Original Article

Risk factors for recurrence of chronic rhinosinusitis with nasal polyps after endoscopic sinus surgery

A retrospective study

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ABSTRACT

الأهداف: تقييم العوامل المرضية التي تؤدي إلى عودة التهاب الجيوب الأنفية المزمن مع الزوائد الأنفية بعد جراحة الجيوب الأنفية بالمنظار ومقارنة السمات السريرية بين المرضى الذين عانوا من عودة الالتهاب والآخرين.

المنهجية: أجريت هذه الدراسة بأثر رجعي من 2015م إلى 2019م. تمت مقارنة عوامل الخطر والتشوهات التشريحية والسمات السريرية بين المرضى الذين يعانون من عودة التهاب الجيوب الأنفية المزمنة مع أولئك الذين لم يعود لهم المرض بعد إجراء العملية، تمت متابعة المجموعتين لمدة 24 شهرًا بعد الجراحة الأولية.

النتائج: من بين 134 مريضًا خضعوا للعملية، 69 مريضًا عاد لهم الالتهاب و65 لم يعد لهم. لم يكن الفرق كبير في الأمراض المزمنة والتشوهات التشريحية بين المجموعتين باستثناء أن الربو أكثر انتشارًا في المجموعة التي عانت من عودة الالتهاب (73.9% مقابل 29.2%؛ القيمة الاحتمالية أقل من 0.01). في جانب السمات السريرية المجموعة التي عانت من عودة الالتهاب يعانون من الزوائد الأنفية في الجهتين أكثر من الأخرى (95.7% مقابل 80%؛ القيمة الاحتمالية أقل من 0.01). وجدنا أيضاً أن 26.1% (العدد=18) من 69 مريضًا يعانون من عودة الالتهاب احتاجوا إلى جراحة أخرى. كانت معدلات التدخين مختلفة بشكل كبير بين المرضى الذين أعادوا الجراحة مقابل الذين لم يحتاجوا لإعادة الجراحة (16.7% (3/18) مقابل 2% (1/51)؛ القيمة الاحتمالية=0.02).

الخلاصة: الربو يعتبر عامل خطر كبير لتكرار التهاب الجيوب الانفية المزمن مع الزوائد الأنفية. بالإضافة إلى أن التدخين يزيد من فرصة إجراء جراحة أخرى في حالة عودة الالتهاب.

Objectives: To assess the pathophysiological factors leading to chronic rhinosinusitis (CRS) recurrence with nasal polyps (CRSwNP) after endoscopic sinus surgery (ESS) and compare the clinical and imaging findings between both groups.

Methods: A retrospective study was carried out at a tertiary hospital. Patients with recurrent nasal polyps were compared to those with no recurrence by demographics, risk factors, anatomical abnormalities, clinical features, and Lund–Mackey (LM) scores. Both groups were followed up for 24 months after the primary surgery to detect recurrence.

Results: Among the 134 patients who underwent ESS for CRSwNP, 69 patients were in the recurrence group and 65 in the non-recurrence group. No significant difference was found in demographics, comorbidities, and anatomical abnormalities between both groups. However, asthma was more prevalent in the recurrence group (73.9% vs. 29.2%; $p<0.01$). All clinical features were similar between both groups. However, the recurrence group had more patients with bilateral polyps than non-recurrence (95.7% vs. 80%; $p<0.01$). We found that 26.1% (n=18) of the 69 patients with recurrence needed revision surgery. Smoking rates were significantly different between reoperated vs. non-reoperated patients (16.7% (3/18) vs. 2% (1/51); $p=0.02$), and the extent of primary ESS was different between them.

Conclusion: Asthma is a significant risk factor for CRS recurrence. Furthermore, smoking and inadequate primary surgery increase the chance of revision surgery in case of recurrence.

