RESEARCH ARTICLE

Evaluation of Recurrent Nasal Polyposis in Patients who had Endoscopic Sinus Surgery

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ABSTRACT

Background: Nasal polyposis is a prevalent nasal mucosal disorder that significantly impairs patients' quality of life. Functional endoscopic sinus surgery (FESS) remains the standard treatment. Multiple comorbidities and etiological factors associated with the development and recurrence of nasal polyps, making recurrence a frequent clinical challenge.

Aim: To identify the most common contributing factors to recurrent nasal polyposis from clinical, endoscopic, radiological, and surgical perspectives.

Methods: This cross-sectional descriptive study was carried out between January and December 2022 at the Otorhinolaryngology Department of Rizgari Teaching Hospital, Erbil City, Iraq. The study included 32 patients (aged 23–70 years, both males and females). Informed consent was obtained from all participants. Quality of life was assessed using the SNOT-22 questionnaire. Comprehensive clinical histories were taken to identify comorbidities. Preoperative evaluations used the Lund-Kennedy endoscopic scoring system and the Lund-Mackay CT scoring system. Intraoperative findings were recorded and correlated with symptom-free intervals for nasal obstruction.

Results: Allergic rhinitis was present in 60% and asthma in 34% of patients with recurrent nasal polyps. All patients experienced nasal obstruction (unilateral or bilateral) based on SNOT-22; 85% reported loss of taste and smell. About half maintained regular follow-up and medication compliance, which was associated with longer symptom-free periods. Forty-five percent scored above 8 on the Lund-Kennedy scale, and over 85% scored above 7 on the Lund-Mackay CT score. Intraoperatively, aside from nasal polyps, lateralized middle turbinate (45%) and retained uncinate process (30%) were the next most common findings. Higher intraoperative scores were strongly inversely correlated with symptom-free periods ($P < 0.001$).

Conclusion: Recurrent nasal polyposis is multifactorial. Major associations with recurrence include comorbidities such as asthma, anatomical variations unaddressed during initial surgery, incomplete removal of ethmoid cells, and retained uncinate processes.

Keywords: Nasal polyps, Functional Endoscopic Sinus Surgery (FESS), Lund-Kennedy score, Lund-Mackay CT score.

INTRODUCTION

Endoscopic technology revolutionized sinonasal disease management by improving diagnosis and treatment. Early use of endoscopic techniques in inflammatory conditions offered better visualization, precision, and lower morbidity than traditional open surgery. As experience and technology advanced, endoscopic surgery became central in treating sinonasal diseases, expanding its use to include refractory inflammation and nasal polyposis. This progress highlights the increasing importance of endoscopic surgery and supports ongoing efforts to improve patient outcomes [1]. Over the past three decades, functional endoscopic sinus surgery (FESS) has become a leading intervention in otolaryngology. Its effectiveness is greatest when part of a multidisciplinary treatment plan that includes perioperative medical therapy such as corticosteroids and antibiotics as indicated and close postoperative monitoring. This combined approach optimizes mucosal healing, reduces recurrence, and improves patient outcomes. The widespread use and success of FESS in treating chronic sinonasal disorders emphasize both its procedural value and the essential role of medical therapy, securing its central place in modern otolaryngologic practice [2]. Nasal polyposis is a challenging sinonasal disorder often requiring both medical therapy and FESS. Combining FESS with adjunctive medical treatment and careful postoperative monitoring significantly improves symptom control and remission rates. However, some patients need revision surgery due to persistent or recurrent disease, making the success of the initial procedure crucial for long-term disease management.

Analyzing revision cases helps refine surgical approaches and optimize outcomes. Ultimately, successful FESS relies on careful patient selection,

thorough perioperative care, precise surgical technique, and ongoing follow-up [3,4]. Nasal polyposis is a benign nasal growth often causing congestion, runny nose, loss of smell and taste, and is linked to chronic rhinosinusitis. Treatment aims to control symptoms, not cure the disease [5]. Nasal polyps affect ~4% of people [6], are as common as adult-onset asthma, and are more prevalent in asthma, AERD, and CRS [7]. First-line treatment is corticosteroids; surgery is for refractory cases, and aspirin desensitization may help AERD patients [8]. Polyps often recur, especially with asthma, and their causes remain unclear [9,10].

