



Original Article

# Multiple analyses of factors related to complications in endoscopic sinus surgery

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## Abstract

**Background:** This study was undertaken to evaluate whether endoscopic sinus surgery (ESS) with a microdebrider had an impact on complication rates, and to facilitate the determination of factors associated with complications in patients who underwent ESS at a tertiary referral center in Taiwan.

**Methods:** This investigation was a retrospective study and literature review. We analyzed 997 consecutive patients who underwent ESS at Mackay Memorial Hospital in Taipei, Taiwan from January 2006 through February 2010. All data including those of patient medical information, and peri- and postoperative complications were provided by the surgeons involved in patient medical care. We analyzed the complication rates using the following 10 variables by univariate analysis and multivariate logistic regression: sex, age, Lund–Mackay score, polyp grading, previous sinonasal surgery, surgeon skill, adjunctive sinonasal surgery, mesenteric type of anterior ethmoid artery, Keros skull base type, and the use of a microdebrider.

**Results:** Of the 997 patients in our study, 78 (7.8%) had complications. Major complications occurred in five patients (0.5%): two with cerebrospinal fluid rhinorrhea, one with medial rectus muscle damage, and two with retrobulbar hematoma. Minor complications were found in 73 patients (7.3%), which included 32 patients with perioperative estimated blood loss > 15% of the total estimated blood volume, 26 with lamina papyracea damage, two with orbital cellulitis, and 13 with postoperative bleeding. Univariate analysis showed that risk factors related to complication rate were advanced Lund–Mackay scores (scores 19–24), advanced polyp grading (Grades 2 and 3), inexperienced surgeon (resident), and microdebrider usage. However, multivariate analysis revealed that complication rate was linked to advanced Lund–Mackay scores (Scores 19–24), mesenteric type of anterior ethmoid artery, and inexperienced surgeon.

**Conclusion:** Overall, the results of our study showed that the ESS complication rate was 7.8%, with risk factors including advanced Lund–Mackay scores (19–24, odds ratio 10.4) and inexperienced surgeon. It was also noted that ESS with a microdebrider had no impact on complication rates, although the presence of a mesenteric type of anterior ethmoid artery proved to be a protective factor.

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**Keywords:** complications; endoscopic surgery; frontal sinus; rhinosinusitis

Conflicts of interest: The authors declare that they have no conflicts of interest related to the subject matter or materials discussed in this article.

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## 1. Introduction

Since endoscopic sinus surgery (ESS) was first introduced by Messerklinger in 1978,<sup>1</sup> and further advanced in the mid-1980s by Kennedy et al<sup>2,3</sup> and Stammberger,<sup>4</sup> it had also become the primary surgery to solve medication-refractory chronic rhinosinusitis and nasal polyps around the globe. In Taiwan, in excess of 10,000 ESS procedures are performed every year, according to claims data from the National Health Research Institutes. These patients will encounter potential risks because the operation field is close to the orbit and anterior cranial fossa.<sup>5</sup> In his 1929 publication, Mosher<sup>6</sup> described that endonasal ethmoidectomy is the easiest way to kill a patient. However, numerous advances have been made since then to reduce this potential risk. In the mid-1990s, the advent of the microdebrider was among the most important surgical instrument inventions in the field, advancing the treatment of sinonasal disease in a more visible field through its suction-based rotating blade; the innovative device became widely used in Taiwan.<sup>7</sup> However, Stankiewicz et al<sup>8</sup> cautioned that patients are most at risk when the microdebrider can easily suction and sever periorbital and dura, which can then be misdirected into the orbit or brain. On the contrary, Hopkins et al<sup>5</sup> said that a microdebrider was not a risk factor for complications in ESS. There was a lack of evidence from comparative studies focusing on the use of microdebriders and complication rates in Taiwan. This study was carried out to evaluate the impact of a microdebrider on complication rates, determine the complication rates of ESS in our institution, and analyze factors associated with ESS complications.

