CASE STUDY

Cystic Meningioma: Case Series and Review of Literature

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Abstract

Background: Cystic meningiomas, a rare subtype accounting for only 2–4% of all meningiomas, present significant diagnostic challenges due to their atypical cystic features. These tumors, which originate from arachnoid cap cells of the meninges, are typically solid in nature. However, in some cases, cyst formation may occur, potentially as a result of microcystic degeneration, intratumoral hemorrhage, or necrosis. On neuroimaging, cystic meningiomas may resemble other cystic intracranial lesions, such as a brain abscesses, cystic astrocytoma, or parasitic cysts, thus complicating accurate diagnosis and treatment planning. **Case Reports:** We describe four cases of cystic meningioma. Case 1 is a 62-year-old female who presented with a sudden attack of seizure. Case 2 is a 50-year-old female who presented with a 3-month history of progressive left lower limb weakness. Case 3 is a 49-year-old female who presented with intermittent headaches and blurred vision. Case 4 is a 40-year-old female presented after an episode of seizure. **Conclusion:** Cystic meningiomas are rare, benign tumors. Successful treatment with total surgical removal leads to excellent outcomes, with no recurrence. Effective management requires advanced imaging, careful surgery, and long-term follow-up.

Key words: Case series, cystic, cystic meningioma, meningioma

INTRODUCTION

Meningiomas, which make up 13–15% of all brain tumors, are the most prevalent primary intracranial neoplasms.[1] They are derived from the dural-based arachnoidal cap cells and usually manifest as solid, well-circumscribed, highly cellular, and well-vascularized masses. On neuroimaging, most meningiomas seem homogenous and solid, although a small percentage show unusual characteristics, including the existence of cystic components.[2]

Cystic meningiomas are relatively uncommon, especially in adults,[3] estimated to comprise only 2–4% of all types of meningiomas.[4] The pathogenesis of cystic change in meningiomas is not fully understood, but several hypotheses have been proposed. One theory suggests that the cysts may arise from microcystic degeneration of the tumor, potentially due to vascular compromise or secretory dysfunction of the neoplastic cells.[4] Alternatively, the cysts may result from intratumoral hemorrhage or necrosis, leading to the accumulation of fluid within the tumor. These atypical features can pose significant diagnostic challenges,[2] as cystic meningiomas can mimic other cystic intracranial lesions such as arachnoid cysts, cystic astrocytoma, and parasitic cysts.

Radiologically, cystic meningiomas can present with a wide spectrum of appearances, ranging from small, well-defined cystic components within a predominantly solid tumor to large, multiloculated cystic masses with only a small mural

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nodule. Careful evaluation of the tumor's characteristics, including the presence and distribution of cystic change, solid components, and patterns of contrast enhancement, is crucial for accurate diagnosis and surgical planning.

CASE 1

Case presentation

A 62-year-old female is not known to have any medical illnesses. She was in her usual state of health up until 3 days before her admission to the hospital, where she had a sudden attack of seizure, generalized tonic clonic in nature that resolved after 3 min, was associated with urinary incontinence and eye rolling upwards, followed by loss of consciousness for 15 min, and on waking up, had a headache and was confused. On examination she was conscious, oriented, Glasgow coma scale (GCS) was 15, pupils equal and reactive bilaterally with no motor and sensory deficit. Computed tomography (CT) and magnetic resonance imaging (MRI) brain showed a left frontal paramedian dural-based lesion inseparable from the anterior part of the superior sagittal sinus [Figure 1].

Surgical operation notes

Patient was taken to the operative suite and through a bicoronal incision and left frontal craniotomy, and the tumor was totally excised.

Outcome

The procedure was uneventful with no complications. Post-operative brain CT scan showed no residual tumor. Postoperatively, the patient showed full recovery with no neurological deficit, she was discharged home on anti-epileptic medications and tapering dose of dexamethasone, follow-up appointment to the outpatient department (OPD) after 1 month was given.

