

# Pneumosinus Dilatans Frontalis- A Rare Anatomical Variation of Frontal Sinus

KHIZER HUSSAIN AFROZE, BS SURESH, SUBHASH LAKSHMIPRABHA

## ABSTRACT

Pneumosinus Dilatans Frontalis (PDF) is a rare malformation of the craniofacial skeleton, characterised by abnormal enlargement of frontal sinus beyond the normal dimension. PDF was observed during routine dissection of orbit in the 60-year-old male formalin fixed cadaver. Abnormal expansion of both frontal sinuses was observed which was extended upto the parietal bone. The sinus

was multi-loculated with multiple septations inbetween. Both the sinuses were asymmetrical with the left frontal sinus being comparatively larger than the right one. So far very few cadaveric reports have been documented because Pneumosinus Dilatans (PD) is often unexpected radiological findings. Here we are presenting a case report of PDF.

**Keywords:** Frontal sinusitis, Paranasal sinuses, Sinus barotrauma

## CASE REPORT

PDF was detected while removing calvarium in the 60-year-old male formalin fixed cadaver, during routine dissection of orbit for medical graduates at Sri Siddhartha Medical College. The dissection was carried out according to the Cunningham's manual of practical anatomy. Abnormal expansion of both frontal sinuses was observed between the two tables of squamous part of frontal bone which was extended upto the parietal bone [Table/Fig-1a]. The sinus was multi-loculated with multiple septations inbetween. Both the sinuses were asymmetrical with the left frontal sinus being comparatively larger than the right one [Table/Fig-1b,c].

## DISCUSSION

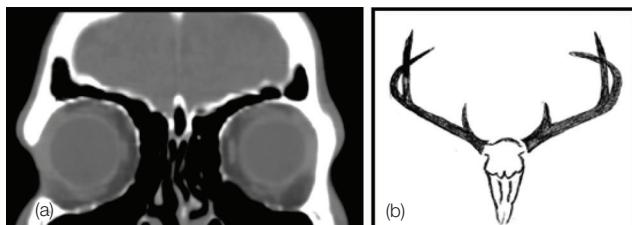
Sinus Pneumatocoele, now termed as PD is a rare malformation of the craniofacial skeleton, first described by Meyes (1898). Pneumocoele, hypersinus, pneumatocoele, hyperpneumatization and PD are terms used synonymously in literature for abnormal enlargement of paranasal sinuses [1]. However, Benjamin (1918) was the first person who coined the term PD. PD is described as an abnormal dilatation of one or more paranasal sinuses without any localized mass. Ricci JA et al., conducted an extensive review of the literature and reported the 134 cases of PD [2]. Among all the paranasal sinus, frontal sinus is one of the most commonly affected by PD followed by sphenoid sinus, ethmoid sinus, and maxillary sinus [3,4]. So far very few cadaveric reports have been documented because PD is often an unexpected radiological finding.



[Table/Fig-1a-c]: Images showing pneumosinus dilatans frontalis.

Pneumatization of paranasal sinuses begins as evaginations of the epithelial cells from the nasal cavity. Among the

entire paranasal sinus, frontal sinus is the only sinus which is rudimentary or which appears after birth. Pneumatization of frontal bone even continues after birth and completed after puberty [5,6]. The size and shape of the frontal sinus not only vary from side to side but also between individuals. The incidence of unilateral or bilateral frontal sinus hypoplasia or aplasia has been documented in the literature [5]. The average dimensions of the frontal sinus are 30 mm in height, 25 mm in width and 19 mm in depth [7]. If the aeration of the frontal sinus and pneumatization extends beyond the normal dimension then it is called as PDF. Pneumatization extends upto the parietal bone, if the squamous part of frontal bone is involved and it extends upto sphenoid bone, if the orbital part of frontal bone is involved. On coronal CT images, extended pneumatization of frontal sinus to the parietal bone may give an appearance of deer horn (deer horn sinus) [Table/Fig-2a,b].



