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# Retrospective analysis of anesthesia management in endoscopic transsphenoidal pituitary surgery

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## ABSTRACT

**Introduction:** Endoscopic transsphenoidal resection of pituitary masses has been preferred by surgeons with increasing frequency in recent years. Anesthesia management for this surgery has unique challenges, requiring special pre-anesthesia preparation and perioperative management.

**Materials and Methods:** After the approval of the ethics committee, anesthesia follow-up forms and electronic records of 34 patients were retrospectively reviewed. Demographic characteristics of the patients, comorbidities, American Society of Anesthesiologist score, presence of acromegaly, cushing, prolactinoma, presence of intubation difficulty, duration of anesthesia, hypertension, hypotension, bleeding, and similar complications were recorded.

**Results:** Of the patients included in the study, 20 (58.8%) were female and 14 (41.2%) were male. The mean age was 46.7±16.38. The average duration of anesthesia was 200.7±37.80 minutes. Of the patients 16 (47.1%) had secretory adenoma, eight patients had acromegaly, four patients had cushings, and four patients had prolactinoma. Difficult airway was observed in a total of six patients.

**Conclusion:** Hypo or hypersecretion of pituitary hormones can cause problems affecting anesthesia. Before the operation, patients should be evaluated in detail by a multidisciplinary team working in harmony with anesthesiologist, endocrinologist and neurosurgeon, and appropriate treatments should be initiated. Appropriate anesthesia method and strict perioperative observation are essential for successful endoscopic surgery, providing early recovery and a soft awakening.

**Keywords:** Anesthesia, endoscopy, pituitary adenoma, transsphenoidal surgery

## Introduction

Pituitary adenomas are common tumors in clinical practice. According to the data obtained from radiological reports and autopsy studies, it is estimated that it can be seen in one in seven people. Those smaller than 10 mm is considered microadenomas, and those larger than 10 mm is considered macroadenomas. In addition, it is classified as functional or non-functional according to the presence of hormone secretion. Patients with functional adenoma often have recourse to with symptoms of hormone excess. Those with non-functioning adenomas usually appear later and show symptoms of headache due to the massive effect of the tumor, loss of vision due to compression on the optic chiasm, or hypopituitarism due to compression on the anterior pituitary.[1,2] The endonasal approach is

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preferred by most surgeons over the sublabial transseptal approach because it requires less dissection. Endoscopic imaging reduces nasal complications and the possibility of septal perforation. It provides better visualization of the tumor.[3] Transsphenoidal pituitary surgery presents unique challenges for the neuroanesthesiologist in the pre-operative, intraoperative, and post-operative management of patients undergoing tumor resection.[4]

In this study, we aimed to evaluate patients who underwent endoscopic transsphenoidal pituitary surgery in our clinic in terms of anesthesia.

## Materials and Methods

The study was started after obtaining ethical approval (Number: 08-2022/39) from Kahramanmaraş Sütçü İmam University Medical Research ethics committee. Between January 2018 and December 2022, 34 patients who underwent endoscopic transsphenoidal pituitary surgery in our clinic were included in the study. No patients were excluded (Fig. 1). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The data of the patients were obtained from anesthesia follow-up forms and electronic records. Demographic characteristics, comorbidities, American Society of Anesthesiologist (ASA) score, acromegaly, cushing, and prolactinoma presence of the patients were recorded. Difficulty in intubation, mallampati score, duration of anesthesia, hypertension, hypotension, bleeding, and similar complications from anesthesia follow-up forms were screened, and the interventions made during the anesthesia process were recorded.

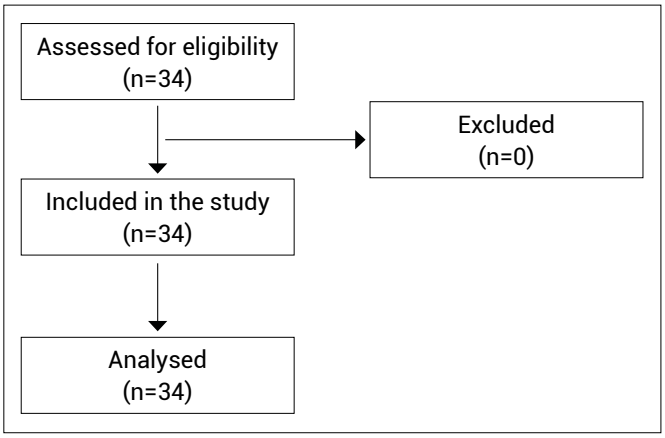


**Figure 1.** Flowchart of the study.

### Statistical Analysis

Statistical analyzes were performed using the IBM SPSS version 29.0 statistical program. Descriptive statistical methods (number, percentage, mean, and standard deviation) were used while evaluating the data.

