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CASE REPORTS

OSTEOMA OF THE POSTERIOR WALL OF THE SPHENOID SINUS IN A 29-YEAR-OLD WOMAN – A CASE REPORT

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Abstract. *Skull base osteomas are rare tumors, typically asymptomatic and without specific clinical manifestations. These are slow-growing benign tumors that, in some cases, can reach significant sizes and exert a mass effect on surrounding neural and vascular structures located at the skull base, leading to corresponding clinical symptoms. Tumors located on the posterior wall of the sphenoid sinus may appear on magnetic resonance imaging (MRI) and computed tomography (CT) as osteomas, polyps originating from the mucosa of the sphenoid sinus, chordomas, or chondrosarcomas. During the second and third decades of life, chordomas and osteomas are commonly encountered tumors. The two imaging modalities are interrelated and complementary since CT visualizes bony structures effectively, while MRI is superior for soft tissues and brain parenchyma. In the present case report, we describe a 29-year-old woman presenting with symptoms of numbness in the right limbs, dizziness, and nausea, without vomiting. She reported dropping objects with her right hand. An MRI of the brain was performed, revealing a lesion localized on the posterior wall of the sphenoid sinus, extending to the clivus and infiltrating the inferior surface of the sella turcica. The lesion showed increased signal intensity on T2-weighted sequences. Given the small size of the tumor and the absence of corresponding clinical manifestations, the lesion is subject to clinical monitoring. Surgical approaches for the removal of such tumors include the endoscopic transsphenoidal approach to the skull base or the sublabial transsphenoidal approach. Complications associated with these surgical interventions may involve dural laceration and subsequent cerebrospinal fluid leakage, as well as potential damage to critical vessels or nerves.*

Key words: *sphenoid sinus, osteomas of the sphenoid sinus, MRI examination of the skull base, CT of the paranasal sinuses and skull base, chordoma of the sphenoid sinus, transsphenoidal approaches to the skull base*

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INTRODUCTION

Osteomas are benign, slow-growing tumors that rarely lead to neurological manifestations [1]. According to Teodora Toteva-Petkova, an osteoma is a benign osteogenic lesion characterized by the proliferation of compact, lamellar cortical bone. It presents as an exophytic mass, typically originating from the bones of the skull and paranasal sinuses. Osteomas can also develop on the clavicle, pelvis, and long bones. They are most commonly localized on the calvarium and do not reach sizes large enough to compress the underlying cerebrum. According to the literature, when the paranasal sinuses are affected and X-ray or CT scans are performed, their prevalence ranges from 0.42% to 3%, with the most common sites being the frontal and ethmoidal sinuses. Their occurrence in the sphenoid sinus is exceedingly rare, with only a few clinical cases reported in the literature [1, 2]. It has been established that males are more frequently affected than females, with a male-to-female ratio of 2.6:1. Only 10% of all osteomas become symptomatic. Chaiyasate et al. compared monozygotic and dizygotic twins for anatomical variations and found that monozygotic twins more frequently exhibit infundibular cells [1, 2, 3]. The primary diagnostic tools are CT, which determines the localization of the osteoma in the paranasal sinuses and its propagation towards the skull base, and MRI, which is crucial for differentiating the process from a mucosal polyp of the sphenoid sinus or a chordoma in the sphenoid sinus [2, 3, 4].

CASE PRESENTATION

A 29-year-old woman presented with complaints of sudden numbness in her right limbs, predominantly the arm, along with dizziness and nausea without vomiting for two days. The symptoms had been present for two weeks. She reported weakness in her right hand and had dropped objects multiple times in the past week. She also experienced difficulty breathing through her nose and facial headaches.

Neurological examination revealed no abnormalities: the patient was conscious, communicative, and coherent, with no evidence of cranial nerve damage. No motor deficits were observed during latent paresis tests, and tendon reflexes were intact and symmetrical. Sensory examination showed hypesthesia in the right hand without localization to specific dermatomes. Coordination was unaffected, and muscle tone was preserved. Laboratory tests revealed no deviations. Cardiology examination identified no heart conditions. An ECG showed sinus rhythm with a heart rate of 81 bpm and an incomplete right bundle branch block.

