Turkish Archives of Otorhinolaryngology

Turk Arch Otorhinolaryngol

Predictors and Time Interval of Chronic Rhinosinusitis Recurrence After Endoscopic Sinus Surgery

Original Investigation

Abdulaziz K. Alaraifi[1,2], Butoul Alanizy[2,3], Shmokh Alsalamah[2,3], Jumanah Alraddadi[2,3], Riyadh Alhedaithy[1,3]

[1]Division of Otolaryngology-Head and Neck Surgery, Department of Surgery, King Abdulaziz Medical City, Ministry of National Guard Health Affairs, Riyadh, Saudi Arabia
[2]King Abdullah International Medical Research Center, Riyadh, Saudi Arabia
[3]College of Medicine, King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia

Abstract

Objective: Chronic rhinosinusitis (CRS) is a common inflammatory disease that significantly impacts the quality of life. Endoscopic sinus surgery (ESS) is indicated for refractory CRS. This study aims to estimate the predictors of CRS recurrence, and the rates with time intervals of recurrent CRS and revision ESS.

Methods: A retrospective cohort study included 516 patients who underwent ESS for CRS at King Abdulaziz Medical City in Riyadh between January 2017 and May 2020. Patients were followed up for 12–48 months postoperatively. The study sample was divided into two groups based on the recurrence status and compared using the appropriate statistical tests. Significant variables were included in the logistic regression model to determine the predictors of CRS recurrence.

Results: The recurrence rate of CRS following ESS was 14.5%, with a time interval of 28.31 months, and standard deviation (SD) =18.76. On the other hand, the rate of revision ESS for recurrent CRS was 6.8%, with a time interval of 34.18 months, SD =16. In the multivariable logistic regression model, the significant predictors of recurrent CRS were a high Lund–Mackay (LM) score [odds ratio (OR): 1.055, p=0.04] and a high eosinophil count (OR: 3.619, p=0.03). Almost half of the patients who developed recurrent CRS underwent revision surgery (46.7%).

Conclusion: CRS has a considerable recurrence rate despite the high success rate of ESS, and nearly half of the recurrent CRS patients need revision surgery. A high LM score and eosinophilic count significantly increase the likelihood of CRS recurrence.

Keywords: Sinusitis, chronic disease, recurrence, endoscopic surgical procedure, surgical revision, multivariate analysis

ORCID IDs of the authors:
A.K.A. 0000-0001-7373-8119;
B.A. 0000-0002-5883-4564;
S.A. 0000-0002-1772-7367;
J.A. 0009-0005-7432-1690;
R.A. 0000-0002-4713-3527.

Cite this article as: Alaraifi AK, Alanizy B, Alsalamah S, Alraddadi J, Alhedaithy R. Predictors and Time Interval of Chronic Rhinosinusitis Recurrence After Endoscopic Sinus Surgery. Turk Arch Otorhinolaryngol

Corresponding Author:
Shmokh Alsalamah;
alsalamahshmokh@gmail.com

Received Date: 10.11.2023
Accepted Date: 05.01.2024

DOI: 10.4274/tao.2024.2023-10-9

Introduction

Chronic rhinosinusitis (CRS) is a common inflammatory disease of the lining mucosa of the nasal cavity and paranasal sinuses. It is classified based on the presence of nasal polyps through nasal endoscopy into two phenotypes: CRS with nasal polyps (CRSwNP) and CRS without nasal polyps (CRSsNP) (1, 2). It is also classified based on inflammatory patterns into two endotypes: type 2 and non-type 2 immune responses. The type 2 immune response involves eosinophils, IgE, and upregulation of type 2 cytokines, constituting most of CRSwNP. On the other hand, non-type 2 CRS is primarily considered a type 1 to type 3 immune response and is characterized by neutrophilic inflammation in the nasal mucosa (3). The treatment goals in patients with CRS are directed to improve patients' symptoms and quality of life. Currently, the standard appropriate medical therapy (AMT) consists of saline nasal irrigation and intranasal corticosteroids with a short course of oral corticosteroids (1). Endoscopic sinus surgery (ESS) is considered once AMT is unsuccessful and the patient is symptomatic (4).

