

# STUDY OF FRONTAL AIR SINUS OPENING IN HIATUS SEMILUNARIS OF NASAL CAVITY

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## ABSTRACT

**Background:** Frontal air sinus opens in Hiatus semilunaris of middle meatus of Nasal cavity. Nowadays plenty of endoscopic surgeries are happening at Middle meatus; so there is need to explore more about detail anatomy of opening of sinuses. So Present study was undertaken to note the exact site of opening of Frontal air sinus in Hiatus semilunaris of Nasal cavity.


**Context and Purpose of study:** Study was conducted on 50 specimens. Out of that 27 were from Right side & 23 were from Left side. The specimens were the sagittal sections of adult cadavers in the department of Anatomy, Krishna Institute of Medical sciences University, Karad. The parameters measured were, Distance of Frontal air sinus opening from Anterior end of Hiatus semilunaris (nasal bone). Distance of Frontal air sinus opening from Posterior end of Hiatus semilunaris (Inferior surface of Body of Sphenoid bone). Diameter of Frontal air sinus opening. Shape of Frontal air sinus opening. All these measurements were taken by Sliding Vernier Caliper of 30cm length & 0.001 accuracy.

**Results:** The mean Distance of Frontal air sinus opening from Anterior end of Hiatus semilunaris (nasal bone) was- 1.63cms on Left side & 1.52cms on Right side. The mean Distance of Frontal air sinus opening from Posterior end of Hiatus semilunaris (Inferior surface of Body of Sphenoid bone) was- 4.26 cms on Left side & 4.17cms on Right side. The mean Diameter of Frontal air sinus opening – 0.19cms on Left side & 0.18cms on Right side. The shape of Frontal sinus opening is mainly Circular.

**Conclusion and Summary:** Knowledge of the anatomy of the Frontal air sinus opening is basically helpful for the Anatomists, to know where exactly is the site of the opening of Frontal air sinus in the middle meatus of nasal cavity; And secondarily it might be helpful to ENT surgeons during the performance of endonasal cystorhinostomies.

**KEY WORDS:** Frontal air sinus, Middle meatus of Nose, Hiatus semilunaris, Nasal cavity, Frontal air sinus opening.

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## INTRODUCTION

Frontal air sinus is one of the Paranasal air sinuses. Paranasal air sinuses drain into the Lateral wall of the Nasal cavity. Frontal air sinus drains by frontonasal duct which opens into the anterior end of the middle meatus of the Nasal cavity [1].

Normal drainage of the paranasal sinuses depends on effective mucociliary clearance; this is dependant on the condition of the sinus ostia [2]. The two of the largest sinuses, the frontal and maxillary, communicate with the middle meatus via narrow and delicate prechambers [3].

It is generally held that the frontal sinus commences to develop at the end of the first or the beginning of the second year of life, as an upward expansion of the ethmoid cell labyrinth. Together, the frontal sinus and the superior compartment of the Frontal Sinus Drainage Pathway resemble an Erlenmeyer flask with the neck of the flask representing the frontal ostium. Anatomical variation of the lateral nasal wall, including the pathway from the frontal, ethmoidal, and maxillary sinuses may affect the communication between the paranasal sinuses and the nasal cavity. The middle meatus and hiatus semilunaris are areas where variations can occur which predispose patients to recurring sinusitis.

When surfaces become more closely apposed due to mucosal swelling, the ciliary action is immobilized. This impairs the ventilation and drainage of larger sinuses, result in mucus stasis, predispose to further infection and establish a vicious cycle, causing chronic sinusitis. The key region for these changes is that part of the lateral nasal wall that encloses the sinus ostia and their adjacent mucosa and prechambers [4].

There is considerable anatomical variation in this area that may interfere with normal nasal function and predispose to recurrent or chronic sinusitis [4]. Because of these reasons current study of frontal air sinus opening is undertaken. Lateral wall of the Nasal cavity (Photograph-1) shows Hiatus semilunaris below the Middle nasal choncha. Frontal air sinus opens into the Hiatus semilunaris.

