Case Series

Early Outcome of Endoscopic Trans-nasal Trans-sphenoidal Pituitary Surgery in Kano, Nigeria

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Abstract

Endoscopic trans-nasal trans-sphenoidal hypophysectomy is a minimally invasive surgical procedure aimed at resection of pituitary tumors. This technique is widely practiced in developed countries but is presently gaining popularity in our environment. This study was aimed at presenting our preliminary outcomes as it relates to the technique of endoscopic trans-nasal trans-sphenoidal pituitary surgery in Kano, Nigeria. This was a retrospective study of patients with pituitary tumors that presented at a government tertiary and private specialist health institutions from October 2018 to December 2019. They all had excision of varying degrees of pituitary tumors via endoscopic trans-nasal trans-sphenoidal approach under general anesthesia. There were 4 females (66.7%) and 2 males (33.3%) and their ages ranged between 25 – 60 years. They presented with varying degrees of clinical symptoms such as gynaecomastia, galactorrhea, irregular menstruation, infertility, intermittent headache and visual impairment. Four (66.7%) had complete tumor excision and 2 (33.3%) had incomplete excision. Four (66.7%) had complete symptom relief and 2 (33.3%) had significant improvement in symptoms. The complications of surgery were nasal septal adhesion 1(16.7%), CSF leak 1(16.7%) and transient diabetes insipidus 2(33.3%). All complications were resolved during admission and at follow up visits. Histopathological analysis of specimens confirmed 5 cases of pituitary adenoma and a case of pituitary Rathkes cleft cyst. Endoscopic trans-nasal trans-sphenoidal pituitary surgery is feasible and has a favorable outcome in our setting with prospects for improvement to ensure safety. Keywords: Nasal endoscopy, Sinus surgery, Pituitary tumors, Skull base, Hypophysectomy.

Keywords: Hypophysectomy, nasal endoscopy, pituitary tumours, sinus surgery, skull base

Introduction

The advent of endoscopes and its introduction into sinus surgery has revolutionised surgical approaches to lesions of the nose, paranasal sinuses and skull base. Furthermore, endoscopic sinus surgery and endoscopic skull-base surgery (ESBS) have advanced worldwide due to various technological advancements, existence of angled endoscopes, high-definition monitors, microsurgical instruments, powered microdebrider, high-resolution imaging modalities (computed tomography scan and magnetic resonance imaging),[1,2] image-guided navigation system and robotic surgery.[3-5] Notwithstanding, these techniques are still presently rudimentary and gradually gaining acceptance in our environment. Although these procedures may appear easy to many, their steep learning curves and very expensive set-up are some of their acclaimed idiosyncrasies. As such, with the exclusion of a few institutions, conventional methods of sinus and skull-base surgeries are common in practice in most centres in Nigeria.[6]

Endoscopic trans-nasal trans-sphenoidal hypophysectomy is a minimally invasive surgical procedure aimed at resection of pituitary tumours. Amid other advantages, it has been shown to provide excellent exposure and visualisation of the surgical field as compared with the traditional operating microscope. In

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addition, its supremacy over trans-cranial, sublabial trans-septal and external rhinoplasty techniques has been well established in the literature.[7-9] As a consequence, it offers better if not complete tumour resection and lesser incidence of complications.[7,10,11]

This study presents our preliminary outcomes as it relates to the technique of endoscopic trans-nasal trans-sphenoidal pituitary surgery in Kano, Nigeria.

Materials and Methods

This was a retrospective study of all patients with diagnosis of pituitary tumours who presented at a government tertiary and private specialist health institution from October 2018 to December 2019 and who had surgery by the authors. The procedures followed were in accordance with the ethical standards of the committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2000. Preoperatively, all patients were reviewed by the team in order to reach a consensus with regard to the surgical approach, post-operative care and fitness to undergo surgery. All patients had blood grouped and cross matched and available in theatre on operative day.

All surgeries were performed under general anaesthesia via oro-tracheal intubation with a gauze pack in the hypopharynx. The patients were positioned supine with their heads fixed with a Mayfield headrest. The chin-forehead line was maintained horizontal, with 15° contralateral tilt and 15° turned towards the surgeon. The trunk was elevated 20° to reduce bleeding and bring the surgical field closer to the surgeon. A four-handed technique was used with one surgeon at the right side close to the head of the table and the other surgeon by his side and at the right side of the patient's chest. The surgical technique was performed in three stages:

Nasal stage

Several pieces of Merocel soaked in 1:5,000 adrenaline solution were used to decongest the nasal mucosa to improve access and reduce bleeding. In some cases, 1:1,000 adrenaline solution was suitable to achieve a satisfactory surgical field.

