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Original Article

Do different headache types present with varying MRI findings?

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Abstract

Aim: Studies evaluating the magnetic resonance imaging findings in headache cases mostly focus on migraine and tension headache. In the current study, we aimed to evaluate the possible differences in the magnetic resonance imaging reports between the common headache types presenting with normal neurological findings.

Materials and Methods: The magnetic resonance imaging findings of 170 patients aged between 18-45 years that presented with the complaints of headache were retrospectively evaluated. The patients with headaches were divided into the following groups: migraine, tension headache, medication overuse headache, and other headaches (cluster headache, hemicrania continua, paroxysmal hemicrania, trigeminal neuralgia), each consisting of 30 cases. Also, a control group was formed with 50 patients without a headache. The extracerebral, major and minor intracranial abnormalities were noted for all groups. The x2 test was used to compare the data between the groups.

Results: When the patients with headaches were evaluated, clinically silent brain infarct was detected as a major intracranial abnormality only in one patient with trigeminal neuralgia. The incidence of minor abnormalities was higher in the headache groups compared to the controls ($p<0.05$). There was no significant difference between the headache groups in terms of minor abnormalities. Similarly, no significant difference was observed in the extracerebral findings between the headache (25.8%) and non-headache (26%) groups ($p>0.05$).

Conclusion: There was no significant difference between the headache types and the MRI findings. Increased white matter hyperintensity was present in patients with headaches, and especially those with migraine compared to the controls.

Keywords: Primary headache; migraine; tension headache; medication overuse.

INTRODUCTION

Headache constitutes a large percentage of cases presenting to the neurology polyclinic. For most of these patients, the complaint is primary headaches, such as migraine and tension-type headaches that are the main problem with no association with any other disease. In primary headaches without any neurological abnormality, imaging is often not needed. However, cranial MRI is still commonly used despite its low diagnostic efficiency due to the defensive medical approach and fear that serious adverse events could be overlooked (1).

Patients diagnosed with a primary headache often use medication regularly. Headaches can sometimes occur due to medication overuse. Most of these cases are known to have previously taken medication for the treatment of migraine (2).

In this study, we aimed to evaluate the differences in the MRI findings of the patients diagnosed with primary headaches by comparing these findings both within the patient group and between the patient and control groups.

MATERIAL and METHODS

Between January 2017 and May 2019, 120 patients that presented to the neurology polyclinic of Adiyaman University Training and Research Hospital with the complaint of headaches and underwent cranial MRI and 50 patients that underwent cranial MRI for non-headache reasons were retrospectively evaluated. The ethics

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committee of Adıyaman University, Turkey approved the study. The cases were divided into the following groups: Migraine (n=30), tension-type headache (TTH), (n=30), medication overuse headache (MOH), (n=30), other headaches (cluster headache, hemicrania continua, paroxysmal hemicrania and trigeminal neuralgia), (n=30), and controls (non-headache), (n=50). The diagnoses were made according to the International Headache 2004 criteria. The age range of the cases was limited to 18-45 years in order to minimize the possible changes related to age. Complicated migraine cases and patients presenting with secondary headaches, except MOH were excluded from the study. The patients that underwent cranial MRI for any reason other than headache (e.g., tinnitus and vertigo) were included in the control group.

The images were obtained using a Philips Achieva 1.5 Tesla MR device (Philips Medical Systems, Best, Netherlands). The MRI examination sequences consisted of T1-weighted sagittal, T2-weighted axial, FLAIR axial and diffusion-weighted images. The cranial MRI findings, age and sex of the cases were recorded retrospectively. The cranial pathologies were divided into two groups as intracranial and extracerebral. In addition, the intracranial abnormalities were classified as major and minor. The patients that required follow-up and/or treatment; e.g., those presenting with infarction, hematoma, tumors, aneurysm or hydrocephalus were evaluated in the major abnormality group. Minor abnormalities included non-specific T2-weighted hyperintense lesions in the white matter, cysts, congenital anomalies and calcification, which potentially did not require follow-up and/or treatment.Non-specific T2-weighted hyperintense lesions in white matter were graded according to the Fazekas scale (3).