MRI of the brain revealed a lesion located in the sphenoid sinus on its posterior wall, beneath the sella turcica, extending toward the clivus. The lesion was interpreted as a chordoma of the sphenoid sinus. MRI characteristics included hyperintensity in T2-weighted sequences and hypointensity in T1-weighted sequences. Intravenous contrast administration with gadolinium resulted in weak homogeneous enhancement of the tumor. Differential diagnosis considered a sphenoid sinus osteoma (Figures 1 and 2).

Panel A shows a sagittal slice through the center of the sphenoid sinus in a T1-weighted sequence, indicating the presence of a hypointense tumor process. Panel B presents an axial slice in a T2-weighted sequence, highlighting the hyperintense tumor. Panel C displays a coronal slice in a T2-weighted sequence. The red arrows point to the osteoma, while the blue circle delineates the boundaries of the sphenoid sinus in all three projections.

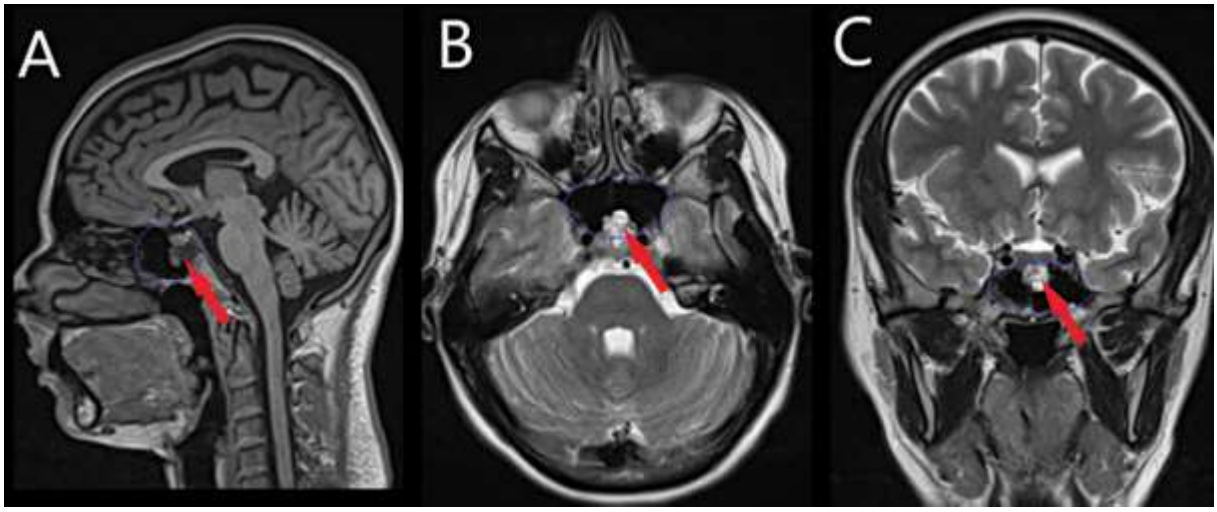

Fig. 1 (A, B, and C). MRI of the brain and paranasal sinuses

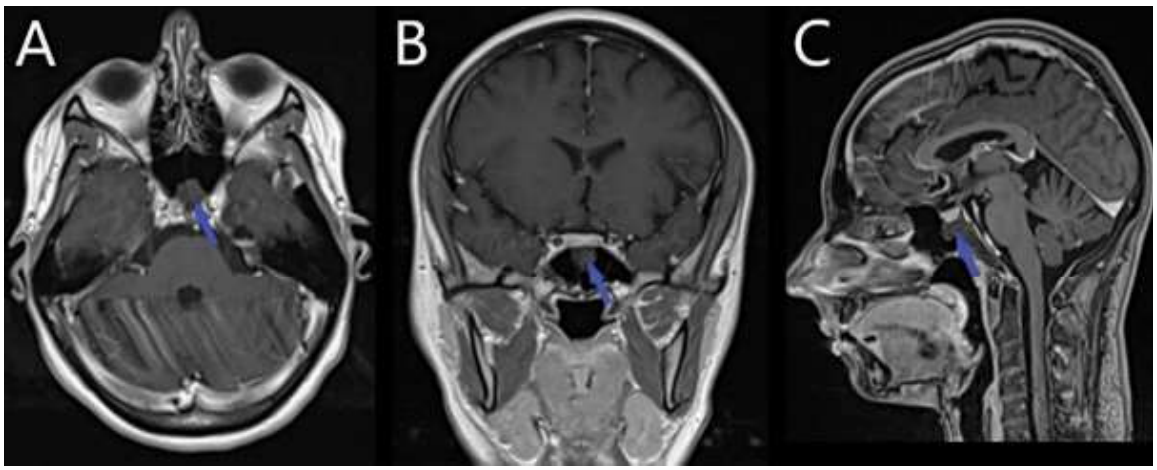

Fig. 2 (A, B, C). MRI of the brain and paranasal sinuses with intravenous contrast (gadolinium) in a T1-weighted sequence of the axial, coronal, and sagittal slices show a hypointense, moderately enhancing tumor formation within the sphenoid sinus (blue arrow)

