

Microdebrider-Assisted Versus Conventional Endoscopic Sinus Surgery for Sinonasal Polyposis: A Prospective Comparative Study

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Abstract

Background: Endoscopic sinus surgery (ESS) is the standard surgical treatment for sinonasal polyposis that fails medical therapy, but the best choice of instrumentation remains debated. This study compared intraoperative and postoperative outcomes of microdebrider-assisted and conventional ESS.

Methods: In this prospective comparative study at a tertiary care teaching hospital, 70 patients aged 20–50 years with sinonasal polyposis underwent either microdebrider-assisted ESS (n = 35) or conventional ESS (n = 35). Operative time, blood loss and surgical field visibility were recorded intraoperatively. Synechiae, crusting, middle meatal collapse, recurrence, Meltzer grade and quality of life were assessed during 6 months of follow-up.

Results: The groups were comparable in age, sex and preoperative Meltzer grade. The microdebrider group had shorter operative time (62.4 ± 8.6 vs 78.7 ± 10.2 min; $p < 0.001$), less blood loss (82.5 ± 15.4 vs 128.3 ± 22.6 mL; $p < 0.001$) and more often good field visibility (80% vs 40%; $p = 0.002$). Synechiae (8.6% vs 31.4%; $p = 0.018$), crusting (14.3% vs 40.0%; $p = 0.014$) and middle meatal collapse (5.7% vs 25.7%; $p = 0.021$) were less frequent. Recurrence at 6 months was 5.7% vs 22.9% ($p = 0.042$). More patients reached Meltzer grade 0 (74.3% vs 45.7%; $p = 0.011$), and the mean quality-of-life improvement was greater (50.2 vs 40.4 points; $p = 0.003$).

Conclusion: Microdebrider-assisted ESS was associated with greater operative efficiency, fewer early postoperative complications, better disease clearance and larger quality-of-life gains than conventional ESS. Randomised multicentre studies with longer follow-up are needed to confirm these findings.

Keywords: Nasal polyps; Chronic rhinosinusitis; Endoscopic sinus surgery; Microdebrider; Recurrence; Quality of life

Introduction

Chronic rhinosinusitis (CRS) is defined as inflammation of the nose and paranasal sinuses lasting more than 12 weeks and affects an estimated 5–12% of adults [1–3]. Its polypoid phenotype, CRS with nasal polyps (CRSwNP), affects roughly 1–4% of the general population and presents with nasal obstruction, reduced sense of smell and rhinorrhoea [1,3]. The disease is frequently associated with asthma and aspirin-exacerbated respiratory disease, tends to recur after treatment and imposes a quality-of-life burden comparable to that of other major chronic illnesses [2,3].

Current guidelines recommend intranasal corticosteroids and saline irrigation as first-line therapy, with endoscopic sinus surgery (ESS) reserved for patients who remain symptomatic despite appropriate medical treatment [1,2]. The functional approach described by Messerklinger and Stammberger aims to clear disease and restore ventilation and drainage of the sinuses through the osteomeatal complex while preserving healthy mucosa [4]. ESS improves symptoms in patients with CRSwNP, but the evidence on how the choice of surgical technique influences outcomes remains limited [5].

Conventional ESS relies on through-cutting and grasping forceps, which can strip mucosa, expose bone and increase bleeding. The microdebrider, a powered instrument that combines an oscillating blade with continuous suction, was introduced to remove polypoid tissue precisely while protecting adjacent mucosa and keeping the operative field clear. Earlier comparative studies, including a double-blind randomised trial, reported less bleeding and greater precision with the microdebrider [6,7], and more recent studies have reported shorter operative times and improved postoperative healing [8,9]. At the same time, device-related adverse events have been documented [10], and many comparative studies have examined only a narrow set of intraoperative endpoints.

We therefore conducted a prospective comparative study to evaluate microdebrider-assisted and conventional ESS in patients with sinonasal polyposis across intraoperative parameters, early postoperative healing, disease recurrence and patient-reported quality of life.

Materials and Methods

Study design and setting

This prospective comparative observational study was conducted in the Department of Otorhinolaryngology, Sree Balaji Medical College and Hospital, Chrompet, Chennai, India, a tertiary care teaching hospital, between May 2024 and December 2025. The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants.

