

Evaluation of Diagnostic Value of Computed Tomography in Headache Patients in Benghazi

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Abstract: Headache is the most common complaint faced by physicians. Referring these cases for a computed tomography (CT) scan requires awareness of red flags in the history and examination by physicians. An assessment of the diagnostic utility of CT among headache patients will help determine the most prevalent causes of headache and identify those who get benefit from it. is to find out the proportion of cranial abnormalities in patients with headache without neurologic abnormalities with the use of a CT scan. Also, to illustrate the most common causes of headache in these patients. This study was carried out among 217 patients with isolated headache who underwent a plain, non-contrast enhanced CT of the brain and para-nasal sinus (PNS). The median age was 34 years. The most prevalent age group was between 20 and 39 years old. The most common cases were females. The female to male ratio was 1.5:1. The most frequently occurring cases in 2012 came from the ear, nose, and throat (ENT) department. The paranasal sinuses (PNS) scan was used by 58.53%, and the brain scan was used by 41.47%. The normal scan was 55.3% and the positive scan was 44.7%, which was further categorized into minor incidental findings (17.97%) and significant abnormalities (26.73%). Abnormal findings represent 44.7% of cases. The most common major abnormality was sinusitis. An equal proportion (3.45%) of major abnormalities included sino-nasal polyposis, chronic small-vessel ischemic changes, a suspicious brain tumor, and a suspicious nasopharyngeal mass.

تقييم القيمة التشخيصية للتصوير المقطعي في مرضى الصداع ببغازي

الكلمات المفتاحية :

التصوير المقطعي،
صداع ،
تشوهات ،
الجيوب الأنفية.

المستخلص : الصداع هو الشكوى الأكثر شيوعاً التي يواجهها الأطباء. وتحتاج إحالة هذه الحالات إلى التصوير المقطعي (CT) إلى الوعي بالعلامات الحمراء للتاريخ المرضي، والفحص الكليني من قبل الأطباء. سيساعد تقييم المنفعة التشخيصية للتصوير المقطعي بين مرضى الصداع لتحديد الأسباب الأكثر انتشاراً للصداع، وتحديد أولئك الذين سيستفيدون منها. وهدفت هذه الدراسة إلى معرفة نسبة اعتلالات القحفية لدى مرضى الصداع دون وجود اضطرابات عصبية مسبقة، وذلك باستخدام الأشعة المقطعية، ولاستبيان الأسباب الأكثر شيوعاً عند مرضى الصداع. أجريت هذه الدراسة على 217 مريضاً بمتوسط اعمار 34 عاماً، يعانون من صداع مجرد، وخضعوا للتصوير المقطعي غير المعزز بالصبغة للدماغ، والجيوب الأنفية (PNS). تراوحت الفئة العمرية الأكثر انتشاراً بين 20 و39 عاماً. الحالات الأكثر شيوعاً هي الإناث. حيث كانت نسبة الإناث إلى الذكور 1.5:1. وكانت أكثر الحالات إحالة في عام 2012 من قسم طب وجراحة الأنف والأذن والحنجرة. تم إجراء المسح المقطعي للجيوب الأنفية (PNS) على 58.53% من الحالات، وفحص الدماغ 41.47% من الحالات. كان المسح الطبيعي 55.3%، والمسح الإيجابي 44.7%، والذي تم تصنيفه إلى نتائج عرضية طفيفة (17.97%)، واضطراب كبير (26.73%). وكانت النتائج غير الطبيعية تمثل 44.7% من الحالات. كان التهاب الجيوب الأنفية هو الاضطراب الرئيسي الأكثر شيوعاً (86.2%). نسب متساوية (3.45%) من حالات الاضطرابات الكبرى المدرجة؛ داء السلائل الأنفية، والتغيرات الدماغية المزمنة للإقفار التروي للأوعية الدموية الصغيرة (الاحتشاء الجوبي)، والاشتباه بأورام الدماغ، واشتباه الكتلة الأنفية-البلعومية.

