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ORIGINAL ARTICLE

Prevalence of Significant MRI Abnormalities among Patients with Chronic Headache

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ABSTRACT

Introduction: *Chronic headache is a common neurological complaint often requiring MRI to exclude secondary causes. While most are primary headaches, some may reveal significant intracranial abnormalities. The prevalence of such MRI findings varies, with limited data from Bangladesh.* ***Methods & Materials:*** *This cross-sectional study at Bangladesh Medical University enrolled 51 chronic headache patients (ICHD-3 criteria). All underwent clinical evaluation and brain MRI, with contrast when needed. Two radiologists independently reviewed scans, classifying findings as significant or incidental. Data were analyzed with p<0.05 as significant.* ***Results:*** *The mean age of participants was 36.5 ± 15.1 years (range 8–65), with females representing 58.8%. Headaches were most commonly bilateral (76.5%) and dull in nature (72.5%). Associated symptoms included nausea, vomiting, or photophobia in 58.8% of cases. Hypertension (37.3%) and diabetes mellitus (39.2%) were the most common comorbidities. MRI revealed abnormalities in 86.3% of patients, while 13.7% had normal scans. The most frequent abnormalities were sinus disease/sinusitis (33.3%), hypertrophy of inferior turbinates (23.5%), white matter lesions (11.8%), infarcts (9.8%), and tumors (9.8%). ICD-based diagnoses showed deep white matter ischemic disease in 86.3% of patients. No statistically significant association was found between abnormalities and age (p=0.28) or sex (p=0.40).* ***Conclusion:*** *A high proportion of chronic headache patients in this study demonstrated significant MRI abnormalities, particularly sinus pathology and ischemic changes. These findings emphasize the importance of selective imaging based on clinical features to optimize resource use in resource-limited settings.*

Keywords: *Chronic-Headache, MRI, Neuroimaging, Ischemic-changes, Bangladesh*

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INTRODUCTION

Headaches are among the most common neurological issues seen in clinical settings and are a leading cause of disorders worldwide [1]. Most individuals experience headaches at some point, but for some, the pain persists and greatly impacts daily life. When headaches occur frequently or last for long periods, they are classified as chronic headaches. According to the International Classification of Headache Disorders, 3rd Edition (ICHD-3), these are defined as lasting at least 3 months, occurring more than 15 days per month [2]. Chronic headaches not only diminish quality of life but also impose a significant socioeconomic impact through increased absenteeism, reduced productivity, and higher healthcare costs [3]. Most chronic headaches are primary, occurring without underlying structural or systemic disease. Migraines and tension-type headaches account for the majority of primary chronic headaches [4]. However, a small but clinically significant portion may be secondary to intracranial lesions like tumors, vascular malformations, demyelination, or infections. In such cases, early identification of the underlying cause is crucial, as prompt intervention can be lifesaving or prevent irreversible damage [5]. Magnetic resonance imaging

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(MRI) is instrumental in evaluating headache patients, offering superior soft tissue contrast compared to computed tomography (CT) and enabling the detection of subtle abnormalities such as demyelinating lesions, small tumors, and vascular issues [6]. Nonetheless, routine MRI for all chronic headache cases remains controversial. International guidelines advise a selective approach, recommending neuroimaging in patients with "red flag" features like sudden onset, worsening symptoms, neurological deficits, and new headaches in older adults [7,8]. Most patients with chronic headaches show normal scans or incidental findings with no clinical relevance. Various studies report different rates of abnormal MRI findings in these patients; some suggest up to 25% may have abnormalities, but only a tiny fraction is directly related to the headache itself [9,10]. Many incidental findings, such as benign cysts or sinus issues, can cause patient anxiety and potentially lead to unnecessary tests and treatments [11]. In clinical practice, balancing the risk of missing serious abnormalities against the costs and implications of unnecessary imaging, a dilemma particularly relevant in resource-limited healthcare systems, where research costs are a concern. In countries like Bangladesh and other developing regions, where medical resources are scarce and economic factors are significant, the decision to perform an MRI must be made with caution. Despite increased MRI availability, data on the prevalence of clinically significant abnormalities in patients with chronic headaches in our environment are lacking. Local evidence is vital for clinicians to make informed, cost-effective decisions based on real prevalence. Hence, this study aimed to assess the prevalence of significant MRI abnormalities among patients presenting with chronic headaches.

