

Pan Pneumosinus Dilatans Presenting with Chronic Headache in a Young African Patient

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ABSTRACT

Background: The facial bones are normally aerated in adulthood, thus reducing the weight of the skull bones. Pneumosinus dilatans (PSD) is a rare condition of unknown aetiology in which there is over aeration and enlargement of one or more paranasal sinuses. PSD may be primary or secondary

Case description: A 16-year-old male presented with recurrent headaches of 4 years' duration. There was no history or examination findings to suggest recurrent sinusitis. Computed tomography revealed enlargement of all paranasal sinuses without evidence of sinus obstruction. There was no facial asymmetry, and intracranial structures appeared normal. The patient was managed conservatively and is doing well. A review of the literature highlights the importance of radiologic investigations in the evaluation of PSD, especially in defining the extent and diagnosing associated conditions.

Conclusion: PSD is a benign condition which can be managed conservatively. Surgical intervention may be reserved symptomatic sinus obstruction or disfiguring changes.

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INTRODUCTION

Pan pneumosinus dilatans (PPSD) is an uncommon and distinct clinical entity characterized by the abnormal, progressive enlargement of all the paranasal sinuses (hyperpneumatization) without of bone erosion, destruction, or thinning. Unlike other sinus pathologies such as mucoceles or tumours, PPSD maintains the integrity of the bony sinus walls despite expansion. PPSD can be asymptomatic, with cases discovered incidentally, or present with clinical manifestations that range from facial deformity, headache, visual disturbances, to nasal obstruction, depending on the extent of sinus involvement and the pressure exerted on adjacent structures.

The aetiology of PPSD remains largely unknown. Hypotheses include congenital drainage aberrations, developmental anomalies, acquired factors such as chronic inflammation or hormonal influences. The diagnosis is primarily radiological, relying on characteristic imaging features seen on computed tomography (CT) scans that demonstrate uniform sinus expansion without bony erosion or inflammatory changes. Magnetic

resonance imaging (MRI) may be used adjunctively to assess surrounding soft tissue involvement and to exclude other pathological conditions.

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Due to its rarity, pan pneumosinus dilatans is often under-recognized and can be mistaken for other more common sinus disorders. Early and accurate diagnosis is essential to guide appropriate management and prevent potential complications such as optic nerve compression or intracranial extension. This case report describes a patient presenting with clinical symptoms attributable to PPSD, highlighting the diagnostic process, radiological findings, and the considerations for treatment in this rare but clinically significant condition.

