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A Descriptive Study of Anatomical Variations of Uncinate Process on Sinonasal Computed Tomography

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Abstract

Aim: The purpose of our study was to assess various anatomical variations of the uncinate process of the lateral nasal wall and to study the clinical association of its anatomical variations on computed tomography. **Methods**: A descriptive study of anatomical variations of the uncinate process with clinical association was undertaken in the Department of Ear, Nose & Throat of a Medical College and Tertiary Health care centre. The study was of 2 years duration and included 50 patients from August 2014-2016 and included 50 patients. Patients were selected according to a specified criteria and sinonasal computed tomography scans were undertaken with the help of Somatom Emotion 6 CT machine. Data was organised charted and analysed using statistical software SPSS 16. **Results**: The key findings in our study were that six types of anatomical variations of uncinate process and there frequency distribution was identified according to Landstiener and Friedman classification. Uncinate process types according to age and gender were charted and tests of association were applied. **Conclusion**: After statistical analysis we found no association between type of uncinate process and sinonasal symptoms. No association was seen between age and gender and variations of uncinate process. In our study, variation of superior attachment of uncinate process were found in 100% cases.

Keywords: Lateral Nasal Wall, Sinonasal Computed Tomography, Uncinate Process, CT-PNS

1. Introduction

The uncinate process of the lateral nasal wall is the key landmark principle to Functional Endoscopic Sinus Surgery and is the first structure removed. Preoperative detection of anatomic variations helps to avoid intra operative damage to the nasolacrimal duct, medial orbital wall, sphenopalatine artery, etc which is therefore important surgically[1]. The uncinate process attaches anteriorly to the bone of the lateral nasal wall at a sharp angle and inferiorly provides the bony connection with the inferior turbinate.If the uncinate process attaches to the orbit laterally the ethmoidal infundibulum ends in a superior blind alley of the terminal recess[2]. If the uncinate process reaches the skull base or turns medially to attach to the middle turbinate of the ethmoidal infundibulum which is contiguous with the frontal recess superiorly.

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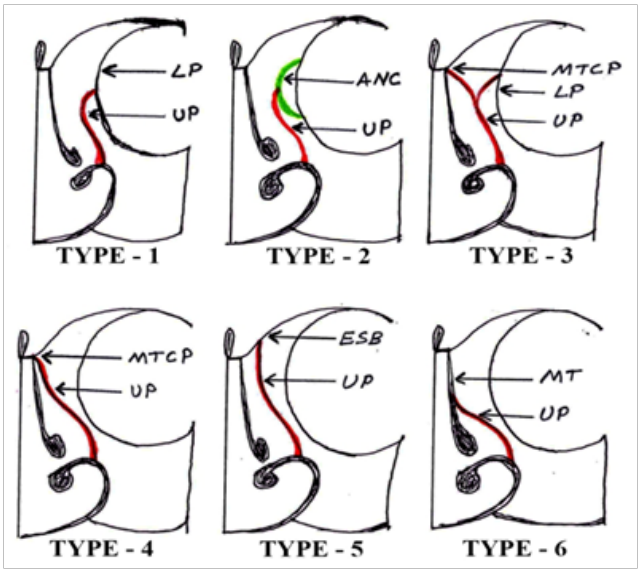


Figure 1. Types of uncinate process based on their superior attachments.

Types of uncinate process based on their superior attachments in figure 1.

Type 1: Insertion into the Lamina Papyracea (LP).

Type 2: Insertion into the posterior wall of Aggernasi Cell (ANC).

Type 3: Insertion into the lamina papyracea and junction of the Middle Turbinate with the Cribriform Plate (MTCP).

Type 4: Insertion in to junction of the middle turbinate with the cribriform plate.

Type 5: Insertion into the Ethmoid Skull Base(ESB).

Type 6: Insertion into the Middle Turbinate (MT)[3].

A study had classified 3 types where the uncinate process is attached superiorly to lamina papyracea or ethmoid skull base or middle turbinate while categorizing deviations and pneumatizations separately[4].

2. Aims and Objectives

1. To study various anatomical variations of the uncinate process of the lateral nasal wall.
2. To study age and gender association of anatomical variations of uncinate process on computed tomography.

3. Materials and Methods

Type of study: Descriptive study

Study settings: Department of Ear Nose Throat in Tertiary Health care centre.

