

One-nostril endoscopic endonasal approach for pituitary macroadenoma resection

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Abstract

Introduction: Endoscopic techniques have become the standard approach for pituitary adenoma surgery, providing improved visualization of the hypophyseal fossa and facilitating precise tumor resection while minimizing surgical morbidity. The one-nostril endoscopic approach further enhances minimally invasive surgery by reducing nasal mucosal trauma and optimizing access to the tumor, thereby improving surgical precision and reducing the risk of postoperative complications

Patients and Methods: Between September 2024 and February 2025, a retrospective analysis was conducted on 12 consecutive patients who underwent one-nostril endoscopic transsphenoidal surgery at Viet Duc University Hospital and Hanoi Medical University. Furthermore, we provide a step-by-step description of the surgical procedure of the single-nostril endoscopic endonasal approach.

Results: The gross total resection rate was 66,7%. The mean tumor volume was 8,4 cm³. Postoperative abnormal visual function improvement was achieved in 6 out of 7 patients. Intraoperative cerebrospinal fluid (CSF) leakage occurred in 2 patients, both of whom required reconstruction using a fat graft and postoperative lumbar puncture. Notably, no postoperative CSF leaks were reported. No other postoperative complications were observed. The most common sinonasal complaint was nasal obstruction or difficulty breathing (41.7%) immediately after surgery, which subsided within 2–3 weeks. At the time of follow-up (mean: 51.6 days), no patients reported loss of smell, and the overall health status had nearly returned to preoperative levels.

Conclusions: The one-nostril endoscopic approach is a safe and effective technique for pituitary macroadenoma resection, offering reduced mucosal trauma and fewer postoperative complications while minimizing sinonasal morbidity and enhancing patient recovery.

Keywords: One-nostril, pituitary macroadenoma, endoscopic endonasal approach, surgical outcomes, gross total resection.

Introduction

Nowadays, the endoscopic endonasal approach (EEA) has become the gold-standard for pituitary tumor resection and other lesions located in the sella turcica and sphenoid sinus. It offers multiple advantages compared to transcranial approaches, including direct midline access to the sella via the nasal cavity and panoramic visualization enabling safe pituitary tumor resection [1], [2], [3], [4]. Considering that these lesions are commonly benign, they should benefit from the least invasive approach. In this article, we present the application of the one-nostril EEA endoscope for pituitary tumor removal. This technique enables a less invasive procedure by allowing surgical access through a narrow corridor, reducing instrument conflict, and minimizing trauma to nasal structures.

Patients and Methods

We performed a retrospective review of 12 patients who underwent one-nostril endoscopic transsphenoidal pituitary adenoma surgery at Hanoi Medical University and Viet Duc University Hospital between September 2024 and February 2025.

All patients diagnosed with pituitary adenomas, regardless of tumor size and without surgical contraindications, were operated by our neurosurgical team.

Patient demographics, tumor characteristics, surgical outcomes, complications, and postoperative

follow-up were analyzed based on medical records. The surgical technique for the one-nostril endoscopic endonasal approach is described below.

Surgical technique

Patient Positioning and Preparation

The patient is positioned in supine position with the head fixed in a head holder. The head is rotated, slightly flexed and tilted toward the surgeon's side. Neuronavigation is installed. The head and thorax are elevated, and the surgical table is placed in a slight reverse Trendelenburg position to promote venous outflow and minimize intraoperative bleeding. The abdomen is prepared for fat grafting.

Nasal Phase

The nostrils were prepared with cottonoids soaked with epinephrine. The procedure was performed using 4 mm endoscopes with 0° and 30° lenses. A 0° endoscope is initially introduced through the right nostril. The middle turbinate is gently mobilized and retracted laterally to expand the surgical field. The rostrum-septal cartilage junction is identified (optionally confirmed using neuronavigation), and a vertical incision is made in the mucosa at this junction, just above the choanal plane, using a monopolar device. An elevator is used to break the septum from the rostrum, keeping the contralateral mucosa intact. The mucosa is then mobilized from both sides of the rostrum laterally using the caudal elevator. (Figure 1)

