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An Investigation of the Prevalence of Subclinical Brain Lesions in MRI Images of Migraine Patients

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Abstract

BACKGROUND: The use of the MRI method has opened up a new perspective on pathogenesis, diagnosis and treatment of brain lesions.

AIM: Therefore, this study aimed to evaluate the prevalence of brain subclinical lesions in MRI images of migraine patients.

METHODS: This cross-sectional study was conducted on 300 patients with a migraine referred to Baqiyatallah and Amir Al-Momenin Hospitals from 2005 to 2006. We measured the relationship between the results of MRI and the type of brain subclinical lesion by indices such as age, gender, type of a migraine, the number of migraine attacks, blood pressure and heart diseases, cholesterol, diabetes and thyroid diseases. Finally, data were analysed by IBM SPSS statistics software version 23. The significance level in this study was considered as $P > 0.05$.

RESULTS: From among 300 patients, 87.7% were women in the age range of 13-72 years. Moreover, the results indicated that with increasing age, blood pressure and some migraine attacks, the frequency of abnormal MRI also is increased significantly as well as the ratio of a migraine with aura was significantly higher than a migraine without aura in individuals with abnormal MRI. Also, the ratio of white matter lesions (WML) is higher in a classical migraine (a Migraine with aura). Statistical analyses did not reveal any significant relationship between MRI results on age, diabetes, cholesterol, heart and thyroid diseases.

CONCLUSION: The prevalence of abnormal MRI in older people and those with high blood pressure and migraine with aura is higher, and the ratio of subclinical lesions in the population of a migraine with aura is more common than a migraine without aura.

Introduction

A migraine is a common and chronic neuro-vascular disease that occurs as a result of numerous and severe attacks of headaches and disturbances in the nervous system [1]. The prevalence of a migraine in the United States and Europe is higher than in other parts of the world [2]. Furthermore, the migraine outbreak in men is between 2% to 15%, and in women between 4% and 35%. Symptoms include nausea, photophobia, vomiting, dizziness, diarrhoea and consciousness disorder [3] [4] [5] [6] [7].

The definitive and main pathophysiology of migraine has been remained uncertain. A migraine with aura is a type of a migraine, which exposed to visual and sensory disturbances before the start of the attack it affects about one-fifth of patients with a migraine [8]. Studies have shown that the most common cause of a headache is vascular difficulties [9]. Hypothalamic interactions, as well as the lack of balance between the sympathetic and parasympathetic nervous system, also cause autonomic brain symptoms in some types of migraine [10].

A migraine can increase the risk of developing brain subclinical lesions such as white matter lesions (WML). Some MRI-based studies have reported an increase in WML prevalence in migraine patients [11] [12] [13] [14]. Over the past three decades, there have been many different and controversial studies on the correlation between a migraine and abnormal cerebral paraclinical changes such as WML lesions, quasi-stroke lesions (ILLs), and volume changes of grey matter (GM) and white matter (WM) identified by MRI [15].

Therefore, the present study was designed to investigate the prevalence of brain subclinical lesions in MRI images of patients with a migraine.

Methods

This cross-sectional research was a descriptive and analytical study. The population under study was migraine patients referring to Baqiyatallah and Amir Al-Momenin Hospitals during the years 2005 to 2006. Initially, based on International Criteria of Headache International Society and using the related questionnaires, it was established whether the patient referred to the clinic had a migraine and then if it was positive, the type of migraine was identified. Accordingly, the number of patients with a migraine participating in the research was 300 people. In this study, the frequency of brain subclinical lesions in MRI was determined by people with a migraine. The questionnaire included questions about duration of the disease, the frequency of attacks per week, the duration of each attack, location of pain and quality of pain, presence or absence of aura, exacerbating factors, symptoms, history of previous diseases (patient inclusion criteria including high blood pressure, high cholesterol, diabetes, Cardiovascular and asthmatic diseases) and family history. To avoid any mistakes, the questionnaire was completed by the researcher himself. Patients were of different age groups without any specific age limitation. The simple non-random sampling method was applied. In all patients, the prevalence of brain subclinical lesions was evaluated in MRI images of patients with a migraine referred to Baqiyatollah and Amir Al-Momenin hospitals. Patient information was analysed using a questionnaire and radiologist's reports of patients' MRI using SPSS version 23 software, with the help of appropriate statistical tests; the probability value less than 5% was considered significant.

