



^{11}C -Methionine PET/CT and ^{18}F -FDG PET/CT in the Evaluation of Adult Alveolar Rhabdomyosarcoma

Erişkin Alveoler Rabdomiyosarkomun Değerlendirilmesinde ^{11}C -Metionin PET/BT ve ^{18}F -FDG PET/BT

Yuka Hiroshima, Yoichi Otomi, Takayoshi Shinya, Hideki Otsuka, Masafumi Harada

Tokushima University, Department of Radiology, Tokushima, Japan

Abstract

A 70-year-old man with a tumor in the nasal and paranasal space, was pathologically diagnosed with an alveolar rhabdomyosarcoma, with right cervical lymph node metastasis. Magnetic resonance imaging revealed a primary tumor in the nasal and paranasal sinuses, with associated intracranial infiltration. ^{11}C -methionine positron emission tomography/computed tomography (PET/CT) revealed increased uptake in the primary tumor and right cervical lymph node metastasis. ^{18}F -fluorodeoxyglucose PET/CT also revealed increased uptake in the primary tumor and right cervical lymph node. However, the physiological brain uptake overlapped with the primary tumor uptake. Our case suggests the usefulness of ^{11}C -methionine PET/CT for accurately assessing the extent of alveolar rhabdomyosarcoma, especially in cases with intracranial infiltration or those approximating the brain.

Keywords: ^{11}C -methionine, ^{18}F -FDG, alveolar rhabdomyosarcoma, PET/CT

Öz

Nazal ve paranasal boşlukta tümörü olan 70 yaşında erkek hasta patolojik olarak sağ servikal lenf nodu metastazı olan alveolar rabdomiyosarkom tanısı aldı. Manyetik rezonans görüntüleme, nazal ve paranasal sinüslerde, intrakraniyal infiltrasyona da yol açan bir primer tümör görüldü. ^{11}C -metiyonin pozitron emisyon tomografisi/bilgisayarlı tomografi (PET/BT), primer tümörde ve sağ servikal lenf nodu metastazında artmış tutulum gösterdi. ^{18}F -florodeoksiglukoz PET/BT ayrıca primer tümörde ve sağ servikal lenf nodunda artmış tutulum gösterdi. Bununla birlikte, fizyolojik beyin tutulumu, primer tümör tutulumu ile üst üste gelmiştir. Bizim olgumuz, özellikle intrakraniyal infiltrasyonu olan veya beyne yakın yayılımı olan vakalarda alveolar rabdomiyosarkomun boyutunu doğru bir şekilde değerlendirmek için ^{11}C -metiyonin PET/BT'nin yararlı olduğunu düşündürmektedir.

Anahtar kelimeler: ^{11}C -metiyonin, ^{18}F -FDG, alveoler rabdomiyosarkom, PET/BT

Address for Correspondence: Yoichi Otomi MD, Tokushima University, Department of Radiology, Tokushima, Japan

Phone: +81-88-633-7173 **E-mail:** otomi.yoichi@tokushima-u.ac.jp ORCID ID: <https://orcid.org/0000-0002-8960-3662>

