CT scan for headache: Importance of CT scan for patients with headache, who needs a CT scan? A retrospective study at Taif, Saudi Arabia

Abdulaziz althubaiti
Radiology, College of Applied Medical Sciences, Taif University, Taif, Saudi Arabia

Abstract:
Background*: There is a huge awareness in a lot of countries that headache constitutes a major public health problem. this study is interested in patients with headache underwent to CT scan. And through that, we can get an answer about how useful a CT scan for headaches is? and why was the CT scan requested for them? Objective of this study is to evaluate the headache by using CT scan in Taif, Saudi Arabia*
Materials and Methods*: is a retrospective review of 200 cases of headache cases, CT scan findings were selected randomly during a period of study from 2019 to 2020 in Taif city on King Abdulaziz Specialist Hospital, King Faisal Specialist Hospital.*
Results*: The typical age for headache cases underwent to CT scan was the age above 60 years old which constituted (24%) of total cases. The most common associated symptom of headache underwent to CT scan is dizziness which constituted 36% of total cases. 131 out of 200 cases are associated with normal CT scan appearance (65.5%) and 69 out of 200 cases are associated with abnormal CT scan appearance (34.5%). The most common positive findings are brain involutional changes where 25 (12.5%) of cases had brain involutional changes followed by ischemia by 18 (9%) of cases. Age groups are significantly correlated with CT findings (P value < 0.05). The majority of CT abnormal findings were found in the age group above 60 years old*
Conclusion: *There is a relationship between CT findings and age group. The majority of CT abnormal findings were found in the age group above 60 years old taking into consideration most of the positive findings may be considered normal for age. CT scan for headache cases is a useful screening modality either to identify or rule out structural abnormalities. large studies with a large number of samples and longer periods may be necessary to determine the role of CT scan in evaluation of patients with headache.*
Key Word*: computed tomography (CT), Headache, Medical imaging, Radiology, Taif.*

I. Introduction

There is a huge awareness in a lot of countries that headache constitutes a major public health problem. About 90% of individuals have at least one episode of headache each year and severe headache is reported to happen at least 1 annually in 40 % of the population [1]. Population-based estimates suggest that roughly 4% of adults have daily or near-daily headache [2][3]. The most important approaches for diagnosing and determining the headache type are neurological examinations and obtaining a detailed history of the patient's symptoms [4]. The prevalence of headaches in Saudi Arabia varies from 8 to 12% [5]. The prevalence of migraine headaches in Taif city about 89.9% [6]. However, this study is interested in patients with headache who underwent to a CT scan. And through that, we can get an answer about how useful a CT scan for headaches is? and why was the CT scan requested for them? Because the headache of a small minority of patients results from serious intracranial disorders such as tumors or intracranial hemorrhage. These must be accurately diagnosed without exposing the many patients who have a benign headache to expensive and possibly harmful over-investigation. In clinical practice using the red flags of headache is accepted in requesting a CT scan for looking about secondary headache [7]. The red flags signs and symptoms include headache in a patient over 50 years old, headache associated vomiting, changes in behavior, conscious level, headache with seizure, new-onset neurological deficit, headache precipitated by coughing, sneezing or exercise, associated with visual disturbance, or jaw claudication, immunosuppressed or history of malignancy, atypical aura, headache with signs and symptoms of glaucoma, headache associated with signs of systemic illness e.g. neck rigidity, rash, fever, and headache after head injury [8]. CT scan is responsible for 40% of total medical diagnostic radiation [9]. So, the use of CT imaging has to be balanced against the radiation dose. The comparison between the negative and positive results were documented in this study. headache can be secondary such as stroke, head and/or neck trauma, brain tumor, cranial cervical vascular illnesses, subdural hematoma (SDH), abscess or

hydrocephalus, etc. [10]. and these can be diagnosed by using a CT scan because the CT scan is sensitive and specific for the detection of intracranial diseases [11][12][13][14]. The international guideline published in 2013 reported brain imaging to be useful for patients aged >50 years with new-onset headaches [15].