The Statistical Package for Social Sciences (SPSS) for Windows v. 12.0 was used for the statistical analysis of the recorded data. In the comparison of the categorical data, the x2 test was used. The results were evaluated at the 95% confidence interval and $p < 0.05$ significance level.

RESULTS

The demographic data of the patients presenting with a headache complaint are given in Table 1.

When the patients with the headache complaint were evaluated, silent brain infarction was detected as a major intracranial abnormality (0.8%) in only one patient with trigeminal neuralgia. There was no major abnormality in the control group (Table 2).

Table 1. Demographic data of the patients

Groups	Number	Age	Female patients n (%)
Migraine	30	27.1±11.98	23 (76.7)
TTH	30	29.13±9.05	19 (63.3)
MOH	30	38.00±6.58	23 (76.7)
Other headaches	30	36.7±6.25	16 (53.3)
Non-headache	50	30.7±8.88	29 (58.0)

TTH: Tension-type headache, MOH: Medication overuse headache

Table 2. Comparison of the MRI findings of the cases

MRI finding	Migraine n (%)	TTH n (%)	MOH n (%)	Other headaches n (%)	Non-headache n (%)
Normal	22 (73.3)	24 (80)	23 (76.3)	24 (8)	46 (92)
Major abnormality					
Chronic infarction					
Minor abnormality	8 (26.7)	6 (20)	7 (23.7)	6 (20)	4(8)
Fazekas grade 1	7	5	6	6	4
Fazekas grade 2	1	1	1		
Extracerebral abnormality	7 (23.3)	11 (36.6)	8 (26.7)	7 (23.3)	13(26)
MT	7	7	7	5	11
Retention cyst		4	1		2
ME				1	

TTH: Tension-type headache, MOH: Medication overuse headache, MT: Mucosal thickening; ME: Mastoid effusion

The only intracranial minor abnormalities were T2-weighted hyperintense lesions in the white matter that were observed in groups with and without headache. When the headache groups were evaluated together (22.5%), the frequency of white matter hyperintensity (WMH) increased compared to the patients without headache (8%) ($p<0.05$, Figure 1). There was an increase in the WMH incidence in patients with migraine compared to the controls ($p<0.05$). However, there was no statistically significant difference between the controls and the TTH, MOH, and the other headaches groups ($p>0.05$). Similarly, no statistically significant difference was found between the migraine and MOH groups, and between MOH and the other headaches groups in terms of WMH ($p>0.05$).

As extracerebral abnormalities, mucosal thickening and retention cysts were usually detected in the paranasal sinuses. Only one case with cluster headache had mastoid effusion. There was no significant difference in the extracerebral findings between the headache (25.8%) and non-headache (26%) groups (p>0.05).When evaluated together, intracranial and extracerebral abnormalities were reported in 41% of the patients with primary headaches and 30% of the controls (p>0.05).

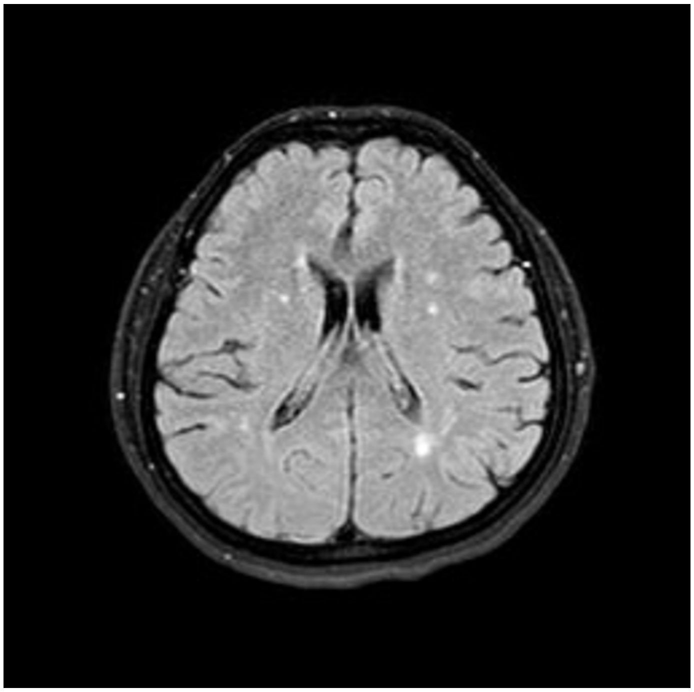

Figure 1. A 44-year-old female patient with tension-type headache has multiple white matter hyperintensities on FLAIR image

