

Antero-medial maxillary sinus angle is an additional predictive factor for enhanced visibility during pre-lacrimal window approach*

A. Andrianakis[#], C. Holzmeister[#], A. Wolf, P. Kiss, U. Moser, A. Redzic, P.V. Tomazic

Department of Otorhinolaryngology, Medical University of Graz, Austria

Rhinology 58: 6, 632 - 634, 2020

<https://doi.org/10.4193/Rhin20.330>

***Received for publication:**

June 30, 2020

Accepted: August 17, 2020

[#] Contributed equally to this work

To the Editor:

Pathologies located at the posterior surface of the anterior wall and the floor (alveolar recess) of the maxillary sinus are challenging to visualize and access. Open approaches including lateral rhinotomy, Caldwell-Luc procedure or midfacial degloving allow a broad visualization but with a significant likelihood of post-operative morbidity ⁽¹⁾. Access to the anterior wall and floor of the maxillary sinus by traditional endoscopic approaches is very difficult ⁽²⁾. The pre-lacrimal window approach (PLWA), as a modified endoscopic medial maxillectomy, provides a wide access to these challenging areas with a very low morbidity rate in total ⁽³⁾. A recent study compared the PLWA against conventional approaches (traditional endoscopic, open and combined) in treatment outcomes of surgically resected inverted papilloma (IP) within the maxillary sinus. The authors found no recurrences in the PLWA group whereas conventional surgery resulted in a 16% recurrence rate – all located in the alveolar recess ⁽⁴⁾. Hildenbrand et al. ⁽⁵⁾ evaluated the long-term outcome of maxillary sinus IP, treated via PLWA, and observed no recurrences after a median follow-up period of 3.8 years. A series of studies have concluded that the PLWA is a safe and effective endoscopic treatment of various diseases within the maxillary sinus, including benign and malignant pathologies ⁽⁴⁻⁸⁾.

A critical factor for the performance of a PLWA is the width of the bony window anterior to the nasolacrimal duct. This pre-lacrimal bony window extends from the anterior wall of the maxillary sinus to the anterior border of the nasolacrimal duct. The feasibility of a PLWA depends on the distance of this bony window. In cases of a small pre-lacrimal window, a significant bone resection and nasolacrimal duct dislocation or even removal with a higher likelihood of morbidity is required to conduct a PLWA. Recently, Simmen et al. ⁽⁹⁾ classified the distance of the pre-lacrimal bony window into 3 types (Type I: 0-3mm, type II:

>3-7mm, type III: >7 mm) in order to evaluate the proportions of patients in whom a PLWA is readily feasible.

At our department, the applied PLWA technique is performed as described earlier ⁽³⁾. Most parts of the PLWA are performed with a 0-degree endoscope, where the access is particularly useful for the alveolar recess. In order to gain visibility of the challenging areas within the maxillary sinus (anterior wall, transition anterior wall/alveolar recess), we use 45-degree or 70-degree endoscopes. Not only the visibility is enhanced but also the range for angled instruments. In some cases, in whom a PLWA was performed, we experienced a limited visibility and access to the posterior surface of the anterior maxillary sinus wall despite the presence of a wide pre-lacrimal bony window and the utilization of a 45/70-degree endoscope. A further investigation of the axial CT-scans of these cases revealed a nearly perpendicular oriented anterior maxillary wall with respect to the medial maxillary sinus wall. We assumed that the angle between the anterior and medial wall of the maxillary sinus may be an additional predictive factor for the visibility and accessibility of the anterior maxillary sinus wall during PLWA where a very wide angle has limitations. Therefore, we aimed to evaluate the antero-medial maxillary sinus angle (AMMSA) distribution in the general population in terms of the PLWA and depending on the data, to implement the angle as predictive factor in the Simmen classification for pathologies located at the posterior surface of the anterior wall and in the alveolar recess of the maxillary sinus. For that reason, a consecutive series of 100 paranasal sinus CT scans (=200 maxillary sinus) of adults with chronic rhinosinusitis sine nasal polyposis, who were admitted to the Department of Otolaryngology, Medical University of Graz to undergone functional endoscopic sinus surgery (FESS), were retrospectively analyzed. The study was approved by the institutional ethics committee

