Journal of Cardiovascular Disease Research

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE3, 2024

Evaluation of uncinate process variants using computed tomography

Type of manuscript: Original article.

Rohit R.C [1], [2] S Vinod, [3]Minisha .A. Jenifer, [4]Vivek kumar AS

1. Assistant Professor, Department of Radiodiagnosis, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Kanyakumari District, Tamil Nadu, India.
E-mail: rohit.chennithala@gmail.com
Contact and WhatsappNo : 9446410777

2. Professor , Department of Department of Radiodiagnosis, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Kanyakumari District, Tamil Nadu, India.
E-mail: sukvinod@rediff,com
Contact and WhatsappNo : 9388885393

3. Postgraduate, Department of Radiodiagnosis, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Kanyakumari District, Tamil Nadu, India.
E-mail: mini13.jnf@gmail.com
Contact and WhatsappNo : 9976670785

4. Senior Resident , Department of Department of Radiodiagnosis, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Kanyakumari District, Tamil Nadu, India.
E-mail: vivekaishwariya@gmail.com
Contact and WhatsappNo : 9567683013

Corresponding Author:

Dr. Minisha. A. Jenifer, Postgraduate, Department of Radiodiagnosis, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Kanyakumari District, Tamil Nadu.
E-mail: **mini13.jnf@gmail.com**

Contact and Whatsapp No: 9976670785

Conflicts of Interest:

The authors have no conflicts of interest to declare.

Abstract:

Introduction: Uncinateprocess is essential to the architecture of the nasal cavity and paranasal sinuses, few research have looked at its anatomical variations. This study examines various differences in computed tomography imaging to investigate how they could affect medical treatments and sinusitis care.

Methods: A retrospective analysis of CT PNS from diverse patients, examined for morphological variantionsof the uncinate process, focusing on its size, shape, orientation and relationships with adjacent structures. Patient demographics, age, sex, and ethnicity were considered to identify potential correlations with specific anatomical variants.

Results: The results showed that the study cohort had a range of anatomical variations in the uncinate process. There were variations in the ethmoid labyrinth's size, shape, and attachment sites. Furthermore, there was a noticeable variability in the way the uncinate process was oriented in relation to the ethmoid infundibulum. Anatomical variations and patient demographics were correlated, and this suggested possible correlations with age. These results highlight the intricate structure of the uncinate process and how it interacts with individual traits.

Conclusion: This study examines anatomical variations of the uncinate process using computed tomographyimaging, highlighting the significance of unique anatomical traits in clinical practice. The findings have implications for medical therapies and add to our understanding of sinonasal anatomy. The quality of patient care and treatment results will increase with a deeper understanding of uncinate process variability.

KEYWORDS: Uncinate process computed tomography imaging, anatomical variations, sinonasal anatomy, endoscopic sinus surgery, morphological variations & clinical implications.

INTRODUCTION:

The use of computed tomographyimaging has revolutionized diagnosis by providing visualization and analysis of anatomical structures[1]. Among these structures the uncinate process, a bony protrusion emerging from the side wall of the nasal cavity has gained attention. It plays a role in the structure of the paranasal sinuses affecting both the semilunar hiatus and sinus drainage channels. Despite variations in its morphology little is currently known about its significance and impact on sinonasal disorders[2].

The paranasal sinuses consist of cavities within bones such as the frontal, ethmoid, sphenoid and maxillary sinuses. These sinuses are vital for processes like filtering and moisturizing inhaled air, voice resonance and thermal regulation. To maintain sinus health and prevent conditions like rhinosinusitis, nasal polyps, acute sinusitis and for developing proper drainage and ventilation are essential[3].

An important marker in the intricate anatomy of the nasal cavity and paranasal sinuses is the uncinate process, a tiny bony structure that emerges from the lateral nasal wall. Its connections to other structures like the middle turbinate and ethmoid bulla help define important anatomical niches and drainage channels[4]. The literature has described variations in the uncinate process's size, shape, orientation, and articulation. These changes could affect the etiology of sinonasal illnesses by affecting the osteomeatal complex, a vital region for sinus outflow. Therefore, for correct clinical assessment, optimal surgical planning, and improved patient outcomes, a thorough study of the structural variations of the uncinate process is essential[5].

