

What is the Better Minimally Invasive Surgery in Pituitary Surgery: Endoscopic Endonasal Transsphenoidal Approach or Keyhole Supraorbital Approach?

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Endoscopic endonasal transsphenoidal approach (EETA) is an acceptable procedure as truly minimally invasive neurosurgery in handling pituitary tumor. EETA can serve many patients in many aspects especially the hospital stay and the scarification. However, EETA still has some limitations that can cause serious complications. These complications such as cerebrospinal fluid leakage and bleeding control are less likely to occur if neurosurgeons use conventional approach named as Pterional approach which was described by Yasargil. To gain the benefit of both pterional approach and minimally invasive surgery, Keyhole Supraorbital Approach (KSA) was proposed by Perneczky in 1999. This approach has not the mentioned limitation. However, there are many controversies between these two approaches in that what is the better minimally invasive surgery in pituitary surgery? The present article, by clearing the pro and con of each approach, can help neurosurgeons select the most appropriate way in handling pituitary surgery.

Keywords: Minimally invasive neurosurgery, Endoscopic endonasal transsphenoidal, Keyhole supraorbital, Pituitary

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For a century since the beginning of brain surgery, surgical treatment for brain lesions was performed using large extensive craniotomies. The uncertain localization of the lesions preoperatively forced neurosurgeons to make large enough craniotomies in removing the intracranial lesions. However, with the new innovative design of many surgical instruments and equipments including the advanced preoperative diagnostic imaging devices, the new developing neurosurgical era called minimally invasive neurosurgery has become a reality. Minimally invasive surgery offers surgeons much improvement in neurosurgical operations to achieve successful surgery and good outcome for the patients. During the past 10 years, there were many attempts to start minimally invasive neurosurgery. One of them was the attempt in 1945 by Dandy in treating hydrocephalus using the endoscope⁽¹⁾. However, due to the lack of proper endoscopic instruments at that time, the result was unsatisfactory. After that, modern neurosurgical

instruments were much developed. The microscope was used as an important tool in critical and vital brain structures. With this aid of the microscope, neurosurgeons could now develop new techniques in neurosurgical operations and these techniques made the conventional neurosurgery shift to the minimally invasive era. However, the microscope was not a sole instrument in developing minimally invasive neurosurgery. Endoscopic neurosurgical instruments together with the modern counter-balanced mobile operating microscope also helped neurosurgeons in developing new techniques for minimally invasive neurosurgery. Pituitary tumor surgery was a good example that got most benefit from these modernized equipments. In the past, the most acceptable approach for pituitary tumor removal was pterional approach proposed by Yasargil. With this approach together with microscopic equipment, a tumor could be removed with fewer complications. Surgeons could see all the vital structures nearby the tumor. Bleeding could be controlled without difficulty. However, this approach was still not considered as minimally invasive surgery.

After the beginning of the endoscopic era, endonasal endoscopic transsphenoidal approach

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(EETA) for pituitary tumor removal was considered as a true minimally invasive pituitary neurosurgery. Pituitary tumor could be removed without visible surgical scar and the patients could be discharged within a few days if they got no surgical complication. Many reports confirmed that EETA was the minimally invasive procedure⁽²⁾, so many institutes considered EETA as a first choice surgery in treatment for pituitary tumor. However, the endoscopic transsphenoidal surgery was not the surgery without complications. In the other way, this approach still had some serious complications compared with the conventional pterional approach especially the bleeding complication. Imagine that a neurosurgeon had to stop arterial bleeding from the internal carotid artery in the deep and narrow space through the nostril. This complication could be handled more easily through pterional approach compared with endoscopic transsphenoidal approach. If neurosurgeons wanted to perform both minimally invasive surgery and safer surgery at the same time, what was the best choice of treatment?