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INTRODUCTION

Headache is an almost universal experience and the most common medical complaint. Headache complaints are highly prevalent worldwide, and they are the most common nervous system complaints. Headache affect individuals of all ages, races, socioeconomic levels, and geographical areas. Headaches affect patients most commonly between the ages of 25–55 years (Stovner et al., 2007). The overall lifetime prevalence was estimated to range from 0.2%–60% for headaches of any kind in adults (Stovner et al., 2007; Stovner & Andree, 2010). Headaches account for about 2% of all patient complaints in the emergency room (ER) (Edlow et al., 2008). The cause varies from a trivial nuisance to a serious disease. However, only about 10% of patients were due to secondary causes (Buljčik-Čupić & Savović, 2007; Perkins & Ondo, 1995). Physicians are confronted with the question of whether or not it is necessary to do radiological imaging to confirm a distinct diagnosis. Although most of the patients with chronic or recurrent headache have no neurologic abnormality, many patients are evaluated with CT and, more recently, magnetic resonance imaging (MRI) to exclude an underlying cause (Tsushima & Endo, 2005).

Different studies have confirmed the low yield of different imaging studies of isolated headache unaccompanied by other neurologic findings. Also showed a low yield of CT scan for these patients (parameter, 1994; Sempere et al., 2005). Headache disorders are classified into many types and subtypes, but a small number of them impose most of these burdens. To make a clinical and economic decision, it is important to differentiate between a primary headache without an underlying abnormality and a secondary headache; associated with an underlying pathology. Sometimes it is difficult to discriminate between primary and secondary headaches. Since the primary headache does not need brain imaging because no underlying

cause exists, Primary headaches, which include migraine, tension-type headache (TTH), are benign and usually recurrent. Underlying organic diseases ranging from benign conditions like sinusitis to serious causes like subarachnoid hemorrhage (SAH) cause secondary headaches. A detailed headache history and a good neurological and general physical examination should help in deciding which patients need a CT scan of the brain to find out the underlying pathology (Clinch, 2001). At times, despite the absence of a red flag, the brain CT scan is sought to calm the anxiety of the patient and their relatives. However, this raises the issue of the radiation dose to the patient (Garvey & Hanlon, 2002). Due to the unavailability and higher cost of MRI, CT is requested more frequently. When the value of negative results is not considered, the costs of headache imaging are usually overstated (Tsushima & Endo, 2005). Mismanagement and overuse of headache medications are major risk factors for problem aggravation. Headache disorders are underestimated, and headache remains under-recognized and under-treated worldwide. However, no data exist in our country about the use of CT for the evaluation of headaches with normal neurological findings. The CT usage needs to be in balance with the radiation dose. As CT is a highly useful tool for diagnostic purposes, it should not replace actual history-taking and clinical examinations. These steps may limit the cost and load on health care systems.

MATERIALS AND METHODS

Study design: This descriptive retrospect review of radiology records by reviewing the CT findings of patients complain of headache those referred to CT scan unitat Benghazi Medical Center (BMC).

Study period: The study included all radiological records of headache cases during the period from January 2012 to December 2013.

Study setting: This study undertaken at CT scan unit, Radiology Department- BMC, which is located in Benghazi. BMC is the largest tertiary referral, governmental and teaching hospital in Benghazi. It receives referred patients from different departments in the center, such as; neurology, neurosurgery and ear, nose and throat departments. In addition, the center receives patients from various referral clinics in Benghazi, as well as patients from all surrounding areas of Benghazi. The BMC Radiology Department staff consultants, specialists and technicians are well qualified and well trained.

Study population: The study included 217 headache cases referred for CT scan who underwent non-contrast CT scan brain and/or PNS during the study period.

Inclusion criteria: All patients of all age groups who were complaining of headache referred for CT scan.

Exclusion criteria: Patients with head injury, previous intracranial intervention, malignancy and the patients with neurological deficit were excluded from the study.

Study tools:

Equipment: Phillips CT scan of 64 slices model used for all referred patients. The scans obtained by special parameters' technique such as Helical set with cut thickness of one millimeter or less. The exposure settings that have been used is 120 KVP with 359 mAs. The medical CT scan images in coronal and axial planes were visualized and studied using the equipment screen.

