MRI Reliability in Correlating Clinical Findings of Trigeminal Neuralgia

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***Abstract*—MRI is not a sufficiently accurate independent study and it does not correlate with the presentation of symptoms in patients for the evaluation of the etiology of trigeminal neuralgia. The objective of this study is to review prior MRIs performed for trigeminal neuralgia and determine if MRI findings correlate with clinical findings. This study represents a retrospective chart review in which all patients from January 1, 2012 through April 1, 2014 receiving gamma knife therapy with associated Magnetic Resonance Imaging (using a 1.5 Tesla MAGNETOM Avanto Siemens imager) for trigeminal neuralgia at the Miami Neuroscience Center at Larkin. The results obtained from this study show that the MRI is unable to reliably find the etiology of symptoms in patients with trigeminal neuralgia. These findings are similar to the observations made in prior reports. This study differs in that we attempted to quantify the reliability rather than simply make the observation. Positive predictive values were obtained for both the left and right. Left PPV - 42.8% and Right PPV - 50.6%.**

Keywords—MRI, Data Corelation, Reliability, Trigeminal Neuralgia

I. INTRODUCTION

The trigeminal nerve is the largest of all the cranial nerves (3, 4). At its origin along the lateral aspect of the Pons at the root entry zone the nerve appears as a single form but as it courses from intra- to extra-cranially it divides into three segments referred to as V1, V2 and V3 or ophthalmic, maxillary and mandibular respectively (4). The fibers of the trigeminal nerve carry both sensory and motor signals. The nerve is customarily divided into four segments to facilitate classifications of pathologies at each of those locations. The segments are: brain stem, cistern, the Meckel cave and cavernous sinus, and extra cranial (5). Abnormalities in any one of these areas have the potential to induce a trigeminal neuropathy and more specifically trigeminal neuralgia (1, 7, and 12).

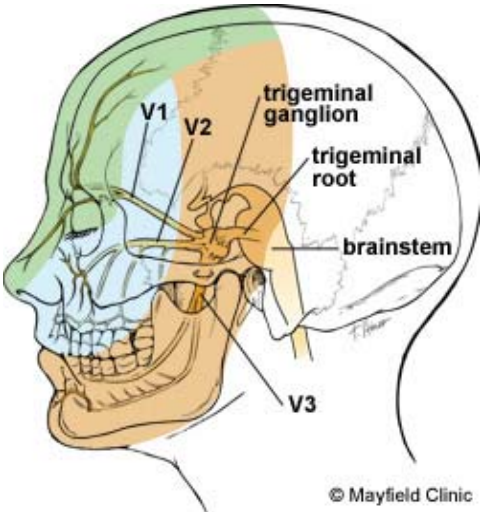

Fig. 1. This diagram demonstrates the trigeminal nerve course from its origin at the level of the pons to its distal extra cranial branches. (Courtesy: Mayfieldclinic.com)

Trigeminal neuralgia can be clinically classified based on 7 different criteria which are outside the scope of this study (8). It affects approximately 4-13 individuals per 100,000. It is classically a disease seen in the elderly (onset usually after age 50) with a greater female to male occurrence about 1.7:1 (13, 14, 15). It has been reported that within the multiple sclerosis population there is an incidence of approximately one in every 100 (1, 5).

Trigeminal neuralgia is currently diagnosed clinically with subsequent neuro imaging and trigeminal reflex tests to help differentiate the possible etiology. In the majority of cases, 80-90% of cases reported are due to compression of the trigeminal nerve root (18, 19, 20). Previous studies done have shown that MRI imaging alone would not be sufficient to confirm trigeminal neuralgia without correlating with clinical presentation, as there are instances in which physical/organic pathology is absent in MRI or sometimes organic pathology is

978-1-4799-7502-0/14 $31.00 © 2014 IEEE
DOI 10.1109/BIBE.2014.59

seen on contra-lateral side to the clinical presentation (6, 9). The objective of this study is to review MRIs performed for trigeminal neuralgia studies and determine if MRI findings correlate with clinical findings.

