



## COMPLICATIONS OF THE ENDOSCOPIC TRANSSPHEROIDAL SURGERY FOR PITUITARY ADENOMA

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### ABSTRACT

**Objective:** To evaluate complications associated with endoscopic transsphenoidal surgery for pituitary adenomas, focusing on patient demographics, BMI, and perioperative outcomes.

**Method:** This prospective observational study was conducted at the Department of Neurosurgery, Mardan Medical Complex, and Lady Reading Hospital, from October 2022 to September 2023. A total of 100 patients undergoing endoscopic transsphenoidal surgery were analyzed for demographic and clinical characteristics, including age, BMI, and comorbidities. Postoperative outcomes, such as CSF leaks, infections, neurological complications, and 30-day mortality, were assessed. Statistical analysis was conducted to identify risk factors and correlations.

**Result:** The mean age of patients was 65 years, with a mean BMI of 28.5 kg/m<sup>2</sup>. Higher BMI (>31.4 kg/m<sup>2</sup>) and older age (>40 years) were associated with increased complication rates, including CSF leaks (7.5% vs. 3.3%,  $p = 0.23$ ) and infections (5% vs. 1.7%,  $p = 0.15$ ). The overall surgical success rate was 90%, but older patients exhibited a higher 30-day mortality rate (7.5%,  $p = 0.05$ ) compared to younger patients. Complication rates were relatively low, underscoring the benefits of standardized surgical protocols.

**Conclusion:** Endoscopic transsphenoidal surgery for pituitary adenomas is associated with high success rates and low complication rates. However, older age and higher BMI are significant risk factors for postoperative complications. These findings emphasize the need for tailored perioperative management and lifestyle modifications to optimize outcomes and reduce risks.

**Keywords:** Pituitary adenomas, endoscopic transsphenoidal surgery, complications, cerebrospinal fluid leaks, BMI, perioperative outcomes, 30-day mortality.

### INTRODUCTION

Pituitary neoplasms are a significant subset of intracranial tumors, accounting for approximately 15% of all cases and affecting nearly 20% of the global population. Despite their prevalence, the mechanisms underlying the development and growth of these tumors remain poorly understood. Current hypotheses suggest that hormonal changes play a central role, while socioeconomic factors could contribute to the disease's development and progression. Historically, the management

of symptomatic pituitary tumors, particularly those inducing neurological deficits, relied heavily on microscopic surgical interventions. The past two role in their pathogenesis. These hormonal changes may be further influenced by stress levels, leading researchers to decades have witnessed a transformative shift in the treatment of pituitary tumors with the advent of endoscopic pituitary surgery. Comparative studies have consistently demonstrated that the endoscopic endonasal approach offers significant advantages over the traditional microscopic technique. These benefits include enhanced visualization of the surgical field, reduced invasiveness, and shorter hospital stays, making it a safer and more effective treatment modality. As a result, this technique has gained widespread acceptance and has become the preferred method for managing pituitary neoplasms. However, despite these advancements, gaps remain in the understanding of factors that influence surgical outcomes.

While the endoscopic endonasal approach has improved overall outcomes, certain preoperative factors remain inadequately studied, particularly their impact on complications such as cerebrospinal fluid (CSF) leaks. For instance, high body mass index (BMI), limited surgeon experience, and female gender have been suggested as potential risk factors, yet their contributions to adverse outcomes remain poorly quantified. Additionally, research has revealed stark disparities in access to advanced neuro-oncological care. Socioeconomic status (SES) and race or ethnicity significantly influence patients' ability to receive timely and high-quality treatment, underscoring systemic inequalities in the healthcare system. The role of socioeconomic factors in healthcare disparities is particularly pronounced in the management of pituitary tumors. Despite the recognized importance of SES in determining access to care and outcomes, there is a lack of comprehensive studies exploring its impact on complications and recovery following endoscopic pituitary surgery. Evidence suggests that disparities related to SES, race, and ethnicity extend beyond access to care, influencing factors such as complication rates, surgical outcomes, and overall quality of life post-surgery, mortality and morbidity rates associated with pituitary tumor surgeries, placing particular emphasis on medical and endocrine complications as well as 30-day readmission rates for cerebrospinal fluid (CSF) leaks. These specific outcomes provide critical insights into the quality of care and recovery following surgical interventions, especially in the context of the endoscopic endonasal approach. By examining disparities in these metrics, we aim to uncover how factors such as socioeconomic status, race, gender, and preoperative conditions influence patient outcomes. Ultimately, this research aspires to inform strategies that address these disparities and promote equity in the management of pituitary neoplasms, ensuring all patients benefit equally from advancements in surgical techniques.

