COINCIDENTAL FINDINGS OF PARA NASAL SINUS PATHOLOGY IN PATIENT REQUESTED BRAIN MAGNETIC RESONANCE IMAGING FOR HEADACHE

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ABSTRACT

Background

Headache is a ubiquitous symptom, for which magnetic resonance imaging (MRI) is the primary modality of choice to investigate its underlying causes. Two categories of headache have been well known" primary versus secondary types. Sinus pathology, including sinusitis, is a well-recognized cause of secondary headaches.

Objectives

A retrospective study was conducted to find the incidence of sinus abnormalities in brain MRI patients presenting with headaches, compare the prevalence of sinus abnormalities versus other structural brain abnormalities at the brain MRI, and categorize the sinus abnormalities into significant and non-significant sinus involvement. In which significant sinus abnormalities might be the cause of headaches.

Methods

A retrospective study at the Sulaymaniyah teaching hospital selected data from brain MRIs of patients with headaches clinically, which were documented on their request paper. First, a Sum of 402 patients (males 157 and females 245) of age (mean age of 40 years) were included in the study from 2021-2022. Patients were grouped according to their imaging findings and specifically sinus abnormality. All statistical analyses were performed on a personal computer with SPSS for Windows (version 27) software.

Results

Four hundred and two cases during 12 months were reviewed; two hundred forty-five patients (60.9%) were female, and one hundred fifty-seven patients (39.1%) were male. Their ages varied from 14 years to 86 years. Approximately 50% of all patients are between the ages of 31 and 50. Sinus abnormalities were the most frequent group (40%), including significant sinus abnormalities of (19,9%), followed by normal brain MR findings (27.8%).

Conclusion

The majority of patients suffering from headaches have sinus abnormalities on the brain MRI, in which near half of these abnormalities were significant findings, and the second most common imaging findings were normal brain imaging, which was more than the significant sinus abnormalities from here it is advisable for a better revision for the indication of brain MRI in headache, and as a consequence multidisciplinary evaluation of patients with headache should be introduced at an early stage. The team should include a headache specialist and a rhinologist to avoid unnecessary investigations. The significant sinus findings contribute to a substantial number of patients suffering from headaches, thus suggesting the inclusion of sinus findings as a regular part of the radiological reporting template.

Keywords: *PNS, MRI, Headache.*

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INTRODUCTION

In all the painful states that afflict humans, headache is undoubtedly the most frequent, and rival's backache is the most common reason for seeking medical help. [1] The World Health Organization includes headaches among the top 10 causes of disability [2]. There are so many cases of headaches that special headache clinics have been established in many medical centers. Insofar as general medical rather than neurologic diseases cause many headaches, the subject is the legitimate concern of the general physician. Nevertheless, there is always the question of intracranial disease, so it is difficult to approach the subject without knowledge of neurologic medicine [1].

Why so many pains are centered in the head is a question of interest. Several causes have been attributed to it. As well recognized, the face and scalp are more highly supplied with pain receptors than many other parts of the body, perhaps to protect the precious contents of the skull. Also, the nasal and oral passages, the eye, and the ear—all delicate organs—reside here and must be protected; when burdened by disease, each can cause pain in its way. Finally, there is more concern about what happens to the head than other parts of the body since the former houses the brain, and headaches frequently raise the specter of a brain tumor or other cerebral disease [1].

The headache may be classified into primary and secondary depending on the etiology. A specific medical condition does not cause a primary headache disorder. A primary headache is more common than the second type of headache [3]. The most common primary headaches include migraine, tension-type headaches, and cluster headaches. Headaches related to infection, vascular disease, and trauma are more common secondary headaches. Only 1% of patients with a brain tumor will have a headache as the sole complaint. [4]

Despite the higher costs, MRI is generally preferred to CT for evaluating headaches. The yield may vary depending on the field strength (0.2 Tesla to 3 Tesla), paramagnetic contrast, selection of acquisition sequences, and MRA and MRV. Depending on the patient's symptoms, the CT scan could be performed first in an emergency. MRI is more sensitive, particularly for lesions in the posterior fossa and neoplasms, cervicomedullary lesions, pituitary lesions, intracranial hyper/ hypotension, and vascular disease (arterial and venous infarctions). [5]

