

Endoscopic Approach for Pituitary Tumours - Outcome and Complications - An Institutional Experience

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ABSTRACT

BACKGROUND

The endoscopic transsphenoidal approach and endonasal microscopic approach are both acknowledged and effective surgical techniques for patients of pituitary tumours. In this observational study, we describe the outcome and complications of the endoscopic approach (transsphenoidal endonasal endoscopic approach) for pituitary tumours.

METHODS

This study was carried out from July 2014 to March 2019 in the Department of Neurosurgery of a tertiary care hospital attached to a medical college in India. We enrolled 30 patients for our study. Assessment of outcome and complications was carried out for all patients over a period of five years.

RESULTS

Out of the 30 patients, 20 patients (66.7 %) presented with headache, 16 patients (53 %) with visual disturbance, 14 (46.7 %) with hypocortisolemia, 12 (40 %) with hypothyroidism, 9 (30 %) with acromegaly and 4 (13.3 %) with infertility. Intraoperative cerebrospinal fluid (CSF) leakage was the most frequently noted complication (40 %). 1 patient died due to carotid artery rupture. Complete tumour resection was confirmed in 86.7 % patients. For functioning PAs, 94.7 % patients achieved biochemical remission.

CONCLUSIONS

Major advancement is seen in endoscope-based trans-sphenoidal pituitary surgery in the management of pituitary macro adenoma. Both the patient and the treating surgeons are benefited by it and microscope-based surgery should be replaced because endonasal endoscopic approach provides better magnification, improved visualisation leading to better gland preservation rates and better extent of resection and has very few postoperative nasal complications.

KEYWORDS

Pituitary Adenoma, Endoscopic, Endonasal, Microscopic

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BACKGROUND

Pituitary adenomas (PAs) are common benign intracranial tumours. According to autopsy and magnetic resonance imaging (MRI) studies, their overall estimated prevalence is 17 % (range 1.5 % - 39 %).¹ The biological and clinical manifestation of PAs is wide, from small, incidental, asymptomatic lesions to giant, invasive, hormone producing tumours.² The objectives of treatment depend on the biochemical and anatomical characteristics of the tumour, but generally include preservation / restoration of pituitary function, decompression of neural structures and prevention of tumour recurrence. Treatment modalities have been constantly evolving, with introduction of new medications for biochemical control of tumours.^{3,4} Improved optimization of hormonal replacement therapies,⁵ novel surgical techniques for more efficient tumour removal^{6,7} and targeted methods to deliver radiotherapy.⁸

The endoscopic transsphenoidal approach offers some technical advantages over the traditional microscopic approach, but previously superiority of one technique over the other in terms of treatment outcome was not established.^{9,10,11} However now, treatment outcome of endoscopic approach is considered superior to microscopic approach,^{12,13} hence most pituitary centers adopt the endoscopic technique.¹⁴

METHODS

This study was carried out from July 2014 to March 2019 in the neurosurgery department of a tertiary care hospital attached to a medical college in India, after obtaining ethical clearance from the institutional ethical committee. Patients with pituitary adenoma of age more than 20 years, admitted to the centre constituted the study population.

Inclusion Criteria

(i) Age more than 20 yrs., (ii) Patients with all non-functional (non-secreting) symptomatic pituitary macro adenomas (more than 1 cm size) except the adenomas that requires extended endoscopic approach. (iii) Patients with all functional (secreting) either micro or macro pituitary adenomas, not responding to medical treatment.

Exclusion Criteria

(i) Non-functioning micro adenomas that received medical treatment, (ii) Functioning adenomas which are responded to medical treatment, (iii) Adenomas with large extension to the parasellar area (e.g. lateral compartment of cavernous sinus) and supra sellar adenomas sized more than 1 cm, that required extended endoscopic approaches, (iv) Patients that required re-intervention (revision cases) and (v) Nonpituitary tumours like craniopharyngioma, meningioma, chordoma. All patients signed informed consent and agreed to participate in this study. All the patients fitting with our inclusion criteria, who reported to

our centre between July 2014 to March 2019 were included in this study. Written informed consent was obtained from all the patients.

