

COMPLICATIONS OF ENDONASAL ENDOSCOPIC TRANSSPHEOIDAL APPROACH FOR PITUITARY ADENOMAS: OUR EXPERIENCE IN 50 PATIENTS TREATED AT OUR TERTIARY CENTRE

Mani Ram Dudi¹, Pankaj Gupta², Jitendra Singh Verma³, V. R. Sardana⁴, Arvind Sharma⁵

¹Resident, Department of Neurosurgery, Sawai Man Singh Hospital & Medical College, Jaipur.

²Professor & HOD, Department of Neurosurgery, Mahatma Gandhi Medical College & Hospital, Jaipur.

³Assistant Professor, Department of Neurosurgery, Mahatma Gandhi Medical College & Hospital, Jaipur.

⁴Ex-Professor, Department of Neurosurgery, Sawai Man Singh Hospital & Medical College, Jaipur.

⁵Assistant Professor, Department of Neurosurgery, Mahatma Gandhi Medical College & Hospital, Jaipur.

ABSTRACT

INTRODUCTION

Between September 2013 and October 2014, we conducted a retrospective analysis to assess the complications related to endoscopic pituitary surgery in a series of 50 patients. We analysed the complications in preoperative, postoperative and endocrinological categories. We had a follow up of 1-2 years. Endonasal endoscopic transsphenoidal surgery (ETSS) is an effective option for pituitary tumors. Complications do occur, but they can be reduced with experience & expertise and there is a steep learning curve. It demands a multidisciplinary approach.

KEYWORDS

Complications, Endonasal Endoscopic, Pituitary Adenoma, Transsphenoidal.

HOW TO CITE THIS ARTICLE: Dudi MR, Gupta P, Verma JS et al. Complications of endonasal endoscopic transsphenoidal approach for pituitary adenomas: Our experience in 50 patients treated at our tertiary centre. J Evid Based Med Healthc 2015; 2(58), 8921-24. DOI: 10.18410/jebmh/2015/1259

INTRODUCTION: Over the past 20 years, endonasal endoscopic transsphenoidal surgery (ETSS) has grown in popularity for removing pituitary tumours and other lesions of the parasellar region.¹ Advocates of this approach note that it provides improved illumination and visualisation of the sella and the surrounding structures compared with traditional sublabial or transseptal microscopic surgery.¹ The use of angled endoscopes provides an additional theoretical advantage for visualising tumours with significant suprasellar extension or lateral invasion within the cavernous sinus.¹ The complications include cerebrospinal fluid (CSF) leak, meningitis, vascular injury, haematoma, chiasmal injury, hypothalamic injury, subarachnoid haemorrhage, nasal bleeding, sphenoid sinusitis, diabetes insipidus, hypopituitarism and other endocrinological complications.^{1,2,3}

We analysed the complications in preoperative, postoperative and endocrinological categories in 50 patients who underwent ETSS for pituitary adenomas at our centre.

MATERIAL AND METHODS: 50 Patients operated by ETSS between September 2013 and October 2014 included in the study. All patients had neurological and endocrinological evaluations and got MRI brain with sellar cuts and CT scans PNS done before surgery.

Submission 06-12-2015, Peer Review 07-12-2015,
Acceptance 14-12-2015, Published 21-12-2015.

Corresponding Author:

Dr. Pankaj Gupta,
Professor and HOD, Department of Neurosurgery,
Mahatma Gandhi Medical College & Hospital, Jaipur.

E-mail: gupta.pankaj297@gmail.com

DOI: 10.18410/jebmh/2015/1259

Patients with visual field defects were referred to an ophthalmologist for visual acuity and formal visual field testing. Patients with low hormone levels were treated with oral medications. Neurological evaluations were done daily. Postoperative contrast MRI was done on 1st or 2nd postoperative day and then after 3 months.

Surgical Procedure: All patients underwent endonasal ETSS. A binasal technique was used to perform middle turbinectomy, a wide sphenoidotomy and posterior septectomy. A rigid 0° and 30° telescope with a 3/4-hand technique was used for the operation. Sellar floor reconstruction by free fat graft and fibrin glue was done in patients with intra-operative or impending CSF leak. Nasal packing was done with merocele, which was removed after 24 hours.

