Original Article

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Computed Tomographic Assessment of Brain and Limited Paranasal Sinuses Study in Subjects with Headache at Bhuj, Kutch

Rajnikant Narsinhbhai Chauhan

Assistant Professor, Department of Radiology, Gujarat Adani Institute of Medical Sciences, Bhuj, Kutch, Gujarat, India.

Abstract

Background: Recent advances in Commuted Tomography (CT) and magnetic resonance imaging (MRI) methods have increased the importance of imaging examinations in the assessment of abnormalities affecting the head and neck. Present study was done with an aim to assess the utility of CT of the brain in the identification of causative factors for headache. To determine the additional value of acquiring limited paranasal sinus images after evaluation of the brain in patients with headache. **Subjects and Methods:** This is a prospective study done in 150 cases with a primary complaint as headache undergoing Computed Tomography of the brain and limited paranasal sinus CT scan in Department of Radiodiagnosis at Gujarat Adani Institute of Medical Science, Bhuj, Kutch, Gujarat during the period from July 2020 to December 2020. **Results:** Of the 150 patients studied, 71 patients were males and 79 patients were females. Among the 71 male patients studied significant abnormality was detected on imaging in 9 male patients. Imaging findings were normal in 132 cases of the study population and significant abnormality was detected in 18 cases. Among the 18 patients with abnormality on imaging, 10 had intracranial abnormality as the cause for headache and 8 patients had sinusitis as the cause for headache. Among the 8 patients with sinusitis, 4 patients had acute onset of headache following runny nose and fever. **Conclusion:** 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. 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 the intracranial cause. CT is very accurate and sensitive in diagnosis and characterization of various abnormalities affecting the nasal cavity and PNS.

Keywords: Commuted Tomography, Headache, Imaging, Paranasal Sinus.

Corresponding Author: Rajnikant Narsinhbhai Chauhan, Assistant Professor, Department of Radiology, Gujarat Adani Institute of Medical Sciences, Bhuj, Kutch, Gujarat, India.

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Introduction

Headache is the most frequently 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] The two reasons that make a patient with a headache consult a physician are one in case of severe pain which is enough to negatively influence her or his quality of life and second is being afraid of having an intracranial lesion such as a brain tumor or aneurysm. Distinctions between different types of headaches carry diagnostic and therapeutic implications. Clinical distinction between primary or secondary headaches is decided by factors such as headache characteristics, patients medical history and neurologic examination. A complete neurologic examination is the first step in evaluation of headache and patients with abnormal examination or history of recent onset headaches should be evaluated with CT or MRI brain study. Vast majority of patients presenting with a headache usually have primary headache.[2,3] Since primary headache disorders do not result from structural brain abnormalities, head CT or brain MRI is unlikely to be helpful for patients with true primary headaches. In a Canadian study investigating the use of CT scans for patients with headache, patient expectations or medicolegal concerns were cited as the primary reason for ordering the scan in 17% of patients. Most of this cohort (85%) had no neurological abnormalities. In 49% of these patients, the referring physician suspected an intracranial tumor.

Recent advances in CT and magnetic resonance imaging (MRI) methods have increased the importance of imaging examinations in the assessment of abnormalities affecting the head and neck.[4–8] Recently, CT was the main imaging modality to assess lesions in the nasal cavity and paranasal sinuses (PNS). It is the investigation of choice for proper treatment and relevant preoperative evaluation of the nasal

cavity and PNS diseases. It is considered the gold standard for differential diagnosis between inflammatory PNS pathologies and neoplasms.[9]

Numerous sinonasal anatomic variants exist and are frequently seen on sinus CT scans. The most common ones are Agger nasi cells (AN), infraorbital ethmoidal Haller cells (HC), sphenoethmoidal Onodi cells (OC), deviated nasal septum (DNS) and concha bullosa (CB).[10–12] A sound knowledge of these variations is important not only for diagnosis but also for planning surgery in order to avoid damage to surrounding vital structures like the orbit and the brain.

