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True Malignant Mixed Tumor (Carcinosarcoma) of Tonsillar Minor Salivary Gland Origin: Diagnostic Imaging and Endovascular Therapeutic Embolization

John K. Horky, John C. Chaloupka, Christopher M. Putman, Toni C. Roth, Edward M. Weaver, and Clarence T. Sasaki

Summary: We report a case of carcinosarcoma of the minor salivary glands of the left palatine tonsil, an especially rare location. Imaging characteristics assessed at CT, MR imaging, and angiography are presented. In addition, we describe our experience with preoperative therapeutic endovascular embolization of this hypervascular tumor.

Index terms: Carcinoma; Salivary glands, neoplasms; Sarcoma

True malignant mixed tumor, or carcinosarcoma, of salivary gland origin is a rare neoplasm that often arises in a preexisting pleomorphic adenoma. Carcinosarcomas are characterized by high rates of recurrence, metastatic spread, and mortality.

Case Report

A 55-year-old woman in whom a small benign mixed tumor of the left tonsillar fossa had been resected 4 years earlier was admitted to the emergency department with partial airway obstruction due to a rapidly expanding oropharyngeal mass. Examination showed a large left lateral pharyngeal wall tumor with superior extension into the soft palate. Initial therapeutic management included emergency intubation and tracheotomy.

Transaxial computed tomography (CT) was performed, which showed a large $6.0 \times 6.2 \times 7.5$ -cm heterogeneous mass obstructing the oropharynx and extending superiorly into the nasopharynx and inferiorly to the level of the hyoid bone (Fig 1A). The mass, which originated from the left tonsillar region and soft palate, involved the left parapharyngeal and pharyngeal mucosal spaces, the masticator space, and the prevertebral space. Although direct extension into the internal and external carotid arteries was not seen, the tumor did abut the carotid space and posteriorly displaced the left internal and external carotid arteries (Fig 1A). No pathologic lymphadenopathy was shown.

Magnetic resonance (MR) imaging showed a large, lobular mass located in the pharynx and left parapharyngeal region (Fig 1B). On contrast-enhanced T1-weighted images, the mass showed marked, homogeneous enhancement (Fig 1C). Of note, the T2-weighted, proton (spin) density-weighted, and fast inversion recovery images of the lesion showed heterogeneity with numerous areas of marked hyperintensity (Fig 1D). Also noted was airway narrowing of the oropharynx at the level of the tongue base and of the left nasal cavity at the posterior choana. Slight posterior displacement of the carotid arteries was shown on T1- and T2-weighted images, on proton (spin) density-weighted images, and on an MR angiogram.

Given the degree of enhancement of the tumor and its involvement of the parapharyngeal fat space, the pathogenesis was thought to be a mixed tumor, possibly malignant, originating from a minor salivary gland of the pharyngeal mucosal space or salivary gland rest of the parapharyngeal spaces. The patient was referred for diagnostic angiography and therapeutic endovascular embolization in preparation for surgical resection. Angiography showed a mass approximately 6.0 cm in longest dimension, with dramatic neovascularity, intense tumor staining, and some arteriovenous shunting (Fig 1E). The major blood supply came from multiple small branches of the mandibular and pterygoid portions of the left internal maxillary artery, branches of the left ascending pharyngeal artery, and ascending palatine branches of the left and right facial arteries.

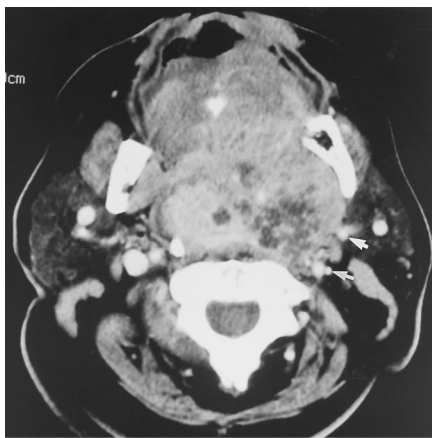
Owing to the extensive neovascularity of the tumor, aggressive preoperative endovascular therapeutic embolization was attempted. Initially, the left internal maxillary artery was superselectively catheterized with a #2.3F microcatheter (Rapidtransit, Cordis Endovascular Systems, Miami Lakes, Fla). Within the pterygopalatine portion of the internal maxillary artery, absorbable gelatin sponge (Gelfoam) pledgets were used to occlude the sphenopalatine artery proximally in order to protect it from partial embolization. Subsequently, the microcatheter was with-

