



Original Article

Anatomical Variations in Superior Attachment of Uncinate Process on CT Nose and Paranasal Sinus

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Received: 01-09-2025

Accepted: 02-01-2026

Available online: 26-03-2026

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ABSTRACT

BACKGROUND: Uncinate process is considered as one of the most important surgical landmarks. Its superior attachment shows great anatomic variability. During endoscopic sinus surgeries, the uppermost segment of uncinat process is a blind spot for the surgeons. Thus, the aim of this study was to observe the superior attachment and presence of any other variation in uncinat process, knowledge of which may reduce the rate of complications during endoscopic sinus surgery.

MATERIAL AND METHOD: This cross sectional observational study was conducted by Postgraduate Department of Anatomy in collaboration with Department of Radio-diagnosis and Imaging, Government Medical College, Srinagar . This study was done on 200 cases. Non-contrast CT scan Nose and Paranasal sinuses (NCCT Nose & PNS) was done. The superior attachment of uncinat process was noted in 400 sides and categorized. Besides any variations in uncinat process were also studied.

RESULTS: In our study of 200 cases (400 sides), in majority i.e. 317 (79.25%) sides uncinat process was superiorly attached to Lamina papyracea (type 1), in 61 (15.25%) attached to skull base (type 2) and in 22 (5.50%) sides uncinat process was attached to middle turbinate (type 3). Our study makes trend of type 1 > type 2 > type 3. Also, In 200 cases, pneumatized UP was found in 4 (2.00%) cases, 3 (1.50%) on left side and 1 (0.50%) on right side while only in 1 (0.50%) case hypertrophied UP was found on left side.

CONCLUSION: It is necessary for the surgeon to be cognizant of any of the uncinat process variations in the patient undergoing functional endoscopic sinus surgery especially when an uncinatotomy is planned.

Keywords: uncinat process, CT scan, anatomical variations, superior attachment.

INTRODUCTION

The uncinat process is a saber-shaped ethmoid bone that attaches to the lateral nasal wall through multiple bony and fibrous attachments. It is a thin bony process projecting posteroinferiorly from ethmoidal labyrinth. It performs a functional role in the ventilatory physiology of the nasal cavity and the paranasal sinuses. During endoscopic sinus surgeries, the uppermost segment of uncinat process is a blind spot for surgeons.^{1,2} The superior attachment of the uncinat process may alter the tract of frontal sinus outflow which predispose to development of frontal sinusitis.³ The uncinat process is considered to be as one of the most important surgical landmarks of the lateral nasal wall for endonasal sinus surgeries. Normal variations in the morphology of the uncinat process give rise to several patterns of drainage from the osteomeatal complex (Isobe, 1998). Pneumatization of the uncinat process is an anatomic variation that can impair sinus ventilation, especially in the anterior ethmoid, frontal recess, and infundibular regions .⁴ Any abnormal growth or excessive pneumatization of the uncinat process can narrow down and ultimately obstruct the outflow tract of multiple sinuses. It also has been implicated as a possible etiologic factor in some cases of recurrent sinusitis and headaches.⁴ However, pneumatization of the uncinat process is an uncommon variation.

The uncinate process, being one of the first structures encountered intraoperatively, hence given immense surgical importance now a days.⁵ Preoperative detection of anatomic variations of the uncinate helps to avoid intra-operative damage to important structures like the nasolacrimal duct, medial orbital wall, sphenopalatine artery etc.^{6,7} Special care should be taken in order to avoid aggressive traction and torque on the upper tip of the uncinate process during uncinectomy, which may inadvertently damage the ethmoid roof. On the basis of superior attachment, uncinate process is classified as Type 1-Insertion of uncinate process into the lamina papyracea, Type 2-Insertion of uncinate process into the roof of the ethmoid (the skull base) and Type 3-Insertion of uncinate process into the middle turbinate. Common uncinate process anomalies include laterally or medially deviated uncinate process, hypertrophied uncinate process and pneumatization of uncinate process. Rarely, the uncinate process may be entirely absent.