Sinusitis is the most common paranasal sinus problem and chronic disease diagnosed in the United States. [6] Infection or blockage of paranasal sinuses is accompanied by pain over the affected maxillary or frontal sinuses. Usually, it is associated with tenderness of the skin and cranium in the same territory. Pain from the ethmoid and sphenoid sinuses is localized deep in the midline behind the root of the nose or occasionally at the vertex (especially with the sphenoid sinus disease). With frontal and ethmoidal sinusitis, the pain worsens on awakening and gradually subsides when the patient is upright; the opposite is true regarding maxillary and sphenoidal sinusitis. These findings are believed to be related to their mechanism; pain is ascribed to the filling of the sinuses and its relief to their emptying, induced by the dependent position of the Ostia. Bending over exaggerates the pain by causing changes in pressure, as does blowing the nose and air travel, especially on the descent, when the relative pressure in the blocked sinus rises [1].

Theories regarding headache and MRI findings have variable results. One study showed that normal MRI findings were the most prevalent pattern (48%) in patients with headaches. The most common pathology was sinusitis (21.34%) [7]. In comparison, another study showed that Migraine and tension-type headaches are the most prevalent causes of complaints in patients reporting to a physician for treatment of 'sinus headaches and facial pain. Multidisciplinary evaluation of patients with 'sinus headaches' should be introduced early. The team should include a headache specialist and rhinologist, allowing for the correct classification of headache type and avoiding unnecessary surgical procedures. [8]

Our aim in this research is to address the prevalence of sinus findings on MRI of patients presented with headaches. From here, we are deciding on the importance of mentioning sinus abnormality in the radiological reporting and better clinical assessment of the patient's symptoms from the beginning to avoid unnecessary extra investigation.

PATIENTS AND METHODS

A retrospective cohort review of Brain MRI patients with a headache at the Sulaymaniyah teaching hospital. A sample size of 402 patients was used for this study. They were selected purposively based on the inclusion criteria from the radiology department database of the selected study center from January 2021 to January

2022. This study specified and included age, gender, and headache request paper.

Brain MR did by GE machine 1.5 Tesla, in which the sequences included AxialT2, Coronal T2, Axial T1, Axial FLAIR & DWI seq.; two radiologists analyzed images. The findings were categorized according to normal brain findings, sinus abnormalities, and intraparenchymal structural abnormalities. The sinus abnormalities were further subdivided into significant and non-significant abnormalities under the Lund Mackay (LM) scoring system. The Lund-Mackay score is a widely used method for the radiologic staging of chronic rhinosinusitis. Ashraf et al. attempted to study this staging system to determine what score should be considered an incidentally normal range. They concluded that an LM score of 3 or less was most likely normal, above six was most likely pathological, and 4-5 was indeterminate [9].

Hence in this study, the significant sinus findings include those with scores above 6, keeping in mind that the ostiomeatal complex (OMC) cannot be adequately assessed on MRI protocols done for headache, as this protocol lacks the proper coronal plane that is required for sufficient visualization of OMC, subsequently excluding OMC from the LM scoring. All statistical analyses were performed on a personal computer with SPSS for Windows (version 27) software.

Table 1.Lund-Mackey scoring system.

Sinus	Right sinus	Left sinus
Frontal	0-2	0-2
Anterior ethmoids	0-2	0-2
Posterior ethmoids	0-2	0-2
Maxillary	0-2	0-2
Sphenoid	0-2	0-2
Ostiomeatal complex	0 or 2	0 or 2

For the sinuses, O=no inflammation; 1 = partial inflammation;2 = 100% inflammationFor the ostiomeatal complex: O=not occluded; 2=occluded. Maximum total score: 24.

Table 2. Imaging findings categorization.