Participants

Patients aged 20–50 years with sinonasal polyposis requiring surgical intervention and who provided written informed consent for surgery were eligible for inclusion. Patients were excluded if they had uncontrolled diabetes mellitus, systemic hypertension, renal or liver disease; bleeding nasal polyps; rhinosporidiosis; other benign or malignant sinonasal masses; or were unwilling to undergo surgery. Eligible patients presenting to the outpatient department were recruited sequentially until the required sample size of 70 patients was achieved. The overall sampling technique was convenience sampling.

The enrolled patients were divided into two groups: Group A comprised 35 patients who underwent microdebrider-assisted endoscopic sinus surgery (ESS), while Group B comprised 35 patients who underwent conventional ESS using standard surgical instruments. The specific method used to allocate patients to the two groups was not documented in the available thesis material and therefore is not stated here.

Preoperative Evaluation

All patients underwent a detailed clinical history and complete ear, nose, throat and head-and-neck examination. Diagnostic nasal endoscopy and computed tomography of the paranasal sinuses were performed as part of the preoperative assessment. The extent of nasal polyposis was graded using the Meltzer grading system [11]. Grade 0 indicated absence of polyps; Grade 1 indicated small polyps or oedema confined to the middle meatus; Grade 2 indicated polyps obstructing the middle meatus; Grade 3 indicated polyps extending beyond the middle meatus without complete obstruction; and Grade 4 indicated massive nasal polyposis with near-complete nasal obstruction. Preoperative quality of life was also assessed using the 22-item Sino-Nasal Outcome Test (SNOT-22), with lower scores representing better quality of life.

Surgical Technique

All patients underwent endoscopic sinus surgery for removal of polypoid tissue and restoration of sinus ventilation and drainage.

In Group A, sinonasal polyps were removed using a microdebrider-assisted technique. In Group B, surgery was performed using conventional endoscopic instruments, including standard through-cutting and grasping forceps. The available thesis material confirms the use of these two operative approaches; however, the manufacturer and model of the microdebrider, blade specification, oscillation speed, type of anaesthesia, surgeon-specific allocation, precise extent of sinus surgery, nasal packing protocol and postoperative medical regimen are not sufficiently documented in the available source material. These details should therefore be inserted only after confirmation from the operative records or original thesis case records.

Outcome Measures

The primary intraoperative parameters assessed were operative time, intraoperative blood loss and visibility of the operative field.

Operative time was recorded from the beginning to completion of surgery. Intraoperative blood loss was calculated from the total volume collected in the suction apparatus after accounting for the volume of saline used for irrigation. Visibility of the operative field was assessed by the operating surgeon and classified as good, moderate or poor according to the clarity of the surgical field and the degree of bleeding. In the study results, 28 patients in the microdebrider group and 14 patients in the conventional group were classified as having good operative-field visibility.

Postoperative assessment was performed at 1, 3 and 6 months using clinical examination and diagnostic nasal endoscopy. Crusting was assessed at 1 month, while synechiae formation was assessed at 3 months. Middle meatal

collapse was assessed during postoperative follow-up; however, the exact predefined assessment time point is not explicitly documented in the available thesis material and should be confirmed from the original case-record forms. Recurrence and postoperative Meltzer grade were assessed at 6 months.

Postoperative Meltzer grading at 6 months was categorized as Grade 0, Grade 1 and Grade ≥ 2 . The study reported Grade 0 disease in 26 (74.3%) patients in the microdebrider group and 16 (45.7%) patients in the conventional group. Quality of life was assessed preoperatively and at 6 months using the 22-item Sino-Nasal Outcome Test (SNOT-22). The mean preoperative SNOT-22 scores were 68.4 in the microdebrider group and 69.1 in the conventional group, while the corresponding 6-month postoperative scores were 18.2 and 28.7, respectively.

Overall surgical outcome was recorded as excellent, good or fair. The available thesis results document these three outcome categories, but do not provide sufficiently explicit operational criteria for assigning patients to each category. Therefore, the criteria should be taken directly from the original case-record form or investigator-defined scoring system rather than retrospectively created.

Statistical Analysis

Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were expressed as frequency and percentage. Continuous variables between the two groups were compared using the independent-samples t-test. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. A p-value of <0.05 was considered statistically significant.

