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Original Research Article

Nasal floor mucosal thickness in chronic rhinosinusitis: a computed tomography-based case-control study

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ABSTRACT

Background: Tissue remodelling is a hallmark of chronic rhinosinusitis (CRS), yet the nasal floor has received little attention as a potential site of structural change. This study aimed to explore whether radiographic evidence of nasal floor mucosal thickening is a distinctive feature of CRS and a potential endotype marker.
Methods: This case-control study included 80 patients with bilateral CRS who underwent endoscopic sinus surgery and 80 controls. Nasal floor mucosal thickness was measured at two points on coronal paranasal sinus computed tomography (CT): anteriorly, where the inferior turbinate inserts the maxilla, and posteriorly, at the nasolacrimal duct opening into the inferior meatus.
Results: Mean nasal floor mucosal thickness was significantly greater in CRS patients than in controls at both anterior (2.52±0.74 mm vs. 2.02±0.59 mm) and posterior (2.05±0.63 mm vs. 1.52±0.44 mm) sites ($p<0.001$). Within the CRS cohort, anterior mucosal thickness was significantly higher in eosinophilic CRS compared to non-eosinophilic CRS patients ($p=0.006$).
Conclusions: Increased nasal floor mucosal thickness is associated with CRS, particularly in the eosinophilic endotype. Given its simplicity and reproducibility, nasal floor thickness may support non-invasive endotype differentiation and aid in clinical decision-making. Further prospective studies are needed to validate its diagnostic and prognostic value.

Keywords: Rhinosinusitis, Nasal mucosa, Airway remodelling, Computed tomography, Nasal cavity, Inflammation

INTRODUCTION

Tissue remodelling is a dynamic process and a hallmark of CRS, involving both transient and permanent alterations in mucosal structure.[1,2] Common histopathological alterations include mucosal hypertrophy, basement membrane thickening, subepithelial collagen deposition and fibrosis.[3] While much is known about these changes in the paranasal sinuses, it remains unclear whether specific regions of the nasal cavity-particularly the nasal floor-undergo consistent structural alterations in CRS.

The anatomical continuum between the nasal cavity and paranasal sinuses, along with shared inflammatory processes, suggest that nasal cavity changes may mirror those in the sinuses. Accordingly, correlations in inflammatory severity have been reported between septal and ethmoid mucosa and between inferior turbinate and ethmoid mucosa.[4,5]

However, the nasal floor mucosa has been largely overlooked in both histopathological and radiological research. To date, no imaging studies have systematically evaluated the nasal floor mucosa in healthy individuals or

patients with CRS. Meanwhile, emerging evidence highlights the utility of paranasal sinus CT for differentiating CRS endotypes, a distinction essential for guiding therapy, anticipating disease severity and optimizing prognostic assessments.[6-10]

Following this rationale, we investigated whether nasal floor mucosal thickening on CT is a distinctive radiological feature of CRS, and whether it relates to different disease endotypes.

METHODS

Study design

Retrospective case-control study involving 80 patients diagnosed with CRS and 80 matched controls. This study received formal approval from the institutional review board and ethical committee of the Unidade Local de Saúde Gaia/Espinho.

Study group

Patients with bilateral CRS who underwent endoscopic sinus surgery (ESS) between 2022 and 2024 were consecutively selected from a tertiary referral clinic. The diagnosis of CRS was confirmed by an Otorhinolaryngologist following the EPOS 2020 criteria.[9] Patients under 18 years of age and those without preoperative CT scans available in the hospital system were excluded from the study.

Control group

Patients aged between 18-80 years old, with no CRS, who underwent maxillofacial CT scan in the emergency service following trauma were consecutively selected. Patients with maxillofacial fractures, traumatic nasal deformities, hemosinus or a Lund-Mackay score greater than 2 were excluded.

Clinical variables

Demographic and clinical data were collected, including age, sex, tobacco use, and the presence of comorbidities, such as asthma and allergic rhinitis. eCRS and neCRS were differentiated by the level of eosinophilic infiltration in histology, with eCRS defined by the presence of more than 10 eosinophils per high-powered field.[9]

CT scan analysis

CT scans were performed at the imaging department of the same hospital in all patients. The CT scans were done with 1mm slice thickness in axial plane and reconstructed in coronal and sagittal planes. Images were analysed using Sectra IDS7 software, ©2024 Sectra AB. The extent of paranasal sinus opacification was assessed and categorized using the Lund-Mackay scoring system, which ranges from 0 to 24.[11]

In the coronal view of the CT scan, we measured the vertical height of the nasal floor mucosa at the midpoint of the nasal floor at two specific locations: Anterior level: At the plane where the inferior turbinate anteriorly inserts the maxilla (Figure 1 A). Posterior level: At the plane where the nasolacrimal duct's opening into the inferior nasal meatus showed its maximal diameter (Figure 1 B).

