



Hypertrophic Pachymeningitis Presenting as “Eyebrows” Sign on ^{18}F FDG PET/CT

Kousik Vankadari¹ Surendar Alwala² Komal Kumar³ Sai Ram¹

¹Department of Nuclear Medicine, Yashoda Hospital, Secunderabad, Telangana, India

²Department of Radiology, Yashoda Hospital, Secunderabad, Telangana, India

³Department of Neurology, Yashoda Hospital, Secunderabad, Telangana, India

Address for correspondence Kousik Vankadari, DNB, Department of Nuclear Medicine and PET/CT, Yashoda Super Speciality Hospital, Alexander Road, Kummari Guda, Shivaji Nagar, Secunderabad, 500003, Telangana, India (e-mail: kousik43@gmail.com).

World J Nuclear Med 2022;21:236–238.

Abstract

Keywords

- ▶ hypertrophic pachymeningitis
- ▶ FDG PET/CT
- ▶ eyebrows sign
- ▶ optic canal

Hypertrophic pachymeningitis refers to linear or nodular thickening of the dura mater covering the brain and spinal cord following various inflammatory/infective processes. Usually, magnetic resonance imaging brain shows uniform thickening with enhancement of involved meninges. Fluorodeoxyglucose positron emission tomography/computed tomography (PET/CT) findings of pachymeningitis are rarely reported in literature. We describe the PET/CT findings of a patient with hypertrophic pachymeningitis involving the bilateral supraorbital regions depicting as “eyebrows” on brain maximum intensity projection image.

Case Report

A 68-year-old male patient presented to our department with a chief complaint of headache associated with diplopia for the last 3 months. Magnetic resonance imaging (MRI) brain examination reveals homogeneously enhancing smooth thickening of pachymeninges overlying the frontal bone (▶**Fig. 1A**; *solid arrows*), dura mater of the falx cerebri (▶**Fig. 1G**; *dashed arrows*) along with inflammation of the meninges surrounding the intracanalicular segment of bilateral optic nerves (▶**Fig. 1D**; *dotted arrow*). F-18 fluorodeoxyglucose positron emission tomography/computed tomography (^{18}F -FDG PET/CT) was done to rule out active systemic infective, inflammatory pathology or occult malignancy. After intravenous administration of 296 MBq ^{18}F -FDG, patient was positioned comfortably in a quiet, dimly-lit room for 60 minutes. Static brain acquisition performed as a part of whole-body assessment was done for 10 minutes under Siemens Healthineers (Siemens Medical Solutions, Liberty Boulevard, Malvern, PA,

USA), Biograph Horizon PET/CT scanner. ^{18}F -FDG PET/CT brain (maximum intensity projection, ▶**Fig. 2**) images show linear increased FDG uptake along the supraorbital regions depicting as eyebrows sign (▶**Fig. 2**; *black arrows*). No abnormal FDG-avid lesion seen in rest of the whole body. Axial and coronal FDG PET/CT brain images localize the increased metabolic activity to bilateral supraorbital meninges (▶**Fig. 1B, C**; *solid arrows*) extending to involve the bilateral optic sheaths at the level of optic canal (▶**Fig. 1E, F**; *dotted arrows*). Metabolically active thickening also seen to involve anterior aspect of falx cerebri (▶**Fig. 1H, I**; *dashed arrows*). Maximum standardized uptake value of metabolically active thickening involving the pachymeninges ranged from 4 to 4.5. Cerebrospinal fluid (CSF) examination with Xpert MTB shows tubercular DNA. Patient showed clinical improvement following antitubercular treatment. In view of metabolically active thickening involving pachymeninges on FDG PET/CT and MRIs along with clinical improvement following antitubercular therapy, a presumptive diagnosis of tubercular pachymeningitis has been considered.

DOI <https://doi.org/10.1055/s-0042-1750014>.
ISSN 1450-1147.

© 2022. World Association of Radiopharmaceutical and Molecular Therapy (WARMTH). All rights reserved.

