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THE ROLE OF MAGNETIC RESONANCE IMAGING IN THE EVALUATION OF TRIGEMINAL NEURALGIA.

Radio-Diagnosis

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ABSTRACT

Introduction: Trigeminal neuralgia is characterized by electric shock-like pain, abrupt in onset and brief, in the distribution of one or more divisions of the trigeminal nerve. [1] Trigeminal neuralgia can be classified into two types- classical and symptomatic by the criteria laid down by the International Headache Society. Hereafter, we will not distinguish the two, with 'trigeminal neuralgia' used for referring to both types. **Objectives:** The current study is to identify the prevalence of abnormal magnetic resonance imaging and its causes using routine and (3D FIESTA) MR imaging sequence in South Indian population with trigeminal neuralgia diagnosed clinically. **Material and methods:** Prospective cross sectional descriptive study was conducted on 40 consecutive patients who presented to the Department of Radio diagnosis, Narayana Hospital, Narayana Medical College and Research Institute between June 2020 to September 2022 . Their clinical data and imaging findings were analyzed. **Results:** Out of 40 patients, 17 were men (42.5%) and 23 were women (57.5%). Abnormal magnetic resonance imaging findings were demonstrated in 32(80%) of the cases. The results are summarized. **Conclusion:** Magnetic resonance imaging with 3D FIESTA sequence is considered the first line of investigation in patients with trigeminal neuralgia. Magnetic resonance imaging helps in determining patients who will benefit from surgical treatment.

KEYWORDS

INTRODUCTION:

Trigeminal nerve is the fifth and largest cranial nerve and arises from one motor nucleus and three sensory nuclei in the brain stem. The three sensor nuclei, namely-

A. The Mesencephalic nucleus.
B. The Main sensory nucleus.
C. The Spinal nucleus.

The Motor nucleus.

The root entry zone (REZ) of trigeminal nerve is its segment in the pre pontine cistern where it is most susceptible to neurovascular conflict and signifies the transition from central to peripheral myelin.

Trigeminal nerve forms Gasserian ganglion in a CSF filled space in the petrous apex called Meckel's cave from which, ophthalmic (V1), maxillary (V2) and mandibular (V3) branches of trigeminal nerve arise.

Trigeminal neuralgia is characterized by electric shock-like pain, abrupt in onset and brief, in the distribution of one or more divisions of the trigeminal nerve.

Trigeminal neuralgia can be classified into two types- classical and symptomatic by the criteria laid down by the International Headache Society. Hereafter, we will not distinguish the two, with 'trigeminal neuralgia' used for referring to both types.

Aims and objectives:

The present study is to identify the prevalence of abnormal magnetic resonance imaging and its causes using routine and (3D FIESTA) MR imaging sequence in South Indian population with trigeminal neuralgia diagnosed clinically**.**

Causes and etiological factors:

The causes of trigeminal neuralgia vary according to the site of involvement.

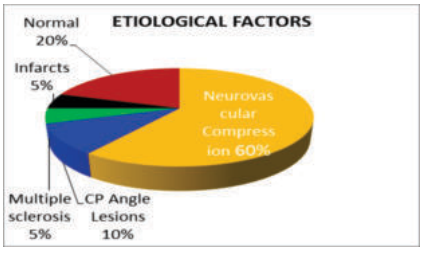
1. At the level of trigeminal nucleus:

The common causes include infarcts, cavernoma, demyelinating plaques of multiple sclerosis (MS), brain stem glioma, etc(.2)

2. At the level of prepontine cistern:

The common causes of trigeminal neuralgia are neurovascular compression, aneurysms and Cerebellopontine (CP) angle tumors.

2. Other recognized causes of trigeminal neuralgia include base of skull tumors, sarcoid, pituitary macroadenoma and perineural spread of salivary gland tumors. The most common cause of trigeminal neuralgia in previous studies was found to be neurovascular conflict most commonly by the superior cerebellar artery and its branches



MATERIALS AND METHODS:

Prospective cross sectional descriptive study was conducted on 40 consecutive patients who presented to the Department of Radiodiagnosis, Narayana Hospital, Narayana Medical College and Research Institute between June 2020 to september 2022. Their clinical data and imaging findings were analyzed.

The age of the patients ranged between 25 to 70 years (average age- 55 years). All patients had clinical symptoms lasting at least 6 months in duration before presenting for the imaging study.

Exclusion criteria:

Patients with contra-indication to magnetic resonance imaging-claustrophobia, cochlear implant, pacemaker etc., were excluded from the study. Also patients with previous history of surgery for trigeminal neuralgia were excluded.

Imaging Protocol:

A 3 Tesla GE MR machine was used for all studies. Routine sequences applied include T1, T2 and FLAIR axial sequences, coronal T2, sagittal T1/FLAIR and diffusion weighted sequence. A 3D FIESTA(Fast Imaging Employing Steady State Acquisition sequence was acquired using the standard factors provided by the vendor. Reconstruction in coronal and sagittal planes was done for interpretation of 3D FIESTA images.

