Multiple Vertebral Metastases from Malignant Cardiac Pheochromocytoma

—Case Report—

Satoshi YAMAGUCHI, Kazutoshi HIDA, Nishio NAKAMURA*, Toshitaka SEKI,
and Yoshinobu IWASAKI

Department of Neurosurgery, Hokkaido University Graduate School of Medicine, Sapporo,
Hokkaido; *College of Medical Technology, Hokkaido University, Sapporo, Hokkaido

Abstract

A 27-year-old male presented with a very rare metastasis to the vertebral body from a cardiac pheochromocytoma manifesting as a pathological fracture of the C-4 vertebral body that occurred while playing golf. The patient was initially treated with hard collar fixation. Gallium scintigraphy demonstrated multiple hot spots in the mediastinum, the frontal bone, the vertebral column, and the rib. Magnetic resonance imaging of the chest delineated a cardiac tumor. The patient underwent biopsies of the cardiac and the frontal bone lesions. The diagnosis was malignant cardiac pheochromocytoma with multiple bone metastases. Initial irradiation of the cardiac and the vertebral lesions was followed by surgical intervention to the cervical spine to prevent aggravation of the kyphotic deformity and spinal cord compression. Preoperative embolization of the feeding arteries was followed by C-4 corpectomy, iliac bone grafting, and anterior titanium plating fixation. The patient was discharged and returned to work. However, 20 months later, he died of a metastatic brain lesion with systemic tumor progression.

Key words: corpectomy and fusion, malignant cardiac pheochromocytoma, vertebral metastasis

Introduction

Pheochromocytoma secretes catecholamines and is usually derived from adrenomedullary chromaffin cells. Pheochromocytomas arise in the adrenal gland in 80–85% of cases.¹³⁾ Pheochromocytoma arising from extra-adrenal chromaffin cells is called extra-adrenal pheochromocytoma or paraganglioma. Extra-adrenal lesions make up about 15–20% of all sporadic pheochromocytomas, and mostly occur in and around the intra-abdominal sympathetic ganglia. Pheochromocytomas may be sporadic or inherited as an autosomal dominant trait.¹³⁾ The malignant form is defined by the presence of metastasis or local invasion rather than by the histological appearance, and accounts for 10–20% of all pheochromocytomas.^{12,13)} Malignant pheochromocytomas grow slowly and metastasize to bone, the liver, lymph nodes, and the lungs.¹³⁾ Vertebral metastases are relatively rare with only a few cases reported.^{2,3,7,10,11)}

Intrathoracic pheochromocytoma constitutes only 1% of all cases, and is found mostly in the posterior mediastinum.^{6,8)} A middle mediastinal or cardiac location is very rare as only 41 cases of cardiac pheochromocytomas have been reported, and malignancy was found in only three of these cases.⁸⁾ One case of bone metastases from malignant cardiac pheochromocytoma has been reported,¹⁾ but spinal involvement has not been encountered.

We report a case of multiple vertebral metastases from malignant cardiac pheochromocytoma.

Case Report

A 27-year-old male experienced sudden severe neck pain while playing golf. Cervical radiography showed dissolved bone of the C-4 vertebral body and slight kyphotic change between the C-3 and C-5 vertebrae (Fig. 1 *left*). Magnetic resonance (MR) imaging of the cervical spine indicated that the spinal cord was mildly compressed by the C-4

Received August 14, 2002; Accepted February 6, 2003

Author's present address: S. Yamaguchi M.D., Sapporo Azabu Neurosurgical Hospital, Sapporo, Hokkaido, Japan.

Fig. 1 *left: Cervical radiogram, lateral view, showing dissolved bone of the C-4 vertebral body and kyphotic deformity between the C-3 and C-5 vertebrae. right: T₁-weighted magnetic resonance image revealing mild spinal cord compression caused by the protruding C-4 vertebral body.*

vertebral body (Fig. 1 right). Neurological examination found no abnormalities except for hyperreflexia in all extremities. The patient was treated conservatively with hard collar fixation.

Gallium (Ga) scintigraphy revealed multiple hot spots in the mediastinum, cervical and thoracic vertebrae (C-2, C-4, and T-10), the 8th rib, and the frontal bone. MR imaging revealed a cardiac tumor that corresponded with the mediastinal hot spot lesion on Ga scintigraphy (Fig. 2). Biopsy specimens obtained from the heart showed cell proliferation with positive staining for chromogranin A. Open biopsy of the frontal bone lesion was performed. The specimen revealed clusters of polygonal cells with round to oval nuclei. The clusters were surrounded by fibrovascular stroma (Fig. 3). Immunohistochemical staining revealed positive staining of the cluster cells for chromogranin A. The diagnosis was primary malignant cardiac pheochromocytoma with multiple bone metastases.

The vertebral column and the heart were irradiated with doses of 25 and 50 Gy, respectively. The radiation therapy palliated the patient's pain. Surgical intervention to the cervical spine was planned to prevent aggravation of the kyphotic deformity and spinal cord compression. Carotid angiography

Fig. 2 *T₁-weighted magnetic resonance image of the chest with gadolinium-diethylenetriaminepenta-acetic acid showing a massive enhanced lesion (tumor: T) surrounding the atria cordis (left atrium: LA, right atrium: RA). The diagnosis was cardiac tumor. Ao: descending aorta.*

Fig. 3 *Photomicrograph of the biopsy specimen obtained from the frontal bone lesion showing clusters of polygonal cells with round to oval nuclei, surrounded by fibrovascular stroma. HE stain, original magnification $\times 400$.*

revealed multiple marked vascular stains via bilateral ascending cervical arteries. These feeding arteries were preoperatively embolized with polyvinyl alcohol particles (Fig. 4). The patient underwent C-4 corpectomy, iliac bone graft, and C3-5 anterior titanium plating. Intraoperative blood loss was not significant due to the preoperative embolization.

