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Original Article

MRI Evaluation of Suspected Cases of Trigeminal Neuralgia

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Abstract

Introduction: Trigeminal neuralgia is a worry some clinical condition causing pain along distribution trigeminal nerve. Cause identification is necessary to provide exact management of this painful condition. MRI is one of the best imaging modalities to find out aetiology of this disease.

Materials and Methods: This descriptive cross sectional study was carried out in enrolling suspected subjects from Multicenter Trigeminal neuralgia for a period of eight months. MRI was carried out in all the cases with conventional sequences with MRA and 3D FIESTA protocol for Trigeminal nerve.

Results: The aetiology of neuralgia were vascular compression (75.71%), CP angle mass (15.38%) and Mass in Meckel's cave (11.53%). Cause was not identified at 15.38% cases. Left trigeminal nerve was affected in most of the cases (61.54%). Aberrant direction of Vertebral artery was most common (33.34%) cause of vascular compression. Most of the patients presented with pain, which was intense (about 46.15%) sudden (38.46%) in nature. Pain was triggered by precipitating factors in 30.76% cases.

Conclusion: MRI was able to find out cause of Trigeminal neuralgia in most of the cases. So, MRI with 3D FIESTA protocol for Trigeminal nerve with MRA is advised for suspected cases of Trigeminal neuralgia referred by physicians.

Keywords: Trigeminal neuralgia, MRI, Vascular compression.

Introduction

Trigeminal neuralgia (TN), also known as tic douloureux is a clinical manifestation of sudden paroxysmal pain in face along distribution of Trigeminal nerve. Diagnostic criteria are there would at least three attacks of unilateral facial pain occurring in one or more division of trigeminal nerve and no radiation beyond its distribution. Sometimes, the pain often leaves patients with uncontrollable facial twitching.^{1,2} Exact prevalence of trigeminal neuralgia is exactly unknown in Bangladesh. However, trigeminal neuralgia affects subjects between 21 and 87 years with a mean age of 50.62 years in India. Mandibular nerve is involved in most of the cases (56.9%), right side of the face (57.1%) is more involved than the left side. Other study showed prevalence was 4 to 13 per 100,000 people per year.^{1,3} The most common cause of trigeminal neuralgia is compression of cisternal portion of the trigeminal nerve by loop of an artery or vein compressing the.

Vascular contact deforming the trigeminal nerve is seen in about 15% of cases.⁴ Nerve root entry zone is the site where the nerve exits the brainstem. There is transition zone of approximately 2 mm in length and this area is vulnerable than any other part of the nerve to be involved. Other rare cause of Trigeminal neuralgia are posterior fossa tumors, most commonly vestibular schwannomas, meningiomas, arachnoid cysts, or epidermoid cysts.^{5,6,7} Multiple sclerosis may be responsible for trigeminal neuralgia and, indeed, its incidence is much higher in multiple sclerosis patients than in the general population.^{4,6,8} From this knowledge dedicated protocol including T2 or T1 volumetric acquisition techniques with thin slices in all three planes should be helpful.⁹ Authors suggested Diffusion weighted imaging can be used to assess the cisternal and brainstem components of the nerve and assess ADC values, fractional anisotropy and mean diffusivity.¹⁰ The most challenging aspect of trigeminal

neuralgia treatment is maintaining pain control to improve patients' quality of life. Patients with intractable pain may require surgical referral. Clinicians should screen and treat patients for comorbid depression and anxiety, which may negatively affect treatment efficacy and outcomes in trigeminal neuralgia.^{9,10,11} The initial treatment of trigeminal neuralgia is medical, with carbamazepine and/or gabapentin. However, large surgical series have confirmed that microvascular decompression of the trigeminal nerve root is an efficient and durable treatment for trigeminal neuralgia. Other advanced procedures include, Gamma Knife radiosurgery, thermal, chemical, or mechanical controlled rhizotomies of the trigeminal ganglion or root and trigeminal nerve stimulation which is considered "off-label" use (2019) in the USA.^{5,9,11} This present descriptive cross sectional study was carried out to find out possible cause of Trigeminal neuralgia in Bogura District, Bangladesh. MRI is becoming one of popular, available modality in peripheral part of Bangladesh, outside Capital Dhaka. The finding of the study will help the Clinician as well as Radiologist to find out aetiology of Trigeminal neuralgia.