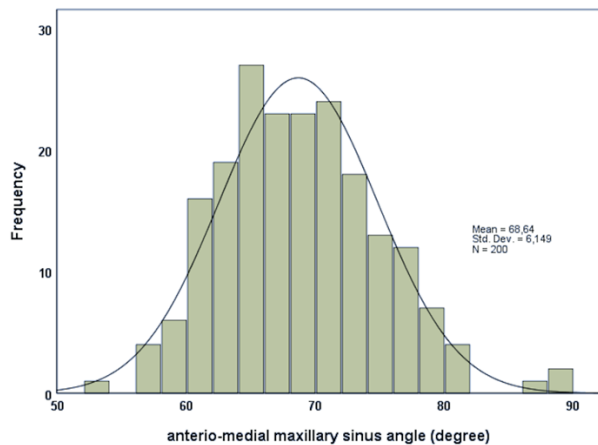


Figure 1. Distribution of the antero-medial maxillary sinus angle (AMMSA)

(32-462 ex 19/20). Methodology of measurements was adopted from Simmen et al.⁽⁹⁾. As primary variable of interest, the AMMSA was measured between the tangential lines through the anterior and medial wall of the maxillary sinus, examined on the same axial CT plane on which Simmen's type of feasibility was identified.

Our results of PLWA feasibility were quite similar compared to Simmen et al.⁽⁹⁾. Type I, II and III occurred in 38.5%, 49.5% and 12% of the sides, respectively. We determined in the entire series a mean AMMSA of 68.6 ± 6.1 degrees with a range of 52.1 - 88.9 degrees. Up next, we examined the AMMSA separately for each feasibility type according to Simmen's classification. Type I, II and III presented a mean AAMSA of 68.2 ± 6.1 degrees (range, 52.1-88.9), 68.7 ± 6.2 degrees (range, 56.4-88.5) and 69.4 ± 6.2 degrees (range, 56.6-81.1), respectively. There were no statistically significant differences between Simmen's types regarding AMMSA ($p=0.707$). In order to evaluate how many patients present a good visibility and accessibility of the posterior surface of the anterior wall and floor of the maxillary sinus during PLWA, we subdivided the AAMSA into two visibility types. As the AMMSA presented a normal distribution (with a mean angle of approximately 70 degrees (Figure 1), we chose 70 degrees as cut-off between the types. Type A (<70 degrees) offers a wide visualization and accessibility and was found in 59.5% of the sides. A type B (≥ 70 degrees) provides a more limited visualization and accessibility and was seen in 40.5% of the sides. For the purpose of creating a unified PLWA prediction classification, we implemented our visibility types into the categorization by Simmen et al.⁽⁶⁾ and propose the modified Simmen classification (Figure 2). In the proposed classification system, each feasibility type (I-III) can be further subcategorized according to the visibility type (A and B), e.g. type I-A, type I-B, Type II-A and so on. The distribution of the proposed classification system

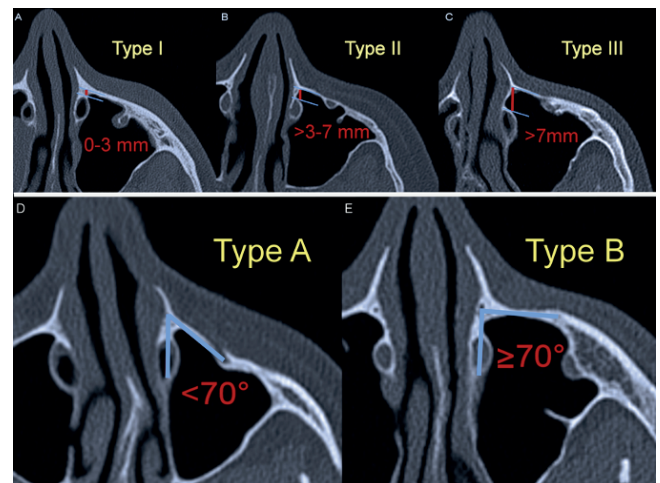


Figure 2. Modified Simmen classification. Upper row depicts the feasibility types according to the distance between the anterior maxillary sinus wall and the anterior border of the nasolacrimal duct. A: Type I (0-3mm). B: Type II (<3-7mm). C: Type III (>7mm). Lower row displays the visibility types according to the antero-medial maxillary sinus angle. D: Type A (<70 degrees). E: Type B (≥ 70 degrees).

