Original Research Article

"Anatomical variations of uncinate process in a tertiary care hospital of a coastal city in Karnataka

Runningtitle-Anatomical variations of uncinate process

Abstract

INTRODUCTION:

Superior attachment of uncinate process is the most important anatomical landmark in frontal recess surgery. The uncinate process; an integral structure of osteomeatal complex; prevents the direct contact of the inspired air with the maxillary sinus, hence acting like a shield. It also plays a role in the muco-ciliary activity.

The preoperative detection of anatomic variations of the uncinate process helps to avoid intra-operative damage to the nasolacrimal duct, medial orbital wall, sphenopalatine artery etc. thereby explaining its surgical significance.

AIM:

This study was done to know the different variations of superior attachment of uncinate process.

MATERIALS AND METHODS

A retrospective observational descriptive study was done in which Computed Tomography (CT) scans of 256 patients from the department of Radio-diagnosis were analyzed from 29-09-2018 to 20-05-2020.

RESULTS

Among 256 CT images 139 belonged to males and 117 females.In the CT films examined, on the right side the most common attachment of uncinate was to lamina papyracea which was (64.8%) followed by skull base (19.5%) and to the middle turbinate(15.6%). Similar findings were seen on left side.

CONCLUSION

Uncinate process shows different variations in its superior attachment. Superior attachment to lamina papyracea was the most common attachment of uncinate in our study.

KEY WORDS

Uncinate process, skull base, middle turbinate, lamina papyracea

Introduction

Blumenbach first identified uncinate process in 1790. It is sickle shaped, sagittally oriented and runs from anterosuperior to posteroinferiorly in ethmoid labyrinth. Its posterior border is bulla ethmoidalis. Anteriorly the uncinate lies along the nasal wall (lateral), can reach as far as lacrimal bone. It terminates by reaching the ethmoidal part of inferior concha inferiorly. Superiorly uncinate is hidden by middle turbinate. The attachment of uncinate is variable superiorly. The relationship of the ethmoidal infundibulum to skull base and frontal recess varies subject to the attachment of uncinate superiorly. (1)

The vital anatomical landmark in frontal recess operation is the attachment of uncinate superiorly. Frontal sinus surgery has always been challenging to ENT surgeons due to its anatomy, as anatomy of frontal sinus always varies with its adjacent structures such as uncinate and agger nasi, and similarly its proximity to important structures. The superior attachment of uncinate process is always variable. (2)

Amid the free edge of uncinate (medially) and bulla ethmoidalis (postero-superiorly), there lies a 2D crescentic area termed as the hiatus semilunaris inferioris, this extends laterally into the 3D area termed as infundibulum. Natural ostium of maxillary sinus opens into this. (3)

Uncinate is a vital structure in the osteomeatal complex, it averts the up-front contact of maxillary sinus with inspired air, hence functioning as a shield, in addition it also has a vital function in the mucociliary clearance. It functions like a barricade which protects the sinuses from microbes as well as allergens, by averting the contaminated air from going to the sinuses.(4)

The location of the attachment of uncinate superiorly has been originally recommended in 1991 by Stammberger along with Hawke, he also provided knowledge regarding anatomical variations of uncinate process.

1. Attachment of uncinate superiorly might be to:

a. Type I—uncinate bends laterally and inserted into the lamina papyracea

b. Type II—uncinate extends superiorly to ethmoid roof, (base of skull)

c. Type III—superior end of uncinate process bends medially, to get attached to the middle turbinate

2. Medially bent uncinate process

3. Laterally bent uncinate process

4. Pneumatized uncinate or uncinate bulla. (5)

The knowledge of anatomic variants of the uncinate pre-operatively aids to prevent injury to nasolacrimal duct , medial orbital wall, sphenopalatine artery etc. during surgery and hence its significant surgically. (6)

Our study is done to know the several variants of uncinate process attachment superiorly.

MATERIALS AND METHODS

It is a retrospective observational descriptive study, in which CT PNS of 256 cases were analyzed from 29-09-2018 to 20-05-2020. CT scans were done using a GE bright speed 16 slice CT machine with optimal exposure settings of 120KV and 150mAS. Slice thickness was 2.5mm which was reconstructed to 1.25mm. All the CT scans were assessed in coronal plane, axial plane as well as in sagittal plane. Patient was positioned in prone with neck extension.

Patients with Malignancy of nose and paranasal sinuses, and revision nasal surgery were excluded.

After obtaining permission from the Hospital Administrator and Medical Superintendent, the CT films of patients were collected and data was extracted on an average of 50 CT films per day. The results were expressed in percentages, proportions and means with standard deviation.

Pre validated checklist was made and each CT film was analyzed by a group of 3 people - consisting of one Radiologist and two Otorhinolaryngologists.

Ethical clearance was obtained from the Institution Ethics Committee. Waiver of consent was taken from the Ethics Committee, as the data was being extracted from the Computed Tomography records. The patients' data was kept completely confidential and the personal identifiers were never revealed in any form while entering or reporting of the results.

