

Medical Aspect of Endoscopic Endonasal Transsphenoidal Hypophysectomy in Skull Base Center of Basra

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Abstract

Background: Endoscopic endonasal transsphenoidal (EETS) approach is a minimally invasive technique that has gained increased acceptability for the removal of sellar and para-sellar tumors. **Objectives:** To evaluate the EETH in the skull base center of Basra and compare our EETH procedures with others done in different centers. **Patients and Methods:** A prospective observational study was carried out in Basra skull base center at Al-Sader Teaching Hospital between August 2017 and July 2019, and it included 50 patients (29 female and 21 male) with a female to male ratio of 1.38:1. We included all patients with a pituitary tumor fit for surgery, and there were no exclusion criteria. The standard technique involved a unilateral, endoscopic, and endonasal approach to the sella turcica via an anterior sphenoidotomy, with enlargement of the natural sphenoid ostium using powered instrumentation and 0° and 30° rigid endoscopes for visualization. This was performed as a joint procedure by a consultant otolaryngologist and a consultant neurosurgeon. **Results:** The most common presenting symptom for pituitary tumor was headache, which is present in 80% (40 patients) of patients, followed by visual disturbance in 56% (28 patients). The MRI study of the brain and sellar region shows that 46 patients (90%) were diagnosed as having pituitary adenomas. Eighty-four patients present had a tumor larger than 1 cm in size. Sixty eight percent (34 patients) had an abnormal hormonal study before the operation, whereas 32% (16 patients) had a normal hormonal analysis. Histopathological examination of the tumors showed pituitary adenoma in 90% (45 patients), followed by craniopharyngiomas in 6% (three patients) and 2% (one patient) was Rathke's cyst and 2% (one patient) was pituitary carcinoma. Postoperative follow-up result indicated headache improvement in 82% (34 patients), improvement in menstrual disturbance in 67% (13 patients), and vision improvement in 46% (13 patients). Seventy-four percent showed hormonal normalization after EETH, which is statistically significant ($P < 0.05$). **Conclusion:** This study show that endoscopic, endonasal, transsphenoidal hypophysectomy is a minimally invasive, effective, and safe procedure to remove pituitary tumors.

Keywords: Endoscopic endonasal transsphenoidal, hormonal normalization, pituitary tumors

INTRODUCTION

The EETS approach is a minimally invasive technique that has gained increased acceptability for the removal of sellar and para-sellar tumors.^[1] Griffith and Veerapen^[2] first described the endonasal approach for the removal of pituitary lesions in 1987 as a modification of Hirsch's original approach. Jho and Carrau^[3] have subsequently popularized the technique.

The feasibility of the technique with good surgical and functional outcomes has made it popular among ENT and neurosurgeons over the past two decades.^[4] Preference of EETS over the conventional transseptal and sublabial approach resulted from improved visualization and

illumination of operative fields and low incidence of related morbidity.^[5] The availability of wide-angled scopes and high-definition cameras allow much better control during surgery and hence significantly better results. This technique has been developed under minimally invasive surgical strategies for patients with pituitary tumors, which eliminates the use of transsphenoid retraction.^[6,7]

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The endoscope represents one of the latest innovations because of its ability to have a wider panoramic view through a narrow surgical corridor and its ability to provide an angled “close up view” to detect eventual tumor remnants.^[8]

A detailed study of the lesion and anatomy of adjacent structures is important to improve the safety and accuracy of surgery. Although endonasal anatomical variations are frequent, they do not pose a relevant hurdle in this procedure.^[9] Recent studies have affirmed that the EETS approach is associated with minimum nasal complications, reduction in operative time, and decreased hospital stay.^[10]

PATIENTS AND METHODS

A prospective observational study was carried out from August 2017 to June 2019 at Basra skull base center in Al-Sader Teaching Hospital, and it included 50 patients as shown in Table 1. Informed detailed consent was obtained from all patients, and it was authorized by the hospital after explaining the benefits, risks, and complications of surgery.

A detailed history, clinical examination, and investigation was performed according to a predesigned questionnaire to inquire about information related to age, sex, residence, occupation, and symptomatology.

All patients scheduled for pituitary surgery underwent radiologic evaluation (CT scan of nose and paranasal sinuses and MRI of brain), endocrine assessment by an endocrinologist, visual field tests pre- and postoperatively by an ophthalmologist, and preoperative and postoperative nasal endoscopic examination, which was also to be a part of a routine assessment done by an otolaryngologist. All patients were evaluated by a neurosurgeon for full neurological examination pre- and postoperatively.