The tumor does not compress the pituitary gland or neural structures, as it expands within the sphenoid sinus. A CT scan of the brain and paranasal sinuses confirmed the diagnosis of an osteoma of the sphenoid sinus (Figures 3 and 4).

The two imaging diagnostic methods are interconnected and contribute to the correct diagnosis. Such a finding is extremely rare, and there are few reports on this in the literature. Given the small size of the tumor, it should be monitored clinically through CT or MRI controls once a year. If the process increases and there is infiltration of the basal dura, surgical treatment can be performed through a microscopic sublabial, transsphenoidal approach or via an endoscopic endonasal transsphenoidal approach.

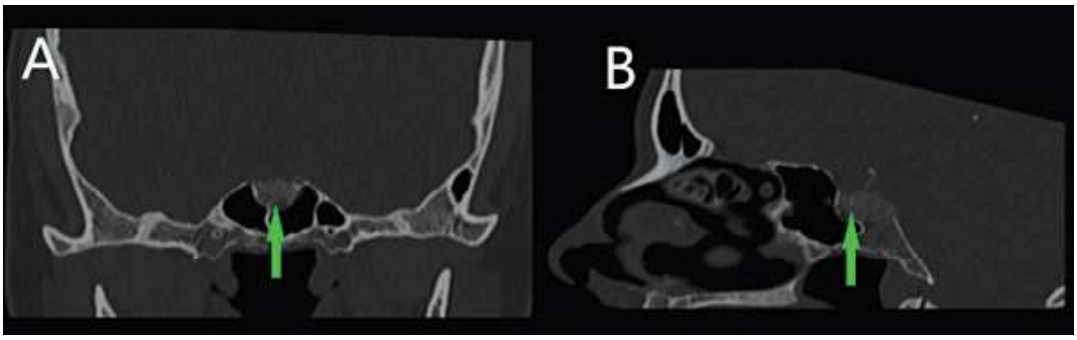

Fig. 3 (A and B). CT scan of the paranasal sinuses using a bone window. Panel A shows a coronal slice of the tumor with intensity identical to that of bone. Panel B displays a sagittal slice of the osteoma and its infiltration into the clivus and the floor of the sella turcica. The green arrow in both images indicates the tumor

