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*Case Report*

# Accurate preoperative diagnosis of a Rathke cleft cyst with the aid of a novel classification for sellar cystic lesions and a diagnostic algorithm decision: Tools for differentiating cystic sellar lesions with a representative case

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Received: 23 January 2024
Accepted: 13 March 2024
Published: 05 April 2024

**DOI**
10.25259/SNI_59_2024

**Quick Response Code:**

## ABSTRACT

**Background:** Rathke's cleft cyst (RCC) is a benign lesion in the sellar and suprasellar compartments. Similarly, pituitary adenomas can present with cystic morphology, making it a differential diagnosis when evaluating a patient with a cystic lesion in the sellar region. Surgical goals differ between RCCs and pituitary adenomas as the first can achieve remission of symptoms with cyst decompression in contrast to pituitary adenomas where complete resection would be the main goal. Imaging analysis alone may not be sufficient to define a preoperative surgical plan. The combination of imaging and conjoined use of validated tools may provide valuable insights to the clinician when defining a surgical approach.

**Case Description:** We present a case of a 27-year-old male with a 3-month history of visual disturbances and headaches. Magnetic resonance imaging showed a cystic lesion in the sellar compartment with compression of nearby structures. The authors were able to accurately diagnose this sellar lesion as an RCC with the conjoined aid of two classifications proposed in the literature. Cyst evacuation was performed with relief of symptoms and improved visual outcomes at follow-up.

**Conclusion:** While cystic adenomas can require total resection for cure, RCCs can show marked improvement with partial resection and evacuation of its contents. An accurate preoperative diagnosis can lead the surgeon to opt for the best surgical approach.

**Keywords:** Classification, Cystic adenoma, Endoscopic, Magnetic resonance imaging, Rathke cleft cyst

## INTRODUCTION

Rathke's cleft cysts (RCCs), classified as benign sellar and suprasellar lesions, trace their origin to the epithelial remnants of Rathke's pouch with a peak incidence within the age range of 30–50 years.[9] These cystic formations typically measure between 10 and 20 mm in diameter, boasting a distinctive composition characterized by mucoid or gelatinous material

encapsulated within a fragile cyst wall comprising simple or pseudostratified cuboidal or columnar epithelium.[3] The exact cause of RCCs is not fully understood, but they are believed to result from incomplete involution or closure of Rathke's pouch during embryonic development.[9] Asymptomatic cysts are frequent, discovered in 2–26% of autopsy cases of unrelated causes, and many are discovered incidentally during imaging studies performed for unrelated reasons.[11,17] However, in symptomatic patients, symptoms may result due to compression of nearby structures being headaches (33–81%), visual disturbances (12–58%), and pituitary hormone abnormalities of one or more axes (19–81%) the most frequent findings.[6] Magnetic resonance imaging (MRI) is the preferred modality for detection.[22] Noteworthy is the distinct radiological signature associated with RCCs, a unique subset of sellar and suprasellar lesions. These cysts notably eschew enhancement after the introduction of contrast material, with the exception of approximately half of the cases, wherein an enhancing rim encircles the displaced and compressed pituitary gland.[21] The characterization of these cystic lesions on T1-weighted and T2-weighted images (T1WI and T2WI) presents substantial variability, rendering individual content analysis challenging.[12] In light of this, a precise evaluation of these lesions through advanced imaging techniques becomes essential in elucidating their etiology. The foremost therapeutic approach revolves around surgical intervention, with the primary objective being the evacuation of the cyst's contents and the excision of the surrounding capsule, typically leading to substantial symptomatic improvement, as evidenced by the resolution or amelioration of headaches in 40–100% of patients and enhancements in visual disturbances witnessed in 33–100% of cases.[10,16] It is imperative to note that surgical intervention is not advocated for incidentally discovered asymptomatic lesions.[14]

RCCs can share radiologic and clinical characteristics with other sellar cystic lesions as cystic pituitary adenomas. However, as cyst evacuation may provide symptomatic relief in RCCs, this might not be sufficient in pituitary adenomas. Therefore, surgical goals must be tailored for each patient undergoing surgery for sellar cystic lesions.[2,12] An accurate preoperative diagnosis through imaging studies could provide the clinician with valuable information to choose the best surgical approach for each lesion. Radiomics and deep learning approaches have been described to discriminate between cystic lesions in the sellar compartment accurately. Nevertheless, this technology still exhibits some downfalls and may not be available in many centers, especially in developing countries centers.[7,13]

In this context, we present a case involving an RCC in a 28-year-old male, highlighting the importance of an accurate preoperative diagnosis based on radiological characteristics supported by the conjoined use of an innovative classification scheme for sellar cystic lesions and a diagnostic tree decision as an alternative to differentiate between cystic sellar lesions.

