RESEARCH PAPER

Isolated sphenoid sinus mucocele presenting as acute visual loss: A radiological diagnostic challenge

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Abstract

Background:

Isolated sphenoid sinus mucocele is a rare paranasal sinus pathology that may produce significant neurological and ophthalmological complications because of the close anatomical relationship between the sphenoid sinus and critical neurovascular structures. Visual impairment may occur when the expanding lesion compresses the optic nerve or optic canal, making early radiological diagnosis essential.

Case Presentation:

A 43-year-old male presented with progressive diminution of vision in the left eye for approximately 40 days, accompanied by intermittent headache and nasal symptoms. Initial clinical evaluation suggested retrobulbar neuritis and corticosteroid therapy was started, but no improvement was observed. Subsequent radiological evaluation revealed a **soft-tissue lesion occupying the sphenoid sinus with expansion of the sinus cavity and erosion of the sphenoid wall**, resulting in **narrowing of the left optic canal**. Magnetic resonance imaging demonstrated a **well-defined T2-hyperintense lesion extending toward the posterior ethmoid region corresponding to the Onodi cell**, causing compression of the optic nerve. Based on these findings, a diagnosis of **isolated sphenoid sinus mucocele producing compressive optic neuropathy** was established. The patient underwent **endoscopic transnasal trans-sphenoidal optic nerve decompression**, with postoperative imaging demonstrating adequate sinus decompression.

Conclusion:

This case highlights the diagnostic importance of **high-resolution CT and MRI in evaluating sphenoid sinus lesions presenting with visual symptoms**. Early recognition of radiological features such as sinus expansion, optic canal involvement, and anatomical variations like the **Onodi cell** is essential to avoid misdiagnosis and enable timely surgical management.

Keywords:

Sphenoid sinus mucocele; Optic nerve compression; Onodi cell; CT; MRI; Visual loss; Radiology case report.

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Introduction

Isolated sphenoid sinus mucocele is an uncommon but clinically important condition that may present with serious neurological or ophthalmological complications, including visual impairment. Paranasal sinus mucoceles are benign, mucus-filled cystic lesions that develop due to obstruction of the normal drainage pathway of a sinus. Progressive accumulation of mucus results in gradual expansion of the sinus cavity, which may lead to remodeling and thinning of the surrounding bony walls. The radiology reference textbook **Diagnostic Imaging: Head and Neck** explains that mucoceles are slowly enlarging expansile lesions capable of exerting pressure on adjacent anatomical structures. The textbook further states that although mucoceles most frequently involve the frontal and ethmoid sinuses, sphenoid sinus involvement is relatively rare but clinically significant because of the sinus's close proximity to vital neurovascular structures at the skull base [1].

The same textbook also describes the anatomical location of the sphenoid sinus within the central skull base, where it lies in close relation to critical structures such as the optic nerve, cavernous sinus, internal carotid artery, and several cranial nerves. Because of this complex anatomical relationship, even a relatively small lesion within the sphenoid sinus can lead to serious neurological or ophthalmological

manifestations. **Diagnostic Imaging: Head and Neck** emphasizes that radiological imaging is essential for the evaluation of sphenoid sinus pathology. Computed tomography (CT) is particularly useful in demonstrating sinus expansion, bony remodeling, and erosion of the sinus walls, whereas magnetic resonance imaging (MRI) provides superior visualization of soft tissue components and helps evaluate the relationship between the lesion and adjacent neural structures, particularly the optic nerve [1].

The radiology educational website **Radiopaedia** describes sphenoid sinus mucoceles as relatively uncommon lesions that represent only a small proportion of all paranasal sinus mucoceles. According to Radiopaedia, patients with sphenoid sinus mucoceles may present with nonspecific symptoms such as headache, retro-orbital pain, or visual disturbance. The website explains that visual symptoms occur when the expanding mucocele compresses nearby structures, particularly the optic nerve. Radiopaedia also highlights that CT imaging typically demonstrates sinus opacification along with expansion of the sinus cavity and thinning or erosion of the surrounding bony walls, making imaging an essential component of diagnosis [2].