MATERIAL AND METHOD

This cross sectional observational study was conducted by Postgraduate Department of Anatomy in collaboration with Department of Radio-diagnosis and Imaging, Government Medical College, Srinagar . This study was done on 200 cases. In this study cases with any history of trauma, previous surgery or pathology distorting normal anatomy in sinonasal region were excluded. The cases of age<20 years were excluded due to the developmental stages of the paranasal sinuses .Non-contrast CT scan Nose and Paranasal sinuses (NCCT Nose & PNS) was done using Siemens Somatom Emotion 16 slice Multidetector Spiral CT scan. The mode of attachment of the uncinate process was carefully studied so as to ascertain the pathway of drainage of frontal sinus. The images were analyzed to see the superior attachment of uncinate process in coronal plane. The superior attachment of uncinate process was classified as Type 1-Insertion of uncinate process into the lamina papyracea, Type 2- Insertion of uncinate process into the roof of the ethmoid (the skull base) and Type 3-Insertion of uncinate process into the middle turbinate. The superior attachment of uncinate process was noted in 400 sides and categorized. Besides any variations in uncinate process were also studied. A pre structured proforma was used to collect relevant data. Photographs generated were photographed at appropriate window widths and window level to depict the anatomical variant.

Technical parameters of CT scan

KV	130
mA	26
Pitch	0.8
Slice thickness	3mm
Window	2000/400HU

RESULTS

In our study of 200 cases (400 sides), in majority i.e. 317 (79.25%) sides uncinate process was superiorly attached to Lamina papyracea (type 1), in 61 (15.25%) attached to skull base(type 2) and in 22 (5.50%) sides uncinate process was attached to middle turbinate(type 3) as shown in table no.-I. In our study of 200 cases, pneumatized UP was found in 4 (2.00%) cases, 3 (1.50%) on left side and 1 (0.50%) on right side while only in 1(0.50%) case hypertrophied UP was found on left side as can be read from table no.-II

TABLE-I: SUPERIOR ATTACHMENT OF UNCINATE PROCESS ON NCCT NOSE & PNS (N=200, TOTAL NO OF SIDES=400)

Uncinate process Superior Attachment	Right	Left	Total no of sides	Total percent(%)
Type 1 (Lamina papyracea)	160	157	317	79.25
Type 2 (Skull base)	32	29	61	15.25
Type 3 (Middle turbinate)	8	14	22	5.50
Total	200	200	400	100.00

