Frontal lobe shrinkage: Is it a cause of headache in adults?

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Abstract:

Objective: This study is an attempt to identify if the frequently-found frontal lobe shrinkage on brain computed tomography (CT) scan can be linked as an etiological factor for headache in adults.

Method: Over six years, 487 adult patients (166 males, 321 females), aged between 18-85 years (mean age: 33. 76 years), who complained of headache only (without any associated symptoms or signs) and referred to do brain computed tomography (CT) scan were included. The age, gender and findings on CT images were recorded. Patients were classified according to age into three groups: 1: 18-40 years, 2: 41-60 years, and 3: > 60 years, and according to CT results into also three groups: normal brain CT, frontal lobe shrinkage and global brain atrophy.

Result: Headache is common among female gender with a male to female ratio of 1:2, and among age group 1 (74.7%). 69.2% of patients had normal CT finding, while 27.7% had frontal lobe shrinkage and only 3.1% had global brain atrophy, with no other findings found. Female gender and young adult age group (group 1) also predominated among the three CT finding groups, and among cases with frontal lobe shrinkage (females: 62.2%, age group 1: 68.9%).

Conclusion: Young female patients were more affected by headache, and the finding of frontal lobe shrinkage was frequent among them, strongly raising the possibility of causative association with headache.

Key words : Headache, frontal lobe, computed tomography.

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انكماش الفص الأمامي للدماغ: هل هو سبب للصداع عند البالغين

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الملخص:

الهدف: هذه الدراسة هي محاولة لتحديد ما إذا كان انكماش الفص الأمامي للدماغ الذي يوجد في كثير من الأحيان عند تصوير الدماغ المقطعي يمكن ربطه كعامل مسبب للصداع عدد البالغين.

الطريقة: على مدى ست سنوات، شملت هذه الدراسة 487 مريضا بالغا (166 ذكور، 321 إناث)، تتراوح أعمارهم بين 18–85 عاما (متوسط العمر: 33. 76 عاما)، والذين اشتكوا من صداع خالص (من دون أي أعراض مرتبطة أو علامات اضافية)، و تم عمل تصوير اشعاعي مقطعي لأدمغتهم. تم تسجيل العمر والجنس ونتائج الصور المقطعية، و تم تصنيف المرضى حسب العمر إلى ثلاث مجموعات: 1: 18–40 عاما، 2: 41–60 عاما، و 3: > 60 عاما، ووفقا لنتائج الصور المقطعية الى ثلاث مجموعات أيضا: الدماغ السليم، انكماش الفص الأمامي للدماغ والضمور العام للدماغ.

النتائج: كان الصداع أكثر شيوعا بين الاناث مع نسبة الذكور إلى الإناث 1: 2، وفي الفئة العمرية 1 (74.7٪). نتيجة الصور المقطعية طبيعية في 69.2 ٪ من المرضى ، في حين أن 27.7 ٪ لديهم انكماش في الفص الأمامي للدماغ و3.1٪ لديهم ضمور عام في الدماغ، مع عدم العثور على أية نتائج أخرى. سادت الإناث والفئة العمرية من الشباب البالغين (مجموعة 1) أيضا بين المجموعات الثلاث لنتائج الصور المقطعية، وبين حالات انكماش الفص الأمامي للدماغ (الإناث: 62.2٪، والفئة العمرية 1: 68.9٪).

الخلاصة: الشباب ومتوسطي العمر من النساء هم أكثر المصابين بالصداع، و انكماش الفص الأمامي للدماغ شائع عندهم، وهذا يزيد بشدة من إمكانية وجود علاقة سببية بينه وبين الصداع.

الكلمات المفتاحية: الصداع ، الفص الأمامي ، التصوير المقطعي.

