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Comprehensive Criteria for Differential Diagnosis and a Surgical Management Algorithm for Occipital Neuralgia and Migraine Headaches

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ABSTRACT

The differential diagnoses and nuances of the surgical management of occipital migraine and occipital neuralgia have not been clearly discussed in the available literature. This study aims to highlight additional diagnostic features and offers an algorithm for the surgical treatment of occipital migraine and occipital neuralgia based on the vast experience of the senior author spanning over 23 years. A retrospective cohort study was conducted to review the number and distribution of patients who underwent surgical treatment for occipital migraine headaches and neuralgia and the signs and symptoms observed.

Among the 660 patients who underwent surgical treatment for headaches within the territory of the greater occipital nerves, 86 patients underwent isolated deactivation of the greater occipital site (site IV) or combined greater and lesser occipital sites (site IV and site VI surgical). Within the isolated occipital headache group, 43 patients met the criteria for migraine headaches and 43 for occipital neuralgia. Our additional observation on the differences between the occipital neuralgia and migraine groups included that

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occipital neuralgia is more commonly unilateral, less commonly familial, and more commonly associated with a whiplash-type injury. In addition, the patient with occipital neuralgia can consistently identify the distinct point of pain using the index finger. An ultrasound Doppler signal can also be detected at the pain site and a pulse is often palpable in the site identified by the patient. Occipital neuralgia is also commonly continuous and unrelenting, with occasional spikes of shooting pain, and is less likely to respond to botulinum toxin-A injection. Patients with occipital neuralgia often have a single-site headache while patients with migraine headaches often suffer from headaches in multiple sites. Additional clinical criteria are offered for the differential diagnosis of occipital migraine headaches and occipital neuralgia based on the vast experience of the senior author and the developed surgical management algorithm.

Introduction

According to the *International Classification of Headache Disorders* (ICHD-3) published in 2018 by the International Headache Society, occipital migraine and occipital neuralgia (ON) are described as two entities with different presentations and diagnostic criteria.[1] Migraine headache (MH) is defined by at least 5 headache attacks in a lifetime lasting 4-72 hours and characterized by moderate or severe intensity, unilateral location, pulsating quality, and aggravation upon performing routine physical activity. During the headache attack, either nausea and/or vomiting or photophobia and phonophobia should occur. If the headache is accompanied by aura symptoms, even 2 attacks during a lifetime allow the diagnosis of MHs.[1]

MH is one of the most prevalent and disabling medical illnesses in the world. Indeed, the annual and lifetime prevalences are estimated as 18% and 33% in women and 6% and 13% in men, respectively.[2,3] The World Health Organization ranks migraine as the third most prevalent medical condition and the second-most disabling neurological disorder in the world.[3]

Alternately, based on the ICHD-3 definition, ON is characterized by unilateral or bilateral paroxysmal shooting or stabbing pain in the posterior part of the scalp in the distribution of the greater, lesser, or third occipital nerves sometimes accompanied by diminished sensation or dysesthesia in the affected area and commonly associated with tenderness over the involved nerve. Pain is usually severe and recurring in paroxysmal attacks and last from a few seconds to minutes accompanied by the sensation of vascular throbbing and burning.[1] ON is considered a rarer disorder than migraine, with an incidence reported at approximately 1.8% in the general population.[4]

In 2000, the senior author reported a modern surgical treatment for frontal MHs.[5] He documented resolution or improvement in MHs in patients who underwent resection of the corrugator supercilii muscle as a part of forehead rejuvenation.[5] Further studies demonstrated that peripheral nerve trigger sites can be surgically deactivated to provide relief from MHs through prospective pilot, comprehensive prospective randomized, and prospective randomized with sham surgeries and 5-year follow-up.[6-10] During the ensuing years, he developed different surgical techniques to deactivate the seven identified MH trigger sites: frontal (site I), temporal (site II), intranasal (site III), occipital (site IV), auriculotemporal (site V), lesser occipital (site VI), and isolated terminal branches of any of these nerves, including those responsible for the nummular headaches (VII).[11-28] The occipital trigger site corresponds to the site of irritation in the distribution of the greater, lesser, and third occipital nerves (GON, LON, and TON).[22,23,27,29]

Despite affecting the same area, occipital MH and ON, as outlined by the ICHD-3 criteria, represent two separate conditions with different clinical presentations. As the treatment plan will be comparatively different based on the nature of the condition, the aim of this report is to offer more subjective and objective criteria for the diagnoses of these conditions and a treatment algorithm of occipital MH and ON based on the senior author's experience spanning over two decades.