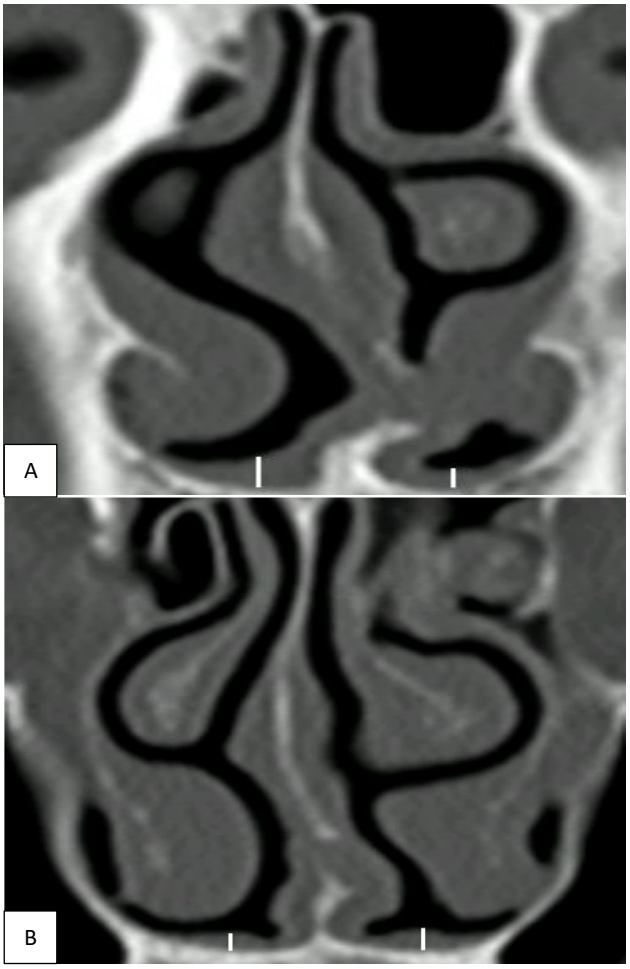

Figure 1: Coronal CT depicts (A) the anterior and (B) posterior nasal floor mucosal thickness.

Statistical analysis

Statistical analyses were performed using SPSS version 25.0, with significance set at $p<0.05$. Categorical variables were expressed as frequencies and percentages, and continuous variables as means±SD or medians with IQR. Group comparisons used t tests or the Mann-Whitney *U* test, as appropriate. Binary logistic regression assessed the association between nasal floor thickness and CRS. Receiver operating characteristic (ROC) curve analysis was conducted to assess the diagnostic performance of anterior mucosal thickness in identifying CRS and in differentiating eCRS from neCRS. Optimal cut-off points were identified using the Youden index.

RESULTS

A total of 160 patients (91 men and 69 women), aged between 18 and 80 years (mean age 47.11±14.73) were included in the study. The CRS group (n=80) and control group (n=80) were similarly distributed in terms of sex (p=0.632) and age (p=0.216). A higher prevalence of asthma and allergic rhinitis was observed in CRS group.

The clinical and radiological characteristics of the CRS and control groups are outlined in Table 1. The median Lund-Mackay score in the CRS group was 14.50 (IQR=8.0), ranging from 4 to 24, while in the control group, it was 0.50 (IQR=8.0), ranging from 0 to 2.

In the CRS group, the mean anterior nasal floor mucosal thickness was 2.49±0.79mm on the right side and 2.55±0.89mm on the left side. The mean posterior nasal floor mucosal thickness on the right and left sides was 2.05±0.71 mm and 2.06±0.73mm, respectively. There was no statistically significant difference in mucosal thickness between the two sides for either the anterior (p=0.514) or posterior (p=0.840) regions.

Control group had a mean anterior nasal floor mucosal thickness of 1.98±0.65mm on the right side and 2.05±0.65 mm on the left side. The mean posterior nasal floor mucosal thickness was 1.56±0.48mm on the right side and 1.48±0.48mm on the left side. No significant difference in mucosal thickness was observed between the two sides for either the anterior (p=0.243) or posterior (p=0.065) regions. Overall, nasal floor mucosal thickness was significantly higher in CRS group compared to the control group in all areas analysed (p<0.001).

