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ORIGINAL ARTICLE

Journal Section

The Role of Magnetic Resonance Imaging in the evaluation of Trigeminal Neuralgia: a pilot study

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Abstract

Introduction: Trigeminal neuralgia is a debilitating painful condition affecting one or more branches of trigeminal nerve characterised by sharp shooting, electric shock like pain lasting for a short time. In most of the cases no specific cause can be identified but certain do tend to occur due to lesions or damage to the trigeminal nerve due to vascular compression, tumours, etc. which can be detected by magnetic resonance imaging. Hence, this pilot study was conducted to identify any underlying causes for trigeminal neuralgia using magnetic resonance imaging. **Method:** A prospective cross-sectional descriptive study conducted on 10 patients who presented to department with clinical symptoms of trigeminal neuralgia. Magnetic resonance imaging of brain with trigeminal protocol was conducted. The evaluation of the entire course of the trigeminal nerve was then performed by an experienced radiologist. **Result:** Out of the 10 patients, 6 were females and 4 males. Four patients did not show presence of any pathology i.e. were idiopathic. Five cases reported with neurovascular compression and one showed the presence of a tumour at the cerebellopontine angle compressing the nerve. **Conclusion:** In this study, with use of magnetic resonance imaging, a 60% occurrence of an underlying pathology was demonstrated which could be treated to relieve the neuralgia. Hence, taking into account, the high prevalence of etiological factors which could contribute towards trigeminal neuralgia detected on MRI, large scale studies can be considered for the same.

KEYWORDS

Magnetic resonance imaging; Neurovascular compression; Tumour; Trigeminal neuralgia

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1 | INTRODUCTION

Trigeminal neuralgia, also called "tic douloureux" is the most commonly reported neuralgia of the craniofacial region.[1] It has a reported incidence of 4-17 per 1,00,000 individuals.[2] Trigeminal neuralgia generally presents as paroxysmal sharp shooting, stabbing, electric shock like

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pain along the course of trigeminal nerve which is stimulated by innocuous stimuli.[1,3] Most of the cases are unilateral though bilateral involvement has been reported. Onset of pain is sudden and lasts for a few seconds. Most of the attacks occurs during waking hours.[1] It has a higher predilection for elderly individuals in the 5th to 7th decade of life and more commonly affects the female population.[4]

Trigeminal neuralgia, according to the International Headache Society is described "as painful unilateral affliction of the face characterized by brief electric shock like pain limited to the distribution of one or more divisions of trigeminal nerve".[5] The etiology of trigeminal neuralgia is not well understood but it has been found that intracranial lesions like tumours, cysts, brain stem infarct, vascular compression of trigeminal nerve root, viral infection, trauma, demyelinating or inflammatory pathologies might be a cause for trigeminal neuralgia.[1] Management of these secondary causes would reduce the insult to the trigeminal nerve and in turn provide symptom relief.

Magnetic resonance imaging is considered for evaluation of patients with trigeminal neuralgia due to its ability to depict clearly the path of trigeminal nerve from its initiation at the Meckel's cave and the surrounding vascular elements.[6,7] Thus, aim of this study was to determine the possible causes of trigeminal neuralgia with the assistance of magnetic resonance imaging.

2 | MATERIALS AND METHODS

Ethical approval was obtained from the institutional (The board of research studies [BORS] at Government Dental College and Hospital, Mumbai) ethical committee (Proposal number: GDCH/SS/EC/6693 dated 16-09-2019). This prospective cross-sectional study was conducted at the department of Oral Medicine and Radiology in Government Dental College and Hospital, Mumbai from Oct 2019 to Nov 2020. A total of 10 patients were included in the study based on the inclusion and exclusion criteria given below:

Inclusion criteria:

1. Patients who presented with clinical signs and symptoms of trigeminal neuralgia were included in the study. ICHD-3 diagnostic criteria was used for identification of patients with trigeminal neuralgia (Table 1).[8]
2. Patients newly diagnosed as well as those undergoing treatment were included in the study.
3. Patients with a local cause of pain were excluded.
4. Patients with contra-indication to magnetic resonance imaging- claustrophobia, cochlear implant, pacemaker etc. were excluded.