Radiopaedia also describes an important anatomical variation known as the **Onodi cell**, or sphenoethmoidal air cell. The website explains that the Onodi cell is a posterior ethmoid air cell that extends superiorly or laterally to the sphenoid sinus. This variation is clinically significant because the optic nerve frequently lies in close proximity to the wall of the Onodi cell and may even protrude into it. As noted by Radiopaedia, pathological processes such as mucoceles developing in this region may directly compress the optic nerve, which can result in visual impairment or acute visual loss if the condition is not recognized early [3].

Therefore, understanding the anatomical relationships of the sphenoid sinus and recognizing anatomical variations such as the Onodi cell are essential for accurate radiological interpretation. Early detection using cross-sectional imaging modalities such as CT and MRI plays a crucial role in preventing complications and guiding timely management of sphenoid sinus mucoceles. This case highlights the importance of radiological evaluation in diagnosing an isolated sphenoid sinus mucocele presenting with acute visual loss and illustrates the diagnostic challenges associated with this rare condition.

Case Presentation

A 43-year-old male presented with a history of **progressive diminution of vision in the left eye for approximately 40 days** prior to admission. The visual impairment was insidious in onset and gradually progressive. The patient also complained of **intermittent left-sided headache for nearly 10 days**, which was described as dull in nature and not associated with nausea or vomiting. There was **no history of diplopia, facial trauma, or previous cranial surgery**. The patient reported symptoms suggestive of upper respiratory tract irritation, including **frequent sneezing and nasal blockage**. He also complained of **intermittent mucoid nasal discharge from the left nostril**, which occasionally dripped posteriorly into the throat. The discharge was **non-purulent and not blood stained**. There was **no history of anosmia, hyposmia, ear discharge, hearing loss, tinnitus, or difficulty in swallowing**.

The patient had initially consulted an ophthalmologist because of the progressive visual symptoms. On ophthalmological evaluation, **reduced visual acuity in the left eye** was noted, and a provisional diagnosis of **retrobulbar neuritis** was considered. The patient was started on **oral corticosteroid therapy (methylprednisolone 40 mg)** for a short course; however, no significant improvement in vision was observed. Due to persistent symptoms, the patient was referred for further evaluation and imaging.

The patient was admitted to the **Department of Otorhinolaryngology** for detailed evaluation. His **general physical examination was unremarkable**, and vital parameters were within normal limits. There was **no history of diabetes mellitus, hypertension, smoking, alcohol consumption, or previous blood transfusion**. Bowel and bladder habits were normal, and the patient reported a normal appetite and sleep pattern.

On **local ENT examination**, the nose showed **no external deformity**. Inspection of the nasal cavity revealed a normal nasal vestibule and columella. The nasal septum was midline without deviation. The **inferior and middle turbinates appeared normal**, and no obvious intranasal mass or polyp was identified. Posterior nasal cavity examination did not reveal any abnormality. **Diagnostic nasal endoscopy** demonstrated a **bony spur impinging on the inferior turbinate**, and the **choanae were patent bilaterally**. The **middle turbinate was noted to be attached to the skull base**, and the **sphenoethmoidal recess region appeared edematous**.

Otoscopic examination showed **bilaterally intact tympanic membranes** with no evidence of middle ear

pathology. **Rinne's test was positive bilaterally**, and **Weber's test was centralized**, suggesting normal hearing. **Facial nerve examination was clinically intact**, and there was **no nystagmus observed**.

Oral cavity and oropharyngeal examination revealed normal mucosa of the lips, gums, teeth, hard palate, buccal mucosa, and tongue. The **uvula was central**, and the **soft palate appeared normal**. The **posterior pharyngeal wall was clear** with no abnormal secretions or lesions.

Radiological evaluation was performed for further assessment. **Computed tomography (CT) of the paranasal sinuses** revealed **soft tissue density occupying the sphenoid sinus with expansion of the sinus cavity**. There was **erosion of the medial wall of the greater wing of the left sphenoid bone and the lateral wall of the sphenoid sinus**, resulting in **narrowing of the left optic canal**. Associated **mucosal thickening was noted within the sphenoid sinus and adjacent ethmoidal air cells**.