PRIMARY OBJECTIVE

This study seeks to identify key clinical, endoscopic, radiological, and intraoperative factors in recurrent nasal polyposis to improve post-surgical outcomes.

SUBJECTS AND METHODS

This cross-sectional, descriptive study was conducted from January to December 2022 in the Department of Otorhinolaryngology in a Teaching Hospital. A total of 32 patients, both male and female, were enrolled. Ages ranged from 23 to 70 years. For each participant, demographic and contact information was recorded. This included name, age, sex, occupation, phone number, and address. All patients were informed of the study objectives and gave written consent before enrollment.

Inclusion Criteria

Adult patients requiring revision surgery for symptomatic chronic rhinosinusitis with nasal polyps (CRSwNP), confirmed by computed tomography (CT) and endoscopic examination, were included.

Exclusion Criteria

Patients with prior functional endoscopic sinus surgery (FESS) for antrochoanal polyps, mucoceles, or tumours.

Patients with a history of conventional sinus surgery.

Ethical considerations

Ethical approval for this study was obtained from the Scientific Committee and the hospital administration. Oral informed consent was obtained from all participants prior to their inclusion in the study. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Preoperative Evaluation

Preoperative assessment included history, examination, smoking status, and comorbid asthma. Data on symptom-free intervals, medication type and duration, and adherence to follow-up were collected. Regular follow-up meant attending all scheduled visits. Regular medication use meant consistent use of intranasal corticosteroids for three months, regardless of dose. Data were collected with a structured questionnaire. Allergic rhinitis was diagnosed clinically and based on the patient's history. Skin prick testing was not available locally. Asthma was only diagnosed if a certified internist documented it. Symptom severity and quality of life were assessed using the 22-item Sino-Nasal Outcome Test (SNOT-22) questionnaire (a validated patient-reported outcome measure widely used in chronic rhinosinusitis research). The questionnaire includes 22 items, each scored from 0 (no problem) to 5 (problem as bad as it can be), generating a total score from 0 to 110, with higher scores indicating greater symptom burden [11]. Preoperative endoscopic evaluation of the nasal cavity and paranasal sinuses was performed after topical decongestion with xylometazoline 0.1% (two puffs per nostril). The Lund–Kennedy (LK) endoscopic scoring system was used [12]. Nasal polyps were scored as 0 (absent), 1 (within the middle meatus), or 2 (extending beyond the middle meatus to the inferior turbinate). Edema, scarring, and crusting were scored 0 (absent), 1 (mild), or 2 (severe). Discharge was scored 0 (absent), 1 (clear, thin), or 2 (purulent). Each side was assessed separately. Scores were summed up for the total LK score. Coronal, axial, and sagittal paranasal sinus CT scans (bone window) were reviewed and Lund–Mackay (LM) scoring system [13] was applied: 0 (none), 1 (partial), 2 (complete opacification). Osteomeatal complex (OMC): 0 (open), 2 (blocked). Anatomy was assessed per Khalil et al.[14] in which middle turbinate lateralization (close to lamina papyracea) and septal deviation (convexity–lateral wall < convexity–midline at turbinate level) is assessed. Additional anatomical variations (incomplete ethmoidectomy, Haller cells, Onodi cells, or concha bullosa) were recorded as 0 (absent) or 1 (present).

Intraoperative Assessment

During surgery, an endoscopic inspection of the nasal cavity was performed to confirm the LK score and identify anatomical factors contributing to recurrence. This included a lateralized middle turbinate, an obstructed osteomeatal complex, a retained uncinate process, septal deviation, or concha bullosa. Each factor was scored as 0 (absent) or 1 (present).