Materials and Methods

This descriptive cross sectional study was carried out in enrolling suspected subjects from Multicenter (TMSS Medical College & Rafatullah Community Hospital, 250 bedded Mohammad Ali Hospital, Bogura and Imaging was carried out at Popular Diagnostic Ltd, Bogura) for a period of eight months (December 2021 to July 2022). Images were obtained by Siemens 1.5T achive MRI machine. Expenditure for MRI study was carried out by study subjects. Ethical Clearance was given by Ethical Review Board of TMSS Medical College. Sequence of MRI were T1 weighted whole brain axial and sagittal (volumetric) for screening. For sagittal image was obtained from ear-to-ear, top of frontal sinus to hyoid bone and all of mandible was within study field, centered on posterior nasal cavity with FOV of about 180 x 180. Coronal images were obtained from tip of nose to 4th ventricle, top of frontal sinus to hyoid bone and all of mandible. FOV was about 180 FH and 150 LR. Axial included top of frontal sinus to hyoid bone and all of mandible,

centered on posterior nasal cavity with FOV of about 180 AP x 170 LR. T2 weighted axial images limited to posterior fossa with thin slices (e.g. 3D FIESTA, In Siemens vendor this protocol called T2 Drive) to assess the trigeminal nerves from their origin at the mid pons anteriorly, through the prepontine cistern until the Meckel's cave (trigeminal ganglion). Additional axial FLAIR image were obtained to exclude multiple sclerosis. Then Post contrast T1 in axial and coronal planes and Fat Sat T1 weighted considered in at least one plane. In poor patient, contrast was not used. Images were obtained by experienced Technologist with sound knowledge of cranial nerve imaging. Images were analyzed by three experienced Radiologist separately to eliminate bias. Relevant demographic, clinical findings were scrutinized by other researchers and finally analyzed by SPSS v23.

Results

The age of the study subjects was ranged from 26 to 61 years. Majority of subjects were females. Most of the subjects (about 23.07%) were within 30 to 39 years age group.

Table-I Age gender distribution (n=26)

Age group	Male (n/%)	Female (n/%)
20-29	01 (03.84)	03 (11.53)
30-39	06 (23.07)	06 (23.07)
40-49	03 (11.53)	05 (19.28)
50 and above	01 (03.84)	01 (03.84)

Most of the patients presented with pain, which was intense (about 46.15%) sudden (38.46%) in nature. About 30.76% subjects experienced stabbing pain and in 30.76% cases pain was triggered by precipitating factors (Table I and Figure 1).

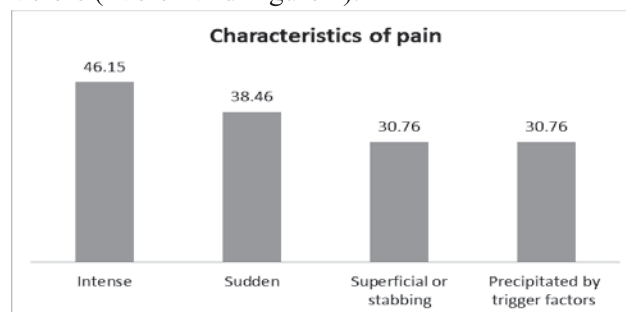


Figure-1 Bar diagram showing characteristics of pain (n=26)

* Multiple responses were elicited.

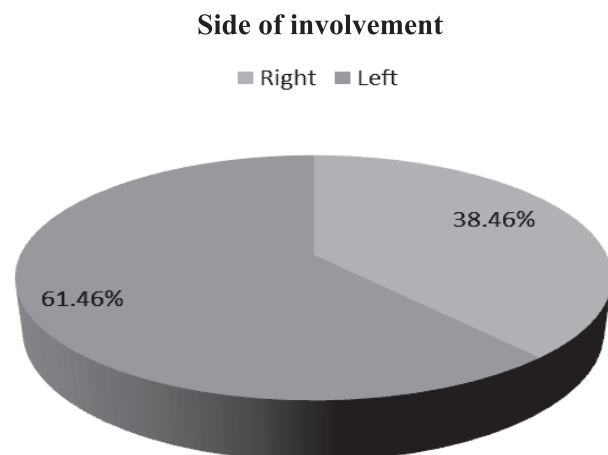


Figure-2 Side of involvement (n=26)

Left side was affected in most of the cases (61.54%) (Figure 02).