This is an open access article published by Thieme under the terms of the Creative Commons Attribution-NonDerivative-NonCommercial-License, permitting copying and reproduction so long as the original work is given appropriate credit. Contents may not be used for commercial purposes, or adapted, remixed, transformed or built upon. (<https://creativecommons.org/licenses/by-nc-nd/4.0/>)

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

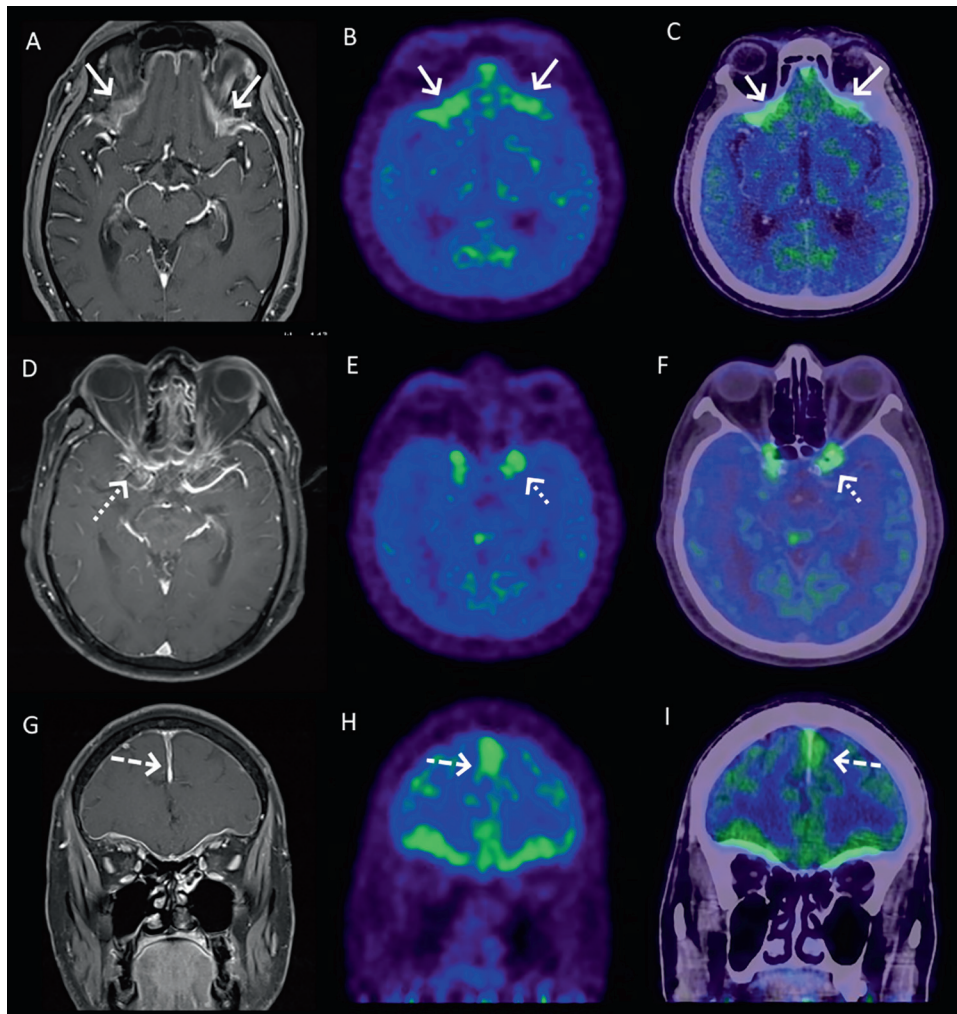


Fig. 1 Axial and coronal magnetic resonance imaging (gadolinium-enhanced T1-weighted imaging sequence), positron emission tomography, and fused positron emission tomography-computed tomography images show metabolically active thickening with enhancement involving the supraorbital pachymeninges (maximum standardized uptake value [SUVmax]-4; A–C), bilateral optic sheaths (SUVmax-4.5; D–F), and dura mater of falx cerebri (G–I).

Pachymeningitis refers to focal or diffuse thickening of dura mater surrounding the brain parenchyma and spinal cord with or without associated inflammation.^{1,2}

Discussion

Even-though significant proportion of patients has idiopathic form of disease,³ other frequently reported causes include autoimmune etiology (immunoglobulin G4-related, neuro-sarcoidosis, antineutrophil cytoplasmic antibody-related, Sjogren's syndrome, rheumatoid arthritis),^{4–6} infectious etiology (mycobacterium tuberculosis, fungal infection, syphilis),⁷ and rarely malignancy (dural carcinomatosis).⁸ Regardless of etiology, most of the patients typically present with chronic headache associated with focal neurologic defect related to compression of cranial nerve by the thickened inflamed dura mater.³ Diplopia seen in our patient is most likely due to compression of bilateral optic nerves by inflamed meninges at the level of optic canal. Tubercular pachymeningitis is a relatively less common compared with other forms of intracranial tubercular disease manifesting as pachy-meningeal thickening of basal meninges and cerebral convexities, although less commonly it involves falcine region as seen in our case.² Definitive diagnosis was based on the histological evidence of granulomatous disease with