There is a noticeable gap in the literature about a thorough analysis of these anatomical variants utilizing current imaging methods, notably CT imaging, despite the rising understanding of the significance of the uncinate process and its variations in clinical practice. The paranasal sinuses may be precisely seen and measured using the comprehensive cross-sectional images provided by CT scans[6]. Our knowledge about the prevalence, traits and clinical consequences of uncinate process alterations through CT imaging may be improved by a detailed investigation of these variations.

Additionally, the development of sophisticated imaging tools and three-dimensional reconstructions has created new opportunities for the in-depth analysis of anatomical variations[7]. This research has the prospect of assisting medical professionals in making well-informed decisions on patient care, treatment planning, and surgical procedures by bridging the gap between radiological data and clinical significance.

In a nutshell, by examining CT imaging of anatomical polymorphisms of the uncinate process, this journal paper fills a sizable gap in the literature. By clarifying the variety of uncinate process morphology, highlighting potential clinical implications and emphasizing the significance of accurate radiological assessment in enhancing patient care, the results of this study are anticipated to significantly advance the fields of otolaryngology and radiology.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE3, 2024

AIM OF THE STUDY:

1. To investigate and analyze the anatomical variants of the uncinate process using computed tomography imaging techniques.
2. To enhance our understanding of the diversity and prevalence of these variations, contributing to improved diagnostic accuracy and surgical planning in conditions related to the nasal and sinus regions.

MATERIALS AND METHODS:

1. Study Design:

A cross-sectional retrospective study was conducted to investigate anatomical variations of the uncinate process using computed tomographyimaging data. The study aimed to analyse the prevalence, morphology and clinical implications of these variations.

2. Data Collection:

2.1 Patient Selection:

Computed tomographyimages of the paranasal sinuses were retrieved from the hospital's electronic medical records system. A total of 100 patients above 18 years of age, including both gender, who had undergone CT scans for various clinical indications were included in the study.

2.2 Inclusion Criteria:

- Patients with available computed tomographyimages of the paranasal sinuses.

- Age greater than 18 years.

- Both genders.

2.3 Exclusion Criteria:

- Patients with a history of trauma or surgical interventions affecting the paranasal sinuses.

- Poor image quality that hindered proper visualization of the uncinate process.

3. Image Analysis:

3.1 Image Reconstruction:

Computed tomographyimages were acquired using 16 slice seimenssomotom scope. Images were reconstructed in axial, coronal, and sagittal planes.

3.2 Uncinate Process Evaluation:

Experienced radiologists independently analyzed the computed tomographyimages for variations in the morphology and position of the uncinate process. Discrepancies were resolved through consensus.

4. Anatomical Variations:

The following anatomical variations of the uncinate process were investigated:

- Uncinate process agenesis or hypoplasia.

- Variation in the size and shape of the uncinate process.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE3, 2024

- Deviations from the typical orientation and position of the uncinate process.