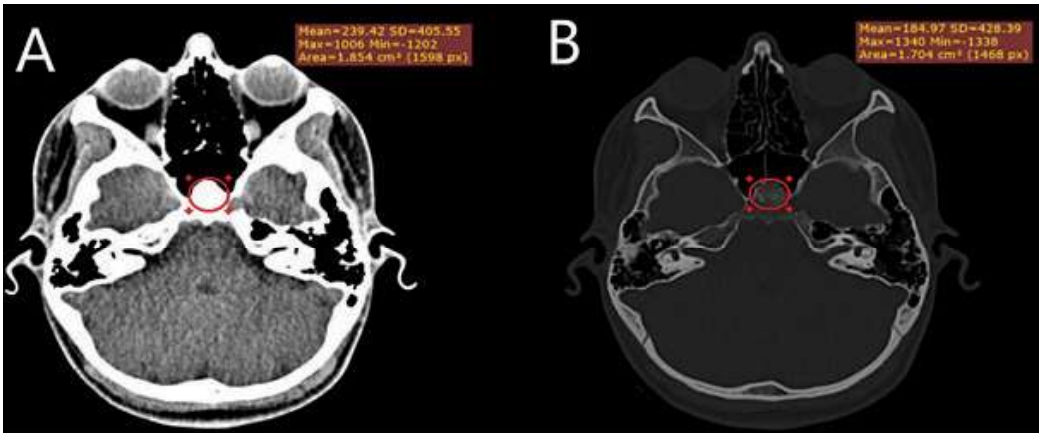

Fig. 4 (A and B). CT Scan of the Brain in Axial View.Panel A illustrates a CT scan showing the density of the brain parenchyma. Panel B highlights the density of the bone structures. A red circle marks the osteoma located in the sphenoidal sinus

DISCUSSION

The sphenoid sinus is located in the body of the sphenoid bone and communicates with the roof of the nasal cavity through the sphenoethmoidal recess. The two hemisinuses are separated by a septum, which is highly variable, but in most cases is located medially. The cavity of the sinus may show a number of septa and depressions associated with neighboring structures. These can include the pituitary gland, the optic nerve, and the internal carotid artery. In close proximity to the sphenoid sinus are the cavernous sinus and the passing neural and vascular structures, the middle cranial fossa, the clivus, and the brainstem located above it. The blood supply of the sphenoid sinus is provided by the posterior ethmoidal artery and the sphenopalatine artery, while venous drainage occurs through the superior ophthalmic veins from the system of posterior ethmoidal veins [2, 4].

Theories on Osteoma Development:

The exact causes of osteomas remain unclear, but several theories exist regarding their development:

I. Embryological theory

II. Traumatic theory

III. Infectious theory

Osteomas are most often diagnosed between the second and fourth decades of life. They arise from the surface of the periosteum as solitary expansive bony masses. According to the literature (Randachev Yu., M. Tsekova et al.), their distribution is as follows:

– Frontal sinus – 80%

– Ethmoidal air cells – 15%

– Maxillary sinuses – 5%

– Sphenoidal sinus – Rare

Extra-skeletal osteomas are most commonly observed in the buccal mucosa, tongue, and nasal cavity. Some paranasal osteomas can propagate into the nasal and oral cavities. They may cause displacement of the nasal septum, dental misalignment, and facial deformation [13].

Histological Structure:

The histological structure of an osteoma resembles normal bone tissue, but the arrangement of bone trabeculae is irregular. The tumor's density may vary depending on the ratio between the proliferating bone trabeculae and bone marrow spaces. Compact osteomas consist of mature lamellar bone under microscopic examination and lack Haversian canals and fibrous components. Trabecular osteomas are composed of trabecular bone with hematopoietic elements surrounded by cortical bone (Teodora Toteva-Petkova) [7, 13].

Cranial osteomas are slow-growing, benign tumors that contain compact or spongy bone tissue. They predominantly localize in the areas of the paranasal sinuses, the temporal bone, and much less frequently in the jawbones, with the frontal and ethmoidal sinuses being the most commonly affected [3, 5]. Involvement of the sphenoid sinus is extremely rare, accounting for only 4.9% according to literature data [6]. Statistically, these tumors develop with a known predilection for men, with their frequency ranging from 1-3%, and the male-to-female ratio is 2.6:1 [2]. However, they may be incidentally discovered more frequently in women due to the higher number of CT scans performed for headache investigations [2]. The majority of these neoplasms are asymptomatic, which explains their relatively rare diagnosis, usually during neuroimaging studies for other reasons. In osteomas located in the sphenoid sinus, the most commonly observed symptoms are headache, visual disturbances due to compression of the optic nerve, and, in rare cases, focal neurological symptoms [6]. Given the nature of the complaints of our patient, associated with dizziness and sensory disturbances in the right limbs, we can conclude that they exclude any connection between the symptoms and the present sphenoid osteoma, which is located far from the primary sensory cortex and pathways for surface and deep sensation.