Keywords: chronic rhinosinusitis, nasal polyps, endoscopic sinus surgery

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Chronic rhinosinusitis (CRS) is inflammation of the nose and paranasal sinuses that lasts for at least 12 weeks with 2 or more major symptoms. These symptoms should include nasal obstruction or discharge, along with facial pain or loss of smell. It can be chronic rhinosinusitis with nasal polyps (CRSwNP) or chronic rhinosinusitis without nasal polyps (CRSsNP).[1] Chronic rhinosinusitis has a wide range of symptoms that may negatively affect patients' health-related quality of life.[2] The prevalence of CRS varies widely between countries, with an overall rate of more than 10%.[3] In Saudi Arabia, females have a higher prevalence of CRS than males, and the most affected age groups are between 21 and 30 years old.[4]

Endoscopic sinus surgery (ESS) is the preferred treatment for CRSwNP that does not respond to medical therapy. It aims to reestablish ventilation and mucociliary clearance of the sinuses, thus improving the function and patency of the osteomeatal complex (OMC).[5] It is important to note that CRSwNP is a chronic condition that may persist even after ESS. Therefore, symptoms may recur at any time.[1] A multicenter study of 363 participants found that approximately 40% experienced recurrence of nasal polyps within 18 months after ESS.[6] Recurrence of CRSwNP is associated with many risk factors, such as aspirin sensitivity, bronchial asthma, and gastroesophageal reflux disease, some of which have been identified in various studies as predisposing patients to CRS. Fungal infections and sinonasal abnormalities may also contribute to the recurrence of CRSwNP.[7,8]

Physicians continue to focus on maintaining and enhancing the clinical prognosis of patients with CRSwNP after ESS. Unfortunately, there is limited data on factors associated with recurrent CRS after surgery in Saudi Arabia. Therefore, our study aimed to assess the prognostic pathophysiological factors leading to the recurrence of symptoms and nasal polyps after ESS and compare the clinical and imaging findings between CRSwNP patients with recurrence and those without recurrence.

Methods. The study included 134 patients of both genders aged 18 years and above admitted for ESS after the diagnosis of CRSwNP between 2015 and 2019, with a follow-up period of up to 24 months. The recurrence group (n=69) included patients with CRSwNP with recurrence after primary ESS, and the non-recurrence group (n=65) included patients with CRSwNP without recurrence after primary ESS. However, patients who presented with sinonasal benign/malignant tumors or missing data from their files were excluded.

This retrospective cohort study included patients who underwent ESS for CRSwNP. The study was approved by the research ethics committee of Alhada Armed Forces Hospital, Taif City, Saudi Arabia (application number: 2021-572). The Department of Otolaryngology-Head and Neck Surgery provided the list of patients. The research team collected the data from the patients' files.

The data containing different variables and risk factors, such as demographic data, comorbidities such as asthma and allergic rhinitis, clinical findings (signs and symptoms), and surgical and radiological data (including the Lund–Mackey [LM] score), were collected using an Excel data sheet. The outcome variable was the recurrence of CRSwNP after ESS.

Statistical analyses. We utilized the Statistical Package for the Social Sciences software for Windows, version 26 (IBM Corp. in Armonk, N.Y., USA). We expressed continuous variables through the use of mean and standard deviation and analyzed them with the t-test. Categorical variables were presented as percentages and analyzed with Pearson's Chi-square test. We consider statistical significance to be present when the *p*-value is <0.05.

Results. The demographic data, including age, gender, and body mass index, did not show significant differences between the recurrence and non-recurrence groups. Additionally, there was no significant difference in the percentage of patients with anatomical abnormalities, such as deviated nasal septum and also in comorbidities, except for asthma, which was more prevalent in the recurrence group than in the non-recurrence group (73.9% versus [vs.] 29.2%; $p<0.01$; Table 1). However, there was no significant difference observed between the 2 groups in terms of allergic rhinitis and aspirin sensitivity. All clinical features were similar in both groups. However, more patients had bilateral polyps in the recurrence group than in the non-recurrence group (95.7% vs. 80%; $p<0.01$). The average polyp's grade was significantly higher in the recurrence group than in the non-recurrence group (1.68 ± 1.14 vs. 1.26 ± 0.7; $p<0.05$; Table 2). Furthermore, the total LM scores on each side were higher in the recurrence group than in the non-recurrence group despite similar extent of surgery. Unilateral maxillary antrostomy and

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Table 1 - Demographic data and anatomical abnormalities in the study participants.