## CASE PRESENTATION

A 27-year-old man presented with chronic severe headaches with a history of pharmacological treatment without improvement and a 3-month history of progressive deterioration in visual acuity with blurring of his left-sided vision. On neurological examination, visual acuity in the right eye was reported to be 20/60 and 20/80 in the left eye with 2 mm isochoric pupils, normal light reflex, and bitemporal hemianopia. Extraocular movements were of full range, and fundus examination was within normal limits.

A pituitary hormonal assay was carried out, revealing panhypopituitarism. MRI was deemed necessary, showing an intrasellar cystic image with peripheral enhancement with an intracystic nodule without a septum or compartments. Displacement of the optic chiasm and the anterior communicating complex were observed, as well as intra-lesional fluid level [Figure 1]. The cystic lesion was classified independently by three neurosurgeons (J.J.C.H, E.C.O, and L.A.P.R). According to the Tavakol classification, a Type I lesion was defined as a well-circumscribed lesion with no solid components noted.[19] As for the Park's diagnostic model, midline location, a negative fluid-fluid level, and the presence of an intracystic nodule made the diagnosis of an RCC most likely.[12] Both tools were employed by the three authors independently with the unanimous agreement on the diagnosis of an RCC. A surgical plan was defined and carried out.

### Surgery

The patient underwent a transsphenoidal endoscopic endonasal approach, allowing the identification of a cystic intrasellar tumor with thickened walls and viscous xanthochromic content with displacement of the pituitary tissue without sellar diaphragm compromise. The tumor was fully resected without complications or incidents [Figure 2]. Histological examination revealed a chronic xanthogranulomatous process with a fibrous wall and epithelial lining compatible with Rathke's pouch cyst [Figure 3]. Immunohistochemistry was negative for Beta-catenin and cytokeratin AE1/AE3. The postoperative course was uneventful, with the improvement of the visual fields leading to discharge three days after surgery. At the 6-month follow-up, the patient remained asymptomatic with improvement of visual acuity and resolution of the bitemporal hemianopia. The patient remained with hormonal therapy with a progressive lowering of dosage requirements.

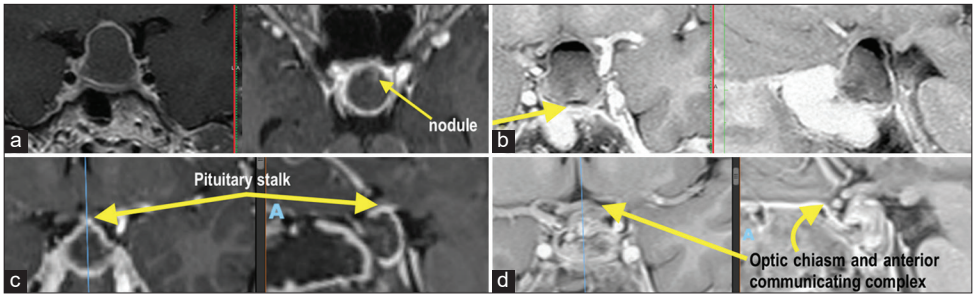


**Figure 1:** Pre and postoperative magnetic resonance imaging. (a) T1 gadolinium with an intrasellar cystic image with peripheral enhancement, intracystic nodule without septum or compartments. (b) Inverted T2 showing the displacement of the chiasm and the anterior communicating complex as well as the intra-lesional fluid level, arrow in figure b refers to "nodule" too. (c) Immediate postoperative T1 gadolinium with evidence of an intact pituitary stalk as well as persistence of peripheral enhancement that may correspond to the pituitary gland. (d) T2 inverted with improvement in the disposition of the chiasm and the anterior communicating complex.

