**Abstract**

**Objective:** To describe the use of MRI imaging using Transtympanic Gadolinium (TT Gad) in distinguishing between Vertiginous Migraine and Meniere’s Disease (MD) in a patient with vertigo.

**Study Case Report**

Methods: Patient’s chart was reviewed for reports of vertigo, vestibular function tests and imaging. The patient underwent TT Gad injection followed by MRI to assess for endolymphatic hydrops (EH). Audiogram before and after was assessed.

Results: A 43 yo man presented with recurrent vertigo attacks lasting more than one hour with right side aural fullness, tinnitus, sensitivity to sound and temperature as well as left side headaches. Vestibular testing demonstrated reduced vestibular response on the left, possible EH on the right, and vestibular Evoked Myogenic Potential suggesting possible right side superior semicircular canal dehiscence. Patient was counseled about performing an MRI after TT Gad injection to rule in Meniere’s disease. MRI 3D FLAIR sequence ruled out EH and he was started on a migraine diet. He was treated for migraines and his vertigo and headaches improved by over 90%.

Discussion: This is an interesting report because using TT Gad and MRI was able to distinguish between MD and Migraine in a patient who presented with symptoms suggestive of both and when conventional vestibular testing gave inconclusive and a complex picture. This has the potential to save the patient from unnecessary treatment for MD and side effects as well as reduced the time to a diagnosis.

**Clinical Course**

The patient’s initial audiogram (Figure 1) demonstrated a right sided conductive hearing loss. At this point multiple etiologies were discussed with the patient. However it was felt that the 2 most likely etiologies included Meniere’s Disease vs. Vertiginous Migraines with semicircular canal dehiscence also a possibility. The patient was referred for further testing including videonystagmography (VNG), electrocochleography (ECOG), cervical vestibular-evoked myogenic potential (cVEMP) testing, and rotational chair testing to better delineate the cause of the vertigo. (Table 1) However, when taken together, balance function testing was inconclusive although Rotary Chair test demonstrated vestibular compensation.

<table>
<thead>
<tr>
<th>Test</th>
<th>Details</th>
<th>Right Ear</th>
<th>Left Ear</th>
</tr>
</thead>
<tbody>
<tr>
<td>VNG</td>
<td>Warm Caloric</td>
<td>53 degree/sec</td>
<td>6 Degree/sec</td>
</tr>
<tr>
<td></td>
<td>Cold Caloric</td>
<td>9 Degree/sec</td>
<td>3 Degree/sec</td>
</tr>
<tr>
<td>Summary</td>
<td>75% Weakness on Left</td>
<td></td>
<td></td>
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<tr>
<td>cVEMP</td>
<td>Tone Burst Threshold</td>
<td>60dBHNL</td>
<td>90dBHNL</td>
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<tr>
<td>Summary</td>
<td>Hypermotivation on Right (Normal 75-100nHL)</td>
<td></td>
<td></td>
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<tr>
<td>ECOG</td>
<td>SP/AP Ratio</td>
<td>0.77</td>
<td>0.38</td>
</tr>
<tr>
<td>Summary</td>
<td>Consistent with EH on right (Normal &lt;0.5)</td>
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Table 1. Selected results from the balance function testing.

**MRI with TT Gad**

Thus, it was recommended that the patient undergo an MRI using TT Gad to assess for EH. The injection was performed as an outpatient. - Magnestiv gadolinium 1/8th dilution in sterile water - 0.6ml injected through the posterior anterior quadrant - Patient was observed for 30 min, patient tolerated it well - The following day the patient underwent an MRI

Results: - Limited visualization of lateral semicircular canals bilaterally on T2-weighted images, likely a susceptibility artifact (Figure 2) - Homogenous distribution of injected gadolinium on perilymphatic inversion recovery on right ear - Membranous labyrinth in continuity on Endolymphatic Sequence No evidence of endolymphatic hydrops

**Post Scan Follow up**

- 1 week after the MRI, the patient denied any major effects from the TT-Gad. He denied otalgia, otorrhea, tinnitus or vertigo.
- 2 months after MRI, patient had seen a neurologist and was being treat for with valproate for the migraines, no vertigo
- 5 months after MRI, headaches 90% improved, no vertigo
- 8 months after MRI, no vertigo, Audiogram normal (Figure 3)

**Discussion**

Vertigo can be a challenging patient complaint. However there are multiple modalities to help delineate the route cause of this symptom. Our patient’s clinical picture did not lead to a definitive diagnosis. Prior research would suggest that treating the patient for MD and switching to treat migraines is reasonable. However, this approach may cause a delay in diagnosis and could potential lead to future non-compliance. Thus further testing was pursued. The audiogram, with the low frequency hearing loss may be suggestive of meniere’s. The VNG was showed vestibular weakness on the left and cVEMP demonstrated hypersensitivity on the right, opposite of what would be expected in either MD or migraines. However, ECOG demonstrated EH, suggestive of MD. Recently, MRI with TT Gad has been shown to be safe and effective at assessing for EH. Furthermore, there is limited evidence to suggest it may be more effective than ECOG at identifying EH. In this case, MRI with TT Gad did not demonstrate EH when ECOG did. The MRI findings allowed the patient to be diagnosed correctly and treated appropriately. The success of the migraine treatment further confirms that this patient suffered from Vertiginous Migraines and not MD.

**Conclusions**

In a patient who’s clinical picture lead to several different diagnoses, and who’s test results did not support a single diagnosis, MRI with TT Gad was able to rule out Meniere’s disease as the cause of his symptoms. This prevented unnecessary trial and error medical treatment and a delay in diagnosis. Furthermore, this case demonstrated the relative feasibility of the MRI with TT Gad, potentially paving the way for it to be used in other disease models.

**References**

3. Myogenic potential (cVEMP) testing, and rotational chair vestibular function tests. Imaging. The patient underwent TT Gad followed by MRI to assess for endolymphatic hydrops (EH). Audiogram before and after was assessed.
5. DeThere are currently no similar articles available.
6. A study comparing the efficacy of two different treatments for Ménière’s disease.
7. A study comparing the efficacy of two different treatments for Ménière’s disease.
8. A study comparing the efficacy of two different treatments for Ménière’s disease.
9. A study comparing the efficacy of two different treatments for Ménière’s disease.
10. A study comparing the efficacy of two different treatments for Ménière’s disease.

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