II. Methodology

A. Hypothesis/Null Hypothesis

Null Hypothesis: MRI is not a sufficiently accurate independent study for the evaluation of the etiology of trigeminal neuralgia.

True Hypothesis: MRI is a sufficiently accurate independent study for the evaluation of the etiology of trigeminal neuralgia.

B. Methodology

This study represents a retrospective chart review in which all patients from January 1, 2012 through April 1, 2014 receiving gamma knife therapy with associated MRI imaging for trigeminal neuralgia at the Miami Neuroscience Center at Larkin. The sample size from January 1, 2012 to April 1, 2014 was 168 cases charts, which were reviewed after approval by the Institutional Review Board (IRB).

C. Inclusion Criteria

- Have clinical findings of trigeminal neuralgia
- Had at least one MRI performed at the Miami Neuroscience Center
- Are between the ages of 18-90, both male and female
- Are being treated with gamma knife

D. Exclusion Criteria

- Had no MRI performed at The Miami Neuroscience Center
- Are below the age of 18

III. Data collection and Statistical Methods

MRI images were obtained on a 1.5 Tesla MAGNETOM Avanto-Siemens imager. The initial MRI images were obtained without contrast in the pre Gamma Knife setting. A board-certified neuro-radiologist reviewed the images independently and generated a report. The patients in the study will have trigeminal nerve involvement be classified as ipsalateral, contra-lateral, neither or both when correlated to the clinical complaint. The initial data will be organized using a Microsoft Excel spreadsheet. The statistical analysis will be performed based on the classifications stated above in relation to the entire patient population and the positive and negative predicative value of the MRI imaging in correlation with the clinical symptoms.

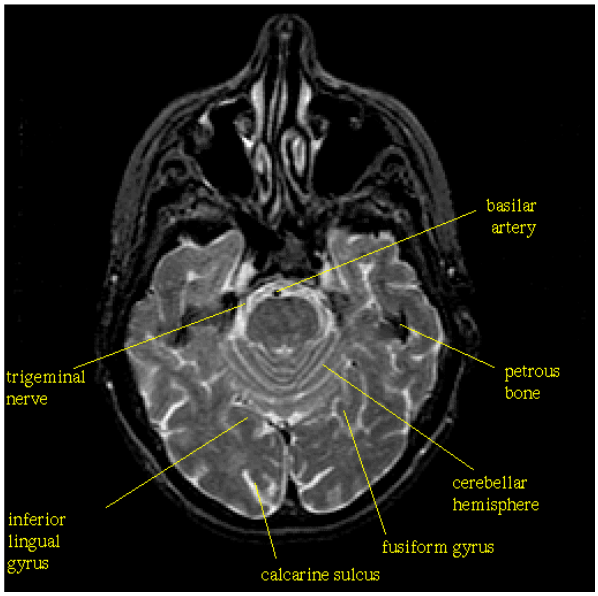

Fig. 2. A MRI image of the trigeminal nerve and surrounding anatomy. (Courtesy: GammaknifeImaging.com)

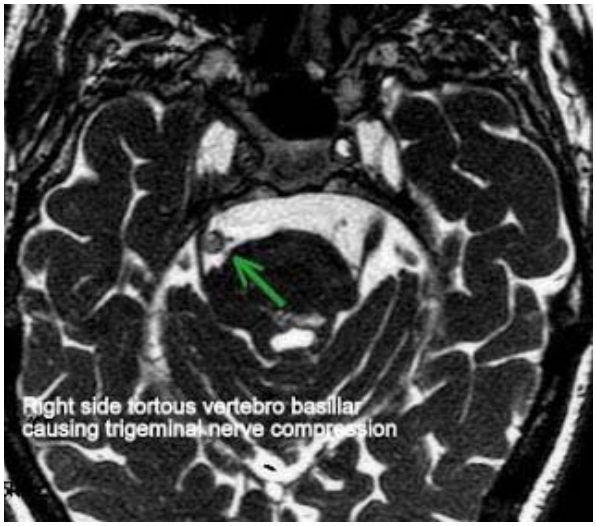

Fig. 3. An MRI of the brain demonstrating the bilateral trigeminal nerves with a tortuous basilar artery adjacent to the right trigeminal nerve close to the cisternal portion and causing mild lateral displacement of the nerve.