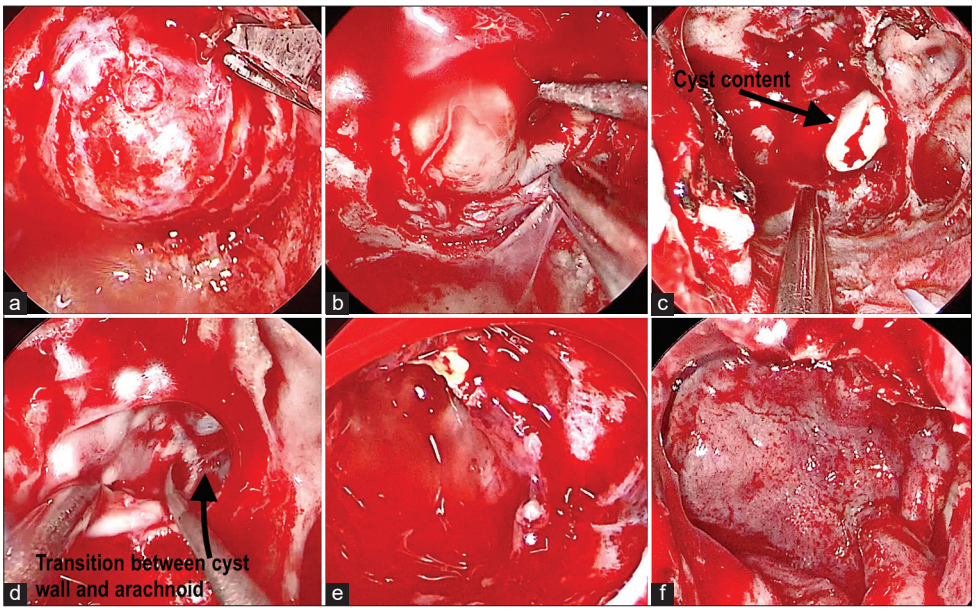


**Figure 2:** Intraoperative images of the endoscopic endonasal approach. (a) U-shaped dural incision. (b) Dissection of the anterior, lateral, and inferior walls of Rathke's cleft cyst capsule. (c) Drainage of cyst contents. (d) Dissection and total removal of the capsule. (e) Surgical bed demonstrating total resection of the capsule with integrity of the arachnoid membrane and residual pituitary. (f) Nasoseptal flap rotation.

The patient will continue on follow-up, but no worsening of the symptomatology is expected.

## DISCUSSION

Before surgery and histopathological analysis, cystic epithelial lesions of sellar or parasellar location can be classified into RCCs, epithelial cysts, epidermoid cysts, dermoid cysts, and craniopharyngiomas.[5] However, hemorrhagic or ischemic events in pituitary adenomas may prompt a cystic appearance in imaging studies, making it a differential diagnosis when evaluating cystic lesions of sellar origin.[12] RCCs tend to be small, asymptomatic intrasellar nonneoplastic lesions. However, bigger cavities can elicit symptoms through compression of nearby structures.[1] Evacuation of its contents and partial resection of the cyst's walls may ensure marked improvements in the patient's symptomatology with low rates of recurrence and postoperative complications.[8] A partial resection and evacuation of contents may achieve a surgical cure in cystic lesions, unlike pituitary adenomas usually requiring gross total resection to alleviate the presenting symptoms.[2,4,8,15] Therefore, an accurate

preoperative diagnosis may allow the neurosurgeon to opt for an optimal procedure. Specific radiological characteristics may ensure precise preoperative diagnosis, guiding the clinician in the decision-making of surgical strategies. Park *et al*., proposed a diagnostic tree model in a study correlating specific radiological findings with a final diagnosis with a 91.6% accuracy rate in 24 patients through external validation [Figure 4]. A fluid-fluid level, a hypointense rim on T2-weighted images, septation, and lesions with an off-midline location showed an increased tendency toward pituitary adenomas, while the presence of an intracystic nodule was more often seen in RCCs.[12] Similarly, Shatri and Ahmetgjekaj described in 2018 that the presence of an intracystic nodule with a non-enhancing noncalcified sellar or suprasellar cyst is a reliable imaging lead for RCCs.[18]

