Bangladesh J Otorhinolaryngol 2009; 15(2): 45-49

Original Article

Endonasal transsphenoidal approach to pituitary surgery: experience of 55 cases

Forhad Hossain Chowdhury[1], Md. Raziul Haque[2], Md. Shafiqul Islam[1], Mani Lal Aich[3], Khandkar Ali Kawsar[1], Momtazul Haque[1], Mainul Haque Sarkar[4]

Abstract:

Transsphenoidal approach to sella is not a new approach. In the last 100 years it has gone numerous changing refinements from using headlight to microscope and more recently the sensitive endoscope. In this prospective study, all patients with pituitary tumor who underwent endonasal transsphenoidal pituitary surgery during the period of January 2006 to July 2009 in the department of neurosurgery, Dhaka Medical College Hospital and Islami Bank Central Hospital, Dhaka, Bangladesh were included. Among the 55 patients 36 cases were operated by combined endoscopic and microscopic techniques and 19 cases were operated by endoscope only. Total 73 procedures were done in 55 patients. Age range was 17 years to 70 years. Follow up period was 03 months to 42 months (mean 14.2 months) .Male: female was almost 1:1. Clinical features were pituitary apoplexy, pituitary apoplexy with 3rd/+6th cranial nerve palsy, headache, amenorrhea, loss of libido, galactorrhoea, gynecomastia, weight gain and psychosis. Visual impairment was in 35 cases. Functioning adenoma was 21 and non functioning adenoma was 34 cases. Among the functioning adenoma acromegaly was seen in 12 cases, gigantism in 01 case, prolactinoma in 05 cases, Cushing's disease 03 cases. Purely sellar tumor was 15, sellar & suprasellar 35 and sellar & parasellar 11 cases.

Microscopic plus endoscopic techniques used in 54 procedures. Purely endoscopic procedures were 19. Complete removal of tumor in single stage was done in 33 cases. Complete removal with more than one stage surgery in 13 cases. In our initial cases of the series, we exposed the sella endonasally with endoscope then we used microscope for the rest of the surgery. In the later part of the series we gained experience and confidence for removal of pituitary tumor with an endoscope completely. The rate of diabetes insipidus occurred in 11(20%) cases and all are transient. Postoperative CSF leak was noted in 10(18%) cases. Patient with ocular palsy improved post operatively within 6 weeks. Among non functioning adenoma that were removed completely (30 cases) recurrence occurred in three cases. Eleven patients were stable in vision as preoperative. Other showed visual improvement to variable extents.

Key words: *Pituitary surgery, Endonasal, Transsphenoidal, Microsurgery, Endoscopic surgery.*

Introduction:

Surgical approach to sellar lesion is a matter of interest among the neurosurgeon dealing the skull base lesions. Pituitary adenoma is the most common lesion in sellar region. Pituitary adenoma represents 15% of all intracranial tumors[1]. Surgical approach to sella developed progressively in this century and here there is two noticeable progress to minimum mortality and morbidity: First development of transnasal-transsphenoidal techniques, that provide direct access to sella without a craniotomy; second technological advancement in illumination, field of view and image magnification[2]. Those were first achieved in traditional microscopic surgical approaches but recently influencing the application of endoscopic sinus surgery[3,4]. Indeed, the third progress in surgical approach to sella is now visible[5,6].

Transseptal transsphenoidal microsurgical approach is commonly used approach to pituitary lesion until recently. However it is associated with a little higher frequency of complications. Endoscopic

1. Resident, Dept. of Neurosurgery, Dhaka Medical College Hospital, Dhaka.
2. Associate Professor, Dept. of Neurosurgery, Dhaka Medical College Hospital, Dhaka.
3. Assistant Professor, Dept. of E.N.T., Dhaka Medical College Hospital, Dhaka.
4. Professor, Dept. of Neurosurgery, Dhaka Medical College Hospital, Dhaka

Address of Correspondence: Dr. Forhad Hossain Chowdhury, Resident, Dept. of Neurosurgery, Dhaka Medical College Hospital, Dhaka, Bangladesh

transsphenoidal approach is associated with low mortality (1%), greater chance of tumor removal, patient convenience, fewer sinus and nasofacial complications as well as fatal intracranial injuries[2,6,7,8,9,10].

