



Original Article

## Evaluating the Efficacy of Endoscopic Sinus Surgery in Chronic Rhinosinusitis: A Longitudinal Study

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### ABSTRACT

**Background:** Chronic rhinosinusitis (CRS) is a common condition that often requires surgery when medical treatment fails. This study evaluated the efficacy of endoscopic sinus surgery (ESS) in CRS.

**Methods:** This longitudinal observational study included 150 patients with CRS who underwent ESS at Malla Reddy Institute of Medical Sciences from September 2024 to March 2026. Patients were followed up at 1, 3, and 6 months. Symptom scores, endoscopic findings, recurrence, and overall outcome were assessed.

**Results:** Most patients showed postoperative improvement in symptoms and endoscopic findings. Good outcome was seen in 58.7% of patients, partial improvement in 21.3%, and poor outcome in 20.0%. Recurrence occurred in 14.7% and revision surgery in 2.7%. Recurrence was significantly higher in patients with nasal polyps than in those without nasal polyps (27.1% vs 8.8%,  $p = 0.007$ ).

**Conclusion:** ESS is an effective treatment for medically refractory CRS. Better outcomes were seen in patients without nasal polyps, while those with nasal polyps had higher recurrence and require closer follow-up.

**Keywords:** Chronic rhinosinusitis, Endoscopic sinus surgery, Nasal polyps, Recurrence, Endoscopic outcomes.

### INTRODUCTION

Chronic rhinosinusitis (CRS) is a common inflammatory condition affecting the nose and paranasal sinuses. It is characterized by symptoms such as nasal obstruction, nasal discharge, facial pain or pressure, and reduction in the sense of smell lasting for more than 12 weeks. The disease has a significant impact on daily functioning and overall well-being. It affects a considerable proportion of the population and contributes to a substantial healthcare burden [1].

The pathophysiology of CRS is complex and involves persistent inflammation of the sinonasal mucosa. Multiple factors play a role, including environmental triggers, microbial agents, and host immune response. Alterations in mucociliary clearance and epithelial barrier function further contribute to disease persistence. This multifactorial nature explains why CRS often becomes chronic and difficult to treat [2].

Initial management of CRS is primarily medical. Standard treatment includes intranasal corticosteroids, saline irrigation, and in selected cases, antibiotics or systemic therapy. While many patients respond to medical treatment, a subset continues to have persistent symptoms. These patients are often considered candidates for surgical intervention [3].

Endoscopic sinus surgery (ESS) has become the standard surgical approach in the management of CRS that is refractory to medical therapy. The procedure aims to restore normal sinus ventilation and drainage by removing obstructive pathology while preserving mucosal function. Evidence from earlier studies supports the role of ESS in improving disease outcomes in appropriately selected patients [4].

Several studies have demonstrated that ESS leads to significant improvement in symptoms and quality of life. Patients often report relief from nasal obstruction, reduction in discharge, and improvement in smell after surgery. These improvements are reflected in validated outcome measures such as symptom scores and quality-of-life instruments [5,6]. Long-term outcomes of ESS have also been explored. While many patients maintain sustained improvement, recurrence of disease can occur, particularly in those with nasal polyposis. Longitudinal studies have shown that disease control varies over time, highlighting the importance of follow-up and continued evaluation after surgery [7].

Although ESS is generally considered safe, it is not without risks. Complications may occur during or after the procedure, and some patients may require revision surgery. Understanding the frequency and nature of these outcomes is essential in evaluating the overall effectiveness of the procedure [8].

Recent updates in guidelines have also emphasized individualized treatment approaches in CRS, especially in cases with nasal polyps where newer therapies such as biologics are being introduced. Despite these advances, ESS continues to play a central role in the management of patients who do not respond adequately to medical therapy [9].

In this context, there is a need for longitudinal studies that assess both subjective and objective outcomes following ESS. Evaluating symptom improvement, endoscopic findings, and overall clinical outcomes can provide a clearer understanding of the efficacy of the procedure in real-world settings.

