ISSN 1220-8841 (Print)
ISSN 2344-4959 (Online)

ROMANIAN
NEUROSURGERY

Vol. XXXVII | No. 1 March 2023

Combined endoscopic-microscopic trans-nasal trans-sphenoidal approach for pituitary adenomas. An institutional experience

Mohammad Kaif,
Kuldeep Yadav,
Amit Upadhyay,
Deepak Kumar Singh,
Rakesh Kumar Singh,
Ashish Chandra Agarwal,
Kshitij Sinha

DOI: 10.33962/roneuro-2023-015

Romanian Neurosurgery (2023) XXXVII (1): pp. 95-100
DOI: 10.33962/roneuro-2023-015
www.journals.lapub.co.uk/index.php/roneurosurgery

Combined endoscopic-microscopic trans-nasal trans-sphenoidal approach for pituitary adenomas. An institutional experience

Mohammad Kaif, Kuldeep Yadav, Amit Upadhyay, Deepak Kumar Singh, Rakesh Kumar Singh, Ashish Chandra Agarwal, Kshitij Sinha

Dr Ram Manohar Lohia Institute of Medical Sciences, Lucknow, Uttar Pradesh, INDIA

Keywords
pituitary macroadenomas, micro-endoscopy, trans-nasal surgery, endoscopy

ABSTRACT

Objective. To obtain evidence that the use of endoscopy along with a microscope in the surgical management of pituitary tumours improves intraoperative visualization and significantly impacts operative outcomes in the trans-nasal approach.

Material and methods. Each patient underwent endonasal transsphenoidal microscopic tumour resection. The procedure was modified by the use of intrasellar endoscopy as an adjunctive imaging modality. Following complete microscopic resection of tumour, rigid 0° and 30° 4.0-mm endoscopes were used to conduct a final survey of the sellar and parasellar spaces. Residual tumour fragments identified during this endoscopic examination were removed.

Results. In 50 patients with pituitary macroadenomas, the rigid 30 ° angled rigid endoscope was found to be highly beneficial. Hidden areas could be visualized and tumour residues were detected. In the majority of the patients with detected tumour residues, adenomatous remnants were safely removed by meticulous endoscopic dissection under optimum visual control after the main part of the tumour had been removed with the operating microscope.

Conclusions. Endoscopy provides distinct advantages over microscopy in imaging intrasellar and parasellar structures during pituitary tumour resection which are often missed by microscopy alone.

Corresponding author:
Kshitij Sinha

Dr Ram Manohar Lohia Institute of Medical Sciences, Lucknow, Uttar Pradesh, India

kshitij.sinha0023@gmail.com

ISSN online 2344-4959
© Romanian Society of Neurosurgery

First published
March 2023 by
London Academic Publishing
www.lapub.co.uk

INTRODUCTION

Since Sir Victor Horsley[1] performed the first surgery for pituitary tumor, different approaches have been described for it. The transnasal-trans-sphenoidal route by Schloffer [2] and Cushing[3] sublabial trans-septal route had been widely used. This surgery was further improved with the introduction of the microscope by Hardy[4] and the use of endoscope in management the first time for such lesions, by Jankowski[5]. With the evolution in the technology of endoscope, it's use has become much more frequent[6].

The endoscopic transsphenoidal approach requires different surgical skills from those needed for microsurgery. Surgeons need to handle surgical instruments in a relatively narrow working space with a two−dimensional view. Added to this, an unfamiliarity of neurosurgeons with sino-nasal surgery is also an obstacle to widespread use of the endoscopic transsphenoidal approach for pituitary lesions. In this study we have applied microscopic endonasal septal pushover technique described by Griffith and Veerapen[7]. Since this approach consists of relatively simple surgical procedures, access to the sphenoid sinus is quick and causes minimum disruption of normal tissue in the nasal cavity. We, later convert this microsurgical technique into endoscopic method by using a rigid endoscope after reaching the sellar floor. In this study, we describe our experience using this technique in 50 patients.

Patients and methods

This is a retrospective review of case records of patients who had undergone endonasal transsphenoidal surgery for pituitary tumors from January 2018 to December 2021. A total of 50 patients with pituitary tumors underwent endoscope-assisted endonasal trans-sphenoidal microsurgery in our institute. All patients underwent a complete endocrinological, neurological, neuro-ophthalmological and neuro-radiological work-up prior to surgery.

Figure 1. (A & B) show intra-op use of microscope and endoscope during resection of pituitary adenoma.

