


Sphenoid Sinus Involvement in Chronic Rhinosinusitis Without Polyps

Allergy & Rhinology
Volume 11: 1–5
© The Author(s) 2020
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/2152656720934472
journals.sagepub.com/home/aar



Ibrahim Sumaily, MBBS, SB¹ , Ibrahim Alarifi, MBBS, SB¹,
Abdussalam Alahmari, MBBS¹ ,
Mohammad Aloulah, MD, SB, KSUF¹, and
Saad Alsaleh, MBBS, FRCSC¹

Abstract

Background: Chronic rhinosinusitis (CRS) is a common chronic disease. It has 2 main clinical subtypes: CRS with nasal polyposis (CRSwNP) and without nasal polyps (CRSsNP). The sphenoid sinus appears to be less frequently involved in CRSsNP cases. Thus, we aimed to compare the incidence of sphenoid sinus involvement between CRSsNP and CRSwNP cases.

Methods: A retrospective chart review of CRS cases was performed. The clinical and imaging findings, including age, sex, adenoid, and inferior turbinate hypertrophy (ITH), deviation of the nasal septum (DNS), presence of polyps, Lund–McKay scores, and the final diagnosis, were assessed. The incidence of sphenoid sinus involvement in each CRS subtype and its correlation with the aforementioned variables were studied.

Results: Of the 289 cases, 151 met the inclusion criteria including 82 CRSwNP and 69 CRSsNP cases. The mean patient age was 35.48 ± 11.88 years. The incidence of men and women were 66.9% and 33.1%, respectively. The sphenoid sinus involvement was 89% and 65.2% in the CRSwNP and CRSsNP cases ($P = .0001$), respectively. The involvement of other paranasal sinuses showed no statistically significant differences between the 2 phenotypes. No other evaluated variables, including age, gender, DNS, ITH, or adenoid hypertrophy, significantly correlated with the incidence of sphenoid sinus involvement.

Conclusions: This is the first study to demonstrate that the sphenoid sinus is less frequently involved in CRSsNP cases. Further studies should investigate the underlying factors causing the lower incidence of sphenoid sinus involvement in CRSsNP.

Keywords

sinusitis, phenotype, sphenoid, nasal polyps, predilection

Introduction

Chronic rhinosinusitis (CRS) is a common disease, affecting 14% to 16% of the adult population in the United States.¹ It has 2 main clinical subtypes: CRS with nasal polyps (CRSwNP) and without nasal polyps (CRSsNP).^{1,2} Pathophysiologically, although both phenotypes are based on sinonasal inflammation, the immune responses are markedly different. In CRSwNP, the T-helper 2 response to the antigen-presenting cells leads to the activation of eosinophils, B cells, mast cells, and Immunoglobulin E production, and in some cases, macrophage activation contributing to inflammation, but without the expression of the

transforming growth factor (TGF)-beta or its receptors. In contrast, in CRSsNP, the T-helper 1 and 0 response leads to the activation of neutrophils and B cells, with increased expression of TGF-beta and its receptors.³ The incidence of CRSsNP is higher than that of CRSwNP.⁴

¹Otolaryngology–Head & Neck Surgery Department, College of Medicine, King Saud University, Riyadh, Saudi Arabia

Corresponding Author:

Saad Alsaleh, Otolaryngology–Head & Neck Surgery Department, King Abdulaziz University Hospital, P.O. Box 245, Riyadh 11411, Saudi Arabia.
Email: alsaad@ksu.edu.sa



However, most patients with CRS have bilateral presentation. The specific sinus predilection of each phenotype has not been reported, to date.

In our patients with CRS, involvement of specific sinuses differed with the subtype. In particular, involvement of the sphenoid sinuses was less frequent in those with CRSsNP. Therefore, we conducted this study to compare the incidence of sphenoid sinus involvement between CRSsNP and CRSwNP patients.