### **AIM**

To evaluate the efficacy of endoscopic sinus surgery in patients with chronic rhinosinusitis by assessing symptom relief, endoscopic improvement, and overall clinical outcome during follow-up.

### **OBJECTIVES**

1. To compare preoperative and postoperative symptom scores in patients with chronic rhinosinusitis undergoing endoscopic sinus surgery.
2. To assess improvement in nasal endoscopic findings during postoperative follow-up.
3. To evaluate the overall clinical outcome of endoscopic sinus surgery in terms of complications, recurrence, and need for further intervention.

### **MATERIALS AND METHODS**

#### **Study design**

This was a hospital-based longitudinal observational study.

#### **Study setting**

The study was conducted in the Department of Otorhinolaryngology at Malla Reddy Institute of Medical Sciences.

#### **Study duration**

The study was carried out from September 2024 to March 2026.

#### **Study population**

The study included patients diagnosed with chronic rhinosinusitis who underwent endoscopic sinus surgery during the study period.

#### **Sample size**

A total of 150 patients were included in the study.

#### **Sampling method**

A consecutive sampling method was used. All eligible patients presenting during the study period were included until the required sample size was reached.

#### **Inclusion criteria**

Patients aged 18 years and above were included in the study. Patients with chronic rhinosinusitis, with or without nasal polyposis, who remained symptomatic despite adequate medical treatment and were planned for endoscopic sinus surgery were enrolled. Only those willing to participate and provide written informed consent were included.

#### **Exclusion criteria**

Patients with acute rhinosinusitis were excluded. Patients with sinonasal malignancy, craniofacial anomalies affecting sinonasal anatomy, severe systemic illness precluding surgery, or unwillingness to participate were also excluded. Patients who did not complete follow-up were not included in the final outcome assessment.

### **Preoperative assessment**

A detailed clinical history was obtained in all cases. Demographic details, duration of symptoms, and presenting complaints such as nasal obstruction, nasal discharge, facial pain or pressure, headache, and reduction in sense of smell were recorded. Relevant associated conditions including allergy, asthma, diabetes mellitus, and smoking history were also noted.

All patients underwent thorough otorhinolaryngological examination. Diagnostic nasal endoscopy was performed to assess the nasal cavity and middle meatus. Computed tomography of the paranasal sinuses was used to confirm the extent of disease and to plan surgery.

### **Surgical procedure**

All patients underwent endoscopic sinus surgery under standard institutional protocol. The extent of surgery was based on the disease pattern and intraoperative findings. The procedure was aimed at restoring sinus ventilation and drainage through clearance of diseased and obstructive tissue while preserving normal mucosa as far as possible.

### **Outcome measures**

#### **Symptom assessment**

Symptom severity was assessed before surgery and during follow-up using a structured symptom scoring system. The following five major symptoms were evaluated:

- nasal obstruction
- nasal discharge or postnasal drip
- facial pain or pressure
- headache
- hyposmia or anosmia

Each symptom was graded on a 0–3 scale as follows:

- 0 = no symptom
- 1 = mild (present but not affecting daily activities)
- 2 = moderate (frequent symptoms affecting daily activities)
- 3 = severe (persistent symptoms significantly affecting daily activities)

A total symptom score was calculated for each patient, ranging from 0 to 15. Preoperative and postoperative scores were compared to assess symptomatic improvement.

#### **Endoscopic assessment**

Nasal endoscopy was performed during follow-up to assess objective improvement. The following parameters were evaluated:

- mucosal edema
- nasal discharge
- crusting
- polypoidal changes
- middle meatal patency
- synechiae formation

Each parameter was graded using a simple ordinal scale (absent, mild, moderate, severe) and documented in a structured format. Postoperative findings were compared with preoperative status to assess improvement.

#### **Overall clinical outcome**

Overall outcome was assessed based on combined symptomatic and endoscopic improvement along with postoperative course.