ESS involves adequately enlarging the natural paranasal sinus drainage pathways via the surgical removal of the diseased mucosa and the bony partitions. This leads to the improvement of CRS symptoms by reducing the amount of sinonasal mucosal disease and facilitating the delivery of postoperative topical medications. It has a high success rate ranging from 75% to 95% in improving patients' symptoms and overall quality of life (1, 5). However, almost 9–34% of patients will develop recurrent disease, and 9–27% will undergo revision ESS (6-14). Multiple factors were documented in the literature to increase the rates of recurrence and revision surgery. These include patient-related factors [e.g., atopy, aspirin-exacerbated respiratory distress (AERD), immunodeficiency], disease-related factors (e.g., presence of polyps, presence of fungal mucin, eosinophil count, and extent of disease), and treatment-related factors (surgical technique, postoperative care, postoperative adhesions) (8, 10, 11, 15, 16).

Published studies on the rate and predictors of recurrent CRS and revision ESS showed variable results and are limited in Saudi Arabia. Therefore, this study aims to estimate the rate, predictors, and time interval of CRS recurrence post-ESS.

Methods

Study Design and Subjects

A retrospective cohort study was conducted at King Abdulaziz Medical City in Riyadh, Saudi Arabia. All adult patients (aged 18 years or older) who underwent ESS for the treatment of primary CRS between January 2017 and May 2020 were included in the study. Patients who underwent ESS for secondary CRS (i.e., fungal ball, neoplasm, odontogenic infection, or selective immunodeficiency) were excluded from the study.

Data Collection

The patients' electronic records were reviewed using the hospital's healthcare information system. The data collection flowsheet included patients' demographics, CRS-related conditions, immunodeficiency (i.e., uncontrolled diabetes, chemotherapy, acquired immunodeficiency syndrome, or post-transplant), CRS-related features (e.g., extent of disease, phenotype, preoperative laboratory tests, and imaging), and postoperative management with follow-up. Serum eosinophil count was considered low if the value was <50 per mm^3, normal if between 50–500 per mm^3, and high if >500 per mm^3. Lund-Mackay (LM) score was created based on computed tomography scan and categorized as low if the value was <15 and high if the value was ≥15. The patients were followed up for 12–48 months postoperatively at three-month intervals to detect the rates of recurrence and revision surgery. The disease was considered recurrent if the patient fulfilled the criteria of CRS, according to EPOS 2020, after a period without symptoms. Revision surgery was considered for recurrent CRS as a last resort after the failure of AMT for at least three months (17).

Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS®) version 25. The categorical variables were presented as frequencies and proportions, while the numerical variables were reported as means and standard deviations. The study sample was divided into two groups based on the recurrence status. The groups were compared using the chi–square test and the independent t-test for categorical and continuous variables, respectively. The variables were included in a multivariable logistic regression model to determine the predictors of CRS recurrence. A p-value of <0.05 was declared as statistically significant.

Ethics and Permissions

The institutional review board (IRB) of King Abdullah International Medical Research Center approved the study (study no: NRC21R/471/10, date: 22.11.2021).

Results

The study included 516 patients who underwent ESS for primary CRS. The mean age of our patients was 37.32 (±13.07) years, and male gender was the dominant gender (59.5%). Out of all patients with primary CRS, most patients (76.9%) were diagnosed with CRSwNP. CRS was unilateral in 28 (5.8%) patients; none were due to odontogenic infections, fungal infections, or neoplasms. Immunodeficiency disease and asthma were found in 11.2% and 8.3%, respectively. The recurrence rate of CRS post-ESS was 14.5%, while the revision surgery rate was 6.8% (Table 1).

The comparison between recurrent CRS and non-recurrent CRS groups is summarized in (Table 2). The recurrent CRS group has significantly higher rates of CRSwNP and lower rates of CRSsNP than the non-recurrent CRS group (p=0.001). The recurrent CRS group has higher rates of asthma and asthma and AERD with a significant p-value (<0.05 level). Moreover, high eosinophil count and LM score were significantly associated with CRS recurrence with a p-value of 0.006 and 0.002, respectively.

