

Case Report

Hibernoma Showing High Uniform Accumulation on an ^{18}F -Fluorodeoxyglucose Positron Emission Tomography Scan: A Case Report

Yasuhiro Kamata^a Kazutaka Kikuta^a Michiro Susa^a
Kazumasa Nishimoto^a Aya Sasaki^b Kaori Kameyama^b Koji Murakami^c
Masaya Nakamura^a Morio Matsumoto^a Hideo Morioka^a

^aDepartment of Orthopedic Surgery, Keio University School of Medicine, Tokyo, Japan;

^bDepartment of Pathology, Keio University School of Medicine, Tokyo, Japan;

^cDepartment of Radiology, Keio University School of Medicine, Tokyo, Japan

Keywords

^{18}F -FDG-PET · Hibernoma · Brown fat

Abstract

Background: Hibernoma is a rare, benign, soft tissue tumor arising from brown fat that cannot be distinguished from other lipogenic tumors on computed tomography and magnetic resonance imaging (MRI) scans. On the other hand, the image of hibernoma on ^{18}F -fluorodeoxyglucose positron emission tomography (^{18}F -FDG-PET) is different from that of other lipogenic tumors. However, fewer studies have investigated the typical features of hibernoma on PET scans. We present the case of a hibernoma that was incidentally detected on ^{18}F -FDG-PET. **Case Presentation:** A 48-year-old Asian man underwent ^{18}F -FDG-PET for routine follow-up of gastric cancer. The patient reported a painless soft mass on the upper arm that had persisted for several years. On ^{18}F -FDG-PET, the mass showed a maximum standardized uptake value of 9.6. The mass showed high intensity on T1- and T2-weighted MRI scans, and showed focally enhanced septa after gadolinium administration. The mass

was surgically resected. Histopathologically, the mass was composed of brown adipose cells characteristic of hibernoma. His postoperative course was uneventful, and there was no local recurrence at the final 24-month follow-up. **Conclusion:** Hibernoma showed strong uniform accumulation on ¹⁸F-FDG-PET, suggesting that ¹⁸F-FDG-PET would be a useful modality for the differential diagnosis of hibernoma versus other lipogenic tumors.

© 2016 The Author(s)
Published by S. Karger AG, Basel

Introduction

Hibernoma is rare, benign, soft tumor derived from brown fat tissue. It accounts for 1.6% of benign lipomatous tumors and approximately 1.1% of all adipocytic tumors [1]. The typical imaging features of hibernoma on computed tomography (CT) or magnetic resonance imaging (MRI) scans have been described [2, 3]. However, fewer studies have investigated the typical features of hibernoma on positron emission tomography (PET) scans [4]. Brown fat generates heat in response to cold exposure or food ingestion. Because it is a major heat producer and contains a large number of mitochondria, brown fat is highly metabolic and shows intense uptake of ¹⁸F-fluorodeoxyglucose (¹⁸F-FDG) [5]. Therefore, hibernoma composed of brown fat would likely exhibit a strong accumulation of ¹⁸F-FDG on PET. Here, we report a case of hibernoma composed of brown fat tissue which showed high uniform accumulation of ¹⁸F-FDG on PET.

Case Presentation

A 48-year-old Asian man had undergone surgical resection for a gastric carcinoma, and 1 year later underwent follow-up including ¹⁸F-FDG-PET/CT. He reported a painless soft mass on the upper arm that had persisted for several years. An ¹⁸F-FDG-PET scan detected a mass in the upper right arm showing abnormally intense FDG accumulation with a maximum standardized uptake value (SUV_{max}) of 9.6 (fig. 1). He was subsequently referred to our department. On physical examination, a soft tissue mass measuring 12 × 10 cm was observed on the upper right arm; the mass was not tender or warm. The patient did not exhibit any neurological deficits. A subsequent contrast-enhanced MRI confirmed the location of the upper right arm mass, which showed heterogeneous hyperintensity on T1- and T2-weighted images, and intense enhancement after gadolinium injection with a linear hyperintensity appearing in the mass (fig. 2). The diagnosis according to imaging was a lipid tumor, including the possibility of malignancy. The patient underwent marginal tumor resection including the tumor capsule. Histopathological analysis of the resected specimen confirmed a diagnosis of hibernoma. The mass exhibited proliferation of microvacuolated eosinophilic cells with nonatypical cells. These cells were dispersed among mature adipocytes that contained a single cytoplasmic vacuole displacing the barely visible nucleus to the cell periphery (fig. 3). His postoperative course was uneventful. At the final 24-month follow-up, the patient showed no signs of local recurrence.

