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Endoscopic endonasal transsphenoidal surgery for pituitary adenomas. A single-centre initial experience

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ABSTRACT

Endoscopic endonasal transsphenoidal surgery (EETS) is a widely accepted technique for the surgical resection of pituitary tumours. In this report, we present our single-centre experience with EETS for pituitary adenomas, mainly focusing on its efficacy and postoperative complications. Among 100 patients who underwent EETS, 57 (57%) were female and 43 were (43%) male. The mean age of the patients was 51.55 ± 13.51 years. Nonfunctional adenoma was found in 61 (61%) patients, acromegaly was found in 29 (29%) patients, Cushing's disease in six (6%), and prolactinoma was found in four (4%) patients. On average, a 75.8% decrease in the postoperative tumour volume was observed in nonfunctional adenomas. Surgical cure was achieved in 51.7% of patients with acromegaly, 50% of those with Cushing's disease, and 25% of those with prolactinoma. The most common postoperative complication was found to be cerebrospinal fluid fistula.

Keywords
adenoma,
endoscopy,
pituitary,
transsphenoidal

INTRODUCTION

Pituitary adenomas, accounting for 10%–15% of all primary intracranial tumors, develop from the adenohypophysis and are considered benign neoplasms.[1] The prevalence of pituitary adenoma was reported to be between 1/865 and 1/2688 persons in different clinical studies.[2-4] Despite their benign nature, pituitary adenomas may cause significant morbidity and mortality because of their endocrine activity and mass effect.[5] The diagnosis, treatment, and follow-up of pituitary adenomas require a multidisciplinary approach, including neurosurgery, endocrinology, and radiosurgery.

The primary aim in the surgical treatment of pituitary adenomas is to excise the tumor without damaging the surrounding anatomical structures. Initially, the transcranial surgical approach was adopted in treating pituitary adenomas. However, less invasive methods have been developed later on because of the high morbidity and mortality rates associated with this method.[6] Recently, the endonasal approach for the surgical excision of pituitary adenomas has gained great popularity and has been considered the "gold standard."[7] Currently, the endoscopic endonasal transsphenoidal surgery (EETS) technique,

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which provides a wide panoramic view of the surgical field and anatomical structures, has become a preferred surgical method.[8,9]

In this study, we report our initial experience with EETS in patients with pituitary adenoma, mainly focusing on its efficacy and postoperative complications.

Materials and Methods

Study Population

In this study, 100 patients diagnosed with pituitary adenoma who underwent EETS at our clinic between February 2014 and December 2020 were included. Patients with missing data, pediatric cases, and those operated with the transcranial route were excluded from the study.

The records of the patients included in this study were retrospectively reviewed, and their clinical, radiological, and biochemical findings were recorded.

Microadenomas were defined as adenomas that have a maximum diameter of 10 mm, and macroadenomas were defined as those with a diameter of at least 10 mm. Tumor volumes were calculated by measuring the largest tumor diameters in the axial, sagittal, and coronal axes in the cranial magnetic resonance imaging (MRI), as described previously in macroadenomas.[10] All patients with nonfunctional adenoma underwent cranial MRI within the first 3 months after surgery, and the postoperative volumetric decrease was calculated. The Knosp grade of the tumor was determined using preoperative MRI.[11]

The efficacy of surgical treatment in functional adenomas was evaluated according to the Pituitary Diseases Diagnosis, Treatment and Follow-up Guideline published by the Society of Endocrinology and Metabolism of Turkey.[12] Accordingly, in patients with acromegaly, a serum growth hormone level of <0.4 µg/L at the third month after surgery was accepted as a marker of surgical remission and a value of <1 µg/L was accepted as a marker of surgical control of the disease. In patients with Cushing's disease, a morning serum cortisol level of <2 µg/dL within the first week after the operation was accepted as surgical remission. Initial remission was defined as a measured prolactin level that had returned to normal.[13]

The study protocol was approved by the local Ethics Committee (2021/3019), and written informed consent was obtained from all participants or their legal successors.

Surgical Procedure

All patients underwent EETS under general anesthesia by the same surgical team. Neuroradiological images of the patients were analyzed before the procedure. Computed tomography of the paranasal sinuses was examined to evaluate the sellar access route and to detect pathologies related to this pathway. Anatomical relationships between the internal carotid arteries (ICAs) and pituitary adenomas were evaluated. Any suprasellar and intrasellar vascular pathologies were excluded.