Follow-up visits

A 3-month follow-up in the outpatient clinic, the patient was doing well with no neurological deficit.

Histopathology report

Grade 1 cystic meningioma.

CASE 2

Case presentation

A 50-year-old female with a body mass index (BMI) of 29 presented to National Guard Hospital in Jeddah with left lower limb weakness for 3 months, which started as a foot drop but then progressed gradually to complete paralysis (0/5 power). There was no decrease in sensation anywhere else in the body. No upper limb weakness and no loss of anal sphincter control were noted.

On examination, the patient appeared alert and well with a GCS score of 15/15. The full neurological examination was unremarkable except for the left lower limb complete loss of power (0/5).

Cranial CT was done 17 days before the surgery and showed a right frontal paracentral complex cystic mass and solid component. The size of the mass was 4.8 × 4 cm, which is larger compared to a previous CT (4.5 × 3.7) cm. There was a focal mass effect caused by the paracentral mass. There was no peri-lesional edema identified, acute hydrocephalus, herniation, acute hemorrhage, major territorial infarction, or any other lesions identified [Figure 2].

Histopathology report

Histopathological examination showed a neoplastic growth arranged in papillary, and solid sheet architecture, with foci with whorls formation in a highly vascularized stroma. The tumor cells are oval to large nuclei with prominent nucleoli and pseudo inclusions and eosinophilic cytoplasm. These histopathological features are consistent with a typical meningioma (Grade II cystic meningioma).

Outcome and follow-up

MRI was done 9 months post-operation and showed no evidence of residual or recurrent mass. The overall impression was stable post-operative changes.

CASE 3

Case presentation

The patient, a 49-year-old female with a BMI of 42.17 and a known history of hypertension, presented to the clinic with a 2-month history of intermittent headaches and blurred vision. On neurological examination, the patient displayed full consciousness, alertness, and orientation. The GCS revealed a score of 15/15, bilateral reactive pupils, normal muscle strength of 5/5 in all extremities, and intact sensation. Ophthalmological evaluation indicated restricted hand motion to each eye, intact extraocular muscle function aside from a slight ±0.5–1 limitation in abduction, equal, round, and sluggishly reactive pupils. Dilated fundus examination detected hyperemia of the optic nerve with blurred margins, absence of cupping, and a small disc without hemorrhage. Bilateral optic nerve swelling was noted, with the right eye exhibiting more pronounced

Table 1: This table compares our four cases based on age, radiological findings, final outcomes, and other key information

Gender	Age	Radiological finding	Size (cm)	Clinical presentation	Management	Surgical approach	Outcome/ resection/ aspiration	Histopathology	Nauta clasification
Female	62-year-old	Left frontal paramedian dural based lesion inseparable from the anterior part of superior sagittal sinus	N/A	Seizure, urinary incontinence, eye uprolling, loss of consciousness for 15 min	Gross total resection	Bicoronal incision and left frontal craniotomy	Uneventful	Grade 1 Cystic Meningioma	Type 3 nauta classification
Female	50-year-old	Right frontal paracentral complex cystic mass and solid component	4.8 × 4 cm	Foot drop but then progressed gradually to complete paralysis (0/5 power)	Gross total resection	Right parietal craniotomy	Uneventful	Grade 2 cystic meningioma	Type 1 nauta classification
Female	49-year-old	Meningeal-based lesion in the right lateral frontal convexity, radiologically suggestive of atypical meningioma	8 × 7 × 5 cm	Two-month history of intermittent headaches and blurred vision	Gross total resection	Right frontal craniotomy with a dural-based tumor excision	Uneventful	Grade 1 cystic meningioma	Type 1 nauta classification
Female	40-year-old	Left frontal dural-based cystic lesion suggestive of cystic meningioma	N/A	Seizure and mild weakness on the right side with a power of 4/5	Gross total resection	Left frontal craniotomy	Uneventful	Grade 1 cystic meningioma	Type 1 nauta classification