The available thesis material does not explicitly document the statistical software and version used for analysis. This should be confirmed from the original statistical analysis record before inclusion in the final manuscript.

Results

Baseline characteristics

Seventy patients were included, 35 in each group. The groups were comparable in age (36.8 ± 7.2 vs 37.4 ± 6.9 years; $p = 0.74$), sex (males 60.0% vs 57.1%; $p = 0.81$) and preoperative Meltzer grade ($p = 0.93$). Most patients were aged 31–40 years, and grade 3 disease was the most common preoperative grade in both groups (Table 1).

Table 1. Baseline characteristics of the study groups

Characteristic	Microdebrider (n = 35)	Conventional (n = 35)	p value
Age, years, mean $\pm$ SD	36.8 ± 7.2	37.4 ± 6.9	0.74
Age group, n (%)			
20–30 years	9 (25.7)	8 (22.9)	
31–40 years	14 (40.0)	15 (42.9)	
41–50 years	12 (34.3)	12 (34.3)	
Sex, n (%)			0.81
Male	21 (60.0)	20 (57.1)	
Female	14 (40.0)	15 (42.9)	
Preoperative Meltzer grade, n (%)			0.93
Grade 2	8 (22.9)	7 (20.0)	
Grade 3	15 (42.9)	16 (45.7)	
Grade 4	12 (34.3)	12 (34.3)	

SD, standard deviation.

Intraoperative outcomes

Mean operative time was 16.3 minutes shorter in the microdebrider group (62.4 ± 8.6 vs 78.7 ± 10.2 min; $p < 0.001$), and mean blood loss was 45.8 mL lower (82.5 ± 15.4 vs 128.3 ± 22.6 mL; $p < 0.001$). Visibility was rated good in 80.0% of microdebrider procedures compared with 40.0% of conventional procedures, and poor visibility occurred only in the conventional group (14.3%; $p = 0.002$) (Table 2).

Table 2. Intraoperative outcomes

Outcome	Microdebrider (n = 35)	Conventional (n = 35)	p value
Operative time, min, mean $\pm$ SD	62.4 ± 8.6	78.7 ± 10.2	< 0.001
Blood loss, mL, mean $\pm$ SD	82.5 ± 15.4	128.3 ± 22.6	< 0.001
Visibility of operative field, n (%)			0.002
Good	28 (80.0)	14 (40.0)	
Moderate	7 (20.0)	16 (45.7)	
Poor	0 (0.0)	5 (14.3)	

SD, standard deviation.

Postoperative outcomes

Crusting at 1 month (14.3% vs 40.0%; $p = 0.014$), synechiae at 3 months (8.6% vs 31.4%; $p = 0.018$) and middle meatal collapse (5.7% vs 25.7%; $p = 0.021$) were all less frequent after microdebrider-assisted surgery. At 6 months, recurrence occurred in 2 patients (5.7%) in the microdebrider group and 8 patients (22.9%) in the conventional group ($p = 0.042$). Complete clearance (Meltzer grade 0) was achieved in 74.3% and 45.7% of patients, respectively ($p = 0.011$) (Table 3).

Quality-of-life scores improved in both groups, from 68.4 to 18.2 in the microdebrider group and from 69.1 to 28.7 in the conventional group. The mean improvement was greater with the microdebrider (50.2 vs 40.4 points; $p = 0.003$). An excellent overall surgical outcome was achieved in 71.4% of the microdebrider group compared with 40.0% of the conventional group ($p = 0.009$).

Table 3. Postoperative Outcomes

Outcome	Microdebrider (n = 35)	Conventional (n = 35)	p value
Crusting at 1 month, n (%)	5 (14.3)	14 (40.0)	0.014
Synechiae at 3 months, n (%)	3 (8.6)	11 (31.4)	0.018
Middle meatal collapse, n (%)	2 (5.7)	9 (25.7)	0.021
Recurrence at 6 months, n (%)	2 (5.7)	8 (22.9)	0.042
Meltzer grade at 6 months, n (%)			0.011
Grade 0	26 (74.3)	16 (45.7)	
Grade 1	7 (20.0)	11 (31.4)	
Grade ≥ 2	2 (5.7)	8 (22.9)	
Quality-of-life score, mean			
Preoperative	68.4	69.1	
6 months	18.2	28.7	
Improvement	50.2	40.4	0.003
Overall surgical outcome, n (%)			0.009
Excellent	25 (71.4)	14 (40.0)	
Good	8 (22.9)	13 (37.1)	
Fair	2 (5.7)	8 (22.9)	

Quality-of-life instrument: 22-item Sino-Nasal Outcome Test (SNOT-22). Lower scores indicate better quality of life. The source data report the mean scores but do not provide standard deviations; therefore, SDs have not been added.

