

Neuro-structural Evaluation by Magnetic Resonance Imaging in Patients Diagnosed with Migraine Headaches, with and without Aura

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Abstract Introduction: Migraine is one of the most common disabling disorders affecting more than 20% of general population at least for once in their lifetime. There are generally two types of migraine headaches, classified as with and without auras, presenting as visual, sensory or motor symptoms. In this study, authors plan to investigate the structural difference between these patients group by Magnetic Resonance Imaging (MRI) in a prospective case-control study. **Materials and Methods:** From August 2015 to October 2017, we have enrolled 40 patients suffering from migraine with aura symptoms into group A, and also we have categorized another 40 patients diagnosed with migraine without any types of aura in group B. These patients were referred to our neurology clinic of one of private hospitals in Tehran. Demographic data and thorough neurological examination performed and they underwent 1.5 Tesla MRI for further assessment of neuro-structures by an expert blinded neuro-radiologist. Statistical analysis was performed by SPSS 17.0 program using Student's T-test and Chi-square test. **Results:** In group A, there were 9 males and 31 females with mean age of 34.3 years, while there were 13 males and 27 females with mean age of 37.6 years in group B. (P value=0.08) Twenty-five patients in group A experienced visual symptoms, followed by 9 patients with sensory symptoms and 6 patients with motor symptoms. MRI study for group A revealed normal neuro-imaging in 18, pineal and choroid plexus calcification in 8, hyperintense lesions on optic nerve and tract in 4, vascular malformation in 4, hyperintense signal on centrum semiovale in 3 and lateral ventricle asymmetry in 3 patients. While MRI study in group B revealed normal neuro-imaging in 24, hyperintense signal on centrum semiovale in 6 and lateral ventricle asymmetry in 4, dilated ventricles defined by Evans' ratio in 3, pineal and choroid plexus calcification in 2 and brain tumor consistent with meningioma in 1 patient. **Conclusion:** Authors have found that some specific MRI pattern such as hyperintense lesions on optic nerve and tract and vascular malformation were exclusive to patients who experienced migraine with aura. Also we have noticed that patients without aura tend to have more normal neuro-imaging rather than patients with aura experience. Also we have found that pineal and choroid plexus calcifications were frequent in patients with migraine and aura experience. These findings, especially hyperintense lesions on optic nerve may prompt further evaluation for possible underlying demyelinating and auto-inflammatory and/or auto-immune diseases.

Keywords: Migraine, Headache, Magnetic Resonance Imaging, Demyelinating

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1. Introduction

Headache accounts for 5% of medical admissions to hospitals and more than 18% of neurology consultation worldwide. [1] In 2012, in global burden of disease figures, World Health Organization (WHO) declares that the cumulative burden of migraine headache has caused it to be in top 40 disabling conditions worldwide. [2] It is defined as complex and recurrent headache, and is characterized by unilateral moderate to severe throbbing headache which is aggravated by physical activity. [3] The

second edition of the International Classification of Headache Disorders (ICHD) lists the following types of migraine: 1) migraine without aura (formerly, common migraine), 2) probable migraine without aura, 3) migraine with aura (formerly, classic migraine), 4) probable migraine with aura, 5) chronic migraine, 6) chronic migraine associated with analgesic overuse, 7) childhood periodic syndromes that may not be precursors to or associated with migraine, 8) complications of migraine, and 9) migrainous disorder not fulfilling above criteria. [4] Based on International Headache Society, migraine is diagnosed in a patient with at least 5 headache attack whom have at least 3 criteria listed in following: 1) pain

duration of 4 to 72 hours, 2) at least 2/4 of the following criteria: unilateral, pulsatile, moderate to severe, aggravating by physical activity, and 3) patient experience at least one of the following during the attack: nausea and/or vomiting, photophobia and/or phonophobia. [5] The mainstay of diagnosis of migraine headache is based on clinical findings and mentioned criteria; however, neuro-imaging is performed in certain settings. [6] In this study, authors plan to investigate the structural difference between these patients group by Magnetic Resonance Imaging (MRI) in a prospective case-control study.

2. Materials and Methods

The authors have enrolled patients with headaches compatible with International Headache Society's migraine criteria, from August 2015 to October 2017. After excluding patients with underlying intracranial malignancies and history of head and neck and intracranial radiation therapy, patients with history of intracranial surgery and infections, patients with history of severe head trauma, patients with underlying demyelinating and auto-immune and auto-inflammatory conditions which could involve cerebrovasculature and collagen-vascular diseases capable of cerebrovascular involvement, patients with decreased mental ability who were incapable of neurological examination interview, patients aged less than 18 years and more than 70 years and patients who refused to sign the written informed consent, 40 patients were enrolled in group A, defined as migraine patients with aura, while 40 migraine patients were enrolled in group B, due to the absence of aura. Patients underwent thorough neurological examination in our neurology clinic in one of Tehran's private hospitals, by an expert neurologist blinded to the study. Demographic data and thorough neurological examination performed and they underwent 1.5 Tesla Magnetic Resonance Imaging (MRI) for further assessment of neuro-structures by an expert blinded neuro-radiologist in T1 and T2 weighted sequence, as well as Diffusion Weighted Imaging (DWI) sequence. Statistical analysis was performed by SPSS 17.0 program using Student's T-test and Chi-square test.