A large study of 3026 scans of patients with headache presented a few numbers of patients who suffered from diseases that could be diagnosed with cerebral imaging: 0.8% brain tumors, 0.2% arteriovenous malformations, 0.3% hydrocephalus, 0.1% aneurysm, 0.2% subdural hematoma, 1.2% strokes, including chronic ischemic processes [16]. In general, headache 2 to 3 times more common in females than males [17][18]. Weingarten et al. [19], in their study showed that a headache associated with brain tumors may be non-specific and cannot be reliably distinguished from other more common benign causes of headache accurately on clinical grounds so in those cases neuroimaging plays an important role to identify or rule out the possible cause. The presence of white matter disease is mostly coexisting with chronic hypertension and aging progression in most of the cases [20] but it may not be primary headache. According to one study indicated to that there are few case reports in which patients with chronic headache and no additional findings show gross intracranial pathologies detected by CT [21]. Most patients presenting with the single symptom of headache and no focal neurologic deficits can be managed without radiologic imaging [22][23]. However, a large number are imaged with computed tomography (CT) and/or magnetic resonance imaging (MRI) to rule out significant pathologic abnormalities [24]. Since a chronic headache frequently raises the suspicion of brain tumor by either patient or physician, the strategy supported by the consensus conference may be too unclear and nonspecific to guide clinical practice or promote the efficient use of imaging procedures. At a time when there is a shrinking availability of health care money, the physicians need to look at the cost-effectiveness of their ways in ordering laboratory and radiological studies for headache. There are a considerable number of studies supporting this impression [25][26][27][28].

This study aims to evaluate the importance of CT scan for headache in Taif, Saudi Arabia.

II. Material And Methods

This is a retrospective study that was conducted at King Abdulaziz Specialist Hospital, King Faisal Specialist hospital, and Children's hospital in Taif. Ethical approval was obtained from Directorate of Health Affairs, Taif, Research and Studies Department.

General objective: To Study the headache by using CT scan in Taif, Saudi Arabia.

Specific objectives:
To classify the positive findings.
To determine the relation of results with sex.
To determine the relation of results with age.
To compare positive and negative results.

Machine used: All patients have examined by Computed Tomography machine - Siemens - 64 slices - sequential CT scanning.

Study population: The study of 200 patients including males and females of different ages who are presenting with headaches in radiology department were evaluated by CT scan of head.

Study period and samples: The samples were collected by simple random sampling from 2019 to 2020.

Method: Total number of 200 patients presenting with headaches in departments of radiology were examined by CT machine. Soft tissue window and Bone algorithms with wide window settings was studied to visualize any positive results for headaches. In each patient, Variables such as patient age and gender, principal presenting complaints, etiology of headache, and findings of the Radiologists, were documented.

Data Analysis: Data were analyzed using Statistical Package for the Social Science (SPSS) software.

Limitations: small sample volume. So, large studies with a large number of samples and longer periods may be necessary to determine the role of CT scan in evaluation of patients with headache.
single center and simple statistical results.

III. Result

Out of 200 cases included in this study 83 (42.5%) are male while females constituted 115 (57.5%) showing female preponderance in headache cases underwent to CT scan in **Figure 1.**

The typical age for headache cases underwent to CT scan according to this study was the age above 60 years old which constituted (24%) of cases followed by age between 41 to 50 years old which constituted (21.5%) of cases and other age groups are shown in **Figure 2.**

The distribution of different associated symptoms is shown, where the most common associated symptom of headache underwent to CT scan is dizziness which constituted 36% of total cases followed by vomiting and numbness each one separately which constituted 9.5%, blurred vision 9%, high blood pressure 7%, weakness 4% and loss of consciousness 3.5% and other associated symptoms are shown in **Table 1.**

131 out of 200 cases are associated with normal CT scan appearance (65.5%) and 69 out of 200 cases are associated with abnormal CT scan appearance (34.5%), **Table 2.**

Distribution of the positive findings in headache cases underwent to CT scan is shown, where 25 (12.5%) of cases had brain involutional changes followed by ischemia by 18 (9%) of cases then arteriolosclerotic leucoencephalopathy which constituted 12 (6%) of total cases, infarction constituted 11 (5.5%), sinusitis 9 (4.5%) and basal ganglia calcification 4 (2%) and other positive findings are shown in **Table 3.**