Methods

A retrospective cohort study was conducted to review all patients who underwent surgery for occipital MH and ON between August 2000 and May 2023 and those who were available for follow-up. All patients were evaluated, operated on, and followed up by the senior author. Institutional Review Board approval was obtained. Data were extracted from a prospectively maintained digital database. A detailed history was obtained. A previous diagnosis of MH or ON by a neurologist was always a contingency for surgery. Patients completed a MH Questionnaire before and after surgery.

Results

A total of 660 patients were treated surgically for headache affecting the occipital area. Among these, 56 patients underwent isolated site IV surgical decompression, 11 patients underwent isolated surgery at site VI, 19 patients underwent combined surgery at sites IV and VI, and 515 patients underwent combined surgery at site IV and one or multiple other trigger sites.

Among the 43 patients with MH, 8 were men and 35 women, with a mean age of 53.9±13 years and a mean follow-up of 14.3±21.6 months. In this group, 27 patients underwent surgery exclusively at site IV, 5 exclusively at site VI, and 11 at sites IV and VI simultaneously.

The ON group included 43 patients (13 men and 30 women), with a mean age of 54.6±14.3 years and a mean follow-up of 17±26.4 months. Among the ON patients, 29 underwent surgery exclusively at site IV, 6 at site VI, and 8 at sites IV and site VI simultaneously.

The patients with ON consistently identified the trigger site using the index finger, and a positive ultrasound Doppler vessel signal was detected at the same point. For these patients, the site was deactivated by removing the vessel that was entangled with the nerve under local anesthesia through a horizontal incision directly over the pain site. When the headache was diffuse in the greater occipital territory, a hallmark of MH, a conventional deactivation of the GON, as previously described by the senior author,[25,29,28] was carried out. The procedure included the removal of a small segment of the semispinalis capitis muscle, release of all fascia bands, and removal of any vessels in the proximity of the GON. A traction neurectomy or transection and intramuscular implantation of the TON was carried out based on the size of the nerve. A subcutaneous flap was place under the GON. A small amount of triamcinolone was injected around the nerve.[30]

Discussion

Some distinct objective and subjective differences were discovered by the senior author between ON and MH based on their extensive experience over a two-decade span in addition to what has been described in the literature. Notably, ON is more commonly unilateral, less commonly familial, and more commonly associated with a whiplash-type injury. Especially, the patient can consistently identify the neuralgia site where an ultrasound Doppler signal can be detected. Often a pulse can be detected at the pain site in the form of palpation. The ON-related headache is commonly continuous and unrelenting, with occasional spikes of shooting pain, and is less likely to respond to botulinum toxin-A injection. Family history is often negative in patients with ON, unlike that in the patients with MH. Patients with ON often have single-site headache, whereas patients with MH frequently suffer from headaches in 2.5 sites on an average, as reported by the senior author.[31]

On comparing the nerves of patients with MHs to those who do not have MHs using electron microscopy and proteomic analysis, we demonstrated that the nerves of the patients with MHs presented myelin sheath disruption.[32] This myelin deficiency is most likely linked to a genetic disposition toward MH. Although the patients with ON almost never report a family history of headaches, they

have often sustained a whiplash injury and may have incurred traumatic damage to the myelin in an area proximal to the occipital artery or its branches. The pulsations of the artery, which do not generally irritate nerves with intact myelin, may inflame the nerves with defective myelin.

The main limitation of this article is its observational nature and the lack of a robust statistical support. A more detailed prospective study is needed to reinforce the observations from this study. However, the vast experience of the senior author over a long time-span lends reliability to this report.

Conclusion

This report offers additional observations on the differences between MH and ON based on the vast experience and keen observation of the senior author along with an algorithm for the management of these two disorders. These observations could serve as the basis for future studies and guide those who are less experienced to more effectively manage patients with these conditions.

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