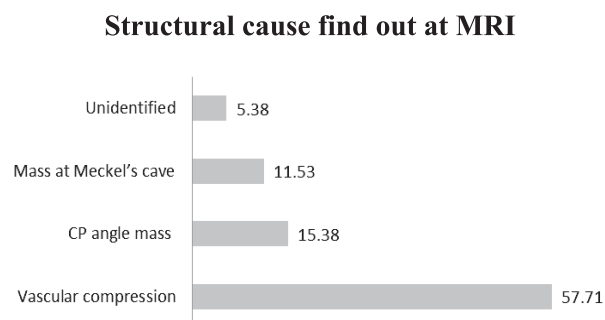


Figure-3 Structural cause find out at MRI (n=26)

The aetiology of neuralgia was vascular compression (57.71%), CP angle mass (15.38%) and Mass in Meckel's cave (11.53%). Cause was not identified at 5.38% cases the structural factors on MRI of Table 3 are shown in (Figure 3 and table III)

Table-II Vascular compression (n=15)

Artery	Number/Percentage (%)
Vertebral (Aberrant direction)	05 (33.34)
Basilar	02 (13.33)
Superior cerebellar	03 (20.00)
Anterior inferior cerebellar	02 (13.33)
Posterior inferior cerebellar	03 (20.00)

Aberrant direction of vertebral artery was most common (33.34%) cause of vascular compression. Besides superior cerebellar, posterior inferior cerebellar arteries (20%) and anterior inferior, basilar arteries (13.33) were involved in vascular compression (Table II).

Table III: CP angle mass (n=04)

Masses	Number/ Percentage (%)
Schwannoma	03 (75.00)
Meningioma	01 (25.00)

CP angle masses causing neuralgia were Schwannoma (75%) and meningioma (25%) (Table III).

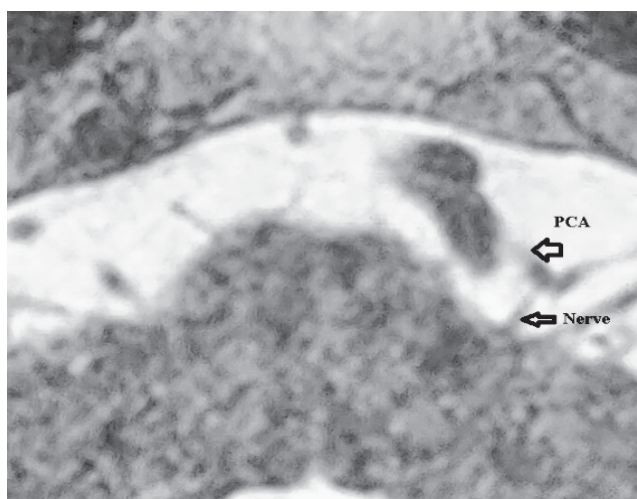


Figure-4 Axial 3D T2 Drive MR image.

Figure-4 Axial 3D T2 Drive MR image revealing compression of cisternal part of left Trigeminal nerve by PCA.

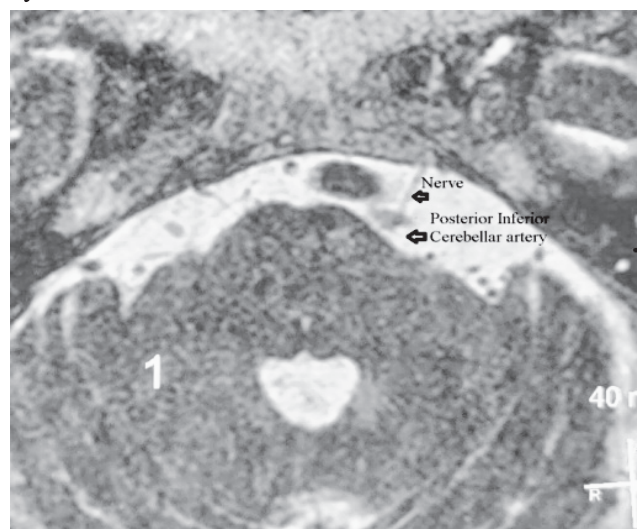


Figure-5 Axial 3D T2 Drive MR image.

Figure-5 Axial 3D T2 Drive MR image showing compression of left Trigeminal nerve by posterior inferior cerebellar artery.

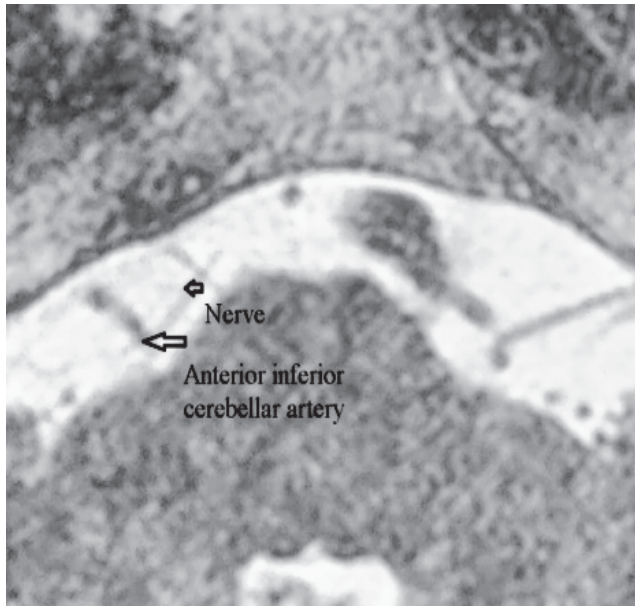


Figure-6 Axial 3D T2 Drive MR image.

