Mandibular Metastasis from a Skull Base Chordoma: Report of a Case with Review of Literature

Bridget Loehn, M.D.,¹ Rohan R. Walvekar, M.D.,¹ Anthony Harton, M.D.,² and Dan Nuss, M.D., F.A.C.S.¹

ABSTRACT

This article reports an unusual presentation wherein the first evidence of distant failure from a locally controlled, recurrent skull base chordoma was a metastasis to the mandible. We present a case report from a tertiary-care academic skull base referral center and a review of literature. A 33-year-old woman with a locally recurrent sphenoid-occipital chordoma that was stabilized with multimodality therapy presented with a right mandibular mass. Immunohistochemical stains demonstrated the tumor cells staining positive for vimentin, cytokeratin, epithelial membrane antigen (EMA), and S100 consistent with metastatic chordoma. Positron emission tomography-computed tomography imaging further revealed widespread distant failure. Chordomas are rare tumors with only four previous reports of metastasis to the mandible. This is the first presentation of a mandibular metastasis from a sphenoid-occipital chordoma. We present a review of literature and summarize the demographic, clinical, pathological, treatment-related data, and discuss follow-up information from previous reports of metastatic chordomas to the mandible.

KEYWORDS: Chordoma, skull base tumor, mandibular metastasis, distant metastasis

Chordomas are rare tumors that account for 1% of intracranial tumors and 3 to 4% of primary bone tumors.¹⁻³ Chordomas arise from the embryological remnants of the notochord and are characterized by their slow growth and tendency to be

locally aggressive with adjacent bone destruction. Consequently, they fail most commonly locally, at the site of origin. Distant metastasis occurs in 7 to 43% of the cases, most frequently involving the lung, liver, bone, skin, or lymph nodes.⁴⁻⁶ We

¹Department of Otolaryngology-Head Neck Surgery, Louisiana State University Health Sciences Center, New Orleans, Louisiana;

²Pathology Group of Louisiana, Baton Rouge, Louisiana.

Address for correspondence and reprint requests: Rohan R. Walvekar, M.D., Assistant Professor, Department of Otolaryngology-Head Neck Surgery, LSU Health Sciences Center, 533 Bolivar Street, Suite 566, New Orleans, LA 70112 (e-mail: rwalve

@lsuhsc.edu).

Skull Base 2009;19:363-368. Copyright © 2009 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA. Tel: +1 (212) 584-4662.

Received: November 14, 2008. Accepted: December 23, 2008. Published online: April 16, 2009.

DOI 10.1055/s-0029-1220203. ISSN 1531-5010.

report an unusual presentation wherein the first evidence of distant failure in a patient with an otherwise locally controlled, recurrent skull base chordoma was a metastasis to the mandible.

CASE REPORT

A 33-year-old woman with a history of locally invasive recurrent spheno-occipital chordoma presented with initial complaints of headaches and diplopia in 2001. She underwent multiple endoscopic surgical resections and three-dimensional conformal radiation therapy, which seemed to stabilize tumor progression. The patient continued to be in a state of remission until she presented with a metastatic left neck mass in April 2005, for which

she underwent a left supraomohyoid neck dissection. In the following year and a half, the patient underwent further chemotherapy, radiation therapy, and salvage surgery for local recurrences. The extensive skull base bone destruction from this locally aggressive tumor created a destabilization of the atlantoaxial joint, which was unique and also representative of its aggressive nature (Fig. 1).

In January 2007, she presented to the skull base center with complaints of a mass in the right mandibular region, with a history of a recent increase in size. Physical examination confirmed a right mandibular swelling that was tender to palpation. Magnetic resonance imaging study confirmed a 5-cm diameter right mandibular soft tissue mass and also revealed an enlargement of the primary tumor at the skull base. The biopsy of the mandibular lesion demonstrated a tumor that

Figure 1 Our patient with locally invasive recurrent spheno-occipital chordoma presenting with a destabilization of the atlantoaxial joint secondary to extensive skull base bone destruction.

Figure 2 Biopsy of the mandibular lesion showing cords and nests of epithelioid tumor cells in a background of extracellular chondroid material (hematoxylin and eosin, original magnification $\times 400$).

was composed of cords and nests of epithelioid cells arranged in a background of copious extracellular chondroid material (Fig. 2). Immunohistochemical stains demonstrated the tumor cells staining positive for vimentin, cytokeratin, epithelial membrane antigen (EMA), and S-100, which is consistent with metastatic chordoma (Fig. 3). In view of the patient's performance status, surgical palliation of the mandibular metastases was deferred. The patient received a combination of palliative chemotherapeutic agents (Gleevec, cetuximab, and Tarceva) based on tumor response. However, persistent complaints of pain in the neck and back and decreased vision in the right eye stimulated further imaging workup with a positron emission tomography (PET)-computed tomography (CT) scan,

Figure 3 Immunohistochemistry demonstrating the tumor cells within the mandibular lesion staining positive for cytokeratin, vimentin, epithelial membrane antigen (EMA), and S-100 consistent with metastatic chordoma (hematoxylin and eosin, original magnification $\times 400$).