Afterwards, diagnostic nasal endoscopy was carried out using an illuminated Karl Storz 4 mm, 18 cm, 0° high-definition sinuscope. Three standard nasal passes were done, and all anatomical landmarks and anomalies were noted. The middle and superior turbinates were lateralised in order to decongest and access the sphenoethmoidal recess [Figure 1].

This recess was then packed serially with Merocel soaked in adrenaline 1:1000 solution for 5 min. The lower half of the superior turbinate was excised using a Xomed microdebrider cutting blade, and the posterior ethmoids and sphenoid ostium were visualised. A salvage flap was then developed using a monopolar sickle knife by making a horizontal incision from the sphenoid ostium to a point 1 cm in front of the anterior end of the middle turbinate. This flap was partially pushed downwards using a suction freer's elevator, and the underlying septal framework was exposed. A posterior septectomy was performed by removing the posterior third of the nasal septum and debriding away the contralateral mucosa over the sphenoid face. The perpendicular plate of the ethmoid and vomer bone near the rostrum was fractured and removed to expose the anterior face of the sphenoid bone.

Sphenoid stage

Submucosal dissection of the mucosal flap over the contralateral face of the sphenoid was done, and the contralateral sphenoid ostium identified revealing a typical owl eye appearance of the surgical site. A V-shaped osteotomy was performed using a 1–2 mm kerrison forceps from the anterior face from the ostia to the floor of the sphenoid sinus. A strong scissor was used to disarticulate the superior end of the face of the sphenoid, and a mallet and gouge was used to chisel out the rostrum of the sphenoid inferiorly [Figure 2].

Afterwards, the rostrum was removed using a pituitary rongeur. The anterior sphenoidectomy was then widened to its limits, i.e., superiorly to the skull base, inferiorly to the pterygosphenoid synchondrosis and laterally to the orbital apex in the posterior ethmoids. The sphenoid mucosa was coagulated using bipolar probes and stripped to expose the intrasphenoid structures and landmarks [Figure 3].

Sellar stage

A Xomed hand drill attached to a Xomed XPS 3000 console and a long coarse diamond burr with irrigation was used to thin out the bone over the sellar floor and in some cases the tuberculum sella. A micro ring curette and kerrison forceps were used to peel off and punch out the thinned out bone, thereby exposing the endosteal layer of the sellar dura [Figure 4].

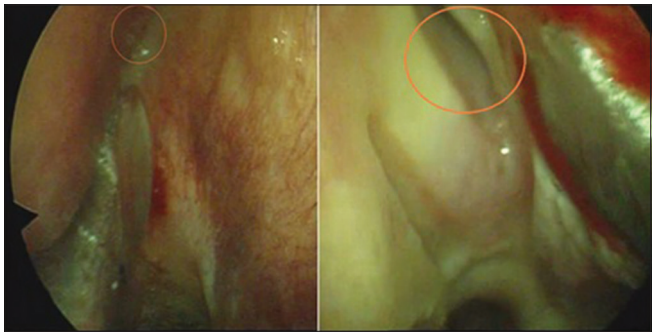

Figure 1: Exposed right and left sphenoethmoidal recesses, respectively, after adequate decongestion of the nasal mucosa

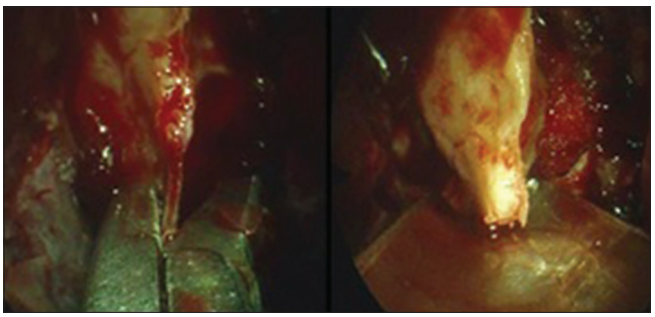

Figure 2: A V-shaped osteotomy on the face of the sphenoid bone and the rostrum chiselled out with a gouge

The dura was opened using a 15-blade surgical knife via a cruciate dural incision with suction in the other hand. A cusp pituitary forceps was used to take biopsy of lesions [Figure 5].

The tumours were removed using a combination of suction nozzles and ring curettes in a systematic fashion and under vision. The angled endoscopes were used to locate tumour remnants [Figure 6].

The sellar cavity was packed with Surgicel and fibrin glue was sprayed over it. In some cases, the Hadad-Bassagasteguy flap was used to reinforce the sellar repair.