Endocrine, Neuroradiological, and Neuro-Ophthalmological Evaluation

All patients underwent preoperative hormonal evaluation which include serum cortisol, growth hormone, ACTH, free thyroxine, thyrotropin (TSH), prolactin (PRL), luteinizing hormone (LH), follicle-stimulating hormone and testosterone. Cushing's disease cases underwent dexamethasone suppression test and GH enhanced glucose tolerance test was performed in cases of acromegaly.

Preoperative neuro-radiological evaluation included Computed Tomography (CT) scans and MRI with contrast imaging of sellar and parasellar regions. If lesion found as a micro adenoma, that was further investigated by dynamic MRI. Pre-operative neuroophthalmological evaluation included formed an essential part of the evaluation, all patients underwent visual acuity and visual field testing. The following factors were taken into consideration in all patients- pre-op: (a) type of lesion, (b) imaging (c) endocrinological features, (d) post-operative outcomes, (e) complications. The following post op factors were considered: (a) post op neurological status, (b) complete endocrinological assessment, and (c) postoperative MRI scans (plane plus contrast) was repeated. A CT scan of sellar region was done on the next day of surgery to rule out possible complications. Sequence of MRI (plane with contrast) of sellar and parasellar region was performed post-op on 3, 6 and 12 months after the surgery and after this, annually.

We considered gross total removal (GTR) when postoperative imaging showed no residual tumour. In all cases the final histopathological diagnosis included study and classification by immunohistochemistry techniques. Factors confirming cure differ for functional tumours, for acromegaly cure is based on clinical remission and postoperative hormonal status that is GH ≤ 1 ng / mL and GH nadir of 0.2 ng / ml or less after an oral glucose tolerance test was performed at 3 and 6 months. In Cushing's disease morning cortisol level measurement ≤ 100 nmol / L requiring substitutive therapy obtained in the first 48 hours after surgery, plus low-dose dexamethasone suppression test and normal 24-hour urinary free cortisol at 3 and 6 months. In prolactinomas, PRL level ≤ 20 ng / mL) is considered sure. Patients who did not fall in these criteria were not be considered to be cured.

Data Collection Technique and Tools

Data was collected by Interviewing and examining the patients as well as patient's medical records i.e. CT scan, MRI scan, hormonal profile and blood reports preoperatively. All the patients were followed after 1year post-operatively for assessment. Thus data was collected systematically pre-operatively and 1 year post-operatively and was statistically analysed.

Statistical Analysis

Data has been summarized and presented as numbers with percentages and mean with standard deviation where applicable.

RESULTS

The age of patients who were included in the study ranged from 20 years to 67 years. The mean patient age was 40. Among 30 patients Females were 18 (60 %) and Males were 12 (40 %). The patient presenting with headache were highest in number 20 (66.7 %), visual complaints in 16 (53.3 %), hypocortisolaemia in 14, (46.7 %) hypothyroidism in 12 (40 %), acromegaly in 9 (30 %) and infertility in 4. (13.3 %) (Table 1) intraoperative CSF leaks occurred in 12 (40 %), one case (3.4 %) had carotid artery rupture leading to death of the patient. (Table 2)

Clinical Features	No. of Cases	% of Cases
Visual Complaints	16	53.3
Headache	20	66.7
Hypocortisolaemia	14	46.7
Hypothyroidism	12	40.0
Acromegaly	09	30.0
Infertility	04	13.3
Total	30	100.0

Table 1. Distribution of Studied Patients According to Clinical Features and Hormonal Screening

Intraoperative Complications	No. of Cases	% of Cases
CSF Leak	12	40
Carotid Artery Rupture	1	3.4
No Complication	17	56.6
Total	30	100.0

Table 2. Distribution of Patients According to Intraoperative Complications

Type of Hormone	Functional Adenomas				Total	
	Remission	Improvement			No. of Cases	% of Cases
	No. of Cases	% of Cases	No. of Cases	% of Cases		
GH	8	88.9	1	11.1	9	100.0
PRL	10	100.0	0	0.0	10	100.0
Total	18	94.7	1	5.3	19	100.0