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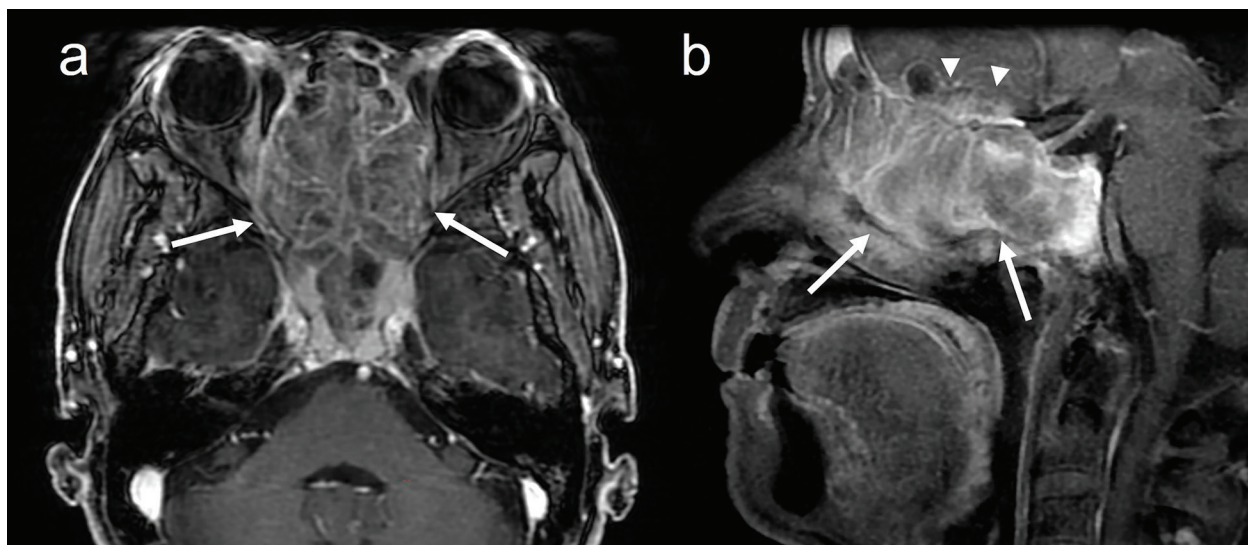


Figure 1. An axial gadolinium-enhanced T1-weighted magnetic resonance imaging (MRI) of a 70-year-old man with a tumor in the nasal and paranasal space. He was pathologically diagnosed with an alveolar rhabdomyosarcoma, with right cervical lymph node metastasis. The image shows a primary lymph node tumor in the nasal and paranasal spaces, located mainly in the ethmoid sinus (arrows) (a, b). The tumor extends into the anterior cranial fossa and the mid to the right frontal lobe (arrowheads) (b).