Radiological requests: All CT requests of headache cases during the study period reviewed thoroughly for collection of required data.

Administrative approval: The director of BMC had approved the study before starting collection of data and the approval of the head of Radiology Department. All data

were accessible from the patient's medical radiological records at the CT unit.

Data processing procedures / analysis: The collected data fed through the computer using Statistical Package for Social Sciences (SPSS) for Windows version 18. The analysis of data done in the form of descriptive statistics as calculating mean, median, mode and Standard deviation (SD). The data then presented in tabular and graphical forms.

RESULTS

The study carried out among 217 subjects of any age groups investigated during the study period. The median age of the studied cases with headache was 34 years. The youngest age was 8 years and the eldest was 73 years. Their mean \pm SD was 35.82 ± 13.63 years. As presented in table 1. The most prevalent age group among cases was between 20 and 39 years representing 57.6% and the least prevalent age group was aged less than 10 years (0.9%), as in table 2. Regarding gender distribution, females had the highest proportion (60.8%) among cases who were complaining of headaches. The male patients represent (39.17%), and the female to male ratio (F:M = 1.5:1).

Table (1). Descriptive statistics of age of cases complaining of headache.

Descriptive statistics of age	Age in years
Mean	35.82
Median	34.00
Mode	30.00
Std. Deviation	13.63
Minimum	8.00
Maximum	73.00

Table (2). Age category of headache cases.

Age category	Frequency	Percent
1 st	2	0.9
2 nd	16	7.4
3 rd	60	27.6
4 th	65	30.0
5 th	33	15.2
6 th	23	10.6
7 th	13	6.0
8 th	5	2.3
Total	217	100.0

Table 3 shows that the most common age group frequently complaining of headache ranging from 20-59 years. The groups between 20- 39years represented by females nearly (55.2%) and males (44.8%). Females represents higher proportion compared to males in all age groups.

Table (3). The age category regarding the gender of patients presenting with headache.

Age group (in years)	Sex		Total
	Male	Female	
<20	7(38.9%)	11(61.1%)	18 (8.3%)
20-39	56(44.8%)	69(55.2%)	125(57.6%)
40-59	19(33.9%)	37(66.0%)	56(25.8%)
≥60	3(16.6%)	15(83.3%)	18(8.3%)

The CT unit of Radiology Department receives referred patients from different departments. The most frequently referring departments were ENT (47.9%) followed by neurosurgery (27.1%) and neurology (24.8%) as shown in Fig. (1).

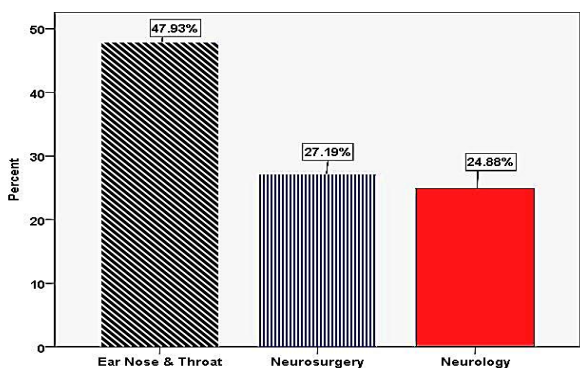


Figure (1). Distribution of headache cases according to the referral headache departments.

The data were retrieved from the patient's medical radiological records archives between January 1st 2012 up to December 31st, 2013. The highest proportion of cases were recorded in the year 2012 (62.67%) compared to 2013 (37.3%) as shown in Fig. (2).

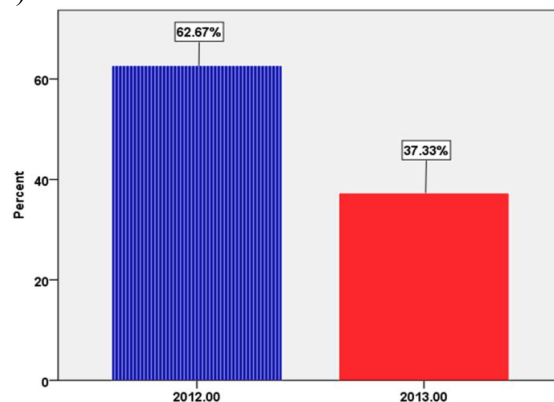


Figure (2). Distribution of cases according to years of investigation.

