EFFICIENCY OF COMPUTED BRAIN TOMOGRAPHY AND MINIMAL PARA-NASAL SINUS SCANNING IN PATIENTS WITH HEADACHE

Dr. Rajesh Kumar Paswan

Associate Professor Dept. of Radio-diagnosis Maharshi Vashisht Autonomous State Medical College Basti OPEC Hospital Kaili Basti

Article Info: Received 23 November 2020; Accepted 22 December 2020

DOI: <https://doi.org/10.32553/ijmbs.v4i12.1591>

Corresponding author: Dr. Rajesh Kumar Paswan

Conflict of interest: No conflict of interest.

Abstract

Background: Headache is the most common human condition and affects a wide range of populations with a number of etiologies. The majority of headaches are accounted for by main headache disorders that involve migraine, cluster and tension-type headaches, whereas secondary headaches are much less common than those with underlying disease (e.g. tumour).

Aims & objectives: To assess the Utility of computed tomography of brain and limited para-nasal sinuses scanning in patients with headache.

Methodology: This prospective research included 400 cases of primary headache symptoms undergoing computed brain tomography and minimal para-nasal sinus CT scans. For the diagnostic yield from imaging, findings were tabulated and analysed.

Results: Isolated headache, accompanied by headache with vomiting, was the most common symptom of referral to CT brain. In 44 subjects, 26 due to intracranial pathology and 18 due to para-nasal sinus disease, a severe abnormality was found. Of the 44 positive cases, 12 were lesions occupying room, 4 vaccine infarctions, 2 subarachnoid haemorrhages, 8 cortical vein thrombosis, and 18 had sinusitis.

Conclusion: Computed tomography is a useful screening tool in the assessment of headache patients.

Keywords: Headache, Computed Tomography, Migraine, Para Nasal Sinus.

Introduction:

Headache is the condition endured most commonly by human beings. Every year, as many as 90 % of people have at least one episode of headache and in 40 percent of the population, serious headache is recorded to occur at least annually. It is responsible for 4% of all hospital visits and causes a deficit in the United States of 150 million working days each year. There are at least two reasons for the headache doctor to be seen by the patient^{1,2}. One is because the patient is afraid of getting an intracranial lesion, such as a brain tumour or aneurysm, and the other is afraid of having an intracranial lesion, since the pain is extreme enough to adversely affect her or his quality of life. Headache, with several possible causes, is a common condition. Many headaches are accounted for by main headache conditions that involve migraine; cluster and anxiety type headaches, whereas secondary headaches that are those with underlying pathology (e.g. tumour or aneurysm) are far less common³. Most headache patients do not have severe underlying problems in the primary care setting. Compared with the vast number of primary headache patients, the relative rarity of secondary headaches poses questions about the wisdom of regular neuro-imaging tests such as computed tomography (CT) to eliminate underlying causes of headache. Although the primary reason for obtaining a neuro-imaging study remains the identification of serious and treatable lesions that influence the quality of life, there are other essential

considerations⁴. Neuro-imaging will alleviate the discomfort of the patient regarding an underlying pathological disorder, thus improving overall patient satisfaction and medical treatment. Other factors for obtaining a neuro-imaging analysis in headache patients include litigation issues and at the request of the patient or the family⁵. Around 18% of all patients referred for cranial computed tomography do have headache problems. Intracranial pathology is the main medical problem when a patient has a headache. Headache aetiology in these patients can be related to intracranial causes such as meningitis, lesions occupying space, etc., or may be due to para-nasal sinus anomalies such as sinusitis, mucocoele and nasal spur deviated nasal septum. The growing availability of computed tomography has fuelled excitement for the use of computed tomography to rule out brain tumours and other severe neurological disorders in patients with headache complaints. In headache patients alone, the high prevalence of headache and low imaging yield contribute to the issue of screening. Nevertheless, there are clinical characteristics that impair the performance of positive imaging analysis. Numerous studies have helped to define the clinical symptoms and signs, which tend to be useful predictors of positive imaging assessment and explain neuro-imaging when combined with headache⁶.

Aims & objectives: To assess the Utility of computed tomography of brain and limited para-nasal sinuses scanning in patients with headache.

