Differentiating Meningioma from Primary Brain Melanoma: A Case Report of a Diagnostic Challenge in Stage IV NSCLC

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Abstract

We present a 74-year-old male with Stage IV non-small cell lung carcinoma (NSCLC) and intracranial masses initially presumed to be meningiomas based on imaging. However, post-surgical pathology unexpectedly revealed primary brain melanoma, highlighting the diagnostic challenge of differentiating these entities. Imaging characteristics, including photopenia on PET-CT and lobulated margins on MRI, favored meningioma, yet heterogeneous enhancement raised suspicion for malignancy. Immunohistochemical staining confirmed SOX10 and HMB45 positivity, leading to the final diagnosis. This case underscores the limitations of imaging in differentiating benign from malignant extra-axial masses and emphasizes the need for refined neuroradiologic criteria in oncology patients.

Introduction

Accurately differentiating intracranial masses in oncology patients is crucial for appropriate management but remains a significant challenge.

Feature	NSCLC[1,2,3]	Meningioma[4,5,6]	Primary Melanoma[7,8]
Nature	Malignant	Typically Benign	Malignant
Origin	Lung Primary	Meningothelial cells	Melanocytes (rare)
Growth Pattern	Intraparenchymal, multiple	Extra-axial, well circumscribed	Extra-axial or intraparenchymal
Imaging Characteristics	Multiple lesions, peritumoral edema, ring-engancement	Dural attachment, homogenous enhancement	Hyperintense on T1, variable enhancement
Common Misdiagnosis	Glioblastoma, lymphoma	Metastasis, melanoma	Menigioma, metastasis
Key Diagnostic Challenge	Can mimc other metastases	Can resemble melanoma on imaging	Can mimic meningioma due to extra-axial location

This case highlights the difficulty of distinguishing meningioma from primary brain melanoma based solely on imaging, underscoring the need for improved diagnostic criteria in patients with known malignancies.

Clinical Presentation

Age: 73-year-old male

Medical History: Hypertension, hyperlipidemia, abdominal aortic aneurysm, and newly diagnosed **Stage IV NSCLC (adenocarcinoma) with spinal metastases**.

Social History: Retired landscape contractor, non-smoker, occasional EtOH.

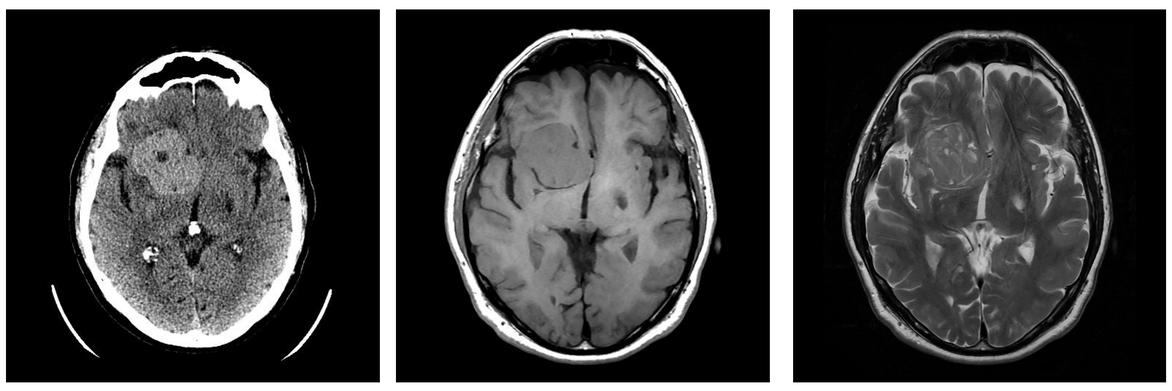
Presenting Symptoms
- Progressive **fatigue and exertional shortness of breath** since February.
- No back pain or neurological symptoms despite **MRI findings of brain lesions**.
- **Stable weight and appetite**; remains active at home.

Hospital Course
- **Admitted for pneumothorax** after lung biopsy.
- **Imaging Findings:** MRI showed multiple small metastases and **two right-sided extra-axial masses** (4.3 cm & 2.0 cm), initially suspected to be meningiomas.
- PET-CT findings confirmed **lung malignancy with bone metastases**.

