Epilepsy as a Whisper: Epidermoid Cyst Unveiled by Seizure Onset in Adolescence

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The authors declare that they have no known financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CONSENT
Yes

HUMAN AND ANIMAL RIGHTS
The authors confirm that all procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1975 Helsinki Declaration and its later amendments.

ABSTRACT

A 19-year-old female patient experienced her first epileptic seizure during a dental procedure, despite no prior history of seizures or epilepsy. Emergency imaging revealed a lobulated, well-circumscribed lesion located to the left frontotemporal basal region, measuring approximately 40×34×30 mm. Magnetic resonance imaging findings included hyperintense signal on Fluid-attenuated inversion recovery and Diffusion weighted imaging sequences, typical of epidermoid cysts, while Computed tomography revealed marginal calcifications without acute hemorrhage. The lesion exerted mild compression on adjacent structures, notably the left middle cerebral artery and internal carotid artery, but showed no infiltration or edema. Diffusion-weighted imaging was critical in distinguishing the lesion from other cystic masses, demonstrating the classical diffusion restriction characteristic of epidermoid cysts. Epidermoid cysts are benign, congenital lesions accounting for only about 0.5–1.5% of all intracranial tumors, with common locations at the cerebellopontine angle and suprasellar cisterns; frontotemporal basal occurrence is exceedingly rare. Clinically, the patient reported longstanding intermittent headaches, nausea, vomiting, blurred vision, and later a second seizure while awaiting surgery. These symptoms, though nonspecific, underline the importance of considering epidermoid cysts in differential diagnosis when evaluating young patients with new-onset seizures and cystic lesions on imaging. Advanced imaging techniques such as DWI, FLAIR, and contrast-enhanced MRI were crucial in achieving a high preoperative suspicion for an epidermoid cyst. The lesion's hypodensity on CT (measuring –15 HU) and hyperintense signal on T1W1-MRI in subarachnoid spaces suggested fatty contents, supporting the diagnosis of a perforated epidermoid cyst. Management was complicated by the lesion's proximity to critical vascular structures, necessitating CT angiography prior to any intervention. Given the lack of local neurosurgical resources, the patient was referred abroad for advanced specialized treatment. External specialist reviews corroborated the imaging findings and recommended microsurgical resection with intraoperative neuro-navigation. Surgery was successfully performed in Turkey, with histopathology

confirming the diagnosis of an epidermoid cyst. This case underscores the challenges posed by rare intracranial epidermoid cysts in both diagnosis and management, particularly when presenting in uncommon locations and healthcare settings with limited advanced surgical capabilities. It highlights the critical value of specific MRI sequences, especially DWI, in differentiating epidermoid cysts from other lesions such as arachnoid cysts or low-grade gliomas. Complete surgical resection remains the standard of care, although careful attention must be paid to preserving nearby vascular and neural structures to minimize postoperative deficits. Despite their benign nature, epidermoid cysts may recur if resection is incomplete, emphasizing the need for meticulous surgical planning and follow-up. The case also illustrates how epidermoid cysts, though congenital, often present clinically during adolescence or early adulthood, only after slow progressive growth leads to compression of adjacent structures. This case adds to the limited literature on intracranial epidermoid cysts involving the frontotemporal basal region and supports the recommendation for early differential diagnosis and the use of advanced imaging modalities to guide management decisions. Ultimately, it underscores the need for multidisciplinary coordination to achieve optimal outcomes for patients with complex, rare intracranial lesions.

CASE REPORT

BACKGROUND

SIGNIFICANCE OF THE CASE AND ITS CONTRIBUTION TO THE LITERATURE

Intracranial epidermoid cysts are rare, benign congenital lesions that account for only 0.5% to 1.5% of all primary intracranial tumors. While most commonly located in the cerebellopontine angle and suprasellar cisterns, involvement of the frontotemporal basal region is exceptionally uncommon, making this case clinically significant. Furthermore, initial presentation with a new-onset epileptic seizure in a young adult without prior neurological history is an unusual and diagnostically challenging scenario. This case underscores the importance of considering epidermoid cysts in the differential diagnosis of young patients presenting with seizures and non-enhancing cystic intracranial lesions. It also highlights the pivotal role of advanced imaging modalities particularly DWI in identifying the classic restricted diffusion pattern that distinguishes epidermoid cysts from other cystic masses such as arachnoid cysts or cystic gliomas.