Complete history and clinical examination was performed for each patient, following which patient with their consent underwent magnetic resonance imaging of the brain.

2.1 | Imaging Methods

The MRI Brain examinations with dedicated trigeminal neuralgia protocol were analyzed. MRI examination protocol included

1. Thin section T2 weighted spin echo sequence -axial and coronal planes.
2. Diffusion weighted imaging (DWI) sequence.
3. 3D FIESTA (fast imaging employing steady state acquisitions, GE)/ 3D DRIVE (Philips)/ 3D CISS (Constructive interference steady state, Siemens) sequence.
4. Pre and post gadolinium axial and coronal T1 weighted imaging sequence in selected patients.

The course of trigeminal nerve was analysed and presence of any pathologies were identified which could be the possible cause of neuralgia. Based on the observations, descriptive statistics was performed.

3 | RESULTS

Total 10 patients were included in this study and among them 6 patients were females and 4 males. The age range of the patients was 26 to 71 years. All patients reported have unilateral involvement with six suffering from left sided and four from right sided trigeminal pain. Six (60%) patients reported involvement of the mandibular nerve and four (40%) reported involvement of the maxillary nerve. MRI shows underlying etiology of trigeminal neuralgia in 6 (60%) patients and among them 5 (50%) patients had presence of vascular loop (Figure 1) and 1 (10%) patient had presence of an enhancing lesion at the

cerebellopontine angle cistern which was suggestive of meningioma (Figure 2). No abnormality was observed in MRI of 4 (40%) patients (Table 2). Thus, based on the clinical and imaging findings, 5 (50%) patients were classified under classical trigeminal neuralgia, 1 (10%) under symptomatic trigeminal neuralgia and 4 (40%) under idiopathic trigeminal neuralgia.

4 | DISCUSSION

Neuralgias are debilitating pain disorders with characteristic symptoms and trigger zones. Trigeminal neuralgia is a pain disorder affecting the trigeminal nerve, the largest cranial nerve. International classification of headache disorders (ICHD-3) has classified trigeminal neuralgia into three types based on its etiology. 1. Classical trigeminal neuralgia which occurs due to neurovascular compression; 2. Secondary trigeminal neuralgia which could be attributed to underlying disease like multiple sclerosis, cerebellopontine angle tumours, A-V malformations, etc; 3. Idiopathic trigeminal neuralgia in which MRI showed no structural abnormalities.[8]

In this study, five (50%) patients of trigeminal neuralgia reported presence of a vascular loop in the imaging which was found to be abutting against the trigeminal nerve in the cisternal region (Fig. 1). Janetta was the first person to identify neurovascular compression as a cause for trigeminal neuralgia.[9] The common belief is that the neurovascular compression at the root entry zone (also called Obersteiner-Redlich zone) leads to demyelination followed by remyelination which leads to aberrant activation of nociceptive A delta fibers.[10] It is said that the root entry zone is the most susceptible to damage by neurovascular compression. Magnetic resonance angiography can be additionally used to further analyse the relationship of nerve root and the vessels.[9] Cruccu et al. demonstrated neurovascular conflict in 19 patients among 128 cases of trigeminal neuralgia.[11] Geneidi et al. found vascular loop in seven patients (15.55%) compromising the trigeminal nerve among 45 patients with trigeminal pain.[6] Maarjberg et al. studied 135 patients with trigeminal neuralgia and found a prevalence of neurovascular contact as 89% on the symptomatic side and 78% on the asymptomatic side.[12] The difference in prevalence could be attributed to the smaller sample size included in this study as it was a pilot study.