Material and Methods

The research covers 400 cases of primary headache symptoms undergoing computed brain tomography and minimal para-nasal sinus CT imaging (with or without intravenous contrast) over a 3-year period at a tertiary health centre. The research was conducted using a dual slice spiral CT scanner from SIEMENS Somatom emotion duo (Siemens Medical Systems, Germany) and a single slice spiral CT scanner from Toshiba Asteion (Toshiba Medical Systems Corporation, Japan). Computed tomography of the brain and minimal para-nasal sinus was performed at 10-25 degrees to the Reid line with the patient in the supine position and the scan plane taken parallel to the orbito-meatal plane. With the sectional plane parallel to the Reid axis, the limited PNS sections were acquired. Serial sections were taken supratentorially with 4 mm slices, in the posterior fossa with 2.5 mm slices and through the para-nasal sinuses with 5 mm. For a contrast analysis of the brain in selected patients with a mean dose of 25 cc, intravenous iodinated contrast media was used. For the period and severity of headache (subjective), diffuse / focal, abrupt or insidious onset, occurrence of nausea and vomiting, photophobia / blurred vision / red eye, neurological impairment, runny nose, fever, etc., the full clinical history of the patients was taken. There have been related systemic illnesses such as hypertension, known additional CNS malignancies, etc. It tabulated the findings. In patients with just headache, headache with related symptoms such as nausea, vomiting, vision abnormality, the statistical analysis was then performed for the diagnostic yield from imaging. Continuous variables such as gender, diagnostic yield analysis from imaging in patients with migraine, tension headache, chronic daily headache, and diagnostic yield were analysed in patients with documented systemic disease.

Inclusion Criteria: Both patients (male and female) over 12 years of age with (acute or chronic) headache, with or without other signs and symptoms of neurology.

Exclusion Criteria: Headache due to ophthalmic origin, with immediate trauma history, reported case of brain tumour or space-occupying brain injury & headache in pregnant women.

Results

In the younger age group, i.e. less than 40 years of age, the majority of headache patients were seen. In the older age group, i.e. more than 50 years, major imaging abnormality was seen. There was no substantial difference in gender in the identification of imaging anomalies. Just headaches with no associated symptoms were the most common reason for referral for neuro-imaging. The imaging quality was poor in headache-only patients. The aetiology attributed to both the causes of the para-nasal sinus and intracranial causes was important in the number of patients presenting with headache. Therefore, additional acquisition of restricted para-nasal sinus along with brain increases yield with cost reduction and enhanced patient management facilitation. In patients with sudden onset of headache, extreme in nature, combined with vomiting, blurred vision, fever and runny nose, the likelihood of detecting an abnormality on imaging was high. The presence of systemic disease with sudden onset of headache, eg-known malignancy, increases the yield. In patients with just headache, headache with nausea, main forms of headache such as stress headache and chronic regular headache, the likelihood of detecting an abnormality on imaging is low. The utility of imaging in migraine patients is strong because there is a drastic improvement in the essence of the patient's headache, a change in severity associated with neurological symptoms. In addition to helping to detect an abnormality, headache screening with CT also helps to rule out structural causes of headache, thus reducing patient apprehension.

Table 1: Age distribution

Age distribution	<20	21-30	31-40	41-50	51-60	61-70	>70	Total
Number of patients	52	104	94	66	40	34	10	400
Percent	13	26	23.5	16.5	10	8.5	2.5	100

Table 2: Distribution of duration of headache

Duration of headache	Number of patients	Percentage
< 1 month	102	25.5
1-3 months	58	14.5
3-6 months	98	24.5
>6 months	142	35.5
Total	400	100

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

Abnormality on imaging	Diffuse n (%)	Focal n (%)	Total n (%)
Present	32 (9.7)	12 (16.7)	44 (11)
Absent	296 (90.2)	60 (83.3)	356 (89)
Total	328 (100)	72 (100)	400

Table 4: Frequency of distribution of abnormalities detected on imaging

Abnormality detected on CT	Frequency (400)	Percent (%)
Infarct	4	1
Cortical vein thrombosis	8	2
SAH	2	0.5
Space occupying lesion	12	3
Sinusitis	18	4.5
Total abnormality	44	11
Normal CT study	356	89
Total	400	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	2	2	8	0	32	44
Absent	6	20	74	8	4	244	356
Total	6	22	76	16	4	276	400