METHODS & MATERIALS

This study was a cross-sectional observational study conducted in the Department of Neurology and Radiology at Bangladesh Medical University, Dhaka, Bangladesh, between May and July 2025. Patients presenting with chronic headache, as defined by the International Classification of Headache Disorders, 3rd edition (ICHD-3), were enrolled consecutively. All participants underwent a detailed clinical evaluation, including a comprehensive history, neurological examination, and assessment for “red flag” symptoms. Brain MRI was performed using a [1.5 Tesla/3 Tesla] scanner. Standard imaging sequences included T1-weighted, T2-weighted, FLAIR, and diffusion-weighted imaging (DWI). Contrast-enhanced studies were performed when clinically indicated. MRI findings were independently reviewed by two consultant radiologists blinded to patient clinical details apart from the chronic headache indication. Findings were categorized as clinically significant (e.g., space-occupying lesions, vascular lesions, demyelinating lesions, infections, ischemic infarcts) or non-significant/incidental (e.g., benign cysts, age-related changes, sinus disease). Demographic data, headache characteristics, and MRI findings were recorded in a structured case record form. Data were analyzed using SPSS version 25. Descriptive statistics were applied to calculate frequencies, percentages, means, and standard deviations. The prevalence of significant MRI abnormalities was expressed as a percentage of the total study population. Associations between clinical variables and MRI abnormalities were evaluated using the chi-square test or Fisher’s exact test where appropriate. A p-value <0.05 was considered statistically significant. Ethical clearance was obtained from the Institutional Review Board (IRB) of Bangladesh Medical University. Written informed consent was taken from all patients before participation.

Inclusion criteria:

- Patients aged ≥8 years presenting with chronic headache, defined as headache occurring on ≥15 days per month for at least 3 consecutive months.
- Patients willing and able to undergo a brain MRI.
- Patients who provided written informed consent (or assent with guardian consent for minors).

Exclusion criteria:

- Patients with acute headache syndromes (e.g., thunderclap headache, trauma-related headache).
- Patients with known prior intracranial pathology (e.g., previously diagnosed tumor, stroke, demyelinating disease).
- Patients with contraindications to MRI (e.g., metallic implants, pacemakers, severe claustrophobia).
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RESULTS

The study included 51 patients with a mean age of 36.5 ± 15.1 years (range: 8–65 years). The largest proportion of patients belonged to the 20–39 years age group (39.2%), followed by 40–59 years (31.4%). The lowest representation was in the 0–19 years group (13.7%). Females constituted the majority (58.8%) compared to males (41.2%). In terms of education, most patients had completed secondary education (45.1%), while only 2% reported other forms of education. Occupationally, office workers (29.4%), homemakers (25.5%), and students (25.5%) formed the major groups, whereas manual laborers and unemployed patients were the least represented (9.8% each). [Table I].

Table – I: Sociodemographic Characteristics of Patients (*n* = 51)

Variable	Categories	n	%
Age (years)	Mean ± SD = 36.5 ± 15.1 (Range: 8–65)	–	–
Age group	0–19	7	13.7
	20–39	20	39.2
	40–59	16	31.4

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	≥60	8	15.7
Sex	Female	30	58.8
	Male	21	41.2
Education	None	8	15.7
	Primary	17	33.3
	Secondary	23	45.1
	Higher Secondary	2	3.9
	Other/Nope	1	2.0
Occupation	Homemaker	13	25.5
	Manual labor	5	9.8
	Office job	15	29.4
	Student	13	25.5
	Unemployed	5	9.8