RESULTS

Among 256 CT images, 139 belonged to male and 117 were females.In the CT films examined, on the right side the very frequent attachment of the uncinate process is to lamina papyracea which is 64.8%, followed by skull base (19.5%) and to the middle turbinate

(15.6%). On the left side also similar findings were seen, that is lamina papyracea (69.5%), skull base (18.4%) and middle turbinate (11.3%).

On the left side uncinate process was found to be attached to two anatomical structures, in one scan to lamina papyracea as well as to the base of skull, and in another to middle turbinate and lamina papyracea**.**

Table 1. Categorizing of attachment of uncinate process superiorly:

SIDE	TYPE I	TYPE II	TYPE III	OTHERS
RIGHT	**166(64.8)**	**50(19.5)**	**40(15.6)**	
LEFT	**178(69.50)**	**47(18.4%)**	**29(11.3%)**	**2(0.8%)**
TOTAL	**344**	**97**	**69**	**2**

Discussion

Osteomeatal complex is a crucial area in the lateral wall. (7) Osteomeatal complex remains the final shared path of drainage of frontal sinus, maxillary sinus and anterior ethmoidal sinuses.

Most common anatomical variation of osteomeatal complex is the uncinate. It is a vital milestone in Functional Endoscopic Sinus Surgery, and it is removed foremost during surgery. Pre-operative observation of uncinate process helps to prevent intraoperative complications such as injury to nasolacrimal duct, medial orbital wall and sphenopalatine artery. (6)

The attachment of uncinate superiorly has been an interesting subject from the beginning. Many prospective as well as retrospective studies have been done to know the different attachments of uncinate process. Stammberger proposed three possible variations. (8) Landsberg proposed 6 types of variations of uncinate superior attachment. According to him classification is as follows:

a. Type I - Insertion into lamina papyracea
b. Type II - Insertion into posteromedial wall of agger nasi
c. Type III - Insertion into both lamina papyracea and the junction of the middle turbinate with the lamina papyracea
d. Type IV - Insertion to the junction of middle turbinate with the lamina papyracea
e. Type V - Insertion to the base of skull
f. Type VI - Insertion to middle turbinate**.**

In our study we aimed at studying the attachment of uncinate superiorly by Stammberger's classification. In this study the most common attachment is to lamina papyracea followed by skull base and middle turbinate. Similar results were found in most studies.

Studies performed by Mohit Srivastav, Tuli, Arun G and Landsberg showed similar results like our study (Table), that is the very frequent attachment of uncinate was to lamina papyracea, then skull base and middle turbinate. (5,6,3,9)

Our study showed more than one attachments in two CT films, one to base of skull and lamina papyracea, and other to the middle turbinate and lamina papyracea, similar attachments were seen in Landsberg's study. (9)

Kumar NV et al in their study found that one more variant was visualized and named as blunt variant. (10)

One more study (Gungor G et al) emphasized on the importance of uncinate, its association with osteomeatal unit by CT findings, and also discussed regarding the attachment of uncinate superiorly and uncinate variants, such as bifid uncinate process, uncinate pneumatization and deviation of uncinate. (4)

The very frequent attachment of the uncinate superiorly as noted by Canopolat S et al was type I, which was contributing to 51.5% followed by IV (15.6%), V (11.5%), II (10.8%), III (7.7%) and VI (3.8%).The following classification was used in their study:

I - Lamina papyracea

II - Middle turbinate

III - Skull base

IV - Lamina papyracea as well as middle turbinate

V - Lamina papyracea as well as skull base

VI - Skull base and middle turbinate

This study proved no association between uncinate superior attachment and pneumatization of ager nasi. (2)

Retrospective study was done by Leyla Kansu et al involved 727 individuals, and followed Landsberg's classification. Most common pattern seen was type II (400 sides - 27.6%) followed by type I (288 sides - 19.8%), IV (224 sides -15.4%), III (212 sides - 14.5%), V (174 sides - 12.0%) and VI (132 sides - 9%). (11)

One more study (et al) followed Landsberg's classification. In this study the very frequent attachment of uncinate is to lamina papyracea followed by skull base. The prevalence of an identical pattern of superior attachment of uncinate was 23% (28 patients in 56 sides) and non- identical was 14% (9 patients in 18 sides).

If uncinate attaches to lamina papyracea then the ethmoid infundibulum gets sealed above and forms a recess termed as terminal recess. (12)

Study by Mohit et al showed that the very frequent attachment of uncinate process is with lamina, which changes the drainage of frontal sinus and hence proving its relationship in frontal sinusitis.(5)

Table 2. Comparison of attachment of uncinate superiorly across various studies

Author	Type I Lamina Papyracea	Type II Skull base	Type III Middle turbinate
Mohit Srivastva	57.8%	20.3%	6.2%
Tuli	79.8%	16.67%	3.57%
Arun G	67.5%	18.5%	9.5%
Kruzeski	17.83%	33.12%	14.33%
Min	54 %	24.5%	21.5%
Landsberg	52%	3.6%	1.4%

Present study	67.2%	18.9%	13.5%

Conclusion

Uncinate process shows different variations in its superior attachment. Though most of the studies have shown attachment to lamina as the frequent one, insertion into the middle turbinate and skull base are not uncommon.

Therefore, CT-PNS evaluation preoperatively gives a good knowledge about its attachment and thus preventing intra-operative complications.

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