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Case Report

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Multimodality PET/CT and MRI Evaluation of a Parasagittal Parietal Brain Lesion: Broad Differential Diagnostic Considerations

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Abstract

Background

Parasagittal parietal lesions present a diagnostic challenge due to overlapping radiological features among dural-based and cortical pathologies. Integration of anatomical and functional imaging can aid in refining the differential diagnosis.

Case Presentation

We report the case of a 19 year old patient presenting with persistent headache. Contrast-enhanced magnetic resonance imaging (CE-MRI) revealed a heterogeneously enhancing parasagittal parietal lesion with associated mass effect. FDG PET/CT demonstrated marked metabolic uptake, while Gallium-68 PET/CT revealed concordant uptake, suggesting somatostatin receptor expression. The differential diagnosis included hemangiopericytoma, meningioma, parafalcine oligodendroglioma, cortical glioma, and dural metastases.

Conclusion

This case emphasizes the importance of a multimodality approach, combining MRI with both FDG and Ga-68 PET/CT, in characterizing complex intracranial lesions and narrowing the differential diagnosis prior to histopathological confirmation.

Keywords: Parasagittal Parietal Lesion, FDG PET/CT, Gallium-68 PET/CT, Meningioma, Hemangiopericytoma, Oligodendroglioma, Dural Metastases, Brain Tumor Imaging

Introduction

Intracranial parasagittal lesions encompass a spectrum of neoplastic and non-neoplastic etiologies. While MRI provides superior anatomical delineation, metabolic imaging with positron emission tomography (PET) can yield complementary information regarding tumor metabolism and receptor expression. FDG PET/CT is widely utilized to assess glycolytic activity, whereas Ga-68 DOTATATE PET/CT offers high sensitivity for somatostatin receptor-expressing tumors such as meningiomas and hemangiopericytomas. When lesions exhibit atypical enhancement patterns, integration of both imaging modalities can aid in surgical planning and guide biopsy strategies.

Case Presentation

A 19 year-old patient presented with a 2-month history of intermittent headaches, progressively increasing in severity. There was no history of seizures, focal neurological deficits, or systemic illness. Neurological examination was unremarkable.

MRI Findings

Contrast Enhanced MRI revealed a well-circumscribed, heterogeneously enhancing lesion in the parasagittal parietal region, causing mild midline shift and adjacent cortical compression. The lesion appeared Dural-based with broad dural

contact and mass effect on the superior sagittal sinus. No calcification or hemorrhage was identified on susceptibility-weighted imaging.

FDG PET/CT

PET CT scan showed FDG avid central necrotic heterogeneously enhancing lesion dural based lobulated lesion in the parafalcine location in the left parietal region, causing mild scalloping of left parietal bone having (SUV max 8.4, 3.2*27.7cm) versus normal brain (SUV max 6.02). Significant perilesional edema not causing hydrocephalous however it is causing effacement of adjacent cortical sulci compression of the ipsilateral ventricle and a mid-line shift towards the right side, with no evidence of extracranial primary malignancy or systemic metastases.

Ga-68 PET/CT

The lesion showed concordant uptake on Ga-68 DOTATATE imaging, indicating possible somatostatin receptor overexpression.

The patient underwent surgical excision. Histopathology confirmed an anaplastic meningioma (WHO Grade III).

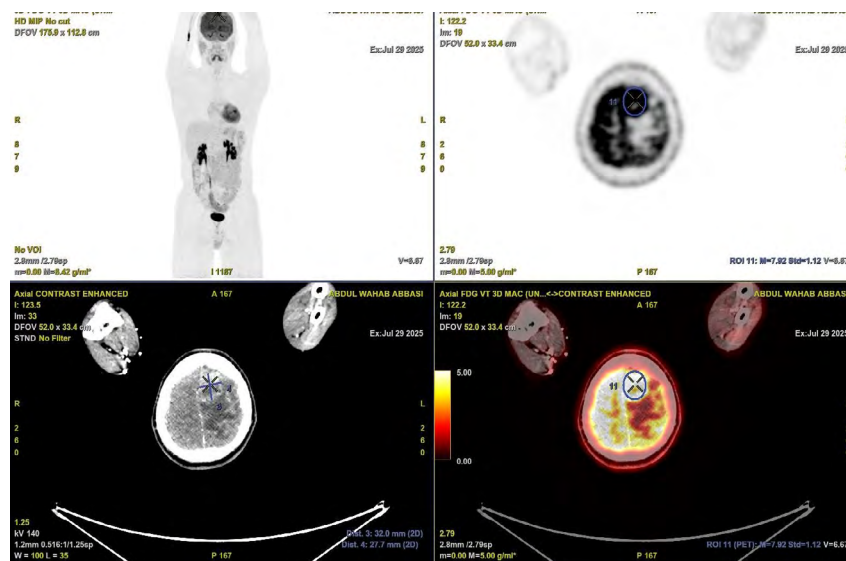


Image no 1 Showing F-18 FDG Uptake in the Parasagittal Location in Left Parietal Region of Skull