Operative technique

Our endonasal trans-sphenoidal surgery for pituitary tumors is performed using combined microscope and endoscope in order to exploit the advantages of each modality. Primarily, we perform the surgeries with an operating microscope. The endoscope is used in later stage to inspect and excise the residual tumor.

The surgical procedure is performed under general endotracheal anesthesia with the patient supine. The oropharyngeal cavity is packed with 3-in moist gauze. The head is cradled in a horseshoe head-holder and tilted toward the surgeon. A navigation system is used for providing intraoperative guidance in the sphenoid sinus and the sella turcica. The lateral side of the thigh is prepared to harvest fat and fascia graft. The procedure in the nasal cavity is primarily performed with a microscope, and later assisted by an endoscope to observe lateral anatomy including carotid prominences, especially in the sphenoid sinus with complicated structure.

A nasal speculum is used to inspect the nasal cavity and identify the middle turbinate. An incision

is made in the nasal septum just opposite to the middle turbinate at the junction of the bony and cartilaginous nasal septum. The mucosa of the intact contralateral nasal cavity is also elevated off the septum laterally. The nasal mucosa is elevated to expose the sphenoid sinus ostia bilaterally, in order to achieve the classical an "Owl's eye" view. A Hardy nasal speculum is placed to achieve a wider surgical field. The perpendicular plate of the vomer is fractured with the blade of the Hardy speculum and dislocated toward the contralateral side. Then, the keel bone of the vomer and the sphenoid rostrum are exposed, which are the distinct landmarks of the midline. It is essential to have the midline orientated to the sella at this point of the surgery. Neuronavigation is used as for assessing the real time location of the surgical exposure. The anterior wall of the sphenoid sinus is removed with alligator forceps and Kerrison rongeurs. The intra-sinus septa are also removed and the floor of the sella turcica is exposed and removed subsequently. The dura is coagulated and incised in a cruciate manner. A high-speed drill is sometimes used on the thick bone or incomplete pneumatization of the sphenoid sinus and the sellar floor to achieve adequate exposure.

The sella is entered and the tumor is debulked using curettes, forceps, and suction. During or after removal of the tumor, an endoscope is used to inspect the tumor cavity, especially in the blind spot of the microscope. The residual tumor is often extirpated under an endoscope (2.7 mm and 4 mm in diameter with viewing angles of 0 and 30 degrees, Olympus, Tokyo, Japan). At the end of surgery, the tumor bed is packed with Surgicel (Ethicon, Somerville, NJ, USA) and fibrin glue. In case of relatively significant cerebrospinal fluid (CSF) leakage, a fascia lata and fat graft harvested from the patient's thigh is also packed with fibrin glue. The speculum is withdrawn and the residual nasal septum and nasal mucosa is returned to the midline. Nasal packing done to prevent formation of the posterior synechiae.

Table 1. Summary of pituitary adenoma

Tumor Characteristics	No. of Patients
Sellar Only	20
Microadenoma	10
Suprasellar Extension	30
Parasellar Extension	12
Non-Secretory Tumor	30
Secretory Tumor	11

Table 2. Post-complications of procedure

Complications	No. of Patients	Treatment
CSF Leak	4	Thigh fat graft placement
Diabetes Insipidus ***Temporary*** ***Permanent***	 8 2	 Temporary Use of Desmopressin Desmopressin
Worsening of Anterior Pituitary Function	6	Hormone replacement
Asymptomatic Synechia of Nasal Mucosa	2	None
Chronic Sphenoidal Sinusitis	3	5- Day oral antibiotic course
Meningitis	2	Injectable antibiotic

Observations

From a total of 50 pituitary adenomas, 11 (22%) were hormonally active, while 39(78%) were non-functioning. Mean follow-up period was 9 months. The average length of hospital stay was 4 days. The most common indications for longer hospitalization included temporary diabetes insipidus and prior co-morbid conditions which required extended monitoring or rehabilitation. All patients had postoperative MRI/CT studies to assess residual or recurrent disease; all patients with hormonally active tumors had additional postoperative hormonal studies. Remission, being defined as no hormonal or radiological evidence of recurrence within the time-frame of the follow-up. Remission was demonstrated in 45/50 (90%) of adenomas. There were 26 males (52%) and 24 females (48%). The age ranged from 18 years to 56 years, with a mean of 26.4 years. Other than hormonal symptoms, the most common presenting complaints includes visual symptoms, changes in visual acuity or visual field deficits (44) (88%) headache (38) (76%) menstrual cycle disturbance or impotence (18) (36%), and acromegalic features (6) (12%). Forty patients had

macroadenoma (80%) and 10 had microadenomas (20%). Thirty patients out of 40 macroadenoma had suprasellar extensions (60%). Only 10 patients (20%) had lumbar drain inserted prior to commencement of the surgery and the majority of these were macroadenomas.