Endoscopic endonasal transsphenoidal approach (EETA)

No one denies that endoscopic surgery is a true minimally invasive surgery. The endoscope is especially ideal for obtaining a detailed view in the deep and narrow space. Such a space like that is the blind spot of microscopic view. Additional information can be obtained for safety's sake during the surgical dissection of the target area. Avoidance of unnecessary retraction of critical structures can be expected under direct endoscopic view. Usually there are two techniques regarding endoscopic microneurosurgery, Endoscope-Assisted Microneurosurgery (EAM) and Pure Endoscopic Microneurosurgery (PEM). For EAM, the endoscope is used as an adjunct tool to provide more detail in the deep surgical field. The endoscope can reveal more detail in these blind spot areas such as the undersurface of the optic nerve or chiasm and the posterior surface of internal carotid artery. Usually, the endoscope will be used for a short period. Both microscope and endoscope will supplement each other due to their different optical properties. For PEM, the endoscope is used for the complete surgical process. A neurosurgeon can use his/her hand as a holding device or the endoscope is fixed with a special holding device, offering free hands for bi-manual dissection under the endoscopic view. EETA is one of the best examples for PEM, another one is 3rd endoscopic ventriculostomy⁽³⁻⁵⁾.

Keyhole supraorbital approach (KSA)

Donald H. Wilson seemed to be the first who described the term "keyhole surgery" as the extension of limited trephinations^(6,7). However, the aim of keyhole neurosurgery is not only limited craniotomy but also limited brain exploration and minimal brain retraction. In short, the criteria of the keyhole concept is minimum iatrogenic neurotrauma but maximum efficiency in handling the lesions. The advantages may contribute to improved postoperative outcome include shorter hospitalization time from less complication compared with conventional technique. In having those advantages, neurosurgeons must have both basic skill needed in conventional microneurosurgery and experience in handling critical neurosurgical situations. According to Perneczky⁽⁶⁾, if the diameter of craniotomy is less than 15 millimeters then the intraoperative use of conventional micro-instruments becomes very limited.

In case of pituitary tumor including other suprasellar lesions, KSA is done using a small incision above just next to the eyebrow about 2-4 cm in length. This incision is just placed above the supraorbital prominence of the orbital wall. Small craniotomy with only diameter about 3-5 cm can be used as a door to attack most lesions in the skull base of anterior cranial fossa. After the dura is opened, surgeons can approach to the deeper structures such as the planum sphenoidale, pituitary stalk, suprasellar space, ipsilateral and contralateral optic nerves, supraclinoid segment of internal carotid artery and posterior communicating artery through subfrontal and limited pterional approach. Using KSA, neurosurgeons can handle these vital structures as the traditional pterional approach does. The main differences between these two approaches are the rapid recovery period and less pain degree. The cosmetic result of supraorbital craniotomy is generally excellent and most patients could accept the visible scar at the eyebrow (Fig. 1). This supraorbital keyhole craniotomy combined with modern and sophisticated instruments help the neurosurgeons to operate on tumor, intra-cerebral hematoma, aneurysm if anterior circulation with less invasive than the conventional pterional approach.

For sellar tumor especially with large suprasellar or parasellar extension, this keyhole approach can be used instead of the endonasal transsphenoidal approach. Surgeons can manipulate the above-mentioned vital structures more effective and safer than endonasal approach. Most case of suprasellar extension of pituitary tumor encased the optic nerve

and arteries of Circle of Willis. They can be totally removed with this keyhole approach and seem to be impossible for endoscopic transsphenoidal surgery.

In some cases such as craniopharyngioma, this tumor often compresses and encases these vital structures in all directions especially the undersurface of the optic nerve and chiasm. Under KSA together with microscope, neurosurgeons cannot visualize the mentioned undersurface area clearly. Endoscope can be used as an adjunct to microscope to obliterate this blind spot. If there are any complications, microscope plus endoscope assistance is far safer than EETA alone.

Pro and Con between EETA vs. KSA

Advantage of EETA

No visible scar

May be this is the most outstanding advantage of EETA compared with other approaches. Using endonasal space for the entrance to the sellar area means that there is no skin incision at all. In an easy case, without using nasal speculum and no destruction of turbinate or nasal mucosa, the first anatomy that will be destroyed is sphenoid ostium and sphenoidal floor. However, the minimally invasive approach does not mean the operation without scar. Neurosurgeons have to concern with many factors before making the decision in choosing the best approach.