Table 2: Comparison Table: The table describes eleven cases of cystic meningiomas (45–80 years, six males, five females) with different variables, managed mostly by gross total resection. Outcomes were generally uneventful, and all were WHO Grade I tumors

Gender	Age	Radiological finding	Size (cm)	Clinical presentation	Management	Surgical approach	Outcome/ Resection/ Aspiration	Histopathology	Nauta classification
F	61-year-old	Right parietal lobe mass with cystic component	7.3 × 5.2 × 6.6	Headache and left lower limb weakness	Embolization of a meningioma	Endovascular embolization	Subarachnoid hemorrhage	Typical benign fibroblastic meningioma with a necrotic center	N/A
M	45-year-old	Left lateral ventricle mass with cystic component, dilated temporal horns (left more than right)	N/A	Global headache, progressively increasing loss of memory, and frequent episodes of abnormal behavior	Gross total resection	Anterior transcallosal approach	Uneventful	Meningothelial meningioma without any atypia	Nauta type 2
M	58-year-old	Left-sided tentorial cystic mass projecting into the cerebellum and CPA, edema and midline shift	5.6 × 4.1 × 3.4	Headache, repeated episodes of vomiting, increasing unsteadiness of gait, and left-sided cerebellar dysmetria with dysdiadochokinesia	Gross total resection	Left retromastoid craniectomy	Uneventful	Angiomatous meningioma with predominant microvascular component and extensive cystic changes	Nauta type 2
M	80-year-old	Left-sided parieto-occipital cystic mass, edema, compression of the adjacent lateral ventricle	6.6 × 5.1 × 65	Recurrent focal motor seizures, secondary generalization, persistent pancephalic headache, grade 4 right-sided pyramidal weakness, grade 4 right-sided pyramidal weakness, exaggerated deep tendon reflexes and an extensor plantar reflex and mild right-sided sensory neglect.	Gross total resection	N/A	Uneventful	Benign WHO Grade I fibroblastic meningioma	Nauta type 4

(*Contd...*)

Table 2: (Continued)

Gender	Age	Radiological finding	Size (cm)	Clinical presentation	Management	Surgical approach	Outcome/ Resection/ Aspiration	Histopathology	Nauta classification
F	48-year-old	Left frontoparietal region mass with cystic component with edema	N/A	Convulsions	Gross total resection	Left frontal craniotomy	Excellent	Microcystic meningioma, WHO grade I.	N/A
F	68-year-old	Right occipital lobe intracranial mass with cystic component	5 × 4 × 4	Headache and dizziness	Gamma Knife surgery (GKS), total excision	Craniotomy	Delayed cyst formation after GKS	Meningioma cells with obvious collagenous fiber formation and calcification with angiomatous lesion	N/A
F	64-year-old	Left temporal lobe mass with cystic component with edema	4 × 2.3 × 2.5	Dizziness, ear fullness and mild cerebellar ataxia	Gross total resection	Temporal surgical approach	Uneventful	Microcystic meningioma, WHO grade I.	N/A
M	70-year-old	Left cerebellopontine angle mass with cystic component	N/A	Progressive headache and gait disturbance	Gross total resection	N/A	Uneventful	Meningothelial meningioma (WHO grade I)	N/A
F	50-year-old	Left frontal-parietal mass, ring enhanced with cystic component with edema	N/A	Headache	Gross total resection	Left frontal-parietal craniotomy	N/A	Benign WHO Grade I fibroblastic meningioma	N/A
M	56-year-old	Left-sided parieto-occipital cystic mass with left lateral ventricle extension with midline shift	10.5 × 6.2 × 6.1	Blunt headache, weakness of the right lower limb, defect of the right visual field	Total microsurgical resection	Transcortical (trans temporoparietal occipital) approach	Uneventful	Benign WHO Grade I fibroblastic meningioma filled with mesenchymal elements, including gelatinous fiber, osseous and myxoid tissue	Nauta type 2

(*Contd...*)