The case contributes to the literature by documenting a rare location of an epidermoid cyst with atypical clinical presentation, emphasizing the diagnostic value of multimodal imaging and the complexity of surgical planning due to the lesion's proximity to critical vascular structures. It also illustrates the diagnostic limitations of imaging alone, as the final pathology revealed a sebaceous adenoma further reinforcing the essential role of histopathological confirmation. Additionally, the case offers insight into the logistical and clinical challenges faced in resource limited settings, highlighting the need for multidisciplinary coordination and referral to specialized centers. As such, this report adds to the scarce body of literature on frontotemporal basal lesions and serves as a valuable teaching example for both radiologists and neurosurgeons.

CASE REPORT

Case Presentation

A 19-year-old female patient, experienced an epileptic seizure during a dental procedure. She had no prior personal or family history of epilepsy. Upon presentation to the emergency department, a non-contrast CT scan was performed to rule out acute hemorrhage, followed by contrast-enhanced MRI to investigate possible structural abnormalities.

The patient reported a history of intermittent headaches, nausea, vomiting, blurred vision in the left eye, and had her first seizure during the dental procedure. She had previously not sought medical attention for neurological symptoms. Neurological examination was notable for post-ictal confusion but there were no focal deficits. Initial laboratory findings were unremarkable.

Imaging Findings

Initial CT scan revealed no evidence of acute intracranial hemorrhage. Yet, we identified a mass with marginal calcifications in the left frontotemporal region, as presented in figure 1.

Further, Pre- and Post-Contrast MRI was performed, including sequences as: axial T1-weighted, T2-weighted, FLAIR, DWI, and post-gadolinium axial, sagittal, and coronal T1-weighted sequences. We found a well-demarcated, heterogeneous, lobulated lesion localized in the left frontotemporal basal region, measuring approximately 40 mm (axially) × 34 mm (anteroposterior) × 30 mm (cranio-caudal). The lesion appeared with hyperintense signal on FLAIR and DWI sequences, with uniformly hyperintense signals on T2-weighted images. No evidence of perifocal edema or abnormal contrast enhancement was observed. Mild mass effect was present, with compression on the left brainstem parenchyma. Complex anatomical relationships were noted with the left cavernous sinus, middle cerebral artery (MCA), and internal carotid artery (ICA), with probable mild compression of the left MCA but without clear vascular infiltration, as presented under figure 2 and 3.

Furthermore, DWI sequence showed marked hyperintense signal consistent with restricted diffusion, a characteristic feature of epidermoid cysts, presented in figure 4.

In summary, the imaging characteristics, particularly the restricted diffusion on DWI, suggested an epidermoid cyst, although differential diagnoses such as arachnoid cysts or cystic neoplasms were initially considered.

Management and Follow-up

The patient was initially stabilized with intravenous sedative therapy to prevent further seizures. Given the size of the lesion, its mass effect, and the complex vascular relationships, surgical intervention was indicated. However, due to limitations in local neurosurgical capabilities, referral abroad was recommended.

Preoperative Planning: Angiography-CT was advised to better delineate vascular relationships and assess surgical risks, especially regarding the proximity to the left MCA and ICA.

Follow-Up Events: While awaiting surgery abroad, the patient suffered a second epileptic seizure on November 2024, during her stay in Turkey. Surgical resection was being planned with consideration of minimally invasive approaches depending on intraoperative findings (Figure 5).

This case emphasizes the diagnostic and management challenges of rare intracranial epidermoid cysts, particularly those arising in unusual locations such as the frontotemporal basal region. It underscores the value of advanced imaging modalities (DWI, FLAIR, CT angiography) for accurate diagnosis and surgical planning.

