

Computed Tomographic (CT) Study of The Pneumatization Pattern of The Maxillary Sinus Prelacrimal Recess and Its Impact on Endoscopic Access

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ABSTRACT

Background: The maxillary sinus is the most one vulnerable to lesions. It has a great variation in size, shape, position, and pneumatization, not only in different persons, but also in different sides of the same person.

Objective: The aim of this study was to define the pneumatization pattern of the maxillary sinus prelacrimal recess and its impact on endoscopic access.

Patients and methods: A series of 99 paranasal CT scans were analyzed retrospectively to define the pattern of pneumatization of the maxillary sinus prelacrimal recess. In a total of 198 maxillary sinus, the distance between the maxillary sinus anterior wall and the anterior margin of the nasolacrimal duct were measured in a millimeter (mm).

Results: A total of 99 patients, 54 (55%) were males and 45 (45%) were females with age ranged from 18 – 69 years, with 198 maxillary sinus prelacrimal recess were measured. There are 3 types of pneumatization: Type I (0–3 mm), Type II (> 3–7 mm) and Type III (> 7 mm). In our study we found that type III was found in 24 maxillary sinus (12 %), type II was present in 156 maxillary sinus (79 %) and type I was present in only 18 maxillary sinus (9 %).

Conclusion: In 12 % of maxillary sinuses there was a widely pneumatized prelacrimal recess, which allow easy endoscopic access, while in 79 % there was a narrow recess so, temporary lacrimal duct dislocation is required to allow endoscopic access and in 9 % there was a very narrow recess so, lacrimal duct dislocation is always needed with bone removal to enable endoscopic access.

Keywords: Maxillary sinus, Lacrimal duct, Prelacrimal recess.

INTRODUCTION

The maxillary sinus is the most approached sinus in endoscopic sinus surgery. Endoscopic access to the lesion inside the maxillary sinus may be difficult particularly if the pathology is located at the floor or the anterior wall ⁽¹⁾.

Wide endoscopic middle meatal antrostomy allow excellent access to the posterior and medial walls of the maxillary sinus ⁽²⁾. By endoscopic medial maxillectomy the entire medial wall can be resected. The exposure of the lesions along the floor and the anterior wall are much more difficult. The exposure may be possible after a type III sinusotomy by using a 70° endoscope, or after an endoscopic medial maxillectomy ⁽³⁾.

To help excellent visualization of the maxillary sinus, some endoscopic sinus surgeons do another approach at the same time via the canine fossa ⁽⁴⁾. Lateral rhinotomy or midfacial degloving are external approaches also provides good access and exposure to the maxillary sinus and lateral nasal wall, but the morbidity is greater than with an endoscopic modified medial maxillectomy ⁽⁵⁾.

With the advancement of endoscopic sinus surgery and the increasing usage of nasal endoscopy for performing middle meatal antrostomy and endoscopic transnasal dacryocystorhinostomy, the relationship between the nasolacrimal pathway and the maxillary sinus became an area of endoscopic research ^(6,7).

With the description of the prelacrimal recess approach (PLRA) by Zhou *et al.* ⁽⁸⁾ by preserving the integrity of the nasolacrimal pathway and keeping the inferior nasal concha intact and obtaining good

exposure to the anterior wall, alveolar recess and the prelacrimal recess of the maxillary sinus, it became possible to preserve the sinus by skeletonizing the lacrimal system before entering anterolateral to it. Also, it is possible to resect the remaining of the medial wall to allow good exposure to the anterior compartment of the maxillary sinus. The amount of bone removal can be tailored according to the extent of the lesion ⁽²⁾.

The goal of this research was to define the pattern of pneumatization of the maxillary sinus prelacrimal recess and its impact on endoscopic access.

PATIENTS AND METHODS

A retrospective study that was done in Assiut University Hospital's Department of Otorhinolaryngology between December 2019 and March 2021 after receiving institutional ethics committee permission and informed consent.

Inclusion criteria: Patients admitted in the Otorhinolaryngology department Assiut University Hospital for a non-rhinogenic problem & patients with rhinogenic problems not destroying the prelacrimal recess.

Exclusion criteria: Patients with age less than 18 years, nasal trauma, lesions in lacrimal canal, and pregnant woman.