Distribution of the CT scan result for the gender group, shows 52 CT negative finding and 33 CT positive findings in male while shows 79 CT negative findings and 36 CT positive findings in female, Consequently the null hypothesis can't be rejected, in another way, there is no significant relationship between CT findings and gender (P value > 0.05), **Table 4.**

Table 5 shows the relationship between CT scan findings and age group, the result shows 31 CT scan positive and 17 CT scan negative in the age group above 60 years old, 12 positive findings and 19 negative findings in the age group between 51 to 60 years old, 12 positive findings and 31 negative findings in the age group between 41 to 50, 6 positive findings and 23 negative findings in the age group between 31 to 40, 5 positive findings and 29 negative findings in the age group between 21 to 30, 3 positive findings and 12 negative findings in the age group between 10 to 20, Consequently the null hypothesis will be rejected, in another way, there is a significant relationship between CT findings and age groups (P value < 0.05).
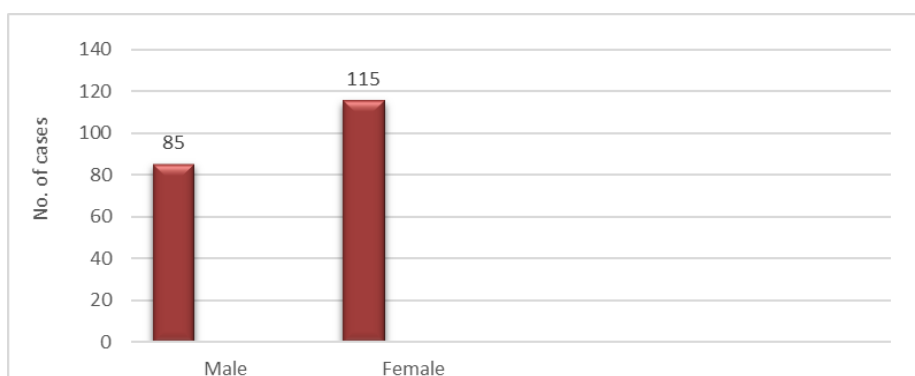
Figure 1: Distribution of gender group
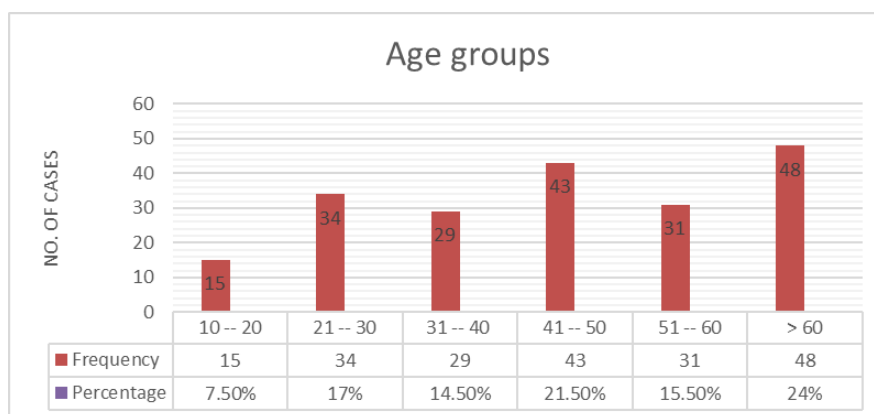
Figure 2: distribution of age groups

Symptoms	Frequency	Percentage
Dizziness	72	36%
Vomiting	19	9.5%
High blood pressure	14	7%
Numbness	19	9.5%
Blurred vision	18	9%
Loss of consciousness	7	3.5%

Convulsion	2	1%
Photophobia	2	1%
Slurred speech	3	1.5%
Nausea	4	2%
Weakness	8	4%

Table 1: distribution of associated symptoms

Table 2: distribution of CT findings

CT findings	frequency	percentage
Normal CT	131	65.5%
Abnormal CT	69	34.5%
total	**200**	**100%**