Methods

A retrospective chart review of patients with CRS who attended the Senior Author Clinic at King Abdul-Aziz University Hospital, King Saud University, Riyadh between January 2016 and December 2018, was performed. Approval to conduct the study was obtained from the Institutional Research Board Committee of King Saud University. The sample size was calculated to investigate whether the difference between CRSwNP and CRSsNP in terms of the incidence of sphenoid sinus involvement was statistically significant. All cases included have been diagnosed to have either CRSwNP or CRSsNP according to the European Position Paper on Rhinosinusitis and Nasal Polyposis 2012 (EPOS 2012).¹ Imaging in the form of a paranasal sinuses computed tomography scan was obtained in the included patients who have failed appropriate medical therapy indicating the need for functional endoscopic sinus surgery. The Lund–McKay (LM) score of 1 or higher for unilateral sphenoid sinus involvement with a power of 80% was used, resulting in the requirement of 22 cases for each group. However, we chose to include all the patients who met the inclusion criteria.⁵ Imaging was evaluated blinded to the clinical data. We reviewed their clinical and imaging findings including age, sex, hypertrophy of

the adenoids and inferior turbinates, presence of polyps, LM scores for all paranasal sinuses, and the final diagnosis. Thereafter, we evaluated the incidence of sphenoid sinus involvement (as defined as LM score of ≥ 1) in each CRS subtype and correlated our findings with the aforementioned variables. The exclusion criteria were allergic fungal rhinosinusitis, LM score less than 10/24 (to overcome the possibility of including CRSsNP cases with minimal sinus involvement), pediatric patients, a history of revision surgery, rudimentary sphenoid sinuses, neoplasms, autoimmune diseases, vasculitis, cystic fibrosis, and syndromic patients. Data were analyzed using the Statistical Package for the Social Sciences (SPSS v 22; IBM Corp., New York), χ^2 test for categorical variables, and one-way analysis of variance for continuous variables. We considered P -value $< .05$ a statistically significant difference.

Results

Out of the 289 records reviewed, 151 met the inclusion criteria including 82 CRSwNP and 69 CRSsNP cases. The mean age was 35.48 ± 11.88 years. The incidence of men and women were 66.9% and 33.1%, respectively. Inferior turbinate hypertrophy and adenoid hypertrophy were present in 80.1% and 11.3% of the patients, respectively. The nasal septum was deviated in 68.2% of the patients. The sphenoid sinuses were involved in 78.1% of the patients including 89% and 65.2% of the CRSwNP and CRSsNP patients, respectively ($P = .0001$; Table 1). Other evaluated variables including age, sex, nasal septum deviation, inferior turbinate hypertrophy, or adenoid hypertrophy did not significantly correlate with sphenoid sinus involvement ($P > .05$; Table 2). The other paranasal sinuses were evaluated to detect any other sinus-associated phenotype predilection of

Table 1. Comparison of Disease Phenotype Distribution in the Paranasal Sinuses and Impact of the Study Variables Between the Unmatched Study Groups.

Variable \ Phenotype	CRSwNP (n = 82)	CRSsNP (n = 69)	P
Age	37.28 ± 13.28	33.33 ± 9.64	.042
Gender, male	65.9%	68.1%	.453
Adenoid hypertrophy	7.3%	15.9%	.079
Turbinate hypertrophy	73.2%	88.4%	.015
Deviated nasal septum	64.6%	72.5%	.197
LM score, mean	16.20 ± 3.94	12.06 ± 2.50	.0001
Frontal sinus involvement	90.2%	82.6%	.128
Maxillary sinus involvement	100%	100%	1
Anterior ethmoid sinus involvement	100%	100%	1
Posterior ethmoid sinus involvement	98.8%	97.1%	.435
Sphenoid sinus involvement	89%	65.2%	.0001

Abbreviations: CRSsNP, chronic rhinosinusitis without nasal polyps; CRSwNP, chronic rhinosinusitis with nasal polyposis; LM score, Lund–McKay score.

Table 2. Impact of Study Variables on Sphenoid Sinusitis.

Variable	Normal Sphenoid Sinus	Sphenoiditis	P
N	33	118	–
Age	32.45 ± 10.83	36.32 ± 12.07	.099
Gender, male	75.8%	64.4%	.223
Adenoid hypertrophy	9.1%	11.9%	.658
Deviated nasal septum	69.7%	67.8%	.837
Inferior turbinate hypertrophy	90.9%	77.1%	.080
LM score	11.09 ± 0.88	15.68 ± 3.61	.0001

Abbreviations: CRSsNP, chronic rhinosinusitis without nasal polyps; CRSwNP, chronic rhinosinusitis with nasal polyposis; LM score, Lund–McKay score.