In the operating room, the patients were placed in the supine position, and their head was fixed using a skull clamp. Image guidance was used in all patients using the Medtronic ®StealthStation (Medtronic, MN, USA) surgical navigation system. Subsequently, the patient's face, both nasal cavities, and abdominal region were cleaned with povidone-iodine solution. The vasoconstrictor agent, adrenaline, was applied to the nasal mucosa. The surgical procedures were performed through the binostril approach with a diameter of 4 mm, length of 18 cm, and rigid scopes of 0° and 30° (Karl Storz GmbH & Co. KG, Tuttlingen, Germany), and related endoscopic skull base instruments were used.

Initially, the middle nasal turbinate was accessed by passing the lower turbinate and choanae. The middle nasal turbinate was dissected laterally using a dissector, and the surgical corridor was established. Then, the superior turbinate was accessed by moving posteriorly between the middle turbinate and the septum. The natural ostium of the sphenoid sinus was identified between the superior turbinate and the septum. Then, the vomer was opened, and a binostril corridor was achieved.

The anterior wall of the sphenoid sinus was opened following clear identification of the sphenoid ostium. Using a Kerrison rongeur or micro-drill, the anterior wall of the sphenoid sinus was opened laterally. The mucosa covering the sellar floor was excised. Then, the base of the sella and neighboring structures were revealed. Then, the base of the sella was opened and widened using a micro-drill and Kerrison rongeur, and the dura mater was exposed. To not damage the ICAs, intraoperative doppler ultrasonography was performed, as necessary. After

that, the dura mater was incised and opened using scalpel blades and micro-scissors. The tumor was identified and evacuated using an aspirator, ring curettes, and micro-forceps (Fig. 1). If cerebrospinal fluid (CSF) leakage was observed during the procedure, fat and fascia grafts taken from the abdomen were placed on the field. Additional nasoseptal flaps, which were prepared in early stages of the operation, were engrafted in some cases (particularly those with large macroadenomas). Multilayer closure was achieved, and the operation was terminated.

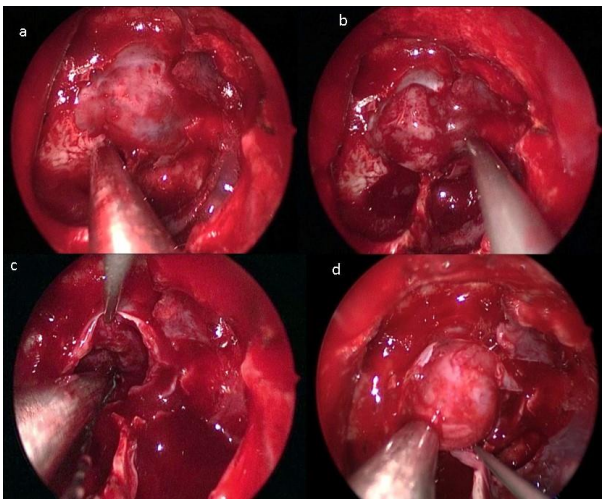

Figure 3 Different stages of the endoscopic endonasal approach in a case of macroadenoma. **a**: Revealing the osseous structures belonging to the base of the sella. **b**: Opening of the dura and excision of the tumor. **c**: Control of the residual tumor. **d**: Sagging of the diaphragm sella toward the surgical field after radical resection.

Statistical Analysis

Statistical Package for the Social Sciences, version 22.0, was used for data analysis. Categorical data are expressed as numbers and percentages, while continuous data are presented as means ± standard deviations.

Results

Among the 100 patients who underwent EETS, 57 (57%) were female, and 43 (43%) were male, and the mean age of the patients was 51.55 ± 13.51 years. Macroadenoma was detected in 84 (84%) patients, and microadenoma was found in 16 (16%) patients.

Nonfunctional adenoma was found in 61 (61%) of the operated patients, acromegaly in 29 (29%), Cushing's disease in six (6%), and prolactinoma in four (4%). When the patients were classified according to their sex, among female patients, 34 (59.6%) had nonfunctional adenoma, 16 (28.1%) had acromegaly, five (8.8%) had Cushing's disease, and two (3.5%) had prolactinoma. Meanwhile, among male patients, nonfunctional adenoma was found in 27 (62.8%), acromegaly in 13 (30.2%), Cushing's disease in one (2.3%), and prolactinoma in two (4.7%).

Of all patients, 25 (25%) had Knosp stage 0 lesions, 23 (23%) had Knosp stage 1 lesions, 16 (16%) had Knosp stage 2 lesions, seven (7%) had Knosp stage 3a lesions, nine (% 9) had Knosp stage 3b lesions, and 20 (20%) had Knosp stage 4 lesions.

Patients with nonfunctional adenomas

The mean preoperative volume of nonfunctional adenomas was 9.84 ± 9.79 cm^3, which decreased to 2.35 ± 3.79 cm^3 within the first 3 postoperative months. When the preoperative and postoperative volumes were compared, on average, there was a 75.8% decrease in the tumor volume postoperatively.