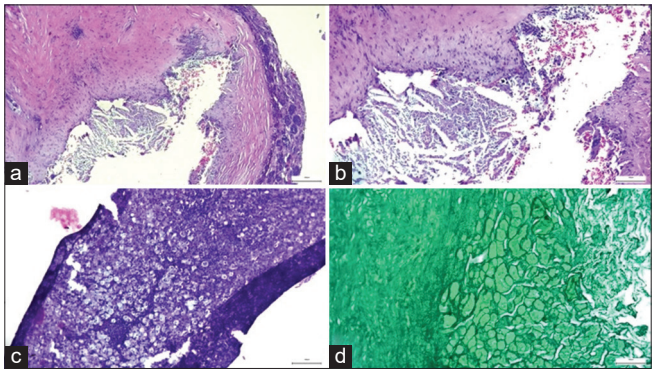


**Figure 3:** (a-c) A predominantly lymphocytic inflammatory process is identified, with macrophages with clear and extensive cytoplasm (xanthocytes) and giant cells within a fibrous wall, which does not show epithelial lining, and displaces the normal pituitary gland. (d) Reticulin stain confirms the normal architectural distribution of the pituitary gland.

In addition, morphological variables in cystic appearing lesions, such as septation and solid components, are highly inconstant, and a proper guideline for its analysis was unavailable until 2021 when Tavakol *et al.* published their work on a new classification for cystic lesions in imaging [Figure 5].[19] This classification proposes the categorization of cystic lesions in four different groups based on the correlation of morphological characteristics and final histopathological findings with a positive predictive value of 82.2% and a negative predictive value of 86.4%. Type 3 and Type 4 groups, as well as lesions with fluid-fluid levels on preoperative MRI, had higher odds of being diagnosed as pituitary adenomas. Furthermore, obesity and endocrine aberrations, like hyperprolactinemia, were more associated with neoplastic lesions. In contrast, Type 1 and Type 2 lesions were more likely to be diagnosed as nonneoplastic lesions (cystic epithelial lesions); still, non Type 1 lesions demonstrated more probability to be diagnosed as pituitary adenomas, making the Type 1 group the most likely category to include nonneoplastic lesions.[19]

This evidence can guide the surgeon to differentiate between the etiologies in sellar cystic lesions, further validation is required. In this case, the conjoined use of these tools positively predicted the final diagnosis of our patient, enabling our team to opt for a proper surgical strategy.

## Radiomics

Radiomics features have been described for the radiologic discrimination between cystic lesions in the sellar

