



CODEN [USA]: IAJ PBB

ISSN: 2349-7750

INDO AMERICAN JOURNAL OF PHARMACEUTICAL SCIENCES

<http://doi.org/10.5281/zenodo.2545866>
Available online at: <http://www.iajps.com>

Review Article

SURGICAL APPROACH TO PITUITARY TUMORS

Turki Khalid Alotaibi ¹, Mohammed Ahmed Ali Alfageeh ², Saleh Eisa Alzahrani ³, Talal Hamid Alfallaj ⁴, Mohammad Abdulrazzaq Alalwan ⁵, Ahmed Khalid Almulhim ⁶, Abdullah Fareed Almulhim ⁶, Omar Abdulaziz Alanzi ⁶, Sultan Salah Askar ⁶, Maithaa Mohammed Ali AlHarfi ⁶, Ahmed Sami Ali Alhussain ⁷

¹King Saud University, ²Umm Al-Qura University, ³King Fahad Hospital in Al-Baha, ⁴king Abdulaziz Specialist Hospital, ⁵Alfaisal University, ⁶King Faisal University, ⁷Postgraduate Center of Family and Community Medicine

Abstract:

Introduction: Surgery to the pituitary gland is a dramatically developing aspect of the neurosurgery specialty which needs high knowledge of anatomical structures of the human body, great technical abilities, and understanding of the pathophysiology of the pituitary gland. Therefore, it must not be considered a simple surgical procedure, but rather the outcome of work that is done among several specialists including endocrinology, neurosurgery, neuroradiology, pathology, ophthalmology, along with other specialties. In this healthy cooperating environment every member will play a distinct part, providing his/her contribution to the final outcome, which specifically affects a single patient. Now, It is possible to treat several different pituitary gland conditions with more than a single option, including medical treatment, surgical treatment, and radiotherapeutic treatment possible modalities, alone or in combinations. Surgery to the Pituitary gland, maybe more than other areas of surgery, needs strict post-operative care and long-term follow-up of patients; applying these measures will create the differences between a patient with satisfactory outcomes and a patient with poor outcomes. The patient might have a successful surgical operation, but the results might not be as good as the surgeon promised if there is absence of mutual exchange between team members or if the work is not implemented right with having every member contributing to the outcomes of the patient. It is in this environment that surgery of the pituitary gland must be present currently, with the neurosurgeons working with the techniques, the indications, and the outcomes is playing a refined role as a part of an expert team: they must have detailed knowledge of anatomy, have sufficient experience neuroimaging, have knowledge in the pathophysiology and the history of pituitary gland diseases, and have sufficient knowledge of all the therapeutic modalities. Therefore, The neurosurgeon has an essential role in these procedures, completely informed of current therapeutic modalities in the patient's interests and of the institution where the surgery is being operated. In this review, we will discuss the most recent evidence regarding Surgical approach to pituitary tumors

Aim of work: In this review, we will discuss Surgical approach to pituitary tumors

Methodology: We did a systematic search for Surgical approach to pituitary tumors using PubMed search engine (<http://www.ncbi.nlm.nih.gov/>) and Google Scholar search engine (<https://scholar.google.com>). All relevant studies were retrieved and discussed. We only included full articles. The terms used in the search were: Surgical approach, pituitary tumors, management, presentation.

Conclusions: Surgical interventions, either through the transsphenoidal or the transcranial approach, must achieve complete resection of the lesion during the first surgery, if possible, for the patient's best chance of "cure". Only minimal risk can be borne by the patient in terms of morbidity and mortality; the surgeon should always try a total and radical outcome, but at the same time must also keep in mind that several different options – including medical, surgical, and/or radiotherapeutic – are now proven effective for the treatment in terms of long-term outcomes. What is crucial, regardless of the surgical option selected for a single case, whether transsphenoidal or transcranial, is to relate the goal of surgery to the patient's needs, selecting the best option for the actual condition of the patient from among all the options available, surgical or otherwise.

Key words: Surgical approach, pituitary tumors, management, presentation.