Recovery period and days of admission

In most cases of EETA, the patients will have short recovery period and hospital stay. If they have not any endocrinologic problem, they can be discharged early. No need to return for stitch off.

Disadvantage of endoscopic endonasal transsphenoidal approach (EETA)

Transsphenoidal surgery, either microscopic or endoscopic, is considered as a safe procedure for pituitary tumor removal especially by experienced surgeons⁽⁸⁾. However, this is not a safe procedure. Many factors could influence on the success of this kind of operation⁽⁹⁾.

Anatomical variation of endonasal pathway

Although endonasal pathway is a straightforward route start of opening of the nose up to the ostium of sphenoid sinus, but anatomical variations do occur frequently and this makes the surgery more difficult and requires strong surgical knowledge of the

endonasal anatomy⁽¹⁰⁾. After the study of Sazgar et al, 63% of patients had septum deviations⁽¹¹⁾. Concha bullosa presented up to 53% of patients and often associated with the deviation of the nasal septum to the contralateral side^(12,13). This caused narrowing of the nasal lumen that can obscure the operative view including the view during the introduction of surgical instruments. Another study that showed discovery of septal deviation is from Erik J van Lindert who described 48% of patients have anatomical variations of endonasal pathway septum deviation⁽¹⁰⁾. Complications during EETA in endonasal phase occurred in 3.8%. Confronting with anatomic variation of the noses may be difficult for neurosurgeons. In such a case, an ear, nose and throat (ENT) surgeon could help neurosurgeons by operating in collaboration. EETA in case of extremely narrowed nasal pathway can endanger the patient if there are bleeding problems during the operation especially if the bleeding sources are from major arteries such as sphenopalatine or internal carotid artery. A coordinated team effort from different specialties is advised to lessen this morbidity⁽¹⁴⁾.

Image guidance needed

Imaged guidance is very important for the newcomers performing EETA. Although there are many useful landmarks during endonasal approach such as the nasal septum, middle turbinate, sphenoid ostium, and vomer plate, these landmarks also have many variations and cannot be easily recognized in some difficult cases. Using C-arm fluoroscope or navigator is very helpful in such cases. This image guidance can help the surgeon when he encountered the anatomical disorientation during dissection. If he gets lost during the approach, a serious devastating situation can occur. For example, if the approach is out of midline in the sphenoidal phase then the internal carotid artery can be injured and this complication could be fatal. Even approaching strictly in the midline, the anatomical variation of internal carotid artery can still come in the way. To reduce the risk of deviation in preoperative evaluation in nasal approach, using either MRI or CT scan is very important especially when the neurosurgeons are in the learning curve period⁽¹⁵⁾.

Mononostril vs. Binostril approach

Approaching in the nasal phase of EETA has two concepts. One preferred a mononostril while another advocated binostril approach⁽¹⁰⁾. The mononostril will harm nasal mucosa more than the

binostril because surgeons need to put many instruments through only one passage. This also can make the surgery more difficult and may increase the degree of complications especially in narrowed nasal passage of some races. In such cases, the patients may have the breathing problem for the rest of their lives. To increase the space for mononostril approach, surgeons often require middle turbinate removal. However, this can be considered as “minimally invasive”?

Skull base destruction and CSF leakage (Table 1)

One of the major and serious complications of transsphenoidal approach (both conventional and endonasal) was cerebrospinal fluid (CSF) leakage. This complication was reported in many literatures and was known as a possible fatal complication^(16,17). Especially in the hands of less experienced surgeons, this complication could be more frequent⁽¹⁸⁾. This complication was rarely seen in conventional pterional approach and even in supraorbital keyhole approach. The CSF leak was treated with external lumbar drainage or even reoperation and secured with a fat graft or dural repair (which was not an easy way). Another pitfall during the surgery, the Onodi cell (Sphenothmoidal cell) may be mistaken for the sphenoid sinus. Removal of Onodi cell may lead to CSF leakage. This complication also seemed to occur less often in an experienced surgeon.

