



## “Anatomical Variations of the Uncinate Process–A CT Scan Imaging Study”

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**Abstract: Background:** The uncinat process is a thin sickle shaped, hook like projection on the lateral wall of nose and medially it covers the maxillary and frontal sinus ostium. It is the key in the bony structures of the ethmoid in the lateral nasal wall, defining the semilunar hiatus together with the ethmoid bulla. **Aim Of This Study:** The aim of this study is to investigate the frequency of these variations in patients with sinonasal symptoms. **Materials and Methods:** This study was conducted in the Department of Otolaryngology at Combined Military Hospital, Rangpur and *Border Guard Hospital, Dhaka* during the period from April 2019 to July 2020. A total of 116 patients with the symptoms of nasal obstruction, nasal discharge, post nasal drip and headache patients who have been diagnosed clinically with chronic rhinosinusitis and nasal polyp willing to undergo endoscopic sinus surgery and high-resolution computerized tomographic (HRCT) scanning of paranasal sinuses were included in the study. **Results:** Among the 116 cases, normal angulation were found in 86 (74.13%) cases on the right side and 91(78.44 %) cases on the left side. Among the study population pneumatization were identified in 34 (14.65 %) cases. Among the study population pneumatization were identified in 34 (14.65 %) cases. Regarding the variations in the superior insertion lamina papyracea were most common on both right and left side. **Conclusion:** A sound knowledge of its variations is important not only for diagnosis but also for planning surgery in order to avoid complications. The study was performed to be investigate the frequency of anatomical variations of uncinat process on CT.

**Keywords:** Ostiomeatal complex Anatomical variations, Computed tomography.

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## INTRODUCTION

In the anterior ostiomeatal complex, there are different anatomical variants, isolated or associated<sup>1</sup>. Most of the anatomical variants involve the concha bullosa, paradoxical middle turbinate, nasal septum deviation, pneumatization of agger nasi cells and ethmoid bulla, presence of haller's cells, onodi cells, pneumatization of vomer and

anomalies of the uncinat process (UP)[1, 2]. UP is a thin sickle shaped, hook like projection on the lateral wall of nose and medially it covers the maxillary and frontal sinus ostium. Both of its medial and lateral surfaces are covered by mucosa [3, 4]. It extends from the frontal recess superiorly and inferiorly to the ethmoid process of inferior turbinate. Normally, it is inserted inferiorly in the posteromedial portion

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of the agger nasi cells of ethmoid bone. When it inserts itself into other structures, it can lead to obstructions [3, 1]. Its concave postero superior free margin is parallel to the anterior surface of the ethmoid bulla. The superior aspect of the uncinat tip may deviate laterally, medially or anteriorly out of the meatus, appearing as a second middle concha. When deviated medially, it comes into contact with and compromises the middle meatus. When deviated laterally, it may encroach on the hiatus semilunaris and infundibulum, impeding drainage and ventilation of the anterior ethmoidal, frontal and maxillary sinuses [5, 6]. The most common anatomical variants of UP are represented by: angulation degree (normal, medialization, lateralization), pneumatization, superior insertion (into a less usual topographical area lamina papyracea, skull base, insertion of the middle turbinate), deformation of the free extremity, elongation with doubling of the middle turbinate contour (in this case, it participates in the formation of the double middle turbinate or duplicate turbinate) [1]. The UP is not only a important structure of osteomeatal complex; it also plays an important role in the ventilatory mechanisms within the nasal cavity by directing the contaminated inspired air away from the sinuses and the more sterile expired air into the sinuses [7]. Injudicious or ill-judged removal of the UP during endoscopic sinus surgery, especially in cases associated with nasal allergy can cause persistent or even worsening of the mucosal disease in the ethmoid cavity and its dependent major sinuses [7, 8]. The study was performed to evaluate and determine the frequency of anatomical variations of uncinat process on CT.

## MATERIALS AND METHODS

This study was conducted in the Department of Otolaryngology at Combined Military Hospital, Rangpur and Border Guard Hospital, Dhaka during the period from April 2019 to July 2020. A total of 116 patients (232 sides CT scans) with the symptoms of nasal obstruction, nasal discharge, post nasal drip and headache patients who have been diagnosed clinically with chronic rhinosinusitis and nasal polyp willing to undergo endoscopic sinus surgery and high-resolution computerized tomographic (HRCT) scanning of paranasal sinuses were included in the study. Patients with a history of previous endoscopic sinus surgery, with chronic sinusitis responding to medical management were excluded. A written consent was taken from every case. A detailed history and a thorough clinical examination were done. Diagnostic nasal endoscopy and HRCT scanning of paranasal sinuses (coronal, axial and sagittal) were done to assess the anatomy and variations of the uncinat process.