Discussion

Hibernoma is a rare, benign, soft tissue tumor arising from brown fat tissue which was first described in 1906 by Merkel, who named it ‘pseudolipoma’ [6]. The name ‘hibernoma’ was coined by Gery in 1914, because of the similarity of the tumor to the brown fat found in hibernating animals [7]. The incidence of hibernoma is low, but slightly higher in men; it usually develops between the ages of 20 and 40 years. The most common location of hibernoma is the thigh, followed by the shoulder, back, head and neck, mediastinum, and retroperitoneum [8]. In humans, brown fat tissue is normally present in the fetus, where it is distributed in the neck, axillae, and subpleural regions. Brown fat deposition gradually decreases as the fetus develops. In adults, brown fat is confined to the more central body parts such as the posterior cervical and intercostal areas [9]. A previous study reported that 3.7% of their patients had increased ¹⁸F-FDG uptake in areas consisting of brown fat tissue, with SUV_{max} values of 1.9–20 [5].

Clinically, hibernomas present as slow-growing, painless, soft-tissue masses. Often, the only clinical manifestations are the result of compression of nearby structures. When typical imaging characteristics are recognized on CT or MRI, hibernoma may sometimes be diagnosed preoperatively. On CT, hibernomas appear slightly hyperdense, because of the subcutaneous fat with attenuation values that are intermediate between those of fat and skeletal muscle [10]. MRI can accurately reveal the size, location, and extent of the mass. On MRI, hibernoma is described as a hyperintense and well-defined mass on both T1- and T2-weighted images. In most cases, hibernomas typically show decreased signal intensity relative to subcutaneous fat on T1-weighted images [3, 8, 10]; therefore, the mass is difficult to distinguish from simple lipoma or well-differentiated liposarcoma. In contrast, PET is useful for differentiating hibernoma from other lipogenic lesions, because of the intense ¹⁸F-FDG uptake by brown fat. Hoshi et al. [11] reported that well-differentiated liposarcomas demonstrated an SUV_{max} of <2.0, whereas the SUV_{max} of hibernomas has been reported to be ≥4.2, with the median SUV_{max} being as high as 27.8. In agreement with these previous reports [3, 8, 10, 11], the hibernoma in the present case displayed a uniform accumulation of ¹⁸F-FDG on PET imaging.

Conclusion

The hibernoma in our case showed strong uniform accumulation of ¹⁸F-FDG on PET, suggesting that ¹⁸F-FDG-PET would be a useful modality for the differential diagnosis of hibernoma versus other lipogenic tumors.

Statement of Ethics

Written informed consent was obtained from the patient for publication of this case report and the accompanying images. A copy of the written consent form is available for review by the Editor-in-Chief of this journal.

Disclosure Statement

The authors declare that they have no competing interests.

References

- 1 Bancroft LW, Kransdorf MJ, Peterson JJ, O'Connor MI: Benign fatty tumors: classification, clinical course, imaging appearance and treatment. *Skelet Radiol* 2006;35:719–733.
- 2 Cantisani V, Mortelet KJ, Glickman JN, et al: Large retroperitoneal hibernoma in an adult male: CT imaging findings with pathologic correlation. *Abdom Imaging* 2003;28:721–724.
- 3 Ritchie DA, Aniq H, Davies AM, Mangham DC, Helliwell TR: Hibernoma – correlation of histopathology and magnetic-resonance-imaging features in 10 cases. *Skelet Radiol* 2006;35:579–589.
- 4 Kim JD, Lee HW: Hibernoma: intense uptake on F18-FDG PET/CT. *Nucl Med Mol Imaging* 2012;46:218–222.
- 5 Yeung HW, Grewal RK, Gonen M, Schöder H, Larson S: Patterns of ¹⁸F-FDG uptake in adipose tissue and muscle: a potential source of false-positives for PET. *J Nucl Med* 2003;44:1789–1796.
- 6 Merkel H: On a pseudolipoma of the breast. *Beitr Pathol Anat* 1906;39:152–157.
- 7 Little BP, Fintelmann FJ, Mino-Kenudson M, Lanuti M, Shepard JA, Digumarthy SR: Intrathoracic hibernoma: a case with multimodality imaging correlation. *J Thorac Imaging* 2011;26:W20–W22.
- 8 Kumazoe H, Nagamatsu Y, Nishi T, Kimura YN, Nakazono T, Kudo S: Dumbbell-shaped thoracic hibernoma: computed tomography and magnetic resonance imaging findings. *Jpn J Radiol* 2009;27:37–40.
- 9 Cannon B, Nedergaard J: Brown adipose tissue: function and physiological significance. *Physiol Rev* 2004;84:277–350.
- 10 Dursun M, Agayev A, Bakir B, et al: CT and MR characteristics of hibernoma: six cases. *Clin Imaging* 2008;32:42–47.
- 11 Hoshi M, Oebisu N, Takada J, Ieguchi M, Wakasa K, Nakamura H: Role of FDG-PET/CT for monitoring soft tissue tumors. *Oncol Lett* 2014;7:1243–1248.