Table 3. Pre-Operative Hormonal Evaluation in Secreting (Functional) Adenomas

Previous Visual Defects	Postoperative Neuro-Ophthalmological Evaluation						Total	
	Disappearance		Improvement		Unchanged			
	No. of Cases	% of Cases	No. of Cases	% of Cases	No. of Cases	% of Cases	No. of Cases	% of Cases
Hemianopsia	6	60.0	2	20.0	2	20.0	10	100.0
Quadrantanopsia	1	33.3	1	33.3	1	33.3	3	100.0
Complete Blindness	0	0.0	0	0.0	1	100.0	1	100.0
Total	7	50.0	3	21.4	4	28.6	14	100.0

Table 4. Distribution of Studied Patients According to Postoperative Neuro-Ophthalmological Evaluation

Complications	No. of Cases	% of Cases
Diabetes Insipidus	06	20.0
CSF Leak	02	6.7
Hypopituitarism	01	3.3
Meningitis	01	3.3
Death	01	3.3
No Complication	19	63.3
Total	30	100.0

Table 5. Distribution of Patients According to Postoperative Complications

Immediate postoperative MRI shows total removal in 25 (86.7 %) patients and subtotal removal in 5 (13.3 %) patients. There were two functional tumours found in the study prolactinomas were highest (10) had complete remission, GH secreting adenomas were 9 in that 8 (88.9 %) cases had complete remission, one (11.1 %) case showed improvement in symptom. (Table 3) Out of 14 patients presented with visual defects, 7 (50 %) cases had complete recovery, 3 (21.4 %) cases showed improvement and 4 (28.6 %) cases didn't show any improvement. (Table 4) Post-operative complications were found in 11 out of 30 cases-diabetes insipidus in 6 (20 %) patients, CSF leak were found in 2 (6.7 %) patients, hypopituitarism in one (3.3 %), meningitis in one (3.3 %) and death occurred in one (3.3%) patient and there were no complication in 19 (63.3 %) patients. (Table 5)

DISCUSSION

We included 30 patients of sellar and suprasellar pituitary adenomas in our study. The highest incidence of our cases was in the third and fourth decades of life, with mean age 40 years, which was coincident with the study by Shen et al.¹⁵ Who had 36.4 years as a mean of age. Men represented about 40 % and women represented about 60 %. Headache was the most common presenting symptoms in this study (66.7 %), which was reported in the study, 59 % by Zhang et al.¹⁶ and 61.5 % by Jackson et al.¹⁷ Visual complaints were represented 53.3 % of the patients, it was reported 60 % in the study by Eltabl et al.¹³ The mean operative time was 2.5 hrs. in the endoscopic approach in the study, however in traditional sub labial microsurgery vs. endoscopic surgery study by Federico et al.¹⁸ it was 3.4 hrs. and 2.7 hrs. respectively.

In the present study group, the most common pathology was prolactinomas in ten (33.3 %) cases followed by GH secreting adenomas in nine (30 %) cases. The study done by Daly et al.¹⁹ and Hemminki et al.²⁰ represented 41 % and 30 % respectively in their observations. Radical excision of tumour was achieved in 25 (86.7 %) cases and subtotal excision in five (13.3 %) cases. The residual was present in lateral and suprasellar masses. Vigorous manipulation was not performed for fear of injury to diaphragm sellae superiorly or to the cavernous sinus laterally. There were very few surgical complications and less need for wound packing and wound management and patients were more comfortable with this endonasal approach, the same was reported by the study Federico et al.¹⁸

There was less wound trauma with endoscopic approach resulting in less nasal and orodental complications. No patients had nasal septum perforation, sinusitis and gum wound disruption or massive nasal bleeding.²¹ Improved visualization allowed the surgeon to identify and avoid injury to normal pituitary, carotid prominences, hypothalamus, and optic chiasm leading to fewer complications with better outcome. The incidence of sinusitis was higher in the microscopic group, because trauma to the sphenoid sinus and nasal cavity is greater as reported in the study by Shahinian et al.²²