Data Analysis

Data analysis was performed using SPSS version 26 (IBM Corp., Armonk, NY). Comparative analyses were conducted using chi-square and Fisher's exact tests. A p-value < 0.05 was considered statistically significant.

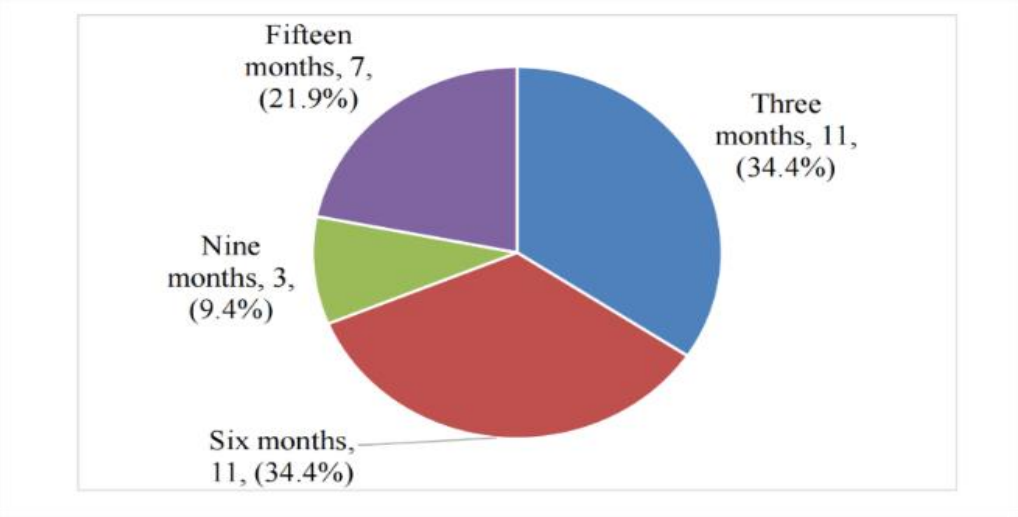

Fig 1. Symptom-free period of nasal obstruction.

RESULTS

Thirty-two patients were included in the study. Their mean age ± (SD) was 40.9± (14.3) years. The median was 40 years, and the age range was 23-70 years. Most patients underwent the first revision FESS. Only two had the second revision, and one had the third. Table 1 shows that around one-third (31.3%) of the patients were aged 20-29 years. More than half (56.3%) were males (Table 1).

Table 1
Age and gender distribution.

Age (years)	No.	%
20-29	10	31.3
30-39	4	12.5
40-49	9	28.1
50-59	4	12.5
60-70	5	15.6
Gender		
Male	18	56.3
Female	14	43.8
Total	32	100.0

In this cohort, smoking (65.6%), possible allergic rhinitis (59.4%), and asthma (34%) emerged as the most prevalent factors associated with recurrent nasal polyposis. The high prevalence of these comorbidities underscores their clinical significance in disease recurrence and persistence. Further contributory variables identified in this study are presented in Table **2**.

Table 2
Factors associated with recurrent nasal polyposis.

Factors	No.	(%)
Smoking	21	(65.6)
Allergic rhinitis	19	(59.4)
Seasonal	8	(42.1)
Perennial	11	(57.9)
Asthma	11	(34.4)
AERD	6	(18.7)
Family history of nasal polyposis	6	(18.7)
Animal contact	8	(25)
Work in a dusty environment	11	(34.4)

This study found that more than one-third (34.4%) of patients had a symptom-free period of three months post-operatively. Another 34.4% experienced a symptom-free period of six months, indicating that early recurrence is common. Fig **1** presents these findings.