Figure 4 An axial computed tomography (CT) scan showing the metastatic chordoma presenting as a mass within the right mandibular body.

which showed a persistence of tumor at the skull base (maximum standardized uptake value [SUV_{max}]: 5.0) with widespread distant metastasis involving the mandible, skin, lungs, vertebral column, and axial skeleton (Fig. 4). The PET-CT image of the mandibular metastasis had an SUV_{max} of 5.3; an uptake similar to that of the primary tumor. The patient continued to receive palliative treatment and supportive therapy and succumbed to disease within a year of distant failure that manifested with metastases to the mandible.

DISCUSSION

Chordomas are rare tumors of notochordal origin that account for 1 to 4% of all primary malignant bone neoplasms.¹ The notochord is a primitive cell line around which the base of the skull and the vertebral column develop.^{1,4,7,8} In normal development, the notochord regresses, and the only derivative of the notochord that remains in the adult is the nucleus pulposus of the intervertebral disc. Occasionally, the notochord does not completely regress, and vestiges may remain within the vertebral column, skull base, and retropharyngeal soft

tissue that lead to chordoma formation.^{7,9} These tumors are most commonly either sacrococcygeal (29.2 to 50%), spheno-occipital (32 to 44%), or vertebral (14 to 32.8%) in location.^{2,4,5,7,8,10} Chordomas affect more males than females (ratio, 2:1) and tend to occur in the fourth decade of life.^{1,3,4,7} Common signs and symptoms include diplopia, headache, and ataxia, which reflect cranial nerve involvement,^{1,4,7} as seen in our case. These tumors are locally aggressive and most often recur at the site of their origin. In their observations, Heffelfinger et al (1973) noted that the first local recurrence of a chordoma occurred in more than 75% of patients within 2 years of initial presentation in vertebral chordomas, 2.5 years for sacrococcygeal chordomas, and 3 to 4 years for spheno-occipital chordomas.⁴

Distant metastasis of chordomas is rare, accounting for 7 to 43% of all failures.⁴⁻⁶ Fifty-eight percent of chordomas metastasize to the lungs, 33% to the lymph nodes, 22% to the liver, 17% to bone, and 9% to skeletal muscle.⁶ Seventy-three percent of chordomas that metastasize are sacrococcygeal, which is more frequent than incidence of metastasis with spheno-occipital or cranial chordomas (9%).⁶ This observation may be related to tumor behavior but may be confounded by the fact that chordomas most commonly are sacrococcygeal (29 to 50%). Interestingly, the sites of metastasis are clinically silent and may go undiagnosed for long periods of time.¹¹ In our case, we similarly observed that widespread distant metastasis was not evident till the patient presented with a mandibular mass as the first manifestation of distant failure.

Metastatic disease of the jaw is rare, only comprising 1% of all maxillary and mandibular neoplasms. The most common primary cancers that metastasize to the jaw are adenocarcinomas originating in the breast, lung, adrenal gland, kidney, colon, rectum, or prostate.¹² Mandibular metastasis as the first sign of distant metastasis of a chordoma is a rare occurrence. There have been four previous reports of chordomas metastasizing to the mandible, with three originating in the sacrococcygeal region and one originating in the lumbar spine. A review of demographics, clinical

Table 1 Overview of Reported Cases of Mandibular Metastasis from Chordoma (1983–2008)

Author	Gorsky et al ⁹	Slee et al ¹³	Meneghini et al ¹¹	Kulamarva et al ¹⁴	Loehn et al (present study)
Year of publication	1983	1989	2002	2007	2009
Patient age (years)	64	32	63	43	33
Patient sex	Female	Female	Female	Male	Female
Primary site	Sacral	Sacroccygeal	Sacroccygeal	Lumbar	Spheno-occipital
Local recurrence	No	Yes	Yes	Yes	Yes
Site of mandibular metastasis	Right angle of the mandible	Right posterior body of mandible	Right mandibular condyle	Left mandibular body and ramus	Right mandibular body
Imaging used for diagnosis of metastasis	CT scan and Panorex film	Radiographic examination	Panoramic radiography and CT scan	Panoramic radiography and CT scan	CT scan and PET/CT
Histology of metastasis	Consistent with metastatic sacral chordoma	Metastatic deposits similar to pelvic tumor	Metastatic chordoma	Metastatic chordoma	Metastatic chordoma
Interval between initial presentation and metastasis	4 years	3 years	18 months	6 years	6 years
Treatment	Tumor debulking, superficial parotidectomy then hemimandibulectomy	No treatment	Surgical excision followed by external beam radiotherapy	No treatment—patient refused treatment	Palliative chemotherapy
Status at last follow-up	Alive at 7 years after initial presentation	Unknown	Death 4 years after initial presentation	Unknown	Death 7 years after initial presentation

and pathological data, and follow-up information is presented in Table 1.^{9,11,13,14} Our literature review did not reveal any previous reports of mandibular metastasis from a sphenoid-occipital chordoma. Consequently, we report possibly the first presentation of this clinical scenario.

