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Surgical outcome of trans-sphenoidal approach to pituitary adenoma in adult patients: 10 years experience in northwest of Iran

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Abstract

Background: Pituitary adenoma (PA) is a frequent intracranial lesion, that needs surgical evacuation. In this study, we evaluated the surgical outcome of PA treated via endoscopic and microscopic trans-sphenoidal approach

Methods: In this retrospective cross-sectional study, we evaluate ten years of PA surgery experience in the northwest of Iran. 721 patients underwent trans sphenoidal surgery of PA. Complication of the surgery, extension of tumors resection, demographic and clinical findings (gender, age , tumor type ,..) were reviewed in this study. SPSS version 25 and statistical tests including chi square and T-test were used. P-value <0.5 was considered as statistically significant.

Results: 483 males (58.9%) and 336 females (41.02%) were included in this study. Mean age of patients was 47.3±1.96 years.The most common initial complaints were deterioration of vision (n=528, 64.4%) and headache (n=343, 41.88%), followed by accelerated development (n=254, 31.01%), amenorrhea and galactorrhea (n=253, 30.8%). 57 (6.95%) patients had symptoms of Cushing's disease. 105 (12.8%) patients had acromegaly. TR was achieved in 87.5% of cases and sub-TR in 103 (12.5%) cases and no patient had a partial or insufficient resection. After surgery, the endocrine function was normalized in 76 (31.7%) patients who had preoperative hyper hormonal levels. 36 (4.3%) patients developed postoperative CSF leakage; of which, 4 (0.48 %) patients did not improve by lumbar drainage and other conservative treatments and needed reoperation for reconstruction of the skull base.

Conclusion: The combination of microscopic and endoscopic trans-sphenoidal approach in PA surgery can be lead to total resection of tumors.

Keywords: Pituitary Adenoma, Pituitary Hormone, Trans-Sphenoidal Approach

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Introduction

Pituitary adenoma (PA) nearly consists of 15 % of intracranial tumors and is the most common neuroendocrine tumor of the central nervous system (CNS). PA is classified according to their size in two groups: macroadenoma (>10mm) and microadenoma (<10 mm). Microadenomas are slightly mo re prevalent compared to

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↑What is "already known" in this topic:
Trans-sphenoidal approach is the main approach in surgery of the sella region especially for the pituitary adenoma. Various outcomes has been explained in previous studies. In contrast to the trans-cranial approach, the trans-sphenoidal approach to the pituitary adenoma has a low rate of surgical complication and time of recovery.

→What this article adds:
In this study, we showed our ten years experience in the surgery of pituitary adenoma in Northwest Iran. We have emphasised on the epidemiological aspect of our finding that can help researcher to focus on major problems in this region of Iran.

macroadenomas. Microadenomas are presented with over-production of pituitary hormones and macroadenomas are almost presented with a mass effect on the suprasellar structures. They present with vision loss or stalk effects; however, many of PA are found incidentally during CNS imagings (1-3). Trans-cranial and trans-sphenoidal approachs are the two major surgical approaches to the sellar region tumors. Trans-sphenoidal approach with an endoscope or microscope is a more common approach among the surgeon. But in the tumors extended laterally and invaded to the carotid area, the trans-cranial approach is the standard approach (4). In this study, we present the results of PA surgery via trans-sphenoidal approach in a referral hospital in northwest Iran within 10 years.

Methods

Study design

We retrospectively reviewed patients with PA records in Emam-Reza hospital (Tabriz , East Azarbaijan , Iran) operated from 2009 to 2019. 819 patients were identified. 98 tumors were resected via trans-cranial approach. We exclude this group of patients. 346 patients had underwent surgery via endoscopic trans-sphenoid approach and 298 patient had underwent microscopic trans-sphenoid trans-septal surgery. In 77 patients, we had used a combination of an endoscope and microscope for the operation. The records of patients were reviewed; age, sex, presentation, tumor size, extent of tumor resection, clinical outcome and surgical complications of the patients were retrieved and reported by mean and standard deviation and number and percentage . Laboratory assessment s including cell count, PT, PTT and hormonal assessment of the pituitary gland, para-nasal sinus computed tomography (CT) scans in axial and coronal reconstruction, visual field and acuity evaluated by an ophthalmologist, brain magnetic resonance imaging (MRI)had done for all patients to evaluate of size, location and extension of the tumor. Extracted data was analyzed using SPSS version 25. For statistical analysis, we used chi-square and T-test. P-value <0.5 was considered as statistical significant.

