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(CASE REPORT)

Epileptic Seizures Associated with an Arachnoid Cyst in an Unusual Anatomical Location: A Case Report

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Abstract

Introduction: Intracranial arachnoid cysts are developmental malformations of the arachnoid membrane characterized by the presence of cerebrospinal fluid within a cystic cavity lined by arachnoid cells. These lesions are thought to result from abnormal embryological development of the leptomeninges and represent approximately 1% of all intracranial lesions. Although they can occur throughout the cranial cavity, a predilection for the middle cranial fossa has been consistently reported. The widespread use of modern neuroimaging techniques has led to an increased rate of incidental diagnosis, as the majority of arachnoid cysts remain asymptomatic throughout life. Nevertheless, symptomatic lesions may produce a broad spectrum of clinical manifestations related to local compression of adjacent neural structures. Seizures constitute a frequent presenting symptom, reported in up to one-third of symptomatic cases, and may occur in association with focal neurological deficits, neurocognitive impairment, headaches, or features of intracranial hypertension. The relationship between arachnoid cysts and epilepsy remains incompletely understood, particularly in cases involving rare anatomical locations, where diagnosis and management continue to be subjects of ongoing debate.

Case description: We present the case of a 26-year-old male patient with no prior history of cranial trauma, congenital anomalies, developmental disorders, intracranial infections, or neurosurgical procedures, who presented with a one-month history of generalized seizures accompanied by headaches and vomiting. Neurological examination revealed no focal deficits. Neurophysiological assessment suggested a right frontal epileptogenic focus, consistent with imaging findings demonstrating a right frontal arachnoid cyst on CT and MRI. Considering the close radiological and electroclinical correlation, microsurgical cyst fenestration with cyst volume reduction was performed. The postoperative course was marked by a gradual decrease in seizure frequency, followed by complete seizure remission. This observation supports the role of microsurgical decompression as a safe and effective treatment strategy for symptomatic arachnoid cysts associated with epilepsy, offering excellent seizure control and favorable long-term outcomes.

Conclusion: When appropriately indicated, surgical treatment of arachnoid cysts can provide complete seizure remission and favorable postoperative outcomes.

Keywords: Arachnoids Cyst; Epileptic; Exerese; Marsupialization

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1. Introduction

Arachnoid cysts are benign cerebrospinal fluid-containing lesions that arise from the duplication or splitting of the arachnoid membrane. Their content closely resembles, although is not entirely identical to, cerebrospinal fluid (1). First described nearly two centuries ago, arachnoid cysts are developmental malformations that may remain clinically silent throughout life or become symptomatic due to progressive enlargement, mass effect on adjacent neural structures, or, less commonly, intracystic hemorrhage (2). The mechanisms underlying cyst growth remain incompletely understood and continue to be debated in the literature.

These lesions can occur anywhere along the neuraxis and are generally considered non-communicating with the surrounding subarachnoid space. Nevertheless, intraoperative observations have occasionally demonstrated a communication through a valve-like mechanism, suggesting a possible explanation for cyst enlargement in certain cases (3). Histologically, the cyst wall is composed of arachnoid cells and is virtually indistinguishable from normal arachnoid tissue. Although spontaneous regression has been reported, it remains an uncommon phenomenon (4).

The clinical presentation of arachnoid cysts is highly variable and largely depends on their size and anatomical location. Common manifestations include headaches, seizures, focal neurological deficits, and signs of increased intracranial pressure. However, many arachnoid cysts are discovered incidentally during computed tomography (CT) or magnetic resonance imaging (MRI) performed for unrelated reasons. In adults, arachnoid cysts located over the cerebral convexity may present with seizures, headaches, intracranial hypertension, and occasionally remodeling of the overlying calvarium with thinning of the inner table. Symptomatic lesions are commonly managed by microsurgical fenestration or excision of the cyst wall, aiming to establish communication between the cyst cavity and the normal cerebrospinal fluid pathways.