Table 1. Characteristic details in pituitary adenoma approach

	EETA	KSO
Numbers of patients (case)	15	28
Operative time (average, in hour)	2.5	1.5
Length of Stay (average, in day)	5	3
Complication (case)		
CSF leakage	4	0
Require medication only	1	0
Require continuous lumbar drainage	3	0
Require reoperation	0	0
Postoperative infection (meningitis)	1	0
Diabetes insipidus	3	5
Optic nerve injury	0	1
Rebleeding	1	0
Carotid artery injury	1	0
Postoperative epistaxis	2	0

EETA = endoscopic endonasal transsphenoidal approach;
KSO = keyhole supraorbital approach

Bleeding control

To control the bleeding in any deep and narrowed space is the nightmare for neurosurgeons. This complication strictly relates to the approach. In pituitary tumor surgery, neurosurgeons are more familiar in controlling bleeding through the pterional approach much more than the transsphenoidal approach⁽¹⁰⁾. Even if the bleeding could be controlled successfully, the patients might have a severe epistaxis later. Sphenopalatine artery at the inferolateral border of the middle turbinate was one of the most common bleeding sources and must be completely secured during the operation. Some patients resulted in shock from the sphenopalatine artery bleeding. Another major source of bleeding was from internal carotid artery especially if there was an anatomical disorientation with loss of route, which occurred during the sphenoidal phase. Uncontrolled bleeding can force neurosurgeons to abort the procedure and shift to conventional surgery. To lessen this, image guidance can restore the anatomical disorientation.

Suprasellar manipulation

Most cases of pituitary tumor have suprasellar and parasellar extension. In such cases, the patients will complain of a visual problem. Even though, transsphenoidal surgery can remove an intrasellar tumor clearly but removing the suprasellar part is not easy because of the higher extension of suprasellar part and the deeper surgical depth. Some cases of pituitary tumor have adhesion with the surrounding structures, clearing the tumor from these structures using endoscope is not easy at all. There are many limitations using endoscope in such the deep space of EETA compared with microscope. One of them is one or two-hands surgery, which will be discussed next.

Advantage of keyhole supraorbital approach (KSA) ***Familiarity of surgeon***

The basic of KSA is much like the subfrontal approach combined with pterional approach. Surgeons can operate in the same way they got familiar. Most of the critical landmarks can be visualized under the microscope. The new innovated magnetic and counter-balanced microscope makes the surgeon more comfortable in such a long operative time compared with the endoscopic procedure. Moreover, craniotomy skill is much easier compared with endoscopic skill in view of most neurosurgeons. Under critical situations, familiarity with the approach may save the life of the patients⁽¹⁹⁾.

Simple instruments

Compared with EETA, basic craniotomy set is much simpler than endoscopic set. Patients undergoing KSA need no image guidance. In the contrary, keyhole surgery needs simple anatomical landmarks such as olfactory tract, internal carotid artery, optic nerve and chiasm, pituitary stalk, planum sphenoidale that can be visualized under direct vision or microscopic view. These landmarks make the surgeons follow their path easier than EETA. Whilst EETA, this approach needs all new separate set of instruments. Most of them are expensive and can be used only in specific surgical operations. In a hospital where cost-benefit is such a great concern, keyhole craniotomy is the best solution in all seasons.

Microscopic vs. Endoscopic skill of surgeon

Skill to handle the endoscope is the new one and demands more surgical experience for the newcomers. Visualization of microscope is in three dimensions whereas the endoscope is only in two dimensions. Under 3D, a neurosurgeon can utilize his surgical skill during pituitary tumor surgery better than in 2D. Endoscopic endosinus surgery is relatively new to neurosurgeons, this makes many neurosurgeons lack of endoscopic skill and may cause fatal complications in critical situations especially when confronting altogether with anatomical variations. However, for ENT surgeons, they are already well-experienced with endoscopic sinus approach. For this reason, some neurosurgeons prefer to perform EETA in collaboration with an ENT surgeon.

