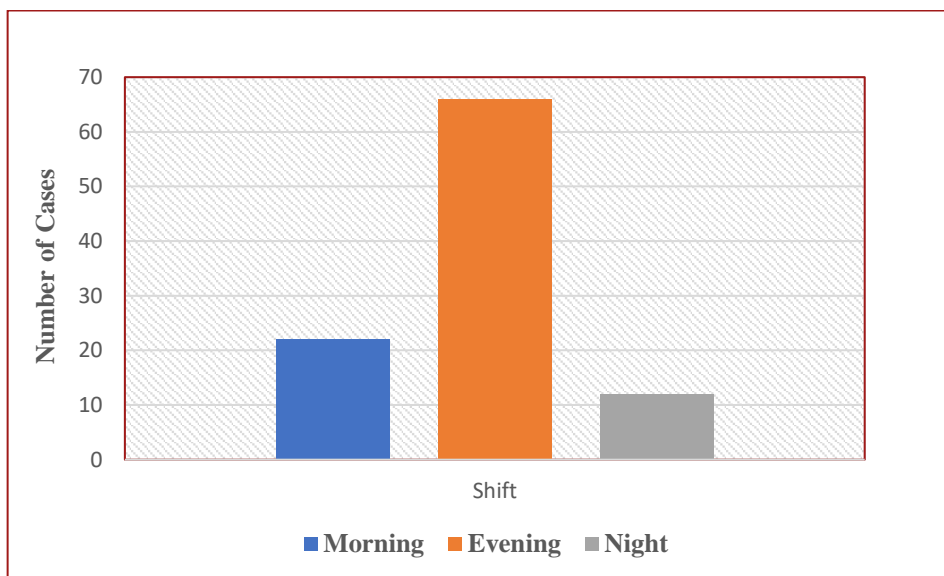


**Fig. 1:** Based on the five types of complications—headache, trauma, CVA, nothing, and others—there were a certain number of instances that received a brain CT scan.

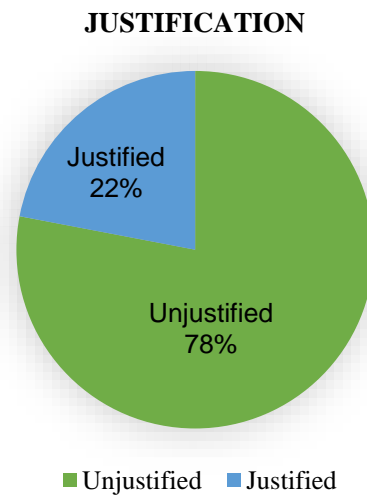
**PHYSICIAN**



**Fig. 2:** According to the doctor (non-specialist or specialist) who made the request, the number of cases that underwent brain CT scans



**Fig. 3:** According to the shift during which the scans were requested, the number of instances that had brain CT scans.



**Fig. 4:** The number of situations where a brain CT scan was performed for valid or invalid grounds.

## 5. Discussion

Make sure to thoroughly assess the patient before asking for a brain CT scan. Can the patient's illness be diagnosed without having a CT scan to reduce radiation exposure?

A comparison of our research's findings with those of earlier studies and research reveals that a study was carried out by Beram et al. (2017) between June and December, with the search results showing that 88.3 percent of cases were found to be negative and 11.7 percent to be positive. The findings of Moradi et al. (2021) at the Mousavi Hospital in Zanjan City-Iran showed that a significant portion of individuals receiving a CT scan is actually in good condition. The careless use of CT scans combined with excessive radiation exposure may cause a sharp rise in cancer rates.

According to the findings of our study, there are some situations in which a CT scan is not required by a doctor. For instance, not everyone who experiences headaches requires a CT scan, and the majority of the images that doctors were asked to provide were unaccompanied by notes, making them unnecessary and unjustified. It was also observed that the majority of the images required a non-specialist doctor to obtain a CT scan, which increased the number of unnecessary CT scans. Due to the high number of internship students and training students, it was also observed that requests for head CT scans increased significantly in the evening hours between 3 pm and 11 pm. These requests are made without consulting a specialist doctor, and when the cases used in the study were presented to the radiologist, the percentage of unjustified brain CT images was 78 percent. Initial management of adult closed head injury was one of the most crucial factors that this research relied on to determine whether the request for a brain scan is justified or not (NSW Health algorithm). And based on the findings, we can also infer that the rise in head CT scan requests is due to a failure to consider the first therapy of head injury precisely before requesting imaging.