When examining the case and control groups separately, no significant differences were observed in anterior or posterior nasal floor mucosal thickness according to the presence of asthma or allergic rhinitis within each group (p>0.05).

After adjustment for potential confounding factors, both anterior (adjusted p=0.049) and posterior (adjusted p=0.012) nasal floor mucosal thicknesses were positively correlated with the presence of CRS.

Of the 80 CRS patients, 72.50% underwent primary ESS, while the remaining (27.5%) required revision ESS. Based on tissue eosinophilia, CRS was classified as eCRS in 59 patients (73.75%) and as neCRS in 21 patients (26.25%). The median anterior nasal floor mucosal thickness was significantly higher in the eCRS group (2.75mm, IQR=0.91), compared to the neCRS group (2.05mm, IQR=0.55), p=0.006. However, the median posterior nasal floor mucosal thickness did not significantly differ between eCRS patients (2.15, IQR=0.85) and neCRS patients (1.88, IQR=1.16), p=0.173.

ROC curve analysis demonstrated that anterior nasal floor mucosal thickness had moderate diagnostic accuracy for distinguishing CRS from controls (AUC=0.712, 95% CI: 0.633-0.792, p<0.001), with an optimal cut-off of 2.0 mm (sensitivity 75.0%, specificity 56.2%). Within the CRS group, anterior thickness showed modest but significant ability to differentiate eCRS from neCRS (AUC=0.679, 95% CI: 0.545-0.813, p=0.015), with a 2.2 mm cut-off yielding 72.9% sensitivity and 66.7% specificity.

Table 1: Clinical and radiological characteristics of the CRS and control groups.

Variables	Overall, (n=160) (%)	CRS group, (n=80) (%)	Control group, (n=80) (%)	Unadjusted p value
Age, mean (SD), (in years)	47.11 (14.73)	48.55 (14.56)	45.66 (14.84)	0.216
Sex, male	91 (56.88)	47 (58.80)	44 (55.0)	0.632
Tobacco abuse[a]				
Never smoker	73 (45.63)	43 (57.33)	30 (56.60)	0.023
Former smoker	24 (15.0)	19 (25.33)	5 (9.43)	
Current smoker	31 (19.37)	13 (17.33)	18 (34.96)	
Asthma[b]	40 (30.30)	34 (43.04)	6 (11.32)	<0.001
Allergic rhinitis[c]	52 (46.02)	39 (57.35)	13 (28.89)	0.004
Lund-Mackay total score, median (IQR)	3.0 (15)	14.50 (8.0)	0.50 (1.0)	<0.001
Anterior nasal floor mucosal thickness, mean (SD) [mm]				
Right side	2.26 (0.79)	2.49 (0.79)	1.98 (0.65)	<0.001
Left side	2.29 (0.81)	2.55 (0.89)	2.05 (0.65)	<0.001
Mean value	2.29 (0.75)	2.52 (0.74)	2.02 (0.59)	<0.001
Posterior nasal floor mucosal thickness, mean (SD) [mm]				
Right side	1.82 (0.69)	2.05 (0.71)	1.56 (0.48)	<0.001
Left side	1.78 (0.69)	2.06 (0.73)	1.48 (0.48)	<0.001
Mean value	1.82 (0.67)	2.05 (0.63)	1.52 (0.44)	<0.001
Nasal septum deviation	76 (47.50)	30 (37.50)	46 (57.5)	0.011
Laterality of septum deviation, right	39 (51.32)	15 (50.0)	30 (52.2)	0.853

*****CRS-chronic rhinosinusitis; CT-computed tomography, [a]32 missing cases; [b]28 missing cases; [c]47 missing cases

DISCUSSION

We conducted a novel CT-based evaluation of the nasal floor mucosal thickness in patients with CRS, demonstrating its potential utility as a radiological marker for the disease and for endotype differentiation. We found a clear association between increased nasal floor mucosal thickness and CRS. Specifically, ROC curve analysis of the anterior nasal floor mucosal thickness demonstrated moderate accuracy in distinguishing CRS from controls and modest discriminative ability in differentiating eosinophilic from non-eosinophilic CRS.