3. Results

Between 40 patients in group A (patients with migraine and aura experience), there were 9 males and 31 females with mean age of 34.3 years. In group B (patients with migraine without aura experience), there were 13 males and 27 females with mean age of 37.6 years in group B. (P value=0.08). Twenty-five patients in group A experienced visual symptoms as following: homonymous hemianopia quadrantanopia field defect in 11 patients (27.5%), central scotoma in 8 patients (20%), tunnel vision in 5 patients (12.5%) and complete blindness which was experienced in 1 patient (2.5%). Also, 9 patients (22.5%) with sensory symptoms as paresthesia and numbness, followed by motor symptoms in 6 patients (15%) as heaviness in a limb. MRI study for group A revealed normal neuro-imaging in 18 (45%), pineal and choroid plexus calcification in 8 (20%), hyperintense lesions on optic

nerve and tract in 4 (10%), vascular malformation in 4 (10%), hyperintense signal on centrum semiovale in 3 (7.5%) and lateral ventricle asymmetry in 3 patients (7.5%). While MRI study in group B revealed normal neuro-imaging in 24 (60%), hyperintense signal on centrum semiovale in 6 (15%) and lateral ventricle asymmetry in 4 (10%), dilated ventricles defined by Evans' ratio in 3 (7.5%), pineal and choroid plexus calcification in 2 (5%) and brain tumor consistent with meningioma in 1 (2.5%) patient. There difference between pineal gland and choroid plexus calcification in patients with and without aura was statistically significant. (P value<0.05)

4. Discussion

It has been found that migraine headaches have strong genetic background, as it is shown that more than 70% of patients suffering from migraine headaches have at least one family member with same diagnosis. [7] This genetic background consists of a multi-factorial inheritance, while there are some specific syndromes associated with migraine, with autosomal dominant pattern. These specific syndromes are familial hemiplegic migraine (FHM) which is categorized as type 1, being migraine attacks with nystagmus and cerebellar symptoms, and type 2, with addition of seizure episode to type 1 FHM; in a mitochondrial disorder called MELAS (mitochondrial myopathy, encephalopathy, lactic acidosis, stroke-like episodes), CADASIL (cerebral autosomal dominant arteriopathy with sub-cortical infarcts and leukoencephalopathy). [8,9,10] Also, migraine association is described in other genetic vasculopathies with autosomal dominant inheritance pattern, being RVCL (retinal vasculopathy with cerebral leukodystrophy) and HIHRATL (hereditary infantile hemiparesis, retinal arteriolar tortuosity and leukoencephalopathy). [11,12] Moreover, there are various triggers described in many studies, including hormonal changes, stress, excessive or insufficient sleep, bright lighting exposure, head trauma, fasting and strong odors. [13] The fact that whether migraine headaches have got other underlying etiologies may prompt further evaluation rather than isolated neurological examination and history taking based on specific defined criteria. Therefore, previous studies have focused on neuro-imaging indications and listed them as following: first or worst severe headache, pattern change of migraine attacks, abnormal finding in neurological evaluation of presence of focal neurological deficits, first migraine attack in patients more than 50 years old, first migraine attack in patients with underlying disease such as malignancies and in patients receiving immuno-suppressors, headache attack which is accompanied by fever which may prompt an underlying infectious process, migraine attack which is accompanied by a seizure and headaches which is associated with intracranial pressure rising alarm signs. [14,15,16] In this study, we have found some interesting data, as patients with migraine who do not experience aura during their attack, tend to have more normal MRI than patients with aura. Also, we have found that pineal gland and choroid plexus calcifications which is a common finding in general population, is more frequent in patients with aura rather than without aura, and it was statistically significant.

Moreover, we have found that there are some patients with lesion enhancement on their optic nerve and tract, which all of the patients were migraine patients with aura. Interestingly, we have found that there was only one patient suffering from migraine, who have got brain tumor, consistent with meningioma, and patient did not experienced any kind of aura.

5. Conclusion

Authors have found that some specific MRI pattern such as hyperintense lesions on optic nerve and tract and vascular malformation were exclusive to patients who experienced migraine with aura. Also we have noticed that patients without aura tend to have more normal neuro-imaging rather than patients with aura experience. Also we have found that pineal and choroid plexus calcifications were frequent in patients with migraine and aura experience. These findings, especially hyperintense lesions on optic nerve may prompt further evaluation for possible underlying demyelinating and auto-inflammatory and/or auto-immune diseases.

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