## 2. Methods

This study was retrospective by means of reviewing charts. Information was collected from patients who underwent ESS in our hospital from January 2006 to February 2010. All medical information was acquired under the approval of Mackay Memorial Hospital Institutional Review Board, Taipei, Taiwan (Institute Review Board No. 14MMHIS187). Complications in these patients were identified from the medical records at the time of surgery. Major complications included orbital, intracranial, and great vessel injuries. Minor complications were defined as perioperative bleeding with over 15% loss of total estimated blood volume, postoperative bleeding requiring treatment, infection, and breach of the lamina papyracea with orbital fat exposure.<sup>9</sup>

Data on 10 variables were collected: sex, age, Lund–Mackay score, polyp grading, previous sinonasal surgery, surgeon skill, adjunctive sinonasal surgery, mesenteric type of anterior ethmoid artery (AEA), Keros skull base type, and the use of a microdebrider. The Lund–Mackay score of patients was calculated based on computed tomography (CT), and the score ranged from 0 (complete lucency of all sinuses) to 24 (complete opacity of all sinuses).<sup>10</sup> The polyp grading system we employed had a four-point classification system under a rigid endoscope (0 = no polyp, 1 = confined to middle

meatus, 2 = below middle turbinate but not causing total obstruction, and 3 = causing total obstruction). Based on the surgical skill, surgeons were classified as resident and experienced. Septomeatoplasty was undertaken in the event adjunctive sinonasal surgery was necessary. Keros skull base type was subdivided into Type I (1–3 mm), Type II (4–7 mm), and Type III (8–16 mm) according to the depth of the olfactory groove.<sup>11</sup> A mesenteric type of AEA is identified on coronal CT image as a suspended band between the cribriform plate and lamina papyracea (Fig. 1).

The complication rates in this study were presented as a percentage according to each variable. Stata 11 statistics software (StataStistical Software, College Station, TX, USA) was used for univariate analysis and multivariate logistic regression model, in order to quantify the influence of these variables on complication rates. We considered  $p < 0.05$  to indicate a statistically significant result.

## 3. Results

This study recruited 997 consecutive patients under the care of consultants for medical conditions associated with the ear, nose, and throat. Of the total 997 patients, 78 suffered complications (7.8%). Five patients presented major complications (0.5%), of which two reported to have cerebrospinal fluid rhinorrhea, one medial rectus muscle damage, and two retrobulbar hematoma. Minor complications were reported in 73 patients (7.3%), including 32 patients with perioperative estimated blood loss of over 15% of total body blood volume, 26 with a breach of the lamina papyracea, two with orbital cellulitis, and 13 with postoperative bleeding.

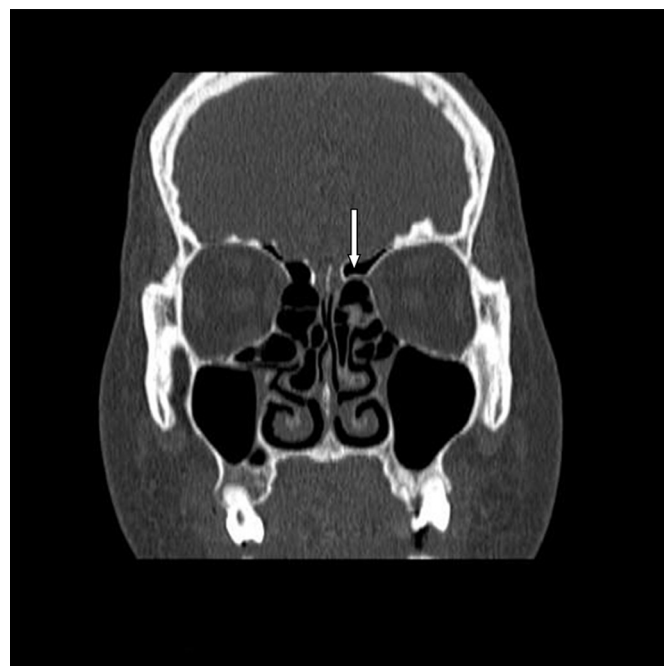


Fig. 1. Coronal computed tomography image. A suspended band between the cribriform plate and lamina papyracea is characteristic of a mesenteric type of anterior ethmoid artery.

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