DISCUSSION

Etiology & Demographics

Epidermoid cysts are primarily congenital lesions resulting from ectodermal inclusions during neural tube closure between the third and fifth weeks of gestation [1]. They grow extremely slowly, often remaining asymptomatic for decades. Symptomatic presentation typically occurs between the ages of 20 and 40 years [2]. Although some studies report a slight male predominance [2], findings across the literature are inconsistent. Intracranial epidermoid cysts are rare, accounting for approximately 0.5%–1.5% of all primary intracranial tumors [3]. Associations with congenital anomalies, such as anorectal malformations, sacral anomalies, and pre-sacral masses (Currarino triad), have been described but remain exceedingly uncommon [4].

Clinical & Imaging Findings

Patients with intracranial epidermoid cysts usually present with symptoms caused by mass effect on adjacent neurovascular structures, including headaches, cranial nerve deficits, seizures, and signs of increased intracranial pressure [5]. In the case presented, the patient exhibited intermittent headaches, nausea, vomiting, visual disturbances, and a first epileptic seizure at 19 years of age.

Radiologically, epidermoid cysts exhibit characteristic findings: On MRI, they often appear hypointense to isointense on T1-weighted images, hyperintense on T2-weighted and FLAIR sequences, and demonstrate marked hyperintensity on diffusion-weighted imaging (DWI) due to restricted diffusion [6].

On CT scans, they may show hypoattenuation and peripheral calcifications [7].

In this case, imaging revealed a well-defined, lobulated, heterogeneous lesion measuring 40 × 34 × 30 mm in the left frontotemporal basal region. The lesion was hyperintense on FLAIR and DWI sequences, with marginal calcifications confirmed by CT, and exhibited no pathological vascular enhancement on post-contrast MRI. The lesion showed complex relationships with the left cavernous sinus and major cerebral arteries without signs of infiltration.

Treatment & Prognosis

The definitive management of symptomatic intracranial epidermoid cysts is surgical resection, aiming for complete excision while preserving critical neurovascular structures [8]. Incomplete resection may result in recurrence, with reported rates varying from 0% to 30% depending on the extent of resection [9].

In the present case, due to the lesion's critical location and complex vascular relationships, the patient underwent referral abroad for microsurgical resection with neuronavigation assistance. Histopathological examination surprisingly revealed a sebaceous adenoma, a benign neoplasm, with areas of mature bone tissue suggestive of possible milimetric osteomas. No malignant features were identified.

Postoperatively, the patient remained clinically stable, though a small pneumocephalus was noted on follow-up CT. No additional seizures occurred during recovery, and the patient was discharged one week later in satisfactory condition.

Differential Diagnoses

Given the lesion's imaging characteristics, the differential diagnosis initially included:

- Epidermoid cyst: suggested by DWI hyperintensity and absence of contrast enhancement [6].
- Arachnoid cyst: usually follows CSF signal intensity on all sequences without restricted diffusion [10].
- Schwannoma: typically enhances post-contrast and shows less restricted diffusion [11].
- Cystic glioma: may demonstrate variable enhancement and more surrounding edema [12].
- Dermoid cyst: contains fat, appearing hyperintense on T1 and hypodense on CT, often with associated chemical meningitis if ruptured [13].

Advanced imaging, particularly the restricted diffusion on DWI, strongly favored the diagnosis of an epidermoid cyst preoperatively. However, the final diagnosis of sebaceous adenoma emphasizes the indispensable role of histopathological confirmation.

TEACHING POINT

Epidermoid cysts, though rare, can present with distinctive imaging characteristics, including hyperintensity on diffusion-weighted imaging (DWI) and fluid-attenuated inversion recovery (FLAIR), which help differentiate them from other cystic lesions. Early recognition through advanced imaging techniques is crucial for accurate diagnosis and appropriate surgical management, especially in complex intracranial locations.

QUESTIONS

Question 1: What is the most common clinical presentation of epidermoid cysts?