Fig. (3) illustrates that more than half (58.53%) of headache, patients had PNS CT scan and 41.47% of the cases underwent non-contrast CT scan for brain.

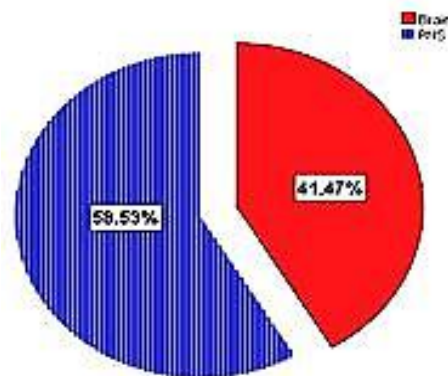


Figure (3). Anatomical site of CT conducted for headache cases.

Fig (4) illustrates that 55.3 % of referred cases were normal and 44.7 % had abnormal findings. These abnormal findings were further divided to minor abnormality such as deviated nasal septum, maxillary retention cyst and absence of frontal sinus represents 18% of the total referred cases and cases with clinically significant abnormalities, e.g. Lacunar infarction, sinusitis. This cate-

gory represents 26.7% of the total referred cases.

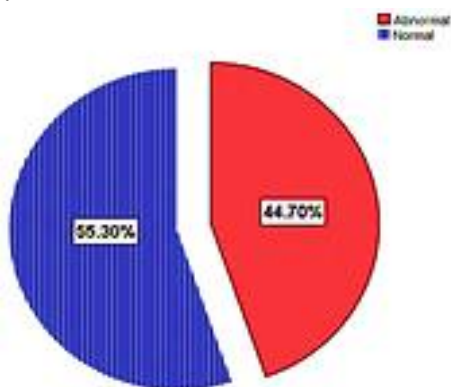


Figure (4). Prevalence of the positive CT scans of the patient presenting with headache.

Fig (5) shows that a higher proportion (55.3%) of CT scan cases who complained of headache were normal, and the abnormal findings were prevalent among 44.7% of cases. Concerning the minor abnormalities among the referred cases, thirty-nine of these cases had minor abnormalities, which included deviated nasal septum represents the highest proportion (41.0%), maxillary retention cyst represents (23.1%), absence of frontal sinus (20.5%), concha bullosa (12.8%) and the lowest proportion of cases had (2.6%) arachnoid cyst, as shown in Fig. (6).

It is evident from the images of PNS scan of patients presented with headache that there are bilateral chonchabullosa Fig. (7) and deviated nasal septa Fig. (4) and (8) both pathological changes lead to nasal obstruction.

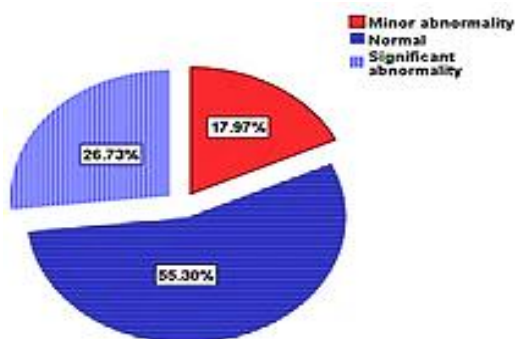


Figure (5). Distribution of referred headache cases according to their CT findings.