CASE DESCRIPTION

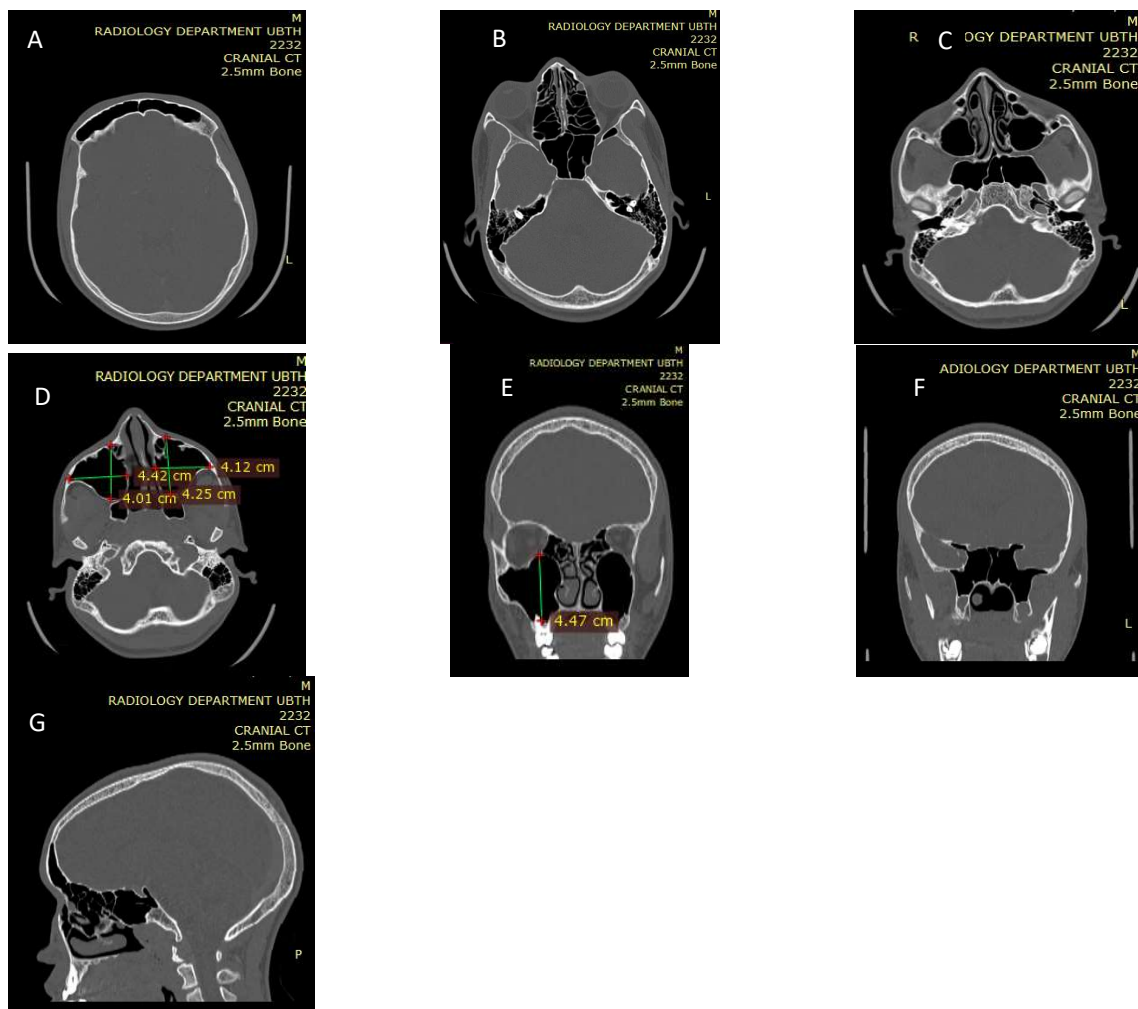
A 16-year-old male with complaints of recurrent headaches for nine years, throbbing in nature and of moderate to severe intensity. The headaches

localized to the fronto-parietal regions and occasionally occipital regions, precipitated by stress and last 2-6 hours, with a frequency of 2-3 episodes per week. There are no known relieving factors. He reported occasional feeling of fainting, but no nausea, vomiting, rhinorrhea or conjunctival injection. No history of head trauma was elicited. Review of systems did not reveal any gross abnormality. Clinical examination of the central nervous system and other systems were grossly normal. Laboratory tests done were grossly normal. He was assessed as a case of tension headaches and had a CT scan done.

Non-contrast computed tomography (CT) scan of the skull showed dilatation of all the paranasal

sinuses without thinning or erosion of the sinus walls. The right maxillary ostium, infundibulum and hiatus semilunaris were narrowed measuring 1.37mm, 1.21mm and 1.21mm respectively. The right maxillary ostium was stenosed, while the left maxillary sinus drained directly into the ethmoidal sinus which in turn drained into the middle meatus. The sphenoid sinus was also enlarged and over pneumatized, with involvement of the greater and lesser sphenoid wings. Bilateral pneumatization of the middle turbinates was also noted.

Given the absence of complications or disfigurement, he was managed conservatively with analgesics as needed and scheduled for regular follow-up.



FIGURES: Axial CT slices in bone window showing pneumatized sinuses; Frontal sinuses (A), Ethmoidal and Sphenoid sinuses (B), body and greater wing of sphenoid (C), maxillary sinuses (D,E) and sphenoid bone. Coronal (F) and sagittal (G) CT slices in bone window showing; pneumatization of the sphenoid bone up to the clinoid process and dorsum sellae

Table showing the dimensions of the right paranasal sinuses

	Height (cm)	width(cm)	Anteroposterior(cm)	Volume (cm ³)
Frontal	3.60	5.24	1.24	12.23
Ethmoidal	1.68	2.40	5.10	10.75
Maxillary	4.47	4.42	4.01	41.44
sphenoidal	2.21	3.29	3.39	12.89

Table showing the dimensions of the left paranasal sinuses

	Height (cm)	width(cm)	Anteroposterior(cm)	Volume (cm ³)
Frontal	3.27	4.64	1.47	11.67
Ethmoidal	1.64	2.24	4.26	9.47
Maxillary	4.83	4.12	4.93	43.29
sphenoidal	2.38	3.65	3.30	14.99