The EETS took place under general orotracheal anesthesia, with the oropharyngeal region being well packed with a gauze roll to prevent postoperative blood and fluid aspiration. Intraoperative antibiotic treatment was carried out with an intravenous third-generation

cephalosporin. The patient was positioned in the supine position with slight elevation of the head.

The surgery has four stages: nasal stage, sphenoid stage, and reconstruction done by otolaryngologist, whereas the sellar stage by the neurosurgeon commences with the endoscopic identification of the middle and superior turbinates. The middle turbinate and the sphenoid ostium lead the surgeon to the sphenoid sinus. Enlargement of the sphenoid ostium is the next step followed by identification of the sphenoid sinus. The same procedure is performed through the other nostril, that is, a “binostril approach.” After both enlargement of sphenoid ostia and removal of sphenoid septum or septa, identification of the structures in the sella region takes place. The neurosurgeon completes the sellar stage with tumor removal. After complete removal of the tumor, reconstruction is done by the otolaryngologist in various ways depending on the state of the surgical defect.

A sphenoid pack and bilateral anterior nasal pack were placed, and the patient was monitored in the ICU for the first 24 h. The nasal pack was removed after 48 h, and the sphenoid pack was removed after five days. Analgesia and antibiotic were routinely prescribed for the patient postoperatively. The patients were followed for one year postoperatively.

Data were collected, included in a data-based system, and analyzed by the statistical package of social sciences (IBM SPSS Statistics version 23).

RESULTS

The most common symptom is headache, which presents in 80% (40 patients) of patients, followed by visual disturbance in 56% (28 patients). Infertility and hemiparesis are the least symptoms 2% for each (one patient) as shown in Figure 1. The diagnostic characteristics of the pituitary tumor detected by MRI preoperatively in Table 2 show that 46 patients (92%) were diagnosed as having pituitary adenomas and 2% (one patient) was Rathke’s cyst and 2% (one patient) was pituitary carcinoma. Figure 2 shows that 68% (34 patient) had an abnormal hormonal analysis before

Table 1: Demographic characteristics

Age (years)	Sex				Total	
	Male		Female		Patient number	%
	Patient number	%	Patient number	%		
1–10	0	0	1	2	1	2
11–20	6	12	1	2	7	14
21–30	1	2	10	20	11	22
31–40	6	12	7	14	13	26
41–50	5	10	9	18	14	28
Older than 50	3	6	1	2	4	8
Total	21	42	29	58	50	100

the operation, whereas 32% (16 patients) had a normal hormonal analysis. We found that 38% (13 patients) had hormonal changes due to prolactin hormone elevation, 23% (eight patients) had GH disturbance, 6% (2 patients) had panhypopituitarism, and only 3% (one patient) had panhyperpituitarism [Figures 2 and 3]. The most common type of tumor shown in HPE was pituitary adenoma in 90% (45 patients), followed by craniopharyngiomas in 6% (three patients) and 2% (one patient) was Rathke's cyst and 2% (one patient) was pituitary carcinoma [Table 3].

In postoperative follow-up [Figure 4], headache improved in 83% (34 patients), menstrual disturbance improved in

68% (13 patients), and vision improved in 46% (13 patients). Postoperative hormonal improvement was observed in 64% of patients, who showed hormonal normalization after EETH, which is statistically significant ($P < 0.05$) [Figure 5].

DISCUSSION

Pituitary tumors are the most commonly encountered intracranial neoplasms, whereas the most recent series estimate the prevalence of clinically apparent pituitary lesions to comprise approximately 10%–15% of all intracranial lesions.^[11]

Many surgical approaches to sella are used, but the EETH approach becomes a standard procedure to access sella and the pituitary region.^[4,12]

Traditionally, pituitary surgery comes within the realm of neurosurgeons but an introduction of the EETS approach to sella has made otorhinolaryngologists active partners in surgical management.^[8]

The most common presenting symptoms for patients with pituitary tumors in our study were headache in 80% (40 patients), followed by visual disturbance in 56% (28 patients), and infertility being the least in 2% (one patient).

This results are comparable with Prajapati *et al.*,^[13] Yildirim *et al.*^[14] and they do not match with Singh *et al.*,^[15] in which visual disturbance is the most common presenting symptoms followed by headache in his review.