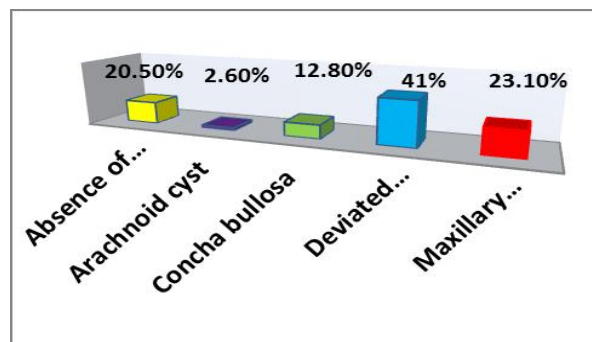


Figure (6). The distribution of minor incidental findings among the headache patients.

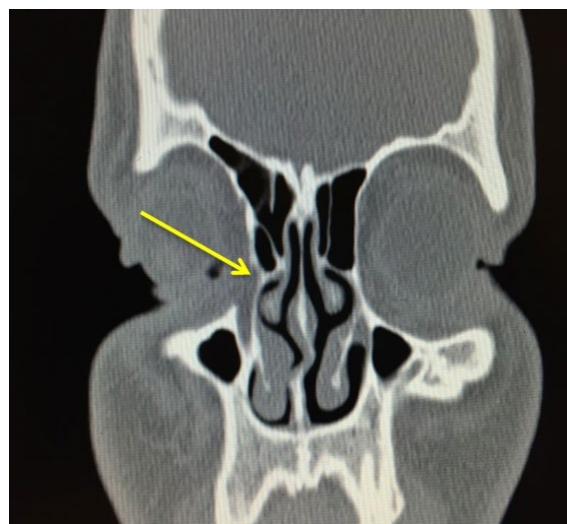


Figure (7). Bilateral concha bullosa.



Figure (8). Deviated nasal septum.

Major significant abnormalities detected among cases that could potentially cause headaches. Their total number was 58; the

highest proportion of these cases (86.21%) was sinusitis. Equal proportions of major abnormalities (3.45%) includesino-nasal polyposis, chronic small-vessel ischemic changes (lacunar infarction), suspicious brain tumor and suspicious nasopharyngeal mass as inFig. (9).

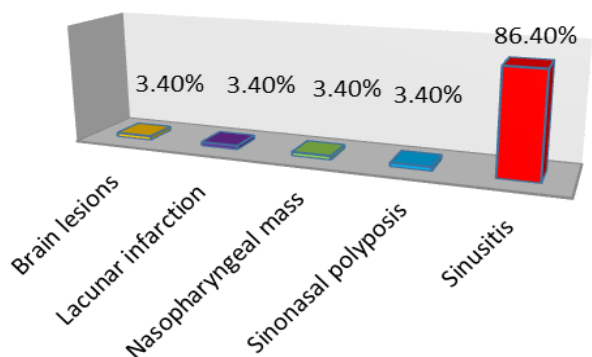


Figure (9). The distribution of major significant findings among the headache patients.

Fig. (10) illustrates the image of PNS, there is maxillary sinusitis in form of mild polypoidal mucosal thickening of both maxillary sinuses more evident in right side as the arrow points. CT scan brain for patient presented with an isolated headache. The scan reveals that there is a small hypodense lesion seen in the left internal capsule, which represents small lacunar infarction as shown in Fig. (11).

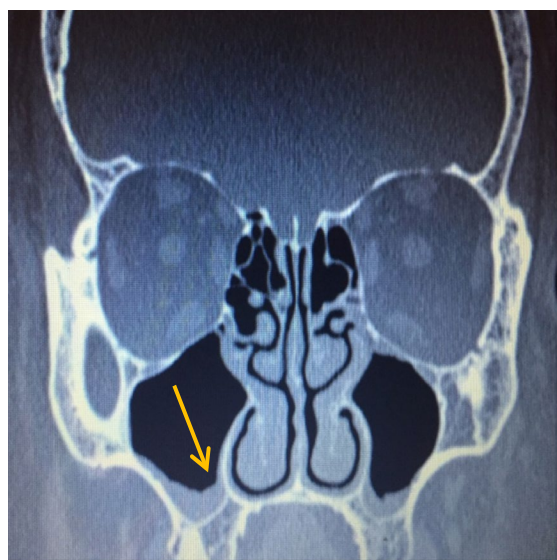


Figure (10). Maxillary sinusitis.

