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CASE REPORT

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Cystic meningiomas: A complex diagnostic challenge and clinicopathological insights from a unique case presentation

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Key Clinical Message

Meningiomas present diverse clinical and radiological characteristics, with cystic formations constituting a lesser subset but posing significant diagnostic hurdles. We explore the complexities of cystic meningiomas through a distinctive case, highlighting the challenges in diagnosis and management due to their variable presentations. A 54-year-old female from Bengaluru, Karnataka, initially presented with transient memory disturbances. Brain MRI revealed a sizable left frontal cystic lesion exerting a mass effect and midline shift. However, rapid neurological decline led to an urgent surgical intervention via decompressive craniectomy unveiling unique intraoperative findings and with subsequent histopathological documentation of a Grade WHO 1 cystic meningioma. Cystic meningiomas present intricate diagnostic challenges resembling other intracranial lesions. Various classification systems attempt to categorize these tumors based on their imaging and histopathological characteristics. Despite this, atypical clinical manifestations often lead to misdiagnoses, necessitating a comprehensive approach to differential diagnosis. Further research is crucial to unravel the mechanisms underlying these tumors' cystic changes for improved diagnostic accuracy and tailored therapeutic interventions.

KEYWORDS

cystic meningioma, diagnostic challenges, histopathological diagnosis, intracranial tumors, neurological deterioration, surgical intervention

1 | INTRODUCTION

Meningiomas, the most prevalent intracranial tumors, exhibit a diverse array of clinical manifestations and radiological characteristics.[1–3] Their occurrence is notably higher in females, with a ratio of 2.3 to 1 compared to males. Among meningiomas, cystic formations represent a smaller subset, accounting for approximately 1.6% to 10% of all cases. The presence of a cyst within the tumor can often create diagnostic challenges, resembling other neoplastic lesions.[4–6]

In this context, we present a distinctive case displaying atypical clinical and radiological features, mimicking characteristics typically associated with abscesses or

high-grade gliomas. Such presentations underscore the complexity involved in diagnosing cystic meningiomas and the potential for misinterpretation due to their varied radiological appearances.

2 | CASE PRESENTATION

2.1 | History and initial presentation

A 54-year-old female from Bengaluru, Karnataka, presented with a recent history of transient memory disturbances (short-term memory loss) and apathy occurring intermittently over the past 15 days. These episodes lasted from 45 s to 2 min each and were not accompanied by any history of trauma, radiation exposure, or positive family neurological conditions. Notably, she did not report experiencing headaches, vomiting, loss of consciousness, or dizziness. Initially suspected to be related to neurodegenerative disorders (e.g., fronto-temporal dementia), she was admitted under the care of neurology. At the time of admission, her neurological examination did not reveal any remarkable findings.

2.2 | Neurological deterioration and imaging findings

However, following a brain MRI, her sensorium rapidly declined, rendering her unresponsive to verbal commands and painful stimuli. Both pupils were dilated and nonreactive to light. The MRI results indicated a sizable cystic lesion (measuring 64 × 54 × 41 mm) with a solid component displaying mixed signal intensity, predominantly located in the left inferior frontal lobe. This lesion was observed to be exerting pressure on the left lateral ventricle (Figure 1). The patient was administered intravenous dexamethasone at a dosage of 4 mg three times per day.

2.3 | Progressive clinical deterioration and surgical intervention

As her neurological condition continued to deteriorate, her Glasgow Coma Scale (GCS) score dropped to E1V1M3, and her pupils further dilated to 4 mm with no response to light stimulation. Due to her worsening condition,

