

Utility of computed tomography of brain and limited paranasal sinuses scanning in patients with headache

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Abstract

Background: Headache is the most frequent illness suffered by human beings and affects wide range of population with a variety of etiology. The primary headache disorders which include migraine, cluster and tension-type headaches, account for the majority of headaches, while secondary headaches which are those with underlying pathology (e.g. tumour) are far less common. **Methodology:** In this prospective study, 200 cases with primary complaint as headache undergoing Computed Tomography of the brain and limited paranasal sinus CT scan were included. Results were tabulated and analyzed for the diagnostic yield from imaging. **Results:** The most common symptom for referral to CT brain was isolated headache followed by headache with vomiting. Significant abnormality was detected in 22 subjects, 13 due to intracranial pathology and 9 due to paranasal sinus disease. Among these 22 positive cases, 6 are space occupying lesions, 2 acute infarcts, 1 subarachnoid hemorrhage, 4 cortical vein thrombosis and 9 had sinusitis. **Conclusion:** Computed tomography is a useful screening modality in evaluating patients with headache.

Key Words: Headache, Computed Tomography, Migraine, Cluster And Tension-Type Headaches, Para Nasal Sinus.

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INTRODUCTION

Headache is the most frequent suffered illness by human beings. As much as 90 percent of individuals have at least one episode of headache each year and severe headache is reported to occur at least annually in 40 percent of the population.¹ It is responsible for 4 percent of all visits to hospitals and causes a loss of 150 million work days per year in the United States. There are at least two reasons that make the patient consult a physician for headache. One being the patient is afraid of having an intracranial

lesion such as a brain tumor or aneurysm and the other because the pain is severe enough to negatively influence her or his quality of life. Headache is a common disorder with many potential causes. The primary headache disorders which include migraine, cluster and tension-type headaches, account for the majority of headaches, while secondary headaches which are those with underlying pathology (e.g., tumour or aneurysm) are far less common.² Most patients presenting with headache in the primary care setting do not have serious underlying conditions.^{3,4} The relative rarity of secondary headaches compared with the large number of patients with primary headache raises concerns about the wisdom of routine neuroimaging studies like computed tomography (CT) to exclude underlying causes of headache. While detection of significant and treatable lesions that impact quality of life remains the primary reason to obtain a neuroimaging study, there are other important considerations. Neuroimaging may relieve the patient's anxiety about having an underlying pathologic condition; therefore improving overall patient satisfaction and medical care. Other reasons for obtaining a neuroimaging study in

patients with headache include litigation concerns and at the patient's or the family's request.^{3,4} Approximately 18 percent of all patients referred for a cranial computed tomography complain of headache only. The primary medical concern when a patient presents with headache is intracranial pathology. Etiology of the headache in these patients may be attributed to intracranial causes like meningitis, space occupying lesions etc. or may be due to paranasal sinus abnormalities like sinusitis, mucocoele and deviated nasal septum with nasal spur. The increasing availability of computed tomography has fueled enthusiasm for its use to rule out brain tumors and other serious neurological conditions in patient who complain of headache. The high prevalence of headache and low yield from imaging in patients with headache alone bring into the question of screening. However there are clinical features that influence the yield of positive imaging examination. Numerous studies have helped to identify the clinical symptoms and signs, those when associated with headache appear to be useful predictors of positive imaging evaluation and justifying neuroimaging.

MATERIAL AND METHODS

The study includes 200 cases with primary complaints of headache undergoing computed tomography of the brain and limited paranasal sinus CT imaging (with or without intravenous contrast). The study was done using a SIEMENS Somatom emotion duo dual slice spiral CT scanner (Siemens Medical Systems, Germany) and Toshiba Asteion single slice spiral CT scanner (Toshiba Medical Systems Corporation, Japan). Computed tomography of the brain and limited paranasal sinus was performed with the patient in supine position and the plane of the scan taken parallel to the orbito-meatal plane at 10-25 degrees to Reid's line. The limited PNS sections were acquired with the plane of section parallel to the Reid's line. Serial sections were taken with 4 mm slices supratentorially, 2.5 mm slices in the posterior fossa and 5 mm through the paranasal sinuses. Intravenous iodinated contrast media was used for contrast study of the brain in selected patients with an average dose of 25 cc. Detailed clinical history of the patients were taken with respect to the duration and severity of headache (subjective), diffuse / focal, sudden or insidious onset, presence of nausea and vomiting, photophobia / blurring of vision / red eye, neurological deficit, running nose, fever etc. Associated systemic illness like hypertension, known extra CNS malignancies etc were taken. The

results were tabulated. The statistical analysis was then done for the diagnostic yield from imaging in patients with only headache, headache with associated symptoms like nausea, vomiting, vision abnormality. Analysis of continuous variables like gender, analysis of diagnostic yield from imaging in patients with migraine, tension headache, chronic daily headache and diagnostic yield in patients with known systemic illness were done.