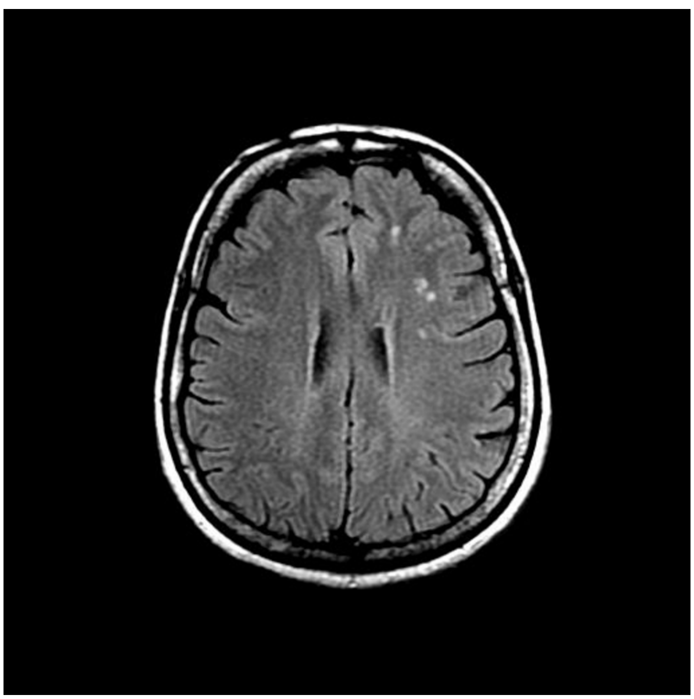

Figure 2. A 41-year-old female patient with migraine has punctate hyperintense lesions (arrow) in the left frontal lobe

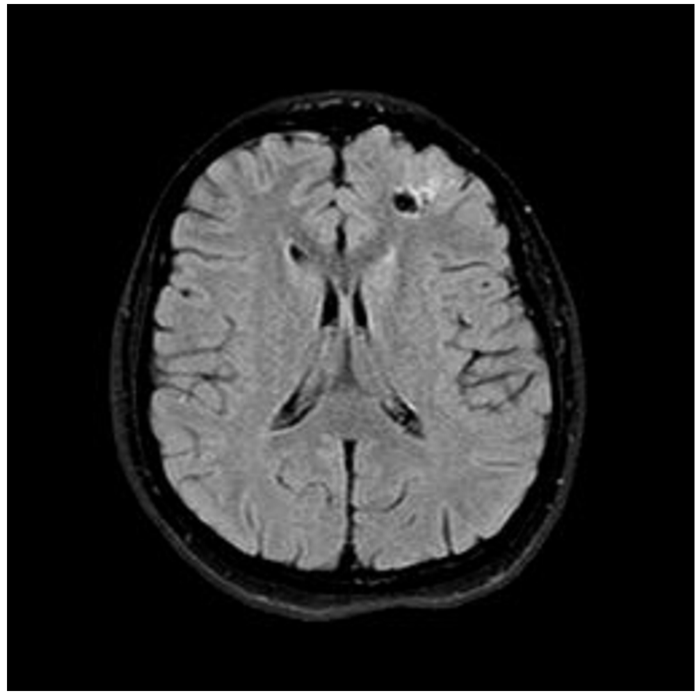

Figure 3. A 29-year-old female patient with trigeminal neuralgia has clinically silent infarct (arrow) in the left frontal lobe

DISCUSSION

In a previous study, the frequency of major abnormalities was not increased in headache cases (4). In the current study, clinically silent chronic brain infarction was identified as a major abnormality only in one case. No major abnormality was found in the non-headache group.