The SNOT-22 questionnaire results showed that patients' quality of life was primarily affected by nasal obstruction (total score = 109), loss of smell (total score = 108), and sneezing (score = 101), indicating these as the most burdensome symptoms. Symptoms: nose blockage (total score was 109), lack of sense of smell, and taste (score = 108), need to blow nose (score = 105), runny nose (score = 105), and sneezing (score = 101). All the scores were out of 110, in addition to the other presentations mentioned in Table **3**. showing SNOT-22 questionnaire.

Table 3
SNOTT-22 questionnaire

items	means	SD	sum
Nasal blockage	4.63	0.87	109
Lack of sense of smell and taste	3.81	1.33	108
Need to blow nose	3.41	1.38	105
Runny nose	3.28	1.19	101
Sneezing	3.16	1.50	101
Cough	3.03	1.55	97
Post nasal drip	3.00	1.45	96
Facial pain and pressure	2.81	1.30	90
Fatigue during day	2.69	1.35	86
Waking up tired	2.59	1.45	83
Reduced productivity	2.50	1.36	80
Lack of sleep	2.47	1.41	79
Thick nasal discharge	2.34	1.28	75
Reduced concentration	2.25	1.32	72
Frustrated/ restless/irritable	2.25	1.41	72
Ear pain and pressure	2.22	1.53	71
Ear fullness	2.19	1.51	70
Ear dizziness	2.13	1.51	68
Waking up at night	2.09	1.22	67
Feeling embarrassed	2.00	1.72	64
Difficulty in falling a sleep	1.91	1.20	61
Feeling sad	1.81	1.44	58

Table **4** shows that regular follow-up is associated with a longer symptom-free period of nasal obstruction: 31% of patients with regular follow-up had a symptom-free period of 9 to 15 months, compared with 0% in patients with no follow-up ($p = 0.025$). Taking treatment regularly was significantly associated with a longer symptom-free period for nasal obstruction ($p < 0.001$). 25% of patients on regular treatment had a 9- to 15-month symptom-free period, compared with 4.1% of those on irregular treatment and 9.3% of those not taking treatment (Table 4). According to the Lund-Kennedy scores on the left side, most patients (81.3%) had nasal polyps and nasal discharge, 68.8% had mucosal oedema and scarring, and 12.5% had crusting. Half of the patients scored high (8-10) indicating more severe condition. Regarding the right side, 81.3% of patients had polyps, and 62.5% had nasal discharge and 40.6% of patients scored 8-10 on the Lund-Kennedy score (Table 5 and Fig 2). It has been noted that the higher the mean Lund Kennedy score, the fewer the symptom-free periods. Fig 3 shows that there was a strong, inverse, significant correlation between the mean Lund Kennedy score and the symptom-free period (rho = -0.879, $p < 0.001$). When considering the distribution of sinus opacity by types and location, around half (46.9%) of the patients had complete opacity of the maxillary sinus, whether of the right or left side. Nearly one third (31.3%) of the patients had complete opacity of the right anterior ethmoid sinus, compared with 25% of the left side. Half (50%) of the patients had complete opacity of the posterior ethmoid sinus, whether right or left. Around two-thirds of the patients had complete opacity of the sphenoid sinus, whether of the right side (65.6%) or the left side (68.8%). The table shows that 53.1% of the patients had complete opacity of the right frontal sinus, and 62.5% had complete opacity of the left frontal sinus.

Regarding the OMC, it was obstructed in 62.5% and 75% of the patients. (regarding the right and left sides respectively) (Table 6).

Table 4
Symptom-free period by follow-up and treatment regularity. By Fischer's exact test

Variable	Category	Symptom-free period in months		Total	P*
		3-6 Months No. (%)	9-15 Months No. (%)	No. (%)	
Follow-up					
	None	3 (9.3)	0 (0.0)	3 (9.3)	
	Regular	10 (34.4)	9 (31.0)	19 (59.3)	0.025
	Irregular	9 (31.0)	1 (3.4)	10 (31.2)	
Treatment regularity					
	No treatment	5 (15.6)	3 (9.3)	8 (25.0)	
	Regular	8 (33.0)	6 (25)	14 (43.7)	<0.001
	Irregular	9 (37.5)	1 (4.1)	10 (31.2)	
Total		22 (68.7)	10 (31.2)	32 (100.0)	