Patients with acromegaly

Surgical remission was achieved in six (20.7%) of the 29 patients with acromegaly, and surgical control was achieved in 15 (51.7%) patients. Of the patients with surgical remission, four had microadenomas and two had macroadenomas. Again, of the 15 patients with surgical control, eight had microadenomas and seven had macroadenomas.

Patients with Cushing's disease and prolactinoma

According to the criteria stated in the methods section, remission was achieved in three (50%) of the six patients with Cushing's disease, and all cured patients had microadenomas.

Surgical remission was achieved in only one (25%) of the four patients with prolactinoma who underwent surgery. All patients with prolactinoma were found to have macroadenomas, which were resistant to medical therapy.

Postoperative complications

Permanent DI occurred in one patient with acromegaly and one patient with Cushing's disease, who all had microadenomas. These patients received desmopressin treatment, which was adjusted after endocrinology consultation.

Postoperative rhinorrhea was observed in eight (8%) patients within the first month after surgery. CSF leakage was ceased with external lumbar drainage in three patients. Two patients underwent reoperation, and the remaining three patients underwent both external lumbar drainage and endoscopic reoperation. All CSF leaks were treated successfully using these methods. Meningitis occurred in two patients and was treated with appropriate antibiotics.

Discussion

In this study, we presented our single-center experience with EEST, a widely used technique for the surgical resection of pituitary adenomas. In our series of 100 patients with pituitary adenomas, we observed a reasonable remission rate, low incidence of postoperative complications, and no mortality. This study contributes to the current literature regarding the safety and efficacy of EETS.

The demographic characteristics of our study population revealed a mean patient age of 51.55±13.51 years and female preponderance. These findings were comparable with the data reported in previous surgical series for pituitary adenomas.[9,14,15] Furthermore, our findings demonstrated that 84% of the study group had macroadenomas and 61% had nonfunctional adenomas. In a previous surgical series, Eseonu et al. have reported that 71.6% of their patients had macroadenomas and 63.6% had nonfunctional adenomas.[14] In another series, Singh et al. have reported that 86% of their patients had macroadenomas and 79% had nonfunctional adenomas.[9] All these data show that our patient group had similar demographic and clinicopathological features with those in previous surgical series in the literature.

Transsphenoidal surgery is the primary therapeutic option for pituitary adenomas, except for prolactinomas, and is associated with high remission rates, particularly in patients with microadenomas (80%–90%).[5,16] We evaluated the preoperative and postoperative tumor volumes in patients with nonfunctional adenomas and found a 75.8% decrease in tumor volume postoperatively. Similarly, Eseonu et al. have reported a 85.1% decrease in tumor volume postoperatively using the EETS technique in a previous study.[14]

In our patient group, surgical control was achieved in 51.7% of patients with acromegaly. In a similar series, including patients with acromegaly, Yildirim et al. have reported that biochemical remission was achieved in 80.0% of patients with microadenomas and 64.7% of patients with macroadenomas. The total remission rate was found to be 66.1%.[17] In another series, Hazer et al. have revealed that biochemical cure was achieved in 62.6% of patients with acromegaly following EETS.[18] All these data suggest that EETS is associated with a reasonable remission rate in patients with acromegaly and that there are minor differences between different series regarding its efficacy.

In addition to its efficacy, EETS has also shown to be associated with low complication rates following the surgical removal of pituitary tumors.[19,20,21] CSF leakage, DI, vascular complications, hypopituitarism, meningitis, and visual complications were most commonly reported complications in other series.[5,19] In our patient group, we detected rhinorrhea because of CSF leakage in 8% of the patients. All these patients were successfully managed with endoscopic repair and/or external lumbar drainage. In previous reports, CSF leakage following EETS was reported in 2.4%–24% of patients.[20,22] Death is a rare complication of EETS and usually occurs because of carotid artery injury and meningitis.[5,19] No carotid injury was observed in our series.

This report has some limitations. First, this was a single-center study and has a retrospective nature, lacking prospective follow-up data. This situation restricts the generalization of the results of this study. Second, there was no control group of patients operated with another surgical technique, such as microscopic endonasal transsphenoidal surgery, to compare perioperative outcomes of EETS. However, we suggested that EETS is a safe and efficient method for treating pituitary adenomas. Although learning is relatively steep, augmented experience and throughout knowledge of the neurosurgical anatomy make significant differences.

Conclusions

EETS is an effective technique frequently used for resecting pituitary tumors. This report revealed that EETS is associated with a good remission rate, low incidence of postoperative complications, and low mortality rates. These findings support the previous

data regarding the safety and efficacy of EETS for the surgical treatment of pituitary adenomas.

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