In the literature, minor intracranial abnormalities were reported to be increased in patients suffering from headaches, with the most common abnormality being WMH (4). The term WMH is used to refer to the T2-weighted hyperintense lesions in cerebral or cerebellar white matter on MRI (5). In a previous study, it was reported that T2-weighted hyperintense foci increased especially in patients with TTH (4).

In our study, the frequency of minor abnormalities was 22.5% in the primary headaches group. In various studies in the literature, minor abnormalities were reported to occur at a rate of 49% by Jordan et al. (6),44% by Tsushima and Endo (7), and 17% by Honningsvad et al. (4). The higher rate of minor abnormalities found in the study by Jordan et al. can be explained by the authors' inclusion of extracranial abnormalities in the analysis. In contrast, Honningsvad et al. and Tsushima and Endo did not evaluate these abnormalities in their respective studies. In the current study, when extracerebral abnormalities were included, the total rate of abnormalities was 41%, which is consistent with the findings of Jordan et al. In addition, the age range of the sample in the research conducted by Honningsvad et al. was higher (50-65 years) compared to our study. Despite the presence of young individuals and cases with primary headaches in our sample, it was interesting to observe a higher rate of minor abnormalities in our study compared to that of Honningsvad et al. As a last point of comparison, all the three studies mentioned above also evaluated patients with secondary headaches.

There are studies showing increased rates of WMH, particularly deep white hyperintensity (8) in patients with migraine (9-11). In our study, the incidence of WMH in patients with migraine was 26.7% ($p<0.05$). Previously, this incidence was reported to be 34.8% by Xie et al. and 34.3% by Kurth et al. (12,13). In a meta-analysis, the increased risk of cerebral white matter lesions was found to be 3.9 (14). While the presence of increased white matter abnormalities was noted in migraine cases in some studies (9,10,15), other researchers did not identify such relationship (16,17).

In the current study, the incidence of WMH was 20% (n=6) in patients with TTH, and there was no statistically significant difference between TTH and control groups ($p>0.05$).Other studies have shown increased WMH in patients with TTH compared to the non-headache group (4,13,18). Kurth et al. reported the incidence of WMH as 32.1% among the patients with TH [13]. This greater WMH incidence can be explained by the higher mean age of the sample in that study (69 years) compared to our sample (29 years).

MOH is the third most common type of headache (19). Overuse of some narcotic analgesics has been reported to cause leukoencephalomalacia (19,20). In the current study, WMH was present in 23.7% (n=7) of the patients with MOH, and the difference was not statistically significant compared with the control group ($p>0.05$). In addition, there was no statistically significant difference between the different primary headache groups ($p>0.05$). In this study, all patients with MOH were using non-steroid anti-inflammatory drugs (NSAIDs).

In a study conducted by Zheng et al., who evaluated patients having migraine with MOH, those having migraine without MOH, and healthy controls, the female patients having migraine without MOH had a higher rate of WMH compared to the remaining two groups. However, there was no significant difference between the three groups among the male cases (21).

However, no significant difference was found for male patients. In our study, although three-quarters of the migraine and MOH cases consisted of women, we did not detect such a difference.

Studies evaluating the MRI findings in patients with headaches generally focused on the findings obtained from migraine and TTH cases (4,10,13). In our study, no significant difference was found in WMH when other headaches (consisting of cluster headache, hemicrania continua, paroxysmal hemicrania and trigeminal neuralgia) were compared to the controls or the migraine and MOH groups ($p>0.05$). The incidence of headache in other headaches was 20% (n=6).

There are some limitations to our study. First, the subgroups of headache contained a relatively small sample size. Second, the study had a retrospective design, in which the data of both patient and control groups were obtained from the hospital records. In addition, the duration of headache complaints was not evaluated. Lastly, although the medications used by the patients with MOH were generally NSAIDs, we did not classify them nor did we determine the duration of their use.

CONCLUSION

In conclusion, there was no significant difference between the headache types and MRI findings. Increased WMH was present in patients with headaches and especially those with migraine compared to the controls. Therefore, it appears that MRI is an unnecessary test in primary headaches and MOH.

Competing interests: The authors declare that they have no competing interest.
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