IV. Study Results

The results obtained from this study are that the MRI is unable to definetely confirm a definete diagnosis of organic etilogy without clinical correlation with symptoms in patients with trigeminal neuralgia. These findings are similar to the observations made in some previous studies. This study attempts to quantify the reliability, the PPV and NPV of MRI studies rather than simply make the observation. Positive predictive values were obtained for both the left and right. The

positive predictive value, Left PPV is 42.8% and Right PPV is 50.6%.

V. Discussion

MRI is an invaluable tool in the non-invasive evaluation of soft tissue structures throughout the body. It has proved to also be of paramount importance in the diagnostic, preoperative and postoperative evaluation of trigeminal neuralgia (2). From its advent to the present MR sequences have morphed into highly specialized protocols with a focal intent of better delineating the trigeminal nerve and deciphering it from adjacent structures(9). This advancement has lead to improved characterization of pathology most specifically vascular compression by a elongated superior cerebellar artery while less commonly due to an elongated anterior inferior cerebellar artery, vertebrobasilar dolichoectasia, or venous compression (5).

Vascular compression of the trigeminal nerve is recognized as the most commonly etiology for trigeminal neuralgia although interestingly prior reviews have demonstrated that there is significant variability with regard to vascular compression and manifestation of trigeminal neuralgia (5, 6, and 11). In one study performed by Tanaka et al. they found that neurovascular compression was present in the asymptomatic side in 18% of their study population. In this retrospective study we will utilize MR imaging as a first line modality for the evaluation of trigeminal neuralgia while simultaneously recognizing that bias is present due to prior clinical workout and possible outpatient treatment. Therefore, the group we are studying is already considered refractory.

Prior studies have proposed MR imaging as an initial screening procedure for all patients with refractory trigeminal neuralgia (5). We intend to test the reliability of MRI in being able to clearly delineate with clinical symptoms where a lesion is along the trigeminal nerve. This finding may help reinforce the work performed by Tash et al. and provide increased confidence in MRIs contributions. Although MRI offers the possibility of defining areas of organic lesion, prior studies reviewed by Gronseth et al. have revealed minimal evidence that is able to support MRI reliability. As such in the current paradigm of diagnostic work up of trigeminal neuralgia the three suggested instances of appropriate neuroimaging include patients with trigeminal sensory loss, patients with bilateral symptoms and young patients (under the age of 40).

In reality it is recognized that some physicians obtain neuroimaging regardless of the suggestions due to the possible clinical implications that can be offered through a pathologically positive exam (17). This thought was echoed by Goh et al. Some have proposed that vascular abutment is insufficient for the propagation of symptoms and that the variable that offers the greatest clinical correlation is compression/deformity of the nerve rather than proximity (5, 6). One limitation of this study is the lack of characterization of compressibility. This deficit is in part due to the use of gamma knife MR sequences that are limited for the evaluation of compression and the fact that this is a retrospective study for which degree of compression was not included.

VI. Conclusion

The results obtained from this study show that MRI imaging alone without clinical correlations is not a definete diagnostic or screening test. These findings are similar to the observations made in some previous studies but in this study we can say with confindence that MRI only has an approximately 50 percent positive predictive for a trigeminal neuralgia patient with clinical presentation. Therefore, it is important to correlate MRI findings with clinical correlations for a definite diagnosis and treatment modalities used for clinical/surgical management.

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