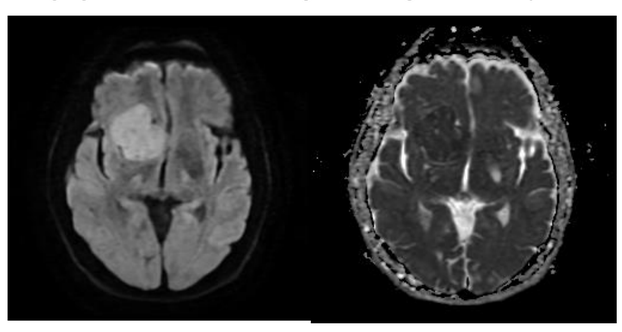
Objective Data
- **Physical Exam:** No focal deficits; lungs clear to auscultation.
- **Labs:** Stable WBC, hemoglobin, and metabolic panel.

Clinical Concern
- **Diagnostic Challenge:** Imaging favored meningiomas, yet MRI heterogeneity suggested possible malignancy.

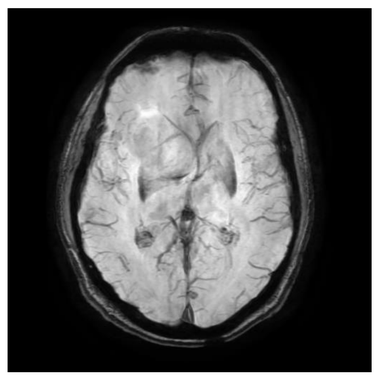
Imaging Findings



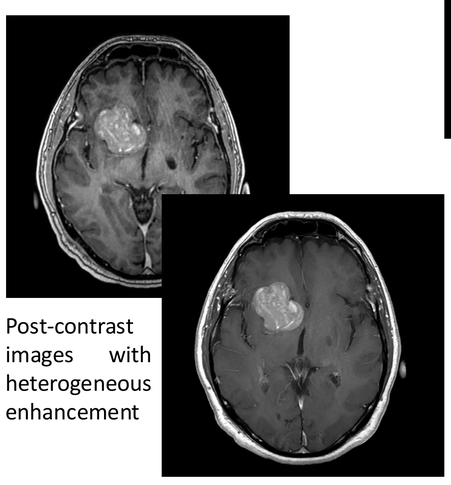
Noncontrast head CT shows a **hyperdense lobulated extra-axial mass** near the right sphenoid bone. Precontrast T1-weighted MRI reveals **isointense signal**, atypical for melanoma, which is usually T1 hyperintense. T2-weighted imaging demonstrates **heterogeneous signal intensity** with internal T2 hyperintense foci.



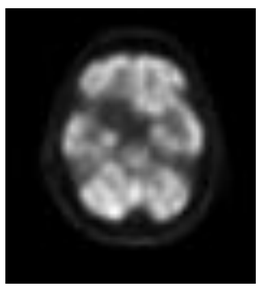
Diffusion weighted sequences demonstrated high internal cellularity with increased signal on DWI and low ADC values.



Susceptibility-weighted imaging shows no dephasing, unlike typical melanin-based neoplasms.



Post-contrast images with heterogeneous enhancement



PET-CT imaging demonstrated hypometabolism and lack of FDG uptake within the lesion. Although not always hypermetabolic, meningiomas are commonly FDG avid.

Operative Course

Surgical Procedure
The patient underwent a **right frontal-temporal/pterional craniotomy** for tumor resection. Using **frameless stereotactic image guidance**, the neurosurgical team performed a **microscopic dissection** and resected the extra-axial tumor from the **middle and anterior cranial fossae**. An **anterior clinoidectomy** was also completed.

Intraoperative Findings & Technique
- The tumor was **extra-axial** with some **pial invasion**.
- The **Sylvian fissure was carefully dissected**, and tumor devascularization and debulking were performed using a **Sonopet ultrasonic aspirator**.
- Tumor margins were meticulously **dissected off the ICA, M1, and optic nerve** before resection.

Pathology

Diagnosis	Melanoma (Primary vs met uncertain)
Microscopy	Malignant epithelioid cells, open chromatin, mitotic figures, no necrosis.
Immuno	**SOX10 & HMB45:** Positive **CKpan & CD45:** Negative
Gross Exam	Yellow-tan & tan-gray soft tissue fragments (largest: 4.3 cm).

Discussion

This case highlights the **challenge** of distinguishing meningioma from melanoma on imaging alone. Despite MRI features suggestive of meningioma, pathology confirmed **primary brain melanoma**, emphasizing **imaging limitations** in oncology patients.

Heterogeneous enhancement and vascularity should raise suspicion in patients with known malignancy. **Pial invasion** seen intraoperatively further supported a malignant diagnosis.

Early consideration of **alternative diagnoses** can impact **surgical planning and treatment**. Future research should focus on **refining imaging criteria** for better diagnostic accuracy.

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