RESULTS:

Patient Demographics and Clinical Presentation: In total 50 patients, 28 were women and 22 were men with a mean age of 36.5 years (range 9-64 years). Average follow up time was 18 months (range 12-24 months). The primary presenting symptom was progressive decreasing vision (44%) followed by headache (30%) and endocrinopathy (20%). 6% of cases presented with pituitary apoplexy. 5 patients had recurrent tumours after prior microscopic transsphenoidal surgery at other centres. Formal visual field testing demonstrated visual field defects in 60% of the patients. The most common visual field defect was bitemporal hemianopia. (Table 1).

Patient Age, Mean	36.5 Years (Range 9-64 Years)
Male/Female, numbers	22/28
Follow up (range), months	18 (12-24)
Presenting Symptoms	n(%)
Visual Symptoms	22(44)
Headache	15(30)
Endocrinopathy	10(20)
Apoplexy	3(6)
Recurrent (previous microscopic surgery)	5(10)
Vision	n(%)
Bitemporal Hemianopia	15(30)
Unilateral Hemianopia	15(30)
Cranial Nerve Deficit	6(12)
Normal	20(40)

Table 1: Patient demographics

Tumour Characteristics and Extent of Resection:

Adenomas were graded with the Knosp scale.⁴ Tumours were presented as Knosp grade 2(34%), grade 3(26%), grade 1(24%), grade 4(10%) and grade 0(6%). Tumour diameter ranged from 1 to 7 cm in maximum dimension. Most tumours (70%) had maximal diameters of 3 to 5 cm. 60% of tumours had a volume <10cm.⁵ There was imaging evidence of invasion into the sphenoid or cavernous sinus in 60% of cases. Clival erosion was present in one case.

Gross total resection was done in 16(32%), near total in 12(24%), subtotal in 16(32%) of the cases and tumoral decompression was done in 6(12%). 3(6%) Patients had significant residual tumours, who were reoperated by ETSS. Other patients with residual tumours referred for radiotherapy/Gamma knife radio surgery (Table 2).

Knosp Score	n(%)
0	3(6)
1	12(24)
2	17(34)
3	13(26)
4	5(10)
Tumor Diameter, cm	n(%)
1-3	6(12)
3-5	35(70)
>5	9(18)
Average Tumor Volume, cm³	n(%)
<10cm ³	30(60)
>10cm ³	20(40)
Evidence of Invasion	n(%)
Sphenoid Sinus	15(30)
Cavernous Sinus	15(30)
No Invasion	20(40)
Extent of Resection of Tumor	n(%)
Gross Total	16(32)
Near Total	12(24)
Subtotal	16(32)
Tumoral Decompression	6(12)

Table 2: Tumor characteristics and extent of resection

Endocrine and Visual Outcomes: 7 of 10 patients (70%), who had endocrinopathy, resolved of their symptoms in 3-4 weeks. Visual fields and cranial nerve palsies improved in 27 (75%) of patients.

COMPLICATIONS: The only peroperative complication was CSF leak in 5(10%) cases. In these patients sellar floor reconstruction with free fat graft and fibrin glue was done (Table 3).

Postoperatively total 7(14%) patients had CSF leak including 4 patients who had intra-operative leak. CSF leak occurred in large, dumbbell shaped tumours in which aggressive tumour removal was done and it was more common in initial part of the study. Lumbar drain was put in 3 patients for 4-5 days, other patients recovered with conservative treatment. Two of these patients (4%) developed meningitis that was successfully treated with antibiotics. Mild nasal bleeding and intrasellar haematoma occurred in 5(10%) and 1(2%) cases respectively which resolved spontaneously.