DISCUSSION

Pneumosinus dilatans is enlarged aerated paranasal sinus without, bony remodeling. The earliest description of pneumosinus dilatans was in 1898, when Meyers, described paranasal sinus enlargement for the first time and named it "pneumatocele" (Meyers, 1898). Pneumosinus dilatans as a term was first used by C.E Benjamin in 1918; where he described it as enlarged air filled paranasal sinuses with regular mucosa lining. Modern classification of abnormal sinus dilatation was proposed by Urken et al. (1987) They described three categories of sinus enlargement: hypersinus, pneumosinus dilatans, and pneumocele. Hyper sinus is simply over aeration of the sinus within its normal cavity. In pneumosinus dilatans, the sinus cavity is over aerated and expanded beyond its normal anatomical confines, but with preserved boundary structure; while in pneumatocele, the over aerated and expanded sinus has thin walls (Urken et al.,1987). Amusa et al. (2011) their study of dried human skulls, reported that the normal paranasal volumetry (cm³) among Nigerians for the frontal, ethmoidal, sphenoidal and maxillary sinuses respectively are 4.44, 5.08, 5.38 and 14.98 on the right and 3.35, 4.77, 4.23, and 14.98 on the left. In our case, the sinuses were over aerated, but with preserved wall thickness, measuring (cm³) 12.23, 10.75, 12.89 and 41.44 on the right, and 11.67, 9.47, 14.99 and 43.29 on the left for the frontal, ethmoidal, sphenoidal and maxillary sinuses respectively thus meeting the criteria for pneumosinus dilatans.

PSD can be can occur de novo (primary) or be preceded by an underlying pathology. The exact aetiology of primary sinus over aeration is unknown, although increased sinus pressure from sinus ostia obstruction has been suggested. Variation in the sinus drainage pathway resulting in ball valve mechanism that leads to progressive trapping of air in the sinus has also been discussed. Secondary PSD are usually syndromic, occurring in

association with brain agenesis or following reduced intracranial pressure and other causes of brain volume loss. PSD association with meningioma and arachnoid cyst has been described. Benjamin (1918) also described transformation of a mucocele to pneumosinus, due to the presence of gas producing bacteria. The normal paranasal sinuses are composed of the frontal, ethmoidal, sphenoidal and maxillary sinuses, which are connected serially to one another and eventually empty into the nasal cavity, via meati, in a system known as the osteomeatal complex. In our case, the patient had a variation in his osteomeatal complex, with a tortuous anomalous drainage pathway for the left maxillary sinus and narrowed right maxillary infundibulum., this may account for the poor sinus ventilation and progressive air trapping.

PSD is a rare condition, although the exact incidence of PSD is unknown, one article reported only 13 cases in 2019 (Sweatman & Beltechi, 2019). Studies have shown that males are more commonly affected than females (Amusa et al., 2011; Sweatman & Beltechi, 2019). In our case, the patient is male, conforming to the reported demographics. This is the first case of PSD to be reported in this region. PSD can be isolated to one or more of the paranasal sinuses, or involve the entire paranasal sinuses. When solitary, the frontal sinuses is most commonly affected, followed by the sphenoid, maxillary then ethmoid sinuses (Begum & Shirbadgi, 2018). The index patient had pan sinus involvement.

Patients with PSD can be asymptomatic, in which case they are detected incidentally, following investigation for other pathology. However, they could also present with progressive changing facial morphology, recurrent headaches, or recurrent sinus infections. In our case, the patient had recurrent headaches, but no significant change in facial morphology. However, if uncorrected, there

may be visual changes in morphology over time due to disease progression.

CONCLUSION

Pan-pneumosinus dilatans is a rare, benign condition characterized by over-aeration of all paranasal sinuses with intact bony walls. It may present with chronic headaches, facial changes, or be discovered incidentally. Computed tomography remains essential for diagnosis and for identifying drainage anomalies that may contribute to air trapping.

Management depends on symptoms: conservative care is appropriate for mild cases, while surgery is reserved for cosmetic deformity or sinus obstruction. This case emphasizes the value of imaging in early recognition and monitoring. Increased reporting, especially in African populations, will enhance understanding of this uncommon entity.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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