The study duration was for a period of 2 years from August 2014 to August 2016

Study population: 1) Sample Size: 50 Patients 2) Eligibility Criteria a) Inclusion criteria: All patients who undergo computed tomography of paranasal sinus, for pathological symptoms related to nose b) Exclusion criteria: i) Patient with a) Nasal and Nasopharyngeal trauma b) Oral and oropharyngeal trauma. c) Malignancy of nose and paranasal sinus. ii) Patients not willing to give informed consent. A total of 50 consecutive patients were included after they satisfied the eligibility criteria. Written informed consent was obtained from all the study participants. A detailed history along with a general and specific examination of the ear, nose and throat was done and findings were recorded in a predesigned proforma. Computed tomography of paranasal sinus was done by Seimens Single Source Somatom Emotion 6 slice Computed Tomography Machine were recorded in predesigned proforma. The sino-nasal CT findings were charted according to Landsberg and Friedman classification and tabulated. Data was charted and analysed using statistical software SPSS 16(Statistical Packages for Social Sciences).

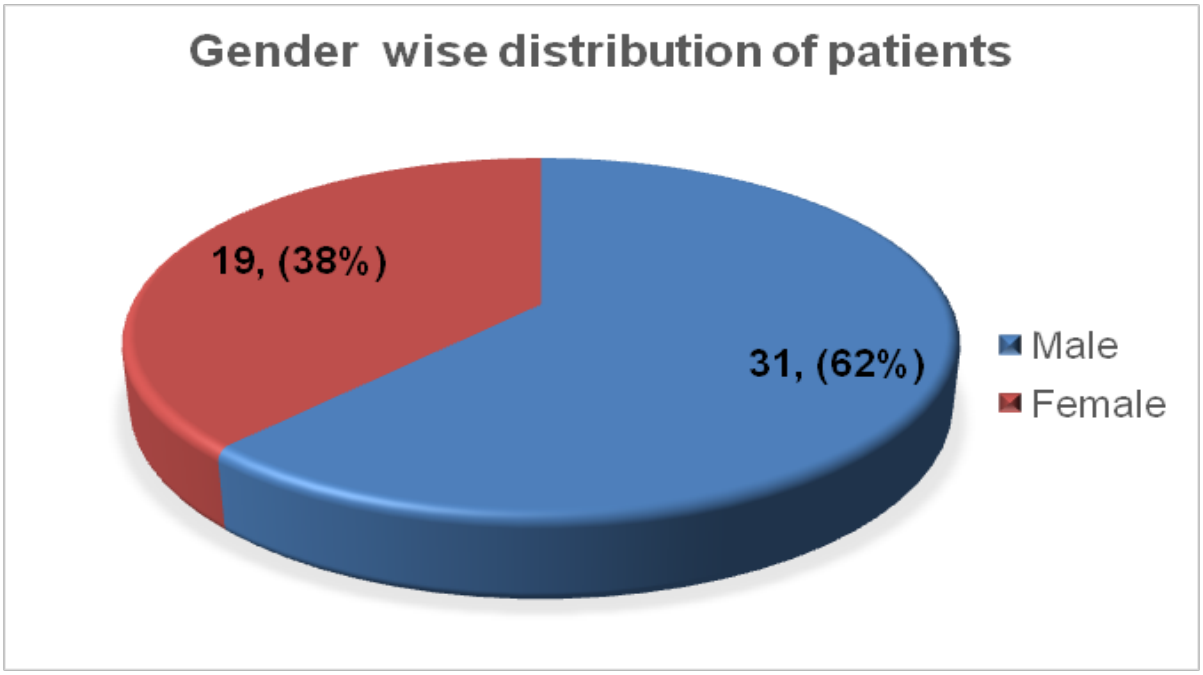
4. Results

During the period of 2 years of study 50 patients who fulfilled our inclusion criteria were studied out of which there were 19 females (38%) and 31 male (62%) participants (graph 1).