Characteristics	Recurrence patients (n=69)	Non-recurrence patients (n=65)
Female	37 (53.6)	35 (53.8)
Age (years)	37.8±13.4	37.5±16
Body mass index	27.6±6.3	27.0± 6.3
Diabetes mellitus	11 (15.9)	8 (12.3)
Hypertension	10 (14.5)	10 (15.4)
Smoking	4 (5.8)	6 (9.2)
Asthma	51 (73.9)	19 (29.2)*
Aspirin sensitivity	10 (14.5)	3 (4.6)
Other comorbidities	9 (13.0)	13 (20.0)
Allergic rhinitis	25 (36.2)	16 (24.6)
GERD	6 (8.7)	4 (6.2)
CRSwNP	60 (87.0)	50 (76.9)
Allergic fungal sinusitis	9 (13.0)	15 (23.1)
Deviated nasal septum	40 (58.0)	44 (67.7%)
Concha bullosa	9 (13.0)	17 (26.2)
Hypertrophied inferior turbinate	42 (60.9)	37 (56.9)

**P*-value of Chi-square test <0.01. GERD: gastroesophageal reflux disease, CRSwNP: chronic rhinosinusitis with nasal polyps, SD: standard deviation

bilateral concha bullosa excision were more common in the non-recurrence group.

Among 69 patients with recurrence, we found that 26.1% (n=18) required revision surgery. The comparison between the 2 groups revealed that smoking rates were significantly different between the reoperated and non-reoperated patients (16.7% [3/18] vs. 2% [1/51]; p=0.02). All other factors were similar between the 2 groups, including asthma. The comparison of clinical features between the 2 groups showed that reoperated patients had a lower incidence of nasal obstruction and discharge before primary ESS and a higher incidence of obstruction, loss of smell, and unilateral nasal polyps before revision ESS (Table 3).

Regarding the extent of surgery in primary ESS, bilateral maxillary antrostomy and anterior and posterior ethmoidectomy were performed more frequently in patients who did not require revision ESS (Table 4). We compared the LM scores on computed tomography scans after recurrence between both groups. The total unilateral and bilateral scores were significantly higher in the reoperated group (Figure 1).

Discussion. Chronic rhinosinusitis with nasal polyps has multiple prognostic factors that can predispose patients to the recurrence of nasal polyps after surgery. Our study found that asthma, bilateral nasal polyps, high nasal polyp grade, and LM scores were associated with increased polyp recurrence in the study population. Patients with recurrence with one of the following factors were required revision ESS: smoking history, clinical presentation after the primary operation with nasal obstruction and loss of smell, high LM scores on CT scan after recurrence, and inadequate primary ESS.

A recent study from Saudi Arabia showed no significant difference in gender, age, or comorbidities such as asthma and autoimmune diseases between the recurrence and non-recurrence groups.[9] Only patients with allergic fungal sinusitis (AFS) had an increased risk of recurrence. We discovered comparable results in this research, with the exception of asthma which was more prevalent in the recurrence group (Table 1). No significant differences were observed in patients with AFS.

Smoking is a modifiable risk factor for the recurrence of nasal polyps.[1] The smoking status was similar in both the recurrence and non-recurrence groups. However, smoking increased the need for revision surgery in patients with recurrence. Exposure to smoke increases the chance of developing nasal polyps.[10] A report described a decrease in the mean period between primary surgery and revision surgery by half in smoking patients compared to that in non-smoking patients.[11]

Unilateral sinus disease is a good prognostic factor for non-recurrence and can be related to CRSwNP pathology. European Position Paper on Rhinosinusitis and Nasal Polyps (EPOS 2020) states that isolated sinusitis, fungal ball, odontogenic sinusitis, and AFS are localized CRS phenotypes.[1] Chronic rhinosinusitis with nasal polyps typically affects both sides and is caused by type 2 inflammation.[12] However, if unilateral pathology recurs, there is a high chance of revision surgery. Allergic fungal sinusitis is a type 2 inflammation with a high recurrence rate after primary ESS. However, we did not find a significant difference in the prevalence of AFS between the recurrence and non-recurrence groups.

