The trigeminal nerve is the largest of all the cranial nerves (4, 7). 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 intracranial to extra cranially it divides into three segments referred to as V1, V2 and V3 or ophthalmic, maxillary and mandibular respectfully(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 these locations. The segments are: brain stem, cistern, the Meckel cave and cavernous sinus, and extra cranial (18). Abnormalities in any one of these areas have the potential to induce trigeminal neupathy and more specifically trigeminal neuralgia (79)(11, 16, and 20).

Trigeminal neuralgia can be clinically classified based on 7 different criteria which are outside the scope of this study (7). It affects approximately 4-13 individuals per 100,000. It is classically a disease seen in the elderly (most usually after age 50) with a greater female to male occurrence about 1.7:1 (11, 12, 18). It has been reported that within the multiple sclerosis population there is an incidence of one in every 100 (11, 18). Trigeminal neuralgia is currently diagnosed clinically with subsequent neuroimaging and trigeminal reflex testing to help differentiate the possible etiology. A majority of the cases (80-90%) reported are due to compression of the trigeminal nerve root (10, 12, 13). Several studies have shown on MRI that there are instances in which physical pathology is absent or even contra lateral to the side of complaint (5, 6).

The objective of this study is to review prior MRI’s performed for trigeminal neuralgia and determine the reliable correlation of MRI findings regarding clinical findings. Our null hypothesis is that MRI is not a sufficiently accurate independent study for the evaluation of TN.

Materials and Methods

After receiving approval by the Institutional Review Board (IRB) we performed a retrospective chart review in which all patients from Jan. 1, 2013 through April 1, 2014 receiving gamma knife therapy with associated MRI imaging for trigeminal neuralgia at the Miami Neuroscience center were included.

MR images were obtained on a 1.5 Tesla MAGNETOM Avanto Siemens imaging. MR images were obtained without contrast in the pre gamma knife setting. A board certified neuroradiologist reviewed the images independently and generated a report. Patients in the study had trigeminal nerve involvement classified as unilateral, contra lateral, neither or both when correlated to the clinical complaint.

The initial data was organized using a Microsoft excel spread sheet. Necessary statistical analysis was performed based on the classifications stated above in relation to the entire patient population. The sensitivity and positive predictive values (PPV) of MRI in correlation with clinical findings were analyzed. Specificity and NPV were not calculated due to the fact all patients had clinical symptoms and therefore no true negatives could be established.

Results

Pathology on Imaging

<table>
<thead>
<tr>
<th>Symptom</th>
<th>MRI</th>
<th>Positive</th>
<th>Total</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>98</td>
<td>8</td>
<td>106</td>
<td>0.845</td>
<td>0.938</td>
</tr>
<tr>
<td>L</td>
<td>97</td>
<td>7</td>
<td>104</td>
<td>0.787</td>
<td>0.921</td>
</tr>
<tr>
<td>Total</td>
<td>195</td>
<td>15</td>
<td>210</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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). The result demonstrates that MRI is not a sensitive test in the evaluation of TN. The PPV indicates the probability that a patient with a positive MRI truly has correlating symptoms. This demonstrates that the PPV is essentially random and that there is an approx. 50% chance of MRI findings correlating clinically.

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 (1). From its advent, to the present MRI sequences have morphed into highly specialized protocols with an evolving effort of better delineating the trigeminal nerve and deciphering it from adjacent structures(5). This advancement has lead to improved characterization of pathology. Most notably vascular compression by an elongated superior cerebellar artery while less common due to a elongated anterior inferior cerebellar artery, vertebral/vascular denticulate, or venous compression(19).

Vascular compression of the trigeminal nerve is recognized as the most commonly etiology for trigeminal neuralgia although interesting prior reviews have demonstrated that there is significant variability with regard to vascular compression and manifestation of trigeminal neuralgia (15, 5, and 2). 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 utilized MRI imaging as a modality for the evaluation of trigeminal neuralgia while simultaneously recognizing that biased is present due to prior clinical work-up and possible outpatient treatment. Therefore, the group we studied is already considered sedentary.

Prior studies have proposed MRI imaging as an initial screening procedure for all patients with seductive trigeminal neuralgia (18). We tested the reliability of MRI in being able to clearly delineate the association with clinical symptoms if there is a lesion along the trigeminal nerve. Our findings reinforce that under the protocols we used MRI is unreliable as a sole source for the evaluation of TN but when used in conjunction with clinical findings it can be beneficial in cases of TN due to adjacent structural abnormalities.

Although MRI offers the possibility of defining areas of insult, prior studies reviewed by Gross et al have revealed minimal evidence that is able to support MRI reliability. As such, in the current paradigm for the diagnostic work up of trigeminal neuralgia the three suggested instances of appropriate neuroimaging include patients with trigeminal sensory loss, patients with bulilateral symptoms and young patients (under the age of 40). In reality it is recognized that some patients obtain neuroimaging regardless of the reasons due to the possible clinical implications that can be offered through a pathologically positive exam (3). This thought is further supported by Gross et al in conclusion our research clearly displays that MRI alone cannot be the singular methodology for the evaluation of TN and clinical findings must remain paramount and guide treatment.

Limitations

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 MRI sequences that are limited for the evaluation of compressions and the fact that this is a retrospective study for which degree of compression was not included.

References

2. Larkin Community Hospital, Nova Southeastern University

Normal and Pathologic Images of TN

Fig 1. Normal TN

Fig 2. Vascular compression

Fig 3. Vascular compression at the right TN root entry zone

Fig 4. Vascular compression of the right TN root entry zone

Fig 5a. No associated vascular compression

Fig 5b. No associated vascular compression

Fig 6. Vascular compression by meningioma

Fig 7. Normal TN