Methods:

In this prospective study, all patients with pituitary tumor who underwent endonasal transsphenoidal pituitary surgery during the period of January 2006 to July 2009 in the department of neurosurgery, Dhaka Medical College Hospital and Islami Bank Central Hospital, Dhaka, Bangladesh were included. All patients were preoperatively assessed clinically, radiologically (plain x-ray skull, CT scan of brain, MRI of brain), preoperative visual field analysis and total pituitary hormone analysis done (along with other hormones where needed). Among the 55 patients 36 cases were operated by combined endoscopic and microscopic techniques and 19 cases were operated by endoscope only. Post operatively patients were regularly followed up with history and clinical examination, hormones analysis, visual field analysis and follow up MRI of brain.

Operative techniques:

Under general anesthesia with endotrachial intubation and pharyngeal packing patient is positioned in typical Fukushima's position with head high, neck neutral position with turning to right. We usually approached through the right nostril. We usually used nasal decongestant from previous night of operation. Zero degree endoscope is introduced in nasal cavity and middle turbinate, inferior turbinate, nasal septum and posterior nasal choana are identified. Middle turbinate is lateralized and endoscope is passed forward between middle turbinate and septum. Superior turbinate and sphenoidal ostium is now usually seen 3-4 mm above the choana. If ostium is not seen a little lateralization of superior turbinate will expose the ostium. Septal mucosa is incised 5mm in front of the posterior extension of the septum and rostrum. Then mucoperiosteal flap is elevated in front of the face of rostrum. Then septum is broken at the junction of rostrum and vomar. Submucoperiosteal dissection is done on the opposite side to clear rostrum and opposite face of sphenoid up to ostium on opposite side. Now we place a self retaining nasal speculum to expose the sphenoid in between two ostia. Sphenoidal sinuses are exposed by removing the bone between the ostia with the karrison up cut or down cut rongeur. Septum in between the sinuses is removed. The sellar floor, opticocarotid recess, carotid and optic protuberance, dorsum sella are identified. Sphenoidal mucosa dissected downward and kept in the lower part of dissection, so it can be used for sellar floor reconstruction at the end of operation. Then sellar floor is removed anteriorly to superior intercavernous sinus, posteriorly inferior intercavernous sinus and laterally up to both cavernous sinuses. From this step, endoscope is removed when we use the microscope (where we deserve microscope); otherwise rest of the operation is also completed with endoscope. Dura is incised with bayoneted long handled no. 11 or no.15 blade. Then tumor is removed using microsurgical or endosurgical technique. Completeness of tumor removal is assessed by checking opticocarotid angles and flapping diaphragma sella as well as thick arachnoid that lies around the tumor. Where we remove the pituitary tumor under microscope, after complete removal of tumor we use angled endoscope to inspect for residual tumor that may be outside the microscopic view. Haemostasis is achieved easily with surgicel and gel foam. When peroperative CSF leak is seen, a thick fat graft harvested from thigh is placed in sella, followed by reposition of sphenoidal mucosa. Self retaining nasal speculum is removed. We usually used an inflated balloon of Foley's catheter in the sinus to support the graft. On 3rd or 4th post operative day we removed it.

Result:

Total 73 procedures were done in 55 patients. Age range was 17 years to 70 years. Follow up period was 03 months to 42 months (average 14.2 months) . Male to female ratio was 1:1. 09 patients presented as a case of pituitary apoplexy (sudden headache, vomiting, visual deterioration with or without unconsciousness and ocular palsy), pituitary apoplexy with 3rd/+6th cranial nerve palsy was seen in 05 cases. All pituitary apoplexy patients had non functioning adenoma except one with acromegaly. Headache was present in 14 cases and amenorrhea in 09 cases. There was loss of libido in 03, galactorrhoea in 02, gynocomastia in 02, weight gain in 02 and psychosis in 02 cases. Visual impairment was in 35 cases. Typical bitemporal hemianopia was in 3 cases only. Functioning adenoma was 21 and non functioning adenoma 34 cases. Among the functioning adenoma acromegaly 12 cases, gigantism 01 case, prolactinoma 05 cases, Cushing's disease 03 cases.