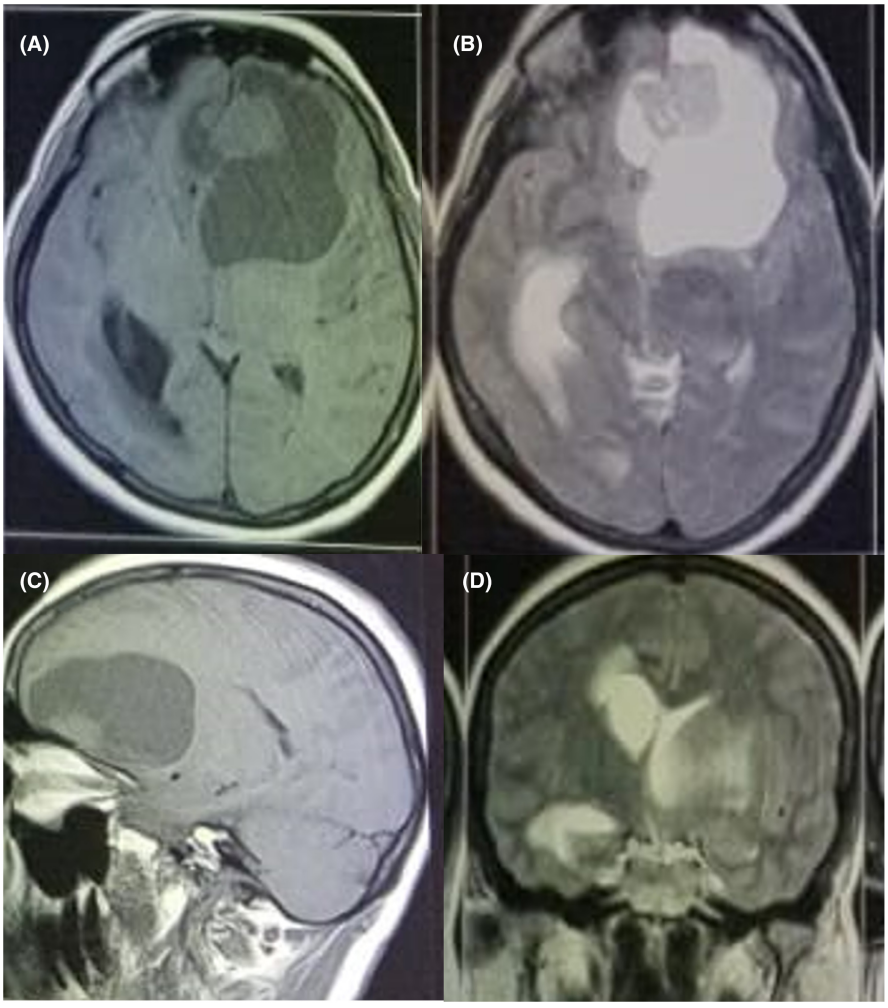

FIGURE 1 MRI brain images displaying axial (A, B), sagittal (C), and coronal (D) views revealing a cystic lesion with a solid component exhibiting mixed signal intensity. The lesion is primarily situated in the left inferior frontal region and is exerting pressure on the left lateral ventricle.

the contrast study was postponed, and she was urgently taken to the operating theater for a decompressive craniectomy. Surgical access to the tumor was achieved through the middle frontal gyrus following corticectomy. Upon exploration, the cystic component was found to contain xanthochromatic fluid, which was carefully extracted (approximately 20 mL). The solid component of the tumor appeared firm, vascular, grayish, encapsulated, and was adherent to the underlying falx (dura), which necessitated excision.

2.4 | Postoperative recovery and histopathological diagnosis

Postoperatively, she required mechanical ventilation for a day before gradually being weaned off and extubated. With time, her neurological status showed improvement, and she was transferred to the ward within a day, and postoperative CT scan was performed to evaluate the extent of tumor's resection (Figure 2). Histopathological examination of the excised specimen revealed characteristic meningoepithelial cells exhibiting a plump appearance arranged in a storiform growth pattern. Focal observations included whorl formations and the presence of psammoma bodies. Notably, the cystic component did not show any signs of atypical cellular activity. The final histopathological diagnosis confirmed a Grade 1 cystic meningioma (Figure 3).

3 | DISCUSSION

Cystic meningiomas, while a subtype of meningiomas, pose unique diagnostic challenges due to their atypical presentation. They demand careful consideration to avoid misdiagnosis and ensure appropriate treatment. Although meningiomas are more commonly found in females, the occurrence of the cystic type is more prevalent in males and children, presenting an intriguing aspect of gender-based variation in manifestation.[7–11]

Our patient's case epitomized the complexity associated with cystic meningiomas. Her rapid neurological deterioration and worsening clinical state within minutes warranted immediate attention. Radiologically, the large lesion observed on imaging exhibited characteristics that mimicked a spectrum of intracranial lesions, including colloid cysts, gliomas, metastatic tumors, and other glial lesions. The urgency of her deteriorating condition, accompanied by decerebrate posturing, necessitated prompt