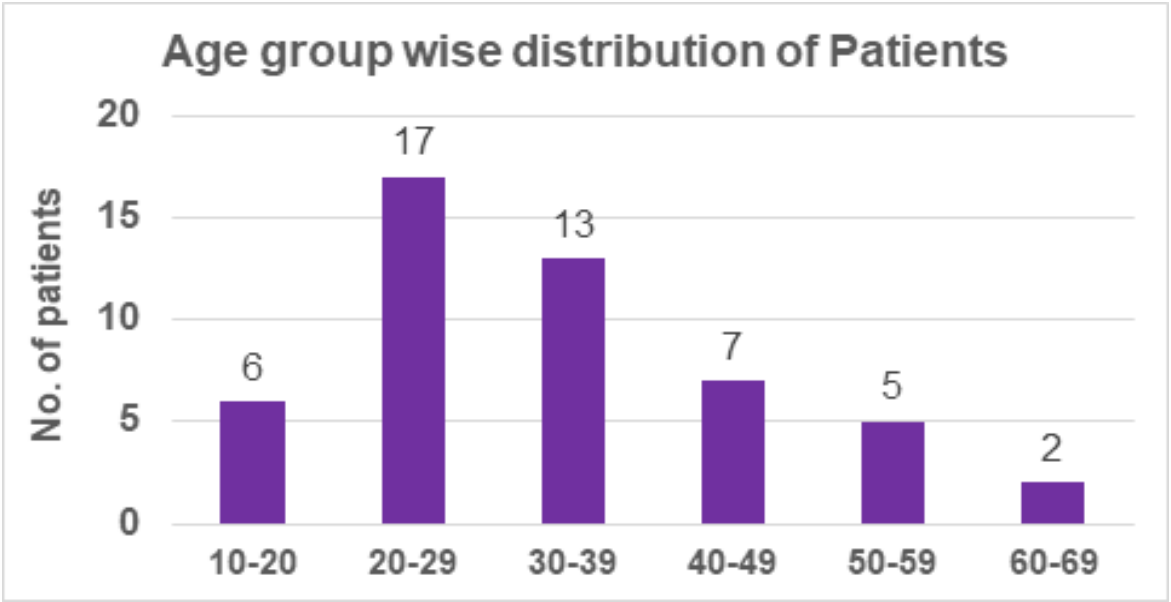
There were 6 (12%) patients in the 10 - 20 years age group, 17 (34%) in 20 - 29 years, 26% in 30 - 39 years, 14% in 40 - 49%, 10% in 50 - 59 years, 4% in 60 - 69% who were included in the study (graph 2).

Out of 50 cases studied CT Scan detection of anatomic variation of uncinate process were noted ,in which 48% inserted into lamina papyracea (16%) uncinate process inserted into aggernasi,(12%) inserted into lamina papyracea and junction of middle turbinate with MTCP (2%) inserted into the middle turbinate (12%) inserted into ethmoidal skull base (10%) (graph 3).

Data was analyzed with the help of statistical software and Chi-Square Tests was applied to detect the association of anatomic variations of uncinate process according to sex,age and symptoms of patients.