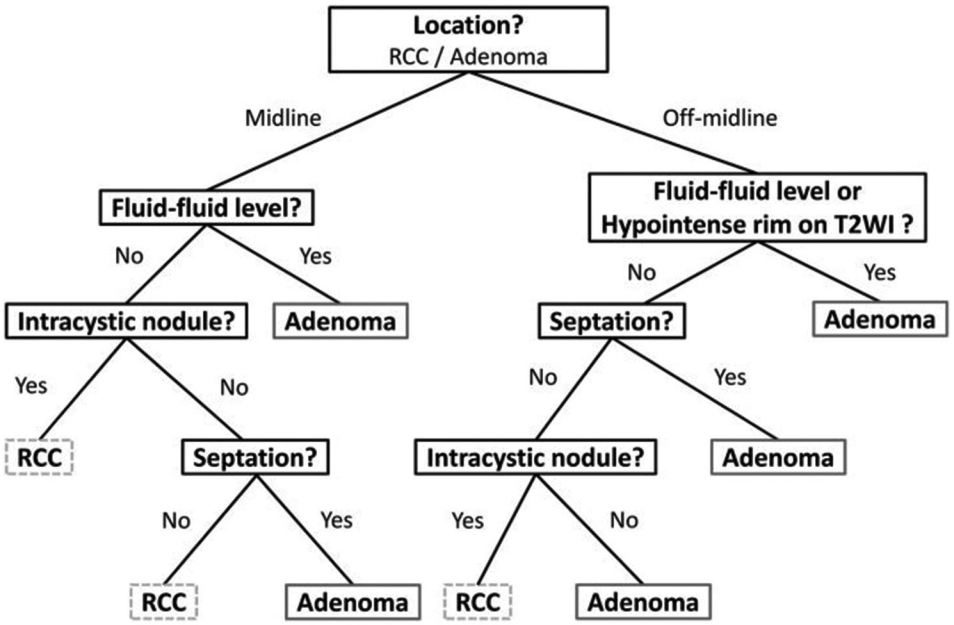


**Figure 4:** Diagnostic decision tree for the differentiation of cystic pituitary adenomas and RCCs using MR imaging. ©2015 Park M *et al*, Used by permission. RCC: Rathke Celft Cyst, T2WI: T2-weighted image

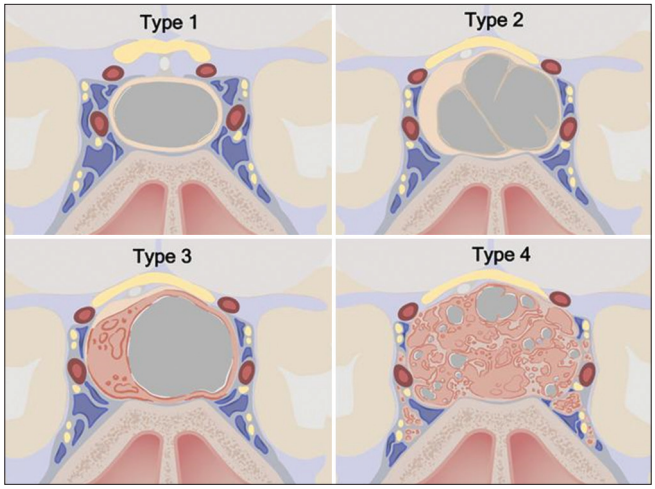


**Figure 5:** Cystic sellar lesion classification scheme. Type 1: No solid component; well-circumscribed, homogeneous cyst. Type 2: Little or no solid component; irregular cyst, with septations or abnormal walls. Type 3: Obvious solid component; well-circumscribed homogeneous cyst. Type 4: Obvious solid component present; irregular cyst(s) with septations or abnormal walls. Type 1: *n* = 68 (33.2%), Type 2: *n* = 72 (35.1%), Type 3: *n* = 10 (4.9%), Type 4: *n* = 55 (26.8%). ©2020 Xian Boles, Used by permission.[19]

compartment with optimal performance. Superiority over traditional clinical discrimination goes up to 8% when radiomic methods are employed. Despite this, several limitations still impede the routine use of this technology. There are no prospective studies that demonstrate superiority against traditional diagnostic methods with possible bias arousing from the exclusion of patients who were not treated with surgery. Similarly, external validation with multi-center studies is unavailable.[7,20,23] This technology has promising use in the near future; however, until evidence allows their use as a regular practice, the employment of validated methods such as the one proposed in this article can be useful.

## CONCLUSION

Effective preoperative differentiation of RCCs from cystic pituitary adenomas can allow the surgeon to opt for a less aggressive approach and avoid specific complications that can result from surgery. Evidence supports the possibility of establishing a preoperative diagnosis for cystic lesions in the sellar region; nevertheless, concomitant use of these tools can increase the odds of defining an accurate diagnosis. Performing prospective studies may help validate and further analyze the conjoined or individual efficacy of these tools and compare their efficacy against emerging technologies.

### Ethical approval

Institutional Review Board approval is not required.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

### Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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**How to cite this article:** Cuellar-Hernández J, Ortega-Ruiz OR, Rodriguez-Armendariz AG, Castillo-Acevedo CD, Pérez-Ruano L, Caro-Osorio E, *et al*. Accurate preoperative diagnosis of a Rathke cleft cyst with the aid of a novel classification for sellar cystic lesions and a diagnostic algorithm decision: Tools for differentiating cystic sellar lesions with a representative case. Surg Neurol Int. 2024;15:120. doi: 10.25259/SNI_59_2024