A. Seizures (applies)
B. Headache
C. Painful swelling
D. Visual disturbances
E. Fever

Explanation: Epidermoid cysts are primarily congenital and grow slowly. They may present significant symptoms, such as seizures, only after many years, as seen in the case presented. This is why seizures are a common clinical manifestation of epidermoid cysts. ["Given that epidermoid cysts are primarily congenital, they often grow very slowly, which is why they may present significant symptoms, such as seizures, only after many years."]

Question 2: Which of the following is a common demographic finding in patients with epidermoid cysts?

A. Typically affects males more than females (applies)
B. Occurs primarily in the elderly
C. Affects individuals under 10 years old
D. Typically affects individuals aged 20-40 years (applies)
E. Affects infants

Explanation: Epidermoid cysts are typically found in patients between the ages of 20 and 40, with a higher likelihood of occurrence in males. However, this finding has not been consistently verified across all studies. ["Patients are usually between the ages of 20 and 40, and the likelihood of their occurrence is reportedly higher in males. However, this finding has not been consistently verified across all studies."]

Question 3: What imaging characteristics are typically seen in epidermoid cysts?

A. Hypointensity on Diffusion weighted imaging\
B. Hyperintensity on Fluid-attenuated inversion recovery and Diffusion weighted imaging (applies)
C. Well-circumscribed, lobular mass with no compressive effects
D. Marginal calcifications (applies)
E. Pathological vascularization post gadolinium

Explanation: Epidermoid cysts typically appear hyperintense on both Fluid-attenuated inversion recovery and Diffusion weighted imaging. In addition, marginal calcifications are commonly seen, as well as a lobular mass. No pathological vascularization is typically observed on post-gadolinium imaging. ["Hyperintense lesion from Flair and DWI, relatively well circumscribed, heterogeneous with lobular shape - expansive intracranial process with temporal and fronto-basal localization on the left..."] and ["Post gadolinium scenes do not present pathological vascularization."]

Question 4: Which of the following is a key recommendation prior to the surgical intervention of an epidermoid cyst located in the intracranial area?

A. MRI with gadolinium
B. CT angiography (applies)
C. Biopsy of the surrounding tissue
D. Pre-surgical radiation therapy
E. MRI without gadolinium

Explanation: Before performing surgery on an epidermoid cyst, particularly one in the intracranial region, it is recommended to conduct an Angiography- CT for evaluation of its relationship with blood vessels, in order to reduce surgical risks. ["P.S.: before the intervention, Angiography-CT is preferred for the evaluation of the relationship with the blood vessels."]

Question 5: What did the biopsy of the lesion in the presented case reveal?

A. Malignant tumor
B. Sebaceous adenoma (applies)
C. Squamous cell carcinoma
D. Osteosarcoma
E. Lymphoma

Explanation: The biopsy of the lesion revealed sebaceous adenoma, which is a benign tumor. There were no signs of malignancy. Two areas of mature bone tissue were identified, suggesting possible presence of osteoma, but no malignancy was observed. ["Diagnosis: Sebaceous adenoma, a benign tumor. There were no signs of malignancy (cancer)."]

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FIGURES

Figure 1: A 19-year old female with epidermoid cyst. FINDINGS: Axial contrast enhanced CT of the brain in the arterial phase demonstrates a hypodense lesion, measuring 15 Hounsfield unit (HU), with rim calcification. TECHNIQUE: Axial CT, 180mA, 130kV, 6 mm slice thickness, 90 ml of Iopromide.