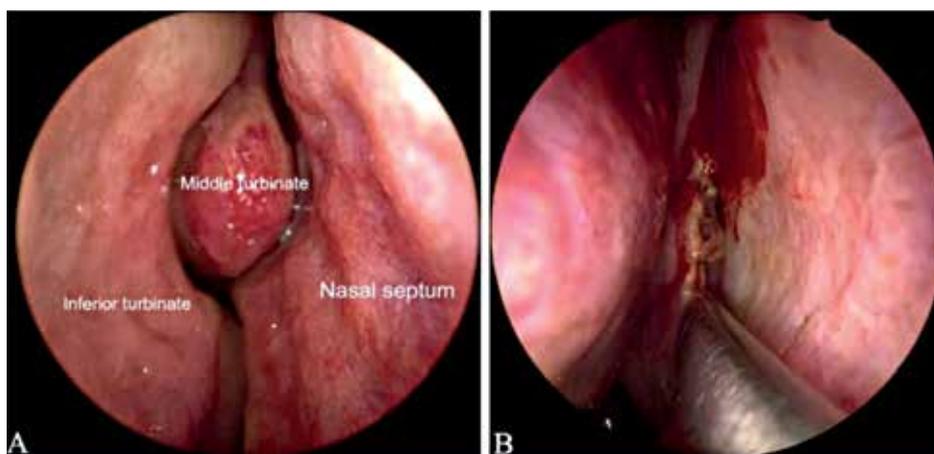


Figure 1 Nasal phase (A) The middle turbinate is preserved and mobilized laterally (B) Incision of the mucosa at the junction of the rostrum and the septum upper to the choanal arch plan.

Sphenoidal phase

The rostrum is then drilled using a 4 mm diamond drill until the sphenoid sinus is fully opened. Additional drilling is performed downward to create sufficient working space. Sphenoidal septations are opened, fully exposing the sphenoidal sinus and the sphenoidal

mucosa covering the sella is removed to identify the relevant anatomical landmarks: sella, opticocarotid recesses; paraclival ICAs, and clival depression. The sella floor is then widely opened without exposing both ICA laterally and a bony rim is kept around the sella to facilitate the reconstruction. (Figure 2)

