Outcome Prediction in Patients with Trigeminal Neuralgia Treated with Novalis Radiosurgery: An Image Analysis Study

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Object

Imaging characteristics such as neurovascular conflict (NVC) and cisternal length of the trigeminal nerve have been implicated in the pathoetiology and response to microsurgical management of trigeminal neuralgia (TN). The relationship between such imaging factors and response to stereotactic radiosurgery (SRS) remain incompletely characterized. The aim of this study is to evaluate the relationship between imaging characteristics and treatment response to SRS for patients with TN.

Methods

This is a retrospective review of patients with TN treated with SRS at the University of California, Los Angeles from 1996 to 2012. Two hundred and eighteen patients had special magnetic resonance imaging (MRI) such as constructive interference in steady state (CISS) or fast imaging employing steady-state acquisition (FIESTA) from which detailed imaging assessments could be made, including the presence of NVC, location of NVC, presence of vertebrobasilar dolichoectasia (VBD), trigeminal nerve length between the root entry zone (REZ) and Meckel's cave, and diameter of vessels over NVC were derived. Patient charts were reviewed to obtain clinical outcomes (stratified by Barrow Neurological Institute (BNI) scores). Imaging differences were evaluated for both the affected and non-affected side. Univariate analysis was performed with a threshold of significance set at p = 0.005 to assess for predictive anatomical factors which may influence clinical outcome.

Results

After SRS, BNI score decreased rapidly within six months and stabilized thereafter. The incidences of NVC and VBD on the affected side were significantly higher than the non-affected side (NVC: affected side 93.6% and non-affected side 69.3%, p <0.001; VBD: affected side 9.2% and non-affected side 0.9%, p<0.001). In terms of trigeminal nerve length within the prepontine cistern, the length of the affected side was shorter than non-affect side (mean/median length: affected side 9.8/9.7 mm and non-affected side 10.0/9.9 mm, p<0.01). Univariate analysis showed that the patients without NVC had more unfavorable BNI score at six months after treatment than that of patients with NVC (p=0.001). Moreover, the location of NVC was shown to be a statistically significant factor: patients with NVC located over the REZ and cisternal segment had the significantly improved short-term outcome when compared to Meckel's cave.

Conclusion

Compared to patients with NVC, patients without visible NVC on preoperative MRI have inferior response rate within six months. The presence of NVC may in fact be a biomarker of true TN. However, the selection of SRS target might be important for treatment response, for which further investigation may be needed.

Key Words: Neurovascular conflict; Stereotaxic Radiosurgery; Trigeminal neuralgia

Reference

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Figure 1

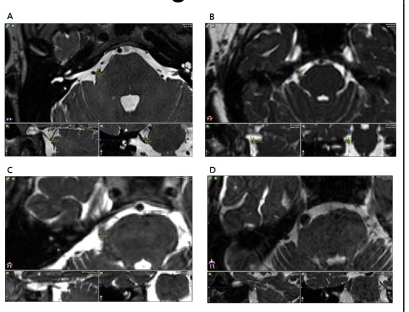
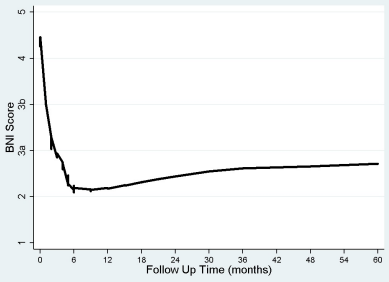


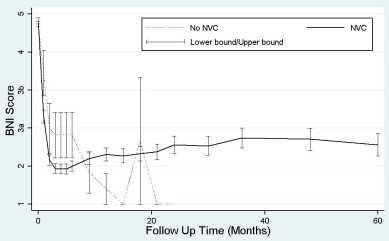
Illustration of neurovascular conflict. The cross mark the place of SRS shot.

Figure 2



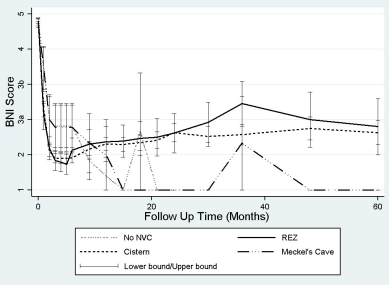
Time course of treatment response

Figure 3



Outcome prediction by neurovascular conflict (NVC: neurovascular conflict)

Figure 4



Outcome comparison between each conflict site (NVC: neurovascular conflict; REZ: root entry zone)