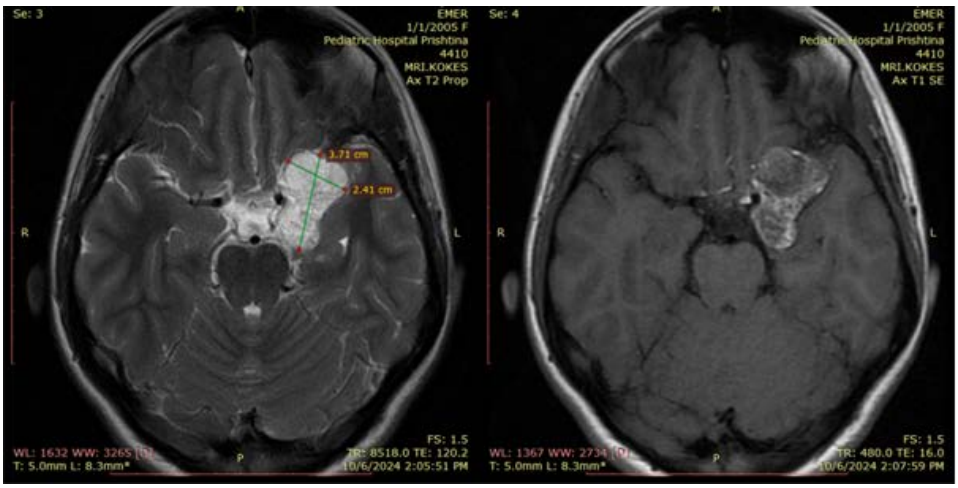

Figure 2: A 19-year old female with epidermoid cyst. FINDINGS: MRI of the brain (pre- and post-contrast) demonstrate a lobulated left frontotemporal basal lesion with hyperintense signal on FLAIR and T2, slight mass effect on the brainstem, and no abnormal contrast enhancement. TECHNIQUE: Axial MRI, TR 480.0, TE 16.0, 5 mm slice thickness, 12ml of Gadopentetate dimeglumine.

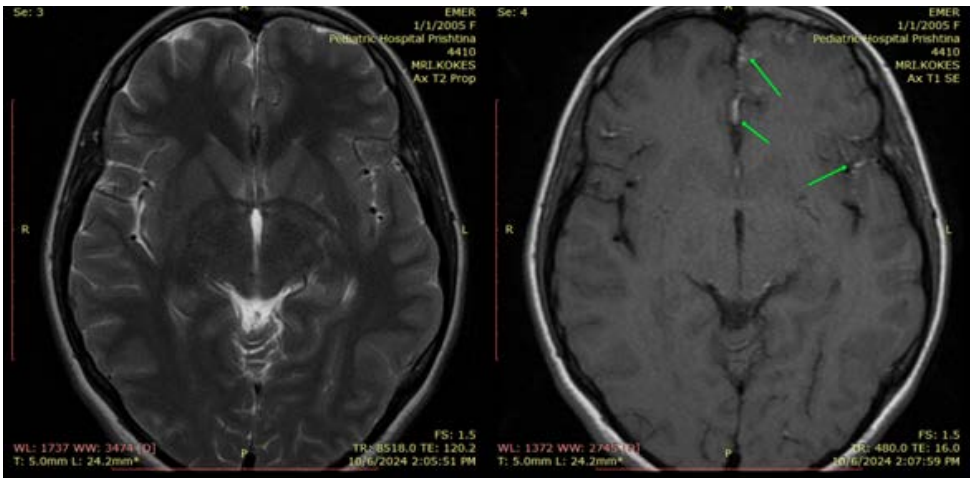

Figure 3: A 19-year old female with epidermoid cyst. FINDINGS: MRI of the brain demonstrates hyperintense signal on T2 sequence in the Sylvian and interhemispheric fissures, and hyperintense signal on T1 within the subarachnoid spaces. TECHNIQUE: Axial MRI, TR 8518.0, TE 120.2, 5 mm slice thickness, 12ml of Gadopentetate dimeglumine.