Our results support the hypothesis that structural remodelling of the nasal floor mucosa occurs in patients with CRS as part of the disease process. This observation aligns with the findings of Shetty et al who reported a correlation between inferior turbinate volume and maxillary sinus mucosal thickening.[12]

In our cohort, asthma and allergic rhinitis did not significantly influence nasal floor mucosal thickness in either CRS or control groups, suggesting that these comorbidities, though linked to type 2 inflammation, may not drive localized remodelling of the nasal floor. Comparable results were reported by Sharhan et al who observed no difference in inferior turbinate thickness or nasal patency between allergic and non-allergic rhinitis patients.[13] However, the evidence regarding the broader influence of atopy on sinus imaging in CRS remains inconsistent, with some studies reporting higher Lund-Mackay scores in patients with asthma or inhalant allergies, while others found no significant differences.[14-16]

An interesting finding in our study was the significantly increased anterior nasal floor mucosal thickness in patients with eCRS. While prior research has established more aggressive remodelling in eCRS at multiple sinonasal sites, our results highlight the nasal floor-a region commonly overlooked-as a potentially informative area in differentiating CRS endotypes.[1,3,17] Clinically, this has promising implications. As CRS management increasingly relies on endotyping, accessible imaging markers of eosinophilic inflammation could enhance early, non-invasive stratification of the disease. In this context, imaging-based indicators, such as nasal floor mucosal thickening, could serve as practical adjuncts to blood eosinophil levels and conventional CT scores in preoperative assessments.[18]

Recent studies have shown that CT-based metrics, such as the ethmoid-to-maxillary (E/M) score ratio can distinguish between eCRS and non-eCRS patients.[6,7] Moreover, radiomics-based models are emerging tools that also demonstrate high predictive accuracy in identifying eCRS, but require complex post-processing workflows.[19,20] In contrast, measuring anterior nasal floor thickness is a simple, reproducible method that could be easily integrated into routine CT evaluation.

Our study has several limitations. First, its retrospective and single-centre design may limit the generalizability of the findings. Second, while CT imaging provides structural insights, it does not fully capture the dynamic and multifactorial nature of sinonasal inflammation. Additionally, we did not account for certain patient-related variables that could influence mucosal thickness, such as recent upper respiratory infections, the use of topical or systemic corticosteroids, or nasal decongestants prior to imaging. Although measurements were consistently obtained at predefined anatomical landmarks to ensure reproducibility, all assessments were performed by a single reviewer, which may introduce observer bias.

A key strength of our study is its focused, imaging-based approach to a specific and underexplored anatomical region-the nasal floor. This is the first study to quantitatively assess nasal floor mucosal thickness in CRS patients compared to healthy controls. The inclusion of a control group and stratification by eosinophilic endotype add further robustness to the findings. By employing consistent measurement techniques relative to fixed anatomical points, we ensured internal consistency and minimized technical variability.

Future prospective studies with histopathological correlation are needed to validate the radiologic findings and further elucidate the relationship between nasal floor mucosal thickening and underlying tissue remodelling. Larger, multicentre cohorts could also help determine whether nasal floor thickness serves as a reliable imaging biomarker for CRS endotyping and whether changes in this measurement reflect therapeutic response over time. If confirmed, this simple, reproducible metric may offer a low-cost, accessible tool to aid clinicians in disease stratification and guide personalized management strategies in CRS.

CONCLUSION

This study demonstrates that nasal floor mucosal thickness, as measured by CT, is significantly increased in patients with CRS, particularly in the eosinophilic endotype. Given its simplicity and reproducibility, nasal floor thickness may serve as a valuable adjunct imaging marker for endotype classification and monitoring treatment response. Further prospective studies are needed to validate its clinical utility and establish standardized thresholds for integration into routine diagnostic workflows.