Figure-6 Axial 3D T2 Drive MR image revealing compression of cisternal part of right Trigeminal nerve by anterior inferior cerebellar artery.

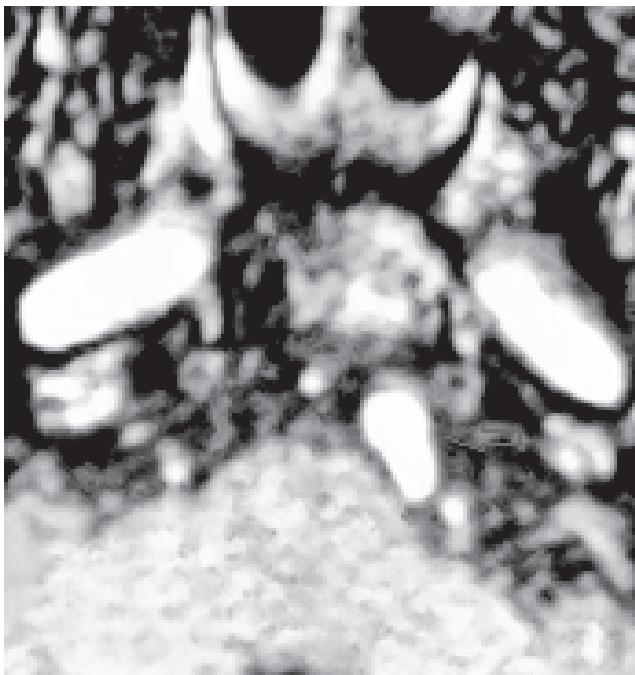


Figure-7 Axial TOF MR image.

Figure-7 Axial TOF MR image revealing compression of cisternal part of left Trigeminal nerve by aberrant vertebral artery (Red arrow).

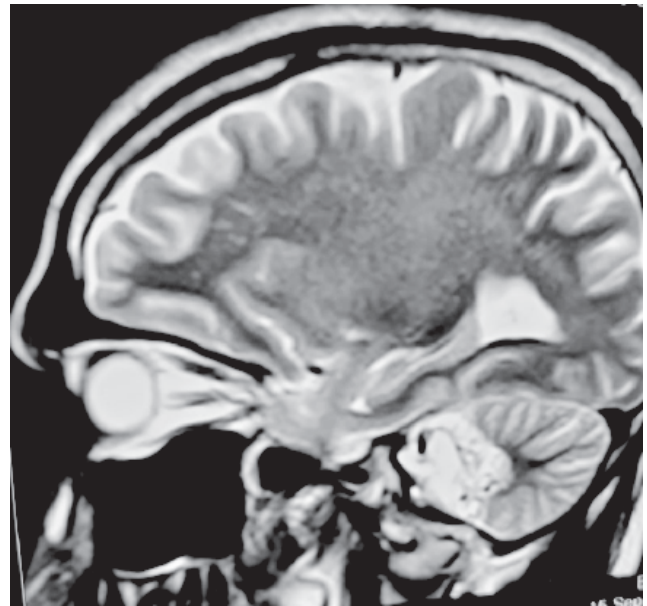


Figure-8 Sagittal T2 weighted MR image.

Figure-8 Sagittal T2 weighted MR image showing compression of left Trigeminal nerve region by CP angle mass.



Figure-9 Coronal T2 weighted MR image.

Figure-9 Coronal T2 weighted MR image in patient with known case of carcinoma of breast showing hyper intense mass (Metastasis) in left Meckel's cave (Red arrow).

Discussion

Trigeminal neuralgia is a condition affecting sudden, severe facial pain along distribution of trigeminal nerve. This neurologic pain presents with episodes of severe, sudden, shock-like pain in one side of the face that lasts for seconds to a few minutes. The exact cause is unknown, but believed to involve loss of the myelin of the trigeminal nerve. This caused by compression from a blood vessel as the nerve exits the brain stem, multiple sclerosis, stroke, or trauma. Less common causes include a tumor or arteriovenous malformation.¹ Diagnosis is typically based on the symptoms, after ruling out other possible causes such as postherpetic neuralgia. In current study it was found that aetiology of neuralgia were vascular compression (75.71%), CP angle mass (15.38%) and Mass in Meckel's cave (11.53%). Cause was not identified at 15.38% cases.