Haemostasis during the nasal stage was achieved using Merocel packs soaked in 1:1,000 solution, and in 1 case, Floseal was used to arrest cavernous sinus bleeding. The sphenoid sinus was packed lightly with stringed Merocel sponges soaked in 10% povidone-iodine to prevent post-operative infection. The middle turbinates were returned back to their anatomical position, and the nasal cavities were suctioned. No packs were placed in the nasal cavities. The throat packs were removed, and the general anaesthesia was reversed. All specimens were sent for histopathological analysis.

Post-operative protocol included 24-h monitoring of urinary output, urea, electrolytes and creatinine, hormonal assays and diagnostic nasal endoscopy. All patients were followed up appropriately by the neurosurgeons, endocrinologists and otolaryngologists. For those with partial resections, they were followed up longer and are still on clinic appointments at intervals.

Results

There were 4 females (66.7%) and 2 males (33.3%), and their ages ranged between 25 and 60 years. They presented with varying degrees of clinical symptoms such as gynaecomastia, galactorrhoea, irregular menses, infertility, intermittent headache and visual impairment. Tables 1 and 2 show the pre- and post-operative parameters of male and female patients, respectively.

Table 1: Pre- and post-operative parameters of male patients that had endoscopic trans-nasal trans-sphenoid hypophysectomy

Parameters	Pre-operative	Post-operative
Case 1: 35 years		
Headache	No headache	No headache
Gynaecomastia	Distressing	Mildly distressing
Galactorrhoea	Frequent complaint	Infrequent complaint
Menstrual irregularity	No irregularity	No irregularity
Serum prolactin	1974 ng/mL	35 ng/mL
Visual acuity	6/6 normal	6/6 normal
Visual field	Early peripheral scotoma	No scotoma
MRI/CT scan	Pituitary tumour	No pituitary tumour
Case 2: 60 years previous history of surgery - External approach		
Headache	Mild headache	No headache
Gynaecomastia	No gynaecomastia	No gynaecomastia
Galactorrhoea	No galactorrhoea	No galactorrhoea
Menstrual irregularity	No irregularity	No irregularity
Serum prolactin	12 ng/mL	10 ng/mL
Visual acuity	Right = NPL, left = 6/36	Right =NPL, left=6/18
Visual field	No defect	No defect
MRI/CT scan	Pituitary tumour	Residual pituitary tumour

MRI: Magnetic resonance imaging, CT: Computed tomography

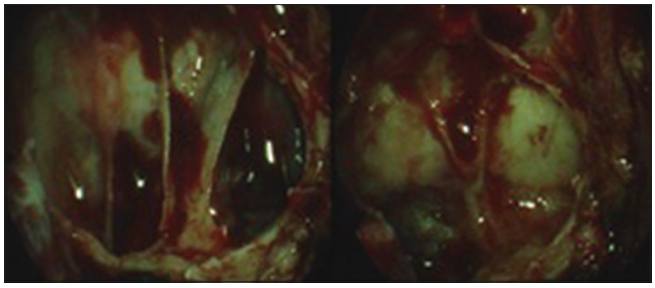

Figure 3: The intrasphenoid cavity with multiple median, paramedian septae and exposed right and left Onodi cells

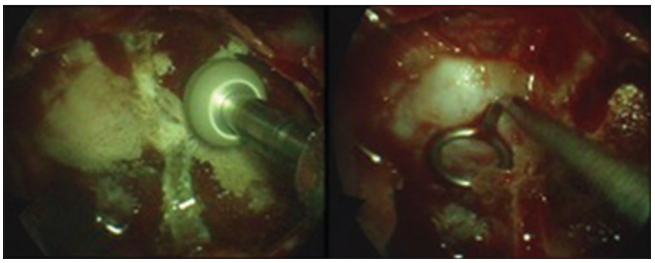

Figure 4: Drilling of the sellar floor and peeling off of the thinned wall to expose the endosteal layer of the dura

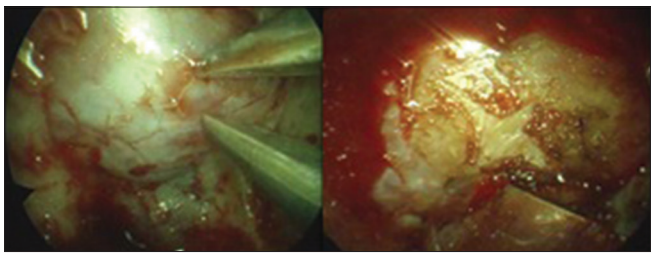

Figure 5: Exposed endosteal layer of the dura and a 15-blade knife used to make a cruciate incision through the endosteal and meningeal layers of the dura