Sphenoid sinusitis occurred in 3(6%) cases. It resolved with antibiotics. Excessive synechia formed in 3(6%) cases for which they were referred to ENT surgeon and endoscopic nasal clearance was done. Altered smell occurred in 7(14%) cases. One patient (2%) developed hydrocephalus, who needed a ventriculoperitoneal shunt. (Table 4)

In endocrinological complications, 2(4%) patients developed panhypopituitarism, who required persistent medication. Transient diabetes insipidus occurred in 8(16%) patients, which resolved in some increased hospital stay by carbamazepine and oral/ nasal vasopressin. One patient (2%) required persistent vasopressin. one patient (2%) developed Syndrome of Inappropriate Antidiuretic hormone (SIADH), who treated successfully by fluid restriction (Table5).

Peroperative Complication	N	%
CSF Leak	5	10
Vascular Injury	-	-
Chiasmal Injury	-	-
Hypothalamic Injury	-	-
Subarachnoid Haemorrhage	-	-

Table 3: Preoperative complications

Postoperative Complication	N	%
CSF Leak	7	14
Meningitis	2	4
Pneumocephalus	-	-
Nasal Bleeding	5	10
Haematoma (Intrasellar)	1	2
Sphenoid Sinusitis	3	6
Excessive Synechia Formation	3	6
Altered Smell	7	14
Hydrocephalous	1	2
Visual Deterioration	-	-
Additional Cranial Nerve Palsy	-	-
Death	-	-

Table 4: Postoperative Complications

Endocrinological Complication	N	%
Panhypopituitarism	2	4
Diabetes Insipidus	8	16
Transient	1	2
Persistent		
SIADH	1	2
Addisonian Crisis	-	-
Table 5: Endocrinological complications		

DISCUSSION: The Major peroperative complication in Endonasal Endoscopic Transsphenoidal Surgery (ETSS) is CSF leak, which is reported in the range of 0% to 16%.^{1,3,6,7,8} In this series CSF leak occurred in 14% of cases. It was more common in large, dumbbell shaped tumours in which aggressive tumour removal was done and in the initial part of the study. Meningitis and pneumocephalus are related complications to CSF leak.⁹ ETSS is a minimally invasive technique that is considered to be safe and effective for pituitary adenoma and other parasellar lesions.⁹ However it allows only a very limited space for instrument manipulation and results in difficulties in dura repair for CSF leak after tumour removal.⁹ If not completely controlled during surgery, postoperative CSF leaks may be troublesome. Long term bed rest, CSF diversion techniques, and revision surgery for sellar floor reconstruction may be needed for the management of CSF leaks.⁹ Thus it is essential to achieve the complete sellar floor reconstruction.⁹ Many different material and methods using autologous and synthetic materials have been introduced.⁹ Graded and modified graded repair of CSF leaks using pedicled nasoseptal flap have been described with good results specially in large diaphragmatic defects.⁹

Other uncommon but most catastrophic peroperative complication is Internal Carotid Artery (ICA) injury. It can occur in up to 1% of cases during dural opening or tumour removal.^{5,1,3,10} One should be cautious of "bare carotid"¹¹ In case of intra-operative carotid bleed, packing of the area should be done and surgery should be abandoned at that time.¹⁰ The ICA injury may present in delayed fashion with severe epistaxis because of pseudoaneurysm due to large size synthetic graft used for sellar reconstruction.^{5,1,12} So if patients present with delayed severe epistaxis, urgent cerebral angiogram should get done.^{1,12} It may require endovascular coiling.^{5,1} The vascular injury may also later result in carotico-cavernous fistula.¹¹ One intra-operative death has been reported due to subarachnoid haemorrhage.²

Other peroperative complications include chiasmal and hypothalamic injury.^{1,3,11} In our series no peroperative complication other than CSF leak was occurred.

The postoperative complications beside CSF leak and its sequelae (Meningitis and Pneumocephalus) are nasal bleeding, haematoma formation, sphenoid sinusitis, altered smell and visual deterioration or additional cranial nerve palsy.^{2,1,3,11} Nasal bleeding occurs in up to 2% of cases.³ It is usually self-limiting, but may require re-exploration and coagulation of bleeders. The incidence was higher in our