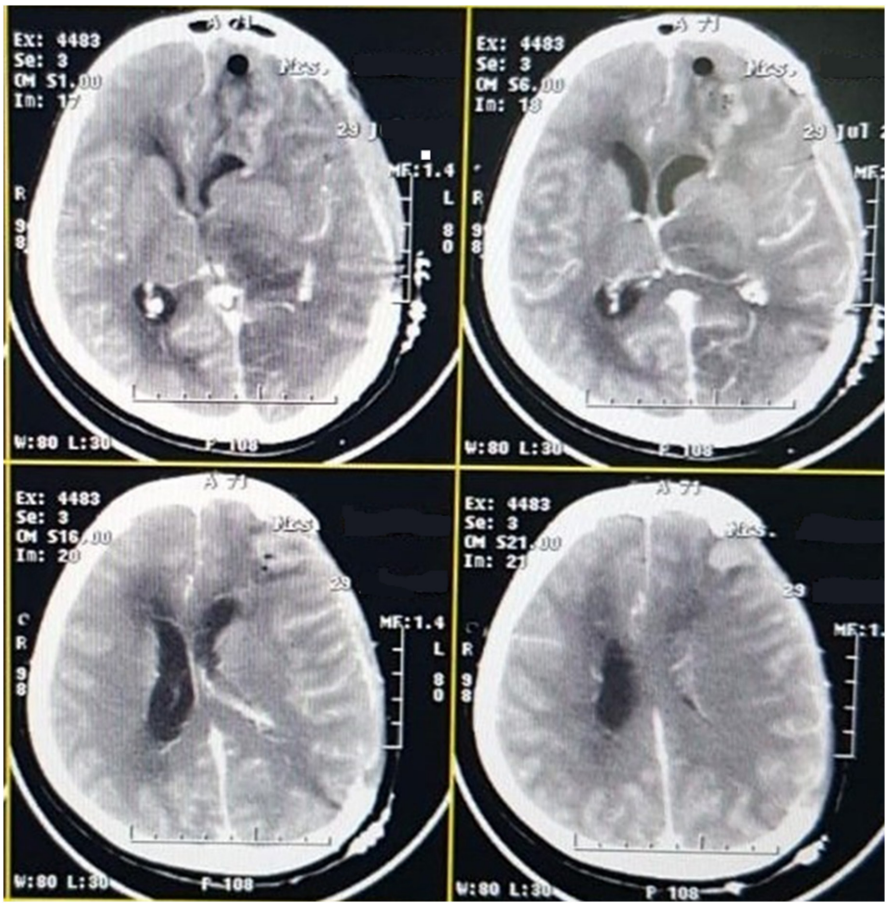

FIGURE 2 Postoperative brain CT scan showing the successful removal of the tumor.

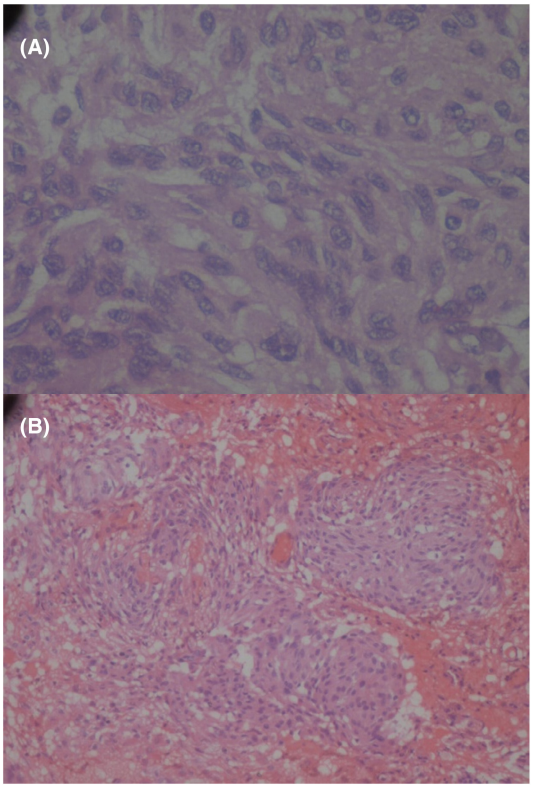

FIGURE 3 Histopathology images (A, B) exhibiting meningothelial cells characterized as plump, spindled cells arranged in intersecting fascicles and a storiform growth pattern. The nuclei are round to oval with prominent nucleoli, along with moderate to abundant eosinophilic cytoplasm forming a syncytium in some areas. Focal presence of whorl formation and psammoma bodies is noted, alongside areas of hemorrhage and fibrinous material. Additionally, thick-walled blood vessels are observed. These features support the diagnosis of meningothelial meningioma WHO I with cystic changes.

intervention, leading to the decision for decompressive craniectomy. Notably, intraoperative findings, particularly the adherence of the lesion to the underlying dura, provided crucial hints toward the ultimate diagnosis of meningioma.