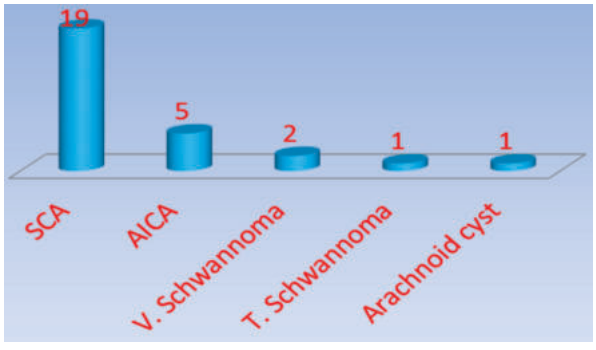
Image analysis
All images were analyzed and multi planar reconstruction was done as required. Thinning of nerve, nerve indentation and change in signal intensity at the site of a vascular loop were taken as positive evidence of neurovascular compression.

Statistical analysis:
Statistical analysis was done using frequency analysis.

RESULTS

Out of 40 patients, 17 were men (42.5%) and 23 were women (57.5%). Abnormal magnetic resonance imaging findings were demonstrated in 32(80%) of the cases. The results are summarized in [Table 1].

S.no	Etiology	Number of females(%)	Number of males(%)	Total (%)
1	Neurovascular Compression	14(35)	10(25)	24(60)
	a. Superior cerebellar artery	11(27.5)	8(20)	19(47.5)
	b. Anterior inferior cerebellar artery	3(7.5)	2(5)	5(12.5)
2	CP Angle Lesions	2(5)	2(5)	4(10)
	a. Vestibular schwannoma	1(2.5)	1(2.5)	2(5)
	b. Trigeminal schwannoma	0	1(2.5)	1(2.5)
	c. Arachnoid cyst	1(2.5)	0	1(2.5)
3	Multiple sclerosis	2(5)	0	2(5)
4	Infarcts	1(2.5)	1(2.5)	2(5)
5	normal	4(10)	4(10)	8(20)



SCA- Superior cerebellar artery, AICA- Anterior inferior cerebellar artery. V. schwannoma- vestibular schwannoma, T.schwannoma-trigeminal schwannoma

Patients with neurovascular Conflict formed an overwhelming majority of the cases. 24(60%) out of 40 patients had a neurovascular conflict demonstrable on the 3D CISS sequence(5).

19 out of 24 patients had superior cerebellar artery as the vessel in contact with the Trigeminal nerve

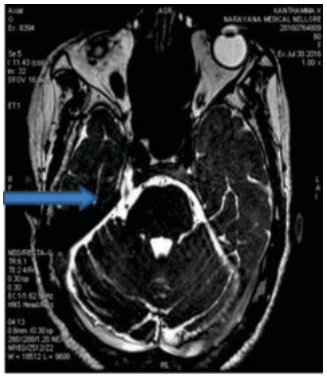


Fig.1:-Neurovascular compression. An axial FIESTA image shows right superior cerebellar artery indenting the trigeminal nerve in a patient with right hemi facial symptoms.

5 out of 24 patients had anterior inferior cerebellar artery as the cause of neurovascular contact.

In all patients, neurovascular compression was seen on the same side as the patient symptoms. Asymptomatic neurovascular conflict was found on the contralateral side in 3 out of 24 patients (6%).

Cerebellopontine angle lesions constituted 10% of the cases, with the demonstrated lesions being vestibular schwannoma (2 cases), trigeminal schwannoma (2 cases) and arachnoid cyst (one case).

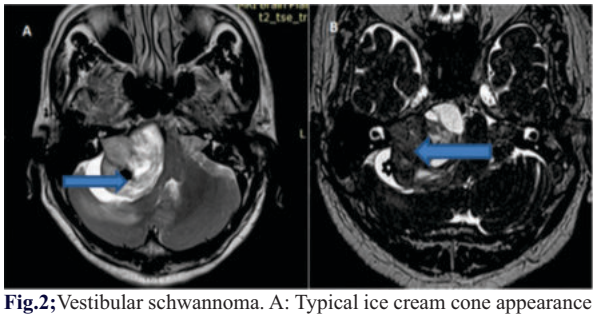


Fig.2;Vestibular schwannoma. A: Typical ice cream cone appearance of a vestibular schwannoma(*) on axial T2 image; B: The heterogeneously hyperintense T2 lesion is also seen on axial CISS sequence.

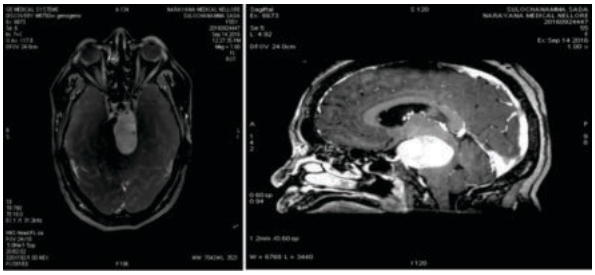


Fig.3: Trigeminal schwannoma A: Axial image showing a lesion in relation to the left trigeminal nerve. B: The lesion is demonstrated in the sagittal contrast enhanced image.