All cases were performed under general anesthesia. Postoperatively all of our patients who underwent this procedure, recovered well with normal and unobstructed nasal airways. Postoperative pain was reported to be minimal and the patients often did not require analgesic medication beyond second day post-operatively. Because of the potential occurrence of diabetes insipidus, every patient was kept in the hospital at least 3 days. Among the 50 endonasal procedures performed, 37 operations were completed with the patients needing to stay 4 days in the hospital. Thirteen procedures were accomplished with the patients requiring a 7 days hospitalization.

The mean follow-up duration for these patients was 9 months. The common complications encountered were diabetes insipidus (8) (16%), cerebrospinal fluid leak (4) (8%), meningitis (2) (4%), epistaxis (2), septal perforation or synechia (2) (4%), and anterior pituitary insufficiency (6) (12%). Mean operative time was 90 min.

Our study reveals that Hybrid transsphenoidal approach is a safe and effective method of management of pituitary adenomas. Patient outcomes were determined from post-operative assessment of tumor resection, postoperative hormonal levels. MR imaging studies were performed for all patients during the early postoperative period, to be repeated after 6–12 months and then annually for the rest of their follow-up period. This combined Microscopic and endoscopic transnasal technique demonstrated remission (being defined as no hormonal or radiological evidence of recurrence within the time-frame of follow-up) in 40/50 (80%) patients. Five of the patients demonstrating recurrent tumor had a mass ranging from 5 to 8 mm on an MRI scan performed postoperatively, 6 of them underwent revision surgery and 3 of them having recurrence located in the cavernous sinus were referred for radiosurgery. There was no mortality in our series.

Discussion

The surgery for pituitary tumors has evolved significantly in the past few decades from trans-cranial approach to Microscopic trans-nasal approach and then to Endoscopic Trans-nasal approach. Gerard Guiot[8] popularized the use of endoscope in the trans-sphenoidal approach. Apuzzo et al.[9] used an endoscope as an adjunct in the microscopic resection of pituitary lesions with extrasellar extension. Axel Perneczky[10] has been credited to describe the micro-anatomy not apparent with the microscope, by endoscope, and introduced the concept of minimally-invasive neurosurgery.

Both, microscope and endoscope have some advantages and disadvantages. The microscope offers a single, unobstructed and continuous three-dimensional field of vision where depth perception is more accurate. However, field of view is relatively narrow as compared to that of endoscope. Most of the Neurosurgeons are familiar and more comfortable with microscope.

On the other hand, endoscope provides panoramic view with better illumination. Angled scope can enhance vision and provide better view at lateral part of tumors and cavernous sinus which helps surgeons to work more efficiently. However, field of view in endoscope is two dimensional and often obstructed by surgical debris and since nasal speculum is not used, maneuvering in nasal cavity is difficult.

In this study we have expressed our experience of combined use of microscope and endoscope where surgery is started with microscope and endoscope is used to excise the residual tumor which is not accessible with microscope.

In present study, we found that residual tumor after microscopic excision could be easily identified with endoscope. Similar findings have also been reported in separate studies of endoscope assisted microscopic surgery, in which after microscopic tumor resection endoscope was introduced into the Sella to look for the residual tumour.[11] In this series, an average of 40% of patients were found to have after microscopic resection and were discovered and resected during the endoscopic surveys. Thus, microscope alone was successful only in 60% of cases for complete tumor removal[12].

In our hybrid technique the surgical procedure is started with microscope. Here, an incision is made at nasal septum mucosa at the junction of bony and cartilaginous part, opposite to middle turbinate and

this junction is fractured. The septal mucosa on opposite side is dissected off the bony septum to expose the keel of vomer. A Hardy nasal speculum is then inserted for adequate retraction and proper visualization of both sphenoid ostia as classical Owl's eye appearance. It also provides an appropriate surgical corridor through which surgical instruments can be taken in and out without hindrance.

Our experience with 50 patients, operated through hybrid technique, shows that it is accurate, convenient and time efficient approach for complete resection of sellar tumours. In majority of the cases, sellar floor was reached within 10-15 minutes of starting the procedure. The most crucial step is to reach sphenoid ostium for which most of the neurosurgeons are unaccustomed, especially during early stage of their practice. In purely endoscopic technique, nasal speculum is not used to achieve sphenoidotomy and thus it needs several other surgical steps to achieve adequate corridor to reach sphenoid ostia. Maneuvering endoscope in nasal cavity is often cumbersome due to limited space, especially for those who are naïve in endoscopic surgery. In microscopy the approach to sphenoid ostia is direct and most of the Sino nasal procedures performed in endoscopy are omitted.