Discussion

In this prospective comparative study of 70 patients with sinonasal polyposis, microdebrider-assisted endoscopic sinus surgery (ESS) was associated with shorter operative time, lower intraoperative blood loss and better surgical-field visibility compared with conventional instrumentation. These intraoperative differences were accompanied by lower rates of postoperative crusting, synechiae, middle meatal collapse and recurrence, together with better postoperative Meltzer grades and greater improvement in quality of life at 6 months. The two groups were comparable with respect to age, sex and preoperative disease severity, reducing the likelihood that the observed differences were attributable to substantial baseline differences between the groups.

Intraoperative Efficiency

In the present study, the mean operative time was 62.4 ± 8.6 minutes in the microdebrider group compared with 78.7 ± 10.2 minutes in the conventional group, representing a reduction of approximately 16 minutes. Mean blood loss was also lower in the microdebrider group (82.5 ± 15.4 mL) than in the conventional group (128.3 ± 22.6 mL). Both differences were statistically significant ($p < 0.001$). Good surgical-field visibility was observed in 80.0% of patients in the microdebrider group compared with 40.0% in the conventional group.

These findings are consistent with the study by Singh et al., which compared microdebrider-assisted ESS with conventional ESS in patients with nasal polyposis and reported favourable intraoperative and postoperative findings with microdebrider-assisted surgery [8]. Eid et al. subsequently compared microdebrider-assisted ESS with conventional ESS in patients with sinonasal polyposis and reported significantly shorter operative duration and lower blood loss in the microdebrider group [9]. The consistency between these observations and the present findings supports the potential intraoperative efficiency of powered instrumentation.

The reduction in operative time and blood loss may be related to the ability of the microdebrider to simultaneously remove tissue and aspirate blood and debris. This may reduce repeated instrument exchanges and interruptions for clearance of the operative field. Controlled tissue removal may also reduce unnecessary traction on adjacent mucosa. The better surgical-field visibility observed in the present study may consequently be related to reduced bleeding and more efficient tissue removal. However, visibility was assessed intraoperatively and is therefore potentially influenced by surgeon assessment.

Safety and Postoperative Healing

Although microdebrider-assisted surgery provides controlled tissue removal, powered instrumentation also requires appropriate anatomical knowledge and careful handling. Saba et al., in their analysis of the openFDA database, identified a range of adverse events associated with microdebrider use in sinus surgery, emphasizing that device-related complications can occur and that appropriate surgical technique remains essential [10].

In the present study, postoperative crusting occurred in 14.3% of patients in the microdebrider group compared with 40.0% in the conventional group. Synechiae were observed in 8.6% and 31.4%, respectively, while middle meatal collapse occurred in 5.7% and 25.7% of patients. These findings indicate differences in postoperative healing between the two techniques.

Sinonasal polyposis represents a chronic sinonasal inflammatory disease in which mucosal preservation and appropriate postoperative management are important considerations. Standardized definitions and clinical criteria for rhinosinusitis and related sinonasal disease have been established to facilitate consistent assessment of disease and treatment outcomes [11]. In the present study, the lower frequency of crusting, synechiae and middle meatal collapse in the microdebrider group may be related to more controlled removal of polypoidal tissue and reduced manipulation of surrounding mucosa.

Postoperative medical management can also influence mucosal healing. Suligavi et al. evaluated postoperative nasal irrigation following functional ESS in patients with sinonasal polyposis and reported differences in outcomes between saline irrigation and saline irrigation combined with budesonide [13]. Therefore, postoperative treatment represents an important factor when interpreting healing outcomes following different surgical techniques. The postoperative findings in the present study should consequently be considered in conjunction with the postoperative care provided to the study participants.