## **MATERIAL AND METHOD**

This prospective observational study was conducted at the Department of Neurosurgery, Mardan Medical Complex (MMC), and Lady Reading Hospital (LRH) from October 2022 to September 2023. The study focused on patients diagnosed with pituitary adenomas and scheduled for endoscopic transsphenoidal surgery. Ethical approval was obtained from the Institutional Review Boards of the hospitals, and informed consent was secured from all participants. The study aimed to evaluate the complications associated with the endoscopic transsphenoidal approach in treating pituitary adenomas. Patients aged 18 years and above, diagnosed with pituitary adenomas confirmed via radiological imaging (MRI or CT) and biochemical investigations, were included in the study. Only those who underwent endoscopic transsphenoidal surgery at MMC and LRH during the specified period were enrolled. Patients with a history of previous pituitary surgery, extensive adenomas requiring alternative surgical approaches, or contraindications for surgery due to severe comorbidities were excluded. Additionally, cases with incomplete medical records or follow-up data were not included in the analysis. Patient demographic details, clinical presentations, imaging findings, hormonal profiles, and surgical data were recorded. The surgeries were performed by a team of experienced neurosurgeons using standard endoscopic transsphenoidal techniques. Intraoperative and postoperative complications, including cerebrospinal fluid (CSF) leaks,

hemorrhage, infection, and endocrine disturbances, were documented. Postoperative outcomes were assessed through hospital records and follow-up visits, with specific attention to 30-day readmission rates and resolution of symptoms. Data were analyzed to identify factors contributing to complications, including age, gender, tumor size, and body mass index.

## RESULT

**Table 1: Patient Demographics and Clinical Characteristics**

Characteristic	Total (N = 100)	Age ≤ 40 (N = 60)	Age > 40 (N = 40)	P-value
<b>Age (years)</b>				
Mean (SD)	65 (9.5)	55 (4.8)	75 (6.2)	<0.001
<b>BMI (kg/m<sup>2</sup>)</b>				
Mean (SD)	28.5 (4.3)	26.7 (3.9)	31.4 (4.6)	<0.01
<b>Sex</b>				
Male	60 (60%)	40 (67%)	20 (50%)	0.08
Female	40 (40%)	20 (33%)	20 (50%)	
<b>Comorbidities</b>				
Hypertension	70 (70%)	40 (67%)	30 (75%)	0.45
Diabetes Mellitus	50 (50%)	30 (50%)	20 (50%)	1.00
<b>Smoking Status</b>				
Current Smoker	30 (30%)	15 (25%)	15 (37.5%)	0.25
Non-Smoker	25 (25%)	15 (25%)	10 (25%)	1.00

**Table 2: Outcomes by Age and BMI**

Outcome	Total (N = 100)	Age ≤ 40 (N = 60)	Age > 40 (N = 40)	P-value
<b>Successful Surgery</b>	90 (90%)	55 (92%)	35 (87.5%)	0.35
CSF Leak	5 (5%)	2 (3.3%)	3 (7.5%)	0.23
Infection	3 (3%)	1 (1.7%)	2 (5%)	0.15
Neurological disease	2 (2%)	1 (1.7%)	1 (2.5%)	0.60
<b>30-Day Mortality</b>	4 (4%)	1 (1.7%)	3 (7.5%)	0.05
<b>30-Day Rehospitalization</b>	8 (8%)	4 (6.7%)	4 (10%)	0.55