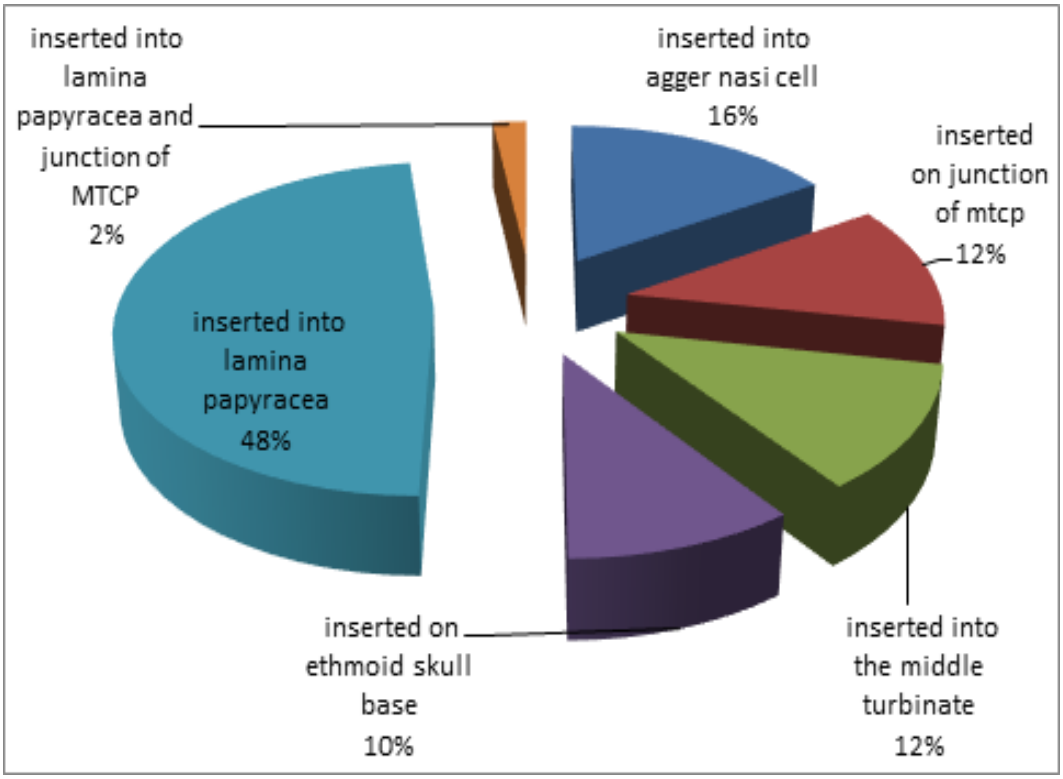


Graph 1. Gender wise distribution of patients.



Graph 2. Age group wise distribution of Patients.

Anatomic variations of uncinate process detected on sinonasal computed tomography were charted in frequency distribution table in relation to gender of patient (graph 4). Insertion of uncinate process into the aggernasi cell was found in 5 males and 3 females, insertion into the ethmoid skull base was found in 4 males and 1 female, insertion into the lamina papyracea in 14 males and 10 females, insertion into lamina papyracea in



Graph 3. Anatomical variations of uncinate process.

Graph 4. Anatomic variation of uncinate process according to sex

Uncinate Process	Sex		Total
	Male	Female	
Inserted Into Lamina Papyracea	14	10	24
Inserted Into posterior wall of AggerNasi Cell	5	3	8
Inserted Into Lamina Papyracea And Junction Of MTCP	0	1	1
Inserted On Junction Of MTCP	5	1	6
Inserted Into Ethmoid Skull Base	4	1	5
Inserted Into Middle Turbinate	3	3	6
Total	31	19	50
Chi-Square value 3.983 Degrees of freedom: 5			

P value=0.552 (not significant)

Graph 5. Anatomic variation of uncinate process according to sex Anatomic variation of uncinate process according to age

Uncinate process	Age						Total
	10-19	20-29	30-39	40-49	50-59	60-69	
Inserted Into Lamina Papyracea	6	9	4	3	1	1	24
Inserted Into AggerNasi Cell	0	3	4	0	1	0	8
Inserted Into Lamina Papyracea And Junction of MTCP	0	1	0	0	0	0	1
Inserted on Junction of MTCP	0	1	2	3	0	0	6
Inserted Into Ethmoid Skull Base	0	2	2	0	1	0	5
Inserted Into Middle Turbinate	0	1	1	1	2	1	6
Total	6	17	13	7	5	2	50

Chi-Square value=28.673Degrees of freedom:25 p value=0.278(not significant)

one female and insertion into the junction of MTCP was found in 3 males while 3 females had the uncinate process inserted into the middle turbinate, finally 5 males and 1 female had the uncinate process inserted in the junction of MTCP.

The p value was 0.552 on chi square test which was less than 0.05, and therefore the variations of uncinate processes were not statistically significant.

Anatomic variations of uncinate process detected on sinonasal computed tomography were charted in frequency distribution table in relation to age group of patient. In chart number 5 there is frequency distribution table between types of uncinate process and age group of patients. In type 1 there were 6 patients in the age group of 10-19 years, 9 in 20-29,4 in 30-39,3 in 40-49, 1 in 50-59, 1 in 60-69. In type 2 there were 3 patients in age group of 20-29, 4 in 30-39,1 in 50-59.In type 3 only 1 patient that was in age group of 20-29 years. In type 4 only one patient was in age group of 20-29years, 2 in 30-39and 3 in 40-49 years.In type 5, 2 patients were there in age group of 20-29 years, 2 in 30-39 years, 3 in 40-49 years. In type 6 there was 1 patient in each age group of 20-29, 30- 39, 40-49, 60-69 years and 2 patients in age group of 50-59 (graph 5).