Quality of Life

Quality of life improved substantially following surgery in both groups. The mean quality-of-life score decreased from 68.4 preoperatively to 18.2 at 6 months in the microdebrider group and from 69.1 to 28.7 in the conventional group. The corresponding mean improvements were 50.2 and 40.4 points, respectively, with a statistically significant difference between the groups ($p = 0.003$).

The quality-of-life assessment in the present study was performed using the 22-item Sinonasal Outcome Test (SNOT-22). Hopkins et al. established the psychometric validity of the SNOT-22 and demonstrated its usefulness as a validated patient-reported outcome measure for sinonasal disease [12]. The substantial improvement observed in both groups in the present study is consistent with the role of ESS in improving patient-reported sinonasal symptoms.

The greater mean improvement observed in the microdebrider group occurred alongside better postoperative endoscopic findings, including a higher proportion of patients with Meltzer grade 0 and lower rates of postoperative complications. However, objective endoscopic findings and patient-reported outcomes assess different dimensions of treatment response and should not be considered interchangeable.

Recurrence and Endoscopic Disease Clearance

At 6 months, recurrence was observed in 5.7% of patients in the microdebrider group compared with 22.9% in the conventional group ($p = 0.042$). Similarly, 74.3% of patients in the microdebrider group had a postoperative Meltzer grade of 0 compared with 45.7% in the conventional group ($p = 0.011$).

Aldajani et al. evaluated outcomes following ESS in patients with chronic rhinosinusitis with nasal polyposis and identified recurrence as an important postoperative outcome [14]. The recurrence rate observed in the conventional group in the present study was within the range reported in clinical series of patients undergoing ESS for chronic rhinosinusitis with nasal polyposis. The lower recurrence observed in the microdebrider group may be related to the better postoperative endoscopic status observed in the same group.

Akiyama et al. demonstrated that early postoperative endoscopic scores could predict longer-term endoscopic outcomes in patients with eosinophilic chronic rhinosinusitis [15]. This observation is relevant to the present findings, where better postoperative endoscopic grades were accompanied by a lower recurrence rate at 6 months. However, recurrence following ESS may continue to develop over prolonged periods. Mascarenhas et al. evaluated long-term outcomes after ESS in patients with chronic rhinosinusitis with and without nasal polyps and demonstrated the importance of long-term follow-up in evaluating postoperative disease control [16]. More recently, Kirtsreesakul et al. developed a prediction model for recurrence after ESS in patients with chronic rhinosinusitis with nasal polyps, highlighting the contribution of multiple clinical factors to postoperative recurrence [17].

Therefore, the recurrence findings in the present study should be interpreted as evidence of short-term postoperative disease control rather than definitive evidence of long-term prevention of recurrence. Factors such as inflammatory phenotype, asthma, disease severity and other patient characteristics may influence recurrence and were not comprehensively evaluated in the present study.

Surgical Extent and Tissue Preservation

The extent of surgical intervention is another factor that may influence postoperative disease clearance and mucosal healing. Jankowski et al. compared radical nasalisation with functional ethmoidectomy in patients with severe sinonasal polyposis and demonstrated differences associated with the extent of surgical intervention [18]. Kuehnemund et al. similarly evaluated extended versus limited endonasal sinus surgery, emphasizing the importance of surgical extent when considering postoperative outcomes [19].

The present study was designed to compare microdebrider-assisted and conventional instrumentation rather than different extents of sinus surgery. Therefore, the better postoperative endoscopic findings observed in the microdebrider group should not be interpreted as evidence that the instrument independently determines the extent of surgical clearance. Rather, controlled tissue removal may contribute to efficient removal of polypoidal tissue while limiting unnecessary mucosal manipulation.

Patient-Reported Outcomes

Patient-reported outcome measures provide information that complements objective endoscopic assessment. Rudmik et al., in a systematic review and quality assessment of patient-reported outcome measures for adult chronic

rhinosinusitis, emphasized the importance of validated instruments for evaluating treatment outcomes from the patient's perspective [20].

In the present study, both surgical groups demonstrated substantial improvement in quality of life, with a greater mean improvement in the microdebrider group. The approximately 10-point difference in mean improvement between groups is notable in the context of the established clinical utility of SNOT-22. Nevertheless, the interpretation of this difference should consider the non-randomized study design and the possibility of unmeasured confounding.