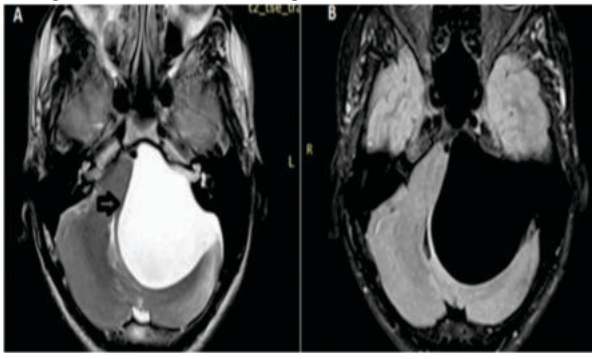


Fig.4: Arachnoid cyst. A: Well-defined lesion following CSF intensity on T2 weighted axial section; B: Same lesion in axial FLAIR image.

2 out of 40 patients (5%), known cases of multiple sclerosis had developed symptoms of trigeminal neuralgia over many months. No vascular loop was demonstrated. However demyelinating plaque was seen in the ipsilateral hemi pons in both these patients and was assumed to be the cause of patients symptoms.

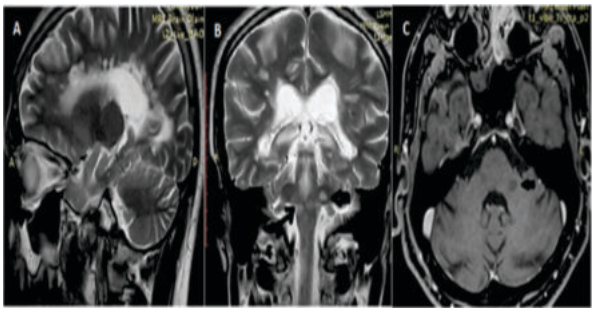


Fig.5:-Multiple sclerosis causing trigeminal neuralgia. A: Sagittal T2

weighted image showing circumscribed T2 hyper intense lesions at the callosseptal interface; B: Open arrow is pointing towards a demyelinating plaque in the left middle cerebellar peduncle. Another arrow is pointing towards multiple plaques in the brain stem

2 out of 40(5%) patients had chronic infarcts in the hemi pons on the same side as the patients' symptoms .

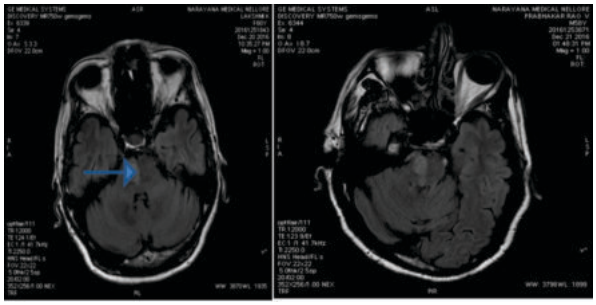


Fig 6:-Brain stem infarct Axial FLAIR images showing infarct in the right hemi pons in two as a hyper intense area. (patients presenting with trigeminal neuralgia).

DISCUSSION:

There is a high percentage (80%) of abnormal brain MRI findings in patients with trigeminal neuralgia(4) with the causative lesions and their relative frequency correlating with other studies(3).

FIESTA sequence had superior spatial and contrast resolution (due to the cisterno graphic effect) and was used in the demonstration of neurovascular contact.

In our study, 24 (60%) patients, constituting 75% of abnormal brain MRI, had a demonstrable neurovascular contact on 3D FIESTA sequence, of which superior cerebellar artery was implicated in 80% of the cases.

This shows that 3D FIESTA sequence has the highest success in demonstrating positive findings on magnetic resonance imaging.

We had two cases of vestibular and trigeminal schwannoma and one case of arachnoid cyst. Multiple sclerosis is the most common demyelinating disease and is a leading cause of non- traumatic neurologic disability. It is also a well- recognized cause of trigeminal neuralgia. About 1-5% of patients with multiple sclerosis develop trigeminal neuralgia In addition to diagnosis, magnetic resonance imaging is highly useful in pre- operative planning and in determining prognosis .

CONCLUSION:

Magnetic resonance imaging with 3D FIESTA sequence is considered the first line of investigation in patients with trigeminal neuralgia. Other than neurovascular compression, MRI also has use in ruling out other causes of trigeminal neuropathy such as cerebellopontine angle lesions, infarcts affecting brain stem etc. Magnetic resonance imaging helps in determining patients who will benefit from surgical treatment.

Abbreviation.

- FIESTA-Fast Imaging employing steady state.
- MM - Millimeter

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