Results

Our population was in the age range between 13 and 72 years. The highest percentage of subjects with normal MRI (26.3%) were at the age range of 21-40 years, while the lowest percentage of subjects with normal MRI (4.3%) were in the age group of 51-60 years. On the other hand, the highest percentage of patients with abnormal MRI (4.3%) was in the age range of 41 to 50 years old and the lowest (0.3%) in the range of 13 to 20 years old. The results of statistical Chi-square test showed that the frequency distribution difference of MRI results in different age groups was significant (P-value = 0.019) (Table 1).

Table 1: Relationship between MRI results and different age groups

Variables		Year						DF	P-value
	Age ranges	13-20	21-30	31-40	41-50	51-60	61-72		
MRI	Normal	9.7%	26.3%	26.3%	17.3%	4.3%	4.7%	5	0.019
	Abnormal	0.3%	2.3%	2.0%	4.3%	0.7%	1.7%		

Based on the estimation of the regression coefficient (0.044) it can be concluded that the frequency of abnormal MRI is directly related to the age. The correlation between the type of MRI and the number of migraine attacks per month by Chi-square test showed that with an increase in the number of migraine attacks per month, the relative frequency of abnormal MRI has also increased significantly (P-value < 0.05) (Table 2).

Table 2: Relationship between MRI results and the frequency of migraine attacks per month

Variables		The frequency of attack in a month		P-value
	Attack in month	1 time in a month	More than 1 time in a month	0.001
MRI	Normal	36.3	52.3	
	Abnormal	2.3	9.0	

From between 300 patients, 12.3% of them were male and 87.7% male. 12.2% of women and 5.6% of men were of abnormal MRI, but Chi-square test revealed that MRI status does not depend on gender (P-value > 0.176). The statistics also showed that the status of MRI results is significantly related to high blood pressure, so that with the increase in blood pressure the ratio of people with abnormal MRI to people with normal MRI is significantly increased (P-value < 0.05) (Table 3).

Table 3: Relationship between MRI Results and Patients' Blood Pressure

Variables		Blood pressure		P-value
		Normal	High	
MRI	Normal	84.7%	4.0%	0.001
	Abnormal	8.0%	3.3%	

However, no association was found between the status of MRI results with cholesterol (P-value > 0.454), diabetes (P-value > 0.226), heart diseases (P-Value>0.316) and thyroid diseases (P-value > 0.454). Statistical analysis revealed that there is a statistically significant relationship between the type of a headache (a common migraine and classical migraine) and MRI status. This means that the ratio of a classic migraine (a migraine accompanied by aura) to a common migraine (a migraine without aura) is increased significantly in people with abnormal MRI (P-value = 0.007) (Table 4).

Table 4: Relationship between MRI results and migraine headache type

Variables		Headache category		P-value
		Common migraine	Classic migraine	
MRI	Normal	80.3%	8.3%	0.007
	Abnormal	8.3%	3.0%	

The highest incidence of lacunar infarct (2.3%) was in the age range of 41 to 50 years and the lowest (0%) in the range of 13 to 30 years. Also, the highest prevalence of WML was in the range of 21-30 years old (2.3%), and the lowest (0%) was between the ages of 51 and 60 years. From the perspective of the Chi-square test, these differences are significant (P-value = 0.003), or, in other words, the type of brain subclinical lesion depends on the age of the patients, as the age increases the incidence of lacunar infarct increases and the prevalence of WML decreases (Table 5).