The mean duration of headache was 6.9 ± 2.7 months (range: 2–18). Most patients experienced headaches 4–5 times per month (39.2%), while the least common frequency was 2–3 times per month (9.8%). Regarding headache duration, 37.3% reported persistence for ≥4 hours, compared to only 3.9% lasting 1–2 hours. Bilateral headache was predominant (76.5%), and dull in nature (72.5%), whereas throbbing pain was least reported (3.9%). Associated symptoms were frequent, with nausea, vomiting, and photophobia present in 58.8% of patients, while aura was the least common (7.8%). Visual aura was reported in 41.2%. Hypertension (37.3%) and diabetes mellitus (39.2%) were the most common comorbidities, whereas psychiatric illness was the lowest (3.9%). Among lifestyle factors, 64.7% had never smoked, 33.3% were current smokers, and only 2% were past smokers. Occasional alcohol use was noted in 15.7%. [Table II].

Table – II: Clinical Characteristics, Associated Symptoms, and Risk Factors (*n* = 51)

Variable	Categories	n	%
Headache duration (months)	Mean ± SD = 6.9 ± 2.7 (Range: 2–18)	–	–
Headache frequency (per month)	2–3 times	5	9.8
	3–4 times	15	29.4
	4–5 times	20	39.2
	≥6 times	11	21.6
Headache duration (hours)	1–2 h	2	3.9
	2–3 h	15	29.4
	3–4 h	15	29.4
	≥4 h	19	37.3
Laterality	Bilateral	39	76.5
	Unilateral	12	23.5
Headache nature	Dull	37	72.5
	Sharp	11	21.6
	Throbbing	2	3.9
	Other	1	2.0
Associated symptoms	Nausea/Vomiting/Photophobia	30	58.8
	Vomiting & nausea	16	31.4
	Aura	4	7.8
	Others	1	2.0
Visual aura	Yes	21	41.2
	No	30	58.8
Comorbidities	Hypertension	19	37.3
	Diabetes mellitus	20	39.2
	Dyslipidemia	15	29.4
	Psychiatric illness	2	3.9
Lifestyle factors	Smoking (current)	17	33.3
	Smoking (past)	1	2.0
	Never smoked	33	64.7
	Alcohol use (occasional)	8	15.7
	Alcohol use (never)	42	82.4

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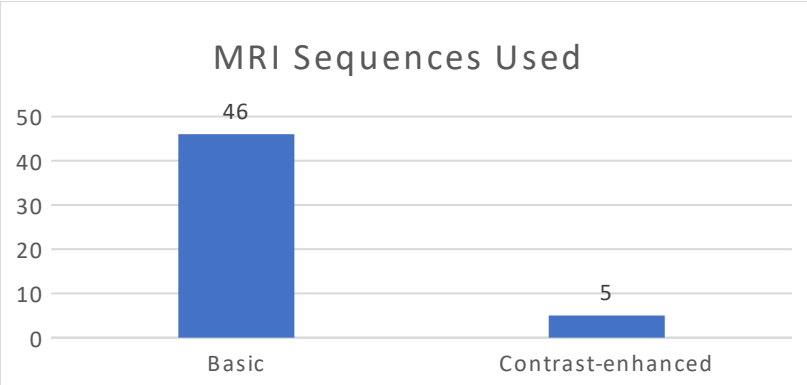

Figure – 1: MRI Sequences Used (*n* = 51)

Figure 1 shows that the majority of patients underwent standard non-contrast MRI sequences (90.2%), while contrast-enhanced studies were performed in only 9.8% of cases.

MRI detected abnormalities in 86.3% of cases, with only 13.7% showing normal findings. [Table III].

Table – III: Prevalence of MRI Abnormalities (*n* = 51)

MRI finding	n	%
Any abnormality detected	44	86.3
Normal MRI	7	13.7
Significant abnormality present	44	86.3
No significant abnormality	7	13.7

The most frequent abnormalities were sinus disease/sinusitis (33.3%) and hypertrophy of inferior turbinates (23.5%). Other findings included ischemic changes, infarcts, and intracranial tumors. [Table IV].