The relationship between surgical technique, disease characteristics and postoperative management is complex. Noon and Hopkins emphasized that outcomes following ESS depend on multiple interacting factors, including patient selection, disease severity, surgical technique and postoperative management [21]. The findings of the present study should therefore be interpreted as an association between the surgical technique and observed short-term outcomes rather than evidence that the surgical instrument alone determines postoperative success.

Limitations

This study has several limitations. First, allocation to the two surgical techniques was not randomized; therefore, selection bias cannot be completely excluded despite comparable baseline characteristics. Second, this was a single-centre study with a relatively modest sample size of 70 patients, which limits generalizability and reduces the ability to detect uncommon outcomes.

Third, follow-up was limited to 6 months. Since sinonasal polyposis is a chronic inflammatory condition with potential for long-term recurrence, longer follow-up would be required to determine whether the observed difference in recurrence persists. Fourth, neither the surgeons nor the outcome assessors were blinded. This is particularly relevant for subjective assessments such as surgical-field visibility and endoscopic grading.

Olfactory function was not assessed in the present study. In addition, potentially important disease modifiers such as asthma, aspirin-exacerbated respiratory disease, inflammatory endotype and tissue eosinophilia were not comprehensively recorded or adjusted for using multivariable analysis. These factors may influence postoperative healing and recurrence.

Finally, cost-effectiveness was not assessed. Although the present study demonstrated differences in operative and postoperative outcomes, economic evaluation would be useful when considering the implementation of microdebrider-assisted ESS, particularly in resource-constrained healthcare settings.

Conclusion

In this prospective comparative study of 70 patients with sinonasal polyposis, microdebrider-assisted endoscopic sinus surgery was associated with shorter operative time, lower intraoperative blood loss and better surgical-field visibility compared with conventional instrumentation. The microdebrider group also demonstrated lower rates of postoperative crusting, synechiae, middle meatal collapse and recurrence, together with better postoperative Meltzer grades and greater improvement in SNOT-22 quality-of-life scores at 6 months.

These findings demonstrate favourable short-term intraoperative, endoscopic and patient-reported outcomes associated with microdebrider-assisted ESS in the study population. However, the non-randomized design, single-centre setting, modest sample size and 6-month follow-up limit definitive conclusions regarding long-term outcomes. Larger multicentre randomized studies with longer follow-up, standardized postoperative care, blinded outcome assessment, assessment of olfactory function and consideration of inflammatory disease characteristics are warranted to further evaluate the long-term effectiveness, safety and cost-effectiveness of microdebrider-assisted ESS.

References

1. 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(Suppl S29):1–464. doi:10.4193/Rhin20.600
2. Orlandi RR, Kingdom TT, Smith TL, Bleier B, DeConde A, Luong AU, et al. International consensus statement on allergy and rhinology: rhinosinusitis 2021. *Int Forum Allergy Rhinol*. 2021;11(3):213–739. doi:10.1002/alr.22741
3. DeConde AS, Soler ZM. Chronic rhinosinusitis: epidemiology and burden of disease. *Am J Rhinol Allergy*. 2016;30(2):134–9. doi:10.2500/ajra.2016.30.4297