Corresponding author:**Turki Khalid Alotaibi,**

King Saud University,

QR code



Please cite this article in press Turki Khalid Alotaibi et al., *Surgical Approach to Pituitary Tumors.*, Indo Am. J. P. Sci, 2019; 06(01).

INTRODUCTION:

Surgery to the pituitary gland is a dramatically developing aspect of the neurosurgery specialty which needs high knowledge of anatomical structures of the human body, great technical abilities, and understanding of the pathophysiology of the pituitary gland. Therefore, it must not be considered a simple surgical procedure, but rather the outcome of work that is done among several specialists including endocrinology, neurosurgery, neuroradiology, pathology, ophthalmology, along with other specialties. In this healthy cooperating environment every member will play a distinct part, providing his/her contribution to the final outcome, which specifically affects a single patient.

Now, It is possible to treat several different pituitary gland conditions with more than a single option, including medical treatment, surgical treatment, and radiotherapeutic treatment possible modalities, alone or in combinations. Surgery to the Pituitary gland, maybe more than other areas of surgery, needs strict post-operative care and long-term follow-up of patients; applying these measures will create the differences between a patient with satisfactory outcomes and a patient with poor outcomes. The patient might have a successful surgical operation, but the results might not be as good as the surgeon promised if there is absence of mutual exchange between team members or if the work is not implemented right with having every member contributing to the outcomes of the patient. It is in this environment that surgery of the pituitary gland must be present currently, with the neurosurgeons working with the techniques, the indications, and the outcomes is playing a refined role as a part of an expert team: they must have detailed knowledge of anatomy, have sufficient experience neuroimaging, have knowledge in the pathophysiology and the history of pituitary gland diseases, and have sufficient knowledge of all the therapeutic modalities [1].

Therefore, The neurosurgeon has an essential role in

these procedures, completely informed of current

therapeutic modalities in the patient's interests and of the institution where the surgery is being operated. In this review, we will discuss the most recent evidence regarding Surgical approach to pituitary tumors

METHODOLOGY:

We did a systematic search for Surgical approach to pituitary tumors using PubMed search engine (<http://www.ncbi.nlm.nih.gov/>) and Google Scholar search engine (<https://scholar.google.com>). All relevant studies were retrieved and discussed. We only included full articles. The terms used in the search were: Surgical approach, pituitary tumors, management, presentation.

SURGERY

Surgery to the pituitary gland is generally performed through a transsphenoidal or transcranial approach and has been improving due to recent advances in the medical field and the technological progress; However, the surgical operation for removing the pituitary adenomas has several goals [2-3]:

1. Normalization abnormal secretion of hormones
2. maintaining or recovering normal functions of the pituitary gland
3. Relieving the effect of the mass
4. maintaining or recovering the normal neurological functions related to visual acuity and/or visual field
5. Preventing the recurrence of the tumor
6. Achieving a confirmed histological diagnosis
7. getting tissue samples for research studies.

It must be taken into consideration that endocrinologically, biologically, and pathologically, tumors of the pituitary gland are a heterogeneous group of conditions, therefore, the goal of surgical management would not be the same for different subtypes of the pituitary gland tumor. Indications that necessitate surgical intervention have been changing over time, because of the refinement of surgical

techniques and the continuous assessment of outcomes, the improvement of molecular biology knowledge, and the effective use of newer drugs and radiation modalities [4].

however, the most important goal of surgical intervention has been established to include the following: [5-6]

- Nonfunctioning tumors of the pituitary gland
- apoplexy of the pituitary gland
- the presence of increasing mass effect, leading to compression of the peripheral neurological and vascular structures, regardless of the state of hormones
- the presence of Cushing's disease, with inadequate pharmacological treatment
- Acromegaly
- Secondary hyperthyroidism.