Table 5: Relationship between the type of brain subclinical lesion and patient's age

		Subclinical cerebral lesion			P-value
		Lacunar infarct N (%)	WML N (%)	Normal N (%)	
Age Ranges	13-20	0 (0%)	1 (0.3%)	29 (9.7%)	0.003
	21-30	0 (0%)	7 (2.3%)	79 (26.3%)	
	31-40	1 (0.3%)	5 (1.7%)	79 (26.3%)	
	41-50	7 (2.3%)	6 (2.0%)	52 (17.3%)	
	51-60	2 (0.7%)	0 (0%)	13 (4.3%)	
	61-72	4 (1.3%)	1 (0.3%)	14 (4.7%)	

The incidence of Lacunar infarct and WML in patients with high blood pressure was equal to 1.7% and 1% and in other individuals 3% and 5.7%, respectively. Statistical analyses revealed a correlation between the blood pressure variable and the prevalence of lacunar infarct and WML lesions so that the ratio of these lesions was significantly higher in those with hypertension. The results also showed that in patients with high blood pressure, the incidence of lacunar infarct is higher and in those with normal blood pressure the incidence of WML lesion is higher (P-value = 0.001) (Table 6).

Table 6: the relationship between the type of subclinical brain lesion and patients' blood pressure

		Blood pressure		P-value
		Normal	High	
Subclinical cerebral lesion	Lacunar infarct	9 (3%)	5 (1.7%)	0.001
	WML	17 (5.7%)	3 (1%)	
	Normal	252 (84%)	14 (4.7%)	

The incidence of lacunar infarct and WML complication in a common migraine was 3.7% and 5%, respectively, and in a classical migraine, it was 1% and 1.7% respectively. Based on the results of proportional statistical tests, there was a significant relationship between the type of subclinical brain lesions and migraine type.

However, in both types of a migraine, the percentage of WML is higher, but the proportion of WML in a classical migraine (a migraine with aura) is greater than that of a common migraine (a migraine without aura). It is also evident in the data that the ratio of the presence of subclinical lesions in the classical migraine population is more than a common migraine (P-Value = 0.034) (Table 7).

Table 7: the relationship between the type of brain subclinical lesion and type of a migraine headache

		Migraine category		P-value
		Common	Classic	
Subclinical cerebral lesion	Lacunar infarct	11 (3.7%)	3 (1.0%)	0.034
	Wml	15 (5.0%)	5 (1.7%)	
	Normal	240 (80.0%)	26 (8.7%)	

Statistics did not reveal any significant relationship between the type of subclinical brain lesions and gender variables (P-value = 0.341), the duration of the disease (P-value = 0.712), and the number of migraine attacks per month (P-value = 0.072).

Discussion

Migraine is a cerebrovascular disorder; according to studies, relatively high rate of migraine disabling characteristics have led researchers to explore different ways to detect intracranial lesions in these patients. A large proportion of these known lesions can be considered as a risk factor for stroke. The incidence of migraine-related stroke, or in other words, every stroke that occurs in migraine conditions ranges from 1.44 to 1.7 in every 100,000 per year [1]. The present study also was designed and conducted aimed at measuring and finding the relationships between the status of MRI results and the type of brain subclinical lesion on the one hand and the indices like age, gender, and type of migraine, the number of migraine attacks, blood pressure and heart diseases, cholesterol, diabetes and thyroid diseases on the other. The results of this study showed that with increasing age, increased blood pressure and increased number of migraine attacks in the month, the abnormal MRI frequency also increased significantly. The statistics also showed that the ratio of classic migraine to common migraine in patients with abnormal MRI increased significantly (P-value < 0.05). Meanwhile, there was no significant relationship between MRI results and age, diabetes, cholesterol, heart and thyroid diseases. On the other hand, it was found that the relative frequency of Lacunar infarct was higher in people with hypertension and older age. Regarding the non-experimental study, which was done in a cross-sectional fashion, and considering that this study cannot determine the causal relationship and only can explain the accompaniment of two phenomena, it can not necessarily be concluded that the presence of brain subclinical lesions in the MRI of patients with Migraine represents the history of ischemic stroke or demyelination disease in the past or its occurrence in the future, but the existence of a relationship can lead us to a wider and more prospective research. The researches whose reports have been published have definitely not declared the causal relationship between these