## Results

A total of 34 patients underwent endoscopic transsphenoidal pituitary surgery for pituitary adenoma, 20 (58.8%) were female and 14 (41.2%) were male. The mean age was 46.7±16.38. The average duration of anesthesia was 200.7±37.80 min. ASA, mallampati characteristics, and comorbidities of the patients are given in Table 1. While one of these patients was taken to an emergency operation due to intratumoral hemorrhage, two patients presented with apoplexy. Standard anesthesia protocol was applied to all patients. After the patients were monitored with ECG, non-invasive blood pressure, $SpO_2$, and $EtCO_2$, anesthesia induction were performed with propofol 2–3 mg/kg, 1–2 mcg/kg fentanyl, and 0.6 mg/kg rocuronium. After endotracheal intubation, wet sponge was placed to prevent postnasal discharge from accumulating in the oropharynx. Body temperature

**Table 1. Demographic and other characteristics of patients**

| | |
|---|---|
| Age (years) | 46.79±16.38 |
| Gender (female/male) | 20/14 (58.8%/41.2%) |
| Weight (kg) | 77.88±17.81 |
| Duration of anesthesia (minutes) | 200.74±37.80 |
| ASA I | 7 (20.6%) |
| ASA II | 12 (35.3%) |
| ASA III | 14 (41.2%) |
| ASA IV | 1 (2.9%) |
| Mallampati I | 6 (17.6%) |
| Mallampati II | 17 (50.0%) |
| Mallampati III | 10 (29.4%) |
| Mallampati IV | 1 (2.9%) |
| Comorbidities | |
| Diabetes mellitus | 7 (20.6%) |
| Hypertension | 10 (29.4%) |
| Ischemic heart disease | 3 (8.8%) |
| Asthma | 3 (8.8%) |

Values are given as number of patients, percentage, mean and standard deviation.

was monitored with a skin temperature probe. Invasive blood pressure monitoring was performed through radial artery cannulation. Urine output was monitored by inserting a urinary catheter. All patients were provided with two wide peripheral venous lines of 16–18 G. A central venous catheter was inserted in only one patient. After induction, the patients were placed in a slightly head-up position. Maintenance of anesthesia was established with 1%–2% sevoflurane, 50% oxygen, and 50% air and 0.1–0.2 mcg/kg/minute remifentanil. At the end of the operation, 1000 mg of paracetamol and 4 mg of ondansetron were administered intravenously. Before starting the awakening, the sponge in the mouth was removed, the oropharynx was washed and aspirated with physiological saline and after 1 mg/kg of lidocaine intravenous administration, the patient was extubated when the extubation conditions were provided. The patients were taken to the ward after being observed routinely in the intensive care unit for 1 day.

Of the patients, 16 (47.1%) had secretory adenoma, and eight patients had acromegaly, four patients had cushing's, and four patients had prolactinoma. Difficult airway was observed in a total of 6 (17.6 %) patients and three of these patients had acromegaly. Intubation of these patients was performed using videolaryngoscopy and if necessary, bougies (Table 2). Post-induction hypotension was observed in 6 (17.6 %) of the patients and was treated with low-dose norepinephrine infusion. Hypertension was observed in one patient and no other intraoperative complications were observed. Postoperatively, 3 (%9) patients were reoperated due to cerebrospinal fluid (CSF) leakage. Diabetes insipidus developed in one patient (Table 3). No blood transfusion was performed in any patient.

**Table 3. Intraoperative and post-operative complications**

| Complications | Number of patients |
|---|---|
| Intraoperative | |
| Hypotension | 6 (17.6%) |
| Hypertension | 1 (2.9%) |
| Post-operative | |
| CSF leak | 3 (8.8%) |
| Diabetes insipidus | 1 (2.9%) |

CSF: Cerebrospinal fluid, Values are expressed as number of patients and percentage.

## Discussion

The minimally invasive endoscopic endonasal approach for pituitary surgery has revolutionized surgery with the transsphenoidal technique, which is effective in up to 95% of pituitary tumors, and has been frequently preferred over the microscopic approach in recent years.[5] Anesthetic goals for transsphenoidal pituitary surgery are to optimize cerebral oxygenation, maintain normal intracranial pressure, maintain hemodynamic stability, support good surgical vision, prevent intraoperative complications, and provide rapid soft recovery from anesthesia.[4,6] Neuroanesthetic principles accepted for other intracranial surgeries are also applied for pituitary surgery. However, the pathophysiological changes that occur as a result of hypo or hypersecretion caused by the pituitary mass or the compression of the mass to the environment should be investigated in detail before the operation.[7] The multidisciplinary approach of the endocrinologist, neurosurgeon, and anesthesiologist is critical for optimal anesthetic and surgical management. Laboratory tests

**Table 2. Characteristics of masses and airway management**

| Characteristic of the masses | Number and percentage of patients | Difficult airway | Use of videolaryngoscopy | Bougie use |
|---|---|---|---|---|
| Secretory adenoma | 16 (47.1%) | 4 (11.8%) | 4 (11.8%) | 3 (8.8%) |
| Acromegaly | 8 (23.5%) | 3 (8.8%) | 2 (5.9%) | 2 (5.9%) |
| Cushing | 4 (11.8%) | 1 (2.9%) | 2 (5.9%) | 1 (2.9%) |
| Prolactinoma | 4 (11.8%) | - | - | - |
| Non-secretory adenoma | 18(52.9%) | 2 (5.9%) | 2 (5.9%) | 1 (2.9%) |
| Total | 34 (100%) | 6 (17.6%) | 6 (17.6%) | 4 (11.8%) |