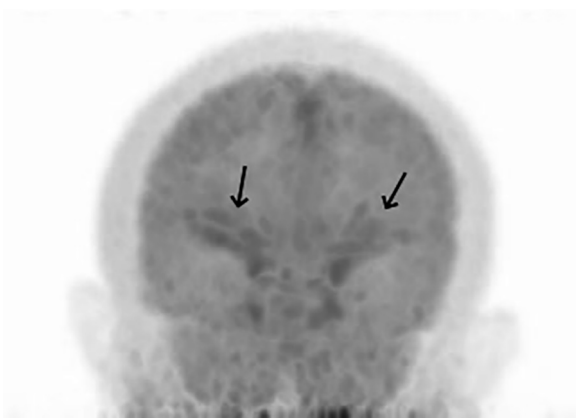


Fig. 2 Static fluorodeoxyglucose positron emission tomography brain (maximum intensity projection) image shows linear increased tracer uptake along bilateral supraorbital regions depicting as eyebrows.

caseous necrosis and tubercular bacilli on dural biopsy. Less commonly CSF evidence of tubercular DNA on PCR along with symptomatic resolution on antitubercular treatment can be presumptive of tubercular pachymeningitis. FDG PET/CT helps to correlate the distribution and extent of active dural inflammation with patient symptoms and MRI findings apart from excluding active infective or inflammatory disease process in rest of the whole body. Recently, Wong et al reported the image findings of pachymeningitis involving the dura surrounding the venous sinus on Ga-67 single-photon emission computed tomography/computed tomography.⁹ Ga-67 scintigraphy can be more sensitive than FDG PET/CT in identifying meningeal inflammation due to lack of physiological uptake in the brain parenchyma; however, limited availability and high radiation exposure remain matter of concern.¹⁰ Furthermore, FDG PET co-registered with MRI can be used for optimally targeting the site of dural biopsy in patients with negative serology, culture, and CSF examination. FDG PET/CT image findings of pachymeningitis are rarely reported in literature and nuclear medicine physician should be familiar with these subtle findings while interpreting various infective and inflammatory pathologies involving the cranial vault.

Patient's Consent

The authors certify that appropriate patient consent was obtained from the patient for publishing the images and clinical information in the journal without revealing patient identity.

Funding

None.

Conflict of Interest

None declared.

References

- Goyal M, Sharma A, Mishra NK, Gaikwad SB, Sharma MC. Imaging appearance of pachymeningeal tuberculosis. *AJR Am J Roentgenol* 1997;169(05):1421–1424
- Thurtell MJ, Keed AB, Yan M, Gottlieb T, Spies JM, Halmagyi GM. Tuberculous cranial pachymeningitis. *Neurology* 2007;68(04):298–300
- Kupersmith MJ, Martin V, Heller G, Shah A, Mitnick HJ. Idiopathic hypertrophic pachymeningitis. *Neurology* 2004;62(05):686–694
- Akahoshi M, Yoshimoto G, Nakashima H, et al. MPO-ANCA-positive Wegener's granulomatosis presenting with hypertrophic cranial pachymeningitis: case report and review of the literature. *Mod Rheumatol* 2004;14(02):179–183
- De Virgilio A, de Vincentiis M, Inghilleri M, et al. Idiopathic hypertrophic pachymeningitis: an autoimmune IgG4-related disease. *Immunol Res* 2017;65(01):386–394
- Higgins WL, Marano GD. Gallium imaging of rheumatoid pachymeningitis. *Clin Nucl Med* 1986;11(05):350–351
- Murai H, Kira J, Kobayashi T, Goto I, Inoue H, Hasuo K. Hypertrophic cranial pachymeningitis due to *Aspergillus flavus*. *Clin Neurol Neurosurg* 1992;94(03):247–250
- Boers J, Schröder CP, Hospers GAP, de Vries EFJ, Glaudemans AWJM. Detection of dural metastases before the onset of clinical symptoms by 16α-[18F]Fluoro-17β-estradiol PET in a patient with estrogen receptor-positive breast cancer. *Clin Nucl Med* 2021;46(03):e165–e167
- Wong VC, Yung G, Russo R, Reddel SW, Mansberg R. Pachymeningitis demonstrated on gallium SPECT/CT scan. *Clin Nucl Med* 2019;44(04):305–309
- Chu KH, Lin YT, Hsu CC, Chen CY, Pan LK. Evaluation of effective dose for a patient under Ga-67 nuclear examination using TLD, water phantom and a simplified model. *J Radiat Res (Tokyo)* 2012;53(06):989–998