Introduction:

Headache is one of the most common symptoms in the general population,[1] with an annual consultation rate of 4.44 per 100 registered patients.[2] Almost everybody has experienced it, 50–80% of adults from all countries report it as a recurring nuisance.[3] Headache is the most frequent cause of consultation in both primary care and neurological practice, and, on top of this, headache promotes many visits to internists, ENT specialists, ophthalmologists, dentists, psychologists and the proponents of a wide variety of complementary and alternative medical practices.[4]

Headaches are broadly divided into primary and secondary. primary when the headache and associated symptoms are an independent disorder, and secondary when the headache is part of another pathophysiological process.[5] Primary headache disorders –mainly migraine, tension headache and cluster headache - constitute nearly 98% of all headaches.[6] However, secondary headaches –underlying brain lesion like tumors, vascular and inflammatory lesions and other space occupying lesions- are important to recognize as they are serious and may be life threatening. Migraine and tension-type headache accounts for the vast majority of headaches, and tension type accounts for most of the non-migraine headaches encountered in population surveys.[7]

Most previous studies about usage of neuroimaging in patients with headache concluded that screening patients with isolated, nontraumatic headache by means of CT or MR imaging was not warranted. However, for some types of headache or populations at risk, imaging may provide a higher yield.[7] Controversially, the results of Thomas, et al.1 study suggest that open access scanning may give general practitioners more confidence in managing the small minority of patients for whom a normal scan will provide reassurance and prevent secondary referral.

So one would assume that a disorder so highly prevalent, and with known adverse consequences for people and societies, would be considered an important medical problem by the affected people, by health-care providers and by health policy-makers everywhere. Thus, best investigation and recognition of the type of headache and any underlying cause will be of great concern. For that reason, and as frontal lobe shrinkage is frequently found during our daily practice in reading CT done for patients with headache, this study is an attempt to identify if this frequent finding can be linked as an etiological factor for headache in adult population.

Patients And Method :

The study was conducted in Mukalla city-Yemen within a period from January 2010 to December 2015, and included 487 adult patients (166 males, 321 females), aged between 18-85 years (mean age: 33. 76 years), who complained of headache and referred by their doctors to do brain computed tomography (CT) scan.

Inclusion criteria: Only adult patients who had pure headache as an isolated symptom without any associated complaints were involving in the study.

Exclusion criteria: Patients less than 18 years of age (for possible congenital or childhood causes of brain atrophy), and patients who had headache with other associated symptoms or signs, with migraine symptoms and patients who had an explained cause of headache on their CT images (like changes of sinusitis) or on clinical examination basis, were excluded from the study.

This exclusion is done in order to include only patients with primary headache of unknown cause that need investigation for underlying etiology.

Computed tomography scanning (CT) of brain was done according to the routine local protocol. Helical scan of the cranium from base of the skull to the vertex was done with collimation of 5 mm except for posterior fossa where the collimation was 3 mm, and multi-planar reconstruction at 0.6 mm thickness when desirable. Interpretation and evaluation of the CT scan images were done by two qualified radiologists.

Widening of the CSF space of the frontal surface was considered to indicate shrinkage of the frontal lobe.8 Hence, frontal lobe shrinkage was diagnosed when the cerebrospinal fluid space (CSF) between the inner layer of the frontal bone and brain cortical surface was dilated (as a consequence of shrinkage) and measures more than 5 mm in width with dilatation of cortical sulci, while it was normal at other areas of the brain (temporal, parietal and occipital).

For purpose of statistics, patients were classified according to age into three groups: 1: 18-40 years, 2: 41-60 years, and 3: > 60 years, and according to the founded CT results into also three groups: those with normal brain CT, those with frontal lobe shrinkage and those with generalized or global brain atrophy.

We also record any presented CT scan with signs of frontal lobe shrinkage but with another complaint rather than headache, and indeed, no cases founded,

as all cases with frontal lobe shrinkage presented with headache during period of data collection.

All data were analyzed and processed statistically using SPSS 20 and Excel computer programs.

Results:

The male to female ratio of included patients was 1:2 (male: 166, 34.1%, female: 321, 65.9%), and among patients with frontal lobe shrinkage was 1:1.65 (male: 51, 37.8%, female: 84, 62.2%).

The number of patients with normal CT finding was 337 (69.2%): 32.9% males, 67.1% females, while 135 cases (27.7%) had frontal lobe shrinkage: 37.8% males, 62.2% females, and 15 of cases (3.1%) had global brain atrophy: 26.7% males, 73.3% females, as shown in table 1.