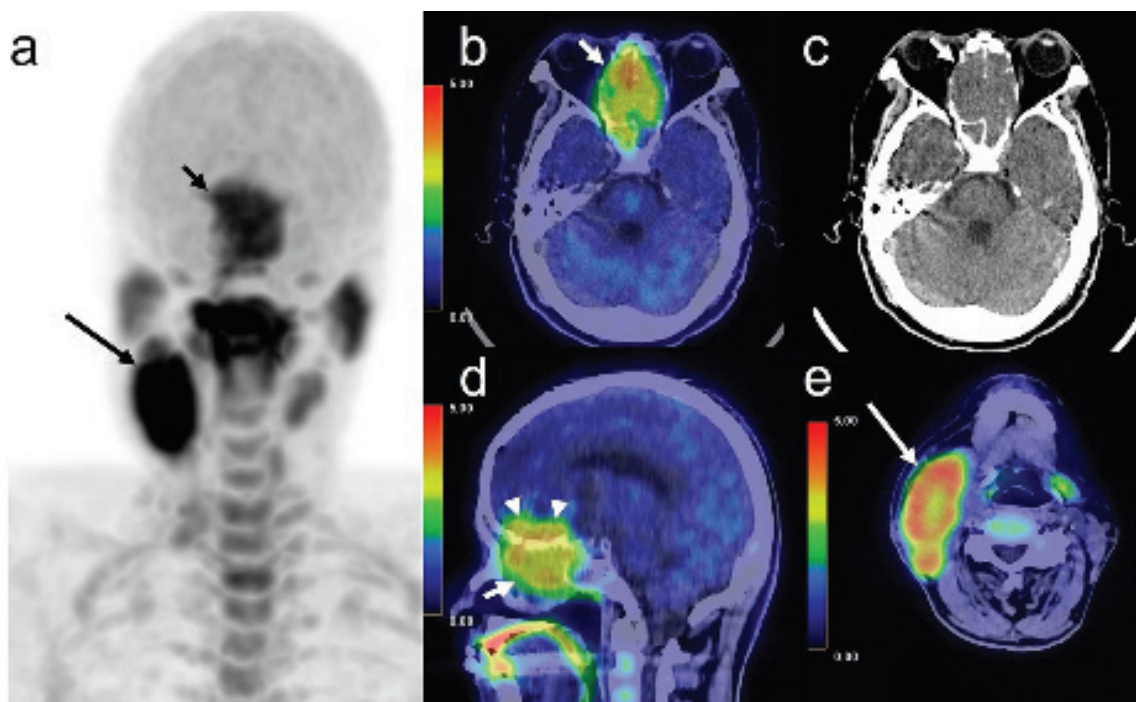


Figure 2. Maximum intensity projection ^{11}C -methionine positron emission tomography (PET) image (a), axial ^{11}C -methionine PET/computed tomography (CT) fusion image (b), CT image at the ethmoid sinus (c), sagittal ^{11}C -methionine PET/CT fusion image at mid-tumor (d), and axial ^{11}C -methionine PET/CT fusion image at the epiglottis level (e). The tumor, located in the nasal and paranasal sinuses, exhibited an increased ^{11}C -methionine uptake, with a maximum standardized uptake value (SUV_{max}) of 3.89 (short arrows). Intracranial invasion of the tumor was observed (arrowheads). The tumoral extension, with high ^{11}C -methionine uptake, can be differentiated from the normal brain area, which has a lower physiological ^{11}C -methionine uptake. The enlarged right cervical lymph node also exhibited increased ^{11}C -methionine uptake, with an SUV_{max} of 4.94 (long arrows).

