NORTHWESTERN MEDICAL JOURNAL

Northwestern Med J. 2026;6(2):109-115
DOI: 10.54307/NWMJ.2026.203

RESEARCH ARTICLES

Analysis of ductus nasolacrimalis and infraorbital foramen diameter measurements in patients operated on for antrochoanal polyps

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This article was presented as an e-poster at the 19th Turkish Rhinology Congress.

Cite as: Atik FN, Gunes A, Halicioglu S, Karali E. Analysis of ductus nasolacrimalis and infraorbital foramen diameter measurements in patients operated on for antrochoanal polyps. Northwestern Med J. 2026;6(2):109-115.

ABSTRACT

Aim: This study aimed to radiographically evaluate the diameters of the nasolacrimal duct (NLC) and infraorbital foramen (IOF) in patients operated on for antrochoanal polyps (ACP) and to investigate the association of these structures with the location of the polyp.

Materials and Methods: The transverse and anteroposterior diameters of NLC and IOF were measured from paranasal CT images of 40 patients who underwent functional endoscopic sinus surgery with a diagnosis of ACP between January 1, 2020, and January 15, 2025. Patients were classified according to the location of the polyp, its origin, and the status of sinus ventilation.

Results: While there was generally no significant difference in NLC diameters, in some subgroups the transverse diameters were found to be significantly larger on the normal side than on the pathological side. On the pathological side, a clear and significant narrowing of the IOF diameter was observed in all groups.

Conclusion: ACP causes morphological changes, particularly at the IOF, and the narrowing of this structure suggests bone remodeling. The effect on the NLC is more limited. A preliminary assessment of these anatomical structures during surgery planning is important to prevent possible complications.

Keywords: antrochoanal polyp, infraorbital foramen, nasolacrimal duct

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Received: 08.05.2025 **Accepted:** 13.06.2025 **Published:** 10.04.2026

INTRODUCTION

Antrochoanal polyps (ACP) are benign masses that arise from the paranasal sinuses, particularly the maxillary sinus, and develop posteriorly, extending into the choana and nasopharynx (1). The literature reports that they account for 4–6% of patients with nasal polyps. They occur more frequently in children and young adults (2). ACP is usually unilateral, isolated, and spreads toward the nasal cavity (3).

Nasal obstruction causes symptoms such as unilateral nasal discharge, postnasal drip, and, rarely, headaches (4). A preliminary diagnosis can be made through a routine physical examination and a nasal endoscopy. Additionally, the use of imaging techniques provides more detailed information about the location and extent of the lesion (5). In particular, it is known that computed tomography (CT) provides more detailed information about the lesion (6). Furthermore, the etiology and pathogenesis of ACP have not yet been clearly established in the literature (7-9).

The nasolacrimal canal (NLC) is a duct system that facilitates tear drainage and must be taken into account during surgery (10). The infraorbital foramen (IOF) is a bony structure through which the infraorbital nerve passes. Any variation in this anatomical structure may lead to complications during surgery (11).

It is thought that the pressure created by ACP within the maxillary sinus may cause various changes in the NLC and IOF regions, which contain delicate bony structures (12). The effects on the NLC and IOF may, in turn, cause tear drainage disorders and neurological disorders (13). Therefore, a detailed preoperative evaluation of these structures can help prevent complications (14).

The aim of this study is to radiologically examine the diameters of the NLC and IOF in patients diagnosed with ACP and to evaluate the effect of ACP on these structures.

MATERIALS AND METHODS

The NLC and IOF diameters were measured from preoperative CT images of the paranasal sinuses in patients diagnosed with ACP who underwent functional endoscopic sinus surgery at the Ear, Nose, and Throat Clinic of Bolu Abant İzzet Baysal Training and Research Hospital between January 1, 2020, and January 15, 2025.

Patients were categorized according to age, sex, right-left position of the maxillary sinus, whether the lesion completely filled the maxillary sinus, and whether the lesion originated from the maxillary sinus ostium or accessory ostium.

Inclusion criteria for the study: Patients who underwent surgery with a diagnosis of ACP between 2020 and 2025, who had complete preoperative CT images, and who were over the age of 7 years.