Table – IV: Distribution of Types of MRI Abnorsssmalities (*n* = 51)

Abnormality Type	n	%
Sinus disease / Sinusitis	17	33.3
Hypertrophy of inferior turbinates (HIT)	12	23.5
White matter lesions / ischemic changes	6	11.8
Infarcts / stroke-related changes	5	9.8
Tumors/masses (glioma, meningioma, astrocytoma, etc.)	5	9.8
Empty sella / microvascular changes	2	3.9
Hydrocephalus (non-obstructive)	1	2.0
Others (polyps, DNS, cysts, GCA, encephalomalacia)	4	7.8

According to ICD-based final diagnoses, deep white matter ischemic disease was the most common (86.3%), while only two patients (3.9%) had no abnormality. Other diagnoses included maxillary sinusitis (5.9%) and hypertrophy of inferior turbinates (2.0%). [Table V].

Table – V: Final Diagnosis Based on ICD (*n* = 51)

Final Diagnosis	n	%
Deep white matter ischemic disease	44	86.3
Hypertrophy of inferior turbinates (HIT)	1	2.0
Right maxillary sinusitis	3	5.9
Normal	2	3.9
Other specified	1	2.0

Analysis of associations showed that significant MRI abnormalities were more frequent in the 40–59 years group (93.8%) compared to the lowest in the 60–65 years group (71.4%). In sex distribution, 90.0% of females and 81.0% of males had significant abnormalities. However, the associations between age group (p = 0.28) and sex (p = 0.40) with MRI abnormalities were not statistically significant. [Table VI].

Table – VI: Association between Age & Sex Group and Significant MRI Abnormalities (*n* = 51)

Variable	Significant Abnormality n (%)	Not Present n (%)	P value
Age Group			
0–19	6 (85.7)	1 (14.3)	0.28
20–39	18 (90.0)	2 (10.0)	
40–59	15 (93.8)	1 (6.2)	
60–65	5 (71.4)	2 (28.6)	
Sex			
Female	27 (90.0)	3 (10.0)	0.40
Male	17 (81.0)	4 (19.0)	

*Chi-square/Fisher's exact test (not significant)