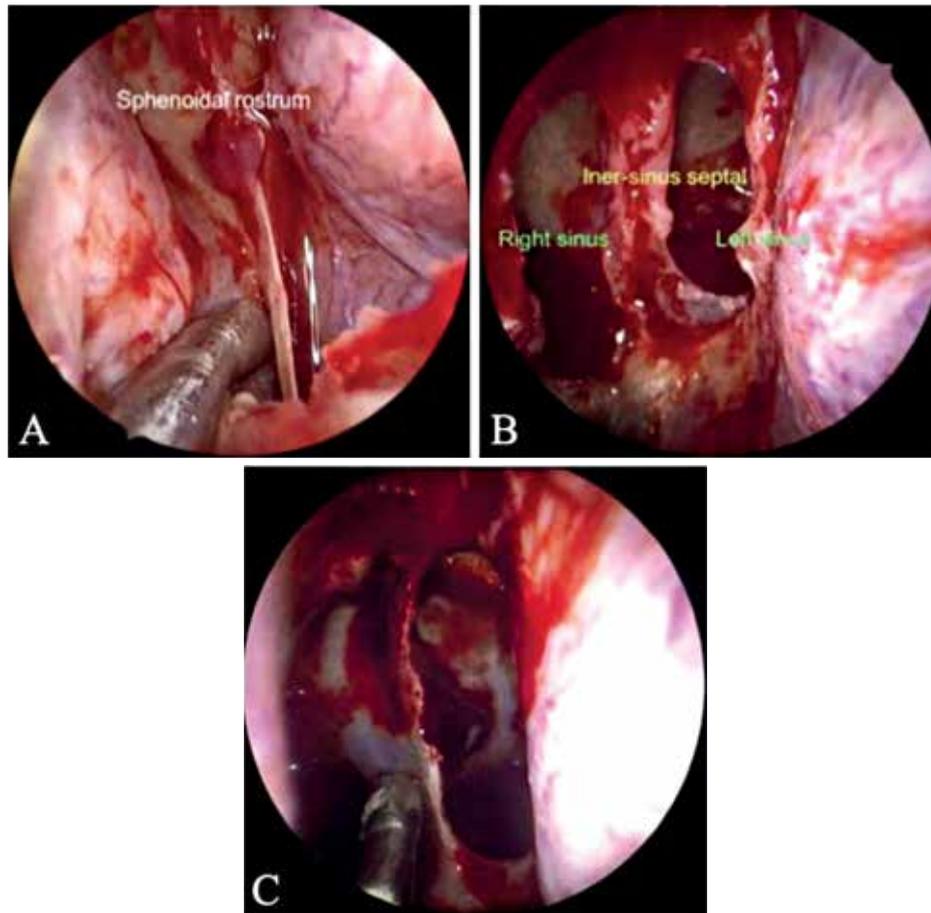


Figure 2 Sphenoidal phase (A) The mucosa is mobilized from both sides of the rostrum after broken of the septum at the junction rostrum-cartilage septum. (B)The rostrum is drilled, and the sphenoid sinus is opened identifying the inner sphenoidal septum. (C) The sella is exposed after removing the septum and the mucosa.

Tumor Removal

A cross-shaped incision is made in the dura mater to access the adenoma. The tumor is exposed and then removed, starting at the bottom and progressing upwards toward the dorsum and laterally, using the chopsticks technique with a malleable angled suction, pituitary forceps and a 0° endoscope. A 30°

endoscope is then used to visualize inside the sella and remove safely the lateral and superior portions of the tumor toward the medial wall of the cavernous sinus and the diaphragm sellae, respectively. The normal pituitary gland is carefully preserved, and the resection is considered satisfactory after a detailed inspection. (Figure 3)