Classification systems designed for cystic meningiomas offer valuable insights into their varied presentations. Nauta's classification system (Nauta et al. 1979) categorizes these tumors based on cyst location, tumor attachment, and imaging characteristics. The system delineates four types, ranging from intratumoral cysts encompassed by the tumor mass to loculated cerebrospinal fluid (CSF) in the subarachnoid space adjacent to the brain, illustrating the diversity of cystic presentations within meningiomas. Another classification system proposed by Wasenko et al. in 1987 further delineates cystic meningiomas based on cyst location and composition. This system emphasizes variations in cyst position within the tumor, eccentricity, peritumoral cyst characteristics, and their relationships with the brain parenchyma or the tumor mass.

Additionally, Zee's classification system (Zee et al. 1995) outlines distinct types of cystic meningiomas based on characteristics observed on MRI imaging. This system highlights features such as intratumoral cysts with necrotic areas, peritumoral cysts with enhancing walls on contrast-enhanced MRI, and nonenhancing peritumoral cysts composed of gliotic tissue in contact with adjacent brain tissue.

In accordance with Nauta's classification, our case of cystic meningioma aligns with Type II, denoted by the presence of a peripheral intratumoral cyst accompanied by an enhancing cyst wall. This subtype holds significance due to its distinct radiological attributes, specifically the identification of a cystic component and the enhancement observed in the cyst wall. Recognizing and characterizing such features are pivotal for precise diagnosis and informed therapeutic interventions. This classification system aids in not only categorizing meningiomas but also refining our understanding of their varied presentations, contributing to advancements in tailored treatment approaches.

It is noteworthy that approximately 30.4% of meningiomas infiltrate the dura mater, further complicating their clinical presentation.[12,13] Cystic meningiomas accompanied by peritumoral edema are considered atypical and unusual, posing diagnostic challenges due to their variable and often unpredictable radiological appearances. The prognosis and therapeutic management of cystic meningiomas depend on various factors, including histological type, location, age, and associated comorbidities. A key recommendation for preventing and minimizing the risk of recurrence is the complete excision of the cyst along with its wall. The management approach is influenced by factors such as histologic subtype, tumor location, symptomatic presentation, and concurrent health conditions.

For small, asymptomatic cystic meningiomas, a watchful waiting strategy involving periodic imaging studies to assess for growth may be appropriate. Surgical resection is typically reserved for large and/or symptomatic cystic meningiomas, with generally low recurrence rates. It is important to note that atypical and higher-grade cystic meningiomas may exhibit an elevated recurrence risk, underscoring the importance of diligent postoperative monitoring.

While total cyst excision remains a fundamental strategy for minimizing recurrence in cystic meningiomas, the overall prognosis and management approach are intricately linked to the specific characteristics of these tumors. Tailored considerations, including histology, location,

symptoms, and the potential for recurrence, should guide the therapeutic decision-making process.

In summary, the case of cystic meningioma in our patient highlights the intricate nature of these tumors, necessitating a nuanced approach to diagnosis and classification, considering the diverse radiological and pathological features they present.

4 | CONCLUSION

The recognition and understanding of the diverse manifestations of meningiomas, particularly cystic variants, are crucial to differentiate them accurately from other intracranial lesions. These tumors pose a diagnostic challenge due to their varied presentations, necessitating a careful approach to avoid misinterpretation. Despite several proposed hypotheses regarding the development of cystic components within meningiomas, scientific evidence supporting these theories remains inconclusive. Speculations about fluid secretion by tumor cells or degenerative changes within the tumor underscore the complexity of these lesions, highlighting the need for further research to elucidate their underlying pathogenesis. Cases of large cystic meningiomas often present with atypical clinical features, leading to potential misdiagnoses such as abscesses or glioblastoma multiforme due to their mimicking radiological appearances. Therefore, it is crucial to include cystic meningiomas in the differential diagnosis of intracranial lesions, especially when confronted with unusual clinical scenarios. In conclusion, identifying cystic meningiomas demands vigilance, as their variable characteristics can mimic other pathologies. Continued research efforts aimed at unraveling the mechanisms underlying these tumors' cystic changes will not only improve diagnostic accuracy but also enhance therapeutic strategies and prognostic outcomes for affected patients.

AUTHOR CONTRIBUTIONS

Deepa Singh: Conceptualization; data curation; investigation; resources; software; writing – original draft. **Gianluca Scalia:** Supervision; validation; visualization; writing – original draft; writing – review and editing. **Veeresh U. Mathand:** Conceptualization; data curation; formal analysis; investigation; resources; software; writing – original draft. **Bipin Chaurasia:** Supervision; validation; visualization; writing – review and editing.

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ETHICS STATEMENT

This case report was compiled after obtaining informed consent from the patient for the disclosure of clinical history and management with the intention of publication. All attached imaging and clinical materials were de-identified to ensure patient anonymity.

CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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