After fulfilling all inclusion and exclusion criteria all patients were subjected to:

I- Full history taking including:

1- Personal History.

- 2- History of nasal obstruction.
- 3- History of nasal discharge.
- 4- History of epistaxis.
- 5- History of allergic symptoms.
- 6- Other nasal and ENT symptoms.
- 7- History of nasal surgery.

II. Full medical examination:

- 1- Vital signs and general examination.
- 2- Full ENT examination with endoscopic nasal examination.

III. Investigations: MSCT of nose and PNS axial, coronal, sagittal cuts without contrast.

Ethical consent:

This study was ethically approved by the Institutional Review Board of the Faculty of Medicine, Assiut University. Written informed consents were taken from all participants. The study was conducted according to the Declaration of Helsinki.

Statistical analysis

Computer software statistical analysis was performed using SPSS version 17, programs under windows. There was no statistical difference between the results of the right and left side ($P > 0.05$) and thus the right and the left side were pooled together for analysis. A two-sided P value ≤ 0.05 was considered statistically significant.

RESULT

A total of 99 patients, 54 (55%) were males and 45 (45%) were females with age ranged from 18 – 69 years, with 198 maxillary sinus prelacrimar recess were measured. The mean distance from the anterior wall of the maxillary sinus to the anterior border of the nasolacrimal duct (Distance 1) was 4.90 ± 2.54 mm (Min 0.00 mm, Max 8.20 mm).

The mean distance from the anterior wall of the maxillary sinus to the posterior margin of the nasolacrimal duct (Distance 2) was 13.11 ± 1.94 mm (Min 8.25 mm, Max 18.50 mm). The size of the nasolacrimal duct ranged from 4.50 – 12.70 mm with a mean of 7.68 ± 1.69 mm. (Figure 1 & 2)

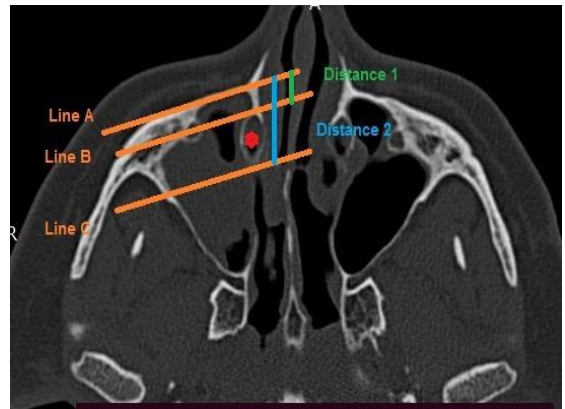


Figure (1): CT axial cut (Green line - distance 1, blue line - distance 2).

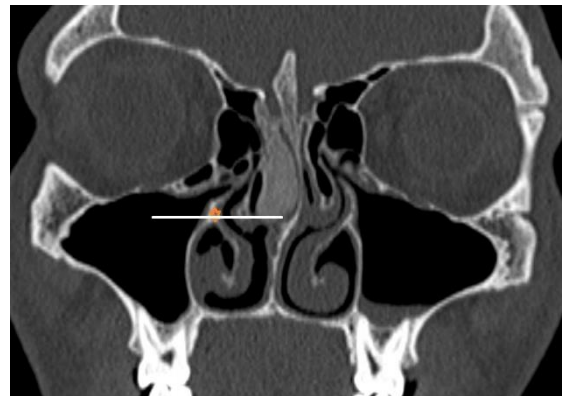


Figure (2): CT coronal cut show the junction of the inferior turbinate with the uncinat process (White line).

According to **Simmen *et al.***⁽³⁾ there was 3 types of maxillary sinus prelacrimar recess pneumatization: Type I (0–3 mm) very narrow recess, Type II (> 3–7 mm) narrow recess and Type III (> 7 mm) wide pneumatization of the recess. In type 1 where the prelacrimar recess was very narrow the PLRA would not be applicable, while in type 2 where the prelacrimar recess pneumatization was narrow PLRA could still be possible, but with the nasolacrimal duct displacement, but in type 3 the prelacrimar recess pneumatization was wide the PLRA could be easily done without nasolacrimal duct manipulation.

In this study, there were a total of 18 maxillary sinus with type 1 (9 %), 156 maxillary sinus with type 2 (79 %) and 24 maxillary sinus with type 3 (12 %) (Figure 3 & 4).