Magnetic resonance imaging (MRI) demonstrated a **well-defined lesion within the sphenoid sinus showing hyperintense signal on T2-weighted sequences**, consistent with a **mucocele containing mucous secretions**. The lesion was seen extending toward the **posterior ethmoid region corresponding to the Onodi cell**, and was closely related to the **left optic nerve canal**, causing compression of the optic nerve. No intracranial extension or brain parenchymal abnormality was identified.

Based on the **clinical, endoscopic, and radiological findings**, a diagnosis of **isolated sphenoid sinusitis with sphenoid mucocele causing compression of the left optic nerve through an Onodi cell variant** was established. The patient subsequently underwent **endoscopic transnasal trans-sphenoidal trans-Onodi optic nerve decompression under general anesthesia**.

During surgery, the **sphenoid sinus was accessed endoscopically and the mucocele contents were drained**. Decompression of the **optic canal and adjacent sphenoid sinus wall** was performed to relieve pressure on the optic nerve. The **intraoperative and postoperative periods were uneventful**. Postoperatively, the patient received **intravenous antibiotics, antihistamines, and analgesics**. The patient showed **clinical improvement and stabilization of symptoms**, and was discharged with advice for **follow-up in the ENT outpatient department for further evaluation and monitoring**.

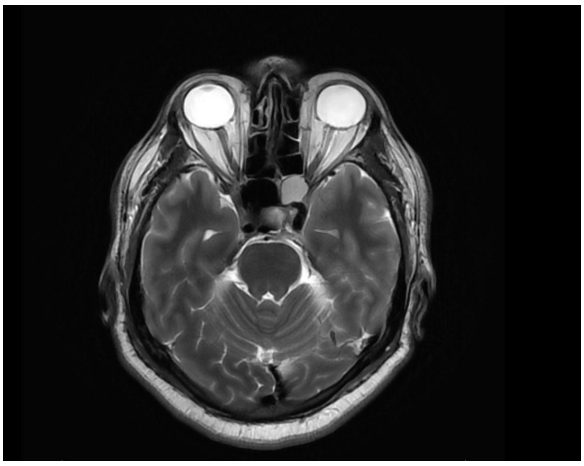

Figure 1: Pre-operative MRI brain (axial T2-weighted image) showing a hyperintense lesion within the sphenoid sinus consistent with a sphenoid mucocele, extending toward the posterior ethmoid region (Onodi cell) and abutting the left optic canal.

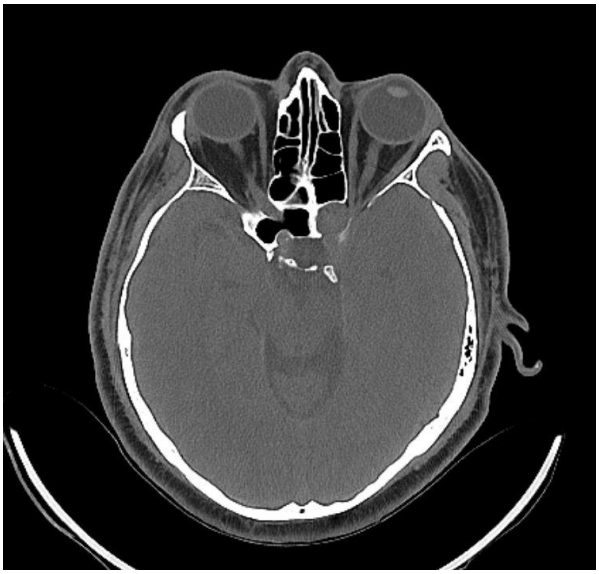

Figure 2: Pre-operative CT paranasal sinus (axial bone window) demonstrating soft-tissue density filling the sphenoid sinus with associated bony erosion of the sphenoid sinus wall and narrowing of the left optic canal.

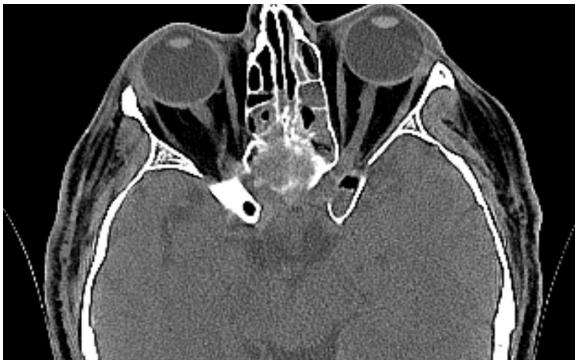

Figure 3: Post-operative CT paranasal sinus (axial section) showing surgical decompression of the sphenoid sinus following endoscopic transnasal trans-sphenoidal approach with partial removal of sinus contents and improved aeration.