Purely sellar 15, Suprasellar 35 (05 with intraventricular extension, 02 with hydrocephalus, 06 had parasellar extension as well), parasellar extension 11cases (06 cases with suprasellar extension).

Plain X-ray skull done in 21 cases and common finding were widening and ballooning of with or without erosion of clinoid process; double floor seen in 3 cases only. CT scan of brain done only in 05 cases; actually these were done before the patients reached to us but it gives better idea about the bony relation of tumor with pneumotization of sphenoidal sinus which is very important in this surgical approach .MRI of brain done in all cases that gives idea about the size, extension (cavernous sinus, suprasellar, intrventricular, sub frontal etc), resectibility, intracranial vascular relation, idea about the path of the approach(i.e. pneumotization of sinuses). Preoperative pituitary hormone level was studied in all cases. Preoperative visual field analysis was done in all cases. Microscopic plus endoscopic techniques used in 54 procedures. Purely endoscopic procedures were 19 which were mostly done in later part of the series. Complete removal of tumor in single stage done in 33 cases. Complete removal in more than one stage surgery was done in 13 cases, most of them were functioning adenoma or with large suprasellar or ventricular extension; here after initial resection rest of the tumor had come down within six months or more of first operation and then we removed it through the same approach. In 09 cases there were residual tumor even with repeated attempt of complete resection (among them 02 growth hormone secreting, 02 prolactinoma, 01 Adrenocorticotrophin(ACTH) secreting tumor and rest were non functioning adenoma. In the later part of series we removed the tumor completely in single stage even in big tumor or functioning adenoma. In our initial cases of the series, we exposed the sella endonasaly with endoscope then we used microscope for the rest of the surgery. In some cases in the middle part of the series we also used the endoscope for initial tumor removal but in the later part we used microscope. In the later part of the series after having some endoscopic cadaveric endoscopic endonasal transsphenoidal skull base dissection we gained experience and confidence for removal of pituitary tumor with an endoscope completely.

Mortality rate is 02(3.6%) in this series. There was per operative carotid injury in one patient, with gigantism in the earlier part of the series for which we ligated the internal carotid artery without extracranial and intracranial carotid bypass but patient could not tolerate and expired on 7th post operative day. Another patient with Cushing's disease underwent three times surgery (one for repair of CSF fistula); two months following third surgery, he expired from intracerebral hemorrhage. The rate of diabetes insipidus occurred in 11(20%) cases and all were transient, there was no permanent diabetes insipidus; it was more common in functioning adenoma where there was every effort to remove the tumor radically. Vascular complications occurred in one (1.8%) of the procedures. Intraoperative cerebrospinal fluid (CSF) leaks were identified in 16(29%)cases, whereas postoperative CSF leak was noted in 10(18%) cases and 08(14.5%) cases needed short duration lumbar CSF drain and two cases needed re-operation for sealing of CSF fistula. No sinusitis, pneumocephalus, cranial neuropathy or meningitis occurred in this series. Patient with third nerve palsy improved post operatively with in 6 weeks. One patient with Cushing's disease did not show any symptoms and signs of recovery even with three times surgery (one surgery for CSF fistula repair) with every effort to remove the tumor completely and patient expired suddenly two months after third operation. Two prolactinoma patients failed to restart menstruation even with post operative bromocriptin, and 02 acromegaly patients failed to improve acromegalic features. Rest of the acromegaly, Cushing's disease and prolactinoma patients are doing well without recurrence, though majority of the patient with secreting adenoma required second operation in earlier part of the series. In functioning adenoma post operative hormonal remission occur only in 10 cases. Among non functioning adenoma 30 tumors were removed completely. Among them three patients recurred within one to three years; two of them had initial presentation with apoplexy. Non functioning adenoma with residual tumor did not show any features of further growth of tumor till last follow up on check MRI. Five patients who were blind in one eye with optic atrophy before operation showed no improvement of vision. Eleven patients were stable in vision as was preoperatively. Other showed visual improvement in variable extents. No visual deterioration observed in our series. Histopathology report was pituitary adenoma in all cases. We advised post operative focused radiotherapy in 05 cases.