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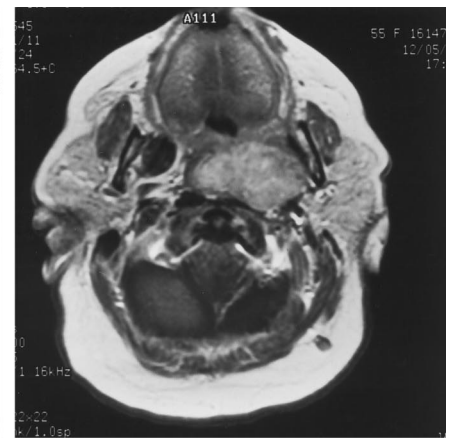
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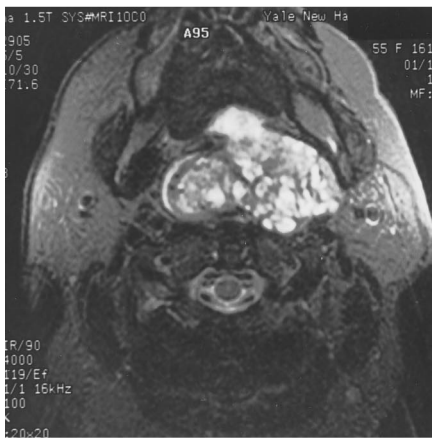
A



B



C



D



E



F



G



H

Fig 1. A 55-year-old woman with carcinosarcoma of tonsillar minor salivary gland origin.

A, CT scan of the head and cervical region shows a large, $6.0 \times 6.2 \times 7.5$ -cm, heterogeneously enhancing mass obstructing the oropharynx. The mass involves the soft palate and extends into the left parapharyngeal and pharyngeal mucosal spaces, the masticator space, and the prevertebral space. The mass abuts the left carotid space, posteriorly displacing the left internal and external carotid arteries (*arrows*). No lymphadenopathy is seen.

B, T1-weighted MR image (500/25/1 [repetition time/echo time/excitations]) shows a large, lobular mass centered in the left parapharyngeal space. Note airway narrowing of the oropharynx at the level of the tongue base and of the left nasal cavity at the posterior choana. Posterior displacement of the left carotid arteries is also shown.

C, Contrast-enhanced T1-weighted MR image (500/25/1), of the mass shows moderate homogeneous enhancement.

D, Fast inversion-recovery image (4000/119/1; inversion time, 100) shows heterogeneous signal intensity within the mass, consisting of multiple small foci of abnormally high signal intensity.

E, Preembolization DSA of the left external carotid artery shows a mass approximately 6.0 cm in longest dimension, having dramatic neovascularity with intense tumor staining and some arteriovenous shunting. Major blood supply arises from multiple small branches of the left internal maxillary artery (*short solid arrows*), branches of the left ascending pharyngeal artery (*long arrow*), and ascending palatine branches of the left facial artery (*open arrow*).

F, Superselective DSA injection of the left ascending pharyngeal artery shows numerous direct feeding branches to the inferior portion of the tumor.

G, Superselective DSA injection of the left facial artery shows numerous feeding branches to the anterior portion of the tumor.

H, Postembolization control DSA injection of the external carotid artery shows nearly complete devascularization of the tumor.

drawn into the pterygoid portion of the internal maxillary artery, and the origins of the accessory and middle meningeal arteries were similarly embolized. A suspension of 150- to 250- μ m polyvinyl alcohol particles (Contour, Interventional Therapeutics Corp, South San Francisco, Calif) was used to embolize the numerous branches of the distal two thirds of the internal maxillary artery supplying the tumor.

Complete occlusion of these portions of the internal maxillary artery was achieved with additional Gelfoam pledgets. Using a combination of 150- to 250- μ m polyvinyl alcohol particles followed by either Gelfoam pledgets or microcoil deposition, we serially embolized the left ascending pharyngeal artery, the ascending palatine branches of the left facial artery, and the ascending palatine branches of the right facial artery (Figs 1F and G). Final control digital subtraction and angiography (DSA) showed nearly complete devascularization of the tumor (Fig 1H).

Immediately after therapeutic embolization, the patient was taken to the operating room for radical resection of the tumor, where, without major complication, she underwent a palatotomy, dissection of the left side of the neck, and radial forearm microvascular free flap reconstruction. Frozen and permanent sections contained no tumor within the resection margins. Final pathologic diagnosis was true malignant mixed tumor (carcinosarcoma) of salivary gland origin, as determined by the presence of two histologically distinct populations of neoplastic cells intermixed throughout the specimen. One population of cells consisted of clusters of epithelial tissue with a mostly basaloid appearance, frequent mitoses and occasional glandular differentiation. The other population of cells, which predominated in most portions of the specimen, was clearly mesenchymal, consisting of actively proliferating spindle cells that had mostly a "bland" reactive appearance, with numerous areas of focal necrosis within the gross and microscopic specimens.

After surgery, the patient underwent adjuvant radiation therapy of the surgical field, receiving a total dose of 60 Gy of external beam radiation.

Discussion

Although the most frequently encountered neoplasm of salivary gland tissue is the benign mixed tumor, its counterpart, the malignant mixed tumor, is rare, representing approximately 3% to 4% of all salivary gland neoplasms (1).

Malignant mixed tumors of the salivary glands comprise a varied group. In the majority of malignant mixed tumors, a carcinoma arises in or from a mixed tumor, in which case the term *carcinoma ex pleomorphic adenoma* is applied. The neoplastic mesenchymal component of carcinoma ex pleomorphic adenoma is be-

nign, and thus metastases arising from these lesions contain carcinoma in the absence of metastatic mesenchymal tissue (2).