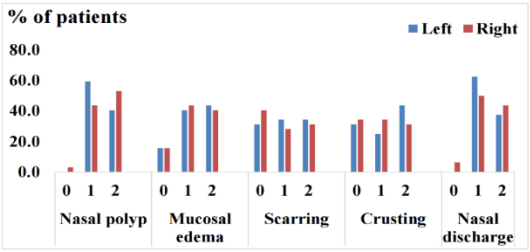

Fig 2. Distribution of patients by severity of symptoms related to the LK endoscopic score system.

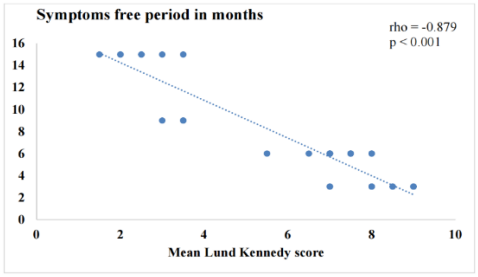

Fig 3. Correlation between symptom-free period and Lund Kennedy scores.

Table 5
Lund Kennedy Endoscopic Findings and Scores for Left and Right Nasal Cavities Among Study Participants (n = 32).

Lund Kennedy items	Left side No. (%)	Right side No. (%)
Nasal polyp	26 (81.3)	26 (81.3)
Mucosal edema	22 (68.8)	26 (81.3)
Scarring	22 (68.8)	8 (25.0)
Crusting	4 (12.5)	2 (6.2)
Nasal discharge	26 (81.3)	20 (62.5)
Sum of Lund Kennedy scores	Left side No. (%)	Right side No. (%)
≤ 4	10 (31.3)	10 (31.3)
5-7	6 (18.8)	9 (28.1)
8-10	16 (50.0)	13 (40.6)

Table 6
Distribution of Sinus Opacity Types by Location and Side

Sinus Region	Side	No Abnormality No. (%)	Partial Opacity No. (%)	Complete Opacity No. (%)
Maxillary	Right	8 (25.0)	9 (28.1)	15 (46.9)
	Left	5 (15.6)	12 (37.5)	15 (46.9)
Anterior ethmoid	Right	6 (18.8)	16 (50.0)	10 (31.3)
	Left	8 (25.0)	16 (50.0)	8 (25.0)
Posterior ethmoid	Right	8 (25.0)	8 (25.0)	16 (50.0)
	Left	4 (12.5)	12 (37.5)	16 (50.0)
Sphenoid	Right	4 (12.5)	7 (21.9)	21 (65.6)
	Left	2 (6.3)	8 (25.0)	22 (68.8)
Frontal	Right	4 (12.5)	11 (34.4)	17 (53.1)
	Left	1 (6.3)	10 (31.3)	20 (62.5)
OMC	Right	12 (37.5) *	--------	20 (62.5) **
	Left	8 (25.0) *	--------	24 (75.0) **