Values are expressed as number of patients and percentage.

showing the levels of all pituitary hormones should be performed preoperatively for both non-functional and secretory pituitary tumors. Pituitary adenomas are non-functional tumors that most commonly affect the anterior pituitary. Patients with morning serum cortisol levels below 3 micrograms/dL are diagnosed with central adrenal insufficiency. Central hypothyroidism is confirmed by decreased serum free T4 levels in the presence of low, normal, or slightly elevated thyroid stimulating hormone. Hydrocortisone and levothyroxine should be started in these patients with the opinion of an endocrine specialist.[8] Appropriate treatments were started before the operation in our patients who were found to have central hypothyroidism and central adrenal insufficiency. Cortisone support was continued with the intraoperative Addison protocol.

Patients presenting with acromegaly as a result of the tumor's excessive secretion of growth hormone are at high risk for cardiovascular disease, including hypertension, cardiomyopathy, congestive heart failure, and arrhythmias.[9,10] Those with Cushing's disease due to excessive production of adrenocorticotropic hormone also have an increased risk of cardiovascular disease, hypertension, and ischemic heart disease. In addition, diabetes mellitus can be seen in these patients.[7] Of our eight acromegalic patients had diabetes mellitus in one patient, hypertension in three patients and heart disease in three patients. Two of the four patients diagnosed with Cushing had diabetes mellitus. In acromegaly, airway management may be difficult due to prognathism and hypertrophy of soft tissues in the mouth, nose, tongue, soft palate, epiglottis, and aryepiglottic folds.[11,12] Up to 70% of acromegalic patients may have sleep apnea, which increases the risk.[9,13] In a study investigating the airway characteristics of acromegalic patients undergoing pituitary surgery, the authors reported that airway abnormalities were detected in the pre-operative otolaryngology evaluation including flexible endoscopy, in 11 (34.4%) of 32 acromegaly patients.[14] In addition, difficult airway may be encountered in patients with Cushing's disease due to truncal obesity.[4,7] We encountered difficult airway in six of our patients and from these patients were diagnosed three patients with acromegaly and one patient with Cushing's. We had difficult airway preparation for patients who were going to undergo pituitary surgery. Their intubation was achieved successfully using videolaryngoscopy and bougie. The most common intraoperative complication was hypotension (17.6%). It improved with the administration of low-dose inotropic infusion. Hypertension was observed in one patient. Invasive arterial blood pressure monitoring was performed to closely monitor blood pressure at an appropriate interval to improve surgical vision and provide cerebral perfusion. When we look at the studies, it is emphasized that it is appropriate to perform invasive arterial pressure monitoring in all patients to prevent complications. Other intraoperative complications that are more common in the semi-sitting position during this surgery are air embolism, bleeding due to carotid artery injury, cranial nerves II to VI, and optic chiasm damage.[4]

Rapid recovery of the patient should be ensured to allow for early post-surgical neurologic examination. Because early neurological evaluation may reveal the most serious surgical complications.[15] For this, short-acting agents should be preferred. We preferred the balanced anesthesia technique with sevoflurane and remifentanil infusion to provide rapid and gentle recovery in the maintenance of anesthesia in our patients. When the use of propofol and remifentanil versus sevoflurane and remifentanil was compared in studies, no difference was observed in hemodynamic parameters, while recovery times were found to be significantly shorter in the sevoflurane and remifentanil groups.[16,17] Extubation should be done with care for a calm awakening. Coughing, straining, and positive pressure ventilation can damage the newly repaired skull base. This can lead to bleeding, CSF leak, and pneumocephalus. Blood and secretions accumulated in the oropharynx were carefully cleaned by removing the previously placed sponge, rinsing the inside of the mouth, and aspirating. Thus, the patient was prevented from straining during the awakening phase and a soft awakening was achieved. All patients were followed up in the intensive care unit for 1 day to recognize early post-operative complications. In the post-operative period, patients should be monitored for the development of hypopituitarism and sodium and water imbalance disorders. Diabetes insipidus which occurs with polyuria and polydipsia is thought to result from surgical manipulation of the pituitary stalk and disruption of arginine vasopressin transition.[18,19] Diabetes insipidus was observed in one of our patients and was treated in line with the recommendations of the endocrinologist.

## Conclusion

Transsphenoidal pituitary surgery presents unique challenges for the anesthetist. It is very important that a

multidisciplinary team consisting of endocrinologist, neurosurgeon, and anesthesiologist work in harmony. Pre-operative optimization of systemic diseases due to pituitary involvement should be performed. Intraoperatively, appropriate anesthesia management should be performed according to the patient's disease and surgical procedure, and recovery from anesthesia should be fast and soft.

### Disclosures

**Ethichs Committee Approval:** The study was approved by the Kahramanmaraş Sütçü İmam University Faculty of Medicine Clinical Research Local Ethics Committee, decision number 08 on December 27, 2022.

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** None declared.

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