## RESULTS

The total number of patients enrolled in this study was 116, thus 232 sides of nose and paranasal sinuses CT images were evaluated in the study. Distribution of cases according to age and sex of the patient was shown in the table-I. The study enrolled a total of 116 patients with chronic sinusitis, among them 63 (54.31%) were male and 53 (45.69%) were female with a ratio of 1.4: 1. Age group of the cases ranged between 15 - 70 years. Majority of the cases 61 (52.58%) were in the age group of 21-34.

**Table-1: Distribution of cases according to age and sex of the patient.**

Age group	Male	Female	Total
11 - 20	11	10	21
21 - 30	17	15	32
31 - 40	16	13	29
41 - 50	10	08	18
51 - 60	7	5	12
61-70	2	2	04
Total	63 (54.31%)	53 (45.69%)	116

In the table-2, distribution of cases according to the degree of angulation of the uncinat process was shown. The degree of angulation of the uncinat process was evaluated for the three variants, both on the left and right side. Among the 116 cases, normal angulation were found in 86

(74.13%) cases, vertical were in 18 (15.51%) and horizontalization were found in 12 (10.34%) cases on the right side. While on the left side 91(78.44 %) cases were found normal angulation, 11 (9.48 %) were vertical angulation and 14 (12.06%) were horizontalization.

**Table-2: Case distribution according to the angulation of the uncinete process.**

Uncinate process angulation		No. of cases	Percentage
Right	Normal	86	74.13%
	Vertical	18	15.51 %
	Horizontal	12	10.34 %
Total		116	100 %
Left	Normal	91	78.44 %
	Vertical	11	9.48 %
	Horizontal	14	12.06
Total		116	100 %

Pneumatization is an uncommon anatomic variation of the uncinete process that can impair sinus ventilation, specifically in the anterior ethmoid, frontal recess and infundibular regions are shown in the Tables-3. Among the study population

pneumatization were identified in 34 (14.65 %) cases. Among them unilateral variant were present in 14 (6.03 %) cases and bilateral pneumatization of the uncinete process were present in 6 (2.28 %) subjects (Table-IV).

**Table-3: Distribution of cases on either presence or absence of pneumatization of the uncinete process.**

Cranio-facial CT scan	No. of cases	Percentage
Pneumatization were absent	198	85.34 %
Pneumatization were present	34	14.65 %
Total	232	

**Table-4: Variations on the pneumatization type of the uncinete process.**

Uncinate process pneumatization	No. of cases	Percentage
Unilateral	14	6.03 %
Left	9	3.87 %
Right	5	2.15 %
Bilateral	6	2.28 %

Variations in the superior insertion of the uncinete process are presented in Table-5. On the right side insertion into the lamina papyracea were most common and seen in 72 (62.06 %) cases. Insertion into the skull base were observed in 21 (18.10 %) and insertion into the middle turbinate

were observed in 10 (8.62 %) cases. While on the left side insertion into the lamina papyracea were most common and seen in 76 (65.51 %) cases. Insertion into the skull base were observed in 20 (17.24 %) and insertion into the middle turbinate were in 9 (7.75 %) cases.

**Table-5: Variations in the superior insertion of the uncinete process.**

Superior insertion of the uncinete process		Number of Case	Percentage
Right	Into the lamina papyracea	72	62.06 %
	Into the skull base	21	18.10 %
	Into the middle turbinate	10	8.62 %
	Other insertions (superior turbinate, ethmoid bulla)	8	6.89 %
	Multiple insertions	5	4.31 %
		116	
Left	Into the lamina papyracea	76	65.51 %
	Into the skull base	20	17.24 %
	Into the middle turbinate	9	7.75 %
	Other insertions (superior turbinate, ethmoid bulla)	7	6.03 %
	Multiple insertions	4	3.44 %
		116	

**DISCUSSION**

Out of 116 patients presented to us with chronic sinusitis, males 63 (54.31 %) outnumbered the females 53 (45.69 %) with a ratio of 1.4: 1. Majority of the cases 61 (52.58 %) were in the age

group of 21 - 34. In a study done by Kansu L found males more than females. He found 396 were males (54.5 %) and 331 females (45.5 %) with a male to female ratio of 1.19: 1 [9]. In another study done by Arun G et al found 61 males and 39 females with a

