CASE REPORT

Breast carcinoma metastasized to vestibular schwannoma: A rare case of tumor-to-tumor metastasis and literature review

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Abstract Tumor-to-tumor metastasis is a well-recognized phenomenon. However, cerebellopontine angle tumor, especially vestibular schwannoma, is a rare location of metastasis, with only six cases being reported previously in English-language literature reviews. We report a case of a 57-year-old woman with underlying breast cancer (T2N3M1, stage IV) who presented with unilateral facial tics, paresthesia and hearing loss, who turned out to have vestibular schwannoma with adenocarcinoma metastasis.

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Introduction

Tumor-to-tumor metastasis refers to one tumor receiving metastatic deposits from another [1,2]. Such a phenomenon should be differentiated from a collision tumor, which is strictly defined as two adjacent neoplasms with distinct origin invading each other. However, these two terms have often been used interchangeably in the literature. In 1968, Campbell et al. proposed even more strict criteria for tumor-to-tumor metastasis [1]: (1) at least two primary tumors exist; (2) the recipient tumor must be a true neoplasm; (3) the metastatic neoplasm should show established growth in the recipient tumor, not the result of contiguous growth from adjacent tumor or tumor emboli; and (4) tumors that have metastasized to the lymph nodes where lymphoreticular malignant tumors already exist, are excluded. All the four criteria should be met to make a diagnosis of true tumor-to-tumor metastasis.

By reviewing the English-language literature, lung adenocarcinoma is the most frequently reported donor tumor. For the recipient tumors, renal cell carcinoma is so far the most common malignant recipient tumor, whereas meningoima is the most common benign recipient tumor [2]. Vestibular schwannoma is a rare recipient tumor, with...
only six cases being reported since 1959 [3–8]. Here, we report a case of vestibular schwannoma with adenocarcinoma metastasis from breast, and a comprehensive literature review to describe the characteristics of the disease.

Case report

A 57 year-old woman presented to our department due to left facial tics and paresthesia noted for several years, with a progressive course. In addition, progressive left hearing loss was noted. The patient had a past history of left breast invasive ductal carcinoma (grade II) with multiple skeletal metastasis (T2N3M1, stage IV), and received left modified radical mastectomy about 6 months before this admission. Chemotherapy was in process. On examination, left peripheral facial palsy (House-Brackmann grade IV/VI), hypoesthesia over the left V2–3 area, and left sensorineural hearing loss were found. Brain magnetic resonance imaging revealed a well-circumscribed tumor over the left cerebellopontine angle, with extension into the left internal auditory canal and mass effect on the brain stem (Fig. 1). The tumor was well-enhanced by gadolinium, with

![Figure 1](image1.png)

**Figure 1.** Magnetic resonance imaging revealed a heterogeneously enhanced tumor of the left cerebellopontine angle with internal acoustic canal extension (T1 with contrast enhancement).

![Figure 2](image2.png)

**Figure 2.** (A) Majority of tumor composed of elongated cells arranged in bundles as the characteristic of schwannoma. (B) Foci of pleomorphic cancer cells arranged in glandular structures were noted. (C) The cancer cells showed strong immnopositivity for cytokeratin. (D) Intracellular mucin was found by mucicarmine stain.
Vestibular schwannoma with metastasis

Table 1  Tumor-to tumor metastasis of vestibular schwannoma.

<table>
<thead>
<tr>
<th>Author</th>
<th>Sex</th>
<th>Age</th>
<th>Origin</th>
<th>Intracerebral metastasis</th>
<th>Systemic metastasis</th>
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<tr>
<td>Wallach &amp; Edberg 1959</td>
<td>F</td>
<td>73</td>
<td>Breast</td>
<td>–</td>
<td>+</td>
</tr>
<tr>
<td>Wong &amp; Bennington 1962</td>
<td>F</td>
<td>48</td>
<td>Breast</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>LeBlanc 1974</td>
<td>M</td>
<td>64</td>
<td>Lung</td>
<td>–</td>
<td>+</td>
</tr>
<tr>
<td>Chambers et al. 1980</td>
<td>F</td>
<td>66</td>
<td>Lung</td>
<td>–</td>
<td>+</td>
</tr>
<tr>
<td>Tang GC et al. 2007</td>
<td>F</td>
<td>57</td>
<td>Lung</td>
<td>–</td>
<td>+</td>
</tr>
<tr>
<td>Current report</td>
<td>F</td>
<td>57</td>
<td>Breast</td>
<td>–</td>
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</tr>
</tbody>
</table>

The patient underwent left suboccipital craniectomy and tumor removal under microscopy. The tumor was well-capsulated without invasion of the surrounding structures. Complete resection of the tumor was achieved, and the cranial nerves were preserved. Histological studies revealed that most of the tumor exhibited typical pictures of vestibular schwannoma, with Antoni A and B components. This part of the tumor was positive for S-100 protein and negative for glial fibrillary acidic protein and epithelial membrane antigen immunostaining. However, foci of pleomorphic cancer cells exhibiting hyperchromatic nuclei, eosinophilic cytoplasm and brisk apoptosis were found within the tumor. The cancer cells were positive for cytokeratin and epithelial membrane antigen, and contained intracellular mucin (Fig. 2). Therefore, the diagnosis of vestibular schwannoma with adenocarcinoma metastasis was made. The cancer cells were identical to the breast invasive ductal carcinoma of the patient being excised 6 months ago, and further immunohistochemical staining revealed that they were all strongly positive for Her-2/neu oncoprotein but negative for estrogen and progesterone receptors.

The patient remained well after the operation. Systemic chemotherapy was continued, and whole-brain radiation of 50 Gy was administered. One year after the operation, the patient is currently being followed at the outpatient department and chemotherapy is in progress.

Discussion

Tumor-to-tumor metastasis rarely occurs in the central nervous system. Of those being reported, meningioma is the most common host tumor, whereas lung and breast carcinomas are the most common donors [1,2]. Vestibular schwannoma as a recipient tumor is even less common, with only six cases being reported in English-language literature reviews (Table 1) [3–8]. By reviewing the cases, some characteristics of the disease have been identified: (1) women are more affected than men; (2) the disease tends to affect older patients; (3) lung and breast carcinomas remain the most common donors; and (4) although all patients have systemic metastasis, concomitant intracerebral metastasis is rare (1 out of 7 patients).

Several hypotheses have been made to explain the propensity of metastasis to meningiomas, including its high incidence, slow growth rate, rich vascularity, high lipid content that serves as energy fuel, particular hormonal factors, and low metabolic rate [2,4,9]. Although not fully understood, vestibular schwannomas are similar to meningiomas in several ways: (1) vestibular schwannomas constitute 85–90% of all neoplasms of the cerebellopontine angle; (2) they grow slowly; (3) although the tumors are not as highly vascularized as meningiomas, the region of the cerebellopontine angle is abundantly vascularized; and (4) rich in lipid content. These characteristics might explain the propensity of metastasis to vestibular schwannoma.

The diagnosis of tumor-to-tumor metastasis of vestibular schwannoma depends on final histopathological verification. Imaging studies offer little help in identifying the intratumoral metastasis due to its heterogeneous content. For those with known vestibular schwannoma, unusual rapid progression of symptoms or signs should raise suspicion, especially when the patient has concomitant malignancy.

In conclusion, although tumor-to-tumor metastasis of vestibular schwannoma is rare, clinicians should keep the phenomenon in mind, because it might present as the only site of intracranial metastasis in patients with disseminated metastatic disease.

References