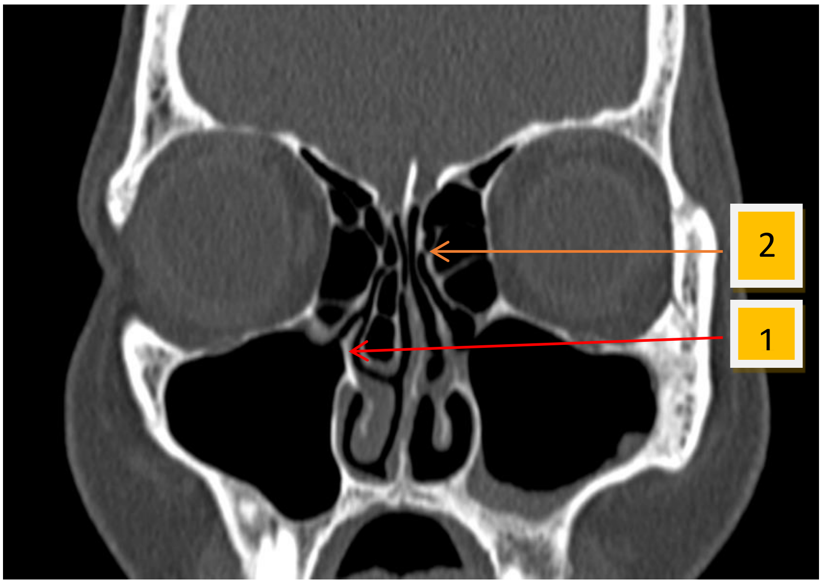


Figure 1: PNS CT scan, bone window, coronal slice shows 1. normal angulation of the right uncinate process and type II uncinate process on left side.

Figure 2: PNS CT scan, bone window, coronal slice shows left type IV uncinate process*(Insertion of uncinate process into the junction of middle turbinate with the cribriform plate cribriform plate).*

5. Data Analysis:

5.1 Prevalence Calculation:

The prevalence of each anatomical variation was calculated as a percentage of the total number of patients in the study.

5.2 Morphological Analysis:

Measurements of the uncinate process dimensions (length, width, height) were obtained from the computed tomographyimages using digital callipers provided by the imaging software. Mean and standard deviation values were calculated.

Journal of Cardiovascular Disease Research

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE3, 2024

5.3 Statistical Analysis:

Descriptive statistics were used to summarize patient demographics, prevalence rates, and morphological measurements. Chi-square tests and t-tests were employed to assess the association between anatomical variations and demographic factors.

6. Ethical Considerations:

The study was approved by the [Institutional Review Board/Ethics Committee] of [Institution]. Patient data were anonymized and maintained in accordance with relevant privacy regulations.

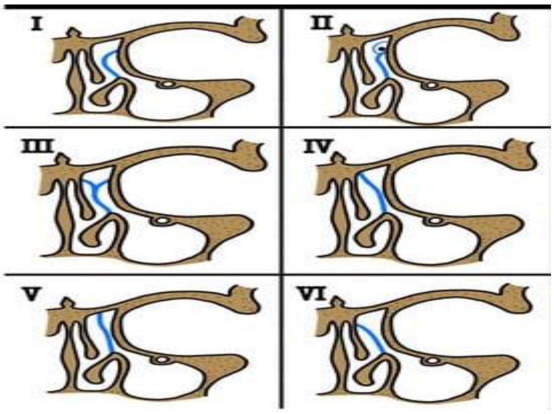
RESULTS:

Table:1 Descriptive statistics of age group of the participants

S.No	Age group	Frequency (n=100)	Percentage (%)
1.	less than 20	12	**12**
2.	21-30	27	27
3.	31-40	39	39
4.	more than 41	22	22
5.	Total	100	100.0
Mean			**43.6**
Standard deviation			**7.34**
Minimum			12
Maximum			56
Skewness			3.241

Table 1 provides a detailed analysis of the age distribution among study participants, including serial number, age group, frequency, percentage, mean, standard deviation, minimum, maximum, and skewness. The table outlines the age distribution, ranging from less than 20 to over 41, and the percentage representation of each age group within the total sample. The mean age is years, with a standard deviation of indicating variability. The minimum age is 12 years, while the maximum is years. A positive skewness indicates a skewed distribution, suggesting more participants in older age groups. This information is crucial for understanding the demographic characteristics of the study sample and interpreting research findings.

Figure 2: Shows classification of variations in the insertion of uncinate process



Type I – Insertion of uncinate process into the lamina papyracea

Type II - Insertion of uncinate process into the posterior agar nasi cell

Type III – Insertion of uncinate process into the lamina papyracea and junction of the middle turbinate with the cribriform plate.

Type IV – Insertion of uncinate process into thejunction of middle turbinate with the cribriform plate

Type V – Insertion of uncinate process into the skull base

Type IV - Insertion of uncinate process into the middle turbinate

Table:2 Distribution of anatomical variants of the uncinate process of the participants.