Table 2: (Continued)

Gender	Age	Radiological finding	Size (cm)	Clinical presentation	Management	Surgical approach	Outcome/ Resection/ Aspiration	Histopathology	Nauta classification
M	61-year-old	Left frontal lobe mass with cystic component, edema, and midline shift	5.9 × 6.4	Right limb weakness and unstable standing and inability to walk independently	Gross total resection	Invasive transcranial lesion resection	N/A	Meningeal skin cells grow around blood vessels, with varying thickness of blood vessel walls accompanied by hyaline degeneration	N/A

WHO: World Health Organization, CPA: Cerebellopontine angle

Figure 1: Case 1: (a) Magnetic resonance imaging (MRI) brain with gadolinium, sagittal view showing left frontal paramedian dural-based cystic meningioma Type 3 Nauta classification (b) MRI brain with gadolinium, axial view showing left frontal paramedian dural-based cystic meningioma. (c) MRI brain with gadolinium, coronal view showing left frontal paramedian dural based cystic meningioma and (d) Post-operative brain computed tomography scan showed no residual tumor

edema than the left. Brain MRI identified a meningeal-based lesion in the right lateral frontal convexity, radiologically suggestive of atypical meningioma. The patient was electively admitted for a cerebral angiogram and coiling, which proceeded without complications. Subsequently, the patient underwent craniotomy for excision of the right frontal convexity meningioma. Following the procedure, the patient was discharged after 2 days with a prescription regimen comprising dexamethasone, metoprolol succinate, senna, omeprazole, prophylactic enoxaparin, and scheduled follow-up at the OPD [Figure 3].

Surgical operation notes

A series of surgical procedures was undertaken, commencing with the application of multiple burr holes, including a keyhole aperture. Subsequently, a craniotomy was performed to elevate the bone flap. Following this, extensive irrigation and meticulous hemostasis of the dura mater were carried out. The circumferential dissection of the dura mater was extended deeply, reaching down to the skull base at the lateral edge of the lateral sphenoid wing. Circumferential devascularization of the tumor was accomplished using bipolar electrocautery. Portions of the dura mater were found to be disrupted at the skull base, with the tumor extending throughout the dural layers. An infiltration of the dura mater was noted at the base. Finally, the tumor was separated from its dural attachment and totally excised.