**Fig. 1:** Lateral wall of the nasal cavity.

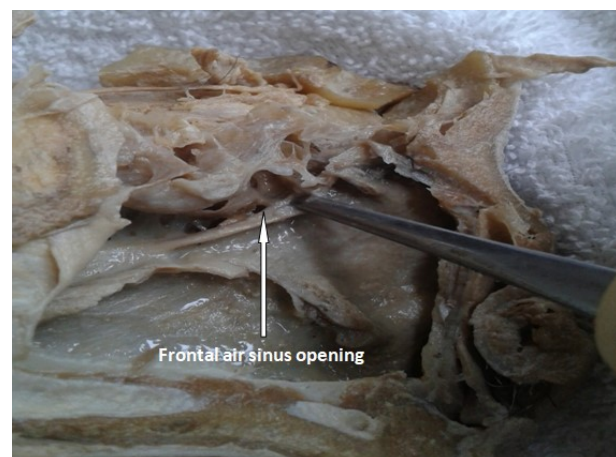


## MATERIALS AND METHODS

This study was carried out on the cadaveric specimens in Krishna institute of medical sciences, Karad, Maharashtra, India.

Total 50(fifty) specimens were studied. Out of that, 23(twenty three) were from Left side, and 27(twenty seven) were from Right side. Formalin preserved cadaveric specimens were taken. Then they were first washed. Then by using Dissection instruments, Lateral wall of the Nasal cavity was nicely exposed. Middle nasal concha is properly dissected, so as to expose the Hiatus semilunaris. Then opening of the Frontal air sinus was noted. The distance of Frontal air sinus opening from Anterior end of Hiatus Semilunaris was measured by using Sliding Vernier Caliper. The distance of Frontal air sinus opening from Posterior end of Hiatus Semilunaris was also measured. Then Diameter of Frontal air sinus opening was measured. Shape of the Frontal air sinus was noted.

**Fig. 2:** Opening of the Frontal air sinus.



After dissection of middle nasal choncha , Hiatus semilunaris is nicely exposed. Openings of

the paranasal air sinuses are seen. Photograph-2 shows exact opening of the Frontal air sinus. Opening of the Frontal air sinus is shown by the tip of the arrow.

**Statistical analysis:** Quantitative data was summarized into maximum, minimum, mean and Standard Deviation; while Qualitative data was summarized into number & percentages. Comparison of quantitative data was done by applying unpaired 't' test while chi-square test was used for qualitative data comparison. Correlation coefficient was determined by using Pearson's correlation method. Difference and Correlation was said to be significant if p was less than 0.05.

## OBSERVATIONS AND RESULTS

The various parameters of Distance of Frontal air sinus opening from Anterior end of Hiatus Semilunaris are shown in Table-1. Distance of Frontal air sinus opening from Anterior end of Hiatus Semilunaris hasn't shown any significant difference as comparison of sides are considered ('t' value- 1.118, 'p' value- 0.2692 ).

**Table 1:** Distance of Frontal air sinus opening from Anterior end of Hiatus Semilunaris (cm).

	Right side	Left side
Maximum	2.42	3.37
Minimum	0.72	1.15
Mean	1.52	1.63
Standard deviation	0.4	0.49

Parameters of Distance of Frontal air sinus opening from Posterior end of Hiatus Semilunaris are shown in Table-2. Sidewise difference in the case of Distance of Frontal air sinus opening from Posterior end of Hiatus Semilunaris is also not significant ('t' value- 0.2447, 'p' value- 0.8078).