4. Stammberger H, Posawetz W. Functional endoscopic sinus surgery. Concept, indications and results of the Messerklinger technique. *Eur Arch Otorhinolaryngol.* 1990;247(2):63–76. doi:10.1007/BF00183169
5. Sharma R, Lakhani R, Rimmer J, Hopkins C. Surgical interventions for chronic rhinosinusitis with nasal polyps. *Cochrane Database Syst Rev.* 2014;(11):CD006990. doi:10.1002/14651858.CD006990.pub2
6. Sauer M, Lemmens W, Vauterin T, Jorissen M. Comparing the microdebrider and standard instruments in endoscopic sinus surgery: a double-blind randomised study. *B-ENT.* 2007;3(1):1–7.
7. Selivanova O, Kuehnemund M, Mann WJ, Amedee RG. Comparison of conventional instruments and mechanical debridors for surgery of patients with chronic sinusitis. *Am J Rhinol.* 2003;17(4):197–202.
8. Singh R, Hazarika P, Nayak DR, Balakrishnan R, Gangwar N, Hazarika M. A comparison of microdebrider assisted endoscopic sinus surgery and conventional endoscopic sinus surgery for nasal polypi. *Indian J Otolaryngol Head Neck Surg.* 2013;65(3):193–6. doi:10.1007/s12070-011-0332-5
9. Eid MA, Abdelkader HM. Microdebrider assisted endoscopic sinus surgery versus conventional endoscopic sinus surgery in management of sinonasal polyposis. *Indian J Otolaryngol Head Neck Surg.* 2025;77(8):3033–9. doi:10.1007/s12070-025-05630-1
10. Saba ES, Hoerter J, Chang J, Chou DW, Xiao C, Eide JG, et al. Microdebrider complications in sinus surgery: analysis of the openFDA database. *World J Otorhinolaryngol Head Neck Surg.* 2023;9(4):328–32. doi:10.1002/wjo2.89
11. Meltzer EO, Hamilos DL, Hadley JA, Lanza DC, Marple BF, Nicklas RA, et al. Rhinosinusitis: establishing definitions for clinical research and patient care. *J Allergy Clin Immunol.* 2004;114(6 Suppl):155–212. doi:10.1016/j.jaci.2004.09.029
12. Hopkins C, Gillett S, Slack R, Lund VJ, Browne JP. Psychometric validity of the 22-item Sinonasal Outcome Test. *Clin Otolaryngol.* 2009;34(5):447–54. doi:10.1111/j.1749-4486.2009.01995.x
13. Suligavi SS, Sridhar V, Doddamani SS. Outcome of post functional endoscopic sinus surgery nasal irrigation with normal saline versus normal saline with budesonide in patients with sinonasal polyposis: a randomized control trial. *Indian J Otolaryngol Head Neck Surg.* 2024;76(4):2968–72. doi:10.1007/s12070-024-04666-z
14. Aldajani A, Alroqi A, Alrashidi A, Alsaif A, Almeshari S, Aldwaighri M, et al. Outcomes of endoscopic sinus surgery for chronic rhinosinusitis with nasal polyposis and risk factors of recurrence in a tertiary care teaching hospital. *Ther Adv Allergy Rhinol.* 2024;15:27534030241274764. doi:10.1177/27534030241274764
15. Akiyama K, Samukawa Y, Hoshikawa H. Early postoperative endoscopic score can predict the long-term endoscopic outcomes in eosinophilic chronic rhinosinusitis (ECRS) patients. *Braz J Otorhinolaryngol.* 2023;89(1):136–43. doi:10.1016/j.bjorl.2021.12.003
16. Mascarenhas JG, da Fonseca VM, Chen VG, Itamoto CH, Silva CA, Gregório LC, et al. Long-term outcomes of endoscopic sinus surgery for chronic rhinosinusitis with and without nasal polyps. *Braz J Otorhinolaryngol.* 2013;79(3):306–11. doi:10.5935/1808-8694.20130055
17. Kirtsreesakul V, Thongsuksai P, Sanghan N, Promsopa C. Prediction model for recurrence after endoscopic sinus surgery in chronic rhinosinusitis with nasal polyps. *Am J Rhinol Allergy.* 2026;40(2):140–50. doi:10.1177/19458924251389175
18. Jankowski R, Pigret D, Decroocq F, Blum A, Gillet P. Comparison of radical (nasalisation) and functional ethmoidectomy in patients with severe sinonasal polyposis. *Rev Laryngol Otol Rhinol (Bord).* 2006;127(3):131–40.
19. Kuehnemund M, Lopatin A, Amedee RG, Mann WJ. Endonasal sinus surgery: extended versus limited approach. *Am J Rhinol.* 2002;16(4):187–92.
20. Rudmik L, Hopkins C, Peters A, Smith TL, Schlosser RJ, Soler ZM. Patient-reported outcome measures for adult chronic rhinosinusitis: a systematic review and quality assessment. *J Allergy Clin Immunol.* 2015;136(6):1532–40.e2. doi:10.1016/j.jaci.2015.10.012
21. Noon E, Hopkins C. Review article: outcomes in endoscopic sinus surgery. *BMC Ear Nose Throat Disord.* 2016;16:9. doi:10.1186/s12901-016-0030-8