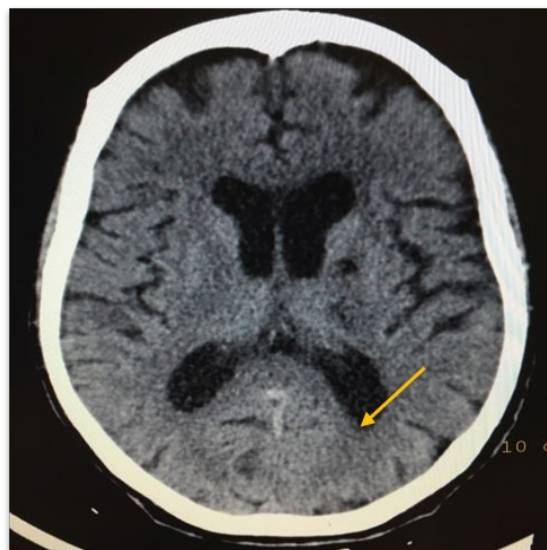


Figure (11). Lacunar infarction.

Fig. (12) reveals that both maxillary sinus and nasal cavity is almost obliterated with polypoidal mucosal thickening which consistent with sino-nasal polyposis. capsule, which represents a small lacunar infarction as shown in Fig. (11).

Fig. (12) reveals that both maxillary sinus and nasal cavity is almost obliterated with polypoidal mucosal thickening which consistent with sino-nasal polyposis.

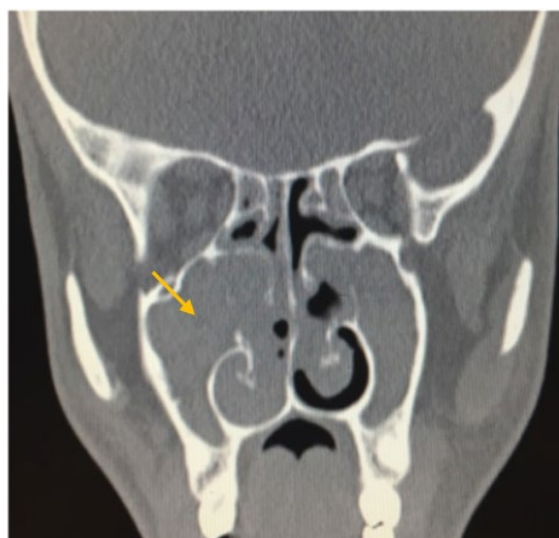


Figure (12). Sinonasal polyposis.

Regarding referred cases, ENT Department had the highest proportion (72.2%) of cases with positive findings, followed by neuro-

surgery (19.6%) and the least referral department with positive findings was neurology (8.2%) table 4.

Table (4). Case referral from various departments and positive CT scan findings.

Referral departments	CT findings		Total
	Positive Cases	Normal Cases	
Ear Nose & Throat	70 (72.2%)	34 (28.3%)	104
Neurosurgery	19 (19.6%)	35 (29.2%)	59
Neurology	8 (8.2%)	51 (42.5%)	54
Total	97 (100.0%)	120 (100.0%)	217

Table 5 shows that (12.9%) of headache cases had hypertension and (87.1%) were non-hypertensive. Concerning between sinusitis and age groups, the highest proportions of cases were observed among age groups 20-39 and 40-59 (60% and 20%) respectively, as shown by table 6.

Table (5). Proportion of hypertension among CT scanned cases.

History of Hypertension	No	%
Yes	28	(12.9)
No	189	(87.1)
Total	217	(100.0)

Table (6). Relationship between age groups and sinusitis cases.

Age group (in years)	Sinusitis as significant abnormalities	
	No	%
<20	6	(12)
20- 39	30	(60)
40- 59	10	(20)
≥60	4	(8)
Total	50	(100)

Table (7). Relationship between gender and sinusitis cases.