Table 1: Patients grouped according to gender and CT findings:

Gender	Finding By CT			Total
	Normal	Frontal lobe shrinkage	Global atrophy	
Male	111	51	4	166
	32.9%	37.8%	26.7%	34.1%
Female	226	84	11	321
	67.1%	62.2%	73.3%	65.9%
Total	**337**	**135**	**15**	**487**
	100.0%	**100.0%**	**100.0%**	**100.0%**

Most patients were at age group 1 (18-40 years, n=364, 74.7%), while 109 (22.4%) in age group 2 (40-60 years), and 14 (2.9%) in age group 3 (60-85 years). Young adult age group (age group 1) also predominated among the three CT finding groups. Frontal lobe shrinkage (see figures 1&2) was found in 135 cases; 93 (68.9%) of them in young adult age group 1, 37 (27.4%) in late adult group 2, and 5 (3.7%) in elderly group 3, while only 15 cases had global brain atrophy; seven (46.7%) in age group 1, 4 (26.7%) in age group 2, and 4 (26.7%) in age group 3. Details was shown in table 2.

Table 2: Distribution of the three CT finding groups according to age groups:

Age Group	Finding By CT			Total
	Normal	Frontal lobe shrinkage	Global atrophy	
18-40	264	93	7	364
	78.3%	68.9%	46.7%	74.7%
41-60	68	37	4	109
	20.2%	27.4%	26.7%	22.4%
61-85	5	5	4	14
	1.5%	3.7%	26.7%	2.9%
Total	**337**	**135**	**15**	**487**
	100.0%	**100.0%**	**100.0%**	**100.0%**

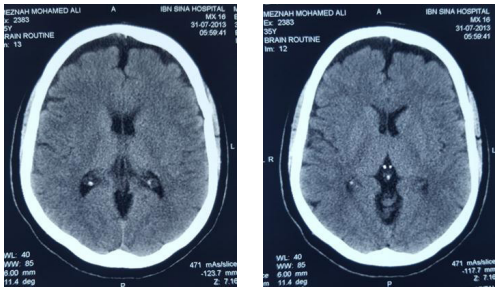

Fig. 1: CT scan images at level of lateral ventricles of a 35 years female patient with headache showed signs of shrinkage at both frontal lobes.

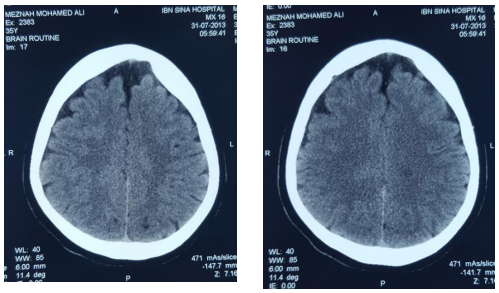

Fig. 2: CT scan images of the same patient in Fig. 1 at higher supraventricular level with clear frontal shrinkage changes.

Discussion:

The major positive outcome derived from neuroimaging in headache is identification of a treatable lesion, the treatment of which will improve the quality of life or improve longevity. In our study, the brain CT scan in all cases either normal or showed frontal lobe shrinkage and in a minority global brain atrophy, and no focal brain lesion detected that can be regarded as a treatable cause. This because we included in the study only cases with pure headache as an isolated symptom, while patients with treatable causes or focal brain lesions usually presents with other symptoms like seizures or focal neurological deficit.[6] So, we can say that all our cases had unknown primary cause of their headache.

Also, the available data indicate a very low rate of intracranial pathology in patients with migraine symptoms and patients with headaches in general when their neurologic examinations are normal.[9,10] So, it was believed that neuroimaging for chronic headache in the absence of focal neurological signs was not recommended. Nevertheless, observational studies indicate that brain scans are widely carried out on patients with normal neurological examinations.[11,12]

Another important outcome of neuroimaging is the relief from anxiety that accompanies the absolute knowledge that a patient does not harbor a brain

tumor or other intracranial disease.