The superior cerebellar artery is one of the most frequent vessels responsible for trigeminal neuralgia, as it contributes to 75–80% of cases. Other blood vessels known to cause trigeminal neuralgia include the anterior inferior cerebellar artery (AICA) and vertebral artery, as well as (to a lesser extent) the petrosal vein.¹⁴ Aberrant direction of Vertebral artery was most common (33.34%) cause of vascular compression in our present study. Besides superior cerebellar, posterior inferior cerebellar arteries (20%) and anterior inferior, basilar arteries (13.33) were involved in vascular compression in our study.

It is estimated that 1 in 8,000 people per year develop trigeminal neuralgia. It usually begins in people over 50 years old, but can occur at any age.^{1,2} Women are more commonly affected than men.^{3, 5 6} In our study The age of the study subjects was ranged from 26 to 61 years. Majority of subjects were females. Most of the subjects (about 23.07%) were within 30 to 39 years age group. Left side was affected in most of the cases (61.54%).

The typical form results in episodes of severe, sudden, shock-like pain in one side of the face that lasts for seconds to a few minutes. Groups of these episodes can occur over a few hours. The atypical form results

in a constant burning pain that is less severe.^{4,6,7,8} Episodes may be triggered by any touch to the face. Both forms may occur in the same person.^{1,2} It is regarded as one of the most painful disorders known to medicine, and often results in depression.⁵ Most of the patients presented with pain, which was intense (about 46.15%) sudden (38.46%) in nature. About 30.76% subjects experienced stabbing pain and in 30.76% cases pain was triggered by precipitating factors like washing face, shaving, brushing teeth, blowing the nose, drinking too hot or cold water.

The correct clinical diagnosis is the most important factor for sufficient treatment. History remains the essential tool for diagnosis. It is important to differentiate trigeminal autonomic cephalalgias. There is a lack of evidence for diagnostic criteria. Hence, imaging important role in diagnosis and subsequent treatment.^{11,12} Imaging can help diagnose causes such as multiple sclerosis and tumors. CT is limited in evaluating the brainstem and the cisterns. MRI is the imaging modality of choice and should be considered the initial screening procedure in the assessment of patients with trigeminal neuralgia.³ In MRI transition zone between oligodendroglial-derived myelin to Schwann cells cannot currently be identified, it is important to mention how far anterior to the trigeminal nerve root entry zone the vessel compressing the nerve is located. The majority of transitional zones extend no further than 3-4 mm anterior to the nerve root entry zone and this has therefore been suggested as a reasonable cut-off between vessels that are likely symptomatic versus those that are more likely incidental.¹¹ It should be noted, however, that occasionally compression of the nerve in the anterior cisternal segment can also be symptomatic and many asymptomatic patients have vessels contacting the proximal nerve. As such, it is not possible to dogmatically state whether a vessel is symptomatic or not.¹² A dedicated protocol including T2 or T1 volumetric acquisition techniques with thin slices in all three planes should be helpful. However, an evidence-based review did not find evidence to support or refute the usefulness of MRI for this purpose.⁵ Diffusion weighted imaging can be used to

assess the cisternal and brainstem components of the nerve and assess ADC values, fractional anisotropy and mean diffusivity.¹² In current study, Sequence of MRI were T1 weighted whole brain axial and sagittal (volumetric) for screening. T2 weighted axial images limited to posterior fossa with thin slices (e.g. 3D FIESTA, In Siemens vendor this protocol called T2 Drive) to assess the trigeminal nerves from their origin at the mid pons anteriorly, through the prepontine cistern until the Meckel's cave (trigeminal ganglion). Additional axial FLAIR image were obtained to exclude multiple sclerosis. Then Post contrast T1 in axial and coronal planes and Fat Sat T1 weighted considered in at least one plane.

Conclusion

Previously trigeminal neuralgia was very difficult to diagnose because there was no specific diagnostic test and symptoms were very similar to other facial disorder. Now due to experience of physician this disease is clinically diagnosed confidently and advanced imaging modalities finally confirms diagnosis in most of the suspected cases. From the study findings it is observed that MRI can find out cause of Trigeminal neuralgia in more than 85% cases and vascular compression is the most common aetiology of trigeminal neuralgia. MRI with 3D FIESTA protocol for Trigeminal nerve with MRA is advised for suspected cases referred by physicians.

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