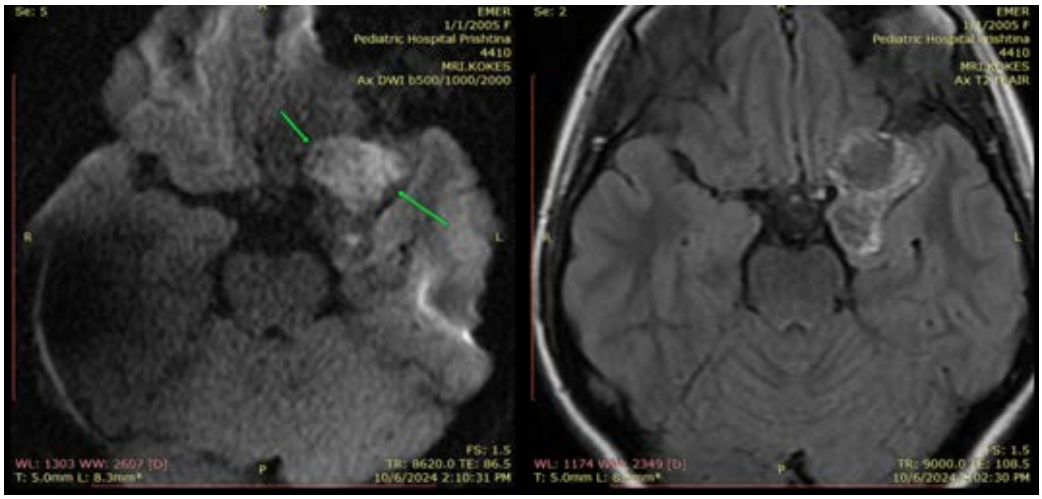

Figure 4: A 19-year-old female with epidermoid cyst. **FINDINGS:** MRI of the brain demonstrates hyperintense signal on DWI sequence consistent with an epidermoid cyst, with marginal hyperintense signal on FLAIR sequence. **TECHNIQUE:** Axial MRI, DWI sequence (TR 9000 ms, TE 108.5 ms), FLAIR sequence, 5 mm slice thickness, following administration of 12 mL of Gadopentetate dimeglumine.

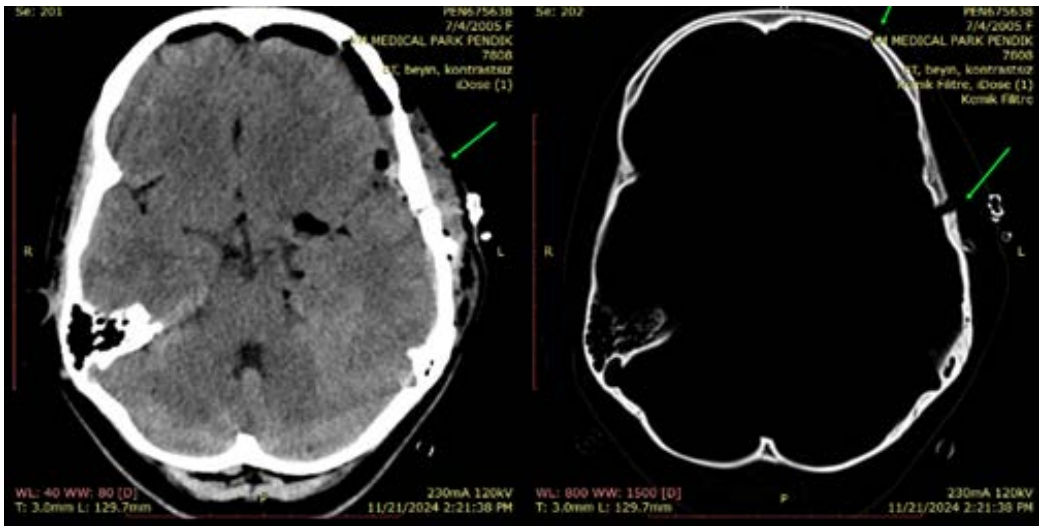

Figure 5: A 19-year old female with epidermoid cyst. FINDINGS: Axial non-enhanced CT of the brain demonstrates postoperative pneumocephalus and craniotomy, TECHNIQUE: Axial CT, 230mA, 120kV, 3 mm slice thickness.

KEYWORDS

Intracranial epidermoid cyst; seizure-inducing lesions; gadolinium-enhanced MRI; cerebral tumor characterization; neurosurgical pathologies

ABBREVIATIONS

MRI = MAGNETIC RESONANCE IMAGING
DWI = DIFFUSION WEIGHTED IMAGING
FLAIR = FLUID-ATTENUATED INVERSION RECOVERY
CT = COMPUTED TOMOGRAPHY
MCA = MIDDLE CEREBRAL ARTERY
ICA = INTERNAL CAROTID ARTERY
HU = HOUNSFIELD UNIT

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