*Non-obstructed OMC. **Obstructed OMC

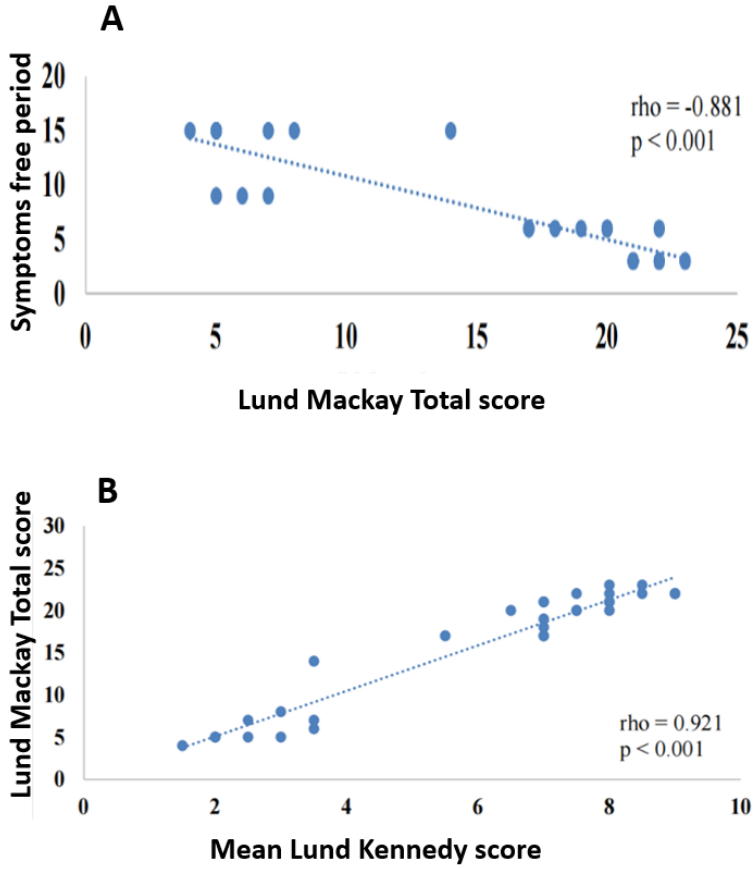

Fig 4. A, Correlation between the free period and LM total score. B, Correlation between LM total score and Lund Kennedy score.

The mean of the Lund Mackay total score was 16.16, the median was 20, and the range was 4-23. Other details are presented in Table **7**. The Lund-Mackay (LM) score provides an objective, reproducible quantification of sinonasal opacification on CT by assigning a value of 0 (no opacification), 1 (partial opacification), or 2 (total opacification) to each of the five paired sinus groups. The higher the LM total score, the shorter the symptom-free period (Fig **4**A) and the more the LM total score, the more the LK score (Fig **4**B).

The most common anatomical variation and finding identified by preoperative CT and intraoperatively, on the right side, were polyps (81.3%) and middle turbinate lateralization (59.4%). The most common intraoperative findings on the left side were polyps (81.3%), a laterally displaced middle turbinate (43.8%), and a residual uncinate process (31%) (Table **8**).

There is a strong negative correlating between these intraoperative findings and symptom free period (Fig **5**) where the higher the score of intraoperative findings (more defects) is associated with shorter symptom-free period.

Table 7
Descriptive statistics of the parameters of the LM CT score system.

Variable	Mean	Median	Minimum	Maximum
Left LM score total	8.38	10.00	2.00	12.00
Rt LM score total	7.78	9.00	2.00	12.00
LM total score	16.16	20.00	4.00	24.00

Table 8
Distribution of patients by anatomical variations found by pre-op CT scan and intraoperatively (n=32).

Intraoperative findings	Right side No. (%)	Left side No. (%)
Polyp	26 (81.3)	26 (81.3)
Middle turbinate lateralization	19 (59.4)	14 (43.8)
Residual uncinate process	17 (53.1)	10 (31.3)
Incomplete resection of the anterior ethmoid	16 (50.0)	9 (28.1)
Incomplete resection of the posterior ethmoid	14 (43.7)	11 (34.3)
Concha Bulosa	10 (31.2)	9 (28.1)
Persistent Haller cell	8 (25.0)	4 (12.5)
Persistent Onodi cell	8 (25.0)	4 (12.5)
Septal deviation	6 (18.8)	4 (12.5)