variables, but despite numerical differences, there is a correlation between these factors. For example, based on data resulting from a comprehensive meta-analysis conducted by Swartz et al., the WML lesion is found in migraine neuronal imaging of individuals with migraine more than non-migraine individuals and it has a high odds ratio equal to 3.9 (95% CI = 2.26-6.72) [14]. While in their meta-analysis study in 2013 Bashir et al., reported less probability than Swartz et al., (CI 1.07-2.65%OR 1.68, 95); it showed that it only was associated with migraine with aura not with Migraine without aura [15]. The results of the study conducted by Bashir et al., are in line with the results of the present study. Because our results also proved that the proportion of WML lesion in the classical migraine (Migraine with Aura) is greater than common migraine (migraine without aura). Kruit et al., & Trauninger et al., reported in separate studies that an increased risk of subclinical infarction and WML lesion is associated with an increased incidence of headache [16] [17]. At a higher level and compared with the study of these two research groups, it was also evident in our data that the ratio of the presence of subclinical lesions in the classical migraine population is more than common migraine. Erdelyi-Botor et al, after tracking the results of MRI in migraine sufferers, showed that WMH increases with the increase in migraine duration [18]. Le Pira et al also reported in their study that there was no relationship between the number of migraine attacks and the progression of brain subclinical lesions [19]. However, our study proved that there is no significant relationship between the type of brain subclinical lesion (Lacunar infarct and WML) and the number of migraine attacks and the duration of the disease. Headache associated with arterial pressure is one of the issues discussed in migraine specialist assemblies. Some people believe that a headache may be a sign of arterial pressure, but sometimes people with high blood pressure may not have the risk of migraine and other types of headaches. Conversely, in some studies this relationship was inverse [20]. The results of this study showed that the status of MRI results is significantly associated with high blood pressure and with the increase in blood pressure, the proportion of people with abnormal MRI to normal MRI increases significantly. Despite the widespread variation in the reports of researchers and despite some controversial and ambiguous cases, there is a comprehensive conformity between this research and the other similar studies. The main reasons for these differences can be attributed to factors such as sample size and target population, age and gender composition, clinical characteristics, technical factors, and technological differences and the like.

In conclusion, the prevalence of abnormal MRI in older people and those with high blood pressure, as well as those who are involved in migraine with Aura (a classical migraine), is significantly higher. Also, about the prevalence of various subclinical lesions in the population under study, it can be concluded that the ratio of the presence of subclinical lesions in the classical migraine population (a Migraine with aura) is more common than a migraine. Ultimately, it's important to note that although clinical studies have shown an increase in the prevalence of brain infarction and white matter lesions of WML in migraine patients, but the increase in the prevalence of these lesions in these patients has not any clear explanation.

References

1. Haji Naghi Tehrani Kh, Mousavi F, Shojaei A. Prevalence of epilepsy in migraine patients and their first-degree relatives. International Research Journal of Applied and Basic Sciences. 2015; 9(4):482-484.

2. Lipton RB, Stewart WF, Diamond S, Diamond ML, Reed M. Prevalence and burden of migraine in the United States: data from the American Migraine Study II. Headache. 2001; 41(7):646-57. https://doi.org/10.1046/j.1526-4610.2001.041007646.x PMid:11554952

3. Burch RC, Loder S, Loder E, Smitherman TA. The prevalence and burden of migraine and severe headache in the United States: updated statistics from government health surveillance studies. Headache. 2015; 55:1-21. https://doi.org/10.1111/head.12482 PMid:25600719

4. Stovner LJ, Andree C. Prevalence of headache in Europe: a review for the Eurolight project. The journal of headache and pain. 2010; 11(4):289-99. https://doi.org/10.1007/s10194-010-0217-0 PMid:20473702 PMCid:PMC2917556

5. Nazari F, Eghbali M. Migraine and its relationship with dietary habits in women. Iranian Journal of Nursing and Midwifery Research. 2012; 17(2 Suppl 1):S65-S71. PMid:23833603 PMCid:PMC3696968

6. Manzoni GC, Torelli P. Epidemiology of migraine. The journal of headache and pain. 2001; 2(Suppl 1):s11-s3. https://doi.org/10.1007/s101940170002 PMCid:PMC3451821