Variety of applications (Table 2)

Case selection for EETA is one of the gold measures in successful surgery. To remove the tumor under a deep and narrow space like the EETA, the tumor should be easily suckable. In some pituitary tumors,

Table 2. Numbers of cases using EETA/KSO

	EETA	KSO
Meningioma		
Suprasellar/Planum sphenoidale	1	15
Craniopharyngioma	2	4
Pituitary adenoma	15	28
Rathke's pouch cyst	1	2
Anterior communicating artery aneurysm	0	2

EETA = endoscopic endonasal transsphenoidal approach;
KSO = keyhole supraorbital approach

the tumor itself is not easily suckable. Neurosurgeons need bipolar cauterization and sharp cut with special design microscissors, this procedure may traumatize critical structures such as internal carotid artery or hypophyseal branch of pituitary gland. Sometimes, neurosurgeons plan to remove easily suckable pituitary tumor using EETA but finally found that the tumor cannot be easily suckable. If they continue operation under this situation, the operative time may take more time and this increased the risk of complications afterwards. In the case of KSA, almost all of the lesions in sellar and suprasellar area can be removed using KSA. These lesions are not only pituitary tumor but also included the non-pituitary tumors such as craniopharyngioma, meningioma, and vascular lesion.

Bilateral free hands

Operation done under bilateral free hands is much more comfortable for neurosurgeon, especially under some critical situations. For example, bleeding control from main arterial source is very difficult to stop with only one free hand like EETA. Even though neurosurgeons use self endoscopic-holding device, bleeding control under bilateral free hands is still not a piece of cake. The lens surface of the endoscope will be obscured by blood stream. Under KSA, surgeons will have bilateral free hands at all time. This makes neurosurgeons feel more comfortable during the whole period in the operating theatre.

Removing encased tumor

In a large pituitary tumor with massive suprasellar or parasellar extension, the tumor has a great likelihood to encase the vital structures such as arteries of Circle of Willis, optic nerve, optic chiasm, optic tract. Under EETA, it is impossible to remove this encased tumor. Surgeons can only decompress these nearby structures. However, under KSA, removing this encased lesion is much easier and safer. Using a microscope with or without endoscope-assisted technique, either decompression or removing this encased tumor is easier compared with EETA.

Bleeding control

Most cases of pituitary tumors can control bleeding easily using cottonoid together with surgicel® packing. Other bleeding control materials such as gel foam, helitene®, avitene® are also helpful. However, if the bleeding point is from a main arterial bleeding like hypophyseal artery or the more serious source like

internal carotid artery, bleeding control in such a deep and narrow space like EETA may be apocalypse. Under KSA, bleeding control is much easier, even from major sources as above-mentioned.

CSF leakage

Under EETA, surgeons have to reconstruct the sellar floor and sphenoid sinus carefully. If CSF comes out of this channel, lumbar drainage or reoperation is mandated. However, in the KSA group, surgeons can repair the dura in watertight fashion. In case of dural shortening, fascia combined with bioglue® is very helpful.

Recovery time and days of admission

Compared with EETA, patients operated under KSA have a rapid recovery time. Most patients can be extubated immediately after the operation. In cases without endocrine problem, they can be discharged within a few days. This is the same as in the EETA group.

Disadvantage of KSA

Special designed instruments

As described by Perneczky, if the craniotomy is smaller than 15 mm then the intraoperative use of conventional microinstruments becomes very limited. Development of new tube-shaft microinstruments is mandatory for performing keyhole surgery. These specially designed microinstruments are very expensive compared with conventional microinstruments in basic microneurosurgical set.