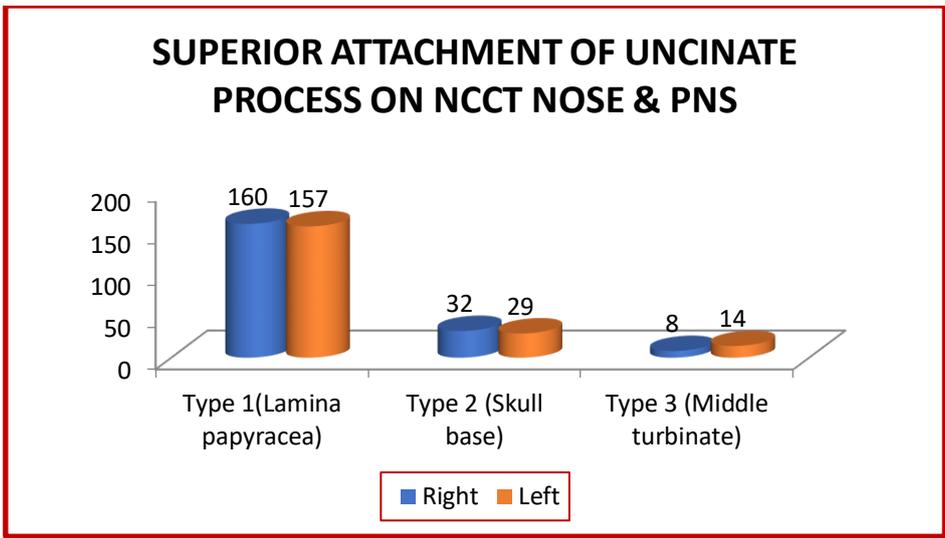
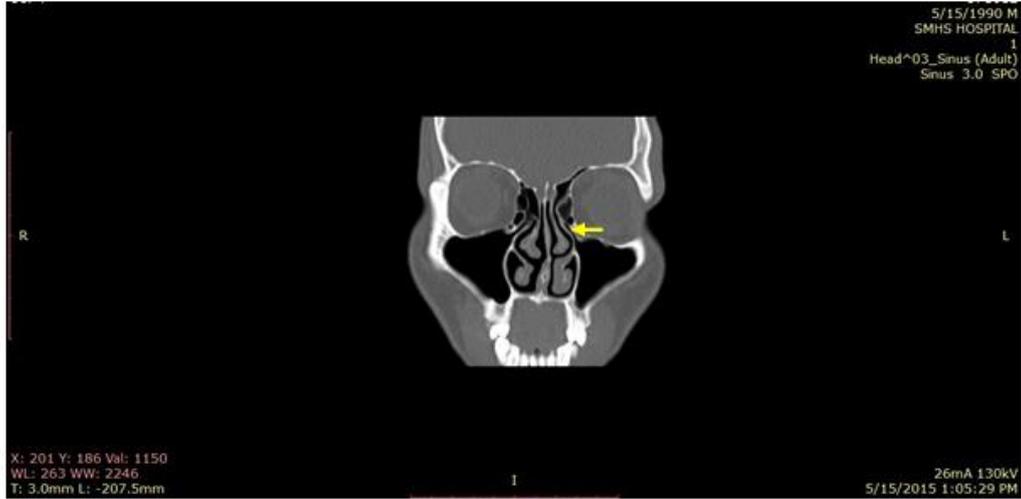


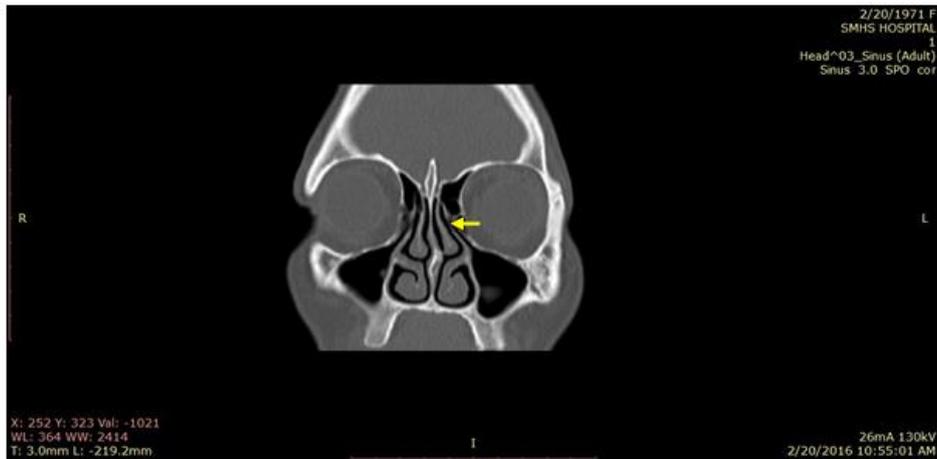
TABLE-II: VARIATIONS IN UNCINATE PROCESS ON NCCT NOSE & PNS (N=200)

Variations in Uncinate Process(UP)	No. of cases			Percent(%)		
	Right	Left	Total	Right	Left	Total
Pneumatized UP	1	3	4	0.50	1.50	2.00
Hypertrophied UP	----	1	1	---	0.50	0.50
No variations		195			97.50	
Total		200			100.00	