A potential advantage of the purely endoscopic approach over the microscopic direct endonasal approach remains to be discussed since these two techniques adopt the same surgical route to the sella. It is accepted that the microscopic direct endonasal approach has the advantage of a simpler and less time consuming sphenoidotomy with fewer postoperative rhinological complications[13]. The microscopic approach also has the drawback in that it does not provides access to the lateral margins of the sellar cavity and the surgical trajectory is deviated from the midline[14]. Surgical microscopes also need the retraction of superficial structures (i.e., the nostrils), which otherwise hinder the entry of the light beam.

The nasal speculum used in the microscopic approach has a wider opening of its blade which can cause excessive stretch force on the nostril, and at time needs a relaxing alar incision. This incision was reported in a 20% of the patients by was Zada et al.[15] in his study of 100 patients. In contrast, endoscopes can provide a more panoramic view without any need of such incision. In our series of 50 patients, we needed alar release incision in only 5 cases that is less than 10% of patients.

Our technique exploits a more simplistic and familiar approach to Pituitary tumors with added advantage of endoscopic visualization of the residual tumor in the lateral part of the sella as well as those trapped in the arachnoid folds. Despite a limited number of cases, the present study also suggests that this simplified hybrid technique is a safe and time efficient technique where judicious use of microscope and endoscope can reduce the operative time and post-op rhinological complication with comparable surgical outcome.

Conclusions

We consider that the endoscope, which allows visualization of areas not seen with the operating microscope, should be used actively in conjunction with the operating microscope that provides three-dimensional visualization and is timesaving. Our surgical method for pituitary tumors provides good results with minimal invasion, by exploiting the advantages of a microscope and an endoscope at the same time.

References

1. Sachs E. Sir Victor Horsley. Br Med J 1957;1:916 – 1917.
2. Schloffer H. Zur Frage der Operationen an der Hypophyse. Beitr Klin Chir 1906;50:767 – 817.
3. Cushing H. Partial hypophysectomy for acromegaly: With remarks on the function of the hypophysis. Ann Surg 1909;50: 1002 – 17.
4. Hirsch O. Symptoms and treatment of pituitary tumors. Arch Otolaryngol 1952;55:268 – 306.
5. Jankowski R, Auque J, Simon C, et al. Endoscopic pituitary tumour surgery. Laryngoscope 1992;102:198 – 202.
6. Kennedy DW, Zinreich SJ, Rosenbaum AE, Johns ME. Functional endoscopic sinus surgery. Theory and diagnostic evaluation. Arch Otolaryngol 1985;111:576 – 82.
7. Griffith HB, Veerapen R. A direct transnasal approach to the sphenoid sinus. Technical note. J Neurosurg 1987; 66: 140-2
8. Guiot G. Trans-sphenoidal approach in surgical treatment of pituitary adenomas: General principles and indications in non-functioning adenomas. Excerpta Med Int Congr Series 1973;303: 159 – 78.
9. Apuzzo MLJ, Heifetz M, Weiss MH, Kurze T. Neurosurgical endoscopy using the side-viewing telescope. Technical note. J Neurosurg 1977;16:398 – 400.
10. Fries G, Perneczky A. Endoscope-assisted brain surgery: part 2 analysis of 380 procedures. Neurosurgery 1998;42:226 – 32.
11. Helal MZ. Combined micro-endoscopic trans-sphenoid

excisions of pituitary macroadenomas. Eur Arch Otorhinolaryngol 1995;252:186 – 9.
12. Jarrahy R, Berci G, Shahinian HK. Assessment of the efficacy of endoscopy in pituitary adenoma resection. Arch Otolaryngol Head Neck Surg 2000;126:1487 – 90.
13. Cooke RS, Jones RAC. Experience with the direct transnasal transsphenoidal approach to the pituitary fossa. Br J Neurosurg 1994; 8: 193–196.
14. Kawamata T, Iseki H, Ishizaki R, Hori T. Minimally invasive endoscopic-assisted endonasal trans-sphenoidal microsurgery for pituitary tumors: experience with 215 cases comparing with sublabial trans-sphenoid approach. Neurol Res 2002;4: 259 – 65.
15. Jho H-D, Carrau RL. Endoscopic endonasal trans-sphenoidal surgery: Experience with 50 patients. J Neurosurg 1997; 87: 44–51.