

The Role of Endoscopic Endonasal Approach to Pituitary Tumours: HUKM Experience

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Summary

Surgery for pituitary tumours at our institution was performed by rhinosurgical route by combined procedure by otolaryngologist and neurosurgeons. A retrospective review of case records of patients who had endonasal endoscopic transphenoidal approach for pituitary tumours from September 1998 to December 2004 was performed. A total of 81 trans-sphenoidal surgeries were performed during this study period. Only 68 case records with adequate information were available for review, 56 patients were included in the study and 12 were excluded. There were 24 males (42%) and 32 females (58%). The ethnic distribution, were 29 Malays, 24 Chinese, 2 Indian and 1 others. The age ranged from 16 years to 76 years, with a mean of 46 years. The majority of our patients presented with visual symptoms (38), headache (28), menstrual cycle disturbance or impotence (14) and acromegalic features (16). Forty patients had macroadenoma (71%) and 16 had microadenomas (29%). Thirty-six patients out of 40 macro-adenomas had suprasellar extensions (90%). Only eleven patients had lumbar drain inserted prior to commencement of the surgery and the majority of these were macroadenomas. The common complications encountered were diabetes insipidus (4), cerebrospinal fluid leak (2), meningitis (3), epistaxis (2), septal perforation (2), intercavernous sinus haemorrhage (3) and anterior pituitary insufficiency (2). Our study reveals that endonasal trans-sphenoidal approach is a safe and effective method of management of pituitary adenomas.

Key Words: Pituitary tumours, Endoscopic transphenoidal approach, Surgical technique, Presentation, Complications.

Introduction

Surgical access to the sellar and parasellar region can be accomplished through trans-cranial as well as extracranial approaches. Lesion in this area, which most commonly include pituitary adenoma, meningiomas, and craniopharyngiomas may have significant suprasellar component. The popular trans-sphenoidal approach has been utilized to extirpate lesions with significant midline suprasellar extension as well as those that extend to the clivus¹. The trans-cranial approach was originally favoured because of

better visualisation of the pituitary gland in the era before the operating microscope was developed.

Fedor Krause reported the first frontal trans-cranial approach to the sella in 1905 which was later used and modified by Dandy, Heuer, Frazier and Cushing^{2,3}. This approaches to the sella continued to dominate through the 1950s. Subsequent attempt to use trans-cranial approaches at the turn of 19th centuries and shortly thereafter resulted in high mortality rate that was generally considered prohibitive. As a consequence of high mortality rates associated with trans-cranial

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approaches, surgeons sought safer alternative extracranial routes to the sella turcica.

The first to propose extracranial trans-facial approach was Giordano in 1897. He described a trans-glabellar-nasal approach via bilateral paranasal and frontal incision and removal of ethmoid bone to reach the anterior wall of sphenoid sinus. Later in 1907 Schloffer reported the first successful removal of pituitary tumour via superior nasal trans-sphenoidal approach, which was based on Giordano's experimental work^{2,3}. In 1909, Kannavel refined and simplified this technique by intranasal transeptal approach in which external nose was reflected upward and septum was resected. In the same year, Theodor Kocher used the trans-nasal approach by resecting the septum sub-mucosally, thus allowing better visualization of sellar anatomy^{2,3}. In 1910, Oskar Hirsch, a Viennese otorhinolaryngologist, described the classical endonasal transeptal approach under local anaesthesia, which was used for almost 50 years. For a number of years, pituitary surgery was dominated by neurosurgeons, Dr Harvey Cushing, operated via sub-labial transeptal approach. Cushing abandoned the endonasal route in preference of transcranial approach as he reported mortality rates of 5.6% by the endonasal route. However, the trans-sphenoidal approach was later repopularised by Norman Dott of Edinburgh followed by Gerard Guiot of Paris and Jules Hardy of Montreal from late 1950's to 1960s^{2,3}.

Since then there have been numerous publications on the outcome of trans-sphenoidal surgery for various pituitary tumours generally. We report the endonasal endoscopic trans-sphenoidal approach to treat pituitary tumours at our referral institution.