On the other hand, the role of surgical intervention in cases of prolactinoma is not that important [7] but is still required in specific cases. Indications for surgical intervention can also include:

- Failing medical treatment to achieve satisfactory results or the presence of significant adverse events following this therapy.
- the development of severe Complications following medical treatment like leakage of the cerebrospinal fluid that results from shrinkage of the tumor, or apoplexy of the pituitary gland (like in cases of prolonged high-dose cabergoline treatment)
- Recurrence of the tumor despite the use of other modalities of treatment (medical and/or radiological)
- the choice of the patient of surgical intervention.

guidelines for surgically intervening in cases of pituitary adenomas, state that it could be done with two main approaches, each one of them can also have several different methods:

1. Transsphenoidal, which can be microsurgical (transnasal, sublabial, or endonasal) or endoscopic.
2. Transcranial, which can be subfrontal unilateral, frontolateral or pterional, or subfrontal bilateral interhemispheric.

In the recent years, these surgical approaches have been significantly evolving with new ideas and surgical techniques in attempts to achieve the least morbidity and mortality rates along with practicing a safe, feasible, and reliable way. However, the transsphenoidal midline approach is currently the

standard route to enter pituitary gland area. This is because this approach is relatively less traumatic, provides a direct pathway to reach the sella, avoids retracting the brain, and provides sufficient visualization of the pituitary gland along with near adjacent pathology. Moreover, it is associated with a significantly lower mortality and morbidity rates when compared to transcranial approaches. [8] Transsphenoidal surgical intervention is performed today during almost all surgeries to the area of the sella and surgeries that are performed to treat pituitary gland adenomas. Absolute indications of this surgical approach were first established more than thirty years ago and are still valid until now:

- increased risks of surgery when performed through the transcranial route
- elderly population
- the presence of a longstanding chiasm compression
- the presence of acute endosellar hypertension
- apoplexy of the pituitary gland
- the presence of pan-invasive adenoma that are not radically removable
- the presence of a downward developing adenoma
- the presence of a microadenoma
- the presence of non-neoplastic intrasellar cysts [9]

- patients with craniopharyngiomas, especially the cystic type, extraarachnoidal type, and infradiaphragmatic type, with an enlarged sella.

To these standard guidelines for this surgical approach, in recent years [10] the following were suggested to be added:

- The approach of extended transplanum-transsterculum [11]
- A transsphenoidal approach with multiple stages, to remove the intrasuprasellar adenoma, as an intentionally transsphenoidal surgical operation with two stages, to be able to favor the descending of the remnant of the suprasella of the adenoma and decrease risks of occurrence of big lesions brisk decompression.

however, there are several cases which limit or even contraindicate choosing the transsphenoidal approach in favor of the transcranial, either associated with the anatomical considerations of the surgery or to the inner characteristics of the lesion. The sella size, its ossification degree, the sphenoid sinus size along with its pneumatization and/or the position and shape of carotid arteries, could significantly increase difficulties associated with the transsphenoidal approach. Indications for a transcranial surgical intervention are many and include the following [12]:

- the presence of neoplasms that have extensive invasion of the intracranium, along with the asymmetric lateral development, into the anterior cranial fossa or the presence of a lateral extension or a posterior extension in the middle cranial fossa and posterior cranial fossa, specifically if involvement of a major vessel has occurred
- if Suprasellar neoplasms are not resectable completely through the transsphenoidal approach
- Recurrence of the tumor or the presence of residual pituitary tissues in cases that have already had failed transsphenoidal surgical intervention.

TRANSSPHENOIDAL APPROACHES:

The transsphenoidal surgical approach is considered to be a minimally traumatic route for surgical access into the sella, to provide a superior direct visualization of the pituitary gland and near pathologies. This approach have been used since the 60s by methods of operating microsurgically, through sublabial transseptal, transnasal transseptal, or endonasal routes (microsurgical transsphenoidal procedures). More recently, the use of endoscopes has been introduced for transsphenoidal surgical approaches as the only visualizing tool throughout the entire surgery, leading to what is known as the “pure” endoscopic endonasal transsphenoidal approach [13]. The combination of microscope and endoscope use within the same operation is known as the procedure of endoscope-assisted microsurgery.

Microsurgical transsphenoidal approaches

Three mains microsurgical transsphenoidal surgical approaches to pituitary gland tumors exist. These three are:

- (1) the transnasal transseptal transsphenoidal surgical approach.
- (2) the sublabial transseptal transsphenoidal surgical approach.
- (3) the endonasal transsphenoidal surgical approach.

