

# Complications Following Powered Endoscopic Sinus Surgery: an 11 Year Study on 1190 Patients in a Single Institute in Israel

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**ABSTRACT:** **Background:** Over the past 20 years, advances in endoscopic sinus surgery (ESS) techniques have led to widespread applications of this technology in both adult and pediatric populations with better results and lower morbidity.

**Objectives:** To update data regarding the rate of minor and major complications following ESS procedures that used powered instrumentation.

**Methods:** We retrospectively reviewed the charts of all patients who, with general anesthesia, underwent ESS utilizing powered instrumentation between January 1996 and December 2006. Age, gender, indication for surgery, length of hospitalization, and type and rate of surgical complications were recorded.

**Results:** A total of 1190 patients were included in our study (1309 surgeries). The male:female ratio was 1.7:1.0 and the average age was 39 years (range 4–86 years). The most common indication for surgery was chronic rhinosinusitis. The rate of major complications was 0.31% and that of minor complications 1.37%. The only major complication that occurred was cerebrospinal fluid leak. The minor complications included epistaxis, periorbital emphysema, ecchymosis and mucocele formation.

**Conclusions:** Compared to previously published series, the rate of major and minor complications in our study was low. The results indicate that the use of powered instruments during ESS is safe.

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**KEY WORDS:** endoscopic sinus surgery (ESS), powered instrumentation, microdebrider, chronic rhinosinusitis, sinus tumors, nasal polyposis

Endoscopic sinus surgery has become a common surgical procedure that has largely replaced the more mutilating and less successful external procedures. This has revolutionized the treatment of paranasal sinus disease and is considered the treatment of choice for a long list of sinonasal pathologies including chronic rhinosinusitis with or without nasal polyposis, and more recently for resection of nasal and paranasal sinus tumors as well as skull base lesions [1]. Technological develop-

ment over the years, including through-cutting instruments, the microdebrider (Shaver/Hummer) and advanced navigation tools, has moved this field to a new era. The microdebrider, adapted from the field of arthroscopy, has been in use in ESS since the early 1990s. The microdebrider design affords excellent control and precision for resection of soft tissue, cutting and removing only tissue suctioned into the rotating opening, while preserving surrounding tissue. This enables cutting instead of tearing, better visualization and safety, improved precision of the surgery, and a shorter operating time [2].

Despite the huge development in surgical instrumentation and surgical abilities, ESS complications still occur. Several major publications from the 1990s reported the occurrence of intraoperative complications in 4.2%–23% [Table 1] [3–10]. The majority of these were minor complications (minor bleeding, adhesions, minor periorbital trauma, hyposmia, asthma exacerbation, dental pain) that were observed in 3.9–20.24% [3,4]. Major complications include intracranial and orbital injury, nasolacrimal trauma, cerebrospinal fluid leak, major nasal bleeding, stroke and anosmia, and were reported in 0.0–2.25%. The aim of the present study was to evaluate the rate of complications following ESS that occurred in our department following the use of the microdebrider and compare it to previously published studies in the English-language medical literature supporting the safety of the procedure.

ESS = endoscopic sinus surgery

**Table 1.** Complication rates for sinonasal surgery in major studies

Author [ref]	Year	N	Minor (%)	Major (%)
May et al. [3]	1994	2108	9.6	0.85
Gross et al. [5]	1997	1106	13.9	0
Li and Xu [6]	1998	1089	4.5	1.2
Keerl et al. [7]	1999	1500	Not given	0.9
Danielson and Olofsson [8]	2006	1915	5.6	0.47
Shi and Wang [9]	2007	1102	Not given	1.91
Siedek et al. [10]	2010	2596	3.1	0.9
This study	2012	1190	1.37	0.31

### PATIENTS AND METHODS

The study protocol was approved by the Institutional Review Board at our medical center. We performed a retrospective analysis of all patients who underwent ESS with powered instrumentation under general anesthesia between January 1996 and December 2006 at our institution. Age, gender, indications for surgery, number of surgical procedures, length of hospitalization and surgical complications were recorded. All ESS procedures were performed using the Microdebrider™ (XOMED 2000, Medtronic, USA). Excluded were patients who were operated on under local anesthesia, those having a combined approach (external and endoscopic), and those in whom the procedure was conducted with grasping instrumentation only and without the microdebrider. Results were compared with the relevant previously reported publications.

### RESULTS

Our study population comprised 1190 patients who underwent ESS (a total of 1309 surgical procedures) using powered instrumentation. The mean age was 39 years (range 4–86 years). Eighty-five operations were performed in children and 1224 in adults. The length of hospitalization for both groups ranged from 1 to 35 days (mean 2.95 days). The male:female ratio was 1.7:1.0.

The most common indications for surgery were chronic rhinosinusitis and nasal polyposis, followed by benign tumors and orbital complications of rhinosinusitis [Table 2].