Materials and Methods

A retrospective review of clinical records was performed on all patients with adequate data who had trans-sphenoidal surgery performed at our institution from September 1997 to December 2004. Data was collected based on clinical presentations, tumour sizes and their complications. All patients who had endonasal surgery were included in this study and those who had other approaches were excluded.

Micro-adenoma is defined as pituitary tumour less than 10mm and if the tumour is more than 10mm it is classified as macro-adenoma. For complications observed, diabetes insipidus is defined as post-

operative polyuria (urine output 3L/day) with urinary specific gravity less/equal to 1.005. It is defined as transient if post operative polyuria requiring desmopressin treatment persisted beyond discharge from hospital for less than or equal to three months in duration, and permanent if it persisted for greater than three months⁴.

Surgical Technique

The patients were orotracheally intubated and positioned with head slightly extended. The patient's midface was prepared and draped with towels. A bilateral greater palatine block was performed transorally. An oro-pharyngeal pack was placed and both nostrils packed with cotton pledgets soaked in a mixture of cocaine and adrenaline (1:1000 concentrations) for vasoconstriction for a minimum of 15 minutes. Local anaesthesia by using Naropin (Ropivacaine) 2mg/ml and adrenaline 1:80,000 was infiltrated intranasally into the nasal septum and the floor of the nasal cavity.

A hemitransfixation incision was made over mucocutaneous junction of the nasal septum. The bilateral mucoperichondrial flap of the cartilaginous septum was elevated under endoscopic guidance. The dissections extended to the perpendicular plate of the ethmoid bone and vomer upward as well as over the nasal crest of the maxillary bone and medial floor of the nose downward. The cartilage was detached posteriorly and inferiorly (chondrotomy) and a swing door quadrangular cartilage created.

A midsize Fahlbush or Hardy speculum was then inserted between the mucoperichondrial flap and the disarticulated septal cartilage pushed laterally. The perpendicular plate of the ethmoid was resected but the vomer was preserved as a midline guide to the anterior face of the sphenoid. The resected bones are preserved for sellar floor reconstruction. A wide sphenodotomy was performed and the sella was identified. In cases where the view is limited, an incision is done over the alar region (alartomy) to accommodate the bigger sized speculum.

Pituitary tumour excision was then performed by the neurosurgical team. After tumour removal, if a cerebrospinal leak was observed, the dural tear was sealed with a fascial graft using fibrin glue and the sphenoid sinus was packed with fat. The nasal septal cartilage was repositioned to the midline using a 13mm, 4-0 vicryl quilting suture. Care was taken to reposition the cartilage on the anterior nasal spine with a 4-0

vicryl suture. The nose was packed with merocel which removal were done 24 to 48 hours post surgery in uncomplicated cases. In complicated cases the merocel were removed after 72 hours.

Results

A total of 81 trans-sphenoidal surgeries were performed during the study period. Only 68 case records with adequate data were available for review, fifty eight patients were included in the study and twelve patients were excluded as the surgery was done by a different approach. There were 24 males (42%) and 32 females (58%). In terms of ethnic distributions, Malay were the majority (29), followed by Chinese (24), Indian (2) and others (1). The age ranged from 16 years to 76 years with a median of 46. The mean follow up was 45 months (three years and nine months), which ranged from six month to 87 months (seven years and three

months). The clinical presentations were also reviewed prior to the surgery (Table I). Majority of our patients presented with visual symptoms (38). Headache was the next most common presenting symptom (28), followed by menstrual cycle disturbance / impotence (14) and acromegalic features (16).

Macroadenomas constituted the bulk of the cases (40) and only 16 were micro-adenomas. Thirty-six patients out of 40 macro-adenomas (90%) had suprasellar extensions. Only twelve patients had lumbar drain inserted before the procedure commenced.

The common complications reported were diabetes insipidus (4), cerebrospinal fluid leak (2), meningitis (3), epistaxis (2), septal perforation (2), intercavernous sinus hemorrhage (2) and anterior pituitary insufficiency (2). (Table III) There was one postoperative death (1.4%), which was due to multiple medical problems such as diabetes mellitus and congestive heart failure.