Herein, we report the case of a patient presenting with frontal lobe epilepsy associated with a frontal arachnoid cyst, in whom microsurgical cyst fenestration resulted in complete seizure remission.

2. Case Presentation

2.1. Clinical Presentation

A 26-year-old man presented with a one-month history of generalized epileptic seizures accompanied by progressive headaches and recurrent episodes of vomiting. His past medical history was negative for cranial trauma, congenital abnormalities, developmental disorders, intracranial infections, or previous surgical procedures. On admission, neurological examination was unremarkable, with no focal neurological deficits or signs of impaired higher cortical function.

2.2. Diagnosis Assessment

The patient underwent a CT brain looking for an epileptogenic lesion showing a large right frontal cystic lesion (Fig.1) was completed with a T1 injected (Fig.2a)and T2 (Fig.2b)brain MRI confirming the large cystic lesion right frontal.

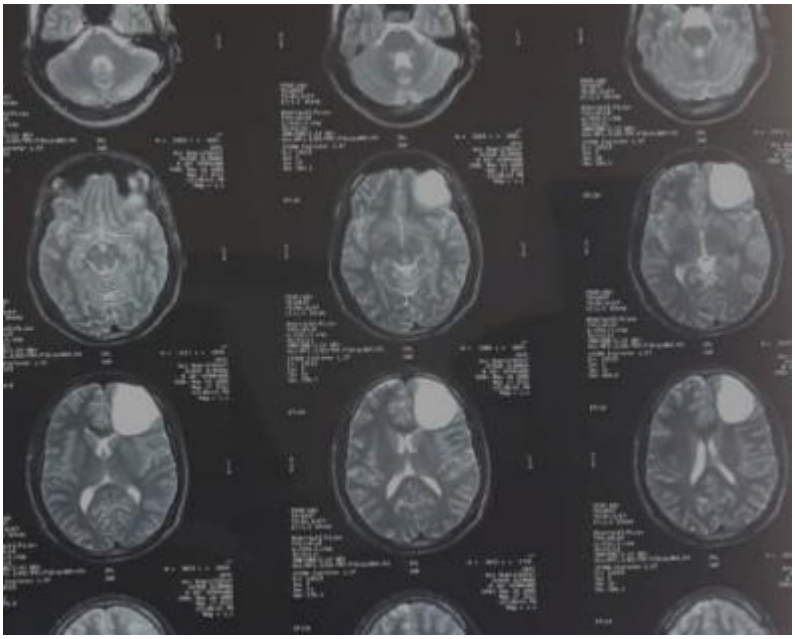

Figure 1a T1- weighted MRI image A large arachnoid cyst deforms the right frontal lobe; outer membrane cysts are faintly visible with overlying bony remodeling. 2b . MRI image T2 The cavity of cysts is the same signal as CSF

2.3. Management

2.3.1. Operative procedures and post-operative course

The patient was positioned supine with the head maintained in a neutral position, slightly elevated and extended, and secured in a Mayfield three-pin head holder. A curvilinear skin incision was planned, extending from the right zygomatic region to approximately 2 cm beyond the midline. A right anterior subfrontal craniotomy measuring approximately 4 × 4 cm was performed, including removal of the orbital rim to optimize surgical exposure. Following dural opening, the operating microscope was introduced into the surgical field (Fig. 3a).

A large arachnoid cyst measuring approximately 6 × 5 cm was identified in the right frontal region. Microsurgical opening of the thick arachnoid cyst wall resulted in the release of clear cerebrospinal fluid under pressure. The mass effect exerted by the cyst had displaced the surrounding neural structures, creating a natural surgical corridor that allowed visualization and access to the deep anatomical landmarks without the need for brain retraction. The cyst wall consisted of a dense, multilayered arachnoid membrane that obstructed normal cerebrospinal fluid circulation toward the frontal cisterns. Careful microsurgical dissection was performed using microsurgical scissors to fenestrate these membranes and progressively access the deeper arachnoid layers. The cyst membrane was subsequently widely opened (Fig. 3b), establishing communication between the cyst cavity and the surrounding subarachnoid spaces. Free cerebrospinal fluid pulsations were observed, confirming adequate restoration of cerebrospinal fluid circulation and successful completion of the fenestration procedure. The postoperative course was uneventful, and the patient recovered without complications.