Exclusion criteria: Patients who had previous sinus surgery, those with a history of maxillofacial trauma, and those with additional pathologies such as sinus tumors were excluded from the study.

Statistical analysis

Data analysis was performed using IBM SPSS Statistics for Windows (version 21.0; IBM Corp., Armonk, NY, USA). Data are expressed as mean ± standard deviation (SD) and n (%). The Mann-Whitney U test, Wilcoxon signed-rank test, and Pearson chi-square test were used for statistical comparison. For statistical significance, a p-value <0.05 was considered significant.

RESULTS

The study included 40 patients aged between 7 and 72 years (mean age 35.5 ± 17.3 years); 67.5% of the patients were male. When comparing the age and gender distribution regarding the location of the polyp (right/left), the exit site (native/accessory ostium), the status of sinus ventilation (partial/complete),

and the patency of the frontal recess, it was found that the average age was significantly higher only in patients with an obliterated frontal recess. In men, the proportion of polyps arising from the native maxillary ostium was significantly higher (Table 1). When evaluating the NLC diameters, no significant difference was found between the pathologic and normal sides in terms of transverse and anteroposterior (AP) measurements.

However, in some subgroups, such as right sinus location, native ostial origin, and complete loss of ventilation, transverse diameters were found to be significantly larger on the normal side than on the pathologic side (Table 2 and Table 3).

Significant differences were observed regarding IOF diameter. The IOF diameter on the pathological side was significantly smaller than on the normal side, and this was consistent across all groups. This difference remained independent of parameters such as sinus position, location of polyp exit, loss of ventilation, and patency of the frontal recess (Table 4).

These results show that the antrochoanal polyp has significant morphological effects, particularly on the IOF, while its effect on the NLC is more limited.

Table 1. Comparison of features of antrochoanal polyps according to demographic characteristics

Polyps	**Mean age**	**p**	**Male %**	**Female %**	**p**
Sinus Cavity Placement					
Right	36.9	0.494	69.6	30.4	0.746
Left	33.6		64.7	35.3	
Place of Origin/Origin					
Native Ostium	38.7	0.297	52.6	47.4	0.050
Accessory Ostium	32.6		81.0	19.0	
Loss of Sinus Aeration					
Partial	35.9	0.988	76.9	23.1	0.484
Total	35.3		63.0	37.0	
Frontal Recess					
Open	30.3	**0.004**	75.0	25.0	0.154
Obliterated	47.7		50.0	50.0	

Table 2. NLC and IOF measurements

Diameter (mm)	**Mean**	**SD**	**p**
Pathological side NLC transverse diameter	4,2	1,0	0.078
Normal side NLC transverse diameter	4,4	1,0	
Pathological side NLC AP diameter	6,4	1,1	0.412
Normal side NLC AP diameter	6,5	1,2	
Pathological side IOF diameter	2,6	0,4	0.001
Normal side IOF diameter	2,9	0,5	

NLC: Nasolacrimal duct; IOF: Infraorbital foramen; AP: Anteroposterior.

Table 3. Comparison of NLC transverse and AP diameters according to polyp characteristics

	Pathological side NLC transverse diameter	Normal side NLC transverse diameter	p	Pathological side NLC AP diameter	Normal side NLC AP diameter	p
Sinus Cavity Placement						
Right	4.1	4.5	**0.050**	6.4	6.4	0.107
Left	4.3	4.2	0.816	6.4	6.4	0.477
P	0.565	0.502		0.956	0.218	
Place of Origin/Origin						
Native Ostium	4.0	4.4	0.055	6.4	6.4	0.983
Accessory Ostium	4.4	4.4	0.601	6.4	6.4	0.262
P	0.132	0.578		0.626	0.766	
Loss of Sinus Aeration						
Partial	4.4	4.2	0.624	6.3	6.3	0.701
Total	4.1	4.5	**0.015**	6.4	6.4	0.103
P	0.241	0.772		0.840	0.102	
Frontal Recess						
Open	4.2	4.5	0.079	6.3	6.3	0.268
Obliterated	4.1	4.1	0.593	6.6	6.6	0.929
P	0.478	0.231		0.848	0.813	

NLC: Nasolacrimal duct; AP: Anteroposterior.