Discussion:

The history of development of pituitary surgery is very long. Sir Victor Horsley removed the pituitary tumor in 1889 through bifrontal craniotomy[3,11]. At the same time middle fossa craniotomy was also applied for the pituitary tumor with high mortality[5,6,11,12]. These approach was replaced by transnasal approach. Schloffer reported the first successful transnasal approach in 1906[3,11]. Though Cusching used sublabial transseptal transsphenoidal approach from 1910 to 1925 for pituitary tumor, due to poor illumination, surgical site complication and infection he abandoned this approach in favor of subfrontal transcranial approach[11]. Due to Cushing's dominancy in that period transnasal approach declined profoundly[9,11]. Norman Dott, Gerrard Guiot and Hardy brought this approach back to life by means of fluoroscopy and microscopes. Now transsphenoidal approach is the gold standard approach to sellar, parasellar and in some cases of clival lesion as well[5,9,11,13].

Standard transseptal transsphnoidal microscopic (with or without sublabial incision) in comparison to transcranial approach has been used frequently as it has fewer surgical complications, safety to midline approach and better accessibility to both sides of mid line[4].

During the last two decades the role of endoscopes has been firmly established in the diagnosis and treatment of nasal and sinus diseases as well as developing surgeons expertise made the use of endoscope, beyond the paranasal sinuses such as sella turcica, seem a logical progression[2,5,6,11,14,15,16,17,18]. Busch and Halves reported first use of endoscope for pituitary till mid 1990s[11,19]. Their outstanding result inspired neurosurgeons and otolaryngologists to apply this approach for sellar lesions[11].

Yaniv and Rappaport described a combined approach in which endoscope is used for initial exposure of sphenoid sinus followed by conversion to standard transsphenoidal microsurgical approach for the tumor resection[20]. This has reduced approach complication. Finally they used angled endoscope to inspect for residual tumor that may be outside the microscopic view[11,20]. Typically we used this approach in our majority cases where we used both endoscope and microscope for removal of pituitary tumor.

There is a learning curve for use of endoscope in neurosurgery. The endoscope can provide better illumination, magnification and visualization than the operating microscope[2,5,21]. Meanwhile the advantage of angled vision and a panoramic view are crucial for safety of the surgical procedure[2], where associated complications such as arterial injury, visual deterioration, ocular falsies and dural injury to para and suprasellar areas can be avoided using the endoscope[21,22].Moreover, the ability of angled telescope to visualize the para and suprasellar areas has resulted in better tumor resection[2,5,7,13]. The smaller size of the endoscopic instruments (as compared to microscopic equipments[13]) and the ability to quickly change the field to view at the surgical site and more panoramic perspective facilitate permanent monitoring of important anatomical landmarks increasing the surgeon's confident[2].

Potential disadvantage of endoscopic surgeries include the lack of biocular viewing and lack of depth of field, but this can be resolved by visual and tactile feedback, obtained while moving the telescope slightly in and out together with palpation of structures with an instrument under endoscopic monitoring, moreover this can be compensated by magnification and wider field of view that can be acheived by endoscope[2,23].

The main advantage of microscope over endoscope is depth assessment of surgical field with binocular vision. Another advantage of microscope is, both hands of surgeon is free for holding two instruments during tumor dissection. In endoscopy when surgeon is holding endoscope, he can not do bimanual dissection but this is not a major problem as surgeon learns quickly dealing of dissection in single hand; when bimanual dissection becomes mandatory then either assistant can hold the endoscope or an endoscope holder can be used. When bleeding is much than usual then use of endoscope is a little difficult; here microscope is better.

From our experience we can say that endonasal transsphenoidal surgery can be safely done with excellent outcome after having an initial relatively long learning curve. Here one can do this successfully after having proper microneurosurgical training with cadaveric endoscopic or microscopic endonasal transsphenoidal dissection and observation of live surgeries.