Discussion

Four hundred patients undertaking a computed brain tomography trial with a primary headache issue were included in this study. In 16 of these 400 patients, contrast enhanced CT (CECT) was performed, and only plain brain CT was performed for the rest of the patients. A small examination of the para-nasal sinuses was performed in all patients. Before including them in the study, a comprehensive clinical history of these patients was taken which included a history of the origin of the headache, onset (sudden or insidious), length, related symptoms such as nausea, vomiting, blurred vision, photophobia, fever, runny nose, neurological defects, or any systemic disease. The research did not involve any patients with known eye refractory errors. Of the 16 patients tested in the CECT trial, 2 had meningitis, 4 had metastasis, and 4 had thrombosis of the cortical vein. The median age of the patients was 35 years, with the largest number of patients in the 21-30 age group (26%). The community with the next largest number of patients was between 31 and 40 years of age (23.5 percent). The average age range of patients was between 12 years and 84 years, with the lowest number of patients over 70 years of age. In the age group of 51-60 years (20 percent), major abnormality was observed on imaging, followed by 61-70 years (17.6 percent). Imaging results were lowest in the age group below 20 years of age. These results were comparable to previous studies that found that rising age was strongly correlated with major abnormalities. The headache duration ranged from 2 days to 84 months, with a median duration of 6 months. The headache length of the highest number of patients was more than six months, i.e. 142 patients (35.5%) followed by less than one month (25.5%). Major image anomalies have been observed in patients with a headache period of less than one month, i.e. 30 out of 102 patients and less in patients with a headache duration of more than 6 months, i.e. 4 out of 142 patients. The results were similar to the research performed by Evans RW *et al.*, in which major anomalies were found

in patients with a recent incidence of headache. 4 patients had acute imaging infarction in this study, and both patients had a risk factor for ischaemic brain insult. Rheumatic heart disease was documented in two cases and migraine in the other two. Sudden onset of extreme headache with vomiting and blurred vision occurred in both of those patients. 8 patients had cortical vein thrombosis in this study. Many of these patients have an acute onset of serious vomiting-related headache. Vision blurring was found in two patients. There were 4 patients with superior sagittal sinus thrombosis, 2 patients with transverse sinus thrombosis and 2 with mixed transverse sinus and straight sinus thrombosis. None of the patients had image-based parenchymal shifts. Among the 44 patients with imaging abnormality, 26 had headache-related intracranial abnormality and 18 had sinusitis as the cause of headache. Nasal septum deviation with sinusitis was found in 8 patients out of 18 patients with sinusitis. Overall, nasal septum deviation (13 percent) was seen in 52 patients. Of the 18 sinusitis patients, 10 had an acute onset of headache following a runny nose and fever. There were four patients with bilateral maxillary sinusitis, four patients with bilateral maxillary and ethmoid sinusitis, and two patients with bilateral sphenoid sinusitis, two patients with bilateral ethmoid and sphenoid sinusitis, two patients with right frontal, two patients with fronto-ethmoid and two patients with pansinusitis. To indicate sinusitis on clinical examination, the patient with sphenoid sinusitis had a chronic on and off headache without any symptoms. One of the frequently clinically missed sinusitis is sphenoid sinusitis, often with persistent headache in patients^{7,8}. A plain radiograph is sometimes overlooked. In these patients, imaging plays an important role in determining the cause of headaches. Because most sinus headache has a clinical feature suggesting either intracranial or para-nasal abnormality, the option to distinguish sinus headache from intracranial cause of headache in difficult circumstances is cross-sectional imaging modality. As seen in this research, acquisition of small PNS parts along with the CT brain increases yield. Other benefits of possessing small PNS

parts are differentiating the source of headache in the para-nasal sinus from intracranial causes and reducing the expense of dedicated CT PNS imaging. The performance of brain CT and minimal para-nasal sinus imaging together was 44 (11 percent) where 26 (6.5 percent) would have been brain CT alone. The presence of polyps / retention cysts is another incidental finding in this study of minimal para-nasal sinus imaging. The most prevalent site for polyp / retention cyst formation was the maxillary sinus. Similar to previous research, many of the patients in this study were concerned about brain disorders. CT helps to rule over any organic cause of headache in these patients, thereby reducing patient apprehension. In contrast with MRI as a screening tool, the availability of the MRI unit, the cost of imaging, the time of procurement, make CT the initial and preferred screening method in headache patients. The perceived drawbacks of CT as a screening modality would be In the assessment of sellar and parasellar causes of headache, posterior fossa lesions, lesion characterization and radiation exposure⁹.

Conclusion

In assessing patients with headache, CT brain is a valuable screening modality either to detect or to rule out structural abnormality. Additional procurement of small PNS parts improves the imaging yield, decreases the expense of dedicated PNS imaging, and helps distinguish the source of headache from the intracranial cause of para-nasal sinus. In patients with extreme headache or sudden onset headache or headache combined with vomiting, fever, runny nose or neurological defects, diagnostic CT production is higher.

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