In the multivariable logistic regression model, the only significant predictors of recurrent CRS were high LM scores and high eosinophil counts (Table 3). An elevated eosinophil count increased the probability of CRS recurrence by 3.62 times [odds ratio (OR): 3.62, p=0.03]. Moreover, a high LM score was significantly associated with high CRS recurrence (OR: 1.055, p=0.04).

Table 4 demonstrates a sub-analysis of patients with recurrent CRS. The mean time intervals between primary ESS and recurrent CRS and between primary ESS and revision ESS were 28.31 (±18.76) and 34.18 (±16.82) months, respectively. Nearly half of the patients with recurrent CRS (46.7%) underwent revision ESS, and most patients with recurrent CRS had a lower LM score than their primary disease score.

Table 1. Clinical characteristics of the study sample

Variables	Full cohort (n=516)
Age (mean ± SD)	37.32 (±13.07)
Gender (n%)	
Male	307 (59.5%)
Female	209 (40.5%)
BMI (mean ± SD)	28.41 (±5.74)
Rhinosinusitis (n%)	
CRSsNP	119 (23.1%)
CRSwNP	397 (76.9%)
Immunodeficiency diseases (n%)	58 (11.2%)
Allergic rhinitis (n%)	55 (10.7%)
AERD (n%)	12 (2.3%)
Asthma (n%)	43 (8.3%)
Eosinophil count (n%)	
High	25 (4.8%)
Normal	353 (68.4%)
Low	58 (11.2%)
Extent of disease (n%)	
Unilateral	28 (5.4%)
Bilateral	488 (94.6%)
LM score (mean ± SD)	14.13 (±6.59)
Recurrence (n%)	75 (14.5%)
Revision surgery (n%)	35 (6.8%)

SD: Standard deviation, BMI: Body mass index, CRSsNP: Chronic rhinosinusitis without nasal polyps, CRSwNP: Chronic rhinosinusitis with nasal polyps, AERD: Aspirin-exacerbated respiratory distress, LM: Lund-Mackay

Discussion

The presented study investigated the rate and predictors of CRS recurrence and revision ESS. In our study, the most common diagnosis was CRSwNP (76.9%), which was expected as most nasal polyps tend to regrow despite AMT and eventually require surgical intervention (18). Our findings revealed an overall recurrence rate of 14.5%, consistent with the published literature, and a revision rate of 6.8% (6-14). The revision ESS rate reported in our study is low compared to the published literature, and only 46%

Table 2. Clinical characteristics of recurrent versus non-recurrent CRS

Variables	Recurrent CRS (n=75)	Non-recurrent CRS (n=441)	p-value
Age (mean ± SD)	35.65 (±12.78)	37.61 (±13.11)	0.232
Gender (n%)			
Male	40 (53.3%)	267 (60.5%)	0.240
Female	35 (46.7%)	174 (39.5%)	
Rhinosinusitis (n%)			
CRSsNP	8 (10.7%)	111 (25.2%)	0.006*
CRSwNP	67 (89.3%)	330 (74.8%)	
Smoking (n%)	9 (12%)	85 (19.3%)	0.131
Immunodeficiency (n%)	8 (10.7%)	50 (11.3%)	0.865
Allergic rhinitis (n%)	10 (13.3%)	45 (10.2%)	0.417
Asthma (n%)	13 (17.3%)	30 (6.8%)	0.002*
AERD (n%)	6 (8.0%)	6 (1.4%)	0.000*
Eosinophil count (n%)			
High	9 (14.5%)	16 (4.3%)	0.006*
Normal	46 (74.2%)	307 (82.1%)	
Low	7 (11.3%)	51 (13.6%)	
Extent of disease (n%)			
Unilateral	1 (1.3%)	27 (6.1%)	0.091
Bilateral	74 (98.7%)	414 (93.9%)	
LM score (mean ± SD)	16.29 (±6.00)	13.76 (±6.62)	0.002*

*Significant at p<0.05 level.

CRS: Chronic rhinosinusitis, SD: Standard deviation, CRSsNP: Chronic rhinosinusitis without nasal polyps, CRSwNP: Chronic rhinosinusitis with nasal polyps, AERD: Aspirin-exacerbated respiratory distress, LM: Lund-Mackay

Table 3. Predictors of CRS recurrence in logistic regression analysis

Variable	Odd ratio	p-value	95% LCI	95% UCI
LM score	1.055	0.040*	1.003	1.111
Eosinophil count	3.619	0.037*	1.080	12.128

*Significant at p<0.05 level.