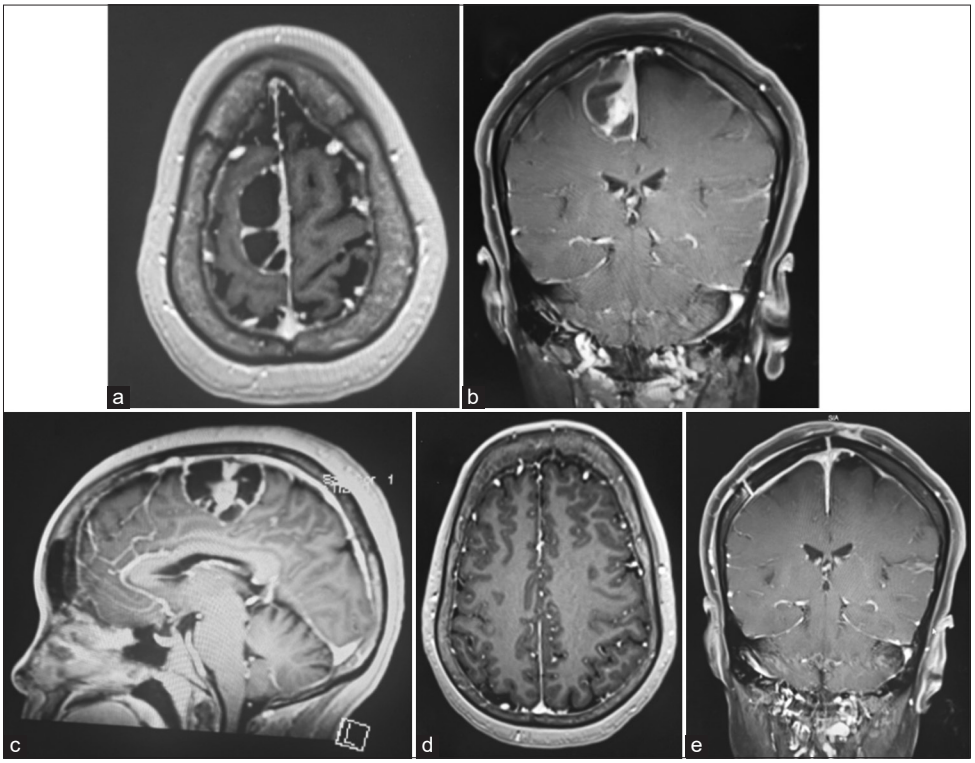

Figure 2: Case 2: (a) Axial, (b) coronal, and (c) sagittal show that there is an irregular, lobulated mass with varying signal intensity located in the right posterior frontal parasagittal region. This mass has both cystic and solid areas, with fluid-fluid levels and a nodular outer wall that enhances with contrast. The enhancing nodular part shows restricted diffusion along with increased blood flow and volume. The dimensions of the lesion are 2.27 × 4.02 × 3.36 cm (anterior-posterior, transverse, and craniocaudal). Most of the mass appears to be extra-axial in location. (d) Axial and (e) Coronal both are post-operative and show complete resection of the lesion

Outcome

No complications during or after the operation; immediate post-operative examination; the patient was conscious, vitally stable, ambulated, and returned to baseline function before the operation.

Follow-up visits

At 2 days post-operation in OPD appointment, vision was improved to counting fingers bilaterally; at 6 months later, the vision improved. Three years post-operation, no evidence of tumor recurrence with persistent vision improvement.

Histopathology report

Right sided frontal convexity meningioma. It consists of single rounded piece of gray-tan, soft tissue, 8 × 7 × 5 cm. Cut section shows cream-colored, smooth, and shiny surface, all submitted in 58 blocks, final diagnosis was cystic meningioma World Health Organization (WHO) Grade 1.

Technique

Multiplanar and multisequential MRI of the brain pre- and post-contrast administration performed.

Impression

This radiological appearance is suggestive of atypical cystic meningioma.

CASE 4

Case presentation

A 40-year-old female presented to the emergency department in a postictal state following an attack of seizure which was treated with anti-epileptic medications. The patient had no significant past medical or surgical history. On admission, she was vitally stable, complaining of a mild headache. On examination, she had mild weakness on the right side with a power of 4/5. She was admitted for investigation. MRI was done, which showed a left frontal dural-based cystic lesion suggestive of cystic meningioma [Figure 4].

Surgical operation notes

The patient was planned for surgery. A left frontal craniotomy was performed with gross total excision of the lesion. The operation was uneventful with no complications.