Visible scar

The distinct difference between EETA and KSA seem to be the visible scar of KSA. EETA uses the nasal pathway as the door to the sellar region while KSA uses the supraorbital area, so KSA leaves the visible scar just next to the eyebrow. To hide this scar, meticulous subcuticular suture can alleviate this problem. In case of serious concern, collaboration with a plastic surgeon may be helpful. However, most scars will fade out after 3-4 months and are hardly seen after 6-12 months (Fig. 1). In clinical practice, most patients do not care about the visible scar as much as the result and the safety of the operation using KSA. For EETA, there will be no visible scar at all. However, in some cases, operations will leave the nasal anomaly such as septal deviation resulting in breathing difficulty. Though this deviation is not visible, it makes the patients uncomfortable for the rest of their life.

Another visible scar is from the craniotomy border. To perform the craniotomy, surgeon must make an initial hole first. Cutting the skull using craniotome, there will be some skull defect that can be seen through the forehead. To hide this visible scar, small diameter blade of craniotome and making a small initial hole by using a small diameter drill are very helpful. Flapfix®, Craniofix®, or Titanium miniplate is very helpful to hide the burr defect. Bone filling substitute can also be used to hide the craniotomy defect.

Numbness of forehead and facial asymmetry

To enter the supraorbital margin, incision must cut through the supraorbital nerve. This will leave numbness above the incision area and make the wrinkle of the ipsilateral side disappear. This facial asymmetry can be seen clearly when the patients express facial appearance. Like the visible scar problem, most cases will have spontaneous recovery within 6-12 months. In some selected cases, surgeons can avoid this complication by making an incision lateral to the supraorbital nerve.

Endocrine problem

Entering the sellar and suprasellar area using KSA has a main difference compared with the EETA in that KSA will reach the suprasellar and pituitary stalk first, whereas the EETA will reach the sellar first and rarely reach up to the pituitary stalk. Mobilizing or injuring the stalk during KSA will aggravate postoperative diabetes insipidus. To alleviate this complication, surgeons must try to identify the stalk as early as possible before cutting or cauterizing the tumor.



Fig. 1 Patients, after KSA, demonstrate visible scar 3 months after the operation. The lady on the left is pituitary tumor. The gentleman on the right is planum sphenoidale meningioma

Intrasellar view

The biggest disadvantage of KSA seems to be this problem. KSA enters the suprasellar and sellar region in the same way as pterional approach. While KSA or pterional approaches have a great advantage in the clear view of sellar region, at the same time, the intrasellar region is the blind spot of this approach under microscopic view. To reveal this blind spot, removal of planum sphenoidale using a high-speed drill may be helpful. However, surgeons must use a great effort during drilling this area because there are lots of critical structures such as optic nerve, arteries of anterior circulation. EAM is very helpful in this situation. Endoscope can pass through the keyhole gateway while surgeons can operate under the microscope at the same time. In many cases, endoscope can also reveal not only the intrasellar area but also the undersurface of optic nerves (Fig. 2). Surgeons can achieve total tumor removal in this blind spot using both microscope and endoscope.

Conclusion

The introduction of endoscope into a special field of surgery seems to be held equivalent with

minimal invasiveness, less traumatization and better results. For neurosurgeons, no one denies that EETA is one of the less approach-related morbidity in pituitary tumor surgery. Another than conventional pterional approach or conventional transsphenoidal approach, neurosurgeons can use this approach as an armamentarium in handling a pituitary tumor. EETA is a truly minimally invasive procedure in removing pituitary tumor. However, a truly minimally invasive surgery does not mean only the operation without scar or operation with short recovery period. It should have enough safety for the patients themselves. Some serious complications are approach-related complications such as bleeding problem or CSF leakage. In a very difficult EETA case, having KSA in armamentarium as a minimally invasive procedure may help surgeons avoid unnecessary complications. To achieve a good outcome under minimally invasive concept, neurosurgeons must select the most appropriate approach based upon his experience and skill.

Potential conflicts of interest

None.