7. Min YW, Lee JH, Min B-H, Lee JH, Kim JJ, Chung C-S, et al. Clinical Predictors for Migraine in Patients Presenting With Nausea and/or Vomiting. Journal of Neurogastroenterology and Motility. 2013; 19(4):516-20. https://doi.org/10.5056/jnm.2013.19.4.516 PMid:24199013 PMCid:PMC3816187

8. Weatherall MW. The diagnosis and treatment of chronic migraine. Therapeutic Advances in Chronic Disease. 2015; 6(3):115-23. https://doi.org/10.1177/2040622315579627 PMid:25954496 PMCid:PMC4416971

9. Zhang Y, Parikh A, Qian S. Migraine and stroke. Stroke and Vascular Neurology. 2017; 2(3):160-7. https://doi.org/10.1136/svn-2017-000077 PMid:28989805 PMCid:PMC5628377

10. Gaul C, Messlinger K, Holle-Lee D, Neeb L. [Pathophysiology of Headaches]. Deutsche medizinische Wochenschrift. 2017; 142(6):402-8. https://doi.org/10.1055/s-0042-111694 PMid:28329901

11. Spector JT, Kahn SR, Jones MR, Jayakumar M, Dalal D, Nazarian S. Migraine headache and ischemic stroke risk: an updated meta-analysis. The American journal of medicine. 2010; 123(7):612-24. https://doi.org/10.1016/j.amjmed.2009.12.021 PMid:20493462 PMCid:PMC2900472

12. Schurks M, Rist PM, Bigal ME, Buring JE, Lipton RB, Kurth T. Migraine and cardiovascular disease: systematic review and meta-analysis. BMJ (Clinical research ed). 2009; 339:b3914. https://doi.org/10.1136/bmj.b3914 PMid:19861375

PMCid:PMC2768778

13. Kruit MC, van Buchem MA, Launer LJ, Terwindt GM, Ferrari MD. Migraine is associated with an increased risk of deep white matter lesions, subclinical posterior circulation infarcts and brain iron accumulation: The population-based MRI CAMERA-study. Cephalalgia. An international journal of headache. 2010; 30(2):129-36.

14. Swartz RH, Kern RZ. Migraine is associated with magnetic resonance imaging white matter abnormalities: a meta-analysis. Arch Neurol. 2004; 61(9):1366-8. https://doi.org/10.1001/archneur.61.9.1366 PMid:15364681

15. Bashir A, Lipton RB, Ashina S, Ashina M. Migraine and structural changes in the brain: A systematic review and meta-analysis. Neurology. 2013; 81(14):1260-8. https://doi.org/10.1212/WNL.0b013e3182a6cb32 PMid:23986301 PMCid:PMC3795609

16. Kruit MC, van Buchem MA, Hofman PA, Bakkers JT, Terwindt GM, Ferrari MD, et al. Migraine as a risk factor for subclinical brain lesions. Jama. 2004; 291(4):427-34. https://doi.org/10.1001/jama.291.4.427 PMid:14747499

17. Trauninger A, Leél-Őssy E, Kamson DO, Pótó L, Aradi M, Kövér F, Imre M, Komáromy H, Erdélyi-Botor S, Patzkó Á, Pfund Z. Risk factors of migraine-related brain white matter hyperintensities: an investigation of 186 patients. The journal of headache and pain. 2011; 12(1):97-103. https://doi.org/10.1007/s10194-011-0299-3 PMid:21331756 PMCid:PMC3056006

18. Erdelyi-Botor S, Aradi M, Kamson DO, Kovacs N, Perlaki G, Orsi G, et al. Changes of migraine-related white matter hyperintensities after 3 years: a longitudinal MRI study. Headache. 2015; 55(1):55-70. https://doi.org/10.1111/head.12459 PMid:25319529

19. Le Pira F, Reggio E, Quattrocchi G, Sanfilippo C, Maci T, Cavallaro T, et al. Executive dysfunctions in migraine with and without aura: what is the role of white matter lesions? Headache. 2014; 54(1):125-30. https://doi.org/10.1111/head.12158 PMid:23808818

20. Finocchi C, Sassos D. Headache and arterial hypertension. Neurological sciences : official journal of the Italian Neurological Society and of the Italian Society of Clinical Neurophysiology. 2017; 38(Suppl 1):67-72.