Inclusion Criteria: All patients (male and female) aged more than 12 years with headache (acute or chronic) with or without other neurological signs and symptoms.

Exclusion Criteria

1. Headache due to ophthalmic cause.
2. With immediate history of trauma.
3. Known case of brain tumors or space occupying lesion in the brain.
4. Pregnant women with headache.

RESULTS

The most number of patients with headache were seen in the younger age group i.e. less than 39 years. Significant abnormality on imaging was seen in the older age group i.e. more than 50 years. There was no significant gender difference in detecting abnormality on imaging. Most common reason for referral for neuroimaging was only headache without any associated symptoms. The yield from imaging in patients with only headache was low. Significant number of patients presenting with headache had etiology attributed to both the paranasal sinus causes and intracranial causes. Thus additional acquisition of limited paranasal sinus along with brain increases yield with cost reduction and facilitation of better management of patient. The probability of identifying an abnormality on imaging was high in patients with sudden onset of headache, severe in nature, associated with vomiting, blurring of vision, fever and running nose. Presence of systemic illness eg-known malignancy with sudden onset of headache increase the yield. The probability of finding an abnormality on imaging is low in patients presenting with only headache, headache with nausea, in primary type of headache like tension headache and chronic daily headache. Utility of imaging in patients with migraine is high when the patient has sudden change in the character of headache, change in severity associated with neurological symptoms. Screening in headache with CT not only helps in identifying an abnormality but also helps to rule out structural causes for headache thereby reducing patient apprehension.

Table 1: Age distribution.

Age distribution	<19	20-29	30-39	40-49	50-59	60-69	>70	Total
Number of patients	26	52	47	33	20	17	5	200
Percent	13.0	26.0	23.5	16.5	10.0	8.5	2.5	100.0

Table 2: Distribution of duration of headache

Duration of headache	Number of patients	Percentage
< 1 month	51	25.5
1-3 months	29	14.5
3-6 months	49	24.5
>6 months	71	35.5
Total	200	100

Table 3: Distribution of nature of headache with or without abnormality on imaging

Abnormality on imaging	Diffuse n (%)	Focal n (%)	Total n (%)
Present	16 (9.7)	6 (16.7)	22(11)
Absent	148 (90.2)	30 (83.3)	178 (89)
Total	164 (100)	36(100)	200

Table 4: Frequency of distribution of abnormalities detected on imaging

Abnormality detected on CT	Frequency (200)	Percent (%)
Infarct	2 (200)	1.0
Cortical vein thrombosis	4(200)	2.0
SAH	1(200)	0.5
Space occupying lesion	6(200)	3.0
Sinusitis	9(200)	4.5
Total abnormality	22(200)	11
Normal CT study	178 (200)	89
Total	200 (200)	100

Table 5: Distribution of type of headache with rate of detecting abnormality on imaging

CT abnormality	TTH	Migraine	CDH	Sinusitis	Meningitis	Others	Total
Present	0	1	1	4	0	16	22
Absent	3	10	37	4	2	122	178
Total	3	11	38	8	2	138	200

DISCUSSION

Two hundred patients undergoing computed tomography of the brain study presenting with a primary complaint of headache were included in this study. Of these 200 patients, contrast enhanced CT (CECT) was done in 8 patients and for rest of the patients only plain CT of the brain was done. All patients had a limited study of the paranasal sinuses. A detailed clinical history of these patients was taken prior to including them in the study and included a history of the nature of the headache, onset (sudden or insidious), duration, associated symptoms like nausea, vomiting, blurring of vision, photophobia, fever, running nose, neurological deficits or any systemic illness. Those patients with known refractory error of the eye were not included in the study. Of the 8 patients assessed with a CECT study, one had meningitis, two patients had metastases and two patients had cortical vein thrombosis. The median age of the patients was 35 years with the most number of patients in the age group of 21 to 29 years (26%). The group with the next most number of patients was in the age group of 30 to 39 years (23.5 %). The total age range of patients was from 12 years to 84 years with the least number of patients above the age of 70 years. Significant abnormality was detected on