Gender	Sinusitis
Female	25 (50%)
Male	25 (50%)
Total	50 (100%)

DISCUSSION

Headaches are a very common complaint among different individuals in communities. This complaint is irritating to these individuals, leading to their continuous seeking of medical advice. The International Headache Society (IHS) classified headaches into primary and secondary headaches. Primary headaches are not related to any organic cause. It includes; migraines, tension headaches, etc. Secondary headache is related to established causes such as tumors of the brain and hemorrhage inside the cranial cavity.

This retrospective study included 217 subjects, of whom 44.7% were diagnosed with probable causes of headaches by CT scan and 55.3% showed an absolutely normal scan. Investigators observed similar results, where most of the CT scans of headache patients were normal. (Dumas et al., 1995) evaluated cases of chronic headache using CT scan and reported that CT has an extremely low yield in patients who were investigated for headache without any neurological abnormality. (Ahmad et al., 2008) conducted a study in a teaching hospital in Swat, Pakistan, and they concluded that 69% of patients who presented with headache had no abnormality in CT scans of the brain. (Ahmad et al., 2008).

More recently, (Lemmens et al., 2021) carried out a retrospective study of 501 patients who had a headache as their main symptom and had visited the emergency room between April 2018 and the end of 2018. They found that about half of the patients were diagnosed with a primary headache disorder, which is in line with this study (Lemmens et al., 2021). Furthermore, (Clinch, 2001) evaluated cases of acute headache using CT and MRI. He stated that the majority of patients who presented with chronic or recurrent headache and had no neurologic abnormality, were routinely exposed to CT and MRI for the diagnosis of

the causes of their headache (Clinch, 2001). Thus, the endeavor of clinicians should be to reduce the radiation burden of a CT scan, which involves considerable radiation. The abnormal findings, like sinusitis, may be falsely increasing the yield of CT.

It is evident from the present study that there was a significant decrease in CT use for patients with isolated headache when comparing the proportion of cases evaluated with CT in the year 2012 (62.67%) compared to the year 2013 (37.3%). Therefore, it is of the utmost importance that our department follows the international guidelines. So that the diagnosis of headache types are done, whether the headache is of a primary type that only needs the appropriate therapy or a secondary type that requires further diagnostic workup.

There is gender variation in relation to headache. The present study reveals that females are nearly two times higher to complain of headache compared to males (60.8% and 39.17%, respectively). This is nearly similar to the study done by (Morgenstern et al., 2001), in which 66% of the patients were female among those complaining of headache (Morgenstern et al 2001).

Cases of headache complaints were more prevalent among the age group (20 to 39) for both males and females (44.8% and 55.2%, respectively). This age group mainly represents the reproductive age group. Unnecessary exposure to CT scan radiation will lead to undesirable side effects. We must have considerable costs and radiation exposure in this vulnerable age group. Therefore, clinicians should consider these side effects when advising CT for patients in this age group. Unless these cases are represented with a red flag and warning symptoms/signs such as headache in a patient with risk factors such as immunocompromised patients or cancer patients, a CT scan is advisable.

Considering the younger age group (less than 20 years), in this study, they represented 8.3% of total cases. Among the age group the sinus pathology represents the highest percentage (60%) of abnormal CT. (Lateef et al., 2009), studied headaches among young children and reported that CT scan of children presenting with headache but non-worrying history and normal neurological findings, occasionally leads to life-threatening diagnosis or contributes to urgent management (Lateef et al., 2009).

The present study showed that the proportion of the younger age group who had sinusitis as proved by CT was 12%, and this finding is similar to the results of the study done by Gupta et al., in which the proportion of young cases with sinusitis ranged from 1% to 13% (Gupta & Belay, 2008; Rho et al., 2011) reported that neuroimaging has a limited value in children who present with an isolated headache. According to this study, neuroimaging is not indicated in children presenting with recurrent headaches and normal neurological findings (Rho et al., 2011). A neuro-pediatrician should reach agreement about the indications for a CT scan for children with of headache according to standardized guidelines.