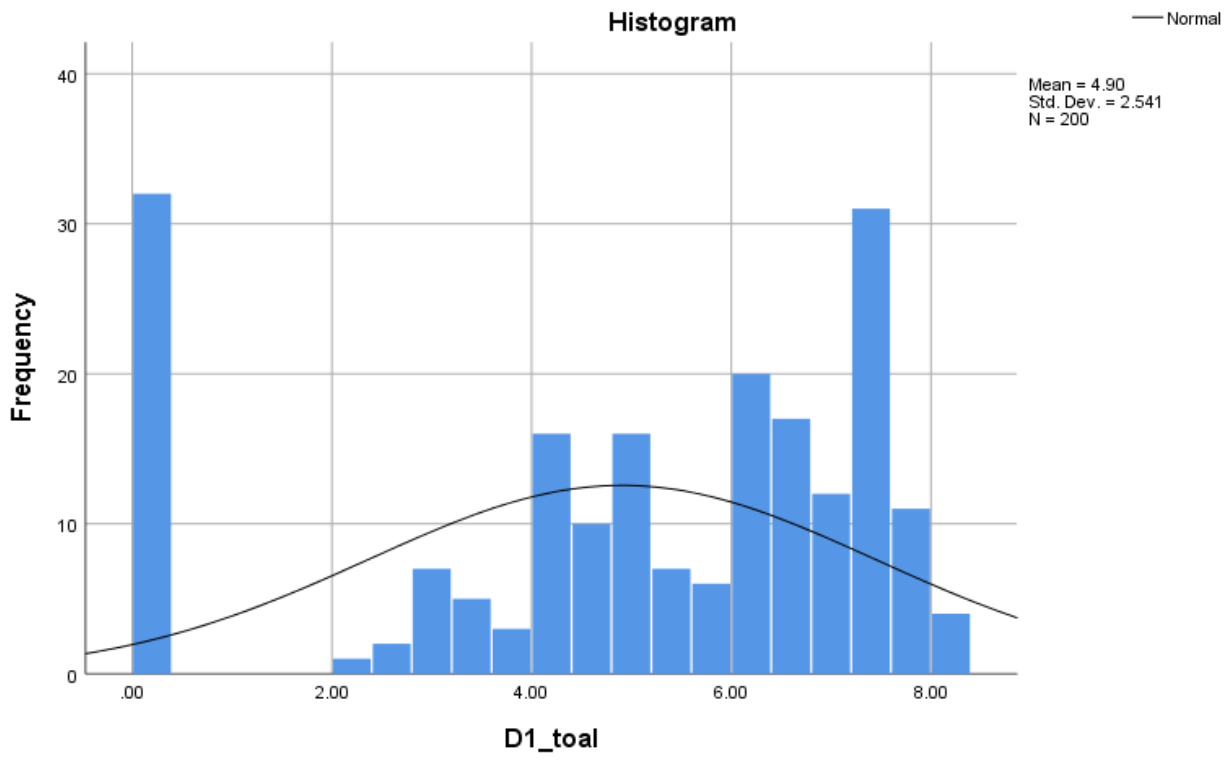


Figure (3): Distribution of Distance (1).