Conclusion:

Our results show that endonasal transsphenoidal pituitary surgery is safe and effective minimally invasive

skull base procedure with low complication rate. But it has a relatively long learning curve to achieve the surgical goal. Cadaveric practice, observation of transsphenoidal procedures, help from other speciality (ENT), complete 3–dimensional anatomical, physiological and pathological integrated knowledge with endoneurosurgical or microneurosurgical skill are very essential for success in this surgical procedure.

References:

1. Donald Paul J. Surgery of the skull base. Lippincottt-Reven. 1998; 558-80.
2. Sethi PS, Pillary PK. Endoscopic management of lesions of the sella turcica. J Laryngol Otol 1995; 109: 956-62.
3. Giuseppe L, Laws ER. Pioneers in the development of transsphenoid surgery; the Odor Koch, Oskar Hirsh, and Norman Dott". J Neurosurg 2001; 95: 1097-1103.
4. Herman P, Lot G, et al. Mucocele of the sphenoid sinus; A late complication of transsphenoid pituitary surgery. Ann Otol Rhinol Laryngol 1998; 170: 765.
5. Harsha V. Gopal Endoscopic transnasal transphenoid pituitary surgery. Current opinion in otolaryngology. H & N Surg 2000; 3: 43-8.
6. Lengigh Anne Den, Jeffery RLD, et al. Transnasal transphenoidal hypophysectomy; choice of approach for otolryngologist. Otolaryn H & N Surg 1999; 12: 824-7.
7. Cappabianca P. cavallo LM. et al. Surgical complications associated with the Endoscopic endonasal transphenoidal approach for pituitary edenomas. J Neurosurg 2002; 97: 293-8.
8. Ciric IS, Ragin A, et al. Complications of transphenoid surgery, result of a national survery, review of the literature and personal experience. Neurusurgery 1997; 40: 225-37.
9. Marks Steven C. Nasal and sinus surgery. Saunders 2001: 399-407.
10. Sheehan MT, Atkinson GL Preliminary comparison of the endoscopic transnasal vs. the sublabial transseptal approach of clinically non-functioning pituitary adenoma. Mayo Clin Prac 1999; 74: 661-70.
11. Jamesk Lia, Kavashik DAS, et al. The history and evolution of transsphenoidal surgery. J Neurosurg 2001; 95: 1083-96.
12. Ciric IS, Tarkington J. Transsphenoid neurusurgery. Surg Neurol 1997; 2: 207.
13. Moses Ronly Keane WM. Endoscopic transseptal transsphenoid hypophysectomy with 3-D. Intraoperative localization technology. Laryngoscope 1999; 109: 509-12.
14. Alfieri A. Endoscopic endonasal transphenoid approach to the sellar region. Technial evolution of the methodology and refinement of a dedicated instrumentation J Nerosurg Sci 1999; 43: 85-92
15. Carrau RL, Jho HD. Ko. Y. Transnasal transphenoidal endoscopic surgery of pituitary gland. Laryngoscope 1996; 106: 914-8.
16. Cappabianca P. Alfieri A. et al. Instruments of endoscopic transphenoidal surgery. Neuro-surgery 1999; 45: 392-6.
17. Jho HD, Carraw RL, et al. Endoscopic pituitary surgery: an early experience. Surh Neurol 1997; 47: 213-23.
18. Jho HD, Carraw RL, et al. Endoscopic endonasal transsphenoid surgery: experience with 50 patients. J Neurosurg 1997; 87: 44-51.
19. Grifith HB, Veerapen R. A direct transnasal approach to the sphenoid sinus (technical note). J Neurosurg 1987; 66: 104-2.
20. Yaniv E, Rappaport ZH. Endoscopic transseptal transsphenoidal surgery for pituitary tumors. Neurosurg 1997; 40: 944-6.
21. Kendy, Bolger, Zinreich. Disease of the sinuses. BC Decker Inc.pp: 213-15,230-1.
22. Black PM. Zervas NT. et al. Incidence and management of complications of transsphenoid operation of pituitary adenoma. Neurosurg 1997; 20: 920-4.
23. Koren I, Hadar T, Rappaport ZH, Yaniv E. Endoscopic transnasal transphenoid microsurgery versus the sublabial approach for the treatment of pituitary tumors. Laryngoscope 1999; 109: 1838-40.