Previously, trigeminal neuralgia due to neurovascular compression and idiopathic causes were considered under a single heading of primary trigeminal neuralgia. However, in the latest classification given by ICHD-3, trigeminal neuralgia due to neurovascular compression was considered under classical category while a separate category was made for idiopathic trigeminal neuralgia.[13] In this study, out of the ten, four (40%) cases reported no structural abnormalities in magnetic resonance imaging and thus were considered under idiopathic trigeminal neuralgia. Geneidi et al. found no underlying pathology in 20 (44.4%) cases of trigeminal neuralgia out of 45 studied.[6] Out of the 49 patients who underwent brain imaging studied by Ayele et al., 36.1% were unremarkable.[14] Similar findings were noted in the present study.

Trigeminal neuralgia due to underlying diseases or lesions such as multiple sclerosis, intracranial cyst or tumours, viral infections, etc; were considered under the term secondary trigeminal neuralgia. One such case was reported in this study, where the patient presenting with symptoms of trigeminal neuralgia along the distribution of the left mandibular nerve, on MRI, presented with two enhancing lesions at the cerebellopontine angle cistern one at the anteromedial and other at the posterolateral aspect. The left cisternal segment of the trigeminal nerve was indented by the anteroinferior margin and was inseparable from the lesion. The radiological appearance was suggestive of meningiomas (Fig. 2). Geneidi et al. identified tumours in a total of 8 (17.7%) cases out of the 45 cases of trigeminal pain included, among which 2 were identified as meningioma.[6] Liu et al. in 2017 found among the 35 cases of trigeminal neuralgia with cerebellopontine angle tumours, 16 cases presented with meningiomas.[15]

Thus, this study reported a 60-40 occurrence of cases of idiopathic trigeminal neuralgia and cases where underlying tumour and neurovascular compression (classical and secondary trigeminal neuralgia) was determined on magnetic resonance imaging. Similarly, Geneidi et al. concluded that MRI could depict the pathology in 25 (55.56%) cases out of 45 studied.[6] Hence, identification

of these etiologies plays an important role as it points towards a different direction of management for these patients.

5 | CONCLUSION

Trigeminal neuralgia is an orofacial pain disorder which tends to deteriorate the quality of life of patients. Based on etiology, it is divided into three categories, namely: classical, secondary and idiopathic. Magnetic resonance imaging with its high sensitivity can be used to identify the underlying condition or any neurovascular compression in patients with trigeminal neuralgia. Hence, based on the findings of the pilot study, large scale studies should be considered for identification of the underlying pathology in patients with trigeminal neuralgia and if reported at a higher prevalence, then MRI could be included as a standard of care for patients with trigeminal neuralgia.

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Nil

Conflict of interest

The authors have no conflicts of interest to declare.

Supporting Information

Additional supporting information may be found at the journal's website.

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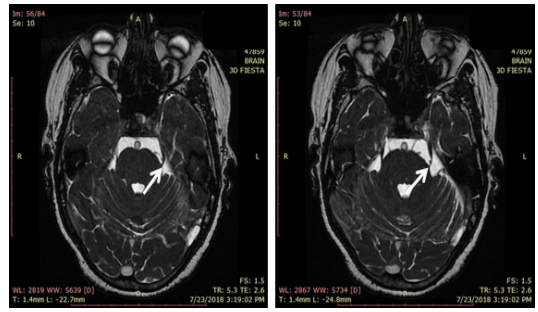

FIGURE 1 Axial T2 MRI images at the level of pons showing vascular loop compressing cisternal portion of left trigeminal nerve.

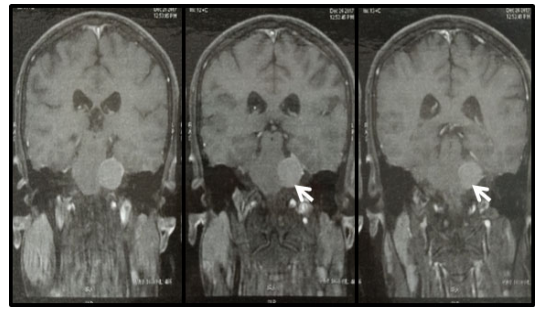

FIGURE 2 Coronal T1 post contrast images at the level of CP angle cistern shows homogeneously enhancing extra axial mass lesion in left cerebellopontine angle cistern.