Surgical technique

All patients received 1 gr intravenous cephazolin 30 minute prior to surgery. Operation done under general anesthesia. In the endoscopic approach, we used a 0-angel rigid neuro-endoscope (Asculap,Germany). Middle conchae was removed initially to make naso-septal flap with vascular pedicle for further reconstruction of the skull base. After finding rostrum and ostium of sphenoid as markers to reach the sella, ostotomy of the sella floor exposed the Dura matter and pituitary adenoma. In the microscopic approach, we used the trans-septal approach with dissection of perichondrium and removal of the bony part of the nasal septum. Sphenoidal ostium was found, and the rostrum was removed from the anterior wall of the sphenoid sinus with a 2mm Krison punch. Final osteotomy was done in the floor of sella. Dura matter and the pituitary adenoma were exposed. Adenoma in both techniques were removed with ring curette and suction. To ensure total removal, we used a 30-degree angle lens to see around and corner of the sellar region at the end of the surgery. For reconstruction of the skull base, we used naso-septal flap fascia lata or fat particle. Nasal cavity was taped by tetracycline and mesh for 72 hours.

Post operative care and evaluation

Third generation cephalosporins continued for 3 days after surgery. Complete bed rest and avoidance of any maneuver which can raise the intracranial pressure and head up to 30 degrees were advised to all patients. For permanent CSF leakage, we used lumbar drainage or serial lumbar punctures. Hormone replacement in cases with hormone insufficiency started as soon as possible and urinary output and Na level were evaluated. Patients presented with DI treated with desmopressin nasal puff. Post operative MRI was taken 2 days and also 3 months after the surgery to evaluate the extension of resection (total resection (TR): no evidence of residual tumor; sub-TR: residual tumor <20%; partial resection: residual tumor <50%; and insufficient resection: residual tumor >50%). Visual field was evaluatedafter 6 months later by an ophthalmologist .

Results

483 males (58.9%) and 336 females (41.02%) included in this study. Mean age of the patients was 47.3±1.96 years. The most common initial complaints were deterioration of vision (n=528, 64.4%) and headache (n=343, 41.88%), followed by accelerated development (n=254, 31.01%), amenorrhea and galactorrhea (n=253, 30.8%). 57 (6.95%) patients had symptoms of Cushing’s disease. 105 (12.8%) patients had acromegaly. 52 (6.34 %) patients with prolactinoma underwent surgery because of the progressive visual defect and no response to medical therapy. 708(86.44%) patients in the imaging studies had macro-adenoma and 111 (13.55%) patients had micro-adenoma. 63 patients go underwent surgery with apoplexy of the pituitary, and 3 patients presented with low consciousness (Table 1). TR was achieved in (87.5%) cases, sub-TR was achieved in (12.5%) cases and no pa-

Table 1. Summary of the demographic and clinical presentation

		Number	Percent
Gender	Male	483	58.9
	Female	336	41.02
Presentation	Visual loss	528	64.4
	Ammenorroha	253	30.8
	Cushing s disease	57	6.95
	Headache	343	41.8
	prolactinoma	52	6.34
	Acromegaly	105	12.8

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Table 2. Surgical outcomes

	Item	Number	Percent
Extension of the resection	Total resection	716	87.5
	Subtotal resection	103	12.5
Endocrinological recovery	Normalized	68	31.7
	Improved	140	65.9
	No changed	6	2.4
Visual recovery	Normalized	166	31.5
	Improved	318	60.3
	No changed	44	8.2

Table 3. Surgical complications

Surgical complication	Number	Percent
Cerebrospinal fluid leakage	36	4.3
Transient diabetes insipidus	114	13.9
Persistent diabetes insipidus	7	0.89
Hypopituitarism	66	8.05
Meningitis	0	0
Reoperation for PA	0	0
Intracranial haematoma	0	0
Death	0	0
Reoperation for CSF leak	4	0.4