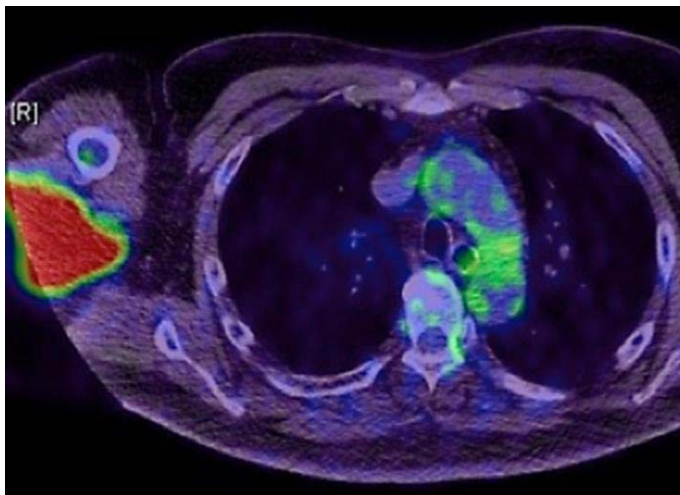


Fig. 1. ¹⁸F-FDG-PET scan showing an area of intense FDG accumulation in the upper right arm. The SUV_{max} was 9.6.

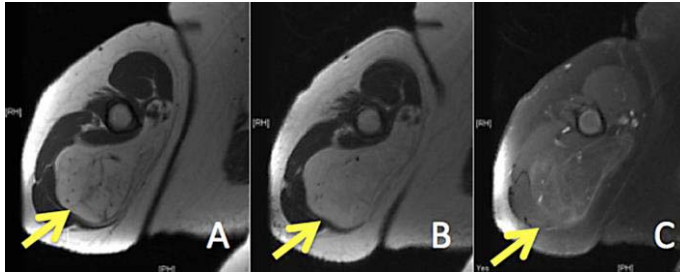


Fig. 2. **A** Axial T1-weighted image without contrast enhancement showing the persistent hyperintensity of the mass (arrow). **B** Axial T2-weighted image without contrast enhancement showing the persistent hyperintensity of the mass (arrow). **C** Axial fat-suppressed T1-weighted image with contrast enhancement showing enhancement of the capsule (arrow).

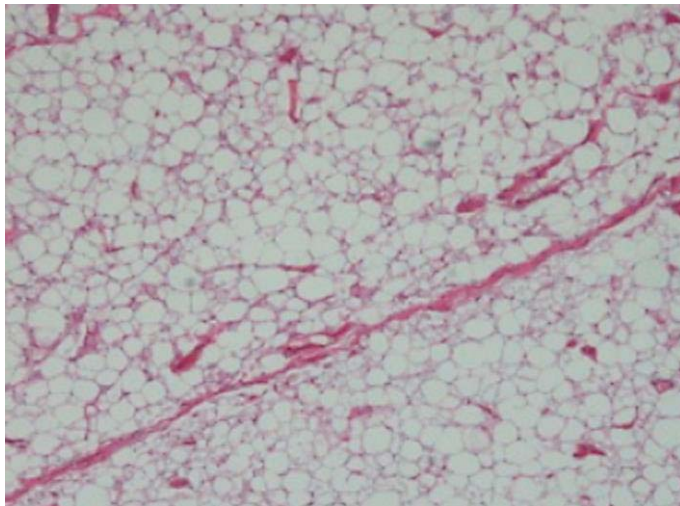


Fig. 3. Histopathological analysis. The mass showed proliferation of microvacuolated eosinophilic cells containing nonatypical cells. These cells were dispersed among mature adipocytes that contained a single cytoplasmic vacuole which displaced the barely visible nucleus to the cell periphery.