Table 1. Results of unified pre-lacrimal window approach prediction classification.

Modified Simmen type	Frequency (n=200)
Type I-A	49 (24.5%)
Type I-B	28 (14%)
Type II-A	57 (28.5%)
Type II-B	42 (21%)
Type III-A	13 (6.5%)
Type III-B	11 (5.5%)

is displayed in Table 1. The most prevalent type (28.5%) was a type II together with an AMMSA of less than 70 degrees (type II-A). The least favorable type for a PLWA (I-B), involving a small pre-lacrimal bony window (type I) and a wide AMMSA (type B), was recorded in 14% of the sides. The most favorable type (III-A) including a wide pre-lacrimal bony window (type III) and a smaller angle between the anterior and medial wall of the maxillary sinus (type A) was found in 6.5% of all maxillary sinus. In conclusion, as this is a significantly smaller percentage as in the other studies examining the width of the pre-lacrimal bony window alone, we think that the additional consideration of the angle is an additional important predictive factor in the planning of the PLWA.

Conflict of interest

No conflict of interest exists.

Authorship contribution

All authors have provided substantial contributions to the conception or design of the work or the interpretation of data for the work (AA, CH, AW, UM, PK, AR, PVT). All worked on the draft or revised it critically for important intellectual content (AA, CH, AW, UM, PK, AR, PVT). The final version was approved for publi-

shing by all authors (AA, CH, AW, UM, PK, AR, PVT). The authors agree on accountability for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Alexandros Andrianakis and Clemens Holzmeister contributed equally to this work.

References

1. Robey A, O'Brien EK, Leopold DA. Assessing current technical limitations in the small-hole endoscopic approach to the maxillary sinus. *Am J Rhinol Allergy* 2010; 24(5): 396-401.
2. Hosemann W, Scotti O, Bentzien S. Evaluation of telescopes and forceps for endoscopic transnasal surgery on the maxillary sinus. *Am J Rhinol* 2003; 17(5): 311-316.
3. Zhou B, Han DM, Cui SJ, Huang Q, Wang CS. Intranasal endoscopic prelacrima recess approach to maxillary sinus. *Chin Med J* 2013; 126(7): 1276-1280.
4. Nakayama T, Tsunemi Y, Kuboki A et al. Prelacrima approach vs conventional surgery for inverted papilloma in the maxillary sinus. *Head Neck* 2020. Online ahead of print.
5. Hildenbrand T, Weber R, Mertens J, Stuck B, Hoch S, Giotakis E. Surgery of Inverted Papilloma of the Maxillary Sinus via Translacrima Approach-Long-Term Outcome and Literature Review. *J Clin Med* 2019; 8(11): 1873.
6. Tran LV, Le LT, Wormald PJ. How I do it: Surgical management of maxillary sinus hemangiomas via prelacrima approach. *Rhinology*. 2020;58(4):413-415.
7. Lin YH, Chen W. Clinical outcome of endonasal endoscopic prelacrima approach in managing different maxillary pathologies. *PeerJ* 2020; 8:e8331.
8. Zhou B, Huang Q, Sun J et al. Resection of Inverted Papilloma of the Maxillary Sinus via a Prelacrima Recess Approach: A Multicenter Retrospective Analysis of Surgical Efficacy. *Am J Rhinol Allergy* 2018; 32(6): 518-525.
9. Simmen D, Veerasigamani N, Briner HR, Jones N, Schuknecht B. Anterior maxillary wall and lacrimal duct relationship - CT analysis for prelacrima access to the maxillary sinus. *Rhinology* 2017; 55(2): 170-174.

Axel Wolf M.D.

Department of Otorhinolaryngology
Medical University of Graz
Auenbruggerplatz 26
8036 Graz
Austria

Tel: +43 (316) 385 - 81355

E-mail: a.wolf@medunigraz.at