Patients were categorized as:

- **Good outcome:** marked symptom relief with significant endoscopic improvement and no recurrence
- **Partial improvement:** moderate symptom relief with residual disease on endoscopy
- **Poor outcome:** minimal or no improvement, persistent or recurrent disease, or need for revision surgery

Postoperative complications and need for additional medical or surgical treatment were also recorded.

## Follow-up

Patients were followed up at 1 month, 3 months, and 6 months after surgery. At each visit, symptom scores and endoscopic findings were recorded. Complications, recurrence, and need for further treatment were documented. All 150 completed 6-month follow-up

## Data collection

Data were collected using a predesigned case record proforma. The proforma included demographic details, clinical features, examination findings, imaging results, operative details, and follow-up outcomes.

## Statistical analysis

Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Quantitative variables were expressed as mean and standard deviation. Qualitative variables were presented as frequency and percentage.

Preoperative and postoperative symptom scores were compared using the paired t-test for normally distributed data. For non-normally distributed data, the Wilcoxon signed-rank test was used. Categorical variables were analyzed using the chi-square test or Fisher's exact test as appropriate. A p-value of less than 0.05 was considered statistically significant.

## Ethical considerations

Approval was obtained from the Institutional Ethics Committee prior to the commencement of the study. Written informed consent was obtained from all participants. Patient confidentiality was maintained throughout the study.

## RESULTS

### 1. Study cohort and baseline characteristics

A total of 150 patients with chronic rhinosinusitis who underwent endoscopic sinus surgery were included in the analysis. The mean age of the cohort was  $41.46 \pm 11.96$  years, and 58.0% were male. Chronic rhinosinusitis with nasal polyps was present in 32.0% of patients. Among the major comorbidities, allergic rhinitis was noted in 34.0%, asthma in 22.7%, diabetes mellitus in 16.0%, and a smoking history in 13.3%. Baseline symptom duration averaged  $13.34 \pm 9.40$  months, while the mean preoperative CT Lund-Mackay score was  $13.57 \pm 3.79$ . These findings indicate that the study cohort represented patients with clinically significant and radiologically established disease at the time of surgery (Table 1).

**Table 1. Baseline demographic and clinical characteristics of the study cohort.**

Variable	Summary
Age (years)	$41.46 \pm 11.96$ ; median 43.0 (32.0-49.8); range 18-70
Symptom duration (months)	$13.34 \pm 9.40$ ; median 11.0 (7.0-15.8); range 3-68
CT Lund-Mackay score	$13.57 \pm 3.79$ ; median 13.0 (11.0-16.0); range 2-24
Male sex	87 (58.0%)
Female sex	63 (42.0%)
CRS with nasal polyps	48 (32.0%)
Allergic rhinitis	51 (34.0%)
Asthma	34 (22.7%)
Diabetes mellitus	24 (16.0%)
Smoking history	20 (13.3%)

### 2. Change in symptom scores after surgery

Symptom burden declined substantially after surgery and this improvement was sustained throughout follow-up. The mean total symptom score decreased from  $8.28 \pm 3.62$  preoperatively to  $3.52 \pm 2.47$  at 1 month,  $2.26 \pm 2.05$  at 3 months, and  $2.15 \pm 2.18$  at 6 months. Overall longitudinal comparison by Friedman test showed a statistically significant difference across visits (chi-square = 276.16,  $p < 0.001$ ). Pairwise Wilcoxon signed-rank testing demonstrated significant improvement from baseline to 1 month, 3 months, and 6 months (all  $p < 0.001$ ). The greatest reduction was observed early after surgery, with benefit maintained at later follow-up (Table 2, Figure 1).