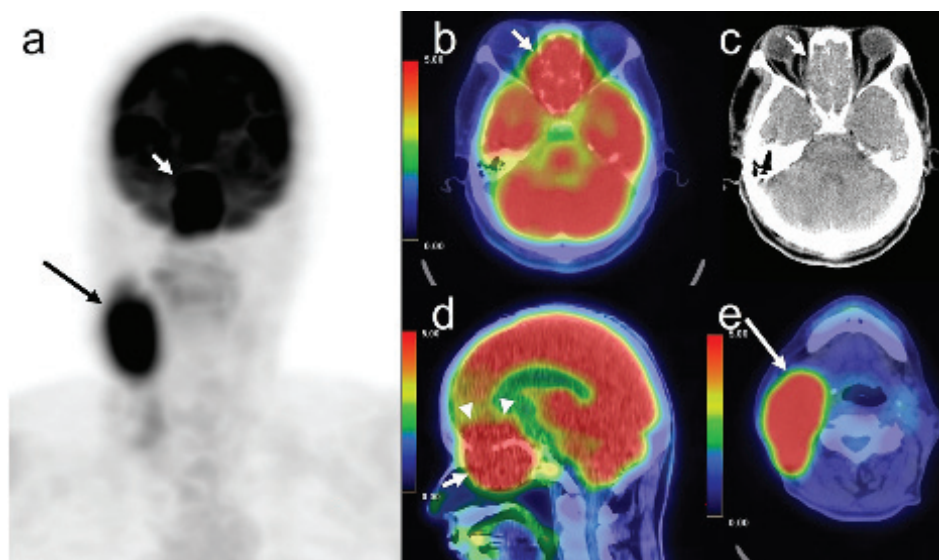


Figure 3. Maximum intensity projection ¹⁸F-fluorodeoxyglucose (¹⁸F-FDG) PET image (a), axial ¹⁸F-FDG PET/CT fusion image at mid-tumor (b), and CT image at the ethmoid sinus (c), sagittal ¹⁸F-FDG PET/CT fusion image at mid-tumor (d), and an axial ¹⁸F-FDG PET/CT fusion image at the epiglottis level (e). The ¹⁸F-FDG PET/CT performed four days after ¹¹C-methionine PET/CT, showed an increased ¹⁸F-FDG uptake in primary tumor with a SUV_{max} of 8.63 (short arrows). Intracranial invasion of the tumor was also observed (arrowheads), but it was challenging to differentiate the tumor ¹⁸F-FDG uptake from physiological ¹⁸F-FDG brain uptake. The enlarged right cervical lymph node also showed increased ¹⁸F-FDG uptake with an SUV_{max} of 10.42 (long arrows). No distal metastases were observed. Although alveolar rhabdomyosarcoma is a common soft tissue tumor in children, it rarely occurs in adults (1,2). ¹⁸F-FDG PET/CT has been reported as a useful modality in detecting tumor and distant lesions, staging, and predicting outcomes in cases of pediatric rhabdomyosarcoma (3,4,5). In our case, the primary tumor in the nasal and paranasal sinuses was visualized using both ¹¹C-methionine PET/CT and ¹⁸F-FDG PET/CT. ¹¹C-methionine PET/CT is a more useful modality in evaluating intracranial tumors (6,7) due to the low physiological brain uptake of ¹¹C-methionine. This allows ¹¹C-methionine PET/CT to delineate the tumor borders clearly. Cervical lymph node metastasis showed increased uptake of both tracers. ¹⁸F-FDG PET/CT is a valuable modality to assess the local alveolar rhabdomyosarcoma other than the head and neck region and to evaluate regional lymph node metastasis and distant metastases. ¹¹C-methionine PET/CT may be a useful tool for patients with alveolar rhabdomyosarcomas, especially in the head and neck regions. Additionally, ¹⁸F-FDG PET/MRI provides further improvements in the staging and assessment of soft tissue tumors (2,8). ¹¹C-methionine PET/MRI images from patients with rhabdomyosarcoma should be collected and discussed in future publications.

Ethics

Informed Consent: Written informed consent was obtained from the patient.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: Y.O., T.S., Design: Y.O., T.S., Data Collection or Processing: Y.H., Y.O., Analysis or interpretation: Y.O., T.S., H.O., M.H., Literature Search: Y.H., Y.O., Writing: Y.H.

Conflict of Interest: No conflict of interest was declared by the authors.

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References

- van der Graaf WTA, Orbach D, Judson IR, Ferrari A. Soft tissue sarcomas in adolescents and young adults: a comparison with their paediatric and adult counterparts. *Lancet Oncol* 2017;18:e166-e175.
- Gennaro N, Marrari A, Renne SL, Cananzi FCM, Quagliuolo VL, Di Brina L, Scorsetti M, Pepe G, Chiti A, Santoro A, Balzarini L, Politi LS, Bertuzzi AF. Multimodality imaging of adult rhabdomyosarcoma: the added value of hybrid imaging. *Br J Radiol* 2020;93:20200250.
- Federico SM, Spunt SL, Krasin MJ, Billup CA, Wu J, Shulkin B, Mandell G, McCarville MB. Comparison of PET-CT and conventional imaging in staging pediatric rhabdomyosarcoma. *Pediatr Blood Cancer* 2013;60:1128-1134.
- El-Kholy E, El Nadi E, Hafez H, Ahmed S, Younes A, El-Kenanii N, Khalid E. Added predictive value of 18F-FDG PET/CT for pediatric rhabdomyosarcoma. *Nucl Med Commun* 2019;40:898-904.
- Ricard F, Cimarelli S, Deshayes E, Moggetti T, Thiesse P, Giammarile F. Additional Benefit of F-18 FDG PET/CT in the staging and follow-up of pediatric rhabdomyosarcoma. *Clin Nucl Med* 2011;36:672-677.
- He Q, Zhang L, Zhang B, Shi X, Yi C, Zhang X. Diagnostic accuracy of ¹³N-ammonia PET, ¹¹C-methionine PET and ¹⁸F-fluorodeoxyglucose PET: a comparative study in patients with suspected cerebral glioma. *BMC Cancer* 2019;19:332.
- Ito K, Matsuda H, Kubota K. Imaging Spectrum and Pitfalls of (¹¹C)-methionine positron emission tomography in a series of patients with intracranial lesions. *Korean J Radiol* 2016;17:424-434.
- Partovi S, Kohan AA, Zipp L, Faulhaber P, Kosmas C, Ros PR, Robbin MR. Hybrid PET/MR imaging in two sarcoma patients- clinical benefits and implications for future trials. *Int J Clin Exp Med* 2014;7:640-648.