

# Nuclear Imaging in Metastatic Paraganglioma

Rohit Kedia<sup>1</sup>, Neil Hansen<sup>2</sup>, and Whitney Goldner<sup>1</sup>

<sup>1</sup>Division of DEM, Department of Internal Medicine, University of Nebraska Medical Center, Omaha, Nebraska; and <sup>2</sup>Department of Radiology, University of Nebraska Medical Center, Omaha, Nebraska

Paragangliomas associated with mutations of the *SDHD* gene can occasionally result in distant metastasis. Diagnosis can be difficult, and nuclear imaging is used to evaluate the case further. Not all tumors are alike; nuclear avidity may differ. We present a case in which metastatic paraganglioma caused by mutations of the *SDHD* gene was negative on <sup>123</sup>I-metaiodobenzylguanidine scintigraphy and positive on <sup>111</sup>In-labeled octreotide scintigraphy. This situation presents an opportunity for a novel therapeutic approach toward metastatic paraganglioma using targeted peptide receptor radionuclide therapy.

**Key Words:** neuroendocrine tumor; peptide receptor therapy; paraganglioma

**J Nucl Med Technol 2016; 44:251–252**

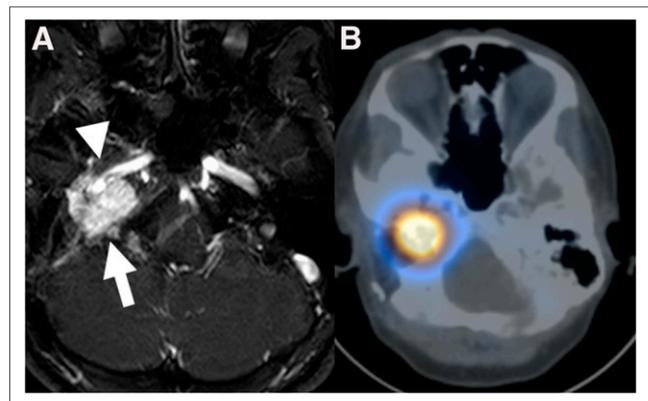
DOI: 10.2967/jnmt.116.180067

In the evaluation of patients with metastatic paraganglioma, nuclear imaging is useful for identifying metastatic sites and determining therapeutic options. <sup>123</sup>I-metaiodobenzylguanidine (<sup>123</sup>I-MIBG) scintigraphy is the initial recommended nuclear imaging test, but its sensitivity in metastatic paraganglioma is only 56%–83% (1). If <sup>123</sup>I-MIBG scintigraphy has negative results, additional nuclear imaging such as with <sup>111</sup>In-octreotide scintigraphy and <sup>68</sup>Ga-DOTATATE PET can be valuable, both of which have been shown to detect metastatic disease better than <sup>123</sup>I-MIBG scintigraphy (2,3). Alternative imaging can also be done with <sup>18</sup>F-FDG PET and <sup>18</sup>F-FDOPA PET (1), as well as with <sup>68</sup>Ga-DOTATATE PET, which was recently approved by the U.S. Food and Drug Administration for use in suspected metastatic neuroendocrine tumors. <sup>111</sup>In-octreotide positivity indicates the presence of somatostatin receptor subtypes 2 and 5 and the potential effectiveness of therapy with octreotide. The emergence of peptide receptor radionuclide therapy (PRRT) offered a new treatment option for <sup>111</sup>In-octreotide-avid metastatic paraganglioma. PRRT uses radiolabeled somatostatin analogs that specifically target somatostatin receptors on the tumor (4,5). The two  $\beta$ -emitting radionuclides used for radiolabeled therapy are