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DISCUSSION

In the present study, significant abnormalities on magnetic resonance imaging (MRI) were detected in 86.3% of patients presenting with chronic headache, while only 13.7% had normal scans. The most frequent abnormalities were sinus disease or sinusitis (33.3%) and hypertrophy of inferior turbinates (23.5%). Other important findings included white matter lesions or ischemic changes (11.8%), infarcts (9.8%), tumors such as glioma, meningioma, and astrocytoma (9.8%), empty sella or microvascular changes (3.9%), hydrocephalus (2.0%), and a small proportion of miscellaneous lesions (7.8%). ICD-based diagnosis revealed that deep white matter ischemic disease was the most common entity (86.3%). Abnormalities were slightly more frequent among females (90.0%) than males (81.0%), and highest in the 40–59 years group (93.8%), although neither age nor sex differences reached statistical significance. The overall prevalence of MRI abnormalities in this study is much higher than that reported in the majority of international literature. A meta-analysis by Tsushima and Endo (2005) reviewing neuroimaging in primary headache found clinically significant abnormalities in only 0.18–2% of patients with migraine, and about 8.86% across all headache types [12]. A Alturkustani et al. (2020) studied 157 patients with chronic migraine in Saudi Arabia and found incidental abnormalities in 57%, but clinically significant lesions in only 8.3% [13]. Legesse et al. (2022) in Ethiopia found MRI abnormalities in 49.2% of headache patients, yet only 21% were clinically significant [14]. Compared with these results, the 86.3% rate in our cohort is extraordinarily high, suggesting that either the study population represented a higher-risk subgroup, or that diagnostic thresholds and classification of abnormalities differed. Sinus disease and inferior turbinate hypertrophy accounted for more than half of the abnormalities in our series. Incidental paranasal sinus findings are well-known in MRI studies of the brain. Ikeda et al. (1996) in a Japanese study reported sinus abnormalities in 47.1% of patients undergoing MRI. Bolger et al. (1991) found incidental sinus disease in 42% of head CT scans. In contrast, studies focusing specifically on headache patients report lower rates. Adekanmbi et al. (2019) in Nigeria observed sinusitis in only 21% of patients presenting with persistent headache. Oguz et al. (2018) reported paranasal abnormalities in 19% of pediatric patients with headache. Compared with these findings, the 33.3% rate of sinusitis and 23.5% turbinate hypertrophy in the present study are relatively high, possibly reflecting environmental factors, higher prevalence of chronic rhinosinusitis in our population, or more detailed reporting of sinonasal variants by radiologists. White matter hyperintensities (WMHs) and ischemic changes were observed in 11.8% of our patients, although ICD-based categorization as “deep white matter ischemic disease” reached 86.3%. This discrepancy highlights possible differences in terminology. The prevalence of WMHs in headache patients varies widely. Zhang et al. (2023) in the Cerebral Abnormalities in Migraine study found WMHs in 44% of migraine patients compared to 12% of controls, with higher rates in migraine with aura [15]. A study by Lee et al. (2019) also confirmed increased prevalence of WMHs in migraineurs, particularly women under 50 [16]. Our raw prevalence of 11.8% is comparable to the lower range of these studies, but the assignment of ischemic disease to 86.3% of patients is far higher than most reports, suggesting that comorbid vascular risk factors such as hypertension (37.3%), diabetes mellitus (39.2%), and smoking (33.3%) in our sample may have influenced radiological interpretation. Tumors and masses were identified in 9.8% of cases, a proportion much higher than generally reported. Tsushima and Endo (2005) similarly concluded that tumors are rare incidental findings in chronic headache populations [12]. A Alturkustani et al. (2020) reported significant abnormalities, including tumors, in only 8.3% [13]. The rate of 9.8% tumors in our cohort suggests either a strong referral bias, with MRI being requested primarily in high-risk or atypical patients, or potentially a genuinely higher background prevalence of neoplastic disease. Stroke-related changes and infarcts were observed in 9.8% of patients in our study. Previous studies have linked migraine, especially with aura, to increased risk of ischemic stroke. Ravi et al. (2024) in a large prospective cohort demonstrated a two-fold increased risk of ischemic stroke among women with migraine with aura [17]. In imaging studies, however, the proportion of overt infarcts in headache patients is generally lower. Kruit et al. (2005) found silent infarcts in 8% of migraine patients compared to 0.7% of controls, a finding broadly similar to our prevalence of 9.8% [18]. This suggests that our study population may indeed carry a higher vascular risk, consistent with their comorbidity profile. Empty sella and microvascular changes were detected in 3.9% of our patients. Giampietro (2025) reported empty sella as an incidental finding in 20% of neuroimaging studies, often clinically silent [19]. The low prevalence in our study is therefore within the expected range. Hydrocephalus was noted in 2.0% of patients, which is slightly higher than in large cohorts such as Tsushima and Endo (2005), who found hydrocephalus in less than 1% of headache patients [12]. The influence of age and sex was not statistically significant in our cohort, although abnormalities were slightly more common among females and peaked in the 40–59 years group. Previous studies have shown variable associations. Kruit et al. (2005) reported that women with migraine had higher prevalence of WMHs compared to men [18]. Our lack of significant associations may be explained by the uniformly high prevalence of abnormalities across all subgroups, which could mask any demographic trends.

Limitations of the Study

The study was limited by its small sample size and single-center design.

CONCLUSION

This study found a remarkably high prevalence of significant MRI abnormalities among patients with chronic headache, with sinus pathology and ischemic changes being the most frequent findings. Although the prevalence exceeded that reported in international studies, comorbid vascular risk factors and possible referral bias may explain the difference.

Careful patient selection for MRI is essential to optimize resource use while avoiding missed diagnoses.

RECOMMENDATION

Larger multicenter studies are needed to confirm these findings and to better define the true prevalence of clinically significant MRI abnormalities in chronic headache patients in Bangladesh. Development of local clinical guidelines incorporating red flag features, vascular risk factors, and cost considerations would help clinicians make evidence-based imaging decisions. In parallel, preventive strategies to reduce vascular risk factors may lower the burden of ischemic brain changes that contribute to chronic headache presentations.

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