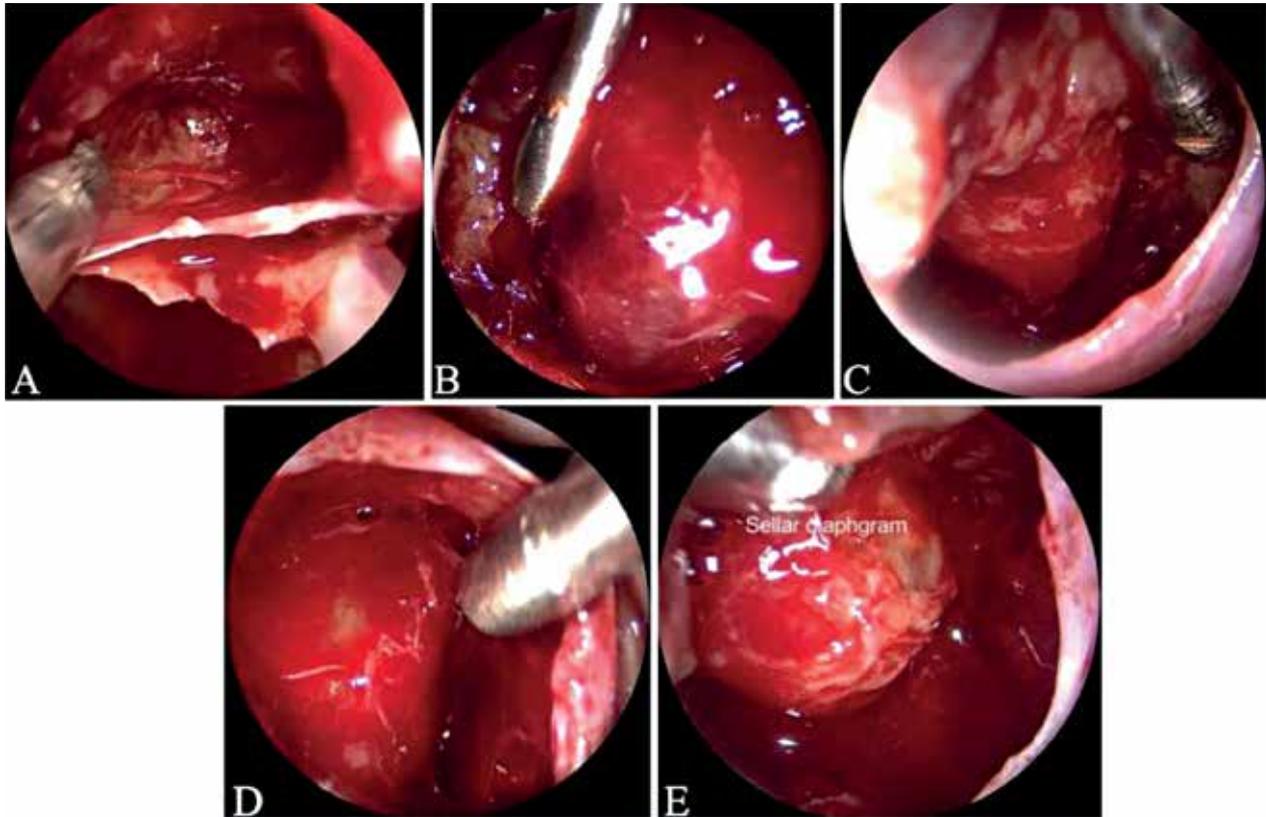


Figure 3 Tumor removal using angled endoscopes. Using the 30-degree endoscope to look inside the hypophyseal fossa, the tumor is completely and carefully removed around the diaphragm sellae: (A) inferior part (B) right side (C) left side (D), (E) superior part with the sellae diaphragm.

Closure

In cases of intraoperative CSF leak, closure is achieved by placing an intrasellar fat graft to avoid excessive descent of the diaphragm, which could lead to postoperative CSF leakage, followed by bioglue to maintain the reconstruction. The middle turbinate is repositioned to its original position at the end of the procedure.

Results

Patient demographics and tumor characteristic

12 consecutive patients (5 men and 7 women) were included in the analysis, with a mean age of

41,9 years. The most common presenting symptoms were headache (75%) and abnormal visual function (58,3%), including vision loss and/or visual field defects, followed by endocrinopathies (16,7%). One patient was incidentally diagnosed through cranial imaging for unrelated symptoms.

The mean tumor volume was 8,4 cm³, and all patients underwent their first surgery. Most tumors were classified as Knosp grade 1 (41,7%), followed by Knosp grade 2 (33,3%) and Knosp grade 3 (25%). Eleven patients had non-secreting tumors, while one patient had an ACTH-secreting tumor. (Table 1)

Table 1: Patient demographics and tumor characteristic

Age	41,9
Male/ female	5/7
Follow-up range (day)	51,6
Tumor volume (cm³)	8,4
Symptoms n (%)	
Abnormal visual functions	7 (58,3%)
Hedache	9 (75,0%)
Endocrinopathy	2 (16,7%)
No symptoms	1 (8,3%)
Knosp score, n (%)	
0	0 (0%)
1	5 (41,7%)
2	4 (33,3%)
3	3 (25,0%)
4	0 (0%)
Non-secreting adenoma n (%)	11 (91,7%)
Secreting adenoma n (%)	1 (8,3%)

Surgical outcome

Gross tumor resection (GTR) was defined by the absence of residual tumor on postoperative MRI. Postoperative imaging showed total gross removal in 8 out of 12 patients and subtotal resection was achieved in 4 out of 12 patients.

Postoperative neuro-ophthalmological evaluation showed improvement in 6 of 7 patients (85,7%) who had preoperative vision loss or field vision defects. The mean time of hospitalization was 4.7 days. (Table 2)

Table 2: Surgical outcome and complications

Gross total Resection, n (%)	8 (66,7%)
Subtotal Resection, n (%)	4 (33,3%)
Partial resection, n (%)	0
Visual outcome, n (%)	
Improve	6 (85,7%)
Stable	1 (14,3%)
Worse	0 (0%)
Mean time of hospitalization (day)	4,7
Intraoperative cerebrospinal fluid leak, n (%)	2 (16,7%)
Postoperative cerebrospinal fluid leak, n (%)	0 (0%)
Temporary diabetes insipidus, n (%)	3 (25,0%)
Epistaxis, n (%)	0 (0%)
Meningitis, n (%)	0 (0%)

Complications

An intraoperative CSF leak occurred in two cases both of which were reconstructed using a fat pad followed by Bioglue, with no need for a nasoseptal flap.