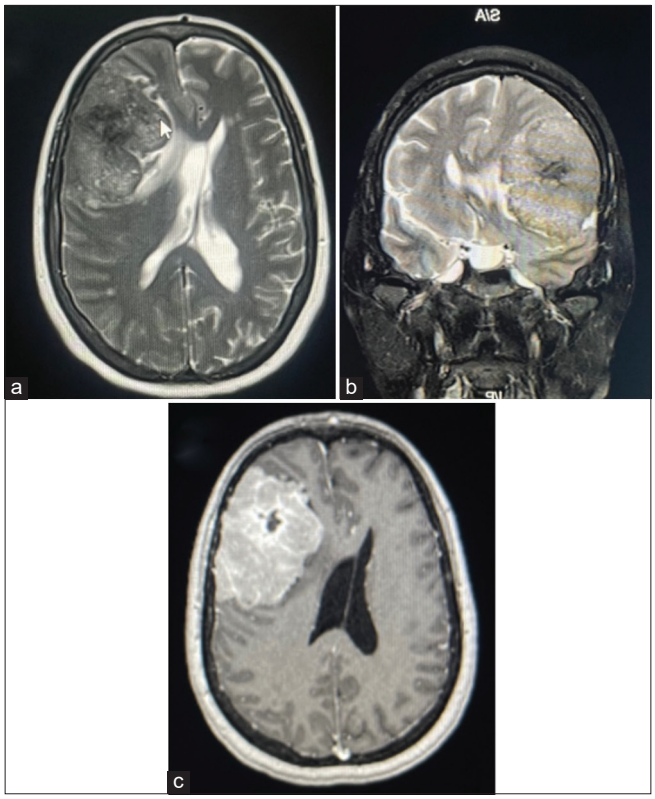

Figure 3: Case 3: (a) Axial T2-weighted brain magnetic resonance imaging (MRI), (b) coronal T2-weighted brain MRI, (c) Axial T1-weighted brain MRI. Type 1 Nauta classification

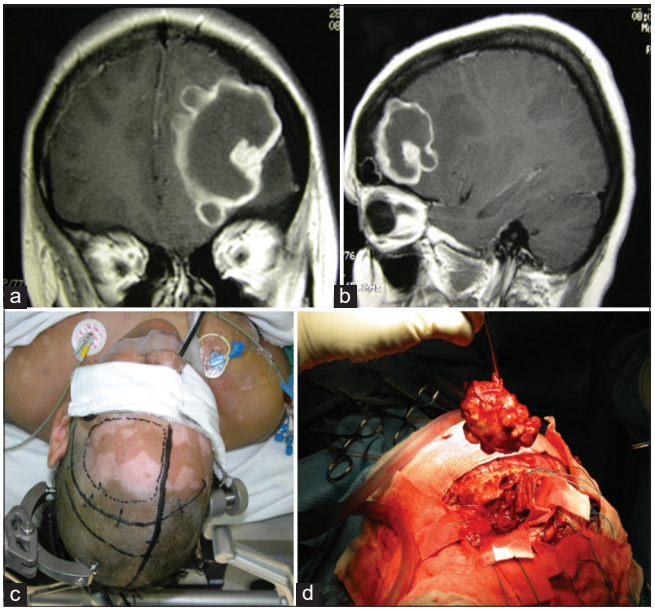

Figure 4: Case 4: (a) Magnetic resonance imaging (MRI) brain with gadolinium, coronal view showing large dural based cystic lesion in the left frontal area suggestive of cystic meningioma Type 1 Nauta classification, (b) MRI brain with gadolinium, Sagittal view showed large left dural based frontal cystic lesion suggestive of cystic meningioma, (c) left frontal craniotomy under general anesthesia, (d) gross total excision of the lesion

Outcome

Postoperatively, the patient showed improvement in her right-sided weakness with full recovery. Post-operative imaging showed a gross total excision with no residual tumor.

Follow-up

The patient was discharged home on regular anti-epileptic medications. A follow-up appointment was given to the patient.

Histopathology report

Histopathology results showed cystic meningioma Grade 1.

Review of literature

Cystic meningiomas represent an uncommon subtype of meningiomas, accounting for approximately 2–10% of all intracranial meningiomas, and frequently pose diagnostic challenges due to their variable radiological appearance and resemblance to other cystic intracranial lesions such as gliomas, metastases, and hemangioblastomas.[1,4,8,9] Unlike typical solid meningiomas, cystic meningiomas may present as extra-axial lesions with intratumoral or peritumoral cysts, sometimes lacking obvious dural attachment, further complicating preoperative diagnosis.[3,7]

Radiologically, cystic meningiomas often demonstrate a solid enhancing component associated with a cystic area and surrounding edema. Several imaging patterns have been described, leading to the widely used Nauta classification, which categorizes cystic meningiomas into four types based on the relationship between the cyst and the tumor.[8] Types I and II, where the cyst is intratumoral or peritumoral but lined by tumor cells, are most frequently reported in the literature.[8,11] Advanced imaging modalities, including diffusion-weighted imaging, may aid in differentiation from other cystic tumors; however, overlap remains significant.[10]