imaging in the age group 50-59 years (20 %), followed by 60-69 years (17.6 %). Imaging findings were least in the age group of less than 19 years. These findings were similar to earlier studies which showed increasing age to be strongly associated with significant abnormality.^{5,6} Duration of headache varied from 2 days to 84 months with median duration being 6 months. The maximum number of the patients had a duration of headache of more than six months i.e. 71 patients (35.5 %) followed by less than one month (25.5 %). Significant abnormality was detected on imaging in patients with duration of headache less than one month i.e 15 patients out of 51 and least in patients with headache duration of more than 6 months i.e 2 patients out of 71. The findings were similar to the study conducted by Evans RW *et al*, where significant abnormality was detected in patients with recent onset of headache.^{7,8,9} In this study 2 patients had acute infarct on imaging and both the patients had a risk factor for ischemic insult to the brain. One was a case of rheumatic heart disease and the other was a patient with migraine. Both the patients had sudden onset of severe headache with vomiting and blurring of vision. In this study, 4 patients had cortical vein thrombosis. All these patients had acute onset of severe headache associated

with vomiting. Blurring of vision was seen in one patient. Superior sagittal sinus thrombosis was seen in 2 patients, 1 patient had transverse sinus thrombosis and 1 had combined transverse sinus and straight sinus thrombosis. None of the patients had parenchymal changes on imaging. Among the 22 patients with abnormality on imaging, 13 had intracranial abnormality as the cause for headache and 9 patients had sinusitis as the cause for headache. Among 9 patients with sinusitis, deviation of the nasal septum with sinusitis was seen in 4 patients. Overall, deviation of nasal septum was seen in 26 patients (13%). Among the 9 patients with sinusitis, 5 patients had acute onset of headache following runny nose and fever. Two patients had bilateral maxillary sinusitis, two had bilateral maxillary and ethmoid sinusitis, and one had bilateral sphenoid sinusitis, one bilateral ethmoid and sphenoid sinusitis, one right frontal, one fronto-ethmoid and one pansinusitis. The patient with sphenoid sinusitis had chronic on and off headache without any symptoms to suggest sinusitis on clinical evaluation. Sphenoid sinusitis is one of the commonly clinically missed sinusitis, often patients come with chronic headache. It is often missed on plain radiograph. Imaging plays an important role in these patients to identify the cause for headache. Since most of the sinus headache have clinical feature suggestive of either intracranial or paranasal abnormality, cross sectional imaging modality is the choice to differentiate sinus headache from intracranial cause of headache in difficult situations. Acquisition of limited PNS sections along with the CT brain increases the yield as seen in this study. Other advantages of acquiring limited PNS sections are to differentiate paranasal sinus cause of headache from intracranial causes and reduce the cost arising from dedicated CT PNS imaging. The yield of CT brain and limited paranasal sinus imaging together was 22 (11%) were as CT brain alone would have been 13 (6.5%). Other incidental findings of limited paranasal sinus imaging in this study are presence of polyps / retention cysts. Maxillary sinus was the most common site for polyp / retention cyst formation. Similar to the earlier studies, many of the patients in this study were apprehensive with fear of having abnormality in the brain. In these patients CT helps to rule any organic cause for headache thereby reducing the patient apprehension. On comparison with MRI as screening modality, availability of MRI machine, the cost of imaging, time of acquisition make CT the initial and preferred screening modality in patient with

headache. Perceived disadvantages of CT as screening modality will be in the evaluation of sellar and parasellar causes of headache, posterior fossa lesions, characterization of lesions and radiation exposure.

CONCLUSION

- CT brain is a useful screening modality in evaluating patients with headache either to identify or to rule out structural abnormality.
- Additional acquisition of limited PNS sections increases the yield from imaging, reduces the cost from dedicated PNS imaging and helps to differentiate paranasal sinus cause of headache from intracranial cause.
- Diagnostic yield from CT is better in patients with severe headache or headache of sudden onset or headache associated with vomiting, fever, runny nose or neurological deficits.

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