Postoperatively, no patients experienced CSF leak complications. Other postoperative complications included transient diabetes insipidus in three cases. No patients developed epistaxis or postoperative meningitis. (Table 3)

Table 3: Status of sinonasal postoperative

Status of sinonasal	Postoperative	Follow-up
Sense of smell, n (%)		
Lost	0	0
Diminished	4 (33,3%)	1 (8,3%)
Stable	8 (66,7%)	11 (91,7%)
Trouble breathing, n (%)	6 (50%)	0
Rhinorrhea, n (%)	5 (41,7%)	1 (8,3%)
No sinonasal discomfort, n (%)	6 (50%)	11 (91,7%)

Postoperative follow-up

The mean follow-up time was 51,6 days (range: 35–66 days). We evaluated the sinonasal status of patients both immediately after surgery and at follow-up.

The most common sinonasal complaints immediately after surgery were breathing difficulties (50%), rhinorrhea (41,7%), and a diminished sense of smell (33,3%). At follow-up, all patients with breathing difficulties had recovered, but one patient continued to experience morning rhinorrhea and a diminished sense of smell. No patients experienced a complete anosmia postoperatively.

Six patients reported no sinonasal discomfort either immediately after surgery or at follow-up. By the time of follow-up, sinonasal function had returned to normal in eleven patients, with no complications.

For symptoms such as diminished sense of smell and breathing difficulties, the average recovery time was 4,8 days postoperatively. (Table 3)

Discussion

Currently, the binostril transsphenoidal approach with a septal flap is the most commonly used endoscopic technique for pituitary adenomas in Vietnam [1], [2]. Meanwhile, the one-nostril transsphenoidal approach for macroadenomas has been described in the literature for several decades. [3], [4], [5]

The effectiveness of these two approaches is primarily assessed based on four key factors: surgical outcomes, instrument maneuverability, postoperative morbidity, and postoperative quality of life. [6-9] Recent studies have shown that both techniques achieve comparable results in terms of gross tumor resection rate, hormonal remission rate, improvement in visual function, CSF leak incidence, and the occurrence of diabetes insipidus. [8], [9], [10]

However, the one-nostril approach is a minimally invasive technique with reduced nasal cavity trauma, thereby decreasing sinonasal complications,

improving early postoperative sinonasal quality of life, and minimizing olfactory disturbances that significantly impact patient satisfaction [3], [4], [5], [6]. For these reasons, we have adopted the one-nostril approach to reduce sinonasal trauma associated with the binostril technique and enhance patients' overall quality of life.

In our series, the surgical outcomes were equivalent to those reported in the literature for endoscopic procedures, [3], [4], [8], [9], [10] with a gross tumor resection rate of 66,7% and an 85,7% improvement in visual function.

Regarding complications, CSF leaks occurred in two cases intraoperatively. This was successfully managed using a fat pad for reconstruction, followed by postoperative lumbar drainage, with no persistent CSF leakage after surgery. Temporary diabetes insipidus was observed in three patients (25,0%), all of whom recovered within 5–7 days without requiring long-term intervention.

These findings suggest that the one-nostril endoscopic approach offers surgical efficacy similar to traditional techniques while maintaining a low complication rate. [3], [4], [5], [7] Furthermore, the minimal sinonasal trauma associated with this approach may contribute to improved postoperative recovery and patient satisfaction. [3], [8], [9], [10]

The advantages of one-nostril approach:

First, the one-nostril technique involves only a small incision in the mucosa of the right nasal septum, minimizing trauma to the olfactory mucosa. Furthermore, the mucosa of the left nasal cavity remains completely intact. As a result, no patients in our series experienced a total loss of smell postoperatively, and, olfactory function remained normal in 11 out of 12 patients, comparable to preoperative levels.

Second, by causing less mucosal damage, the one-nostril approach minimizes the risk of vascular injury, particularly to the pterygopalatine artery, which can cause severe postoperative hemorrhage, a complication that has been reported in some cases [8], [9], [10] In our series, none of

the patients experienced postoperative epistaxis. Additionally, all patients were able to have their nasal packing removed within 2–3 days after surgery without any signs of bleeding or related complications, further supporting the safety and efficacy of this technique.