**Table 2. Longitudinal change in total symptom score after endoscopic sinus surgery.**

Visit	Mean $\pm$ SD	Median (IQR)	Minimum-Maximum
Pre-op	$8.28 \pm 3.62$	8.5 (6.0-11.0)	1-15
1 month	$3.52 \pm 2.47$	3.0 (2.0-5.0)	0-12
3 months	$2.26 \pm 2.05$	2.0 (1.0-3.0)	0-9
6 months	$2.15 \pm 2.18$	1.5 (0.0-3.0)	0-9

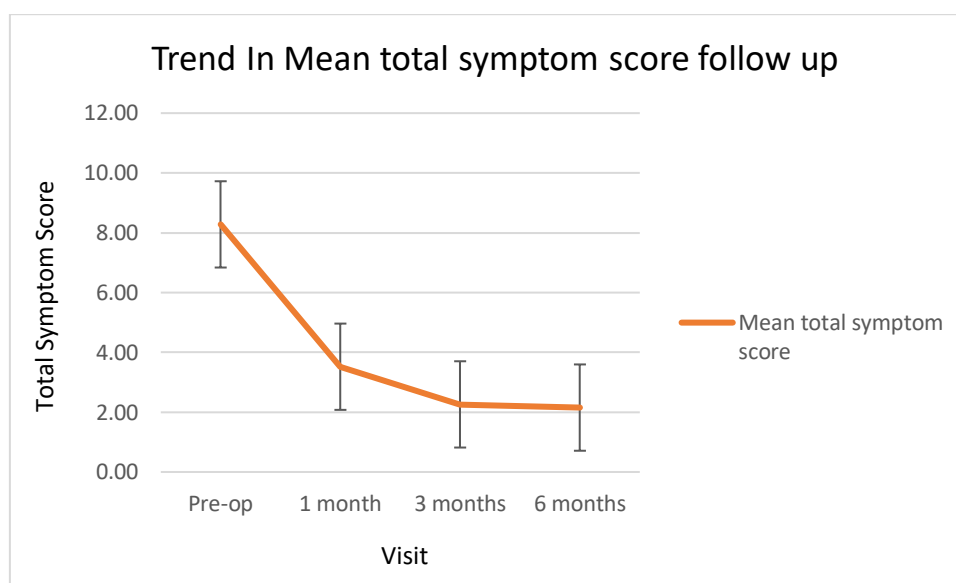
**Overall comparison:** Friedman test, chi-square = 276.16,  $p < 0.001$ . **Pairwise comparisons:** pre-op vs 1 month,  $p < 0.001$ ; pre-op vs 3 months,  $p < 0.001$ ; pre-op vs 6 months,  $p < 0.001$ .

Analysis of individual symptom domains showed statistically significant improvement in each component of the symptom score. Nasal obstruction demonstrated the highest baseline mean score and remained the dominant symptom

domain despite marked postoperative decline. Hyposmia/anosmia and nasal discharge also showed clear reductions over follow-up, while facial pain and headache declined to low mean levels by 3 and 6 months. The consistency of improvement across all five domains supports the symptomatic efficacy of endoscopic sinus surgery in this cohort (Table 3).

**Table 3. Change in individual symptom domains across follow-up.**

Symptom	Pre-op	1 month	3 months	6 months	Friedman p
Nasal obstruction	2.00 ± 0.94	1.03 ± 0.88	0.71 ± 0.79	0.75 ± 0.84	<0.001
Nasal discharge/postnasal drip	1.69 ± 0.98	0.69 ± 0.75	0.41 ± 0.59	0.41 ± 0.59	<0.001
Facial pain/pressure	1.42 ± 0.98	0.55 ± 0.67	0.35 ± 0.61	0.27 ± 0.55	<0.001
Headache	1.46 ± 0.95	0.47 ± 0.67	0.27 ± 0.53	0.30 ± 0.58	<0.001
Hyposmia/anosmia	1.71 ± 0.95	0.79 ± 0.83	0.51 ± 0.74	0.42 ± 0.66	<0.001



**Figure 1. Trend in mean total symptom score across preoperative and postoperative follow-up visits.**

Line plot showing the decline in mean total symptom score from the preoperative visit to 1 month, 3 months, and 6 months after surgery. Error bars represent standard deviations.