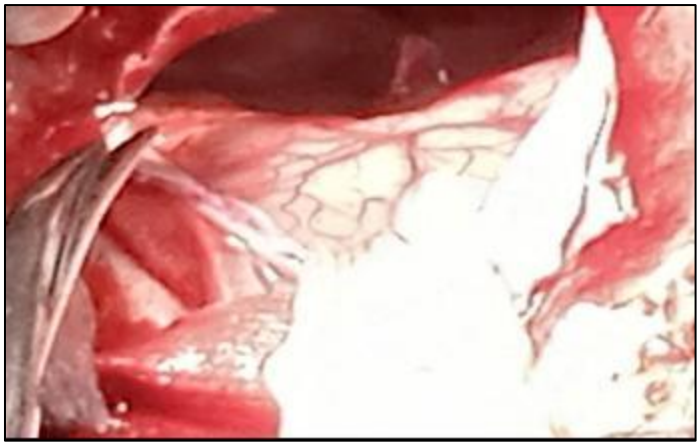

Figure 2a View operative showed open dura mater a large cyst frontal with membrane translucent

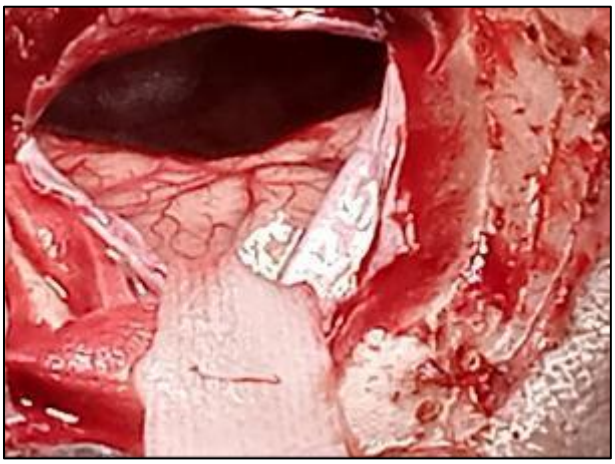

Figure 2.b. View evacuated cysts with marsupialization to subarachnoid space. B. Outcomes

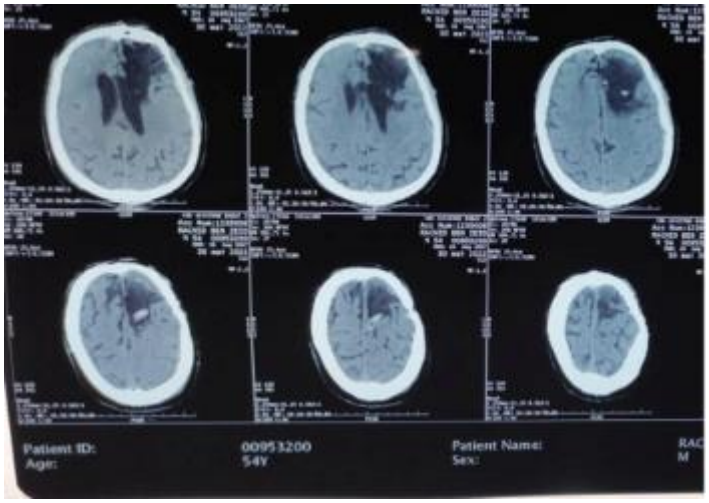

Figure 3 Post-operative CT showed a small cyst in the frontal convexity with reduced size and mass effect

The postoperative course was favorable, and the patient was discharged on the seventh postoperative day under antiepileptic treatment with lamotrigine and valproic acid. Seizures completely resolved within three weeks after surgery, and sustained seizure freedom was maintained during follow-up. At 18 months postoperatively, the patient

remains on a low-dose regimen of lamotrigine. Follow-up cranial CT imaging (Fig. 4) revealed marked reduction of the cyst volume, with near-complete collapse of the lesion and complete resolution of the associated mass effect on the surrounding cerebral parenchyma.