ratio of 1.56: 1[3]. Study done by Tuli IP et al. also found males more than females with a ratio of 1.94: 1. They also found the age group of 21–35 (38 %) was the most affected [10]. In another study MK Gupta et al showed 52 % patients were female and 48 % patients were male and male to female ratio was 1.08: 1. Majority of patients, 44 % were in age group of 31-40 years [4]. Aramani A et al found 32 females and 22 males with male to female ratio was 1: 1.45. In their study 73 % of the patients were relatively younger as they were either equal to or less than 40 years of age with equal proportion of the patients in the age groups of 21-30 and 31-40 years [11]. In the present and other studies found males more than females but study done by Aramani A et al. found females more than male. In the present study, among the 116 cases, normal angulation were found in 86 (74.13 %) cases, vertical were in 18 (15.51 %) and horizontalization were found in 12 (10.34 %) cases on the right side. While on the left side 91(78.44 %) cases were found normal angulation, 11 (9.48 %) were vertical angulation and 14 (12.06 %) were horizontalization. In a study done by Tuli IP et al. found typical uncinat process in 70 % cases and variations in 30 % cases. The identified incidence of medially deviated uncinat process in 24 %, lateral deviation in 2 % [10]. Baldea V et al found normal angulation in 159 (77.56 %) cases, verticalization in 14 (6.82 %) subjects and horizontalization in 32 (15.60 %) cases on the left side. On the right side 162 (79.02 %) found normal angulation, 31 (15.12 %) were verticalization and 12 (5.85 %) were horizontalization [1]. In the present study pneumatization of the uncinat process were identified in 34 (14.65 %) cases. Among them unilateral variant were present in 14 (6.03 %) cases and bilateral pneumatization were present in 6 (2.28 %) subjects. In a study Kumar NV found 34 (17 %) of the uncinat process was pneumatised, among which 45.5% was unilateral and 54.5 % bilateral [12]. In another study Kale S and Preetha K found uncinat process pneumatized in 6 % cases. Of these, left-sided pneumatization (4 %) were the most common ones while bilateral pneumatization (2 %) were the least common [13]. Baldea V identified the pneumatization of the uncinat process in 7 (3.41 %) patient. Bilateral pneumatization was present in 3 (1.46 %) and the unilateral variant in 4 (1.95%) cases [1]. In another study Yenigün A et al identified uncinat process pneumatization in 6.26 % patients with 1.60 % being bilateral, 2.53 % on the right only, and 2.13% on the left side only [14]. Regarding the variations in the superior insertion of the uncinat process, we found insertion into the lamina papyracea in 72 (62.06 %) cases on the right side and in 76 (65.51 %) cases on the left side. In a study Kansu L found type 1 or insertion in to the lamina papyracea in 288 (19.8 %) cases [9]. While Landsberg R and Friedman M found attachment to

the lamina papyracea in 52 % [15]. Arun G et al. also found most common pattern of superior attachment of the uncinat process was Type I, which accounts for 67.5 % cases [3]. In another study Tuli IP et al. found Type I or attachment to lamina papyracea in 67 (79.8 %) cases. In our study we found attachment into the skull base in 21 (18.10 %) cases on right side and 20 (17.24 %) on the left side [10]. Kansu L found type 5 or skull base is the point of attachment in 174 (12.0 %) cases, [9] and Shivaraj R et al. showed attachment to the skull base in 34 (34 %) sides [16]. In another study done by Baldea V found attachment into the skull base in 12 (5.85 %) cases on the left side and 10 (4.88 %) cases on right side [1]. Insertion into the middle turbinate was observed in 10 (8.62 %) cases on the right side and 9 (7.75 %) cases on the left side in the present study. Kansu L observed type 3 or where middle turbinate and cribriform plate join are the points of attachment in 212 (14.5 %) cases [9]. Landsberg R and Friedman M found attachment to the junction of the middle turbinate with the cribriform plate in 7% cases [15] and Shivaraj R et al. showed attachment to the middle turbinate in 13 (13 %) sides [16]. Arun G et al found attachment to middle turbinate or type 3 attachment in 9.5 % cases [3]. In another study Tuli IP et al. identified Type 3 or attachment to the middle turbinate in 3 (3.57 %) of 84 sides [10]. Regarding the superior attachment some of the other study results are closure to us and did not match with our study.

## CONCLUSIONS

In conclusion, bony anatomical variations of the uncinat do not appear to influence the occurrence of rhinosinusitis and thus indiscriminate uncinectomy is to be condemned. Intrinsic mucosal disease is probably of much more importance than the bony anatomy. There are still many lacunae in our knowledge. Influencing factor of the superior attachment of the uncinat process in development of chronic rhinosinusitis needs further exploration. Those who lack a good grasp of anatomy are prone to commit serious and sometimes even fatal mistakes. Despite knowing the various anatomical and pathological variations of uncinat process, we are yet to fully identify how it varies the course of chronic sinusitis.

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