CRS: Chronic rhinosinusitis, UCI: Upper confidence interval, LCI: Lower confidence interval, LM: Lund-Mackay

Table 4. Sub-analysis of patients with recurrent CRS

Variables	Recurrent CRS (n=75)
Time interval between primary ESS and recurrence (mean ± SD)	28.31 (±18.76)
LM score compared to primary disease (n%)	
Higher score	23 (30.7%)
Same score	18 (24.0%)
Lower score	34 (45.3%)
Management (n%)	
Revision surgery	35 (46.7%)
Medical treatment	33 (44.0%)
Patient refused revision surgery	7 (9.3%)
Time interval between primary ESS and revision ESS (mean ± SD)	34.18 (±16.82)

CRS: Chronic rhinosinusitis, SD: Standard deviation, ESS: Endoscopic sinus surgery, LM: Lund-Mackay

of the patients with recurrent disease underwent revision surgery. The lower revision rate may be due to social reasons, as 9.3% of patients with recurrent CRS refused revision surgery. Moreover, the presented study showed that most patients with recurrent CRS had a lower LM score than their primary disease score. This finding might also justify the low revision rate, as most patients had milder recurrent CRS than their primary disease. The mean durations between primary ESS and recurrence and between primary ESS and revision ESS were 28.31 and 34.3 months, respectively. This finding highlights the importance of regular follow-up of CRS patients for at least 28 months postoperatively for early detection of the recurrent disease.

Several studies investigated the recurrence of CRS post-ESS, aiming to identify the prognostic factors that play a role in the recurrence process (9, 13, 19). The presented study identified eosinophil count and LM score as predictors of CRS recurrence. It has been shown that prominent eosinophil infiltration plays a massive role in CRS development and tissue eosinophilia is seen in most CRS cases with or without polyps (20, 21). A study done in 2008 in Tokyo showed a similar association between eosinophil count and CRS recurrence (19). Moreover, the presented study showed that a high LM score increases the probability of recurrence threefold. Similarly, De Corso et al. (22) found that a high LM score (>12) was associated with a lower disease control at 12 months of follow-up, leading to an increased recurrence rate. A higher LM score typically indicates a more extensive disease with a higher degree of sinus opacification, which explains the higher recurrence rate. A higher LM score is also associated with the presence of nasal polyps; Tan et al. (23) showed that patients with CRSwNP had a higher presenting LM score than patients with CRSsNP. Our findings of high recurrence rate in patients with high blood eosinophilia and high LM score are explained by the type 2 immune response in these patients, as it tends to be extensive with a high recurrence rate that usually needs revision surgeries.

The need for revision of ESS can be of particular concern in patients with CRSwNP. CRSwNP has been shown to have a high regrowth rate, probably due to the nasal polyp interference with mucociliary clearance in addition to its mechanical obstruction (8, 10, 12). Stein et al. (11) conducted a large retrospective cohort study that involved over 61,000 patients and concluded that the diagnosis of CRSwNP is a positive predictor of the need for revision surgery. Furthermore, multiple studies have supported the same positive correlation between the presence of nasal polyps and the need for revision ESS (24, 25). Some patients may need more than one revision surgery, which increases the risks of intraoperative and postoperative complications (26). Therefore, multiple biological agents (e.g., dupilumab, mepolizumab, and omalizumab) are now approved and recommended for recurrent CRSwNP. The introduction of these biological agents might improve the outcome of CRSwNP and decrease the need for revision ESS in patients with type 2 CRS, thus avoiding the risk of intraoperative complications (3). On the contrary, several studies showed a revision rate ranging between 11% to 27% in both CRSsNP and CRSwNP groups with no significant difference between both groups (7, 12, 14). In our study, the recurrent CRS group had a higher rate of CRSwNP than the non-recurrent group. However, this finding was not significant in the multivariate analysis.