Extensive disease with a high LM score on CT or high polyp grade on endoscopy has a well-known correlation with recurrence.[1] Thus, this could be related to the CRSwNP pathology or primary surgery failure to address all diseased sinuses. In addition, the need for revision depends more on the LM score and the extent of polyps after surgery. Schalek et al[13] suggested extensive primary surgery for diffuse polyposis had better results than minimal intervention. Recently, a study showed that the recurrence rate is lower with the "reboot approach," which is extensive and includes the removal of all diseased mucosa, compared to that with the classic ESS.[14]

Table 2 - Clinical features in recurrence and non-recurrence patients.

Parameters	Non-recurrence patients (n=65)	Recurrence patients (n= 69)	
		Non-reoperated (n=51)	Reoperated (n=18)
Nasal obstruction	54 (83.1)	46 (90.2)	11 (61.1)**
Nasal discharge	23 (35.4)	24 (47.1)	3 (16.7)**
Loss of smell	24 (36.9)	21 (41.2)	4 (22.3)
Facial pain	10 (15.4)	4 (7.8)	1 (5.6)
Postnasal drip	7 (10.8)	8 (15.7)	1 (5.6)
Bilateral polyps	52 (80.0)*	50 (98.0)	16 (88.9)
Unilateral polyps	13 (20.0)*	1 (2.0)	2 (11.1)**
Polyp grade (0–4)	1.26 (SD=0.7)‡	1.71 (SD=1.17)	1.60 (SD=1.09)
Mucosa edema	6 (4.5)	11 (21.6)	3 (16.7)
Nasal discharge	1 (0.7)	5 (9.8)	1 (5.6)
Mucin discharge	2 (1.5)	2 (3.9)	0 (0.0)

*P-value of Chi-square <0.05 when comparing recurrence and non-recurrence patients. ‡P-value of independent t-test <0.05 when comparing recurrence and non-recurrence patients. **P-value of Chi-square <0.05 when comparing non-reoperated and reoperated recurrence patients.

Table 3 - Comparison of clinical features clinical between non-reoperated and reoperated recurrence patients.

Parameters	On presentation (n=69)		After recurrence (n=69)	
	Non-reoperated (n=51)	Reoperated (n=18)	Non-reoperated (n=51)	Reoperated (n=18)
Nasal obstruction	46 (90.2)	11 (61.1)*	24 (47.1)	16 (88.9)*
Nasal discharge	24 (47.1)	3 (16.7)*	23 (45.1)	10 (55.6)
Loss of smell	21 (41.2)	4 (22.3)	20 (39.2)	11 (61.1)*
Facial pain	4 (7.8)	1 (5.6)	5 (9.8)	4 (22.2)
Postnasal drip (PND)	8 (15.7)	1 (5.6)	4 (7.8)	1 (5.6)
Bilateral polyps	50 (98.0)	16 (88.9)	44 (86.3)	14 (77.8)
Unilateral polyps	1 (2.0)	2 (11.1)*	7 (13.7)	4 (22.2)
Polyp grade (0-4)	1.71 (SD=1.17)	1.60 (SD=1.09)	1.43 (SD=0.90)	2.00 (SD=1.28)
Mucosa edema	11 (21.6)	3 (16.7)	10 (19.6)	5 (27.8)
Nasal discharge	5 (9.8)	1 (5.6)	7 (13.7)	4 (22.2)
Mucin discharge	2 (3.9)	0 (0.0)	0 (0.0)	0 (0.0)

*P-value of Chi-square <0.05. SD: standard deviation

Statistically, the reoperated group exhibited a lower incidence of symptoms such as nasal obstruction and discharge at the time of initial presentation before the primary surgery compared to the non-reoperated group. A study that used SNOT-22 to compare CRSwNP outcomes found no difference in SNOT-22 between those who had recurrence and non-recurrence.[15] Nevertheless, the role of surgery in recurrence compared to medical treatment is controversial.[16] Additionally, these patients underwent surgery after showing significant complaints of nasal obstruction and loss of smell. We identified that the surgeon would prefer a surgical approach and more extensive surgery for patients with severe symptoms at presentation or after recurrence.