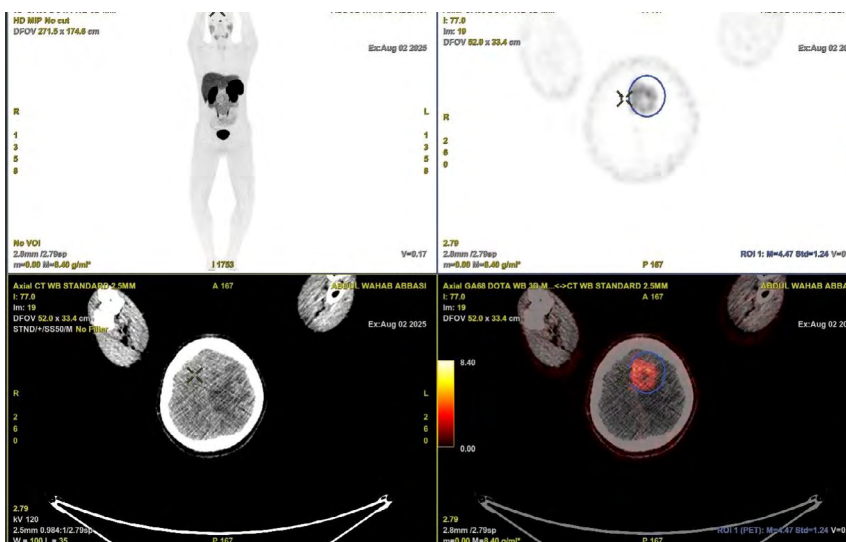


Image no 2 of the Same Patients Injected with Ga 68 DOTATE and the Scan Showed Increased Uptake in the Same Lesion

Discussion

The imaging findings in this case—a parasagittal lesion in the parietal region with both FDG and Ga-68 uptake—prompt a multifaceted differential diagnosis. Integrating MRI morphologic details with metabolic and receptor-based PET imaging enhances diagnostic precision.

Hemangiopericytoma (HPC)

- An aggressive dural-based neoplasm originating from pericytes. HPCs often mimic meningiomas on MRI but tend to exhibit more heterogeneous enhancement and minimal calcifications.
- On FDG PET-CT, HPCs demonstrate high glycolytic activity, while Ga-68 DOTATATE uptake is commonly noted due to somatostatin receptor expression [1,2].

Meningioma

- The most prevalent dural-based brain tumor, typically demonstrating strong and homogeneous enhancement on MRI, often with a visible “dural tail.” Although generally benign, atypical or high-grade subtypes may appear heterogeneous radiologically.
- Ga-68 uptake is well-documented in meningiomas owing to somatostatin receptor overexpression [3,4].

Parafalcine Oligodendroglioma

- A rare glioma arising near the falx, potentially simulating dural-based lesions. Imaging may reveal calcifications and cortical infiltration.
- FDG uptake tends to be similar to white matter unless high-grade, with amino acid tracers like 11C-methionine providing more specificity (Radiopaedia; Imaging review) [5].

Cortical Glioma

- Primary intra-axial lesions that may abut the dura and complicate differentiation from dural-based tumors. FDG uptake varies depending on tumor grade and overlaps with gray matter baseline activity, lowering sensitivity (Imaging literature on gliomas and oligodendrogliomas).

Dural Metastases

- Secondary neoplastic involvement of the dura, commonly associated with systemic malignancies (e.g., breast, lung, prostate). On imaging, these lesions often enhance heterogeneously and show high FDG uptake reflective of their aggressive nature.
- While FDG PET-CT can identify metabolic activity, Ga-68 is not typically taken up unless the metastasis expresses the relevant receptors (Bone metastases imaging examples, general PET/CT literature) [6].

Meningiomas represent ~30% of adult primary intracranial tumors, with anaplastic variants (Grade III) accounting for <3% and associated with aggressive clinical course, recurrence, and poor prognosis [3].

Imaging Challenges

On MRI, high-grade meningiomas often mimic hemangiopericytomas, gliomas, or dural metastases, complicating diagnosis [7].

FDG PET/CT provides metabolic information; high-grade meningiomas typically demonstrate increased FDG uptake, correlating with proliferation and aggressiveness [8]. However, background cortical uptake may reduce specificity.

Ga-68 PET/CT with somatostatin analogs (DOTATATE, DOTATOC, DOTANOC) provides high lesion-to-background contrast due to overexpression of SSTR2 in meningiomas. It has proven value in pre-surgical mapping, radiotherapy planning, and selection for PRRT [9,10].

Dual-tracer approach. FDG uptake reflects metabolic aggressiveness, while Ga-68 uptake reflects receptor density and therapeutic potential. In our case, concordant FDG and Ga-68 uptake suggested high-grade biology, later confirmed histopathologically. This dual-tracer correlation is rarely reported in anaplastic meningiomas and may represent an imaging biomarker for disease stratification [11,12].

Supporting Literature

Our case underscores the synergistic role of dual-tracer PET/CT in both diagnosis and therapeutic planning of aggressive meningiomas.

- FDG PET-CT captures metabolic activity and is particularly useful for high-grade tumors or metastases, though intracranial uptake must be interpreted cautiously due to physiologic gray matter activity (FDG-PET limitations in brain metastases).
- Ga-68 DOTATATE PET-CT serves as a receptor-based modality, sensitive to somatostatin receptor-positive lesions, thus helping differentiate meningioma or HPC from gliomas or metastases WikipediaRadiopaedia.
- The concurrent uptake on both imaging modalities in our case significantly increases the likelihood of a perfused, receptor-positive extracerebral mass such as meningioma or HPC.

Nevertheless, histopathological confirmation remains essential, as imaging, though highly informative, cannot definitively distinguish between these entities.

Patient Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

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