The incidence of minor complications was 1.37% (18 adults), which included periorbital emphysema and ecchymosis in 2 patients, minor bleeding during surgery or in the subsequent first 24 hours postoperatively in 12 patients, and purulent nasal discharge in 4 patients [Table 3]. The incidence of major complications was 0.31%, namely, a CSF leak in four adults [Table 3]. No orbital complications, major bleeding or nasolacrimal injuries were observed in this series. Three of the

CSF = cerebrospinal fluid

**Table 2.** Pathological findings in patients who underwent endoscopic sinus surgery

Etiology	N	%
Chronic rhinosinusitis	662	50.5
Nasal polyposis	536	40.9
Excision of benign tumor	90	6.8
Orbital cellulitis	14	1
Hereditary Osler-Weber-Rendu syndrome	3	0.2
Nasolacrimal stenosis	2	0.15
Removal of orbital foreign body	2	0.15
Total	1309	

**Table 3.** Rate and type of complications for sinonasal operations

Complication	N	Comment
<b>Minor</b>		
Periorbital emphysema and ecchymosis	2	
Minor bleeding	12	
Purulent nasal discharge	4	
<b>Major</b>		
Cerebrospinal fluid leak	4	One case developed meningitis

patients with a CSF leak underwent successful intraoperative repair of the skull base defect, and the fourth patient, who presented with bacterial meningitis, was treated initially with intravenous antibiotics without any sequelae and was thereafter operated on endoscopically to seal the defect. No surgical complications were observed in the pediatric age group.

### DISCUSSION

The ESS technique was pioneered in Europe during the 1970s and was introduced in the United States in the mid-1980s. It is considered a relatively safe and effective procedure for treating chronic sinusitis with or without nasal polyps in adults [11]. The addition of powered instrumentation in 1994 heralded the modern era of powered ESS [12].

Several large-scale published studies assessed ESS complications [3–10], but most of them were published before the introduction of powered instrumentation [Table 1]. The overall incidence of complications associated with ESS was not statistically different from that of the non-powered instrumentation endonasal surgery according to these studies.

The literature regarding the rate of potential complications with powered instruments is limited. While the mean reported rate of major complications of ESS is approximately 0.5%, the use of powered instruments may increase the severity of these complications, as suggested by some authors who claim that the use of a microdebrider brought better precision but raised the potential for complications. Graham and Nerad [13] reported three cases of medial rectus injury following endoscopic surgery with a microdebrider. One of the patients developed blindness from an orbital hemorrhage. The authors attribute the increased severity of complications to the ability of the powered suction to draw material, such as the medial rectus and orbital fat, into the rotating blades with great speed and efficiency.

Skull base injuries such as CSF leaks and exposure or penetration of brain matter are other major complications of ESS. Church and colleagues [14] reported their experience of three cases with large skull base defects that resulted from the use of powered instrumentation. The authors speculated that the relatively large microdebrider tip may obscure visualization of the fovea ethmoidalis and the suction component might convert a simple penetration into a significant one.

Krouse and Christmas [15] were the first to report a retrospective comparison of powered instrumentation using ESS with traditional endoscopic surgical techniques. The powered instrumentation group was reported to have less bleeding, and to heal faster with less crusting and synechia formation [15]. More recently, Selivanova et al [16] reported a prospective study of 24 patients with bilateral chronic rhinosinusitis who underwent conventional ESS on one side and ESS with powered instrumentation on the other. The authors found no differences between either method regarding polyp recurrence, access to the ethmoid complex, patency of middle meatal antrostomy, or synechia formation. A significantly decreased polyp recurrence rate in favor of the powered ESS group was observed at the 3 and 6 month follow-up, but it did not persist further. This might indicate a more complete resection of the nasal polyps with a microdebrider.

General or local anesthesia may be a factor, although Stankiewicz [16-18] found no difference between the two with regard to complication rate. In our study, all patients were operated on under general anesthesia, so the difference between local and general anesthesia could not be evaluated.

In our study, the only major complication, which had a very low rate, was a CSF leak and no major orbital complications were observed. This might be due to the use of several techniques during the procedure by the senior author, including early recognition of the lamina papyracea in its most anterior part and bidirectional maneuvers for detection of the lamina papyracea dehiscence [19]. Furthermore, no nasolacrimal duct injuries were observed as the microdebrider does not resect bone.

The fact that in the present study the surgeons did not use the navigation system is noteworthy as this would probably have lowered the overall complication rate even more, specifically the rate of CSF leaks. Meticulous preparation and early recognition of the important anatomic landmarks on the computed tomography scan prior to surgery and during surgery were essential to achieve the low complication rate reported in this study.

No complications were found in the pediatric group when taking into consideration its small size, only 85 patients. We believe that due to the nature of the endoscopic surgeries used in this group, in which intervention is limited mostly to the maxillary and anterior ethmoid sinuses, a lower rate of complications is anticipated.

According to the reported data from the last decades regarding ESS complication rates, the risks for major complications have remained almost unchanged, supporting the use of the latest developments.

## CONCLUSIONS

The present study highlights the importance of using powered instrumentation during ESS. Despite a wide range of sinusa-

sal pathologies and the extensive use of the microdebrider, there was a low rate of postoperative complications compared to previously reported studies. We assume that these results are due to careful preoperative imaging evaluation, adequate planning of the surgical procedure, and less mucosal damage. We conclude that the use of powered instrumentation during ESS is safe.

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