There have been many histological studies performed to define the factors that would predict the metastatic potential of a chordoma. The lack of intercellular material, variable cellular and nuclear size, increased mitosis, cell density, excessive intracellular mucin formation, pleomorphism, anaplasia, hyperchromatism, size, and invasiveness of tumor have all been hypothesized as features seen in chordomas that metastasize. However, these features have also been seen in tumors that did not metastasize.⁶ As a result, what determines whether a chordoma will metastasize is still largely unknown.

In general, chordomas have a poor prognosis. The 5- and 10-year relative survival rates are 67.6% and 39.9%, respectively, with a median survival of 6.29 years.¹⁰ This corresponds well with the pattern of disease progression seen in our patient, who succumbed 7 years after receiving multimodality therapy for an aggressive, locally recurrent tumor with consequent widespread distant failure. The recurrence rate and metastatic potential of chordomas is directly proportional to increased survival.⁴ Hence, it would be relevant to study the quality of life in patients with chordomas in whom we seem to prolong survival by offering aggressive local, regional, and systemic therapy but who, by definition of the tumor epidemiology, continue to fail locally and at distant sites.

The mandibular metastasis in our case was managed conservatively because the patient had a poor performance status. The other options for treatment of the mandibular metastasis include surgical palliation involving a segmental mandibulectomy with or without bony reconstruction.

ACKNOWLEDGMENTS

The authors would like to thank Ms. Annette Cecelia Barnes (Clinical Coordinator, Skull Base

Center, Department of Otolaryngology, LSU Health Sciences Center) for her help with acquiring the pathology slides for this report.

REFERENCES

1. Erdem E, Angtuaco EC, Van Hemert R, Park JS, Al-Mefty O. Comprehensive review of intracranial chordoma. *Radiographics* 2003;23(4):995-1009
2. Shugar JM, Som PM, Krespi YP, Arnold LM, Som ML. Primary chordoma of the maxillary sinus. *Laryngoscope* 1980;90(11 Pt 1):1825-1830
3. Mizerny BR, Kost KM. Chordoma of the cranial base: the McGill experience. *J Otolaryngol* 1995;24(1):14-19
4. Heffelfinger MJ, Dahlin DC, MacCarty CS, Beabout JW. Chordomas and cartilaginous tumors at the skull base. *Cancer* 1973;32(2):410-420
5. Fischbein NJ, Kaplan MJ, Holliday RA, Dillon WP. Recurrence of clival chordoma along the surgical pathway. *AJNR Am J Neuroradiol* 2000;21(3):578-583
6. Chambers PW, Schwinn CP. Chordoma. A clinicopathologic study of metastasis. *Am J Clin Pathol* 1979;72(5):765-776
7. Schonegger K, Gelpi E, Prayer D, et al. Recurrent and metastatic clivus chordoma: systemic palliative therapy retards disease progression. *Anticancer Drugs* 2005;16(10):1139-1143
8. Forsyth PA, Cascino TL, Shaw EG, et al. Intracranial chordomas: a clinicopathological and prognostic study of 51 cases. *J Neurosurg* 1993;78(5):741-747
9. Gorsky M, Silverman SJr, Greenspan D, Deluchi S, Merrell P. Metastatic chordoma to the mandible. *Oral Surg Oral Med Oral Pathol* 1983;55(6):601-604
10. McMaster ML, Goldstein AM, Bromley CM, Ishibe N, Parry DM. Chordoma: incidence and survival patterns in the United States, 1973-1995. *Cancer Causes Control* 2001;12(1):1-11
11. Meneghini F, Castellani A, Camelin N, Zanetti U. Metastatic chordoma to the mandibular condyle: an anterior surgical approach. *J Oral Maxillofac Surg* 2002;60(12):1489-1493
12. Hirshberg A, Leibovich P, Buchner A. Metastatic tumors to the jawbones: analysis of 390 cases. *J Oral Pathol Med* 1994;23(8):337-341
13. Slee RW, al-Hilli F, Abdul-Wahab AW. Secondary chordoma of the mandible. *Br J Oral Maxillofac Surg* 1989;27(4):346-349
14. Kulamarva G, Wilbourn M, Anand R, Mourouzis C, Spedding AV, Brennan PA. Metastasising chordoma to the mandible from a rare vertebral site: the first reported case. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2007;104(2):240-242