Objective: Neuroradiological imaging is also used to differentiate between primary and secondary headaches. The aim of this study was to evaluate retrospectively the significant abnormal neuroradiological imaging results and rates in the primary headache group. In addition, it was also planned to analyze the results of all headaches with imaging and discuss the imaging in the headache with the literature.

Methods: Medical records of headache patients of the neurology outpatient clinic at the tertiary care center were reviewed. Patients who required brain imaging and did not have any disease that could cause pathology in imaging were included. Neuroradiological images were grouped as brain computed tomography (CT), brain magnetic resonance imaging (MRI) and others. Results were normal, significant abnormal findings and others.

Results: Total 1545 patients were included. Primary headache 992, secondary headache 91, painful cranial neuropathies and other headaches were observed in 462 patients. Significant abnormal radiological findings were found to be 4.3% in primary headache, 14.3% in secondary headache, and 6.6% in painful cranial neuropathy and other headaches. Significant findings in primary headache were Arnold Chiari Malformation, sinus thrombosis, intracranial mass, choroid plexus xanthogranuloma, hydrocephalus, vascular malformation.

Conclusion: In this series, the rate of significant findings in neuroradiological imaging in primary headache is low. Secondary headaches require neuroimaging because of the presence of underlying life-threatening causes, although the rate of abnormal neuroradiological imaging is low. History, examination, and red flags in headache may lead to imaging, but patient and physician concerns may also increase imaging rates.

Key Words: Neurology, headache, primary headache, neuroimaging, computed tomography (CT), magnetic resonance imaging (MRI)

Received: 08.03.2019
Accepted: 11.18.2019
INTRODUCTION

Headache is one of the most common symptoms that could impair an individual’s quality of life. It is a common cause of presentation to physicians’ offices and has a large share in health expenditures worldwide. The global prevalence of headache is unclear, and the prevalence of primary headache is greater. In 2010 global disease burden questionnaire, stress type headache and migraine are the second and third most common disorders worldwide, with migraine being also the seventh most common cause of disability (1). Although secondary headaches are rarer, they are of greater importance. Their etiologies may include life threatening conditions of central nervous system or other systems. Thus, evaluation of pain and decision making about the necessity of imaging studies are crucial for patients presenting to neurologist with headache. The aim of this study was to retrospectively evaluate neuroimaging rates and results in primary headache group. It is also planned to review the results of other headaches which have neuroimaging, which is important in the headache, and to discuss the imaging of headache with relevant literature.

METHODS

In this retrospective and cross-sectional study, electronic medical records of our neurology outpatient clinic were reviewed by four neurologists between July 2016 and July 2017. Patients with headache were enrolled who have main diagnosis of headache and brain neuroimaging (CT, MRI and other brain studies (MRI/CT venography-angiography, diffusion, or their combinations with brain CT/MRI) was performed. Patients with a known intracranial neoplasm, vascular lesion or seizure disorder were excluded. All MRI studies had done with 1.5 Tesla and two detector computed tomography had used. The results of imaging studies were reviewed by radiologist and neurologist from written report and image archive systems. The main diagnosis of headache was determined with pain history and international classification of disease (ICD) code. Age, gender, headache diagnosis, type and result of neuroimaging and neurological examination findings of all patients were recorded. The results of neuroradiological imaging were categorized according to McCrory et al. in the US Headache Consortium as follows: normal (normal, T2 hyperintensity of migraine), important abnormalities and others, i.e. unimportant findings (sinusitis, ischemic gliotic focus, lacunar infarction, meningeoma, arachnoid cysts, demyelinating plaques) (2). Important abnormalities included tumors, hydrocephalus, vascular malformations (aneurysm, arteriovenous malformation, cavernoma, venous angioma) and Arnold-Chiari malformation (ACM), intracerebral and extracerebral hemorrhage, acute and subacute ischemia, and sinus thrombosis. Headache was categorized by (ICHD)-3 beta as primary, secondary, painful cranial neuropathies, and other headache disorders. Other headaches were non-specific headaches of primary headaches which did not meet the diagnostic criteria and excluded the secondary causes. In the primary headache it was known headache class but unexpected age was requested in the presence of a change in the character of pain, in the presence of unresponsiveness to treatment, in secondary headaches and in others in the presence of a red flag and history that did not meet the primary headaches (3). Imaging findings were assessed by subgroups in the primary headache category. The study was approved by our university’s clinical research ethic committee (02.06.2018-03/01).

Statistical analysis

The statistical analyses were performed with SPSS 21 (SPSS Inc, Chicago, Ill, USA) software package. Quantitative variables were expressed as percentage, mean, and standard deviation. Data distribution was assessed with the normality test, with non-normally distributed variables being compared with Mann Whitney-U test. p value of less than 0.05 was considered statistically significant.

RESULTS

In this study, medical records of 2980 patients who have headache were reviewed. Total 1545 patients were included according to inclusion and exclusion criterias. There were 1113 women (72.03%) and 432 men (27.9%) in study group. The mean age was 42.8 (range 16-90) years. There is not significant difference in mean age between female and male patients (42.53±16, 43.69±17 p=0.264).