Table 3: distribution of CT positive findings

Positive findings	Frequency	Percentages of total positive findings	Percentages of total cases
Sinusitis	9	8.7%	4.5%
Infarction	11	10.6%	5.5%
Ischemia	18	17.3%	9.0%
Cyst	3	2.9%	1.5%
Encephalomalacia	1	0.9%	0.5%
Vitreous Hemorrhage	1	0.9%	0.5%
Brain Involutional changes	25	24%	12.5%
Arteriolosclerotic leucoencephalopathy	12	11.5%	6%
Subarachnoid hemorrhage (SAH)	2	1.9%	1%
Brain Atrophy	3	2.9%	1.5%
Enlarged Sella Turcica	1	0.9%	0.5%
Vein Calcification	1	0.9%	0.5%
Subdural hemorrhage (SDH)	1	0.9%	0.5%
Cerebral Small Vessel Disease	2	1.9%	1%
Maxillary Polyp	1	0.9%	0.5%
Basal Ganglia Calcification	4	3.8%	2%
Mega Cisterna Magna	1	0.9%	0.5%
Concha Bullosa	1	0.9%	0.5%
Hydrocephalus	2	1.9%	1%
Intramuscular Hemorrhage	1	0.9%	0.5%
Partial Empty Sella	2	1.9%	1%
Intraventricular Hemorrhage (IVH)	1	0.9%	0.5%
Asymmetry of Frontal Horn	1	0.9%	0.5%
Total positive findings	**104**	**100%**	

Table 4: Shows the relationship between CT scan results and gender group

CT findings	Gender		Frequency	Percentage
	Male	Female		
Negative	52	79	131	65.5%
Positive	33	36	69	34.5%
Total	85	115	200	100%
		P value = 0.271		

Table 5: Shows the relationship between CT scan results and age group

Age groups	CT findings		Frequency	Percentage
	Positive	Negative		
10 - 20	3	12	**15**	**7.5%**
21 - 30	5	29	**34**	**17%**
31 - 40	6	23	**29**	**14.5%**
41 - 50	12	31	**43**	**21.5%**
51 - 60	12	19	**31**	**15.5%**
Above 60	31	17	**48**	**24%**
Total	**69**	**131**	**200**	**100 %**
		P value = 0.001		

IV. Discussion

The international headache society has classified headaches broadly into two categories, primary and secondary, primary is without any organic cause while secondary is with an established cause [10]. Various studies have been conducted in different regions of the world at different times to assess the utility of CT and neuroimaging techniques in patients with headaches [29][30]. However, the secondary causes constitute only about 10% of patients with headache [31]. For example, a brain tumor is secondary cause of the headache and constitutes less than 0.1% of lifetime prevalence of headache [32]. the international guideline published in 2013 reported brain imaging to be useful for patients aged >50 years with new-onset headaches [15]. And this recommendation is matching to our study where our study indicates that the age groups are significantly correlated with CT findings (P-value < 0.05) in table 3, Consequently, the age group can be taken into consideration in requesting a CT scan for patients with headache. Although the majority of patients who present with chronic or recurrent headache in OPD of any general practitioner or hospital without any neurological deficit, many of them use to undergo neuroimaging with CT or MR imaging to exclude any serious intracranial pathology [32][33][34]. Previous studies have demonstrated that CT is of extremely low yield in patients who undergo imaging for chronic headache without neurologic abnormality [35]. Our study shows 34.5% abnormal scans out of all the cases who underwent CT scans for headache. According to our study, there is no significant relationship between gender group and CT results, So, the gender group can't be taken into consideration in requesting a CT scan for a patient with headache. And this result is similar to study conducted by Rawal S [36]. When comparing an MRI with a CT scan in the evaluation of patients with headaches, the MRI is not a first line imaging technique for the evaluation of patients who presented with chronic or recurrent headaches with normal neurological signs. One study was conducted at Gunma University Hospital of Japan, to evaluate the efficiency of MRI in the diagnosis of an abnormality in patients suffering headaches without any neural deficit, out of a total of 306 patients, 169 patients (55.2%) had no abnormality in the CT/MRI scan, 135 patients (44.1%) had a minor associated abnormality while only two patients (0.7%) have intracranial pathology which may be the cause of headache [37]. In this study, the rate of detection of positive CT findings in terms of frequency was noticed highest in the age group above 60 years old with abnormality found in 31 out of 48 cases, and this result similar to several studies. one study conducted from 2013 to 2014 shown abnormal CT findings were detected highest in age group >60 years old [36]. One study conducted by Khan CE over three years similar to this study where the rate of detection of positive CT findings was higher in the older age group compared to younger [38]. Another study conducted by Carrera GF presented increasing age to be strongly related to positive CT findings

in patients with a history of chronic headaches [39]. In this study showed 131 out of 200 cases are associated with normal CT scan appearance (65.5%) and 69 out of 200 cases are associated with abnormal CT scan appearance (34.5%), obviously, this study shows negative CT scan preponderance in headache cases underwent to CT scan, and this result is similar to study was conducted at Chitwan medical college [40].