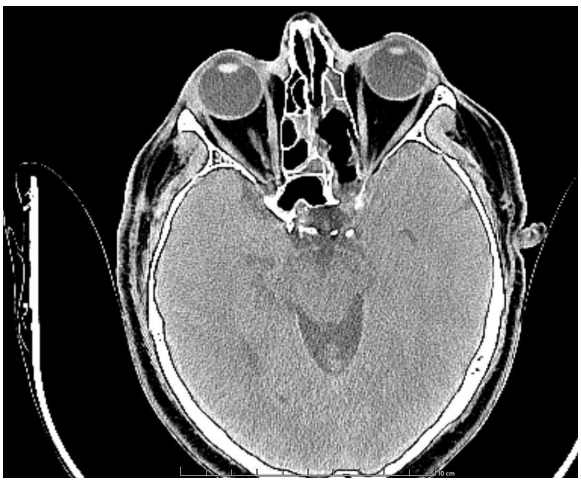

Figure 4: Post-operative CT paranasal sinus (axial section) demonstrating post-surgical changes with decompressed sphenoid sinus cavity and relief of optic canal narrowing following optic nerve decompression.

Discussion

Isolated sphenoid sinus pathology represents a diagnostically challenging entity because of the deep anatomical location of the sphenoid sinus and its intimate relationship with critical neurovascular structures. Radiologically, sphenoid sinus mucoceles are characterized by **expansile cystic lesions that produce sinus opacification, thinning of bony walls, and potential compression of adjacent neural structures**. In the present case, cross-sectional imaging demonstrated **complete opacification and expansion of the sphenoid sinus with focal erosion of the sphenoid wall and narrowing of the left optic canal**, findings consistent with a **sphenoid sinus mucocele producing compressive optic neuropathy**. MRI further revealed a **well-defined T2-hyperintense lesion extending toward the posterior ethmoid region corresponding to the Onodi cell**, confirming the close anatomical relationship between the lesion and the optic nerve.

Visual impairment secondary to sphenoid sinus mucocele has been reported in several recent studies, highlighting the importance of imaging in early detection. **Raguraman et al.** described a similar case in which CT imaging demonstrated an expansile sphenoid sinus lesion compressing the optic nerve and producing acute visual loss [4]. Their report emphasized that **prompt radiological identification followed by surgical decompression plays a critical role in preventing irreversible optic neuropathy**. The imaging findings observed in the present case are comparable, particularly with regard to **sinus expansion and optic canal involvement**. However, an important difference lies in the clinical progression. In the report by Raguraman et al., visual impairment developed acutely, whereas the patient in the present case experienced **gradual visual deterioration over several weeks**, which initially led to diagnostic uncertainty and delayed imaging evaluation.

An important radiological consideration in sphenoid sinus disease is the presence of the **Onodi cell**, a posterior ethmoidal air cell that lies superior or lateral to the sphenoid sinus and may closely relate to the optic nerve canal. **Morino et al.** reported optic neuropathy caused by a mucocele arising from an enlarged Onodi cell, where CT imaging demonstrated direct compression of the optic nerve by the expanded air cell [5]. Their findings highlighted that **identification of the Onodi cell on preoperative imaging is crucial because lesions arising in this region have a higher probability of producing optic nerve compression**. In the present case, MRI and CT imaging clearly demonstrated **extension of the sphenoid sinus lesion toward the posterior ethmoid region corresponding to the Onodi cell**, with associated narrowing of the optic canal. This observation supports the concept that **anatomical variations within the sphenoethmoidal complex can significantly influence the pattern of neural compression**.