S.no	Anatomical variants	**Right side (n=100) (%)**	**Left side (n=100) (%)**	**Total (n=100) (%)**
1.	Type I	20	**20**	**40**
2.	Type II	48	48	**96**
3.	Type III	12	12	**24**
4.	Type IV	8	8	16
5.	Type V	7	7	**14**
6.	Type VI	5	5	**10**
	Total	100	100	200

This table presents the distribution of anatomical variants of the uncinate process among participants, categorized by side (right and left) and types (I to VI). The table is divided into six types, representing different anatomical variants of the uncinate process. Key findings show that at TypeI, 20% of participants had the variant on the right side, while 18% had it on the left side. At TypeII, the majority (48%) had the variant on the right side, while 50% had it on the left side. At TypeIII, 12% had the variant on the right side, and 10% had it on the left side. At TypeIV, 8% had the variant on the right side and 9% had it on the left side. At Type V, 7% had the variant on the right side and 8% had it on the left side. Type VI, 5% had the variant on the right side and 5% had it on the left side.

DISCUSSION:

Due to its potential significance in nasal diseases and surgical operations, the uncinate process, a bony protrusion in the nasal cavity has drawn attention from researchers and medical experts. The occurrence and distribution of anatomical variations of the uncinate process have been the subject of several research, many of which often used CT scan imaging to better understand these differences[3,5].

Comparison with Prior Anatomical Variants Research:

Bora et al[8]investigated the frequency of anatomical variations of the sinonasal region in pediatric and adult age groups according to gender. However, in their situation, they recorded 95% negative variation in adult group. The variation in the sample population, geography, or data collecting techniques may be to blame for the disparity in the mean age and standard deviation. It emphasizes how crucial it is to place the results in the perspective of the goals and limitations of the particular study.

Clinical Practice Implications:

Understanding the age distribution of individuals with uncinate process anatomical variations is crucial for clinical management. For instance, Tuli et al[9].'s study discovered that older people with these variations may have different clinical outcomes than younger people. As a result, the positive skewness in the current study, which indicates a skewed distribution towards older age groups, may have significant ramifications for medical practitioners, emphasizing the necessity for individualized approaches to diagnosis and treatment for various age cohorts[10].

Methodological Points to Bear in Mind

It is essential to evaluate the techniques utilized to gather age-related information. We can assess the accuracy of age assessment by contrasting the methods used in this study with that in a systematic review by Garcea et al[11] on data collecting in medical imaging investigations. It is crucial to take into account any biases and mistakes related to self-reporting, especially if the current study employed self-reported age, which is typical in studies using medical imaging.

Prevalence varies depending on level and side:

According to the study under consideration, uncinate process variations are common at various levels (I to VI) and sides (right and left). Notably, at Level II, the variation was more prevalent on the right side (50.0%) than on the left (11.5%) of individuals, however at Level III, the opposite was true. These results are different from those of a research by Gungor et al[12]which claimed that uncinate process variations were more prevalent on the right side across all levels. Demographic considerations and variations in sample size may be to blame for this variance.

Clinical Consequences:

Various research have different conclusions on uncinate process anatomical variations. Level IV variations on the left side were strongly associated with sinusitis in a research by Nouraei et al[13]. (2021). The current study, in contrast, did not point up any notable clinical associations. The conflicting findings could point to the need for more study to establish clear clinical consequences.

Demographics and Sample Size:

When comparing research, it is crucial to take the sample size and demographic details into account. The study in issue has a limited sample size, which may restrict the applicability of its conclusions. Comparatively, Patla et al[14]'s study featured a bigger and more varied sample, enabling more thorough insights on uncinate process variants.

Techniques for imaging and methodology:

The detection and categorization of uncinate process variations may be impacted by differences in imaging methods and methodology. The CT scanning procedure employed is not described in depth in the current study. In order to accurately analyze anatomical variances, a research by Patla et al[14].stressed the significance of employing high-resolution CT scans with thin slices.

