Original Article

Outcomes following Purely Endoscopic Endonasal Resection of Pituitary adenomas

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Abstract

Background: *The use of endoscope for the management of pituitary adenoma is not new. The better magnification and illumination provided by the endoscope gives better outcome than microscopic pituitary surgery.* ***Objective:*** *To find out the benefits of endoscope in relation to microscopic surgery.* ***Materials and Methods:*** *We performed 45 cases of pituitary adenoma surgery by endoscopic endonasal approach from July 2008 to July 2010.* ***Results:*** *Forty five cases underwent endoscopic transsphenoidal approach. Gross total removal was done in 35 cases and subtotal removal was done in 10 cases. Residual tumours were seen in 10 cases (22%) in postoperative follow-up MRI scan. Visual improvement was satisfactory, and hormonal improvement of functional adenoma was nice. Postoperative visual acuity and visual field were improved in 75% cases. There were 37% cases of temporary diabetes insipidus and about 4.5% cases of permanent diabetes insipidus. The average duration of follow-up was 20 months. One patient required reexploration to correct visual deterioration in the immediate postoperative period. There were 4.5% cases of CSF leak and 6.6% mortality. Mortality was due to electrolyte imbalance and improper management of infection and hydrocephalus.* ***Conclusion:*** *Endoscopic endonasal pituitary surgery now has become a gold standard surgery for most of the pituitary adenomas because of its better advantages in relation to microscopic surgery and less complications and less hospital stay.*

Key words: *Endoscopic pituitary surgery, Endoscopic transsphenoidal approach, Endonasal endoscopic approach.*

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Introduction

Pituitary adenomas are slow growing tumours that constitute about 10-15% of all intracranial neoplasms. They can produce compression symptoms when enlarged or give rise to hormonal disturbances. These tumours are often diagnosed late or remain undiagnosed. Radiology is the best tool for diagnosis along with hormonal assays.[1] Since the late 1970s, the transsphenoid approach has been the preferred procedure for removal of these tumours.[1,2] With the advent of endoscopic surgery the endoscopes have now been applied to access these tumours with favourable results. The better magnification and illumination provided by the endoscopes have helped in precise delineation of the tumour and have ensured completeness of tumour removal.[2] It has also greatly reduced the postoperative morbidity.[2] Embryologically pituitary tumour is formed partly from brain tissue itself (the posterior lobe or neurohypophysis) and partly from upward extension of the Rathke's pouch (anterior lobe or adenohypophysis).[1-3] The average size of the pituitary gland is 12 mm (transverse) × 8 mm (sagittal) × 6 mm (vertical). It secretes various hormones required to maintain normal metabolic and

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cellular functions within the body. The gland has important relations with the optic chiasma and the cavernous sinus. The hormones secreted by the pituitary gland are thyroid stimulating hormone (TSH), follicle stimulating hormone (FSH), luteinizing hormone (LH), prolactin (PRL), growth hormone (GH), ACTH, alpha melanocyte-stimulating hormone (a-MSH) from the anterior lobe and oxytocin and vasopressin from the posterior lobe. Classically, pituitary tumours are divided into two groups: functional (secretory) and non-functional (non-secretory). The non-functional tumours usually do not present until reaching a sufficient size to cause mass effect or compression on the surrounding neurovascular structures, mainly the optic nerves. The functional tumours frequently present at an earlier stage caused by the physiological effects of the excess hormones they secrete. This distinction is not always adhered to as "secretory" tumours which may grow large enough to cause symptomatic mass effect and "non-secretory" tumours, that can grow and destroy the normal pituitary gland leading to a decrease in the secretion of some or all of the pituitary hormones, a condition known as panhypopituitarism which includes hypothyroidism, hypocortisolism and hypogonadism.[4,5]

Materials and Methods

This observational study included 45 cases of pituitary adenoma surgery by endoscopic endonasal approach from July 2008 to July 2010 in BSMMU and in some private clinics. Patient characteristics (age, sex, follow-up), tumour factors (size, position, extension, previous surgery), and outcomes (visual, endocrine, and surgical morbidity) were documented.