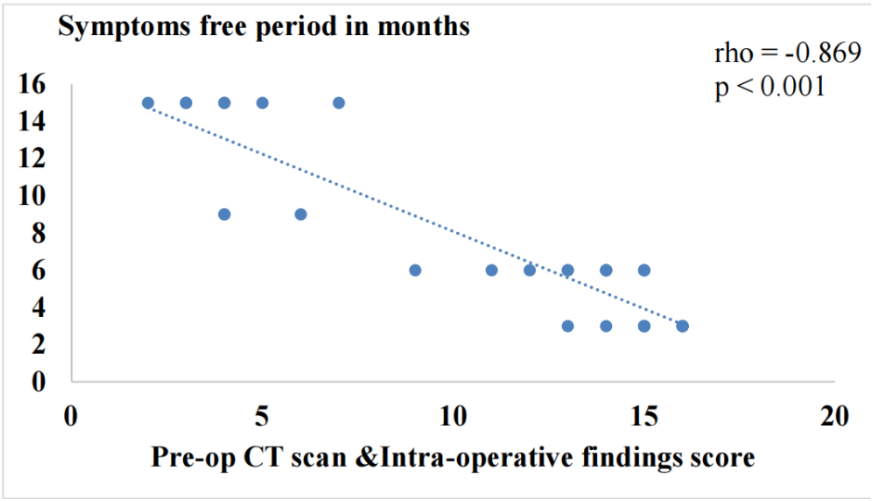

Fig 5. Correlation between the symptom-free period of nasal obstruction vs. pre-op CT scan and intraoperative finding

DISCUSSION

Recent research has sought to identify key factors associated with recurrent nasal polyposis after functional endoscopic sinus surgery (FESS), as many patients still require additional surgery despite medical therapy. This study systematically examined clinical, endoscopic, radiological, and intraoperative predictors of polyp recurrence and their correlation with symptom-free periods following initial FESS. The study demonstrated that thorough assessment of patient history, perioperative findings, and postoperative adherence can clarify recurrence risks and guide improved long-term outcomes. Comorbidities were highly prevalent, with 60% of patients having allergic rhinitis, 34% asthma, and 65% being smokers, consistent with Baban et al. (33% asthma, 25% smoking), S. Albu et al. [15], and Sancez-Collado et al. [16] (40% asthma, 32% allergic rhinitis); most smokers consumed at least one pack per day, and few were passive smokers. The SNOT-22 questionnaire confirmed that nasal obstruction and hyposmia/anosmia were the most frequent and severe symptoms, affecting nearly all patients. This is consistent with EPOS2020 [17], which emphasizes these as key indicators for outpatient assessment and surgical candidacy. Rebecca Hall et al. [18] also reported universal nasal obstruction and a high prevalence of smell and taste loss, highlighting the significant impact on quality of life and the likelihood of chronic rhino sinusitis associated with recurrence. Follow-up and medical adherence emerged as important determinants of outcome.

Around 59% of patients were on regular follow-up, and 44% maintained medical therapy, both groups demonstrating longer symptom-free intervals. This observation aligns with the work of Adame S. Deconde et al. [19], who stressed the importance of postoperative endoscopic surveillance, and with that of Giuseppe Riva et al. [20], who reported lower recurrence rates in adherent patients. Conversely, Rimmer et al. [21] reported less supportive findings, possibly due to differences in study design, broader surgical techniques, and less emphasis on follow-up care. Objective scoring systems further reinforced these findings. Higher Lund–Kennedy (LK)