References

1. Dandy WE. Diagnosis and treatment of strictures of the aqueduct of Sylvius (causing hydrocephalus). *Arch Surg* 1945;51:1-14.
2. Dusick JR, Esposito F, Mattozo CA, Chaloner C, McArthur DL, Kelly DF. Endonasal transsphenoidal surgery: the patient's perspective-survey results from 259 patients. *Surg Neurol* 2006; 65: 332-42.
3. Cappabianca P, Alfieri A, de Divitiis E. Endoscopic endonasal transsphenoidal approach to the sella: towards functional endoscopic pituitary surgery (FEPS). *Minim Invasive Neurosurg* 1998; 41: 66-73.
4. de Divitiis E, Cappabianca P. Endoscopic endonasal transsphenoidal surgery. *Adv Tech Stand Neurosurg* 2002; 27: 137-77.
5. Jho HD, Carrau RL. Endoscopic endonasal transsphenoidal surgery: experience with 50 patients. *J Neurosurg* 1997; 87: 44-51.
6. Perneczky A, Reisch R. Keyhole approaches in neurosurgery. Volume 1: Concept and surgical technique. Wien: Springer-Verlag; 2008.
7. Perneczky A, Muller-Forell W, van Lindert E, Fries G. Keyhole concept in neurosurgery: with endoscope-assisted microneurosurgery and case studies. New York: Thieme Verlag; 1999.
8. Cappabianca P, Cavallo LM, Colao A, de Divitiis E.

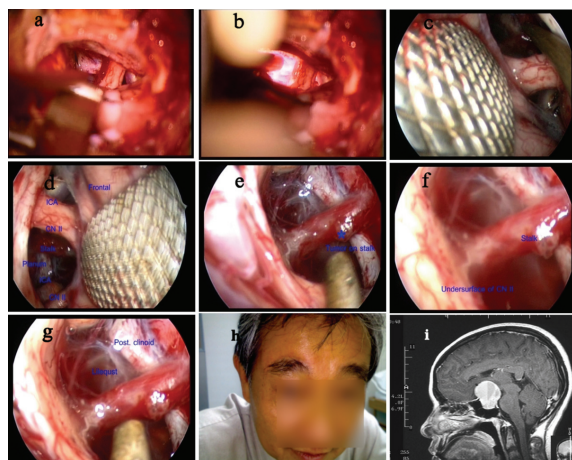


Fig. 2 Endoscopic assisted microneurosurgery via KSA of large sellar and suprasellar tumor. (a) view under microscope (after subtotal removal by microscope) (b) endoscope was passed through the keyhole (c) and (d) views under endoscope (e) asterisk (*) is the remaining tumor attached with the stalk (f) pituitary stalk and undersurface of optic chiasm (g) closer view of endoscope demonstrated remaining tumor, Lilequist's membrane and posterior clinoid process (h) patient 6 months after the operation (i) Preoperative MRI

- Surgical complications associated with the endoscopic endonasal transsphenoidal approach for pituitary adenomas. J Neurosurg 2002; 97: 293-8.
9. White DR, Sonnenburg RE, Ewend MG, Senior BA. Safety of minimally invasive pituitary surgery (MIPS) compared with a traditional approach. Laryngoscope 2004; 114: 1945-8.
 10. van Lindert EJ, Ingels K, Mylanus E, Grotenhuis JA. Variations of endonasal anatomy: relevance for the endoscopic endonasal transsphenoidal approach. Acta Neurochir (Wien) 2010; 152: 1015-20.
 11. Sazgar AA, Massah J, Sadeghi M, Bagheri A, Rasool E. The incidence of concha bullosa and the correlation with nasal septal deviation. B-ENT 2008; 4: 87-91.
 12. Stallman JS, Lobo JN, Som PM. The incidence of concha bullosa and its relationship to nasal septal deviation and paranasal sinus disease. AJNR Am J Neuroradiol 2004; 25: 1613-8.
 13. Mladina R, Cujic E, Subaric M, Vukovic K. Nasal septal deformities in ear, nose, and throat patients: an international study. Am J Otolaryngol 2008; 29: 75-82.
 14. Cappabianca P, Cavallo LM, Colao A, de Divitiis E. Surgical complications associated with the endoscopic endonasal transsphenoidal approach for pituitary adenomas. J Neurosurg 2002; 97: 293-8.
 15. Cavallo LM, Dal Fabbro M, Jalalod'din H, Messina A, Esposito I, Esposito F, et al. Endoscopic endonasal transsphenoidal surgery. Before scrubbing in: tips and tricks. Surg Neurol 2007; 67: 342-7.
 16. Cappabianca P, Cavallo LM, Colao A, Divitiis E. Surgical complications associated with the endoscopic endonasal transsphenoidal approach for pituitary adenomas. J Neurosurg 2002; 51: 699-707.
 17. Koren I, Hadar T, Rappaport ZH, Yaniv E. Endoscopic transnasal transsphenoidal microsurgery versus the sublabial approach for the treatment of pituitary tumors: endonasal complications. Laryngoscope 1999; 109: 1838-40.
 18. Cavallo LM, Messina A, Esposito F, de Divitiis O, Dal Fabbro M, de Divitiis E, et al. Skull base reconstruction in the extended endoscopic transsphenoidal approach for suprasellar lesions. J Neurosurg 2007; 107: 713-20.
 19. Snyderman C, Kassam A, Carrau R, Mintz A, Gardner P, Prevedello DM. Acquisition of surgical skills for endonasal skull base surgery: a training program. Laryngoscope 2007; 117: 699-705.