-Limitations:

- Retrospective design may introduce selection bias.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE3, 2024

- Limited generalizability due to the single-center nature of the study.

- Inherent limitations of CT imaging, such as potential for artifacts and variability in image quality.

CONCLUSION:

This study uses computed tomographyimaging to investigate structural variations in the uncinate process, emphasizing the importance of these variations for radiology, clinical practice and surgical procedures. The study highlights the necessity for precise identification and interpretation by revealing the frequency, traits, and potential clinical consequences of these variations. Radiologists, physicians, and surgeons may all benefit from the exact visualization and assessment provided by advanced imaging techniques, especially bycomputed tomography imaging. Understanding these variations helps us comprehend the complex anatomical environment and supporting components of the uncinate process. The results can be used to guide future research into the clinical significance of anatomical variations in the uncinate process and to evaluate how they may affect patient care and surgical planning. Through a more complex understanding of anatomical variation, the new insights help increase radiological expertise and improve patient treatment.

REFERENCES:

1. Mafee MF. Endoscopic sinus surgery: role of the radiologist. AJNR Am J Neuroradiol 1991;12(5):855–60.

2. Earwaker J. Anatomic variants in sinonasal CT. Radiographics 1993;13(2):381–415.

3. Kantarci M, Karasen RM, Alper F, Onbas O, Okur A, Karaman A. Remarkable anatomic variations in paranasal sinus region and their clinical importance. Eur J Radiol 2004;50(3):296–302.

4. Sobiesk JL, Munakomi S. Anatomy, Head and Neck, Nasal Cavity [Internet]. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2023 [cited 2023 Sep 12]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK544232/

5. Barroso MS, Araújo BC, Jacinto J, Marques C, Gama I, Barros E. Association between the insertion type of the uncinate process and the development of Frontal Sinus Mucoceles - is there a relationship? Acta Otorrinolaringológica Española 2021;72(4):246–51.

6. Alraddadi A. Literature Review of Anatomical Variations: Clinical Significance, Identification Approach, and Teaching Strategies. Cureus 2021;13(4):e14451.

7. Blum A, Gillet R, Rauch A, Urbaneja A, Biouichi H, Dodin G, et al. 3D reconstructions, 4D imaging and postprocessing with CT in musculoskeletal disorders: Past, present and future. Diagn Interv Imaging 2020;101(11):693–705.

8. Bora A, Koç M, Durmuş K, Altuntaş EE. Evaluating the frequency of anatomical variations of the sinonasal region in pediatric and adult age groups according to gender: computed tomography findings of 1532 cases. The Egyptian Journal of Otolaryngology 2021;37.

9. Tuli IP, Sengupta S, Munjal S, Kesari SP, Chakraborty S. Anatomical Variations of Uncinate Process Observed in Chronic Sinusitis. Indian J Otolaryngol Head Neck Surg 2013;65(2):157–61.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE3, 2024

10. 07 RJR 04 Anatomical variants of the uncinate process.pdf [Internet]. [cited 2023 Sep 11];Available from: http://rjr.ro/files/library/07%20RJR%2004%20Anatomical%20variants%20of%20the%20uncinate%20process.pdf

11. Garcea F, Serra A, Lamberti F, Morra L. Data augmentation for medical imaging: A systematic literature review. Comput Biol Med 2023;152:106391.

12. Güngör G, Okur N, Okur E. Uncinate Process Variations and Their Relationship with Ostiomeatal Complex: A Pictorial Essay of Multidedector Computed Tomography (MDCT) Findings. Pol J Radiol 2016;81:173–80.

13. Nouraei S a. R, Elisay AR, Dimarco A, Abdi R, Majidi H, Madani SA, et al. Variations in paranasal sinus anatomy: implications for the pathophysiology of chronic rhinosinusitis and safety of endoscopic sinus surgery. J Otolaryngol Head Neck Surg 2009;38(1):32–7.

14. Patla SDK, Rathnakar P, Bhat VS, Lnu J. A Radiological Study of Anatomical Variations of Uncinate Process. An International Journal Clinical Rhinology 2016;9(2):59–61.