The complete improvement of vision was achieved in seven (50 %) cases and 3 (21.4 %) cases improved but did not reach the normal visual acuity and rest remained unchanged. Postoperative neuro-ophthalmological evaluation is not significantly associated with previous visual field defects (p -value > 0.05). All prolactinomas 10 (100 %) cases achieved complete remission and GH secreting adenomas out of 9 cases 8 (88.9 %) had complete remission, one (11.1 %) case showed improvement in the symptoms. Secreting adenomas are not significantly associated with pre-operative hormonal evaluation (p -value > 0.05).

Regarding postoperative complications, nasal complications were minimal like crusting, required frequent clearing and ENT follow up in our study group. And were 33.3 % in the microscopic group of study Eltabl et al.¹³ Post-operative CSF leak was noticed in two (6.7 %) cases which was similar to the study by Zhang et al.¹⁶ The post-operative CSF leak has been stopped by conservative management. Postoperative Diabetes Insipidus was noticed in six [20 %] cases, which was 9.75 % in microscopic group of study Messerer et al.⁹ Hypopituitarism was noticed in one [3.3 %] case, required hormonal replacement therapy. As compared to 10.7 % in microscopic group of study Messerer et al.²³

Meningitis was noticed in one [3.3 %] case which was treated with appropriate antibiotics after CSF culture and sensitivity. In the microscopic group of study by Messerer et al.²³ had an incidence of 4.87 %. One case [3.3 %] {1 of 30} had mortality due to intra-op rupture of unknown branch of internal carotid artery leading to diffuse SAH and tonsillar herniation in immediate postoperative period, and the study by A. B. Kassam et al.²⁴ reported mortality of 1.2 % [5 of 413] in their study, so precautions like MRI scans and intra-operative doppler are necessary to know the course of vessels.

CONCLUSIONS

Major advancement is seen in endoscope-based trans-sphenoidal pituitary surgery in the management of pituitary macro adenoma. Both the patient and the treating surgeons are benefited by it and microscope-based surgery should be replaced because endonasal endoscopic approach provides better magnification, improved visualisation leading to better gland preservation rates and better extent of resection and has very few postoperative nasal complications. We can use 0, 45, 70 degree endoscopes for better operating field. Because of this, approach time required for adjustment of microscope is saved and there is no narrowing of field of vision leading to better gland preservation rates and better extent of resection. Endoscopic technique maximizes patient safety by lowering complication rate, quick postoperative recovery and short hospital stays. Surgical outcome in endoscopic trans-sphenoidal approach is better than microscopic approach with regard to postoperative nasal complications.

Recommendations

Endocrine evaluation is required for pre-operative assessment including hormone tests such as cortisol, free thyroxin, thyrotropin (TSH), corticotropin (ACTH), prolactin (PRL), growth hormone (GH), luteinizing hormone (LH), follicle-stimulating hormone and testosterone. In Cushing's disease, a dexamethasone suppression test and in cases of acromegaly, GH enhanced glucose tolerance test are necessary investigations.

Neuro-radiological evaluation including CT PNS scan to assess midline septum and MRI with contrast imaging of sellar and parasellar regions, MRI coronal sections for internal carotid artery position should be done. Dynamic MRI for micro adenoma is required in pre-operative assessment in every case. Neuroophthalmological evaluation is required for formal visual-field and visual acuity testing.

Intraoperative carotid Doppler should be used to know the course of vessels and to avoid the major vessel injury. For each patient in postoperative neurological status, a full endocrinological assessment, and post-operative MRI scanning should be routinely performed in all patients at 3, 6 and 12 months after the surgery and annually. The surgical specimens will be studied and classified by immunohistochemistry techniques which will be useful in post-operative management.

In patients with functioning adenomas, surgical cure will be based on clinical remission and postoperative hormonal results. Standard criteria should be followed to declare cured cases.

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