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REFERENCES

1. Barham HP, Osborn JL, Snidvongs K, Mrad N, Sacks R, Harvey RJ. Remodeling changes of the

upper airway with chronic rhinosinusitis. Int Forum Allergy Rhinol. 2015;5(7):565-72.
2. Lee K, Tai J, Lee SH, Kim TH. Advances in the Knowledge of the Underlying Airway Remodeling Mechanisms in Chronic Rhinosinusitis Based on the Endotypes: A Review. Int J Molec Sci. 2021;22:2.
3. Kuhar HN, Tajudeen BA, Mahdavinia M, Gattuso P, Ghai R, Batra PS. Inflammatory infiltrate and mucosal remodeling in chronic rhinosinusitis with and without polyps: structured histopathologic analysis. Int Forum Allergy Rhinol. 2017;7(7):679-89.
4. Bhattacharyya N. Chronic rhinosinusitis: is the nose really involved? Am J Rhinol. 2001;15(3):169-73.
5. Ardehali MM, Amali A, Bakhshaee M, Madani Z. Histopathologic characteristics of inferior turbinate vs ethmoidal polypin chronic rhinosinusitis. Ann Diagn Pathol. 2011;15(4):233-6.
6. Rai G, Roy P, Gupta N, Sharma S, Dar SA, Ansari MA, et al. Computed Tomography Score an Excellent Marker: Differentiates Eosinophilic and Non-eosinophilic Variants of Chronic Rhinosinusitis with Nasal Polyp. Indian J Otolaryngol Head Neck Surg. 2019;71(3):1787-92.
7. Li F, Wang S, Cha X, Li T, Xie Y, Wang W, et al. Blood Eosinophil Percentage and Improved Sinus CT Score as Diagnostic Tools for ECRS. OTO open. 2024;8(1):e106.
8. Rosati D, Rosato C, Pagliuca G, Cerbelli B, Della Rocca C, Di Cristofano C, et al. Predictive markers of long-term recurrence in chronic rhinosinusitis with nasal polyps. Am J Otolaryngol. 2020;41(1):102286.
9. Fokkens WJ, Lund VJ, Hopkins C, Hellings PW, Kern R, Reitsma S, et al. European Position Paper on Rhinosinusitis and Nasal Polyps 2020. Rhinology. 2020;58(S29):1-464.
10. Bachert C, Marple B, Hosemann W, Cavaliere C, Wen W, Zhang N. Endotypes of Chronic Rhinosinusitis with Nasal Polyps: Pathology and Possible Therapeutic Implications. J Allergy Clin Immunol Pract. 2020;8(5):1514-9.
11. Lund VJ, Mackay IS. Staging in rhinosinusitus. Rhinology. 1993;31(4):183-4.
12. Shetty SR, Al-Bayatti SW, Al Kawas S, Al-Rawi NH, Kamath V, Shetty R, et al. A study on the association between the inferior nasal turbinate volume and the maxillary sinus mucosal lining using cone beam tomography. Heliyon. 2022;8(3):e09190.
13. Sharhan SSA, Lee EJ, Hwang CS, Nam JS, Yoon JH, Kim CH, et al. Radiological comparison of inferior turbinate hypertrophy between allergic and non-allergic rhinitis: does allergy really augment turbinate hypertrophy? Europ Arch Oto-rhino-laryngol. 2018;275(4):923-9.
14. Liu Y, Zeng X, Nie Z, Guo Y, Li N, Chen J, et al. Comparison the Impacts of Asthma and Allergic Rhinitis on Chronic Rhinosinusitis With Nasal Polyps. The Laryngoscope. 2025;135(10):3556-65.
15. Batra PS, Tong L, Citardi MJ. Analysis of comorbidities and objective parameters in refractory chronic rhinosinusitis. The Laryngoscope. 2013;123(7):S1-11.
16. Penezić A, Paić M, Gregurić T, Grgić MV, Baudoin T, Kalogjera L. The impact of asthma on quality of life and symptoms in patients with chronic rhinosinusitis(). Curr Med Res Opin. 2020;36(6):1043-8.
17. Saitoh T, Kusunoli T, Yao T, Kawano K, Kojima Y, Miyahara K, et al. Relationship between epithelial damage or basement membrane thickness and eosinophilic infiltration in nasal polyps with chronic rhinosinusitis. Rhinology. 2009;47(3):275-9.
18. Poto R, Pelaia C, di Salvatore A, Saleh H, Scadding GW, Varricchi G. Imaging of chronic rhinosinusitis with nasal polyps in the era of biological therapies. Curr Opin Aller Clin Immunol. 2024;24(4):243-50.
19. Zhu KZ, He C, Li Z, Wang PJ, Wen SX, Wen KX, et al. Development and multicenter validation of a novel radiomics-based model for identifying eosinophilic chronic rhinosinusitis with nasal polyps. Rhinology. 2023;61(2):132-43.
20. Darbari Kaul R, Sacks PL, Thiel C, Rimmer J, Kalish L, Campbell RG, et al. Radiomics of the Paranasal Sinuses: A Systematic Review of Computer-Assisted Techniques to Assess Computed Tomography Radiological Data. Am J Rhinol Allergy. 2025;39(2): 147-58.

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