V. Conclusion

Gender group is not correlated with CT findings.

Majority of results for patients with headache underwent to CT scan is negative.

Age groups are significantly correlated with CT findings. Consequently, age groups can be taken into consideration in requesting a CT scan for patients with headache.

Majority of CT abnormal findings were found in the age group above 60 years old.

There is no relationship between CT results and headache associated symptoms.

References

[1]. Macdonald G. Harrison's Internal Medicine, 17th edition. - by A. S. Fauci, D. L. Kasper, D. L. Longo, E. Braunwald, S. L. Hauser, J. L. Jameson and J. Loscalzo. Intern Med J. 2008;38(12):932–932.

[2]. Kavuk I, Yavuz A, Cetindere U, Agelink MW, Diener HC. Epidemiology of chronic daily headache. Eur J Med Res. 2003;8(6):236–40.

[3]. Stovner K, Hagen R, Jensen Z, et al. The global burden of headache: a documentation of headache prevalence and disability worldwide. Cephalalgia. 2007;27 (3):193–210.

[4]. Sandrini G, Friberg L, Coppola G, Jänig W, Jensen R, Kruit M, et al. Neurophysiological tests and neuroimaging procedures in non-acute headache (2nd edition). Eur J Neurol. 2011;18(3):373–81.

[5]. Benamer HTS, Deleu D, Grosset D. Epidemiology of headache in Arab countries. J Headache Pain. 2010;11(1):1–3.

[6]. Almalki ZA, Alzhrani MAG, Altowairqi AT, Aljawi YA, Fallatah SA, Assaedi LM, et al. Prevalence of Migraine Headache in Taif City, Saudi Arabia. J Clin Med Res. 2018;10(2):125–33.

[7]. Frishberg BM. The utility of neuroimaging in the evaluation of headache in patients with normal neurologic examinations.Neurology1994; 44:1191-1197.

[8]. Clinch CR. Evaluation of acute headaches in adults. Am Fam Physician. 2001;63(4):685-92.

[9]. Garvey CJ, Hanlon R. Computed tomography in clinical practice. BMJ: British Medical Journal. 2002;324(7345):1077.

[10]. Headache Classification Subcommittee of the International Headache Society The International Classification of Headache Disorders: 2nd edition. Cephalalgia. 2004;24(Suppl 1):9–160.

[11]. Lannsjö M, Backheden M, Johansson U, af Geijerstam JL, Borg J. Does head CT scan pathology predict outcome after mild traumatic brain injury? Eur J Neurol. 2013;20(1):124–9.

[12]. Kim JJ, Gean AD. Imaging for the Diagnosis and Management of Traumatic Brain Injury. Neurotherapeutics. 2011;8(1):39–53.

[13]. Wildermuth S, Knauth M, Brandt T, Winter R, Sartor K, Hacke W. Role of CT angiography in patient selection for thrombolytic therapy in acute hemispheric stroke. Stroke. 1998;29(5):935–8.

[14]. Wasay M, Kheleani BA, Moolani MK, Zaheer J, Pui M, Hasan S, et al. Brain CT and MRI findings in 100 consecutive patients with intracranial tuberculoma. J Neuroimaging. 2003;13(3):240–7.

[15]. Beithon J, Gallenberg M, Johnson K, Kildahl P, Krenik J, Liebow M, et al. Diagnosis and Treatment of Headache. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2013.

[16]. Evans RW. Diagnostic testing for the evaluation of headaches. Neurol Clin. 1996;14(1):1–26.

[17]. Lipton RB, Stewart WF, Diamond S, Diamond ML, Reed M. Prevalence and burden of migraine in the United States: data from the American Migraine Study II. Headache: The Journal of Head and Face Pain. 2001;41(7):646-57.