Table 3. Comparison of Disease Phenotype Distribution in the Paranasal Sinuses and Impact of the Study Variables Between the Matched Study Groups.

Variable	Phenotype	CRSwNP (n = 52)	CRSsNP (n = 62)	P
Age		37.96	34.02	.068
Gender, male		73.1%	69.4%	.410
Adenoid hypertrophy		7.7%	16.1%	.140
Turbinate hypertrophy		75%	87.1%	.078
Deviated nasal septum		63.5%	71%	.257
LM score, mean		13.56	13.06	.228
Frontal sinus involvement		84.6%	87.1%	.454
Maxillary sinus involvement		100%	100%	1
Anterior ethmoid sinus involvement		100%	100%	1
Posterior ethmoid sinus involvement		98.1%	98.4%	.706
Sphenoid sinus involvement		89%	65.2%	.024

Abbreviations: CRSsNP, chronic rhinosinusitis without nasal polyps; CRSwNP, chronic rhinosinusitis with nasal polyposis; LM score, Lund–McKay score.

CRS, but no significant differences were found ($P > .1$; Table 1).

In the analysis of sphenoid sinus involvement, the total LM score showed a significant difference between the phenotypes. This could be attributed to the nature of the phenotypes such that, the CRSwNP cases are expected to have higher LM scores than CRSsNP cases. However, for confirmation, we performed a subgroup analysis of the phenotypes with matching LM scores. Sphenoid sinus involvement was still significantly less in the CRSsNP cases than in the CRSwNP cases when the other variables had no statistically significant impact on this difference (Table 3).

Discussion

Our study demonstrated a significant difference in the incidence of sphenoid sinus involvement between the 2 CRS subtypes, with a higher incidence in the CRSwNP cases. To the best of our knowledge, this finding has not been reported in the English literature. Further studies are needed to comprehend the underlying causes for the

observed lower frequency of sphenoid sinus involvement in the CRSsNP cases. Studies focusing on the effect of anatomical, physiological, and microbiological variables on each paranasal sinus in different inflammatory states could possibly answer this question; however, these studies are currently lacking.

Several studies have evaluated the effect of the CRS phenotype on patient presentation and therapy. However, specific predilection of the phenotypes for certain sinuses has not been investigated.

Regarding the symptoms of CRS, Banerji et al. found that facial pain, pressure, and headache were more prevalent in CRSsNP than in CRSwNP ($P = .01$), while nasal obstruction and hyposmia or anosmia were more prevalent in CRSwNP than in CRSsNP ($P = .025$ and $.01$, respectively). However, the severity of symptoms was generally greater in the CRSwNP group. In addition, a multivariate analysis confirmed that a history of surgery, the LM score, and male sex were independent predictors of the polyp and polypoid phenotypes.⁶

Banerji et al. found that medication use was higher in CRSwNP patients than in the CRSsNP patients.⁶

Bhattacharyya found significantly greater antibiotic use (9.6 vs 3.9, $P=.036$) and physician visits (5.8 vs 1.8, $P=.024$) among those with complete sphenoid sinus opacification, although a prospective comparison showed no statistically significant difference in the rhinosinusitis symptom inventory score compared with an LM score-matched control group.⁷

Although sphenoid sinusitis is usually associated with involvement of other sinuses, isolated sphenoid sinusitis occurs occasionally. Celenk et al. studied sphenoid sinus involvement in 21 patients with an isolated sphenoid sinus disease and found polypoidal disease to be more prevalent than chronic inflammation with no polyps.⁸ This finding appears to have overestimated the incidence of isolated sphenoid sinus polyps.⁹ In addition, it did not reflect the predilection for specific sinuses in the CRS phenotypes.

Involvement of the sphenoid sinus is generally less frequent than the other paranasal sinuses. Jyothi et al. found the sphenoid sinus to be the least frequently involved, with an incidence of 13%, of 100 CRS cases.¹⁰ Similar findings of sinus predilection with higher incidences were noted in previous studies (20%–41.8%).^{11–13} Unfortunately, none of these studies correlated the findings with CRS phenotypes.