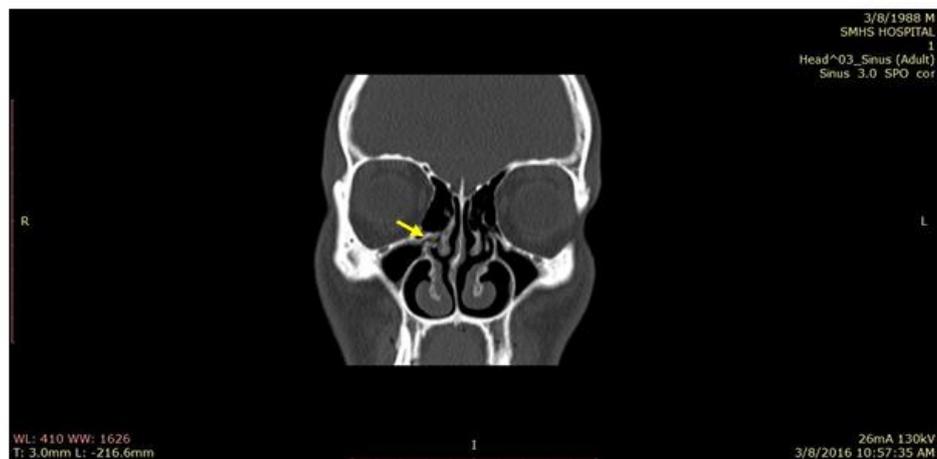
Computed tomography (CT) scan



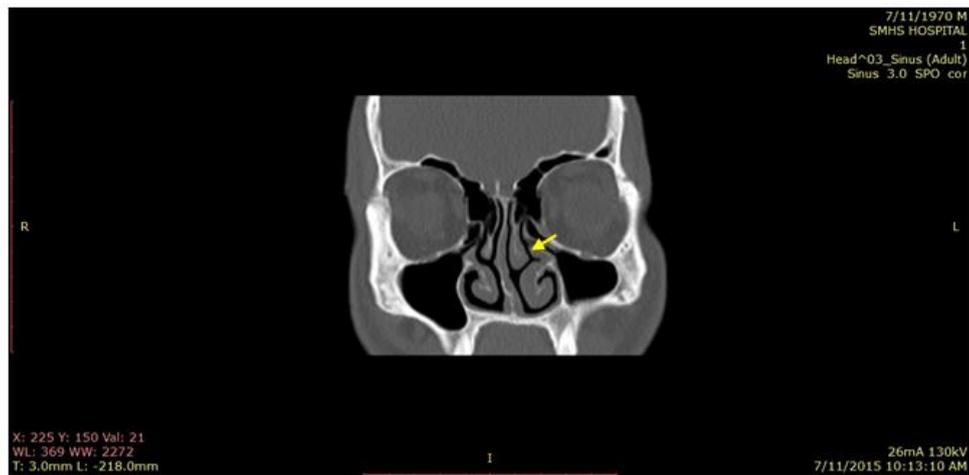
The coronal computed tomography (CT) scan showing Type 1 uncinat process superior attachment (arrow)



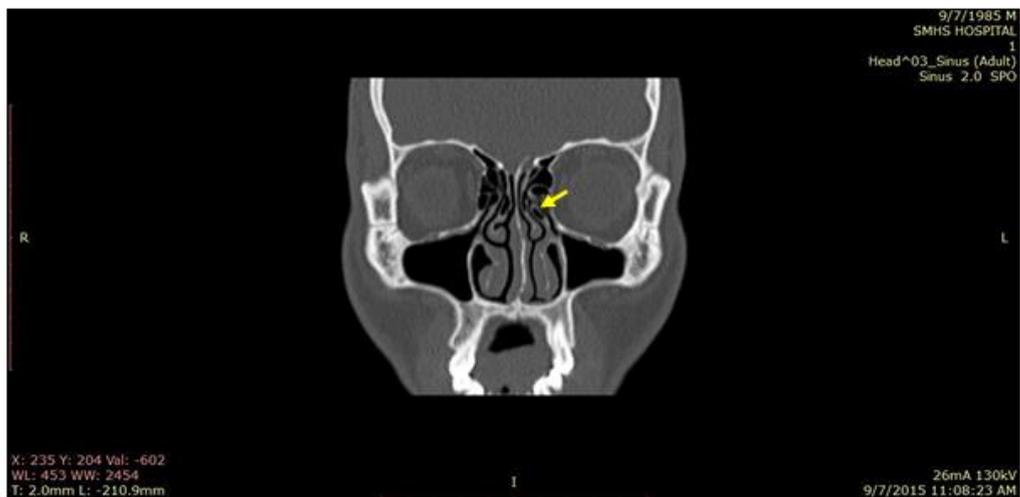
**The coronal computed tomography (CT) scan showing Type 2
uncinate process superior attachment (arrow)**