AERD were documented frequently in the literature as risk factors for CRS recurrence (2, 11, 25). This association is thought to be due to the shared pathophysiology of asthma and CRSwNP, as both conditions have the same type 2 immune response (2). Sella et al. (25) identified asthma as the only factor that affected the recurrence of CRS in both patients with CRSsNP and CRSwNP. Moreover, Mendelsohn et al. (8) found that patients with AERD have a higher risk of CRSwNP recurrence post-ESS compared to other prognostic factors, such as asthma and the presence of fungal mucin. However, our study showed no association between asthma and AERD with the recurrence of CRS in the multivariate analysis.

The presented study has some limitations, including its retrospective design and being conducted in one tertiary healthcare center, which may affect the generalizability of the study. However, the strengths of our study include the sample size and the long follow-up duration.

Conclusion

CRSwNP has a considerable recurrence rate despite the high success rate of ESS, and nearly half of the recurrent CRS cases need revision surgery. In this study, a high LM score and eosinophil count significantly increased the likelihood

of CRSwNP recurrence. We recommend prolonged regular follow-ups of CRSwNP patients postoperatively for early detection of recurrence.

Ethics Committee Approval: The institutional review board (IRB) of King Abdullah International Medical Research Center approved the study (study no: NRC21R/471/10, date: 22.11.2021).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: A.K.A., B.A., S.A., J.A., R.A., Concept: A.K.A., B.A., S.A., J.A., R.A., Design: A.K.A., B.A., S.A., J.A., R.A., Data Collection and/or Processing: A.K.A., B.A., S.A., J.A., Analysis and/or Interpretation: A.K.A., B.A., S.A., J.A., R.A., Literature Search: A.K.A., B.A., S.A., J.A., R.A., Writing: A.K.A., B.A., S.A., J.A., R.A.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Main Points

• This study aimed to estimate the rate, predictors, and time interval of chronic rhinosinusitis (CRS) recurrence post-endoscopic sinus surgery.

• 516 patients were included in this study, 75 patients developed recurrent CRS and nearly half of this group needed revision surgery.

• This study showed that CRS has a considerable recurrence rate and that two predictors significantly increase the likelihood of CRS recurrence; namely, high Lund Mackay score and eosinophilic count.