Table I: Clinical presentation at the time of diagnosis

Symptoms	Patient N(%)
Visual Symptoms	38(68)
Headaches	28(50)
Disturbance of Menstrual Cycle / Impotence	14(25)
Change In Appearance or Acromegaly	16(28)
Fatigue	6(11.2)
Anosmia	1(2)
Ptosis	1(2)
Incidental Findings	1(2)

Table II: Radiological assessment pre-operatively

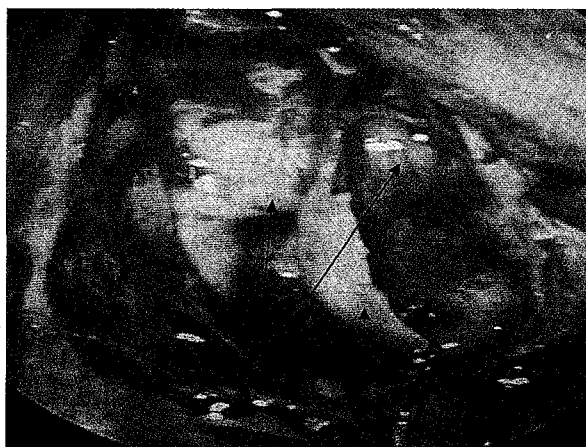
Radiological Investigations	No of Patients
MRI & CT Scan	33
MRI Only	20
CT Scan Only	1

Table III: Complications of transphenoidal pituitary surgery

Complications	Patient N (%)
Diabetes insipidus	4(7.1)
CSF leaks	2(3.6)
Meningitis	3(5.3)
Intercavernous sinus haemorrhage	2(3.6)
Septal perforation	2(3.6)
Anterior pituitary insufficiency	2(3.6)
Procedure abandoned due to bleeding	1(1.7)

Table IV: Comparison of complications rates with other published series

Complications	Complications(%)					
	Present Study	Woolons <i>et al</i> ⁵	Ciric <i>et al</i> ⁶	Black <i>et al</i> ⁷	Wilson & Dempsey ⁴	Kennedy <i>et al</i> ⁸
Diabetes insipidus	7.1	8.7	3.4	2.0	9.1	9.6
Cerebrospinal fluid leak	3.6	4.3	1.1	2.7	6.6	9.6
Meningitis	5.3	0.5	0.2	0.4	3.2	1.8
Nasal septal perforation	3.6	7.6	4.1	-	-	7.0
Visual loss	-	1.1	0.5	-	2.8	0.9
Intercavernous sinus hemorrhage	3.6	1.6	0.6	0.4	1.2	0.9
Ophthalmoplegia	-	1.4	0.3	-	1.2	-
Sinusitis	-	0.5	-	1.2	1.2	15

**Fig 1: Endoscopic endo-nasal view of sella via a wide sphenoidotomy. The inter-sinus septum of sphenoid is shown by dashed arrow and the sella by double arrow.**

Discussion

Pituitary adenomas represent 10-12% of all intracranial tumours. They are histologically benign lesions originating in the adenohypophyseal cells. Despite their histological benign nature, the mass effect on the optic apparatus and adjacent structures such as cavernous sinus, hypothalamus, and cerebrospinal fluid pathways may reflect their presentation^{8,9,10}. Our study reveals that visual defect was the most common symptoms (68%), followed by headache (28%), disturbance of menstrual cycle (14%) and acromegaly (25%), fatigue (11.2%), anosmia and ptosis 1% respectively. Cannavo *et al*¹¹ reported a slightly different observation with most common symptoms being oligomenorrhea (62%), galactorrhea (59%), headache (16%) and growth failure (9%). Whereas Ciric *et al*⁶ noted the most frequent symptoms chronologically were headache, galactorrhea and dysmenorrhea, while visual defect was the most frequent sign. The variation in our study could likely be due to wide adult age groups whereas Cannavo *et al*¹¹ constituted teenagers only.