**Table 2:** Distance of Frontal air sinus opening from Posterior end of Hiatus Semilunaris (cm).

	Right side	Left side
Maximum	6.38	6.76
Minimum	2.05	2.33
Mean	4.17	4.26
Standard deviation	1.33	1.38

Diameter of opening of the Frontal air sinus in Hiatus semilunaris on Right & Left side shows following results (Table-3)

**Table 3:** Diameter of opening of the Frontal air sinus in Hiatus semilunaris on Right & Left side (cm).

	Right side	Left side
Maximum	0.39	0.31
Minimum	0.05	0.11
Mean	0.18	0.19
Standard deviation	0.08	0.06

Diameter of opening of the Frontal air sinus in Hiatus semilunaris on Right & Left side doesn't show statistically significant difference ('t' value- 0.4741, 'p' value- 0.6376 ).

Shape of the opening of the Frontal air sinus in Hiatus semilunaris was mainly Circular on the Right as well as on the Left side (Table-4).

**Table 4:** Shape of the opening of the Frontal air sinus in Hiatus semilunaris.

	Right side			Left side		
Type	No	Total	%	No	Total	%
Oval	6	27	22.2	6	23	26.09
Circular	21	27	77.8	17	23	72.91

## DISCUSSION

Average Diameter of the opening of Frontal air sinus into the Hiatus semilunaris, according to our study is: on Right side is 0.18cm & on the Left side is 0.19cm. As per the study of Landsberg R et al [5], Average anteroposterior diameter of the opening of Frontal air sinus into the Hiatus semilunaris is 7.2 mm and transverse diameter is 8.9 mm.

Our study shows Shape of the opening of the Frontal air sinus into the Hiatus semilunaris is mainly Circular, 77.8% on the Right side and 72.9% on the Left side.

According to our study the Frontal air sinus opens into the anterior part of Hiatus semilunaris. Gray's anatomy mentions opening of the Frontal air sinus into the upper and anterior part of the Hiatus semilunaris [15]. Our study correlates with that. According to article in AJNR, left side shows multiple openings of the frontal sinuses [8]. According to D'Souza et al [10], sinus opens into the osteomeatal complex. Osteomeatal complex is the term used for a group of anatomical structures that contribute to the final common drainage pathway of Maxillary, Anterior Ethmoidal and Frontal sinuses [12]. Frontal sinus open into the hiatus semilunaris in the middle meatus [16].



Frontal sinus opens in the infundibulum which is at the anterosuperior end of the hiatus semilunaris [17]. The frontal sinus ostium opens inferiorly into the frontal sinus recess [14]. One particular type of frontal sinus cell is a single isolated cell that exists completely within the frontal sinus and has no connection to the frontal recess [18]. Where the sinus frontalis has two nasofrontal ducts, the drainage is of course partly into the middle meatus and partly into the infundibulum ethmoidale [13]. As far as our study is concerned, in all cases, Frontal air sinus opens by one way only, and that into the anterior part of the Hiatus semilunaris.

### CONCLUSION

Frontal air sinus opens into the Anterior part of the Hiatus semilunaris. Average distance of Frontal air sinus opening from Anterior end of Hiatus Semilunaris is 1.52cm on the Right side & 1.63cm on the Left side. Average distance of Frontal air sinus opening from Posterior end of Hiatus Semilunaris is 4.17cm on the Right side & 4.26cm on the Left side. Average diameter of Frontal air sinus opening on Right side is 0.18 cm & on the Left side is 0.19 cm. Shape of the opening of the Frontal air sinus into the Hiatus semilunaris, is mainly Circular. The anatomical variants of the paranasal sinuses are not incidental, being found in a large number of patients and may be a predisposing factor in the onset and recurrence of sinuses inflammation [6].

The endoscopic bidimensional vision offered by the endoscope during endoscopic sinus surgery involves difficulty in visualizing surgical field depth which makes it difficult to learn this surgical technique and makes it necessary for the endoscopic surgeon to mentally create a three-dimensional (3D) picture of the paranasal sinuses anatomy, In particular, Frontal recess surgery [7].

Surgery on the frontal recess and frontal sinus remains a challenge for endoscopic sinus surgeons. An increased understanding of the anatomy of this region should improve the surgeon's surgical confidence and ability to remove all the obstructing cells from the frontal sinus ostium [9].

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### Conflicts of Interests: None

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