การผ่าตัดแบบที่เจ็บตัวน้อยที่สุดสำหรับการผ่าตัดเนื้องอกบริเวณต่อมใต้สมอง: การผ่าตัดแบบสอดกล้องผ่านรูจมูกหรือการผ่าตัดแบบรูกุญแจบริเวณเหนือกระดูกตา

เมธี วงศ์ศิริสุวรรณ

การผ่าตัดเนื้องอกบริเวณต่อมใต้สมองโดยการใช้กล้องเอนโดสโคปสอดเข้าทางช่องจมูกเป็นการผ่าตัดที่ได้รับการยอมรับว่าเป็นการผ่าตัดแบบที่เจ็บตัวน้อยที่สุดสำหรับโรคนี้ ผู้ป่วยจะได้ประโยชน์มาก โดยเฉพาะระยะเวลาที่ต้องอยู่ในโรงพยาบาลและการไม่มีแผลเป็นใด ๆ ให้เห็น อย่างไรก็ตามการผ่าตัดแบบนี้มีข้อจำกัดบางอย่าง โดยเฉพาะอย่างยิ่งข้อจำกัดที่อาจส่งผลให้เกิดภาวะแทรกซ้อนร้ายแรง โดยเฉพาะอย่างยิ่งการเกิดภาวะน้ำไขสันหลังรั่ว หรือ การห้ามเลือดที่ทำได้ลำบากในบางสถานการณ์จะเกิดขึ้นน้อยกว่า เมื่อทำการผ่าตัดแบบปกติผ่านทาง Pterional approach ที่เสนอโดย Yarsargil ทั้งนี้เพื่อให้ได้ประโยชน์จากทั้งการผ่าตัดแบบปกติ และแบบเจ็บตัวน้อย การผ่าตัดแบบรูกุญแจผ่านทางช่องเล็ก ๆ เหนือกระดูกตาจึงถูกเสนอโดย Perneczky การผ่าตัดด้วยวิธีนี้ไม่มีข้อจำกัดแบบที่การผ่าตัดทางกล้องผ่านรูจมูกมีแต่คล้ายแพทย์ระบบประสาท ก็ยังคงถกเถียงกันว่าระหว่างสองวิธีนี้วิธีไหนกันแน่ที่เหมาะสม และเป็นการผ่าตัดแบบเจ็บตัวน้อยที่สุดสำหรับผู้ป่วยเนื้องอกบริเวณต่อมใต้สมอง บทความนี้ได้สรุปข้อดีข้อเสียของการผ่าตัดแต่ละแบบไว้เพื่อให้ประสาทศัลยแพทย์ได้ตัดสินใจเลือกแนวทางที่เหมาะสมที่สุดในการผ่าตัดเนื้องอกต่อมใต้สมอง