The etiology of cranial osteomas is not well established, although hereditary factors are frequently discussed due to the known association of these tumors with congenital cholesteatomas and Gardner's syndrome. Frequent trauma at the sites of their formation, in addition to muscle activity and inflammatory foci, suggests a possible traumatic-inflammatory genesis [5, 7]. The relatively higher predilection for males may be due to the greater frequency of frontal injuries among men [2]. Nevertheless, a certain percentage of patients with osteomas lack any anamnesis of traumatic damage, pointing toward another non-hereditary cause – such as inflammatory diseases of the paranasal sinuses, leading to persistent local proliferation in the mucosal layer and enhanced osteoblastic activity [2].

Osteomas are classified into three types based on their macroscopic growth – central, growing into the bone; peripheral, growing in the periosteum; and extracostal, developing in soft tissue structures such as muscles [7]. Histopathology of these tumors is characterized by two main subtypes – those resembling compact bone with a lamellar structure, and those resembling spongy bone containing bone marrow [7].

The gold standard for diagnosing osteomas remains CT, as the neuroimaging characteristics of these neoplasms are almost identical to normal bone density, hyperdense, with an oval shape and sharply defined,

smooth edges. The histological variant resembling compact bone is very dense with uniform hyperdensity resembling ivory, while the spongy variant has a different density, resembling fibrous tissue [7]. Due to the characteristics of the latter, it can often be difficult to differentiate it from fibrous dysplasia, which has a similar radiological appearance of ground-glass [8]. In our case, initial MRI imaging revealed hypointensity on T1 and hyperintensity on T2, and after the administration of contrast, the tumor remained hypointense due to lack of contrast uptake. Despite the lower informative value of MRI compared to CT for imaging dense bone structures, MRI can distinguish certain soft tissue neoplasms in the sphenoid sinus, such as ectopic pituitary adenomas, and their anatomical relationship to the normal gland [9, 10].

For most asymptomatic osteomas, a wait-and-see approach with routine neuroimaging studies is recommended. The approach for our patient is similar, given the relatively small size of the tumor and the absence of any neurological deficit directly caused by it. Surgical intervention may be considered in cases with large tumors, focal symptoms, headache, or osteomas compressing adjacent structures [6]. Several surgical approaches to the sphenoid sinus exist, with the sublabial transseptal approach, transethmoidal, and transpalatal approaches having been routinely applied in the past [6, 11]. The introduction of the endoscopic transnasal approach has significantly changed the approach to surgical interventions in the sphenoid sinus, offering the surgeon a wide-angle view from multiple different projections. However, attention must be paid to the increased risk of involvement of neighboring vital structures due to the wide opening of the sinus [4]. When accessing the osteoma, the mucosal layer must be excised, the formation resected en bloc, or the tumor scraped using a drill [12].

CONCLUSIONS

Osteomas of the sphenoid sinus are rare benign tumors with slow growth and predominantly asymptomatic characteristics. When the tumor grows to sizes that compress neural structures, neurological symptoms from the cranial nerves appear. CT and MRI are the gold standard in diagnosing these types of tumors, and they are complementary examinations. In the absence of clinical manifestations related to the tumor, clinical observation is the best approach for such processes. Surgical treatment will establish the histological nature of the tumor but increases the risks of dural laceration and subsequent cerebrospinal fluid leakage or iatrogenic trauma to the vascular and nerve bundle in the parasellar area. Possible surgical approaches include the endonasal endoscopic approach to the sphenoid sinus or the sublabial microscopic approach.

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