Steps of surgery

The surgery was done under general anaesthesia.

1. Position: The patient was supine on the operation table with the head resting on a horseshoe. The head and trunk were raised 10^0 and the head was slightly flexed and rotated 10^0 towards the surgeon.
2. Disinfection of the nasal cavities: Using a nasal speculum, cotton pledgets soaked in 50% polyvidone-iodine were placed along the floor of the nasal cavities and in the space between the nasal septum and the turbinates, and those were allowed to take effect for approximately 5 minutes.
3. Choice of the nostril: We usually chose both the nostrils.
4. Nasal stage: During this stage, a 0^0 telescope, 4 mm in diameter and 18 cm in length, was used freehand. Once the telescope was inserted into the chosen nostril, the inferior and middle turbinates, and the nasal septum were identified. With a tilleys forceps, long cotton pledgets soaked in diluted adrenaline (1/10,000) or xylometha-zoline hydrochlorate, were inserted in the space between the middle turbinate and the nasal septum to achieve a vasoconstrictive effect particularly at the relevant, richly vascularised areas. The middle turbinate was gently medialised or removed to make sure that the surgical pathway, that passes between the nasal septum and the turbinate itself (Fig 1), was wide enough. Once the cotton pledgets were removed, adequate inspection of the posterior portion of the nasal cavity, where the choana, the spheno-ethmoidal recess and the sphenoid ostium were identified was possible (Fig 1A).

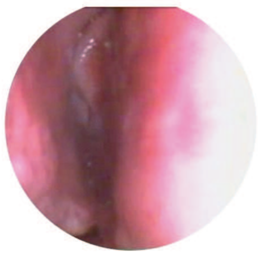

Fig 1A

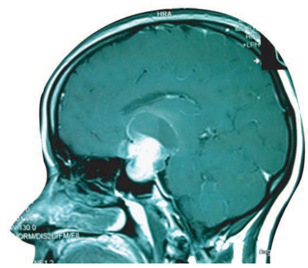

Fig 1B

Fig 1A. The middle turbinate and nasal septum
Fig 1B. The pituitary adenoma in sagittal view and the base of middle turbinate corresponding with sphenoidal air sinus.

5. Sphenoid stage: The sphenoid stage of the procedure begins with coagulation of the sphenoethmoidal recess. The target site of coagulation is located approximately 0.5 cm above the roof of the choana, or from the base of the middle turbinate up to the superior margin of the nasal cavity (Fig 2).

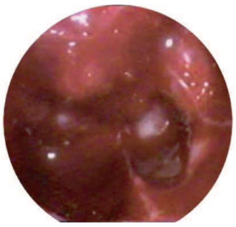

Fig 2. Sellar floor is seen following sphenoidectomy

6. Sellar stage: For free movement of the surgeon's hands and simultaneous use of two operating instruments during this stage of surgery, the 0^0 telescope (4 mm in diameter and 18 cm in length) was held by an assistant. The consistency of the sellar floor depends on the type of lesion present in the sellar cavity; it is nearly always intact in microadenomas, while it is frequently thinned-out and/or eroded in case of pituitary macroadenomas. Therefore, depending on its condition, the sellar floor was intially opened by diamond drill and the opening was made enlarged with kerrison bone punches. The dural opening was made by a cross (X), or a rectangular incision (Fig 3).

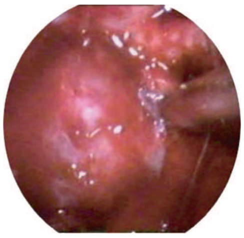

Fig 3. Bulged pituitary dura following sellar bone removal

7. Tumour removal: Following durotomy, the tumour was removed by suction and curettage – sometimes by two sucker techniques (Fig 4A, 4B).