He was discharged after 6 weeks hospitalization, and returned to work without an external orthosis. However, 20 months later, multiple systemic

Fig. 4 Right cervical angiogram, anteroposterior view, showing multiple marked vascular staining via branches of the ascending cervical artery.

metastases of pheochromocytoma were detected. Finally, he died of a metastatic brain lesion.

Discussion

In our case, MR imaging of the chest showed a cardiac tumor that surrounded the atria cordis. Ga scintigraphy suggested multiple lesions in the skeletal system and mediastinum, but no intra-abdominal lesion was detected. Therefore, the origin of the metastatic tumors was considered to be the cardiac pheochromocytoma. The only previous case of skeletal metastases from malignant cardiac pheochromocytoma manifested as iliac bone metastasis, resulting death due to tumor progression.¹⁾

Previous cases of metastatic pheochromocytomas of the vertebral body were treated by laminectomy to decompress the spinal cord in 13 cases, with adjuvant radiation therapy in three cases.²⁾ Direct removal of the pathological vertebral body was attempted in three cases, with preoperative embolization of the feeding arteries in two cases.^{2,5)} Our case also showed marked vascularity of the tumor, and preoperative feeder embolization reduced intraoperative blood loss significantly.

No optimum therapy has been established for

vertebral metastases from pheochromocytomas.¹⁰⁾ The following recommendations have been made: If a spinal lesion is discovered and is causing only pain, or only radiculopathy, radiation therapy should be used; if the patient progresses to new neurological deficits during or after radiation therapy, serious consideration should be given to surgical decompression depending on the overall medical condition.¹¹⁾ Anterior corpectomy, reconstruction with autologous bone or polymethylmethacrylate, and fixation are generally accepted as surgical options for vertebral body tumors.^{4,9)} However, the optimum material needed to reconstruct the vertebral body defect has not been established. Whether autologous bone graft can be incorporated into an irradiated vertebral bone bed is still not clear.^{4,9)} Anterior cervical plating for the treatment of neoplasms in the cervical vertebrae was used in 26 patients who underwent corpectomy of the pathological vertebrae, reconstruction with autologous bone graft, and anterior cervical plating. Immediate and persistent stability was achieved even after radiation therapy was performed.⁴⁾

Our patient presented with a pathological fracture of the C-4 vertebral body. Surgical treatment had to be carefully chosen considering the multiple systemic metastases already discovered at the time of diagnosis. We determined that the patient's quality of life would be compromised by persistent hard collar fixation. Therefore, internal surgical fixation was performed so the patient could return to his previous work and daily life without wearing an external orthosis.

References

- 1) Arai A, Naruse M, Naruse K, Tanabe A, Yoshimoto T, Iwama T, Kusakabe K, Obara T, Demura R, Demura H: Cardiac malignant pheochromocytoma with bone metastases. *Intern Med* 37: 940-944, 1998
- 2) Brodkey JA, Brodkey JS, Watridge CB: Metastatic paraganglioma causing spinal cord compression. *Spine* 20: 367-372, 1995
- 3) Brown JW, Burton RC, Dahlin DC: Chemodectoma with skeletal metastasis: report of two cases. *Mayo Clin Proc* 42: 551-555, 1967
- 4) Caspar W, Pitzen T, Papavero L, Geisler FH, Johnson TA: Anterior cervical plating for the treatment of neoplasms in the cervical vertebrae. *J Neurosurg* 90 (1 Suppl): 27-34, 1999
- 5) Cybulski GR, Nijensohn E, Brody BA, Meyer PR, Cohen B: Spinal cord compression from a thoracic paraganglioma. Case report. *Neurosurgery* 28: 306-309, 1990
- 6) Jeevanandam V, Oz MC, Shapiro B, Barr ML, Marboe C, Rose EA: Surgical management of cardiac pheochromocytoma. Resection versus transplanta-

- tion. *Ann Surg* 221: 415-419, 1995
- 7) Jindel R, Gupta AK, Mahapatra AK, Bal CS, Singhal RM: Extradural paraganglioma with multiple skeletal metastases. *Br J Radiol* 65: 938-940, 1992
 - 8) Jirari A, Charpentier A, Popescu S, Boidin P, Eisenmann B: A malignant primary cardiac pheochromocytoma. *Ann Thorac Surg* 68: 565-566, 1999
 - 9) Miller DJ, Lang FF, Walsh GL, Abi-Said D, Wildrick DM, Gokaslan ZL: Coaxial double-lumen methylmethacrylate reconstruction in the anterior cervical and upper thoracic spine after tumor resection. *J Neurosurg* 92 (2 Suppl): 81-190, 2000
 - 10) North CA, Zinreich ES, Christensen WN, North RB: Multiple spinal metastases from paraganglioma. *Cancer* 66: 2224-2228, 1990
 - 11) Olson JJ, Loftus CM, Hitchon PW: Metastatic pheochromocytoma of the cervical spine. *Spine* 14: 349-351, 1989
 - 12) Somasundar P, Krouse R, Hostetter R, Vaughan R, Covey T: Paragangliomas. A decade of clinical experience. *J Surg Oncol* 74: 286-290, 2000
 - 13) Young JB, Landsberg L: Catecholamines and the adrenal medulla. Pheochromocytoma, in Wilson JD, Foster DW, Kronenberg HM, Larsen PR (eds): *Williams Textbook of Endocrinology*, ed 9. Philadelphia, WB Saunders, 1998, pp 705-728

Address reprint requests to: S. Yamaguchi, M.D., Sapporo Azabu Neurosurgical Hospital, North 40, East 1-1-11, Higashi-ku, Sapporo, Hokkaido 007-0841, Japan.