Table 4. Comparison of IOF diameters according to polyp characteristics

	Pathological side IOF diameter	Normal side IOF diameter	p
Sinus Cavity Placement			
Right	2.5	2.8	**0.001**
Left	2.8	3.0	**0.006**
P	0.123	0.118	
Place of Origin/Origin			
Native Ostium	2.7	3.0	**0.001**
Accessory Ostium	2.6	2.8	**0.006**
P	0.703	0.139	
Loss of Sinus Aeration			
Partial	2.7	2.9	**0.039**
Total	2.6	2.9	**0.001**
P	0.931	0.885	
Frontal Recess			
Open	2.7	2.9	**0.001**
Obliterated	2.6	3.0	**0.005**
P	0.964	0.225	

IOF: Infraorbital foramen.

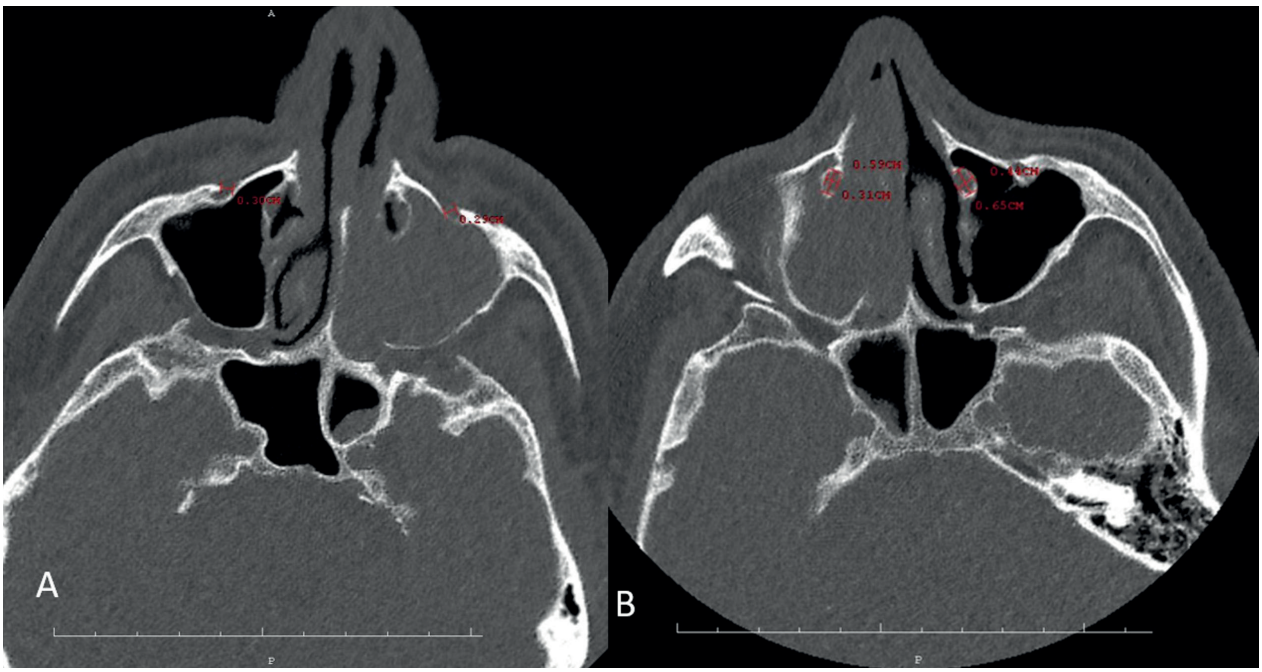

Figure 1. In axial paranasal sinus CT examination, the measurement method of the infraorbital canal at the level of the inferior orbital rim (A) and the nasolacrimal canal at the level of the middle turbinate (B) are shown.

The measurement method of the infraorbital canal and nasolacrimal canal in axial paranasal sinus CT examination is shown in Figure 1.

DISCUSSION

In this study, NLC and IOF diameters in patients operated on for antrochoanal polyp (ACP) were radiologically evaluated, and morphological differences between the pathological side and the normal side were examined.