tient had a partial or insufficient resection. 716(87.5%) patients underwent total resection and 103 (12.5%) achieved subtotal resection. Also, we detected visual defect (acuity and field) in 491 (92.9%) of 528 patients. Complete recovery was detected in 31.5% and partoal improvement in 60.3 % pof the atients. Postoperative hormonal level was considered as normalif PRL= 3.34–26.72 ng/mL, GH= 0.126–9.88 ng/mL and ACTH= 7.2–63.3 pg/mL. Endocrine function reached to normal values in 68 (31.7%) patients who had preoperative hyper hormonal levels (Table 2). 36 (4.3%) patients developed postoperative CSF leakage, of which 4 patients did not improve by lumbar drainage and other conservative measures and needed reoperation to reconstruct the skull base. 66 (8.05%) patients developed hypopituitarism, which required hormone therapy. After the operation, 114 (13.9%) patients developed transient DI, of which 7 (0.85%) patients developed persistent DI; they were treated using nasal desmopressin. Meningitis, intracranial hematoma, reoperation or death did not found in the patients (Table 3).

Discussion

PA is a prevalent CNS tumor. It is accounted for 5% to 20% of the primary central nervous system tumors. As mentioned in previous studies, it is more frequent in females (f/m: 5.9/2.2) (5). Secreting adenomas can be distinguished earlier than non-secreting ones using hormonal evaluation and clinical symptoms. Macro-adenomas are always seen in patients with visual defect or raising intracranial pressure (6). The main paraclinical modality to diagnose the pituitary tumor is MRI with thin cuts of the sella region in coronal and sagital plans. Trans-cranial and trans-sphenoidal approachs are the two major surgical approaches for resection of this tumor (7). Endoscopic trans-sphenoid approach has been introduced as a minimal invasive technique compred to older approachs but with some limitation and can't be used for every patient (8, 9). In this study, PA was slightly dominant in males rather than female (8), that can be related to the sampling technique in this study. In this study, many of the prolactinomas treated medically and this type was more frequent in females than males and most of the patient with high prolactine serum level didnot evaluated generally by MRI. In our study, macro-adenoma was more prevalent than micro-adenoma. This can be due to the imaging technique; some patients with micro-adenoma need dynamic pituitary imaging with thin cuts specially in non–secreting adenomas. In this study, the rate of TR was 87.5% , which is comparable to previously reported rates of 77.8% and 81.5%.. In our study, previous nasal cavity surgery, poor penumatization of thesphenoid sinus and severe nasal septal deviation were major limitations to trans-sphenoid approach. In secreting adenomas, normalization of hormonal level is one of the goals of the surgery (10). In our study, 31.7 % of patients achieved this goal; however, in other studies, the value was 49 – 70 %. In this study, normalization or undetectable hormonal levels in GH-secreting adenomas were more important than other ones. Visual field defect is a commonpresentation of PA and mainly seen in macro-adenoma. Surgical decompression of the optic nerve and chiasm can improve the visual defect (11). In our series, most of the patients with visual defect improved significantly. In another study, improvement of visual defect, especially the visual field, achieved in 78-100 % of patients. This finding showed that surgical evacuation of PA can prevent permanent visual field defect. CSF leakage is one of the important complications of brain surgery specially following trans-sphenoid approach to PA. SF leakage can be complicated by CNS infection that worsens the patient's condition. Reconstruction of the skull base is as important as the tumor surgery (12, 13). In our series, we found CSF leakage in 4.3 % of patients and only 4 patients needed re-operation for CSF leakage. We reconstructed the skull base with a septal pedicular flap and mucosal tissue of the middle conchae, which is better than reconstruction with only adipose tissue, or facia lata.Studies have shown that permanent DI is rare and occurrs in 1- 2% of patients (14). In our study, persistent DI was found in less than 1%. Hypopituitarism can occurr after surgery. Studies have shown an incidence between 4-12 % (15, 16). In our study, transient hypopituitarism was found in nearly 8%, but pan-hypopituitarism developed in only 2 patients that needed long-life hormonal replacement. Hypopituitarism should be considered in postoperative period in all patients. Secondary adrenal insufficiency can lead to a critical situation. Cortisol replacement therapy should be considered after the operation.

Conclusion

Trans-sphenoid approach to PA a common approach to the sellar region because of its minimally invasive technique compared to the transcranial approach. Better surgical view of the sellar region helps the surgeon to complete the resection of the tumor. Combination of microscope and endoscope can cover the limitation of both modalities.

Compliance with ethical guidelines

All steps of this research were reviewed by Urmia University of Medical Sciences, ethical committee, with ethical code of IR.TMSU.REC1389. 4354/1132.

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Conflict of Interests

The authors declare that they have no competing interests.

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