Normal(A)	Sinus abnormalities alone(B)		Intra parenchymal structural abnormalities(C)		B+C= including those patients sharing both findings	
	B1= Significant	B2= non-significant	C1= Non-specific white matter signal intensity change	C2= Other structural abnormalities include (arachnoid cyst, meningioma, pituitary adenoma) + encephalomalacia, encephalitis, hydrocephalus)	Significant	Non-significant

RESULTS

Four hundred and two cases during 12 months were reviewed. Two hundred forty-five patients (60.9%) were female, and one hundred fifty-seven patients (39.1%) were male. Their ages varied from 14 to 86 years, with approximately 50% of all patients between 31 and 50 years.

Table 3, shows the group distribution of the patients. 40% in the B group (sinus abnormalities), including 20.1% were found in the Non-Significant Sinus group, 19.9% of the patient were found in the Significant Sinus group, 27.8% of the patients were found in the normal group, and 20.5% were found in the C-group (Intra parenchymal structural abnormalities)

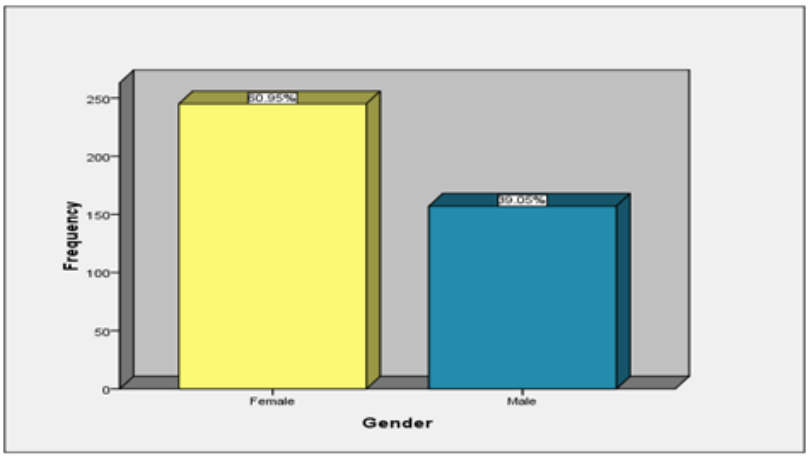

Fig 1. Females (60.9 %) were more prevalent than males (39.1%)

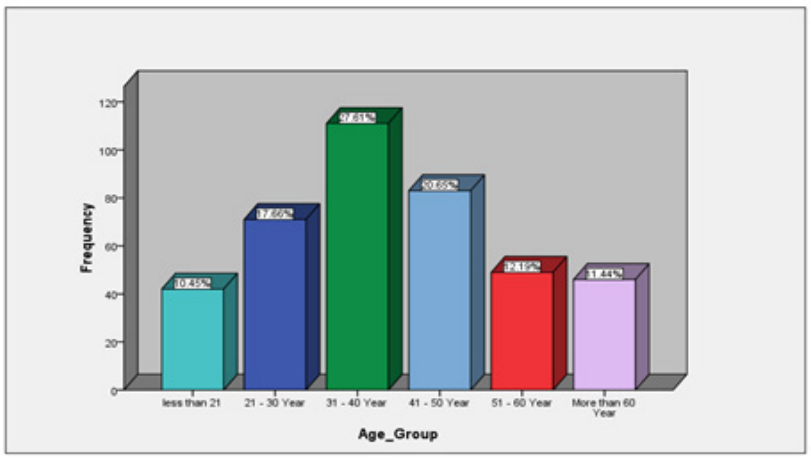

Fig 2. Patients Age Group.

Table 3. The group distribution of the patients.