Most of the cases, 46 patients (92%), enrolled in the present study had pituitary adenoma, diagnosed by an imaging study; there were two cases of craniopharyngiomas, one case of Rathke's cyst, and one case of meningioma. These results match with those of Singh *et al.*,^[15] Charalampaki *et al.*,^[16] and Kumar *et al.*^[17]

About 68% (34 patients) of patients had an abnormal hormonal profile before surgery. These results are comparable to those of Jho *et al.*,^[18] Varshney *et al.*,^[8] Charalampaki

Type	Frequency	Percentage
Pituitary adenoma	42	84
Pituitary adenoma with apoplexy	4	8
Craniopharyngiomas	2	4
Rathke's cyst	1	2
Meningioma	1	2
Total	50	100

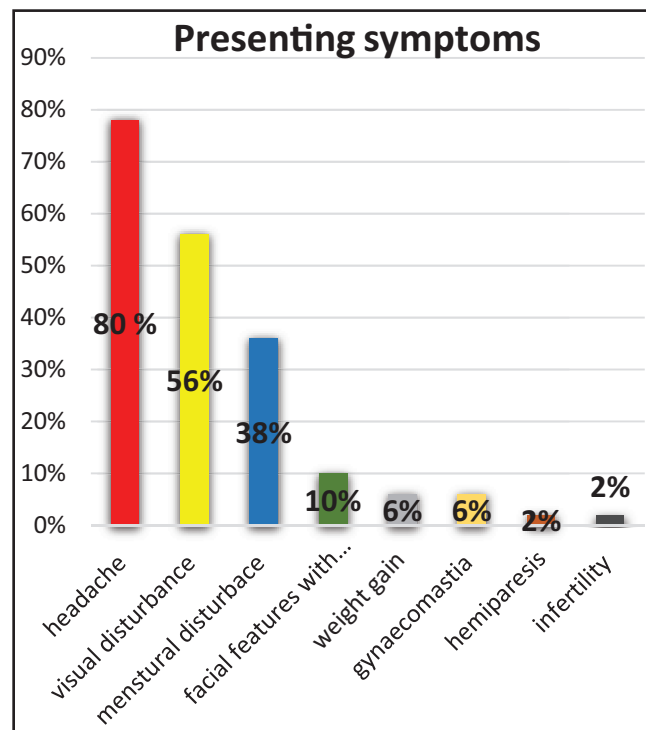


Figure 1: Clinical presentation of patients

Type	Frequency	Percentage
Pituitary adenoma	45	90
Craniopharyngiomas	3	6
Rathke's cyst	1	2
Pituitary carcinoma	1	2
Total	50	100