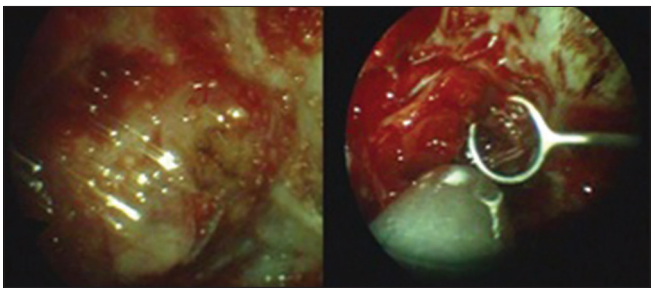

Figure 6: Oak-like pituitary tumour and a suction nozzle and ring curette used to remove tumour in the sellar cavity

Table 2: Pre- and post-operative parameters of female patients that had endoscopic trans-nasal trans-sphenoid hypophysectomy

Parameters	Pre-operative	Post-operative
Case 1: 25 years		
Headache	No headache	No headache
Gynaecomastia	No gynaecomastia	No gynaecomastia
Galactorrhoea	Frequent complaint	Infrequent complaint
Menstrual irregularity	No irregularity	No irregularity
Serum prolactin	14,100 ng/mL	1360 ng/mL
Visual acuity	6/6 normal	6/6 normal
Visual field	No defect	No defect
MRI/CT scan	Pituitary tumour	No pituitary tumour
Case 2: 35 years		
Headache	Severe	Not severe
Gynaecomastia	No gynaecomastia	No gynaecomastia
Galactorrhoea	Frequent complaint	Infrequent complaint
Menstrual irregularity	No irregularity	No irregularity
Serum Prolactin	719 ng/mL	213 ng/mL
Visual acuity	6/6 normal	6/6 normal
Visual field	No defect	No defect
MRI/CT scan	Pituitary tumour	No pituitary tumour
Case 3: 44 years and 2 previous surgeries - external and endoscopic approach		
Headache	No headache	No headache
Gynaecomastia	No gynaecomastia	No gynaecomastia
Galactorrhoea	Frequent complaint	Infrequent complaint
Menstrual irregularity	No irregularity	No irregularity
Serum prolactin	38,000 ng/mL	1300 ng/mL
Visual acuity	NPL both eyes	NPL both eyes
Visual field	Not applicable	Not applicable
MRI/CT scan	Pituitary tumour	Residual pituitary tumour
Case 4: 59 years		
Headache	Moderate	Mild
Gynaecomastia	No gynaecomastia	No gynaecomastia
Galactorrhoea	Frequent complaint	Infrequent complaint
Menstrual irregularity	No irregularity	No irregularity
Serum prolactin	0.3 ng/mL	Not done
Visual acuity	6/6 normal	6/6 normal
Visual field	No defect	No defect
MRI/CT scan	Pituitary tumour	No pituitary tumour

MRI: Magnetic resonance imaging, CT: Computed tomography

Four (66.7%) had complete tumour excision and 2 (33.3%) had incomplete excision. Four (66.7%) had complete symptom relief and 2 (33.3%) had significant improvement in symptoms [Figure 7].

The complications of surgery were nasal septal adhesion 1 (16.7%), cerebrospinal fluid (CSF) leak 1 (16.7%) and transient diabetes insipidus 2 (33.3%). All complications were resolved during admission and at follow-up visits. Histopathological analysis of specimens confirmed 5 cases of pituitary adenoma and a case of pituitary Rathke's cleft cyst.

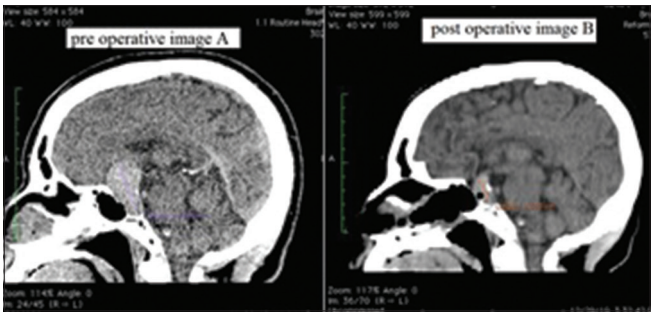

Figure 7: Pre- and post-operative findings in a patient with pituitary macroadenoma with suprasellar extension of the tumour