**The coronal computed tomography (CT) scan showing Type 3
uncinate process superior attachment (arrow)**



The coronal computed tomography (CT) scan showing hypertrophy of uncinate process on left side (arrow)



The coronal computed tomography (CT) scan showing pneumatization of uncinate process on left side (arrow)

DISCUSSION

Osteo meatal region is frequently prone for anatomical variations that results in osteomeatal obstruction and blockage of mucus drainage leading to chronic rhinosinusitis. One of such variation is different patterns in superior attachment of uncinata process that impairs ventilation of anterior ethmoid, frontal and infundibular sinus regions leading to chronic pathology warranting uncinectomy⁸. Injudicious removal of the uncinata process especially in cases with allergic rhinosinusitis can result in exposure of the sinus mucosa to contaminated air thereby causing persistent or even worsening of the mucosal disease in the ethmoid cavity and its dependent sinuses.⁹ Some of authors are of opinion that uncinata process probably prevents direct ventilation of sinuses with contaminated inspired air.^{10,11}

In our study of 200 cases (400 sides), most common in 317(79.25%) sides uncinata process was superiorly attached to lamina papyracea (type 1), in 61 (15.25%) sides attached to skull base (type 2) and in 22 (5.50%) sides uncinata process was attached to middle turbinate (type 3). Our study makes trend of type 1>type2>type3. Isha Preet Tuli et al (2013)¹² evaluated 50 patients of chronic sinusitis (100 sides) in India. They reported Type I uncinata process in 79.8 %. Type II uncinata process was seen in 16.67 % and Type III was seen in 3.57 %. Another Indian study by Gnanavelraja C et al (2014)¹³ reported Type 1 uncinata process in 59%, Type 2 uncinata process in 24% and Type 3 uncinata process in 17.5%. The results of our study concerning superior attachment of uncinata process are quite consistent with the results

made by above mentioned Indian studies. In all studies mentioned above the most common type of attachment was to lamina papyracea, similar to trend as reflected in our study.

In present study, pneumatized UP was found in 4 (2.00%) cases, 3 (1.50%) on left side and 1 (0.50%) on right side. Also a single case of hypertrophied UP (0.50%) was found on left side. Indian studies by Isha Preet Tuli et al (2013)¹² and Partha Sarathi Sarkar et al (2016)¹⁴ found pneumatization of uncinat process in 4% and 2.6% respectively on NCCT Nose and PNS. Also retrospective study done in Romania by Vasilica Baldea et al (2012)¹⁵ reported pneumatization of uncinat process in 3.41%. Asif A Wani et al (2009)¹⁶ studied CT scans of 150 patients with chronic rhinosinusitis and reported hypertrophied uncinat process in 14% cases. In 10% cases hypertrophied uncinat process was present unilaterally and in 4% bilaterally. Our observations concerning the pneumatization of uncinat process is in accordance to that observed by above mentioned authors while our observation concerning hypertrophied uncinat process is very less as compared to Asif A Wani et al (2009)¹⁶. It may be attributed to fact that study done by them was conducted on symptomatic patients with chronic rhinosinusitis in which medical treatment for atleast 6months had failed while no such inclusion criterion were in our study.

CONCLUSION

Accurate knowledge about the anatomical variants of the Uncinat process is critical for surgeons, especially with the advent of functional endoscopic sinus surgery(FESS). It is necessary for the surgeon to be cognisant of any of the uncinat process variations in the patient undergoing FESS especially when an uncinatotomy is contemplated.

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