Much less commonly, a malignant mixed tumor consists of a carcinoma that develops in association with a sarcoma, typically chondrosarcoma. When these carcinomatous and sarcomatous components are synchronous, the lesion is labeled either a true malignant mixed tumor or, synonymously, a carcinosarcoma. Metastases of true malignant mixed tumors contain both carcinomatous and sarcomatous elements. When a mixed tumor contains epithelial and mesenchymal elements that appear histologically benign, and yet both components metastasize to distant sites such as lung or bone, the lesion is denoted a metastasizing mixed tumor (2).

The present case illustrates a true malignant mixed tumor of salivary gland origin. Tortoledo et al (2) estimated the frequency of true malignant mixed tumors to be 0.2% of all malignant neoplasms of the major salivary glands. True malignant mixed tumors of the oral minor salivary glands (ie, situated within the hard and soft palates, cheeks, lips, tongue, and tonsillar crypts) are rarer yet, with only approximately 10 cases documented in the literature (2-9). Of note, a high percentage of patients with carcinosarcomas have a history of prior resection of a benign mixed tumor (1, 8), an association strengthened by immunocytochemical studies demonstrating expression of the S-100 and glial fibrillary acidic proteins in mesenchymal and epithelial regions of both benign mixed tumors and carcinosarcomas (8, 10, 11).

We are aware of a few reports that describe the imaging findings of carcinosarcomas in the head and neck region. In a report of a submandibular salivary gland carcinosarcoma, Bleiweiss et al (12) presented a CT scan showing a mass with homogeneous high attenuation. A case report by Carson et al (9) of a carcinosarcoma of the parotid gland included only a coronal, T1-weighted MR image of the lesion, which appeared as an inhomogeneous, enhancing tumor mass. Finally, Lai et al (13) reported two cases of major salivary gland carcinomas (parotid and submandibular), in which only CT scans were obtained. In one of these cases, the CT scans showed somewhat inhomogeneous attenuation within the tumor with an associated necrotic lymph node; in the other case, a prominent area of central low attenuation was seen.

Portions of both tumors showed enhancement. The authors concluded that the variable imaging appearance of the tumors was possibly related to the variable histopathologic appearance of carcinosarcoma, including areas of cystic change, necrosis, calcification, and stromal hyalinization (13). In our case, the heterogeneous appearance on both CT and MR studies parallels the findings in one of the cases reported by Lai et al (13). We speculate that this appearance is most likely attributable to focal areas of necrosis within the tumor, which were observed on histopathologic analysis.

The origin of the carcinosarcoma described in our case was probably the pharyngeal mucosal space. This assumption is based on the fact that the patient had a previous resection of a benign pleomorphic adenoma in the left tonsillar fossa, wherein adenomatous salivary gland rests are known to occur within the tonsillar crypts of the pharyngeal mucosal space. The large size of the subsequent neoplasm and its aggressive nature of local invasion most likely resulted in false localization of the tumor within the parapharyngeal space. A detailed review of the case revealed that neither CT nor MR imaging showed an enveloping fatty plane around the entire tumor, which is uncharacteristic of parapharyngeal space lesions (14). However, it is theoretically possible for a carcinosarcoma to arise from the parapharyngeal space, since salivary gland rests are normally present there (14).

Salivary gland carcinosarcomas are exceedingly rare, and therefore a well-established therapeutic approach is lacking. Current recommendations for the treatment of carcinosarcoma include radical surgical resection, lymph node dissection for palpable lymphadenopathy, and radiation therapy (1). A small series by Gnepp (1) showed an overall mortality rate of 58%, with a mean survival of 29 months from the time of diagnosis. Adjuvant chemotherapeutic regimens will likely assume increased importance in the future, as greater than 50% of patients are now treated for metastases locally or at distant sites, including the lungs, hilar and cervical lymph nodes, bone, liver, and central nervous system.

Numerous authors attribute the majority of failed carcinosarcoma treatments to the use of radiation as the primary therapy, and, for cases in which surgery is the primary treatment, to incomplete resection (1, 9, 15, 16). In

the current case, the MR imaging and angiographic findings were that of a hypervascular neoplasm. As is customary at our institution, the patient underwent preoperative endovascular therapeutic embolization. We believe that preoperative transarterial embolization of such a hypervascular tumor is very beneficial, because it facilitates complete resection and limits intraoperative hemorrhage. Similar preoperative endovascular embolizations have been used successfully and effectively in the treatment of other hypervascular neoplasms, such as paragangliomas, meningiomas, hemangiopericytomas, schwannomas, juvenile nasopharyngeal angiofibromas, and hemangiomas (17).

In conclusion, the tonsillar minor salivary glands of the pharyngeal mucosal space are a rare site of occurrence for a true malignant mixed tumor. Despite its rarity, however, true malignant mixed tumor of minor salivary gland origin must be included in the differential diagnosis of malignant lesions of the pharyngeal mucosal space. Preoperative endovascular embolization in our case helped minimize intraoperative bleeding of the tumor, which was in a technically difficult location for excision, and most likely enabled a more complete resection of this highly malignant neoplasm.

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