scores were associated with shorter symptom-free periods, reflecting the impact of mucosal health and sinus ventilation on recurrence. The mean LK score in this cohort was 8–10 in nearly half of the patients, comparable to that reported by Baban et al. [2], who noted that the majority exceeded 7. Alkis J. Psaltis et al.[12] have similarly highlighted the LK system as a reliable and clinically meaningful tool for assessing CRS severity. The Lund–Mackay (LM) CT score also proved valuable. More than 85% of patients had a score above 7, comparable to the 91% reported by Baban et al. [2], who documented scores above 6. Ashraf et al. [17] proposed that scores above 4 are abnormal and those exceeding 6 are pathological, underscoring the reliability of this system in correlating radiological severity with clinical burden. The high LM scores in this study confirm that most patients had significant disease both symptomatically and radiologically. Moreover, patients with higher LM CT scores had shorter symptom-free periods following FESS, supporting the role of imaging not only in assessing disease severity but also in anticipating recurrence. These findings are consistent with those of Steven G. Brooks et al. [22], who reported a significant correlation among LM CT scores, CRS severity, and quality of life. In this study, approximately 85% of patients scored 70 or higher on the SNOT-22 questionnaire, further supporting this association. Importantly, LM and LK scores were concordant, indicating that radiological severity was supported by endoscopic findings, thereby strengthening the reliability of these assessment tools. This also highlights the role of anatomical variations in recurrence. Preoperative CT and intraoperative findings confirmed nasal polyps as the most frequent observation, but incomplete resection of the anterior and posterior ethmoids was noted in nearly 55% of cases. Similar findings were reported by Ashraf et al. [23], Garrel et al. [24] and Levine et al. [25], who documented incomplete ethmoidectomy rates ranging from 64% to 90%. This highlights the surgical challenge, as many surgeons adopt a conservative approach around the ethmoid roof and adjacent vessels to minimize complications. Anatomical variations further increased the risk of recurrence. Lateralized middle turbinate was observed in 60% of patients, comparable to the 60% reported by Khalil et al. [14], the 29% by Gore et al. [26], and the 78% by Lazar et al. [27]. Residual uncinate process occurred in 50%, aligning with Khalil et al. [14] at 60% and with Gore et al. [26] and Lazar et al. [27]

when compared to their respective figures. Septal deviation (20%) and concha bullosa (31%) were also comparable to rates described by Khalil et al. [14] and Gore et al. [26.] Onodi cells were identified in 17% of patients, in line with Khalil et al. [14] and Gore et al. [26] at 29%, and with Lazar et al. [27] as available. Haller cells were found in about 20%, similar to Khalil et al. [14] at 20.8%, Gore et al. [26] and Lazar et al. [27] where noted. These findings reinforce the role of anatomical variations in limiting postoperative ventilation and in their association with recurrence.

This study provides useful insights, but it has some methodological limitations that should be noted. Because it used a cross-sectional design, it cannot establish cause-and-effect relationships, as all variables were measured simultaneously. Collecting data after the fact might have led to recall bias and missing information, especially for subjective CT assessments. The small sample size might have reduced statistical power and made it harder to apply the results to a larger population. There could also be selection bias if the participants do not fully represent the target group.

Some confounding factors, such as comorbidities, environmental factors, and individual behaviors, were not fully controlled and may have influenced the results. Even with these limitations, the study found that incomplete resection, anatomical differences, and higher intraoperative scores are linked to early recurrence of nasal polyposis. These factors should be considered during initial surgery. Better management of comorbidities, careful anatomical assessment, and regular long-term follow-up may help patients stay symptom-free longer and improve their quality of life.

CONCLUSIONS

Within the limitations of this study, recurrence of nasal polyposis was found to be associated with comorbidities such as asthma, as well as risk factors including smoking. Higher Lund–Kennedy and Lund–Mackay scores were observed in patients with recurrence, indicating their usefulness in reflecting disease severity. Incomplete resection and unaddressed anatomical variations at the time of initial surgery were also linked to recurrence. In addition, regular follow-up and adherence to treatment appeared to be associated with longer symptom-free periods. However, due to the descriptive and retrospective nature of the study, these findings should be interpreted as associations rather than causal relationships. Further well-designed prospective studies are needed to better clarify these associations and guide clinical practice.

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Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

Ethical consideration

Ethical considerations were observed in accordance with institutional and international research standards, and all procedures conducted in this study complied with the ethical principles relevant to the study design.

Author's contribution

The contribution of the first author included study conception and design, data collection, data analysis, and drafting of the manuscript. The contribution of the second author involved supervision of the research process, critical revision of the manuscript for important intellectual content, and final approval of the version to be published.

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