The goal of this study is to elucidate the key differences between the more common vestibular schwannoma (VS) of the internal auditory canal (IAC), and the rare metastatic lesion to the IAC.

**Study design:** Retrospective case series

**Setting:** Tertiary referral center

**Methods:** History, history, audiogram, MRI scans, cerebrospinal fluid (CSF) cytology we reviewed patients who had metastatic lesions to the IAC. Distinguishing patterns of the metastatic cases to the IAC were analyzed.

**Results:** Each patient had a history of prior malignancy. The most frequent metastases came from the breast - three of the seven total cases. Other primary malignancies originated from the parotid, gastric, and the colon. The primary malignancy location for one case could not be identified. All seven patients complained of some degree of hearing loss, five accompanied with dizziness, and three with facial palsy. Four patients had bilateral neoplasms within the IAC. Leptomeningeal carcinomatosis was found in two CSF samples. A varied form of adenocarcinoma was identified in three metastases followed by infiltrating lobular carcinoma pleomorphic variant; invasive, and high grade ductal carcinoma; and moderately differentiated squamous cell carcinoma. The duration between diagnosis of metastasis to the IAC, and identification of the primary site ranged from 24 to 48 months.

**Conclusion:** Metastatic disease to the IAC/CPA angle should be suspected in cases with sudden hearing loss, age exceeding 55 years, facial nerve neuropathy, and a history of prior malignancy. CSF cytology should be considered as a diagnostic tool in cases suspected of metastatic disease.

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**Introduction**

Refinements in neuroradiology have contributed to the diagnosis of more subtle internal auditory canal (IAC) lesions through magnetic resonance imaging (MRI). Subtle lesions may be difficult to differentiate between the more common vestibular schwannoma and a metastatic lesion. A past history of a prior malignancy, e.g., lung carcinoma or breast, mandates consideration for metastasis to the IAC from a distant site. Metastasis can occur by the seeding of malignant cells into the leptomeninges from a solid tumor. Metastasis may present with or without an accompanied cranial nerve neuropathy such as facial paresis. Vestibular schwannoma and metastatic lesions to the IAC may appear nearly identical on infused MRI. There have been few metastatic IAC cases reported in the literature. It is suspected that the actual incidence may be underestimated. The objective of this study is to elucidate factors supporting the suspicion of a metastatic tumor to the IAC.

**Methods and Materials**

Seven cases of metastasis to the IAC were obtained from Ear Institute of Chicago (EIC), from Rush University Medical Center and from the U. of Missouri. An additional case was submitted by A. Rivera, former fellow of EIC. Cases were monitored over a number of months.

**Results**

Please, refer to the table below. Primary is the original malignant site, and the metastatic side is the location of the tumor within the left or right IAC/CPA. “None” under CSF cytology denotes a test was not performed or disclosed. “NA” indicates not available from the record.

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Sex</th>
<th>Primary</th>
<th>Metastatic (Side)</th>
<th>ENT Symptoms</th>
<th>CSF Cytology</th>
<th>Approximate months Between Metastatic &amp; Primary Finding</th>
<th>Approximate months Between Metastatic &amp; Death</th>
<th>Histology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>59</td>
<td>M</td>
<td>Parotid</td>
<td>IAC (R)</td>
<td>Dizziness, hearing loss</td>
<td>None</td>
<td>24</td>
<td>19</td>
<td>High grade ductal carcinoma</td>
</tr>
<tr>
<td>2</td>
<td>74</td>
<td>M</td>
<td>Unknown</td>
<td>IAC (L)</td>
<td>Dizziness, hearing loss, facial weakness</td>
<td>None</td>
<td>48</td>
<td>8</td>
<td>Moderately differentiated squamous cell carcinoma</td>
</tr>
<tr>
<td>3</td>
<td>41</td>
<td>F</td>
<td>Breast</td>
<td>IAC (R)</td>
<td>Dizziness, ear fullness, headaches, bilateral tinnitus, hearing loss</td>
<td>None</td>
<td>None</td>
<td>28</td>
<td>Adenocarcinoma mammory type</td>
</tr>
<tr>
<td>4</td>
<td>68</td>
<td>F</td>
<td>Colon</td>
<td>IAC (R)</td>
<td>Dizziness, facial weakness, sudden hearing loss</td>
<td>Negative (Probable Malignancy)</td>
<td>NA</td>
<td>1</td>
<td>Colon adenocarcinoma</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>M</td>
<td>Gastric</td>
<td>IAC (B)</td>
<td>Dizziness, facial weakness, bilateral sudden hearing loss, bilateral tinnitus</td>
<td>None</td>
<td>None</td>
<td>0.5</td>
<td>Adenocarcinoma</td>
</tr>
<tr>
<td>6</td>
<td>59</td>
<td>F</td>
<td>Breast</td>
<td>IAC (B)</td>
<td>Dizziness, hearing loss, seizures</td>
<td>Negative</td>
<td>30</td>
<td>Alivel of 2011</td>
<td>Lobular carcinoma pleomorphic variant</td>
</tr>
<tr>
<td>7</td>
<td>53</td>
<td>F</td>
<td>Breast</td>
<td>IAC/CPA (R)</td>
<td>Hearing loss, intermittent hoarseness and dysphasia</td>
<td>None</td>
<td>24</td>
<td>Alivel of 2015</td>
<td>Invasive Ductal carcinoma</td>
</tr>
</tbody>
</table>

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**References**


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**Abstract**

**Discussion**

Metastasis to the IAC from a distant site is typically known as leptomeningeal carcinomatosis. Metastatic seeding of the leptomeninges occurs by hematogenous spread, or dissemination through veins or lymphatics. The most frequent primary sites of malignancy that metastasize to the IAC are the lungs, followed by the breast, and GI tract.

Malignant reportable cases number in the low hundreds making detection difficult. Similar configurations between metastatic lesions and VS, on gadolinium enhanced MRI of the IAC, have led to recommendations for high resolution MRI, where segments of the cranial nerves may be thinned. Protein in the subarachnoid space from fluid attenuated inversion techniques can also suggest metastatic disease. Perfusion weighted imaging (PWI) MRI, with the perfusion parameters raise the suspicion of metastatic focus. PET/CT scans are not accurate at the base of the skull. Bilateral IAC metastases, as seen with cases 3, 4, 5, and 6, can often be confused with Neurofibromatosis II, especially in young patients.

Lumbar puncture may assist in diagnosis, as cytology may be positive for malignant cells. However, 20-50% of patients with leptomeningeal carcinomatosis may have negative cytology (as in case 6). Elevated lymphocyte and protein in CSF are consistent but not diagnostic of metastasis. Recently, CSF biomarkers aid in reducing the amount of malignancy needed for a positive reading. For example, CSF analysis with carcinomembrycin antigen (CEA) can be used as a biochemical marker when suspicious of adenocarcinoma. Newer emphasis is placed on cancer genomics, classifying the DNA of each lesion to tailor treatments and define the mechanism of brain metastasis.  

Generally, metastasis to the IAC occurs in older individuals with a history of cancer. Five of our cases were older than 50. Cranial nerve 7 deficit is a frequent sign of leptomeningeal carcinomatosis of the IAC, three of the cases presented with facial weakness. Rapid unilateral or bilateral hearing loss was the most typical complaint in our case series. Sudden or rapidly progressive hearing loss is typically the first sign, and facial nerve palsy, which is less common, can often suggest malignancy. In our cases, all patients with the exception of 1, died within 12 months after diagnosis.

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