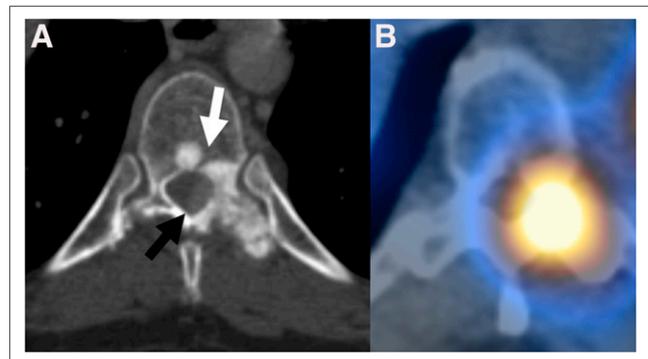
<sup>90</sup>Y and <sup>177</sup>Lu (4,5). The response to <sup>90</sup>Y has been reported to be between 4% and 33% (5). Complete and partial remission with <sup>177</sup>Lu has been reported to be 2% and 28%, respectively (5). Quality of life is improved in up to 70% of cases, with minimal toxicity (4,5).

## CASE REPORT

A 52-y-old woman with a known *SDHD* mutation was diagnosed and treated for bilateral dopamine-secreting cervical paragangliomas in 1996 and did well until 2013. She

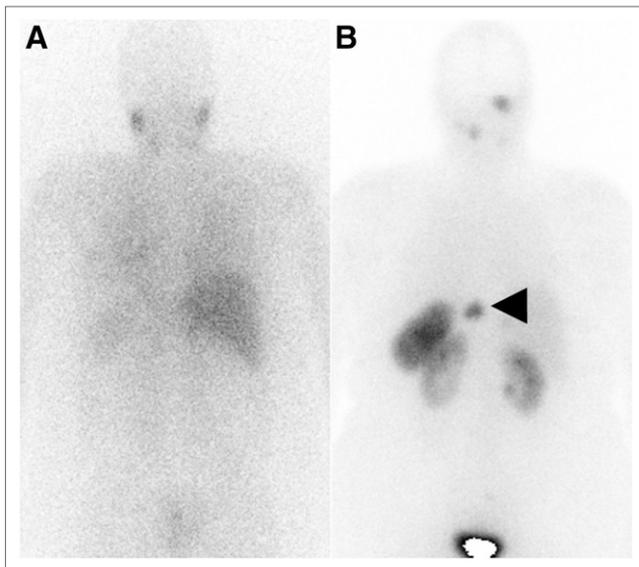


**FIGURE 1.** (A) Axial MR image of avidly enhancing recurrent nonresectable mass of right skull base at level of jugular bulb (arrow), partially encasing right internal carotid artery (arrowhead). (B) Corresponding axial SPECT/CT <sup>111</sup>In-octreotide image showing intense avidity in mass.



**FIGURE 2.** (A) CT scan of T9 vertebra showing predominantly sclerotic bone metastasis involving vertebral body, left pedicle, and left transverse process (white arrow) and solid enhancing epidural soft tissue (black arrow). (B) Corresponding axial SPECT/CT <sup>111</sup>In-octreotide image showing intense avidity in bone metastasis.

Received Jul. 19, 2016; revision accepted Sep. 19, 2016.  
For correspondence or reprints contact: Rohit Kedia, 23803 McBean Pkwy., Valencia, CA 91355.  
E-mail: rohitkediado@gmail.com  
Published online Oct. 27, 2016.  
COPYRIGHT © 2016 by the Society of Nuclear Medicine and Molecular Imaging, Inc.



**FIGURE 3.** (A) Whole-body posterior  $^{123}\text{I}$ -MIBG  $\gamma$ -camera image showing normal uptake in salivary glands in neck and no uptake in known metastases. (B) Whole-body posterior  $^{111}\text{In}$ -octreotide  $\gamma$ -camera image showing focal intense uptake within disease sites in neck and in T9 metastasis (arrowhead).

developed recurrent bilateral neck masses and was treated with repeated surgical excision of the left-side tumor and radiation therapy of the right-side tumor, given that the latter was unresectable (Fig. 1A). In 2014, she developed hypertension, flushing, and tachycardia. Biochemical evaluation revealed a serum dopamine level of 280 (reference level,  $<20$  pg/mL). Neck imaging revealed stable lesions, but on chest CT she was found to have a ninth thoracic vertebral lesion (Fig. 2A). After  $\alpha$ -blockade, she underwent vertebral biopsy, which revealed metastatic paraganglioma. She was treated with radiation therapy to the thoracic spine. Her dopamine levels remained elevated and she underwent  $^{123}\text{I}$ -MIBG imaging (Fig. 3A), with negative results.  $^{111}\text{In}$ -octreotide imaging, however, showed increased uptake in the right cervical tumor and the ninth thoracic vertebral body (Figs. 1–3).