Primary headache was the most common type of headache (991 patients, 64.2%), followed by painful cranial neuropathies and other headaches (462 patients, 29.5%) and secondary headache (91 patient, 5.9%). The primary headache subtypes were migraine (345 patients, 34.8%), tension type headache (TTH) (528 patients, 53.2%), migraine with TTH (108 patients, 10.9%), trigeminal autonomic headache (4 patients, 4%), and other primary headaches (stabbing headache, 7 patients, 7%) (Table 1). Neurological examination was pathological (papillary edema) only three cases in primary headache group. In painful cranial neuropathy and other headaches, neurological examination was normal but neurological examination findings could not be achieved in secondary headaches.

Table 1. Groups of headache

| Headache group                                | n (%)   |
|-----------------------------------------------|---------|
| Primary headaches                             | 992 (64.2) |
| Painful cranial neuropathies and other headaches | 462 (29.9) |
| Secondary headaches                           | 91 (5.9)  |
| Total                                         | 1545    |

The rates of neuroimaging studies are given on Table 2. The most frequent imaging method was MRI (828, 53.6%) in the study group. The important radiological finding was found 4.3% in primary headache, 14.3% in secondary headache, and 6.6% in painful cranial neuropathy and other headaches. Abnormal imaging findings in primary headache subgroup were present 2% in migraine, 1.6% in TTH, 0.6% in combined migraine and TTH, and 0.1% in trigeminal autonomic headache (Table 3). Normal radiological imaging findings were present 86.4% in primary headache and 9.3% in other findings.

Table 2. The types of neuroimaging

| Neuroimaging study | n (%)   |
|--------------------|---------|
| Brain MRI         | 828 (53.6) |
| Brain CT          | 598 (38.7) |
| Others            | 119 (7.7)  |
| Total             | 1545    |

MRI, Magnetic rezonans imaging; CT, Computerize tomography

Table 3. Significant neuroimaging abnormalities in patients with primary headache

| Primary subtypes | headace | Neuroimaging findings | Significant abnormalities | Other | Total |
|------------------|---------|-----------------------|---------------------------|-------|-------|
|                  | Normal  | Significant          |                           |       |       |
| Migraine         | 300     | 20                    | 25                        |       | 345   |
| TTH              | 454     | 16                    | 58                        |       | 528   |
| Mikst (migraine +TTH) | 93  | 6                     | 9                         |       | 108   |
| TOH              | 3       | 1                     | 0                         |       | 4     |
| Other primary headache | 7 | 0                     | 0                         |       | 7     |
| Total            | 857     | 43                    | 92                        |       | 992   |

TTH, Tension type headache; TOH, Trigeminal autonomic headache

DISCUSSION

History, neurological and systemic examinations are important tools to make an accurate diagnosis of headache, a complaint commonly observed in the neurology practice.
Neuroradiological imaging serves to differentiate primary headaches from secondary ones. In addition, some conditions may require neuroradiological imaging if a follow-up or primary headaches are suspected. This study examined imaging data of large patient group who were diagnosed as having primary headache (migraine, stress, trigeminal autonomic headache and other primary headaches). It revealed a prevalence of 4.3% for important abnormal radiological findings. Studies in the literature assessing brain CT findings in chronic headaches (with unknown main diagnosis) have revealed a prevalence of 0-3% for important radiological findings. While focus on the finding of cerebellar tonsils through foramen magnum for 3 to 5 mm downwards; it is controversial if it is a true cause of headache. In our study, 19 cases in the primary headache group had incidental ACM Type I, of which 10 were diagnosed with migraine. Other incidental findings were choroid plexus xanthogranuloma, vascular malformation (aneurysm, cavernoma), and hydrocephalus. An intracranial mass (schwannoma, paraganglioma and occipital mass) was observed in two migraine patients and one TTH. Prior clinical studies have reported that isolated headache is rare, occurring rather with other symptoms. Moreover, stress type headache was the most common headache type followed by migraine type headache in primary and secondary metastatic tumors. Sinus thrombosis was detected in three patients (two migraines, one TTH) who were found to have papillary edema in neurological examination.

The retrospective analysis revealed that there were 91 secondary headache cases, which had a rate of important radiological findings of 14.3%. Apart from neuroradiologically diagnosable secondary headaches such as subarachnoid bleeding, cerebral venous thrombosis that are mentioned in the literature, some conditions may be of interest to the clinician. While focus on the finding of cerebellar tonsils through foramen magnum for 3 to 5 mm downwards; it is controversial if it is a true cause of headache. In our study, 19 cases in the primary headache group had incidental ACM Type I, of which 10 were diagnosed with migraine. Other incidental findings were choroid plexus xanthogranuloma, vascular malformation (aneurysm, cavernoma), and hydrocephalus. An intracranial mass (schwannoma, paraganglioma and occipital mass) was observed in two migraine patients and one TTH. Prior clinical studies have reported that isolated headache is rare, occurring rather with other symptoms. Moreover, stress type headache was the most common headache type followed by migraine type headache in primary and secondary metastatic tumors. Sinus thrombosis was detected in three patients (two migraines, one TTH) who were found to have papillary edema in neurological examination.

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