Finding Group	Frequency	Percent
A-Normal	111	27.8
B- Sinus abnormalities	161	40
B1-significant	80	19.9
B2-non-significant	81	20.1
C- Intra parenchymal structural abnormalities	83	20.5
C1-Group	63	15.6
C2-Group	20	4.9
B+C	47	11.7
Significant B+C	16	4
Non-significant B=C	31	7.7
Total	**402**	**100**

These are the results of the non-parametric test administered to each non-sinus and sinus sample in the patient's group. First, the interpretation of the scores will be given, and then relevant non-parametric tests that are run to compare the relative effectiveness of each type of sample will be explained. Table (4) Compares each sinus abnormalities sample and non-sinus sample in patients. The result was analyzed by a non-parametric test and revealed a statistically significant difference between them at the level of (α =0.05). It is noted that the P-value for the above test is equal to (0.000), which is smaller than the level of significance (α =0.05) that is the mean. Table (5) Compares each B+C group sample and other samples in patients. The result was analyzed by a non-parametric test and revealed a statistically significant difference between them at the level of (α =0.05). It is noted that the P-value for the above test is equal to (0.000), which is smaller than the level of significance (α =0.05) that is the mean.

Table 4. Compares each sinus abnormalities sample and non-sinus sample in patients.

	No-sinus abnormalities	**Sinus abnormalities**		**Total**
Count		Non-significant-sinus	Significant- sinus	
	241	81	80	402
% of Total	**60.0%**	**20.1%**	**19.9%**	**100.0%**

Chi-square = 147.447 with p-value (0.000)

Table 5. Compares each B+C group sample and other samples in patients.

	B+C= including those patients sharing both findings		**Other findings (excludingB+C)**	**Total**
Count	Non-significant B+C	Significant B+C		
	31	16	355	402
% Total	**7.7%**	**4.0%**	**88.3%**	**100.0%**

Chi-square = 125.86 with p-value (0.000)