The study has highlighted the fact that ACP alters major anatomical structures. ACP may result from obstruction induced by inflammatory stress in the sinus ostium (8,15), as reported in the literature. This obstruction results in increased pressure within the maxillary sinus (16) and compresses adjacent tissues. This significant reduction in IOF diameter is in agreement with previous studies. Moreover, in this study, we also evaluated NLC diameters. Injury to the NLC during surgery may cause various symptoms (17). In both the pathological and normal sides of the NLC evaluated in this research, no significant difference in the size of the NLC was found. This may indicate that ACP is less effective than IOF in altering the NLC. However, the limited number of patients prevents generalization of the outcome. A further key theme in the results was that the difference was most pronounced in polyps located in the right sinus or polyps derived from the natural maxillary sinus ostium. We assume that the location and origin of the polyp are important parameters regarding its influence on the NLC. However, this, along with the limited number of patients, limits generalization.

Likewise, the older average age of patients with an obliterated frontal recess suggests that the inflammatory process lasts longer in these patients, and therefore the polyp may cause more anatomical changes in the surrounding structures. These results suggest that age and patency of the frontal recess may be important predictors in assessing the anatomical impact of ACP.

The IOF is a bone canal through which the infraorbital nerve passes and is located very close to the maxillary sinus wall. Therefore, the inflammatory or mechanical

pressure generated by ACP can lead to a reduction in the diameter of this foramen and indirectly cause symptoms such as paresthesia in the postoperative period (18,19). In fact, our study found a significant difference in IOF diameters between the pathological and normal sides in patients with polyps in both the right and left sinus areas. Similarly, it has been shown in the literature that diseases of the maxillary sinuses, particularly chronic inflammation, can lead to remodeling in the area of the IOF (20).

In our study, it was found that whether the exit site is a native maxillary ostium or an accessory ostium also has an impact on the IOF diameter. The IOF diameter on the pathological side decreased significantly in both groups. This shows that no matter which ostium the polyp originates from, it can affect the IOF adjacent to the maxillary sinus wall. Furthermore, the fact that the narrowing of the IOF diameter is significant even with complete loss of ventilation supports the effect of increased intrasinus pressure on the IOF. These results highlight the need for a systematic evaluation of the IOF in diseases of the maxillary sinuses (21).

Our study emphasizes the importance of radiological measurements in assessing anatomical changes due to ACP. Morphological assessment of critical structures such as the NLC and IOF is valuable not only for surgical planning but also for preventing potential complications. It has been shown that complications that may arise, particularly after sinus surgery, may be directly related to the spread of the polyp into the paranasal sinuses and its effects on neighboring structures (22).

Limitations of this study include the limited number of patients and its retrospective design. Furthermore, our study did not establish a correlation between postoperative symptoms and radiological findings but only assessed anatomical changes using objective measurements. Future prospective studies may be more informative regarding the association of changes in the diameter of these structures with clinical symptoms. In addition, simultaneous examination of the degree of inflammation with histopathological examinations can more clearly reveal the pathogenesis of these morphological changes. In conclusion, it has been shown that antrochoanal polyps cause significant morphological changes in the bony structures around the maxillary sinus, especially the IOF. These findings suggest that a detailed preoperative CT examination should evaluate not only the spread of the polyp but also its structural effects on the IOF and NLC. Surgeons should minimize the risk of neurological complications by considering that this structure may have narrowed during operations close to the IOF. The relationship between these morphological changes and symptoms should be evaluated in larger and prospective studies.

Ethical approval

This study has been approved by the Bolu Abant Izzet Baysal University Non-Interventional Clinical Research Ethics Committee (approval date 04.03.2025, number 2025/98).

Author contribution

Concept: AG, FA; Design: AG, FA; Data Collection or Processing: FA, AG, SH; Analysis or Interpretation: FA, EK, SH; Literature Search: AG, FA, EK, SH; Writing: AG, FA, EK, SH. All authors reviewed the results and approved the final version of the article.

Source of funding

The authors declare the study received no funding.

Conflict of interest

The authors declare that there is no conflict of interest.

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