Headaches resulting from disease of the nose or paranasal sinuses are usually associated with symptoms that point to the site of origin. Occasionally, however, nasal or sinus disease can be manifested solely as headache. In that circumstance, computed tomography (CT) scan of the sinuses may demonstrate an abnormality or disease of the nose or paranasal sinus.[13] Paranasal sinus causes of headache includes sinusitis (acute or chronic, bacterial or fungal), mucoceles, paranasal neoplasms. Whether or not nasal obstruction can lead to chronic headache is controversial. Paradoxically, sinus disease also tends to be under diagnosed, as sphenoid sinus infection frequently is missed.[14]

Present study was done with an aim to assess the utility of CT of the brain in the identification of causative factors for headache. To determine the additional value of acquiring limited paranasal sinus images after evaluation of the brain in patients with headache.

Subjects and Methods

This is a prospective study done in 150 cases with a primary complaint as headache undergoing Computed Tomography of the brain and limited paranasal sinus CT scan in Department of Radiodiagnosis at Gujarat Adani Institute of Medical Science, Bhuj, Kutch, Gujarat during the period from July 2020 to December 2020.

Exclusion Criteria: Headache due to ophthalmic cause, with the immediate history of trauma, known case of brain tumors or space-occupying lesion in the brain, and pregnant women with a headache.

Computed tomography of the brain and limited paranasal sinus was performed with the patient in the supine position and the plane of the scan was taken parallel to the orbital-meatal plane at 10-25 degrees to Reid's line. The limited PNS sections were acquired with the plane of section parallel to Reid's line. Serial sections were taken with 4 mm slices supratentorial, 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 ml. Detailed clinical history of the patients were taken concerning 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 illnesses 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 the 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 was done.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

Of these 150 patients studied, contrast enhanced CT (CECT) was done only in 6 patients and only plain CT of the brain was done for the rest of the patients. 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, duration, associated symptoms like nausea, vomiting, blurring of vision, photophobia, fever, running nose, neurological deficits or any systemic illness. Of the 6 patients assessed with a CECT study, one had meningitis, one patient had metastases and two patients had cortical vein thrombosis. The age of the patients studied ranged from 11 years to 85 years. The patients involved in the study were divided into 7 age groups: less than 20, 21- 30, 31-40, 41-50, 51-60, 61-70 and greater than 70 years. There were 17 patients in the less than 20 years of age group, 45 patients in the 21-30 years age group, 39 patients in the 31-40 years age group, 24 patients in the 41-50 years age group, 12 patients in the 51-60 years age group, 10 patients in the 61-70 years age group and 3 patients in the greater than 70 years age group. Imaging findings were least in the age group of less than 20 years. Of the 150 patients studied, 71 patients were males and 79 patients were females. Among the 71 male patients studied significant abnormality was detected on imaging in 9 male patients. Significant abnormality was detected on imaging in only 8. The maximum number of the patients had a headache with duration of more than six months. Headache without any associated symptoms or neurological deficit was the main reason for referral of patients for neuroimaging followed by headache with vomiting. Among the study group

Table 1: Frequency of distribution of abnormalities detected on imaging

Abnormality detected on CT	Number	Percentage (%)
Infarct	1	0.66
Cortical vein thrombosis	3	2
SAH	1	0.66
Space occupying lesion	5	3.33
Sinusitis	8	5.33
Total abnormality	18	12
Normal CT study	132	88