### 3. Change in nasal endoscopic findings during follow-up

Objective endoscopic findings improved in parallel with symptom relief. The mean total endoscopy score decreased from  $8.71 \pm 3.92$  preoperatively to  $3.89 \pm 2.83$  at 1 month,  $3.11 \pm 2.52$  at 3 months, and  $2.97 \pm 2.28$  at 6 months. This reduction was statistically significant on Friedman testing (chi-square = 234.92,  $p < 0.001$ ). Wilcoxon signed-rank testing confirmed significant improvement between baseline and each postoperative assessment (all  $p < 0.001$ ). These findings indicate sustained postoperative improvement in the objective endoscopic appearance of the sinonasal cavity (Table 4, Figure 2).

**Table 4. Longitudinal change in total endoscopy score after endoscopic sinus surgery.**

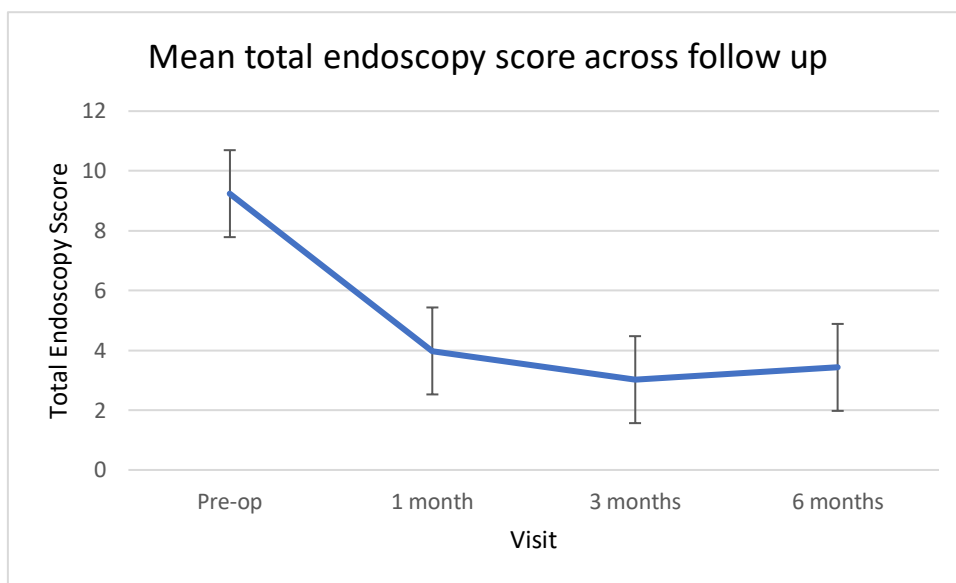
Visit	Mean ± SD	Median (IQR)	Minimum-Maximum
Pre-op	8.71 ± 3.92	8.5 (6.0-11.0)	0-18
1 month	3.89 ± 2.83	3.0 (2.0-5.8)	0-12
3 months	3.11 ± 2.52	3.0 (1.0-4.0)	0-13
6 months	2.97 ± 2.28	3.0 (1.0-4.0)	0-10

**Overall comparison:** Friedman test, chi-square = 234.92,  $p < 0.001$ . **Pairwise comparisons:** pre-op vs 1 month,  $p < 0.001$ ; pre-op vs 3 months,  $p < 0.001$ ; pre-op vs 6 months,  $p < 0.001$ .

All individual endoscopic parameters also improved significantly over time. Mucosal edema and endoscopic nasal discharge showed the highest preoperative scores and the most consistent postoperative decline. Polypoidal changes, middle meatal patency impairment, crusting, and synechiae likewise showed favorable trends, with low residual mean scores by 6 months. Taken together, these observations demonstrate that surgery was associated with broad-based objective improvement across the principal endoscopic markers of disease activity (Table 5).