**[Table/Fig-2a,b]:** (a) Coronal CT image showing deer horn appearance of pneumosinus dilatans frontalis; (b) Schematic presentation showing deer horn appearance of pneumosinus dilatans frontalis.

Many theories and hypothesis are revolving around this pathogenesis. The most accepted theory is one-way ball valve mechanism. This mechanism suggests that the expansion may be due to the progressive increase of the pressure within the sinus caused by one-way valve obstruction at nasal ostium [8]. The other proposed mechanism in the literature like the presence of gas forming micro-organisms especially bacteria, hormonal cause, congenital cause, and even trauma

or surgery may be one of the aetiology for this pathogenesis [1]. The most common clinical presentations are a local pain, ocular disturbances, headache, facial bossing and cosmetic disturbances. Anatomy of this sinus and possible variation should be borne in mind for diagnosing PDF. This will help in differentiating the PDF with mucocoele, fibrous dysplasia, and bony exostosis.

## CONCLUSION

PDF is a rare craniofacial pathogenesis, characterized by enlarged expansion of frontal sinus beyond the normal dimensions. It is advisable to have a CT-scan of brain and paranasal sinus to diagnosis and to establish a good preoperative plan for PDF.

## REFERENCES

- [1] Tellado MG, Mendez R, Lopez-Cedrun JL, Fantini M, Martin-Sastre R, Somoza I, et al. Pneumosinus dilatans of the frontal and ethmoidal sinuses: case report. Journal of Cranio-Maxillofacial Surgery. 2002;30(1):62-64.
- [2] Ricci JA. Pneumosinus dilatans: over 100 years without an etiology. J Oral Maxillofac Surg. 2017 Feb 21. pii: S0278-2391(17)30219-27.
- [3] Knapp FB, Klenzner T. Pneumocele as a rare differential diagnosis in trigeminal irritation. Am J Otolaryngol. 2003;24(4):236-38.
- [4] Purohit K, Purohit A, Palanisamy R. Pneumosinus dilatans: a cadaveric case report. Int J Med Res Prof. 2016;2(1):89-91.
- [5] Moideen SP, Khizer Hussain Afroze M, Mohan M, Regina M, Sheriff RM, Moideen CP. Incidence of frontal sinus aplasia in Indian population. Int J Otorhinolaryngol Head Neck Surg. 2017;3:108-11.
- [6] Duque CS, Casiano RR. Surgical Anatomy and Embryology of the Frontal Sinus. In: Kountakis SE, Senior BA, Draf W. The Frontal Sinus. Berlin, Germany: Springer-Verlag; 2005. p. 21-31.
- [7] Strong EB. Frontal sinus fractures. 2007. Available at :<http://www.emedicine.com/ent/topic419.htm>. [Accessed February 21, 2017].
- [8] Urken ML, Som PM, Edelstein D, Lawson W, Weber AL, Biller HF. Abnormally large frontal sinus. II. Nomenclature, pathology, and symptoms. The Laryngoscope. 1987;97(5):606-11.

## AUTHOR(S):

1. Dr. Khizer Hussain Afroze
2. Dr. BS Suresh
3. Dr. Subhash Lakshmi Prabha

## PARTICULARS OF CONTRIBUTORS:

1. Research Scholar, Department of Anatomy, Sri Siddhartha Medical College, Tumkur, Karnataka, India.
2. Professor, Department of Anatomy, Sri Siddhartha Medical College, Tumkur, Karnataka, India.
3. Professor and HOD, Department of Anatomy, Sri Siddhartha Medical College, Tumkur, Karnataka, India.

## NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Khizer Hussain Afroze,  
Research Scholar, Department of Anatomy,  
Sri Siddhartha Medical College,  
Tumkur-527107, Karnataka, India.  
E-mail: drafroze.homoeo@gmail.com

## FINANCIAL OR OTHER COMPETING INTERESTS:

None.

Date of Online Ahead of Print: **May 04, 2017**  
Date of Publishing: **Jul 01, 2017**