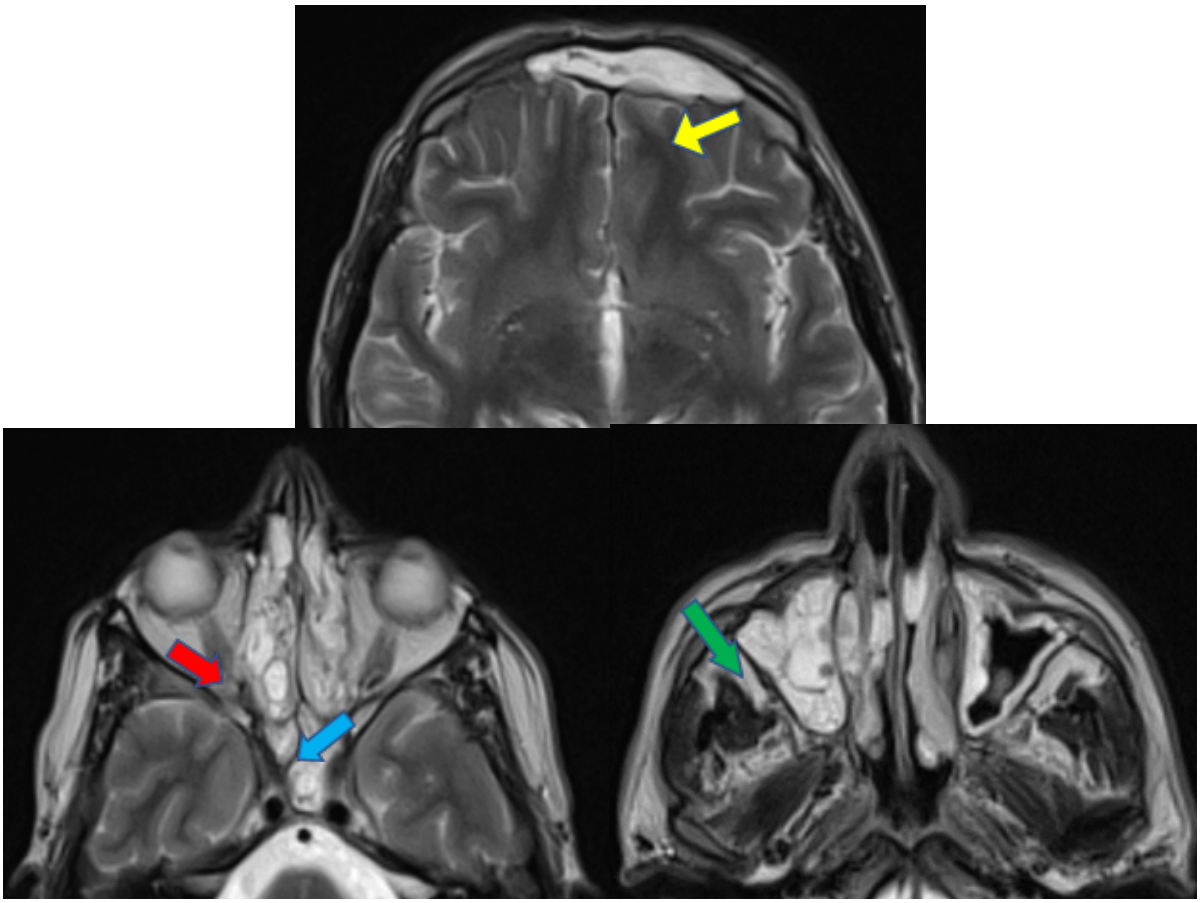

Figure 3. Axial T2-weighted MRI images of an abnormal patient.
(LM score=19) shows the hyperintense thickened sinus mucosa in the frontal (yellow arrow), ethmoid (red arrow), sphenoid (blue arrow), and maxillary sinuses (green arrow).

DISCUSSION

A retrospective study on MRI images of 402 patients presented with headaches during twelve months with the predominant female gender of 245 patients (60.9%), while male gender of 157 patients (39.1%). About 50% of all patients are between the ages of 31 and 50. In this study, 40% of patients showed sinus abnormalities, including; 20.1% non-significant sinus findings (LM score below 6), 19.9% significant sinus findings (LM score above 6), also 28.9% of patients showed normal brain MRI findings, and 20.5% of patients showed structural brain abnormality, these findings indicating that sinus abnormality prevalence is much higher than other.

This study's most frequent MRI finding was sinus pathologies, including both significant and non-significant findings. In this agreement with other studies conducted by Ogolodom et al. [7], Nazri et al. [10], and Ukamaka and Adaorah [11]. However, contrary to other studies by Hansen AG et al. (12) and Surendra Maharjan [13], they found no significant association between paranasal sinus opacification and headache.

According to this study, normal brain imaging is the second most common finding. It is more than significant sinus abnormalities, and this finding is supported by other studies by Ogolodom et al. [7], Cain et al. [14], Wang et al. [15], and Young et al. [16] and Frishberg[17]. In Young et al. study, they recommended a high need to reduce unnecessary neuroimaging of patients with a headache by designing and implementing interventional policies [16]. According to Frishberg, the routine investigation of all cases of headaches should not be recommended [17].

The key limitations in this study were the inability to assess the detailed clinical data of the patients, including the patient's dedicated headache history, neurological evaluation, and past medical condition, as these data were unable to be reached, which most of the patients cannot be recalled by the unavailability of their

contact information. This implement recommendation of further studies for those patients who presented with headache and had significant sinus abnormality on their brain MRI, to be well interpreted with their clinical findings, and to reach the definite etiology of their headache, whether it is a primary or secondary headache.

Conclusion and Recommendations

Most patients suffering from headaches have normal findings on the brain MRI; from here, it is advisable for a better revision for the indication of brain MRI in headaches. The second most imaging abnormality of that patient with abnormal brain findings include sinus abnormality; consequently, multidisciplinary evaluation of patients with headaches should be introduced early. In addition, the team should include a headache specialist and rhinologist to avoid unnecessary investigations. The significant sinus findings contribute to a substantial number of headache sufferers, thus suggesting the inclusion of sinus findings as a regular part of the radiological reporting template. MRI may be used as an adjunct to CT for assessing sinus conditions and anatomical variations. As an imaging modality, MRI can aid radiologists in making a more accurate differential diagnosis and enhance the clinical management of patients.