Fig 4A

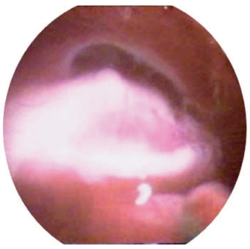

Fig 4B

Fig 4A. Tumour removal by pituitary microrounger

Fig 4B. Opening of suprasellar arachnoid after tumour removal

8. Closure: Sellar reconstruction was conducted in most of the cases, using various materials. Care had to be taken to avoid overpacking which could involve the risk of damage to the optic chiasma. If a CSF leak became evident during the operation, it was necessary to close the sellar floor by intradural, extradural or intraextradural ("sandwich") technique (Fig 5)

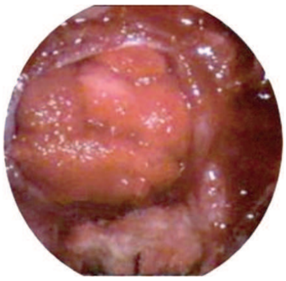

Fig 5. Filling of the sellar floor and sphenoidal air sinus by gel foam

Results

Forty five patients underwent endoscopic endonasal approach from July 2008 to July 2010 in BSMMU and some private clinics. Among them 25 cases were women and 20 were men (Table I). Male female ratio was 1:1.25. Age range was from 22 to 55 years (median was 33.5 years). Among 45 cases of pituitary adenoma 36 cases (80%) were macroadenoma and 9 cases (20%) were microadenoma. Functional adenomas were 11 (25%) which include acromegaly in 6 cases (54%), Cushing syndrome in 4 cases (36%) and prolactinoma in 1 case (10%) and rest 34 cases (75%) of the tumours were nonfunctional adenomas (Table II).

Table I: Distribution of sex and age (n=45)

Variables	Number	Percentage
Sex		
Male	20	44.45
Female	25	55.55
Age (yrs)		
10-20	3	6.66
21-30	6	13.33
31-40	10	22.22
41-50	18	40.00
51-60	8	17.77

Table 2: Distribution of pituitary adenoma (n=45)

Pituitary Adenoma		Number	Percentage
Nonfunctional		34	75.55
Functional	Acromegaly	6	13.33
	Prolactinoma	1	2.22
	Cushing	4	8.88
Total		45	100

Sellar enlargement was found in 33 cases (73%). Most of the cases had suprasellar extension. Only 8 cases (17%) had parasellar extension. Hydrocephalus was present in 5 cases (11%). Only 6 cases (13%) presented with pituitary apoplexy.

Table III: Distribution of hydrocephalus, pituitary apoplexy and sellar size (n=45)

Variables	Number	Percentage
Hydrocephalus		
Present	5	11.11
Absent	40	88.88
Pituitary apoplexy		
Present	6	13.33
Absent	39	86.66
Sellar Size		
Normal	12	26.66
Enlarged	33	73.33

The average duration of follow-up was 20 months. One patient required reexploration to correct visual deterioration in the immediate postoperative period.

Visual outcome

Preoperative visual presentation: Typical chiasmal syndrome (bitemporal hemianopia) was in 25 cases (55%), junctional syndrome (unilateral blindness and contralateral temporal field defect due to involvement of von Willebrand fibre of opposite optic nerve) was in 18 cases (40%) and bilateral upper quadrantanopia was in 2 cases (5%) (Table IV).

Postoperative visual outcome: Visual improvement was satisfactory. Postoperative visual acuity and visual field were improved in 35 cases (78%) (Table IV). The visual outcome (for both acuity and fields) was better in younger patients and those with a shorter duration of symptoms. Patients with lesser degrees of preoperative visual acuity compromise had better postoperative visual acuity outcome. However, the severity of preoperative visual field defects did not seem to predict postoperative field outcome, and even patients with severe preoperative field defects had striking postoperative improvement. Patients who had undergone prior operation were less likely to have good visual acuity improvement.