5. Discussion

Uncinate process is an important landmark in anatomy of osteomeatal complex of frontal recess which plays crucial role in ventilation of middle meatus and paranasal sinuses[5-9]. Process is a constant anatomical structure seen in lateral nasal wall. The function of uncinate process is not known and is presumed as vestigial remnant in the process of its development[10,11]. Now uncinate process rather than being just a vestigial remnant, performs a definite functional role in ventilatory physiology of nasal cavity and sinuses[12].

The uncinate process being one of the first structures encountered intraoperatively, is now given immense surgical importance[9,13,14]. Uncinate process is a part of osteomeatal region and it is frequently prone for anatomical variation that results in osteomeatal obstruction and blockage of mucous drainage leading to chronic rhinosinusitis. One such variation is deviation in superior attachment of uncinate process that impairs ventilation of anterior ethmoid, frontal, infundibular

sinus region leading to chronic pathology warranting uncinectomy[4]. Few other authors opine that uncinate process prevents direct ventilation of sinuses with contaminated inspired air.[5,9,15,16]

Superior attachment of uncinate process had been studied and documented. Zienereich et al first observed that the uncinate process may be curved or bent, impairing sinus ventilation especially in the anterior ethmoid,frontal recess and infundibulum[8].

In our study variation of superior attachment of uncinate process were found in all 100% cases. 30% was reported in Aiyer et al., study[17]. 2% in Asruddin et al., study[18]. 45% reported by Wanamaker[19] and 65% reported by Mamatha *et al.*,[20].

The most commonly seen superior attachment in our series was type 1 uncinate process 48% cases this was higher than that reported by Krzeski et al.,[21] (17.83%), Lansberg and Friedman[3] (52%). Type II uncinate process was the second most common seen in 16% cases and type IV & VI in 12% cases and type V seen in 10 % of cases. Type III uncinate process was seen in 2% these were lower than that reported by Krzeski et al.,[21] of type II being 33.12% and type III 14.33%. However in these studies the most common type attachment was to lamina papyracea which is similar to our study and Krzeski et al.,[21] found least common to skull base but in our study we found least common type attachment was to MTCP type III.

In our study we found no statistically significant relationship of anatomical variation of uncinate process with regards to age and sex of the patient which as also reported by Santos Jr et al., study[23].

In our study we found no statistically significant relationship when we compare anatomical variants incidence in relationship of symptoms like need to blow nose, sneezing, runny nose, cough, post nasal discharge, thick nasal discharge, ear fullness, ear pain/pressure, sense of smell/taste, nasal blockage and headache. Tonai and baba analyzed studies of PNS of 75 adult patients and he also showed no significant difference on comparision of anatomic variants incidence in the symptomatic and asymptomatic groups[24].

The incidence of pneumatization of uncinate process from previous reports ranged from 0.4%-4% and among them few studies have also described 0.5-2.5% extensive pneumatisation of uncinate bulla[19,20,24–26]. Also a study declared that anterosuperior region was the predominant position for pneumatization[9]. It has been proposed that pneumatization is due to growth of aggernasi cell into the most antero-superior region of uncinate process[27] but in our study we did not find any patient with pneumatization of uncinate process.

Few studies had described deviation of uncinate process either medially or laterally leading to the narrowing of the infundibulum, frontal and anterior ethmoidal recess producing impaired sinus ventilation in maxillary, frontal and ethmoidal sinus[1,7,9]. We did not include association of uncinate process directed medially laterally or straight.

6. Conclusion

Uncinate process is an important landmark in Functional endoscopic sinus surgery.Uncinate process is highly variable in anatomy. Sinonasal computed tomography is necessary for evaluation of uncinate process.Superior attachment of uncinate process is most commonly inserted on the lamina papyracea or laterally directed. There is no association between anatomical variation of the uncinate process with sinonasal symptoms.The present study has its own limitation of having less sample size so it is suggested to increase sample size to give significant contribution for clinical implications. It is important for surgeons to be aware of variations that may predispose patients to increased risk of intraoperative complications. The present study is a step to provide suggestive findings to surgeons regarding various parameters involved and our contribution to enormous work of other research workers.

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