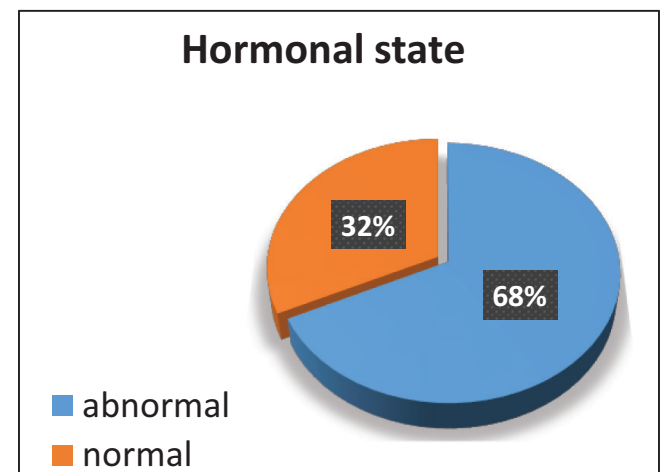


Figure 2: Hormonal state of patients

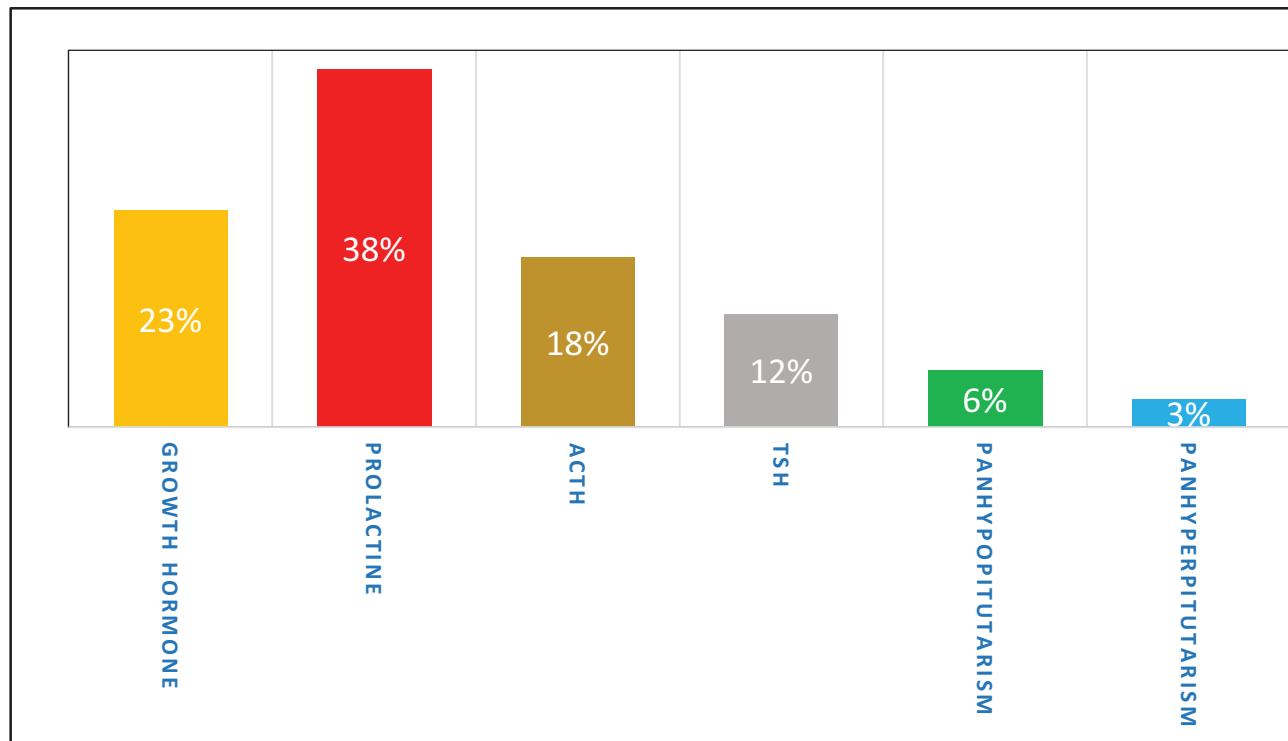


Figure 3: Types of hormonal abnormalities

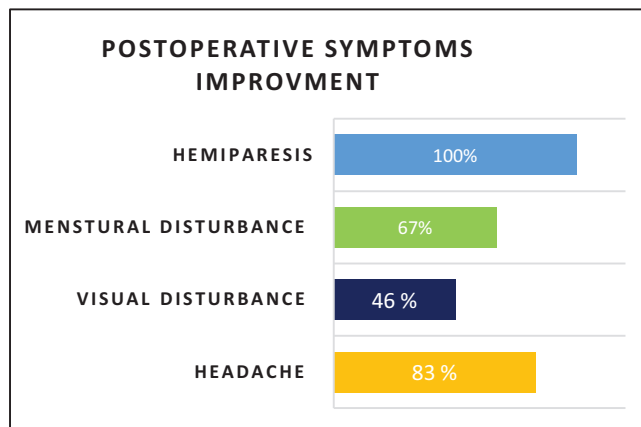


Figure 4: Postoperative symptoms improvement

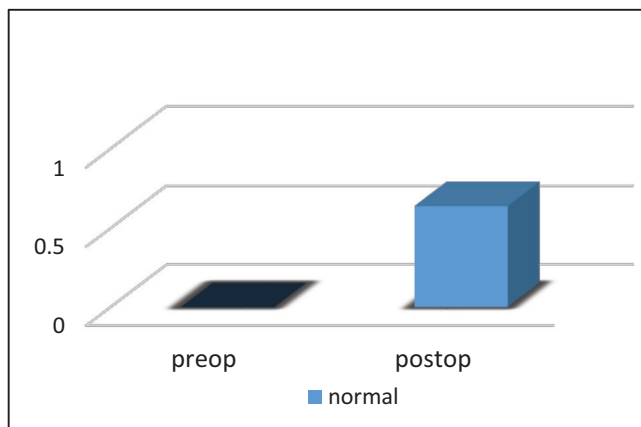


Figure 5: Postoperative hormonal improvement

et al.,^[16] Sarkiss *et al.*,^[19] and Kumar *et al.*,^[17] whereas they are indistinguishable from those of Singh *et al.*,^[15] Dehdashti *et al.*,^[20] Prajapati *et al.*,^[13] and Yildirim *et al.*,^[14] who reported that nonfunctional tumors are more common than functional tumors (79%, 59%, 58%, and 54%, respectively).