Third, extensive mucosal damage can trigger a stronger postoperative inflammatory response, resulting in nasal congestion, difficulty breathing, prolonged rhinorrhea, rhinitis, and, in severe cases, empty nose syndrome, which significantly impacts a patient's quality of life.^{4,8,9,10} In our series, because the one-nostril approach preserved most of the septal mucosa, sinonasal function was better maintained. Immediately after surgery, 6 (50%) patients reported no sinonasal discomfort. At follow-up, 11 of 12 patients had normal sinonasal function. Initially, 50% of patients experienced breathing difficulties, and 41.7% had rhinorrhea, however these symptoms resolved within 4–5 days. At follow-up, only one patient still experienced mild morning rhinorrhea, and none had persistent breathing difficulties.

Because of the limited sample size, in-depth comparisons with other published studies—particularly regarding postoperative nasal outcomes—were not conducted. Nonetheless, our initial findings indicate that the one-nostril approach helps reduce sinonasal trauma, thereby supporting faster postoperative recovery and contributing to improved patient comfort and satisfaction.

Difficulties and Solutions

Despite the numerous advantages of the one-nostril endoscopic endonasal approach, several challenges were encountered during its initial implementation.

First, due to the small mucosal incision, the surgeon must operate within a narrow surgical field, which can lead to instrument conflicts during the procedure. Overcoming this limitation requires not only advanced surgical experience and technical skills but also a thorough understanding of surgical anatomy and orientation within the operating field.

Additionally, effective coordination between the surgeon and the assistant is crucial when working in such a confined space. To address this issue, in some cases, we use a 30° endoscope from the beginning of the procedure and utilize the "chopsticks technique" to minimize instrument conflicts. In this technique, the surgeon holds the endoscope and suction device with the left hand, while the right hand is used for manipulating surgical instruments, allowing for more efficient maneuvering within the limited space. [5] The bone opening at the sella was sufficiently expanded to expose the lateral carotid arteries, anterior ethmoid sinus, and posterior clinoid. This allowed clear visualization of hidden angles. We applied this approach to all pituitary adenomas, including Knosp grade 4 tumors. In our series, the technique did not present additional technical challenges compared to the traditional binostril method. However, these findings are based on our initial experience and should be confirmed in larger-scale studies.

Second, in cases of intraoperative CSF leakage, the small incision limits the availability of a vascularized septal flap for reconstruction, potentially increasing the risk of postoperative CSF leakage. However, in our series, we successfully managed this issue by using a fat pad combined with bioglue for reconstruction, followed by postoperative lumbar drainage, resulting in no cases of postoperative CSF leakage. Additionally, when necessary, we can perform mucosal suturing or create a septal flap on the right side to enhance reconstruction and ensure better sealing of the defect.

Conclusions

The one-nostril endoscopic transsphenoidal approach is a safe and effective technique for pituitary macroadenoma resection, providing favorable surgical outcomes while minimizing nasal trauma. By preserving more of the nasal septum and mucosa, this approach reduces the risk of postoperative complications such as nasal

congestion, rhinorrhea, and olfactory disturbances, thereby contributing to improved sinonasal function and patient recovery. Additionally, it is associated with fewer bleeding complications and a lower risk of extensive vascular injury, facilitating a smoother postoperative course.

However, this technique presents certain challenges. The restricted surgical field increases the risk of instrument conflicts, requiring a high level of technical skill, experience, and coordination between the surgeon and the assistant. Furthermore, in cases of CSF leakage, the limited mucosal incision restricts the availability of a vascularized septal flap for reconstruction, necessitating alternative repair strategies such as fat grafting, biogluce application, and, when needed, mucosal suturing or septal flap creation.

Despite these challenges, the one-nostril approach remains a valuable option for pituitary surgery due to its ability to reduce sinonasal morbidity and enhance patient quality of life. However, given the small sample size in this study, the results might be affected by certain biases. The limited sample size reduces the ability to apply the findings to a broader population. Therefore, these results should be considered preliminary, further research with larger patient cohorts and extended follow-up periods is needed to validate its long-term efficacy and optimize surgical strategies for overcoming technical limitations.

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