Radiological diagnostic challenges associated with Onodi cell mucoceles have also been described by **Diafas et al.**, who reported optic neuropathy resulting from an expansile lesion within the Onodi cell [6]. Their imaging findings demonstrated **posterior ethmoid sinus expansion with direct contact between the lesion and the optic nerve**, leading to visual symptoms. An important point highlighted in their study was that patients frequently present with **isolated ophthalmological symptoms**, which may lead to misdiagnosis if sinonasal pathology is not considered. A similar diagnostic difficulty was encountered in the present case, where the patient initially received treatment for suspected retrobulbar neuritis before radiological evaluation identified the sphenoid sinus lesion. This similarity underscores the **importance of early cross-sectional imaging in patients presenting with unexplained visual impairment**.

The spectrum of optic nerve involvement in sphenoid sinus disease may vary depending on the extent of sinus

expansion. **Deb et al.** described a case of **bilateral compressive optic neuropathy caused by sphenoid sinus mucocele**, where imaging revealed bilateral optic canal involvement [7]. Their findings illustrate how extensive sinus expansion can affect both optic nerves simultaneously. In contrast, imaging in the present case demonstrated **localized narrowing of the left optic canal**, resulting in **unilateral optic nerve compression**. This difference highlights how the **direction of mucocele expansion and surrounding anatomical variations determine the pattern of neurological involvement**.

Cranial nerve deficits other than optic neuropathy have also been reported in sphenoid sinus lesions. **Lasrado et al.** described a case in which sphenoid sinus mucocele produced **lateral rectus palsy due to compression of the abducens nerve** [8]. Their report demonstrated that sphenoid sinus expansion may involve the cavernous sinus region and affect multiple cranial nerves. In the present case, however, no cranial nerve palsy was observed clinically or radiologically. Imaging findings suggested that the lesion was primarily directed toward the **optic canal rather than the cavernous sinus**, which likely explains the absence of additional neurological deficits.

The clinical and radiological spectrum of isolated sphenoid sinus disease has been further examined in a systematic review conducted by **Mughal et al.**, who analyzed symptomatic patients with radiologically isolated sphenoid sinus lesions [9]. Their study demonstrated that **headache and visual disturbance are the most common presenting symptoms**, while imaging findings typically include sinus opacification and expansion. These observations closely correspond with the present case, where the patient presented with **headache and progressive visual loss**, and imaging revealed **expansion of the sphenoid sinus with optic canal involvement**.

Earlier clinical experience reported by **Sadashiva et al.** also highlighted the rarity and diagnostic complexity of isolated sphenoid sinus lesions [10]. Their study emphasized that **radiological imaging remains the cornerstone for diagnosis because clinical symptoms are often vague and nonspecific**. In the present case, CT and MRI were essential in identifying the lesion, evaluating its relationship with the optic nerve, and guiding surgical planning for optic nerve decompression.

From a contemporary radiological perspective, this case underscores several key observations. **First, sphenoid sinus mucoceles should be considered in the differential diagnosis of unexplained visual loss. Second, high-resolution CT and MRI are indispensable for assessing sinus expansion, optic canal involvement, and anatomical variations such as the Onodi cell. Third, early radiological diagnosis facilitates timely surgical intervention and may prevent permanent optic nerve damage.** The present case therefore highlights the diagnostic value of modern cross-sectional imaging in identifying rare sphenoid sinus lesions and guiding appropriate management strategies.

Conclusion

Isolated sphenoid sinus mucocele is an uncommon but clinically significant cause of visual impairment due to its close anatomical relationship with the optic nerve and surrounding neurovascular structures. The present case highlights how sphenoid sinus lesions may initially mimic primary ophthalmological conditions, leading to diagnostic delay. Radiological evaluation using **high-resolution CT and MRI plays a pivotal role in identifying sphenoid sinus expansion, bony erosion, and optic canal involvement**, enabling accurate diagnosis. In this case, imaging demonstrated a **sphenoid sinus mucocele extending toward the Onodi cell region with compression of the optic nerve**, explaining the patient's progressive visual loss. Early recognition of these radiological features allowed timely **endoscopic transnasal trans-sphenoidal decompression**, which relieved neural compression. This case emphasizes that **cross-sectional imaging is indispensable in patients presenting with unexplained visual symptoms**, and awareness of anatomical variations such as the **Onodi cell** is essential to prevent misdiagnosis and guide appropriate surgical management.

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