**Table 5. Change in individual endoscopic parameters across follow-up.**

Endoscopic parameter	Pre-op	1 month	3 months	6 months	Friedman p
Mucosal edema	2.01 ± 0.93	1.11 ± 0.86	0.94 ± 0.87	0.94 ± 0.87	<0.001
Endoscopic nasal discharge	1.78 ± 0.96	0.81 ± 0.81	0.73 ± 0.78	0.63 ± 0.73	<0.001
Crusting	1.26 ± 0.95	0.45 ± 0.68	0.35 ± 0.59	0.33 ± 0.63	<0.001
Polypoidal changes	1.49 ± 1.04	0.65 ± 0.84	0.43 ± 0.71	0.44 ± 0.66	<0.001
Middle meatal patency impairment	1.60 ± 0.97	0.66 ± 0.79	0.51 ± 0.67	0.47 ± 0.65	<0.001
Synechia	0.56 ± 0.74	0.20 ± 0.54	0.15 ± 0.50	0.15 ± 0.50	<0.001



**Figure 2. Trend in mean total endoscopy score across preoperative and postoperative follow-up visits.**

Line plot showing the decline in mean total endoscopy score from the preoperative visit to 1 month, 3 months, and 6 months after surgery. Error bars represent standard deviations.

**4. Overall clinical outcome, complications, and recurrence**

Postoperative adverse events were infrequent, and major complications were uncommon. Bleeding occurred in 3.3% of patients, infection in 4.0%, postoperative synechia in 6.0%, and orbital injury in 1.3%, whereas no cerebrospinal fluid leak was observed. By 6 months, recurrence was documented in 14.7% of patients, and 27.3% required additional medical treatment. Overall outcome at the final follow-up was categorized as good in 58.7%, partial improvement in 21.3%, and poor in 20.0%. These results suggest that endoscopic sinus surgery was associated with favorable short-term clinical control in the majority of patients, although a relevant minority required further management (Table 6).

**Table 6. Postoperative complications and overall clinical outcome by 6 months.**

Measure	n	%
Bleeding	5	3.3
Infection	6	4.0
CSF leak	0	0.0
Orbital injury	2	1.3
Postoperative synechia	9	6.0
Recurrence by 6 months	22	14.7
Additional medical treatment	41	27.3
Revision surgery	4	2.7
Need for further intervention	43	28.7
Overall outcome: Good	88	58.7
Overall outcome: Partial improvement	32	21.3
Overall outcome: Poor	30	20.0

## 5. Subgroup analysis by nasal polyp status

Exploratory subgroup analysis showed that postoperative recurrence differed by disease phenotype. Recurrence occurred in 8.8% of patients with chronic rhinosinusitis without nasal polyps and in 27.1% of those with nasal polyps, and this difference was statistically significant (chi-square test,  $p = 0.007$ ). In contrast, the need for further intervention, revision surgery, and additional medical treatment did not differ significantly between the two groups ( $p = 0.926$ ,  $p = 1.000$ , and  $p = 0.962$ , respectively). Final overall outcome distribution also differed significantly by phenotype (chi-square test,  $p < 0.001$ ), with a higher proportion of good outcomes in the non-polyp group and a less favorable distribution in the polyp group (Table 7).

**Table 7. Clinical outcomes according to nasal polyp status.**

Outcome	CRSSNP	CRSwNP	Test	p
Recurrence	9/102 (8.8%)	13/48 (27.1%)	Chi-square	0.007
Need further intervention	29/102 (28.4%)	14/48 (29.2%)	Chi-square	0.926
Revision surgery	3/102 (2.9%)	1/48 (2.1%)	Fisher exact	1.00
Additional medical treatment	28/102 (27.5%)	13/48 (27.1%)	Chi-square	0.962
Overall final outcome distribution			Chi-square	<0.001

**CRSSNP:** Good 73 (71.6%), Partial 14 (13.7%), Poor 15 (14.7%)

**CRSwNP:** Good 15 (31.2%), Partial 18 (37.5%), Poor 15 (31.2%)

## DISCUSSION

The present study showed that endoscopic sinus surgery provides significant clinical benefit in patients with chronic rhinosinusitis who remain symptomatic despite medical therapy. Most patients demonstrated postoperative improvement in both symptom scores and endoscopic findings during follow-up. At final assessment, 58.7% of patients had a good outcome, 21.3% had partial improvement, and 20.0% had a poor outcome. Recurrence was noted in 14.7% of cases, while revision surgery was required in only 2.7%, indicating favorable short-term surgical outcomes.