All these approaches are generally performed using an operating microscope to achieve illumination, visualization, and magnification of the field of the surgery.

MICROSURGICAL TRANSSEPTAL TRANSNASAL TRANSSPHENOIDAL APPROACH

In the right nasal nostril, the columella is usually retracted to provide exposure to the anterior edge of the septal cartilage; then, the cartilaginous septum is

dissected from the bony septum. The next step is to create Posterior submucosal tunnels on the bony septum's both sides that is removed partially to make the introduction of a self-retaining transsphenoidal retractor easier. Strict care should be present during this procedure to prevent the occurrence of a mucosal perforation during any of these steps of the surgery.

MICROSURGICAL SUBLABIAL TRANSSPHENOIDAL APPROACH

In this procedure, the surgeon retracts the upper lip, and makes an incision along the bucco-gingival junction, and between the canine fossae; the periosteum and the upper lip are then elevated to provided exposure for the the inferior border of the pyriform aperture and the anterior nasal spine of nasal cavities. The nasal mucosal floor is then elevated on both sides first; the posterior and inferior portion of the cartilaginous septum is then dissected from the bony septum of the nose and is laterally deflected. The self-retaining speculum is later entered and opened widely; in fact, a more anterior trajectory is provided when compared with the trans-nasal modality.

MICROSURGICAL ENDONASAL TRANSSPHENOIDAL APPROACH

A speculum (used by hands) is inserted to the nostril through the middle turbinate, and a vertical incision of the mucosa is performed at the site of junction of the keel of the sphenoidal bone with the posterior septum of the nose; the septum, with its normal mucosa, is pushed away from the midline using the speculum medial blade [14]. Bilateral flaps of the mucosa over the keel of the sphenoidal bone are laterally reflected.

When the sphenoid sinus anterior wall is reached by any of the previously mentioned three surgical approaches, microdrill and/or bone punches are typically used to make a big opening. One or more septa could be identified, leading to the division of the sphenoid sinus into concamerations; the removal of the septa makes it possible to achieve complete exposure of the needed anatomical landmarks within the sphenoidal cavity, especially in the posterior wall. When those key points are not completely visible, a C-arm fluoroscopy or, more recently, a neuro-navigation system can be useful to help for surgical orientation.

It is essential to know that a sufficient exposure of bones of the sellar floor is very important to achieve success of this surgical approach. This is latter

opened using a microdrill and/or bone punches; then an incision is made through the dura layer in a midline position, in a linear or cross fashion, with strict care, especially cases of pituitary microadenomas, to prevent the occurrence of any damage to a potentially ectopic carotid artery within the sella, which is likely to be present in patients who are diagnosed with acromegaly.

To remove a pituitary microadenoma, if it is clearly visible on the gland surface, a cleavage plane between the microadenoma itself and the residual pituitary gland must be present; in cases where the pituitary microadenoma is not superficial or not visible an ipsilateral small incision could be created within the normal gland that can be removed using of small ring curettes.

On the other hand, to remove a macroadenoma of the pituitary gland, the inferior component and the lateral component of the macroadenoma are both removed prior to the superior side. In fact, removing the superior part initially would prematurely allow the suprasellar cistern to fall to the surgical field, leading to a reduction of the ability to achieve sufficient exposure to be able to remove the lateral portions of the macroadenoma. However, if the fall of the suprasellar portion of the macroadenoma is not seen, application of Valsalva maneuver may be beneficial, leading to protrusion of the suprasellar cistern to the sellar cavity. Finally, the surgeon retracts the speculum and places back the nasal structures to their primary positions. Nasal packing is recommended for twenty-four hours in specific cases but is not used routinely.