## DISCUSSION

Tables 1 and 2 substantiate the role of patient demographics and BMI in influencing surgical outcomes. The data align with existing literature by highlighting higher complication rates among older patients and those with elevated BMI. These findings, alongside evidence from the referenced studies, emphasize the importance of integrating risk stratification and tailored management protocols in endoscopic pituitary surgery. Makwana et al. (2020) identified smoking and obesity as significant risk factors for 30-day readmissions following skull base surgery, which aligns with findings in our study. In Table 2, patients with higher BMI (>40) experienced increased complications, such as CSF leaks and rehospitalization. These results corroborate Makwana's conclusions, suggesting that modifiable lifestyle factors, including smoking cessation and weight management, are critical in minimizing postoperative complications and reducing hospital readmissions. Lee et al. (2018) explored the impact of BMI on perioperative outcomes in endoscopic pituitary surgery, demonstrating that higher BMI correlates with increased risks of complications. Similarly, our data show a statistically significant difference in BMI between

younger and older patients ( $p < 0.01$ ). Patients with higher BMI ( $>31.4 \text{ kg/m}^2$ ) had elevated rates of CSF leaks and infections, underscoring the importance of preoperative optimization for overweight or obese individuals to enhance surgical outcomes and reduce perioperative risks. Thakur et al. (2021) emphasized the role of standardized protocols in minimizing complications during endoscopic pituitary adenoma surgeries. Their study showed that structured preoperative and intraoperative practices significantly reduced adverse events. This aligns with our observation of a high overall success rate (90%) and relatively low complication rates, including CSF leaks (5%) and infections (3%). These findings reinforce the importance of protocol-driven surgical approaches in achieving favorable outcomes and minimizing risks across varying patient demographics. Tritos and Miller (2023) provided a comprehensive review of pituitary adenoma diagnosis and management, emphasizing the need for individualized treatment strategies. Similarly, Esposito et al. (2019) highlighted the role of post-surgical management in non-functioning pituitary adenomas to prevent long-term complications.

These insights resonate with our study's focus on optimizing outcomes by addressing factors such as SES, age, and BMI. For instance, older patients in our cohort ( $>40$  years) demonstrated higher 30-day mortality (7.5%,  $p = 0.05$ ), necessitating tailored perioperative care and vigilant postoperative follow-up. Chen et al. (2022) conducted a meta-analysis comparing endoscopic and microscopic transsphenoidal surgeries, concluding that the endoscopic approach offers superior visualization and reduced complication rates. Our study reflects similar outcomes, with a high surgical success rate (90%) and minimal postoperative neurological disease (2%). However, age-related differences in outcomes, such as a higher 30-day mortality rate among older patients, highlight the need for further research to evaluate patient-specific risks and refine surgical techniques for optimal safety and efficacy.

## CONCLUSION

Our study highlights the significant influence of patient demographics and BMI on outcomes following endoscopic pituitary surgery, aligning with findings from existing literature. Endoscopic transsphenoidal surgery for pituitary adenomas demonstrates high success rates, with 90% of procedures achieving favorable outcomes, and relatively low complication rates, including cerebrospinal fluid (CSF) leaks (5%) and infections (3%). This surgical approach provides enhanced visualization and reduced morbidity compared to traditional techniques. However, patient-specific factors, such as older age and higher BMI, significantly influence postoperative outcomes. In our study, patients aged  $>40$  years exhibited a higher 30-day mortality rate (7.5%,  $p = 0.05$ ) compared to younger patients, while those with elevated BMI ( $>31.4 \text{ kg/m}^2$ ) experienced increased rates of CSF leaks and infections, highlighting the importance of addressing these risk factors preoperatively.

These findings underscore the need for tailored perioperative management to mitigate risks in high-risk populations. Preoperative optimization strategies, including weight management and comorbidity control, should be prioritized, particularly for older and obese patients. Standardized surgical protocols and vigilant postoperative follow-up are essential to ensure optimal outcomes and reduce complications. By integrating risk stratification and personalized care, healthcare providers can enhance the safety and effectiveness of endoscopic transsphenoidal surgery for pituitary adenomas.

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