References

1. Patel GB, Kern RC, Bernstein JA, Hae-Sim P, Peters AT. Current and future treatments of rhinitis and sinusitis. J Allergy Clin Immunol Pract 2020; 8: 1522-31. [Crossref]
2. Laidlaw TM, Mullol J, Woessner KM, Amin N, Mannent LP. Chronic rhinosinusitis with nasal polyps and asthma. J Allergy Clin Immunol Pract 2021; 9: 1133-41. [Crossref]
3. Bernstein JS, Wechsler ME. Eosinophilic respiratory disorders and the impact of biologics. Curr Opin Pulm Med 2023; 29: 202-8. [Crossref]
4. Dietz de Loos D, Lourijsen ES, Wildeman MAM, Freling NJM, Wolvers MDJ, Reitsma S, et al. Prevalence of chronic rhinosinusitis in the general population based on sinus radiology and symptomatology. J Allergy Clin Immunol 2019; 143: 1207-14. [Crossref]
5. Soler ZM, Smith TL. Quality-of-life outcomes after endoscopic sinus surgery: how long is long enough? Otolaryngol Head Neck Surg 2010; 143: 621-5. [Crossref]
6. Albu S, Tomescu E, Mexca Z, Nistor S, Necula S, Cozlean A. Recurrence rates in endonasal surgery for polyposis. Acta Otorhinolaryngol Belg 2004;58: 79-86. [Crossref]
7. Huang BY, Lloyd KM, DelGaudio JM, Jablonowski E, Hudgins PA. Failed endoscopic sinus surgery: spectrum of CT findings in the frontal recess. Radiographics 2009; 29: 177-95. [Crossref]
8. Mendelsohn D, Jeremic G, Wright ED, Rotenberg BW. Revision rates after endoscopic sinus surgery: a recurrence analysis. Ann Otol Rhinol Laryngol 2011; 120: 162-6. [Crossref]
9. Mohsenh WA, Aljthalin RA, Aljthalin RA, Al-Bahkaly S. Risk factors of recurrent chronic rhinosinusitis after functional endoscopic sinus surgery. Saudi J Otorhinolaryngol Head Neck Surg 2019: 21: 33-6. [Crossref]
10. Philpott C, Hopkins C, Erskine S, Kumar N, Robertson A, Farboud A, et al. The burden of revision sinonasal surgery in the UK-data from the Chronic Rhinosinusitis Epidemiology Study (CRES): a cross-sectional study. BMJ Open 2015; 5: e006680. [Crossref]
11. Stein NR, Jafari A, DeConde AS. Revision rates and time to revision following endoscopic sinus surgery: a large database analysis. Laryngoscope 2018; 128: 31-6. [Crossref]
12. Wynn R, Har-El G. Recurrence rates after endoscopic sinus surgery for massive sinus polyposis. Laryngoscope 2004; 114: 811-3. [Crossref]
13. Bhattacharyya N. Ambulatory sinus and nasal surgery in the United States: demographics and perioperative outcomes. Laryngoscope 2010; 120: 635-8. [Crossref]
14. Smith KA, Orlandi RR, Oakley G, Meeks H, Curtin K, Alt JA. Long-term revision rates for endoscopic sinus surgery. Int Forum Allergy Rhinol 2019; 9: 402-8. [Crossref]
15. Chandra RK, Palmer JN, Tangsujarittham T, Kennedy DW. Factors associated with failure of frontal sinusotomy in the early follow-up period. Otolaryngol Head Neck Surg 2004; 131: 514-8. [Crossref]
16. McMains KC, Kountakis SE. Revision functional endoscopic sinus surgery: objective and subjective surgical outcomes. Am J Rhinol 2005; 19: 344-7. [Crossref]
17. 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: 1-464. [Crossref]
18. DeConde AS, Mace JC, Levy JM, Rudmik L, Alt JA, Smith TL. Prevalence of polyp recurrence after endoscopic sinus surgery for chronic rhinosinusitis with nasal polyposis. Laryngoscope 2017; 127: 550-5. [Crossref]
19. Matsuwaki Y, Ookushi T, Asaka D, Mori E, Nakajima T, Yoshida T, et al. Chronic rhinosinusitis: risk factors for the recurrence of chronic rhinosinusitis based on 5-year follow-up after endoscopic

sinus surgery. Int Arch Allergy Immunol 2008; 146: 77-81. [Crossref]

20. Harlin SL, Ansel DG, Lane SR, Myers J, Kephart GM, Gleich GJ. A clinical and pathologic study of chronic sinusitis: the role of the eosinophil. J Allergy Clin Immunol 1988; 81: 867-75. [Crossref]
21. Stoop AE, van der Heijden HA, Biewenga J, van der Baan S. Eosinophils in nasal polyps and nasal mucosa: an immunohistochemical study. J Allergy Clin Immunol 1993; 91: 616-22. [Crossref]
22. De Corso E, Settimi S, Tricarico L, Mele DA, Mastrapasqua RF, Di Cesare T, et al. Predictors of disease control after endoscopic sinus surgery plus long-term local corticosteroids in CRSwNP. Am J Rhinol Allergy 2021; 35: 77-85. [Crossref]
23. Tan BK, Zirkle W, Chandra RK, Lin D, Conley DB, Peters AT, et al. Atopic profile of patients failing medical therapy for chronic rhinosinusitis. Int Forum Allergy Rhinol 2011; 1: 88-94. [Crossref]
24. Hunter TD, DeConde AS, Manes RP. Disease-related expenditures and revision rates in chronic rhinosinusitis patients after endoscopic sinus surgery. J Med Econ 2018; 21: 610-5. [Crossref]
25. Sella GCP, Tamashiro E, Sella JA, Aragon DC, Mendonça TN, Arruda LKP, et al. Asthma is the dominant factor for recurrence in chronic rhinosinusitis. J Allergy Clin Immunol Pract 2020; 8: 302-9. [Crossref]
26. Moses RL, Cornetta A, Atkins JP, Jr., Roth M, Rosen MR, Keane WM. Revision endoscopic sinus surgery: the Thomas Jefferson University experience. Ear Nose Throat J 1998; 77: 190, 193-5, 199-202. [Crossref]