The most common hormonal abnormalities are prolactinomas in 38% (13 patients), followed by GH elevation in 23% (eight patients), with the least being hyperpituitarism. These results are agreeable with the study by Topus *et al.* (35% prolactinomas, 18% GH) but different from that by Dehdashti *et al.*^[20] in which the GH secreting tumor was the most common (40%) followed by the ACTH secreting tumor (30%) and then prolactinomas (27%). They are also incomparable with the study by Prajapati *et al.*,^[13] in which GH was the most common (58%) followed by prolactinomas (38%) and then ACTH (6%).

The most common type of tumor was pituitary adenoma in 90% (45 patients), followed by craniopharyngiomas in 6% (three patients), 2% (one patient) was Rathke's cyst and one patient was pituitary carcinoma. The results in Table 3 match with those of Jho *et al.*^[18] (88% pituitary adenoma [44 patients], one craniopharyngiomas and one Rathke's cyst [2% for each]), and Charalampaki *et al.*^[16] (94% pituitary adenoma, 2% pituitary carcinoma), Kumar *et al.*^[17] (87% pituitary adenoma, 4% Rathke's cyst, and 1.8% craniopharyngiomas). Pituitary carcinomas are rare neoplasms that are distinguished from invasive adenomas by the presence of craniospinal and/or systemic metastases. Thirty percent of cases are presented as nonfunctioning

tumors. To date, 52 such cases have been reported in the literature published.^[21]

All the studied patients were evaluated postoperatively for full neuro-ophthalmic assessment, full endocrinological review, and postoperative MRI.

Among the 40 patients (80%) complaining of headache preoperatively, 83% of them develop an improvement in headache postoperatively. The main cause for the relief from headache may be the removal of a mass effect of tumor. These results are comparable with Fleseriu *et al.*,^[22] who report an 85% improvement of headache after EETH; Rizzoli *et al.*^[23] reported 81% improvement, Abe *et al.*,^[24] 75%, and Schankin *et al.*,^[25] 74%. The mechanism of headache in pituitary tumors remains unclear. These lesions may provoke headaches directly via a biochemical mechanism, either by eroding laterally into the cavernous sinus containing the first and second divisions of the trigeminal nerve, or by involvement of the dural lining of the sella turcica^[24] or diaphragm of the sella that are also innervated by the trigeminal nerve, or through an increase in intracranial pressure causing dural stretch.

Our study shows that 46% (13 patients) experienced postoperative improvement of vision. These results match with those of Dehdashti *et al.*^[20] (50%), but they differ from those of Powell,^[26] who reported (88%) overall improvement. This improvement in visual disturbance in the study by Powell^[26] may be due to the long-term follow-up (one year) for patients and the different procedures used (microscopic transsphenoidal surgery).

There are many factors that can be related to visual improvements in postoperative EETH: procedure, duration of symptom, tumor, and patient related.

Factors related to the procedure may affect visual outcomes in several ways, such as the experience with EETS. Although visual outcomes may improve with increased experience, this may be balanced out by the selection of more complex cases. Despite this, the surgeon's experience was found to be a significant influence on visual outcomes in studies.^[27,28] However, gross total resection was not associated with improved visual outcomes, probably because partial resection will also result in decompression of the optic nerve/chiasm^[29-31]; besides the surgeon's experience, the surgeon's preference for preventive surgery or surgery after the development of visual deficits may also result in different results.

On the other hand, the duration and severity of preoperative visual symptoms may also affect postoperative outcomes.^[32,33]

Tumor characteristics may also affect visual outcomes; the tumor size and whether the tumor is hormone producing does not seem to greatly alter the visual outcomes.^[34-36]

Only one patient (2%) in our study complained of hemiparesis preoperatively. Fortunately, paresis improved on the fourth postoperative day. This is a rare symptom of the pituitary tumor, which may be due to cavernous sinus invasion or the compression of distant cerebral structures.^[37] The overall hormonal improvement in our study was 64% (22 patients) for patients who had hormonal disturbance preoperatively. The hormonal level returned to normal or near normal in those patients. These results are matching with those by Singh *et al.* (66%),^[15] Kumar *et al.* (60%),^[17] and Charalampaki *et al.* (78%).^[16]

CONCLUSION

The frequency of pituitary tumors varies greatly according to age and sex. The various tumor types have their peak occurrence in distinctly different age groups and differ greatly in their female-to-male ratios. The EETH is safe, effective and has a low complication rate. Postoperative assessment shows encouraging symptomatic improvement and significant hormonal normalization.

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Conflicts of interest

There are no conflicts of interest.

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