REFERENCE

1. Ropper AH, Adams RD, Victor M, Brown RH, Victor M. Adams and Victor's principles of neurology. New York: McGraw-Hill Medical Pub. Division; 2005.

2. Stovner, L. j., Hagen, K., Jensen, R., Katsarava, Z., Lipton, R., Scher, A., Steiner, T., & Zwart, J. A. (2007). The global burden of headache: worldwide documentation of headache prevalence and disability. Cephalalgia: an international journal of headache, 27(3), 193–210. https://doi.org/10.1111/j.1468-2982.2007.01288.x.

3. Evans, R. W. (1996). Diagnostic testing for the evaluation of headaches. Neurologic clinics, 14(1), 1-26.

4. Green, M. W. (2012). Secondary headaches. CONTINUUM: Lifelong Learning in Neurology, 18(4), 783-795.

5. Mechtler, L. L. (2008). Neuroimaging of headaches. CONTINUUM: Lifelong Learning in Neurology, 14(4), 94-117.

6. Dähnert W. Radiology review manual. Lippincott Williams & Wilkins; 2011.

7. Ogolodom MP, Mbaba AN, Abam R, Maduka BU, Nengi A, Wekhe C. Magnetic resonance imaging findings in patients with headaches in Port Harcourt, Rivers State, Nigeria. Journal of Biomedical Sciences. 2019;8(3).

8. Gryglas-Dworak A, Nowaczewska M, Bro zek-Madry E, Martelletti P. Etiology of 'Sinus Headache'—Moving the Focus from Rhinology to Neurology. A Systematic Review. Brain Sci. 2021, 11, 79.

9. Ashraf, N., & Bhattacharyya, N. (2001). Determination of the "incidental" Lund score for the staging of chronic rhinosinusitis. Otolaryngology--head and neck surgery: official Journal of American Academy of Otolaryngology-Head and Neck Surgery, 125(5), 483–486. https://doi.org/10.1067/mhn.2001.119324

10. Nazri M, Bux SI, Tengku-Kamalden TF, Ng KH, Sun Z. Incidental detection of sinus mucosal abnormalities on CT and MRI imaging of the head. Quantitative Imaging in Medicine and Surgery. 2013 Apr;3(2):82-8.

11. Itanyi, U. D., Okere, P. C., Iloanusi, N. I., & Uduma, F. U. (2020). Magnetic resonance imaging in chronic headache: our experiences and perspectives. African health sciences, 20(3), 1496–1506.

12. Hansen AG, Stovner LJ, Hagen K, Helvik AS, Thorstensen WM, Nordgård S, Bugten V, Eggesbø HB. Paranasal sinus opacification in headache sufferers: A population-based imaging study (the HUNT study-MRI). Cephalalgia. 2017 May;37(6):509-16.

13. Maharjan S. Assessment of paranasal sinuses in Magnetic Resonance Imaging of brain. Bangabandhu Sheikh Mujib Medical University Journal. 2016 Aug 17;9(2):104-6.

14. Cain, M. R., Arkilo, D., Linabery, A. M., & Kharbanda, A. B. (2018). Emergency Department Use of Neuroimaging in Children and Adolescents Presenting with Headache. The Journal of paediatrics, 201, 196–201.

15. Wang R, Liu R, Dong Z, Su H, Ao R, Liu Y, Wang Y, Ma L, Yu S. Unnecessary neuroimaging for patients with primary headaches. Headache: The Journal of Head and Face Pain. 2019 Jan;59(1):63-8.

16. Young, N. P., Elrashidi, M. Y., McKie, P. M., & Ebbert, J. O. (2018). Neuroimaging utilization and findings in headache outpatients: Significance of red and yellow flags. Cephalalgia: an international journal of headache, 38(12), 1841–1848.

17. Frishberg B. M. (1994). The utility of neuroimaging in evaluating headache in patients with normal neurologic examinations. Neurology, 44(7), 1191–1197.