3. Discussion

In the present report, we describe a rare case of a frontal arachnoid cyst presenting with epilepsy and successfully managed through microsurgical fenestration. The patient presented with generalized seizures associated with headaches and vomiting, and experienced complete seizure remission following surgical treatment.

Arachnoid cysts are developmental lesions whose natural history remains incompletely understood. While the mechanisms underlying cyst enlargement continue to be debated, several hypotheses have been proposed, including active fluid secretion by the cyst wall, osmotic gradients, and valve-like communication with the subarachnoid space. Histologically, the cyst wall is virtually indistinguishable from normal arachnoid membrane, supporting the developmental nature of these lesions. The majority of arachnoid cysts remain asymptomatic throughout life and are frequently discovered incidentally during neuroimaging investigations. When symptoms occur, they are generally related to the mass effect exerted on adjacent neural structures, cranial bones, or cerebrospinal fluid pathways. Consequently, the clinical presentation varies considerably according to the size and anatomical location of the lesion.

The differential diagnosis includes other intracranial cystic lesions involving the cerebral convexity and leptomeninges. In particular, cystic fluid collections developing within the arachnoid layers secondary to intracranial hemorrhage or meningitis should be distinguished from glioependymal cysts, infectious cystic lesions, and cystic neoplasms (5,6). The etiology of arachnoid cysts remains controversial and has been attributed to congenital malformations, traumatic events, inflammatory processes, or disturbances in cerebrospinal fluid dynamics.

The relationship between intracranial arachnoid cysts and epilepsy remains a subject of ongoing debate. Although seizures represent one of the most common manifestations of symptomatic arachnoid cysts, establishing a causal relationship between the lesion and the epileptogenic focus is often challenging. Several authors have emphasized the importance of correlating electroencephalographic findings with neuroimaging features before attributing epileptic manifestations to the cyst itself (7). Evidence regarding the efficacy of surgical treatment for seizure control remains limited, largely owing to the rarity of the condition and the small number of reported cases. Nevertheless, available studies suggest that surgical decompression may result in significant improvement or complete resolution of seizures in carefully selected patients, particularly when a clear electroclinical-radiological correlation is demonstrated (8).

Furthermore, Helland and colleagues reviewed the available literature to investigate whether postoperative seizure outcomes were associated with cyst volume reduction following surgical decompression. Their analysis included only cases in which both preoperative and postoperative cyst dimensions and seizure outcomes were reported, highlighting the potential relationship between effective cyst decompression and favorable seizure control (9). In our patient, complete seizure freedom was achieved after microsurgical fenestration and was accompanied by a marked reduction in cyst volume on follow-up imaging, further supporting the hypothesis that the cyst played a direct role in the epileptogenic process.

4. Conclusion

Intracranial arachnoid cysts should be considered a potential cause of epilepsy when a clear anatomical and electroclinical correlation exists. Comprehensive preoperative evaluation, including electroencephalography, video-EEG monitoring, and high-resolution magnetic resonance imaging, is essential to accurately identify the epileptogenic focus. In patients whose seizure focus corresponds to the location of the arachnoid cyst, surgical treatment—whether through microsurgical fenestration, endoscopic fenestration, or cyst shunting—should be considered as a safe and effective therapeutic option, with the potential to achieve long-term seizure freedom and favorable neurological outcomes.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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