[18]. Honkasalo M - L, Kaprio J, Heikkilä K, Sillanpää M, Koskenvuo M. A Population- Based Survey of Headache and Migraine in 22,809 Adults. Headache J Head Face Pain. 1993;33(8):403–12.

[19]. Weingarten S, Kleinman M, Elperin L, Larson EB. The effectiveness of cerebral imaging in the diagnosis of chronic headache. Archives of internal medicine. 1992;152(12):2457-62.

[20]. Diener HC, Katsarava Z, Weimar C. Headache associated with ischemic cerebrovascular disease. Rev Neurol (Paris). 2008;164:819–24.

[21]. Schlake HP, Grotemeyer KH, Husstedt IW, Schuierer G, Brune GG." Symptomatic migraine"; lntracranial lesions mimicking migrainous headache - A report of three cases. Headache. 1991;31:661-665.

[22]. Wong TW, Wong KS, Yu TS, Kay R. Prevalence of migraine and other headaches in Hong Kong. Neuroepidemiol. 1995;14(2):82-91.

[23]. Jordan JE, Ramirez GF, Bradley WG, et al. Economic and Outcomes Assessment of MR Imaging in the Evaluation of Headache. J Natl Med Assoc. 2000;92:573-578.

[24]. Grosskreutz SR, Osborn RE, Sanchez RM. Computed tomography of the brain in the evaluation of the headache patient. Mil Med. 1991;156(3):137-140.

[25]. Larson EB, Omenn GS, Lewis H. Diagnostic evaluation of headache. Impact of computerized tomography and cost-effectiveness. JAMA. 1980;243(4):359-362.

[26]. Sargent JD, Lawson RC, Solbach P, Coyne L. Use of CT scans in an out-patient headache population: An evaluation. Headache. 1979;19:388-390.

[27]. Knaus WA, Wagner DP, Davis DO. CT for headache: cost/ benefit for subarachnoid hemorrhage. AJR. 1981;136:537-542.

[28]. Knaus WA, Davis DO. Utilization and cost-effectiveness of cranial computed tomography at a university hospital. J Cornput Assist Tomogr. 1978;2:209-214.

[29]. Aygun D, Bildik F. Clinical warning criteria in evaluation by computed tomography the secondary neurological headaches in adults. European Journal of Neurology. 2003;10(4):437-42.

[30]. Lateef TM, Grewal M, McClintock W, Chamberlain J, Kaulas H, Nelson KB. Headache in young children in the emergency department: use of computed tomography. Pediatrics. 2009;124(1):e12-17.

[31]. Perkins AT, Ondo W. When to worry about headache; Head pain as a clue to intracranial disease. Postgrad Med 1995;98:197–208.

[32]. Goadsby PJ. To scan or not to scan in headache. Editorial. BMJ 2004; 329: 469–70.

[33]. Report of the Quality Standards Subcommittee of the American Academy of Neurology. Neurology. 1994;44:1353-54.

[34]. Steiner TJ, Fontebasso M. Headache. Clinical review. BMJ 2002; 325: 881-886.
[35]. Dumas MD, Pexman JH, Kreeft JH. Computed tomography evaluation of patients with chronic headache. Can Med Assoc J.1995; 152:158.
[36]. Rawal S, Mukhi S, Subedi S, Maharjan S. Role of Computed Tomography In Evaluation of Patients With History of Chronic Headache. J Univers Coll Med Sci. 2015;3(4):6–9.
[37]. Tsushima Y, Endo K. MR Imaging in the Evaluation of Chronic or Recurrent Headache. Radiology. 2005;235(2):575-79.
[38]. Kahn CE, Sanders GD, Lyons EA, Kostelic JK, MacEwan DW, Gordon WL. Computed tomography for nontraumatic headache: current utilization and cost-effectiveness. Can Assoc Radiol J. 1993 Jun;44(3) 189-193.
[39]. Carrera GF, Gerson DE, Schnur J, McNeil BJ. Computed tomography of the brain in patients with headache or temporal lobe epilepsy: findings and cost-effectiveness. J Comput Assist Tomogr. 1977 Apr;1(2) 200-203.
[40]. Nepal P, Shrestha A, Ghimire N. Evaluation of CT Scan Findings in Patients Presenting with Headache. Journal of Chitwan Medical College. 2014;3(4): 9-12.