The symptomatic benefit observed in the present study is consistent with earlier reports. Damm et al. found postoperative improvement in quality of life in 85% of patients, with relief of nasal obstruction in 84%, headache in 82%, and postnasal drip in 78% after functional endoscopic sinus surgery [13]. Schaitkin et al. reported an overall success rate of 91% at 4-year follow-up, although 25% of patients required more than one procedure for long-term control [14]. These findings support the view that ESS offers substantial symptom relief in most patients, even though long-term disease control may vary.

The endoscopic improvement seen in this study is also comparable with previous literature. Saratziotis et al. reported postoperative endoscopic improvement in 83.85% of patients, along with improvement in SNOT-22 in 78.85% and NOSE score in 92.10% [12]. They reported recurrence in 8.7% of patients, which is lower than the 14.7% observed in the present study [12]. This difference may be related to variation in disease severity, follow-up profile, or the proportion of patients with nasal polyps.

A key finding of the present study was the effect of disease phenotype on outcome. Recurrence was significantly higher in patients with chronic rhinosinusitis with nasal polyps than in those without nasal polyps, at 27.1% versus 8.8%. This is in agreement with previous evidence that CRSwNP has a more refractory postoperative course. Schaitkin et al. noted that late failure was commonly associated with recurrent symptomatic polyposis [14]. Matsuwaki et al. also showed that recurrence after ESS is associated with factors such as asthma, peripheral eosinophilia, and eosinophilic chronic rhinosinusitis [11]. The present findings therefore support the prognostic importance of inflammatory phenotype in postoperative disease control.

The revision surgery rate in this study was low. Hunter et al. reported a revision ESS rate of 4% at a median follow-up of 28 months [15]. In another analysis, revision rates within 1 year were 3.5% in CRSwNP and 1.6% in CRSSNP [16]. In the present study, the corresponding subgroup rates were 2.1% and 2.9%, respectively. These findings suggest acceptable short-term durability, although longer follow-up is needed because revision burden may increase over time [14,15].

An additional observation was that recurrence differed significantly by phenotype, while further intervention, revision surgery, and additional medical treatment did not. This may indicate that recurrent disease was initially managed medically and had not yet progressed to the point of further surgery within the study period. Such a pattern is clinically plausible, especially in polyp disease, where relapse may develop gradually over time [14].

The broader clinical relevance of ESS has also been highlighted in patients with associated asthma. Vashishta et al., in a systematic review and meta-analysis of 891 patients, found improvement in asthma control in 76.1% after ESS, with reductions in asthma attacks in 84.8%, hospitalizations in 64.4%, and oral corticosteroid use in 72.8% [10]. Although

asthma-specific outcomes were not assessed separately in the present study, these findings support the wider benefit of effective sinonasal disease control.

This study has certain limitations. The follow-up period was limited to 6 months and may underestimate long-term recurrence and revision rates. The study was also conducted at a single center. In addition, subgroup analysis by nasal polyp status was exploratory. Despite these limitations, the study provides useful prospective data from a tertiary care setting and demonstrates that ESS is associated with meaningful short-term improvement in medically refractory chronic rhinosinusitis.

Overall, the findings of the present study support endoscopic sinus surgery as an effective treatment option in chronic rhinosinusitis, particularly for patients who do not respond adequately to medical therapy. However, the higher recurrence seen in CRSwNP indicates the need for closer postoperative surveillance in this subgroup.

## CONCLUSION

Endoscopic sinus surgery is an effective treatment for medically refractory chronic rhinosinusitis. In the present study, it resulted in significant improvement in symptoms and endoscopic findings in most patients, with a favorable overall outcome in the majority. Recurrence was higher in patients with nasal polyps, indicating that disease phenotype influences postoperative course. Despite this, revision surgery was uncommon during follow-up. Endoscopic sinus surgery remains a useful and reliable option in the management of chronic rhinosinusitis, while continued surveillance is especially important in patients with chronic rhinosinusitis with nasal polyps.

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