of 150 patients, 8 patients had migraine, 2 patients had tension headache, 33 patients had chronic daily headache, 6 patients had headache due to sinusitis, 2 patients had headache due to meningitis and in rest of the cases the headache did not fit into any of the diagnostic criteria and are labelled as others. No abnormality was detected in patients with tension type of headache.. Imaging findings were normal in 132 cases of the study population and significant abnormality was detected in 18 cases. Among the 18 patients with abnormality on imaging, 10 had intracranial abnormality as the cause for headache and 8 patients had sinusitis as the cause for headache. Among the 8 patients with sinusitis, 4 patients had acute onset of headache following runny nose and fever. Two patients had bilateral maxillary sinusitis, one had bilateral maxillary and ethmoid sinusitis, one had bilateral sphenoid sinusitis, one bilateral ethmoid and sphenoid sinusitis, one right frontal, one fronto-ethmoid and one pansinusitis. Among the 150 patients in the study group, 104 patients had diffuse headache with abnormality detected in 11 and 27 had focal headache with abnormality detected in 4. Significant abnormality in the brain CT was seen in 3 cases; 1 patient had acute infarct, 1 had metastasis to the cerebellum and 3 cortical vein thrombosis. [Table 1] Headache with nausea had positive likelihood ratio 0.71. Headache with vomiting was seen in 31 patients and 8 of these patients showed significant abnormality on imaging. Headache with fever was seen in 11 patients. Of these patients 3 had sinusitis on imaging with an odds ratio of 3.2. Severe headache was seen in 11 patients. No grading scale was used for grading the degree of headache and it was purely subjective. Of these 11 patients, 5 had abnormality on imaging with odds ratio of 6.3. Systemic illness was present in 16 patients, most of them being hypertensive. Of these, significant abnormality was seen in 3. SAH was seen in one patient who had come with a history of sudden onset of severe headache and accelerated hypertension, two known cases of carcinoma of cervix had posterior fossa metastasis, one known case of chronic myeloid leukemia had subdural deposits and one known case of rheumatic heart disease with heart valve replacement had multiple acute infarcts. In this study, 3 patients had cortical vein thrombosis. 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. 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.

Discussion

Recently CT has become the best diagnostic modality for evaluation of nasal cavity, paranasal sinuses, and for demonstrating various sinonasal diseases.[15,16] Among the 150 patients studied, most number of patients with headache belonged to the younger age group of 31 to 40 years These findings were similar to studies done by Carrerra G. F et al,[17] and Aygun D et al,[18] which showed increasing age to be strongly associated with a significant abnormality. These epidemiological data were similar to previous studies conducted in Saudi patients.[16,19]

Most common reason for referral for neuroimaing was only headache without any associated symptoms. Significant abnormality was detected on imaging in patients with a duration of headache less than one month.These findings were in concordance to the study conducted by Ewans RW et al.[20] where the significant abnormality was detected in patients with recent onset of headache .In our study a significant abnormality were noted in 18 patients, where 5 showed a space-occupying lesion in the brain (intra or extra-axial), 1 had acute infarcts, 1 had a subarachnoid hemorrhage, 3 had cortical venous thrombosis and 8 had sinusitis. The prevalence of space-occupying lesions in the brain was similar to the study conducted by Sherf M et al,[21]Headache without any associated symptoms or neurological deficit was the main reason for referral of patients for neuroimaging followed by headache with vomiting. These observations was similar to the study conducted by Sherf M et al,[21] to evaluate the indications and results for brain CT by primary care physians.

Among the 150 patients in the study group, 104 patients had diffuse headache with abnormality detected in 11 and 27 had

focal headache with abnormality detected in 4., the headache did not fit into any of the diagnostic criteria and are labeled as others. The yield from imaging in primary type of headache is low, which is similar to the study conducted by Evans RW et al,[20] in other studies done by Sharma et al (68%) and Yadav et al (68%) in Nepal but was quite high as compared to those done by Maru et al and Dua et al in India.[22–25] Geographic variation might be the cause for high prevalence in our study. In yet another study from Nepal, Badhu et al have found DNS in 55 % of patients with associated nasal diseases.[26] No grading scale was used for grading the degree of headache and it was purely subjective.

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. Patel et al evaluated the role of CT in the characterization of non-neoplastic PNS diseases and reported that CT has 100% sensitivity and specificity in detecting the PNS diseases correctly.[27]

In comparison with MRI as a screening modality, availability of MRI machine, the cost of imaging, time of acquisition make CT the initial and preferred screening modality in a 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

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. 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 the intracranial cause. CT is very accurate and sensitive in diagnosis and characterization of various abnormalities affecting the nasal cavity and PNS. Proper knowledge of both common and uncommon sinonasal variations in community could help in better surgical planning and overall management of sinonasal disorders.

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