Study limitations. There could be some limitations and biases due to our study's retrospective nature. Most symptoms were collected as primary patient complaints, and no patient-reporting questionnaire was used to collect the patients' symptoms before and after surgery. We did not contain all data regarding all risk factors for recurrence such as non-compliance to medications due to documentation problems or the unavailability of some data. However, we attempted to identify the factors that could be seen commonly in the Saudi community, and we compared the factors that led to revision surgery. Further studies focusing on the role of patient symptoms and their relationship to the extent of primary surgery and the factors that affect the surgeon's decision to consider revision surgery for recurrence need further research.

In conclusion, our study has revealed that certain factors, such as asthma and the severity of the disease, can impact the recurrence rate of CRSwNP in the

Table 4 - Comparison of the extent of surgery between recurrence and non-recurrence patients.

Parameters		Recurrence (n=69)		No recurrence (n=65)
		Non-Reoperated	Reoperated	
Septoplasty	Yes	10 (19.6)	3 (16.7)	18 (27.7)
Maxillary sinus	Unilateral	1 (2.0)	3 (16.7)**	12 (18.5)*
	Bilateral	45 (88.3)	11 (61.1)**	51 (78.5)
Anterior ethmoid	Unilateral	2 (3.9)	1 (5.6)	7 (10.8)
	Bilateral	45 (88.2)	6 (35.3)*	38 (58.5)
Posterior ethmoid	Unilateral	2 (3.9)	1 (5.6)	7 (10.8)
	Bilateral	43 (84.3)	8 (44.4)*	37 (56.9)
Sphenoid sinus	Unilateral	1 (2.0)	1 (5.6)	6 (9.2)
	Bilateral	33 (64.7)	7 (38.9)	28 (43.1)
Frontal sinus	Unilateral	3 (5.90)	1 (5.6)	1 (1.5)
	Bilateral	12 (23.5)	3 (16.7)	8 (12.3)
Concha bullosa	Unilateral	7 (13.7)	2 (11.1)	7 (10.8)
	Bilateral	0 (0.0)	0 (0.0)	10 (15.4)*
Middle turbinectomy	Unilateral	1 (2.0)	1 (5.6)	1 (1.5)
	Bilateral	5 (9.8)	0 (0.0)	2 (2.9)
Inferior turbinate surgery	Unilateral	5 (9.8)	4 (22.2)	15 (23.1)
	Bilateral	25 (49.0)	6 (33.3)	21 (32.3)

*P-value of Chi-square test <0.01. **P-value of Chi-square test <0.05.

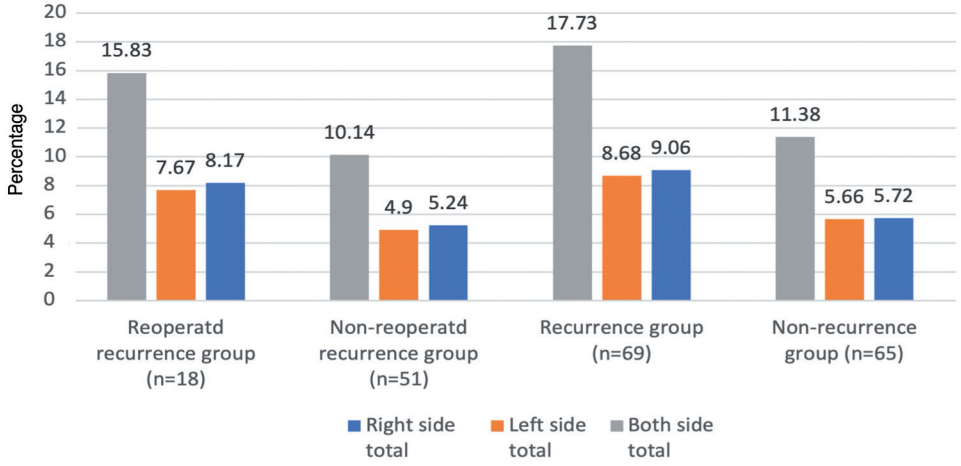

Figure 1 - Lund–Mackey scores. Comparison of LM scores between recurrence and non-recurrence group on preoperative CT scan and between non-reoperated and reoperated recurrence groups using independent T- test. *All results were statistically different with a p-value <0.01

Saudi community. In addition, smoking habits and less extensive primary surgery are associated with the likelihood of needing revision surgery in cases of recurrence.

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