## DISCUSSION

This case highlights the importance of nuclear imaging in diagnosing metastatic paraganglioma. If initial  $^{123}\text{I}$ -MIBG scintigraphy studies are negative, then  $^{111}\text{In}$ -octreotide scintigraphy can potentially aid in localizing the metastatic paraganglioma and can also have therapeutic implications. Additional nuclear imaging such as with  $^{18}\text{F}$ -FDG PET,  $^{18}\text{F}$ -FDOPA PET, and  $^{68}\text{Ga}$ -DOTATATE PET can also be useful (1–3). In this case, it allowed us to treat the patient with  $^{111}\text{In}$ -octreotide subcutaneously and to refer her for a clinical trial of the use of PRRT.

## CONCLUSION

Diagnosis of metastatic paraganglioma is difficult and may require more than one nuclear medicine imaging modality. Although  $^{123}\text{I}$ -MIBG scintigraphy is the initial test recommended to evaluate for metastatic paraganglioma, not all tumors are  $^{123}\text{I}$ -MIBG-positive, and alternate imaging such as with  $^{111}\text{In}$ -octreotide scintigraphy,  $^{18}\text{F}$ -FDG PET,  $^{18}\text{F}$ -FDOPA PET, and  $^{68}\text{Ga}$ -DOTATATE PET may be indicated. Receptor positivity can help dictate the radiolabeled therapy options.

## DISCLOSURE

No potential conflict of interest relevant to this article was reported.

## REFERENCES

1. Lenders JW, Duh QY, Eisenhofer G, et al. Pheochromocytoma and paraganglioma: an Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab.* 2014;99:1915–1942.
2. Koopmans KP, Jager PL, Kema IP, Kerstens MN, Albers F, Dullaart RP.  $^{111}\text{In}$ -octreotide is superior to  $^{123}\text{I}$ -metaiodobenzylguanidine for scintigraphic detection of head and neck paragangliomas. *J Nucl Med.* 2008;49:1232–1237.
3. Maurice JB, Troke R, Win Z, et al. A comparison of the performance of  $^{68}\text{Ga}$ -DOTATATE PET/CT and  $^{123}\text{I}$ -MIBG SPECT in the diagnosis and follow-up of pheochromocytoma and paraganglioma. *Eur J Nucl Med Mol Imaging.* 2012;39:1266–1270.
4. Dash A, Chakraborty S, Pillai MR, Knapp FF Jr. Peptide receptor radionuclide therapy: an overview. *Cancer Biother Radiopharm.* 2015;30:47–71.
5. Kwekkeboom DJ, Krenning EP. Peptide receptor radionuclide therapy in the treatment of neuroendocrine tumors. *Hematol Oncol Clin North Am.* 2016;30:179–191.



## Nuclear Imaging in Metastatic Paraganglioma

Rohit Kedia, Neil Hansen and Whitney Goldner

*J. Nucl. Med. Technol.* 2016;44:251-252.

Published online: October 27, 2016.

Doi: 10.2967/jnmt.116.180067

---

This article and updated information are available at:

<http://tech.snmjournals.org/content/44/4/251>

---

Information about reproducing figures, tables, or other portions of this article can be found online at:

<http://tech.snmjournals.org/site/misc/permission.xhtml>

Information about subscriptions to JNMT can be found at:

<http://tech.snmjournals.org/site/subscriptions/online.xhtml>

*Journal of Nuclear Medicine Technology* is published quarterly.  
SNMMI | Society of Nuclear Medicine and Molecular Imaging  
1850 Samuel Morse Drive, Reston, VA 20190.  
(Print ISSN: 0091-4916, Online ISSN: 1535-5675)

© Copyright 2016 SNMMI; all rights reserved.