cases (10%). Intracellular, suprasellar or pontine haematoma has been reported in 0.3% to 1% of cases and may require urgent surgery.^{1,3} One of our case developed this complication. Sphenoid sinusitis occurs in 1.6% to 10% of cases.^{1,3} It usually resolves with antibiotics but may require functional endoscopic surgery, so also removal of dislodged polyethylene graft.¹ The incidence was 6% in our series. In our 3 cases (6%) there was formation of excessive synechia for which endoscopic surgery required for nasal clearance. Altered smell occurred in 7(14%) patients which is within reported range.¹ One patient developed hydrocephalus which required shunt surgery. Other minor postoperative complications reported are numbness in upper lip, tooth necrosis, mucosal atrophy, chronic rhinitis, saddle nose and sphenoid mucocoeles.¹¹ The incidence of new hypopituitarism after transsphenoidal surgery for pituitary tumours is reported to be as high as 30%.¹ In present series; two patients (4%) developed new persistent panhypopituitarism. One patient (2%) developed new persistent diabetes insipidus and required replacement with oral vasopressin. These endocrinological complications are within reported range.

CONCLUSION: Endonasal endoscopic transsphenoidal surgical approach is fast growing and an effective option for pituitary tumours. Complications do occur, but they can be reduced with experience and expertise.

REFERENCES:

1. Dallapiazza Robert F, Grober Yuval, Starke Robert M, et al. Long term results of endonasal endoscopic transsphenoidal resection of nonfunctioning pituitary macroadenomas. *Neurosurgery*. Jan 2015;76(1):42–53.
2. Charalampaki Patra, Reisch Robert, Ayad Ali, et al. Endoscopic endonasal pituitary surgery: surgical and outcome analysis of 50 cases. *J Clin. Neurosci*. 2007;14(5):410-415.
3. Gondim JA, Almeida JP, Albuquerque LA, et al. Endoscopic endonasal approach for pituitary adenoma: surgical complications in 301 patients. *Pituitary* Jun 2011;14(2):174-83.
4. Knosp E, Stienen E, Kitz K, et al. Pituitary adenomas with invasion of the cavernous sinus space: a magnetic resonance imaging classification compared with surgical findings. *Neurosurgery* 1993;33(4):610-617.
5. Crowley RW, Dumont AS, Jr Jane JA. Bilateral intracavernous carotid artery pseudoaneurysms as a result of sellar reconstruction during the transsphenoidal resection of a pituitary macroadenoma: case report. *Minim Invasive Neurosurg* 2009;52(1):44-48.
6. Cappabianca P, Cavallo LM, Colao A, et al. Surgical complications associated with the endoscopic endonasal transsphenoidal approach for pituitary adenomas. *J Neurosurg* 2002;97(2):293–298.

7. Kelly DF, Oskouian RJ, Fineman I. Collagen sponge repair of small cerebrospinal fluid leaks obviates tissue grafts and cerebrospinal fluid diversion after pituitary surgery. *Neurosurgery* 2001;49(4):885–889, discussion 889-890.
8. Shiley SG, Limonadi F, Delashaw JB, et al. Incidence, etiology, and management of cerebrospinal fluid leaks following trans-sphenoidal surgery. *Laryngoscope* 2003;113(8):1283–1288.
9. Park Jae-Hyun, Choi Jai Ho, Kim Young-II, et al. Modified Graded Repair of Cerebrospinal Fluid Leaks in Endoscopic Endonasal Transsphenoidal Surgery. *J Korean Neurosurg Soc* Jul 2015;58(1):36-42.
10. Smith Stuart James, Eralil George, Woon Kelvin, et al. Light At the End of the Tunnel: The Learning Curve Associated with Endoscopic Transsphenoidal Skull Base Surgery. *Skull Base* Mar 2010;20(2):69-74.
11. Ramamurthi Ravi, Sridhar K, Vasudevan MC. Endoscopic Endonasal Approach. Text book of operative neurosurgery. B. I. Publications Pvt. Ltd. New Delhi. First Publication 2005. Reprint 2007;399-401.
12. Starke Robert M, Raper Daniel MS, Payne Spencer C, et al. Endoscopic vs Microsurgical Transsphenoidal Surgery for Acromegaly: Outcomes in a Concurrent Series of Patients Using Modern Criteria For Remission. *J Clin Endocrinol Metab* August 2013;98(8):3190-3198.