Diabetes insipidus is the most common complication reported, persisting in 0.4 to 9.6% of cases^{4,5,6,7,8}. Initial treatment of this problem involves administration of cortisone and subcutaneous vasopressin, which is subsequently converted to vasopressin nasal spray. In present study 25% had transient diabetes insipidus with urine output of at least 800ml/3h or 3 litres/24 hours. Only 7.1% of these were persistent which required vasopressin treatment. Hardy *et al*¹² suggest that this complication was due to a direct manipulation or trauma to the hypophyseal stalk. Kenan *et al*¹⁰ in his report suggested that some degree of diabetes insipidus is frequently present throughout immediate post-operative period and, in most instances, resolves dramatically within 24 to 48 hours. Therefore, routine administration of cortisone is advisable for some time post-operatively, even when pre-operative pituitary function is normal.

Cerebrospinal fluid fistula can occur in 1.1% to 9.6% of patients^{4,5,6,7,8}. Two patients (3.6%) with CSF leaks in our study required surgical repair. All of these patients had macro-adenoma with suprasellar extension. Spinal drains were initially advocated and surgical repair performed if leak persisted. Current management advocates for immediate repair of CSF leak, which has the advantage over conservative treatment, namely reduced prophylactic antibiotic coverage, reduced patient hospital admissions, and decreased incidence of meningitis. Repair by endoscopic approach need

special attention to avoid bulky graft as it may compress optic chiasma, which may affect the vision¹³.

Loss of vision post operatively is one of the most feared complications of trans-sphenoidal surgery. Barrow *et al*¹³ suggested that potential risk factors thought to increase the likelihood of this complication include the presence of macro-adenoma, pre-operative visual impairment, a dumbbell-shaped tumour, vascularity of tumour and a history of previous pituitary surgery or radiotherapy. In our series, there was no evidence of visual loss.

Meningitis is a rare complications and it has been documented to occur in 0.2% to 3.1% of cases^{4,5,6,7,8}. Woollons *et al*⁶ reported 0.5% incidence of meningitis in his 185 cases of trans-sphenoidal surgery, whereas in our study a 5.3% incidence of meningitis was evident. Post-operative CSF leakage and significant preoperative sinus infection have been implicated as a risk factor for meningitis.

Frank epistaxis was evident in two patients, one resolved subsequently by repacking and the other needed cauterisation under local anaesthesia after failed repacking. None of our patients had a massive bleeding that required blood transfusions.

Nasal septum perforation is not an uncommon complication of trans-sphenoidal surgery. Often small mucosal tears were evident upon withdrawing the bivalve Hardy speculum from the nose. Unless there were bilateral symmetrical tears, the majority tends to heal well. The incidence of septum perforation is more common in cases with gross deformity of the nasal septum, re-exploration for CSF leak, in a revision surgery and surgery in post-radiated patients. Patients who had previous surgery or radiation were at higher risk as a result of difficult dissection caused by adherent mucosal flap. Previous studies have shown the incidence of septum perforation ranged from four to 40%^{5,8}. In our study, the incidence of septum perforation was 3.6%.

The estimated mortality rate in trans-sphenoidal surgery is 0.9%^{5,14}. In our study, there was only one case (1.7%) of post-operative mortality in a pre-morbidly patient with multiple medical problems such as diabetes mellitus and congestive heart failure.

More serious complications listed in the literature can occur but were not encountered in our study. These

include carotid artery injury, fracture of sphenoid body, hypothalamic injury, cosmetic problems and synechia formation. Presence of synechia post-operatively was due to mucosal tear that fused together forming a band of tissue that may cause certain degree of nasal obstruction.

Conclusion

Trans-sphenoidal surgery has evolved since it was started in early 1900s and it continues to be modified

by otorhinolaryngologist and neurosurgeons as joint rhinosurgical procedure for better visualization of the sella. Pituitary tumours in our study mainly presented with visual symptoms, followed by headache, menstrual disturbance or/impotence and acromegalic features. The complication rates encountered were similar to other larger series. The trans-cranial approach carries a higher risk of mortality and morbidity. The endo-nasal trans-sphenoidal route remains the choice of approach in the management of pituitary tumours at our referral centre.

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