Many patients seek attention for their headaches because they have a real fear that a brain tumor is causing them.10 Patterson et al.13 found in their study that patients who underwent a brain CT examination for atraumatic headache at an initial emergency department (ED) visit were less likely to return to the ED within 30 days. So, we believe that it is desirable to perform non-contrasted CT scan for patients with headache to exclude secondary causes, detect any associated brain findings and relieve patient fear if the CT result is normal.

In addition, health-care providers need better knowledge of how to diagnose and treat the small range of headache disorders that affect large numbers of people, knowledge which will avoid time wastage , improve usage of available treatments and produce better outcomes. For this purpose, several previous studies were done to distinguish the different subtypes of primary headache that had characteristic symptomatology rather than the usual tension type and migraine, like cluster and medication overuse headache types,6 nummular headache 13 and the new daily persistent headache (NDPH) 14 in an attempt to create a special care and treatment schedule for each type.

Other studies were also performed to investigate association of headache with other health conditions, as, for example, Peres et al.15 stated that migraine has been linked to comorbid psychiatric conditions, mainly mood and anxiety disorders, and they also found an association between the new daily persistent headache (NDPH) subtype and anxiety disorders, particularly panic disorder, for which simultaneous treatment of both disorders may lead to good outcomes.

Mild atrophic changes at only frontal lobes of the brain, with normal other lobes (frontal lobe shrinkage) was frequently noticed during our daily practice specially among young people with headache. This was the reason that rise our suspicious of probable causative association. During the six years of data collection, a significant percentage of patients with pure headache was found to have brain frontal lobe shrinkage (more than quarter of cases, 27.7%). Since no other causes detected and no other clinical symptomatology presented favoring other causative mechanism including migraine and other known primary headache subtypes, it can't be easily neglected as a possible contributor factor in the underlying pathophysiology of their headache complaint.

In the other hand, brain atrophy, global or regional, was usually linked with cognitive activity disturbance and behavioral aspects, and linked with some non-Alzheimer's causation.16 Some other studies talked about frontotemporal lobar degeneration or dementia which is another entity produces selective brain atrophy involving both frontal and temporal lobes, that present chiefly as progressive aphasia or as disintegration of personality and behavior that may be misdiagnosed as a psychiatric disorder. 17-19

But unfortunately no information found in the literature signified special effect of isolated frontal lobe shrinkage, or linked it with headache or other presenting complaint, except the study of alcohol consumption effect on frontal lobe shrinkage done by Kubota et al 8, although it was a frequent finding in CT neuroimaging of a cognitively intact adult patients, and noted as a people questions in some online health service sites on the internet without accepted descriptive answer. Absent association with cognitive disturbance may be the reason for which not considered as a significant finding or causative underlying mechanism for a clinical presentation like headache.

From the study, it was clear that females were most commonly affected by headache with near two times more prevalent than males (65.9%). This finding was also shown in other previous studies. For example, Queiroz et al.20 in a population-based study in Brazil concluded that chronic daily headache was 2.4 times more prevalent in women. Furthermore, Ayzenberg et al.21 found prevalent female gender among primary headache disorders in Russia. Ahmed 6 also reported that headache in general was more common in women.

Young adults (18-40 years) were the most common age group seeking medical care for headache in our study (74.7%). This was also found in a study done by Steiner et al. in England,22 and by Radtke and Neuhauser in Germany, 23 who concluded that the prevalence of all headache types was highest in young and middle-aged adults up to age 50 years and declined thereafter.

Finally, frontal lobe shrinkage among young and middle age adults is a real detected finding in neuroimaging of their brains, and its frequency in those patients with headache needs special attention and further research to evaluate their highly possible association.

Conclusion:

In this study, headache was more common among young and middle-aged adults, and more prevalent among female gender with a 2:1 F:M ratio. Despite large number of normal brain CT findings among patients with headache, frontal lobe shrinkage was a frequent finding (27.7%), especially in young adult age group and female patients, where it constituted around two thirds of cases in these two groups. This finding raised the possibility of causative association between frontal lobe shrinkage and headache, which needs further wide studies and thorough investigation to evaluate this hypothesis.

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