Our study findings may impact clinical care by studying the proposed decreased need for a sphenoidotomy in CRSsNP cases specifically and the impact of that decision on clinical improvement and need for revision surgery on long-term follow-up. In addition, some surgeons prefer performing a sphenoidotomy routinely prior to anterior skull base dissection to attain certain anatomical landmarks. This practice has the potential to cause iatrogenic sphenoid sinusitis and/or unwanted complications which is not warranted especially with the decreased involvement seen in the CRSsNP population in this study. This will also influence the initiation of further studies to evaluate the pathophysiological background of these results to possibly uncover how the sphenoid sinus is different from other paranasal sinuses.

The retrospective design of this study is one of the major limitations along with the lack of some intra- and postoperative clinical data to correlate the mentioned findings with the patients' clinical course. These could be addressed in a prospective trial to evaluate the indications of a sphenoidotomy and long-term fate of the sphenoid sinus in CRSsNP cases.

Conclusions

This is the first study to show that the sphenoid sinus is less frequently involved in CRSsNP cases. Further studies should be conducted to investigate the factors causing the higher incidence of sphenoid sinus involvement in CRSwNP.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Approval

This study was approved by our institutional review board.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Statement of Human and Animal Rights

This article does not contain any studies with human or animal subjects.

Statement of Informed Consent

There are no human subjects in this article and informed consent is not applicable.

ORCID iDs

Ibrahim Sumaily  <https://orcid.org/0000-0003-2740-8682>
Abdussalam Alahmari  <https://orcid.org/0000-0001-7867-8258>

References

1. Fokkens WJ, Lund VJ, Mullol J, et al. EPOS 2012: European position paper on rhinosinusitis and nasal polyps 2012. A summary for otorhinolaryngologists. *Rhinology*. 2012;50:1–12.
2. Rosenfeld RM, Piccirillo JF, Chandrasekhar SS, et al. Clinical practice guideline (update): adult sinusitis. *Otolaryngol Head Neck Surg*. 2015;152(2 Suppl):S1–S39.
3. Bachert C, Akdis CA. Phenotypes and emerging endotypes of chronic rhinosinusitis. *J Allergy Clin Immunol Pract*. 2016;4:621–628.
4. Cho SH, Kim DW, Gevaert P. Chronic rhinosinusitis without nasal polyps. *J Allergy Clin Immunol Pract*. 2016;4:575–582.
5. Lund VJ, Mackay IS. Staging in rhinosinusitis. *Rhinology*. 1993;31:183.
6. Banerji A, Piccirillo JF, Thawley SE, et al. Chronic rhinosinusitis patients with polyps or polypoid mucosa have a greater burden of illness. *Am J Rhinol*. 2007;21:19–26.
7. Bhattacharyya N. The completely opacified frontal or sphenoid sinus: a marker of more severe disease in chronic rhinosinusitis? *Laryngoscope*. 2005;115:2123–2126.
8. Celenk F, Gulsen S, Gonuldas B, et al. Isolated sphenoid sinus disease: an overlooked cause of headache. *J Craniomaxillofac Surg*. 2015;43:1914–1917.
9. Ozcan M, Ozlugedik S, Ikinciogullari A. Simultaneous antrochoanal and sphenochanoanal polyps: a rare clinical entity. *J Laryngol Otol*. 2005;119:152–154.
10. Jyothi AC, Shrikrishna BH, Sandeep S, et al. Predilection of site in chronic rhinosinusitis: tomographic findings in 100 patients. *Online J Otolaryngol*. 2014;4:72.

11. Bolger EW, Butzin CA, Parsons DS. Paranasal sinus bony anatomic variations and mucosal abnormalities-CT analysis for endoscopic sinus surgery. *Laryngoscope*. 1991;101:56–64.
12. Smith LF, Brindley PC, Galveston H. Indications, evaluation, complications and results of functional endoscopic sinus surgery in 200 patients. *Otolaryngol Head Neck Surg*. 1993;108:688–696.
13. Maru YK, Gupta V. Anatomic variations of the bone in sinonasal CT. *Indian J Otolaryngol Head Neck Surg*. 2001;53:123–128.