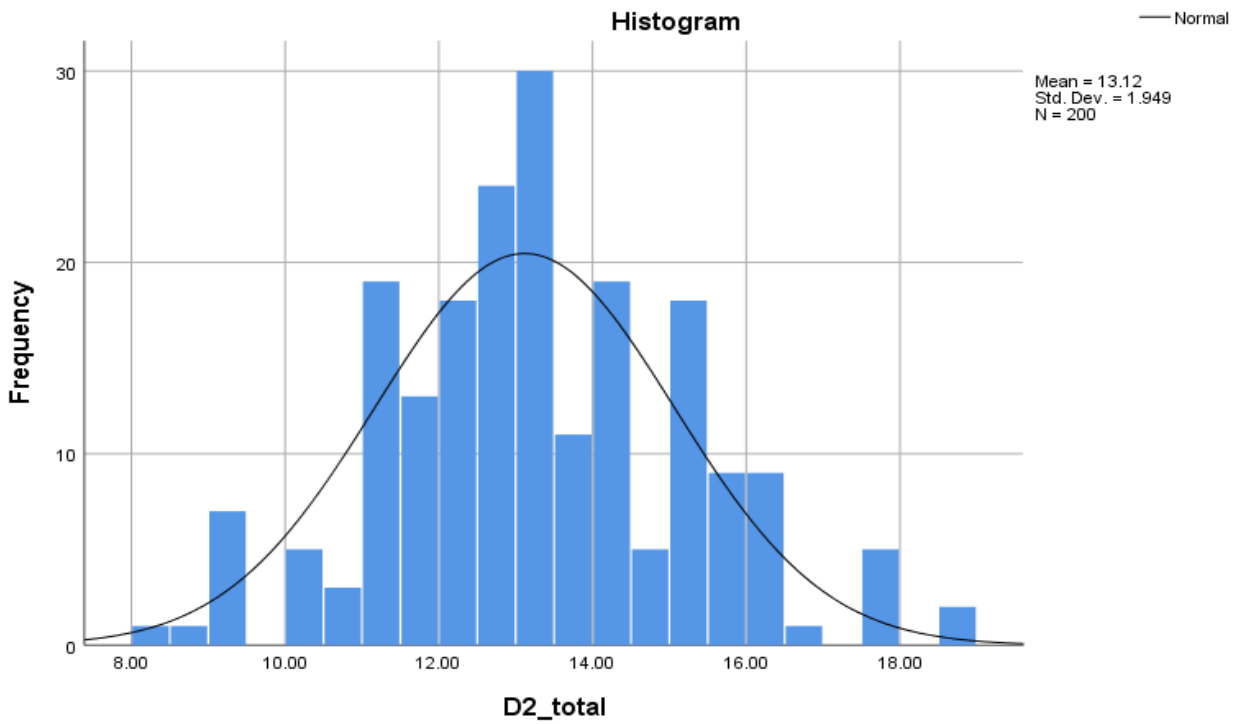


Figure (4): Distribution of Distance (2).

DISCUSSION

Regarding this subject, a lot of studies have been done evaluating the maxillary sinus prelacrima recess anatomy and the accessibility of the PLRA to the maxillary sinus. From these studies, there is a widely variation between individuals regarding the pneumatization of the maxillary sinus prelacrima recess, therefore the PLRA is easy and accessible in some patients and difficult in others.

The interior of the maxillary sinus full of hidden recesses that make a problem to endoscopic surgical exposure and instrumental access. With wide pneumatization of the maxillary sinus prelacrima recess, an excellent endoscopic access pathway to the maxillary sinus anterior wall is always possible. It is a challenge to access and instrument every maxillary sinus wall even by highly experienced surgeons^(9,10).

Thanks to the PLRA in endoscopic access excellent visualization of the floor and the anterior wall of the maxillary sinus with low complications compared to the external approaches. The physiology of the nasolacrimal pathway and the inferior nasal concha was undisturbed postoperatively^(11,12).

Based on our study, to define in which patient a prelacrima recess approach is possible without manipulation or resection of the nasolacrimal duct we examine radiologically the extent of pneumatization of the prelacrima recess of the maxillary sinus and we found 3 types of pneumatization. We found that only 9% of the maxillary sinuses were non-pneumatized or with narrow pneumatized prelacrima recess with a distance between 0 and 3 mm (type I). In this type of pneumatization prelacrima recess approach is only possible with nasolacrimal duct dislocation and with a significant bone removal with limited exposure to the maxillary sinus anterior wall. In Type II with narrow pneumatization, distance of > 3 mm – 7 mm, we found this type in 79% of maxillary sinuses, the prelacrima recess approach was possible with bone removal along with dislocation of the nasolacrimal duct, while in type III with wide prelacrima recess pneumatization, distance of > 7 mm, the prelacrima recess approach was easily performed with minimal bony work and with excellent exposure of the floor and the maxillary sinus anterior wall, we found this in only 12% of maxillary sinuses.

CONCLUSION

A wide pneumatization of the prelacrima recess of the maxillary sinus was found in 12 % which allow easy endoscopic access, while in 79 % there was a narrow recess pneumatization so, temporary lacrimal

duct dislocation was required to allow endoscopic access and in 9 % there was a very narrow recess pneumatization, so lacrimal duct dislocation was needed with bone removal to allow endoscopic access.

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