The overuse of CT scanning among the young age group in the present study could be attributed to family pressure as the parents insist on neuroimaging procedures thinking that they will help in the diagnosis of the etiology of their children's headaches and exclude major problems. Consequently, only minor abnormal findings were discovered with the CT procedure. Therefore, physicians have to explain the nature and etiology of headache to parents and families to minimize their anxiety, and the hazards of ionizing radiation from CT scans.

The definition of minor and significant abnormalities, however, was not uniform among the different studies performed. The

minor abnormality did not affect the management of the patient. Many studies have shown that CT scans of headache patients without abnormal neurological examination yield a low percentage of positive clinically significant findings (Grosskreutz et al., 1991). The current study showed that the proportion of minor abnormalities was 18%. Concerning major abnormalities represents 26.7% of total referred cases that need management and further workup, such as sinusitis.

The present study revealed that the most common cause of headache was sinusitis (86.40%). This percentage could explain the higher proportion of ordered PNS scans (58.53%) compared to brain CT scans (41.47%). Furthermore, this may indicate the high yield of the PNS CT scan as a diagnostic tool. (Buljčik-Čupić & Savović, 2007), reported that the PNS CT scan is preferred to be used as a golden standard tool when medical treatment fails and when planning for surgery⁽¹⁶⁾.

The current study showed that the most frequently referred department (47.9%) was ENT. Accordingly, the highest proportion of total positive findings (72.2%) was detected among ENT cases. The highest proportion (60%) of the age group with sinusitis was (20-39 years) and there were no gender differences. In general, the PNS scan is needed for headache patients with suspected sinus pathology.

The current study showed that a low proportion of cases had lacunar infarction as diagnosed by CT. These findings are in accordance with (Tentschert et al., 2005), who reported that headache was less common with transient ischemic attacks and lacunar infarction (Tentschert et al., 2005).

Regarding headaches as an isolated clinical feature of tumors, a study showed that a low proportion of headache cases diagnosed by CT were suspected brain tumors. This is in

agreement with (Vazquez - Barquero et al., 1994), they conducted a prospective study and revealed that headaches are an isolated clinical feature, which is rare in patients with brain tumors (Vazquez - Barquero et al., 1994). This suspected diagnosis is considered a preliminary diagnosis, that needs further work up.

Most of the minor findings were incidental and did not affect headache management at all. The most common one was a deviated nasal septum, which may lead to lateral displacement of the middle concha and, subsequently, nasal obstruction and headache (Morgenstein & Krieger, 1980). Followed by the maxillary retention cyst, which represents 23.1%, a study showed the maxillary retention cyst incidentally was reported to be around 29.4%, despite the fact that most mucosal retention cysts are asymptomatic. Some cases presented with symptoms such as headache and facial pain. One of the minor findings was concha bullosa, which may cause middle meatus or infundibulum obstruction in conjunction with a deviated nasal septum to the contralateral side. (Morgenstein & Krieger, 1980), described contact nasal headache among a group of patients with headache. He attributed the headache to a pressure point within the nose due to the existence of the middle turbinates of the concha bullosa touching the septum (Morgenstein & Krieger, 1980).

CONCLUSION

The most prevalent age group among headache cases was (20 and 39 years), female to male ratio 1.5:1. Abnormal findings represent 44.7% of cases. The commonest major abnormality was sinusitis. Equal proportion of major abnormalities included; sino-nasal polyposis, chronic ischemic changes, suspicious brain tumor and nasopharyngeal mass. Minor abnormalities represented 17.97% of the total cases. The most prevalent type of minor abnormalities was deviated nasal sep-

tum. Among headache cases, only 12.9% had hypertension.

Duality of interest: The authors declare that there is no conflicts of interest.

Authorship Contributions: Conception and design of the study; Hawa M. Hawla, Faisal M. Shembesh, Mohammed Buzgheia, Ossama El-factory, Murshed H. Haidar. Generation, collection, assembly, analysis and/or interpretation of data; Hawa M. Hawla, Mustafa A Karwad, Ibrahim M. M. Elomami, Narges M. Elzaidi, Azza El Saddiek Greiw. Drafting or revision of the manuscript; all Approval of the final version of the manuscript: all.

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