Clinically, patients typically present in middle to late adulthood with symptoms related to tumor location and mass effect, including headache, seizures, focal neurological deficits, gait disturbance, and cognitive changes.[2,5,11] Although meningiomas show a female predominance, cystic variants have been reported in both sexes and across a wide age range, including elderly patients.[5] Histopathologically, most cystic meningiomas are WHO Grade I, with fibroblastic, meningothelial, microcystic, and angiomatous subtypes commonly encountered, though higher-grade lesions have also been described.[2,9,11]

Surgical excision remains the treatment of choice, with gross total resection of both the solid tumor and cyst wall,

when feasible, associated with favorable outcomes and low recurrence rates.[1,8,11] Complete resection is particularly important in cystic meningiomas, as residual cyst walls containing tumor cells may contribute to recurrence.[8] Overall, the literature supports that despite their atypical imaging features, cystic meningiomas generally carry an excellent prognosis when appropriately diagnosed and surgically managed [Tables 1 and 2].

DISCUSSION

We report four cases of cystic meningiomas, all in adult female patients, aligning with the established predominance of meningiomas in females.[5]

Cystic meningiomas are a rare subset of meningioma, representing 2–4% of all cases reported in the literature.[6] Their cystic nature may be associated with different radiological appearances, including intratumoral or peritumoral cysts, which can complicate diagnosis. While the majority are benign (Grade I), their size and associated mass effect can result in significant neurological symptoms, as seen in our patients. Surgical resection remains the gold standard treatment.[7] It shows excellent outcomes when complete excision is performed. The lack of recurrence in our series supports this observation and underscores the benign nature of Grade I cystic meningiomas.

All four cases were confirmed to be benign, with no evidence of malignancy. These tumors were commonly located in the supratentorial compartment and were relatively large at the time of presentation. Histopathological examination confirmed them as low-grade tumors, classified as WHO Grade I.

The main presentation of our patients is seizures and motor weakness that was controlled with medical management initially, that is, Anticonvulsant and steroid. Total excision was achieved in all cases, with no intraoperative bleeding or post-operative complications. Follow-up imaging demonstrated no signs of recurrence.

The pathogenesis of cystic meningioma is not fully understood, and it has been proposed that it could be one of the following factors: tumor necrosis, microcystic degeneration, the entrapment of cerebrospinal fluid in widened subarachnoid spaces, ischemic necrosis, and hemorrhage.[8] This diversity in pathogenesis contributes to the diverse radiological and clinical presentations. Cystic meningiomas can arise in various locations, though they are most frequently found in the convexity and parasagittal regions.[9] In one of our cases the tumor was attached to the superior sagittal sinus. Their clinical presentation is often more acute compared to solid meningiomas, likely due to the mass effect caused by cyst development.[10] Symptoms commonly include seizures, motor weakness, headaches, and focal neurological deficits, all of which were present in our patients.[11]

In conclusion, our series adds to the limited literature and rarity of cystic meningiomas by emphasizing their female predominance, benign histology, and excellent surgical long-term outcomes with gross total excision. Multimodality imaging, meticulous surgical planning, and long-term follow-up are critical for optimizing outcomes in these uncommon tumors.

CONCLUSION

Cystic meningiomas, though rare, present unique diagnostic and clinical challenges due to their atypical features and resemblance to other cystic intracranial lesions. This case series highlights their female predominance, benign histology, and favorable prognosis with gross total surgical excision. All four cases demonstrated excellent outcomes, with no recurrence and complete symptom resolution upon follow-up. These findings reinforce the importance of multimodality imaging, proper surgical planning, and thorough long-term monitoring for optimal management of this uncommon tumor subtype. Future studies are encouraged to further elucidate the pathogenesis and enhance diagnostic precision in cystic meningiomas.

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