## 6. Conclusion

The purpose of the study was to gauge how informed clinicians are when they seek a brain CT. Knowing why the image is needed and whether the requester is a specialist or general practitioner were key components of the review process. The radiologist then assessed the image to determine its need. The study's findings indicated that 78 percent of cases had inappropriate images. Additionally, it was discovered that most of the shots were requested by general physicians who are not specialists (82 percent). In light of the data, gathered and the results, authors can further conclude that the rise in head CT scan requests is due to a failure to thoroughly research the primary care of head injuries before making an imaging request.

## 7. Recommendations

- The study's goal was to determine how knowledgeable clinicians are about brain CTs.
- Key elements of the screening process included determining why the image was required and if the requester was a specialist or general practitioner. The radiologist next evaluated the image to decide whether it was necessary.
- According to the study's findings, improper photos were present in 78 percent of the cases. Additionally, it was found that general practitioners (82 percent) who are not specialists requested the majority of the shots).

## References

- Al-Nsoor, N. M., & Mhearat, A. S. (2010). Brain computed tomography in patients with syncope. *Neurosciences Journal*, 15(2), 105-109.
- Al-Tell, A. (2019). Justification of Urgent Brain CT Examinations at Medium Size Hospital, Jerusalem. *Atlas Journal of Biology*, 655–660.
- Beram, A., Alagha, S., & Abu-Safieh, Y. (2017). Rational use of brain CT scans at Al-Shifa Hospital in Gaza Strip: an analysis of hospital records. *The Lancet*, 390, S20.
- WebMD (2017, February 2). *What Is a CT Scan?*. <https://www.webmd.com/cancer/what-is-a-ct-scan>
- Mansoor, M., Gul, P., & Mahmood, S. (2018). Assessment of the effectiveness of computed tomography brain plain in headache patients. *Pakistan Journal of Medical and Health Sciences*, 12(2), 576–578.
- Ministry of Health. (2018). *Health Annual Report Palestine 2017*. Palestine, Ministry of Health.
- Moradi, H., Chehre, H., Ghaderi, B., Saghatchi, F., Najafi, M., Karami, P., & Rezaeejam, H. (2021). Evaluating the Necessity and Radiation Risk of Brain CT Scans Requested by the Trauma Emergency Department. *Journal of Biomedical Physics and Engineering*. December 2020.
- Radiologyinfo.org. (2022). What are the benefits of CT scans? In *What Are the Benefits of Ct* [https://www.radiologyinfo.org/en/info/safety-hiw\\_04](https://www.radiologyinfo.org/en/info/safety-hiw_04)
- Saleim, A. (2019). Head CT scans for Young Patients and Compliance with NICE Guidelines: A Retrospective Audit Ali Riyad Salem. *Indian Journal of Forensic Medicine & Toxicology*, 13, 297.
- Shobeirian, F., Ghomi, Z., Soleimani, R., Mirshahi, R., & Sanei Taheri, M. (2021). Overuse of brain CT scan for evaluating mild head trauma in adults. *Emergency Radiology*, 28, 251-257.
- Tan, X. M., Shah, M. T. B. M., Chong, S.-L., Ong, Y.-K. G., Ang, P. H., Zakaria, N. D. B., Lee, K. P., & Pek, J. H. (2021). Differences in radiation dose for computed tomography of the brain among pediatric patients at the emergency departments: an observational study. *BMC Emergency Medicine*, 21(1), 106.
- Johns Hopkins Medicine. (n.d.). What is a CT scan?. <https://www.hopkinsmedicine.org>

- Ugwuanyi, D. C., Sibeudu, T. F., Irole, C. P., Ogolodom, M. P., Nwagbara, C. T., Ibekwe, A. M., & Mbaba, A. N. (2020). Evaluation of common findings in brain computerized tomography (CT) scan: A single center study. *AIMS neuroscience*, 7(3), 311.
- Zahabi, S. S., Rafiei, H., Torabi, F., Salehi, A., & Rezaei, B. (2020). Evaluation of causes of brain CT scan in patients with minor trauma. *International Journal of Surgery Open*, 27, 220-224.
- Zarb, F., & Xerxen, P. J. (2009). *Justification of CT brain when referred as accident and emergency* (Bachelor's thesis, University of Malta).