Table IV: Distribution of preoperative and postoperative visual status (n=45)

Visual status	Number	Percentage
Preoperative		
Bitemporal field defect	25	55.55
Unilateral blindness and contralateral field defect	18	40.00
Upper quadrantanopia	2	4.45
Postoperative		
Improved	35	77.78
Not improved/Static	8	17.78
Deteriorated	2	4.44

Endocrine outcome

Preoperative endocrine presentation: Typical endocrine findings were hypocortisolism in 12 cases (26%), hypothyroidism and hypogonadism in 17 cases (37%) in nonfunctional adenomas. In functional adenomas there were acromegaly in 6 cases (13%), prolactinoma in 1 case (2%) and Cushing syndrome in 4 cases (8%).

Postoperative endocrine outcome: Postoperative anterior pituitary dysfunction improved in 17 cases (37%) out of 45 cases. There were 37% cases of temporary diabetes insipidus (DI) and about 5% cases of permanent DI. In functional adenomas, all patients of acromegaly, Cushing syndrome and prolactinoma improved except 1 case of acromegaly who died following surgery.

Extent of resection

Among 45 cases undergoing endoscopic trans-sphenoidal approach, gross total removal was done in 35 cases and subtotal removal was done in 10 cases (Table V). Residual tumours were found in 10 cases (22%) in postoperative follow-up MRI scan.

Table V: Distribution of extent of tumour removal (n=45)

Extent of removal	Number	Percentage
Total	35	77.77
Subtotal	10	22.22

Postoperative mortality and morbidity

CSF leak was present in 2 cases, severe pneumocephalus in 2, meningitis in 3, postmeningitis hydrocephalus in 2 and 1 patient developed subarachnoid haemorrhage (SAH) (Table VI). There was 6.6% mortality. Mortality was due to electrolyte imbalance and improper management of infection and hydrocephalus.

Table VI: Distribution of morbidity (n=45)

Morbidity	Number	Percentage
Permanent DI	2	4.44
Temporary DI	17	37.77
Meningitis	3	6.66
CSF Leak	2	4.44
Pneumocephalus	2	4.44
Hydrocephalus	2	4.44
SAH	1	2.22

Discussion

Endoscopic management of pituitary adenoma offers not only the advantage of improved visualization, but also magnification, and a panoramic perspective of the important relationships of the sella turcica. The disadvantages of endoscopic pituitary surgery when compared to microscopic surgery are that endoscopic images are two dimensional monitor generated. The clearness and sharpness of the endoscopic images are little reduced than microscopic images. Endoscopic video-images are still inferior to those of direct microscopic visualisation. Digitally enhanced cameras have improved the picture quality to some degree. High-definition cameras and monitors will further improve the quality of endoscopic views. Another disadvantage is the learning curve for neurosurgeons who are already well trained in conventional microscopic surgery.[7] Postoperative CSF leakage has been a major potential complication in transsphenoidal surgery.[8] Occasionally it needs lumbar drainage, fluid therapy for its management. It may develop in early or late postoperative period. Meningitis, hydrocephalus, pneumocephalus are sequelae of CSF leak. Arterial bleeding, venous bleeding, subarachnoid haemorrhage are other potential complications.[8] In a study of Tabaee et al[9], endoscopic pituitary surgery was done on 821 patients where the overall mortality was 0.24%, permanent diabetes insipidus 1% and CSF leak was 2%. In our study, we had high rate of mortality, diabetes insipidus and CSF leak due to learning curve and improper postoperative management. Early diabetes insipidus was a common problem which was managed by injection vasopressin or minirin (desmopressin) nasal spray. Hypocortisolism, hypothyroidism and hypogonadism were common endocrine abnormalities which were usefully managed by hormone replacement therapy.

Now-a-days endoscopic pituitary surgery remains the main line of treatment for pituitary adenomas. The panoramic exposure, magnification and flexibility of the endoscope combined with the absence of skin incisions, brain retraction and cranial nerve dissection, give better outcome in endoscopic pituitary surgery. Endoscopic pituitary surgery now is not a fashion but an ongoing demand from the patient side for its greater advantages, maximum tumour removal, less complications, less hospital stay and no scar.

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