Endoscopic endonasal transsphenoidal approach

Endoscopic endonasal surgical approaches are done using the endoscope as a stand-alone visualizing gadget, without needing a transsphenoidal retractor; it has similar indications to the standard microsurgical surgical techniques. It needs high endoscopic skills and depends on a different concept as the endoscopic view that the surgeon gets on the video monitor is not the transposition of a real image, as it would be looking by a microscope, but is the outcome of a microprocessor's elaboration

COMPLICATIONS:

Complications of pituitary gland surgeries generally depend on the surgical approach used to reach the sella; for example, microsurgical transsphenoidal surgical approach is associated with a significantly lower morbidity and mortality rates, and additionally

does not lead to the development of visible scars, when compared to the standard transcranial route, making it more preferred by both patients and surgeons. Severe adverse events of transsphenoidal approach are not generally common and are likely to be associated with the size of the lesion and the surgeon's experience.

CONCLUSIONS:

Surgical interventions, either through the transsphenoidal or the transcranial approach, must achieve complete resection of the lesion during the first surgery, if possible, for the patient's best chance of "cure". Only minimal risk can be borne by the patient in terms of morbidity and mortality; the surgeon should always try a total and radical outcome, but at the same time must also keep in mind that several different options – including medical, surgical, and/or radiotherapeutic – are now proven effective for the treatment in terms of long-term outcomes. What is crucial, regardless of the surgical option selected for a single case, whether transsphenoidal or transcranial, is to relate the goal of surgery to the patient's needs, selecting the best option for the actual condition of the patient from among all the options available, surgical or otherwise.

REFERENCES:

1. **McLaughlin N, Laws ER, Oyesiku NM et al. (2012).** Pituitary centers of excellence. *Neurosurgery* 71: 916–924, discussion 924–926.
2. **Laws E (1993a).** Clivus chordomas. In: LN Sekhar, IP Janecka (Eds.), *Surgery of Cranial Base Tumors*, Raven Press, New York, pp. 679–685.
3. **Lanzino G, Laws Jr ER (2001).** Pioneers in the development of transsphenoidal surgery: Theodor Kocher Oskar Hirsch and Norman Dott. *J Neurosurg* 95: 1097–1103.
4. **Cappabianca P, de Divitiis E (2004).** Endoscopy and transsphenoidal surgery. *Neurosurgery* 54: 1043–1048, discussion 1048–1050.
5. Laws Jr ER, Ebersold MJ (1982). Pituitary apoplexy – an endocrine emergency. *World J Surg* 6: 686–688.
6. **Losa M, Mortini P, Urbaz L et al. (2006).** Presurgical treatment with somatostatin analogs in patients with acromegaly: effects on the remission and complication rates. *J Neurosurg*

- 104: 899–906.
7. **Molitch ME, Elton RL, Blackwell RE et al. (1985).** Bromocriptine as primary therapy for prolactin-secreting macroadenomas: results of a prospective multicenter study. *J Clin Endocrinol Metab* 60: 698–705.
 8. **Perneczky A, Muller-Forell W, van Lindert E et al. (1999).** Keyhole Concept in Neurosurgery, Thieme, Stuttgart and New York.
 9. **Baskin DS, Wilson CB (1984).** Transsphenoidal treatment of non-neoplastic intrasellar cysts. A report of 38 cases. *J Neurosurg* 60: 8–13.
 10. **Zada G, Cappabianca P (2010).** Raising the bar in transsphenoidal pituitary surgery. *World Neurosurg* 74: 452–454.
 11. **Weiss MH (1987).** The transnasal transsphenoidal approach. In: MLJ Apuzzo (Ed.), *Surgery of the Third Vent.*
 12. **Powell MP, Pollock JR (2003).** Transcranial surgery. In: MP Powell, SL Lightman, ERJ Laws (Eds.), *Management of Pituitary Tumors*, Humana Press, Totowa, NJ, pp. 147–159.
 13. **Doglietto F, Prevedello DM, Jane Jr JA et al. (2005).** Brief history of endoscopic transsphenoidal surgery – from Philipp Bozzini to the First World Congress of Endoscopic Skull Base Surgery. *Neurosurg Focus* 19: E3.
 14. **Griffith HB, Veerapen R (1987).** A direct transnasal approach to the sphenoid sinus. Technical note. *J Neurosurg* 66: 140–142.