Discussion

ESBS is currently in use in the management of diverse skull-base pathologies. Furthermore, its scope and application continue to expand as both surgical techniques and experience with more complex lesions' advances. Precisely, it is now selectively employed to treat lesions from the frontal sinus to the clivus and also those relating to the anterior, middle and posterior intracranial fossae. Endoscopic trans-sphenoidal pituitary surgery is now a widely accepted approach for resection of pituitary tumours because of its advantages of improved visualisation and minimal invasiveness.[10]

In this study, 3 (50%) of our patients presented with visual disorders and 2 (33.3%) improved after surgery. In addition, 5 (83.3%) of our patients had macroadenomas confirmed via imaging and histopathological analysis. In line with our findings, pituitary macroadenomas (>10 mm diameter) remains one of the most common indications for ESBS and have often been reported to present with visual deficits, reduced visual acuity and impaired colour perception related to chiasmal compression such as visual field deficits (46%–75%) and decreased visual acuity (14%–44%).[12,13] Probable cause is the fact that the tumour may compromise the arterial supply of the optic nerve or chiasm or by direct pressure on the anterior visual pathway. This nerve compression may decrease axoplasmic conduction with or without axonal demyelination which can be observed even after 2 days.[14] Furthermore, the remarkable improvement in vision observed in some of our patients despite partial tumour resections lends credence to the fact that sufficient decompression of the optic nerve/chiasm can be achieved with even partial resection of pituitary tumours.[15,16] At variance with our findings, post-operative visual deficits/deterioration after trans-sphenoidal surgery has been reported in up to 4% of cases.[17] This might be a consequence of either direct surgical damage, vascular compromise, post-operative bleeding, overpacking in sealing a CSF leak or as a consequence of optic nerve and chiasm prolapse into an empty sella.[18]

Furthermore, in this study, majority (5, 83.3%) of our cases had secreting pituitary adenomas (prolactinomas). In addition, they were all found to have good endocrine remission postoperatively with dramatic symptomatic improvement. To corroborate our findings, Cho and Liau demonstrated significant hormonal remission (66%) in patients that had endoscopic hypophysectomy for pituitary tumours.[9] Hence, our findings lend credence to advocates of endoscopic trans-sphenoidal surgery in the resection of secreting pituitary adenomas. Among other advantages, they argue that it offers improved illumination and panoramic field of view and is a minimally invasive approach.[19] Although it is a standard clinical practice to routinely do an endocrine evaluation of all anterior pituitary hormones, this was not strictly adhered to in our resource-limited setting. We routinely do serum prolactin as it is readily available and affordable. However, it takes weeks to get results of growth hormone, adrenocorticotrophic hormone and serum cortisol assays which are also very expensive. Unfortunately, none of the patients in this study were able to afford the cost of all the hormonal assays. As such, we had to rely on their clinical features to request for some hormonal assays in order to prevent the patients conditions from deteriorating.

Postoperatively, this study found that 33.3% of our patients had transient diabetes insipidus which was effectively treated using fluid, electrolytes and desmopressin therapy. In agreement, several large endoscopic series have reported the incidence of transient diabetes insipidus to be between 4.6% and 8.7%.[20,21] In patients with pituitary adenomas, it typically arises 24 h–48 h postoperatively presumably due to disruption or surgical manipulation of the hypothalamic-hypophyseal transit of the nonapeptide arginine vasopressin at the level of the neurohypophysis or infundibulum leading to decrease in serum levels.[22] Diagnosis of such electrolyte imbalances requires a high index of suspicion as well as close clinical and laboratory follow-up to prevent potentially catastrophic complications.[20,22]

It is recommended that after pituitary adenoma resection, an effective skull-base repair is crucial to avoid a post-operative CSF leak and related complications such as meningitis, pneumocephalus and reoperation.[23,24] These CSF leaks can be confirmed with a Valsalva manoeuvre by the anaesthesiologist or use of intrathecal fluorescein. In this study, we found only 1 (16.7%) of our patients developing small CSF leak intraoperatively which was repaired immediately by plugging the defect with Surgicel, a septal bone graft and CSF diversion with a lumbar drain. A possible reason for the low incidence of CSF leak might be that most pituitary macroadenomas are known to remain confined in the subdiaphragmatic space; therefore, high-grade leaks are less common than with other parasellar pathologies such as craniopharyngiomas.[24]

Conclusion

Endoscopic trans-nasal trans-sphenoidal pituitary surgery is feasible and has a favourable outcome in our setting. Notwithstanding, this study was limited by the small sample size; therefore, our findings cannot be dubbed as universal. It is recommended that large multicentre studies are necessary, especially in our locale in order to corroborate our findings and also assist in establishing standard facts on this subject matter in Nigeria.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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