

TRANSSPHENOIDAL ENDOSCOPIC SURGICAL TREATMENT OF PITUITARY TUMORS AT THE CAYETANO HEREDIA NATIONAL HOSPITAL IN LIMA PERU: OUTCOMES OF A SERIES OF CASES

Tratamiento quirúrgico endoscópico transesfenoidal de tumores de hipófisis en el Hospital Nacional Cayetano Heredia en Lima Perú: Resultados de una serie de casos

JUAN GARAY H.^{1a}, WESLEY ALABA G.^{1a}, JERSON FLORES C.^{1a}, RÓMULO RODRIGUEZ C.^{1a}, GONZALO ROJAS D.^{1a}, YVAN SALCEDO F.^{2b}

¹Department of Neurosurgery, ²Department of Otorhinolaryngology, Cayetano Heredia National Hospital, Lima, Peru.
^a Neurosurgeon, ^b Otorhinolaryngologist

ABSTRACT

Introduction: In recent years, transsphenoidal endoscopic surgery has become a surgical procedure of choice for the treatment of pituitary tumors. The objective of the present study was to describe the demographic, clinical characteristics, complications, and postoperative results of the patients who underwent transsphenoidal endoscopic resection.

Methods: A descriptive case series study of patients with pituitary tumors operated through a transsphenoidal endoscopic approach was carried out from January 2016 to August 2018 in the Neurosurgery Department of the Cayetano Heredia National Hospital. Data were obtained by reviewing the medical records.

Results: A total of 20 endoscopic surgeries were performed, of which 08 were for pituitary macroadenomas, 07 for giant pituitary adenomas, and 05 for other tumor lesions. Of the total number of operated patients, 11 were male (55%) and the most frequent age group was between the 3rd to 5th decade of life (70%). Regarding the postoperative results, a total and subtotal resection was performed in 60% of the patients and partial resection in 20%. Regarding postoperative complications, 45% of patients had transient diabetes insipidus. 1 patient died (5%) due to septic symptoms.

Conclusions: Endoscopic transsphenoidal surgery provides several advantages over microscopic transsphenoidal surgery, such as providing greater anatomical detail, direct visualization of the tumor, and cerebrospinal fluid leak sites, which allows achieving better results in terms of disease control and the prevention of complications. However, studies with a larger number of patients are necessary.

Keywords: Pituitary Neoplasms, Endoscopy, Neurosurgical Procedures, Diabetes Insipidus. (source: MeSH NLM)

RESUMEN

Introducción: Durante los últimos años la cirugía endoscópica transesfenoidal se ha convertido en un procedimiento quirúrgico de elección para el tratamiento de tumores hipofisarios. El objetivo del presente estudio fue describir las características demográficas, clínicas, complicaciones y resultados postoperatorios de los pacientes sometidos a resección endoscópica transesfenoidal.

Métodos: Se realizó un estudio descriptivo de serie de casos, de los pacientes con tumores hipofisarios operados mediante un abordaje endoscópico transesfenoidal, desde enero del 2016 a agosto de 2018 en el servicio de Neurocirugía del Hospital Nacional Cayetano Heredia. La obtención de datos se obtuvo mediante revisión de las historias clínicas.

Resultados: Se realizaron un total de 20 cirugías endoscópicas de las cuales, 08 fueron por macroadenomas hipofisarios, 07 por adenomas gigantes de hipófisis y 05 por otras lesiones tumorales. Del total de pacientes operados, 11 fueron varones (55 %) y el grupo etáreo más frecuente estuvo entre la 3ra a 5ta década de vida (70%). Con respecto a los resultados postoperatorios, en el 60 % de los pacientes se realizó una resección total y subtotal y en el 20% una resección parcial. Con relación a las complicaciones postoperatorias, el 45% de pacientes presentaron diabetes insípida transitoria y se tuvo 1 paciente fallecido (5%) debido a un cuadro séptico.

Conclusiones: La cirugía transesfenoidal endoscópica, proporciona diversas ventajas respecto a la cirugía transesfenoidal microscópica, como el brindar mayor detalle anatómico, una visualización directa del tumor y sitios de fuga de líquido cefalorraquídeo, lo cual permite alcanzar mejores resultados en términos de control de la enfermedad y la prevención de complicaciones. Sin embargo, estudios con mayor número de pacientes son necesarios.

Palabras clave: Neoplasias Hipofisarias, Endoscopia, Procedimientos Neuroquirúrgicos, Diabetes Insípida (Fuente: DeCS Bireme)

Peru J Neurosurg 2020, 2 (4): 109-116

Submitted : May 21, 2020

Accepted : August 30, 2020

HOW TO CITE THIS ARTICLE: Garay H, Alaba W, Flores J, Rodríguez R, Rojas G, Salcedo I. Transsphenoidal endoscopic surgical treatment of pituitary tumors at the Cayetano Heredia National Hospital in Lima Peru: outcomes of a series of cases. *Peru J Neurosurg* 2020; 2(4): 109-116

Pituitary tumors represent 20% of intracranial tumors, with pituitary adenomas being the most frequent sellar tumors and can be classified on a histopathological basis as benign lesions despite invading contiguous anatomical structures such as the cavernous sinuses and clival bone structures.¹

Invasion of the cavernous sinus by pituitary adenomas occurs between 6% and 43%. Pituitary tumors are usually not diagnosed promptly due to their initial nonspecific symptoms, they are late detected when the tumor lesion produces compressive effects on adjacent neurovascular structures. Surgery for pituitary macroadenomas constitutes a neurosurgical challenge because the resection of these tumors is difficult, and in some cases dangerous, fundamentally when they have expansion and vascular compromise; for that reason, various neurosurgical techniques have been developed.²

The role of endoscopy in pituitary surgery has evolved over time. Initial reports described the use of the endoscope as an adjunct to the standard microscopic transsphenoidal approach, for example, the endoscope could be used for anterior sphenoidotomy before using the microscope, or it could simply be used at the end of resection to inspect the surgical site for residual tumor. The pure endoscopic transsphenoidal approach was introduced by Jho and Carrau in the late 1990s, with modifications by Kassam and colleagues that allowed the use of the endoscope to be extended to surgery for complex skull base tumors. Other pioneers include Cappabianca and De Divitiis in Italy, as well as Frank, Pasquini, Locatelli, and others who have made significant contributions to the development of endoscopic techniques and transsphenoidal surgery.³

In Latin America Brazil, Chile and Colombia have reported a small series of cases of endoscopic surgery for pituitary adenoma since 2004. In Peru, the Cayetano Heredia National Hospital is a pioneer institution in performing this surgery, having performed the first surgery in December 2008 and continuing with this technique in the following years; along time the Cayetano Hospital has become one of

the pioneer centers in the performance of this complex surgery in recent years.⁴

METHODS

A descriptive case series study was carried out. A total of 20 patients with a diagnosis of pituitary pathology operated by transsphenoidal endoscopic surgery were found in the Neurosurgery Department of the Cayetano Heredia National Hospital from January 2016 to August 2018. A detailed review of the medical records, operative report, and pathological anatomy report and epicrisis was carried out. Those patients operated by transcranial surgery were excluded

Diagnosis and preoperative studies

All patients were evaluated according to clinical and radiological criteria, and had evaluations by the endocrinology, otorhinolaryngology, and ophthalmology Departments.

The preoperative evaluation by otorhinolaryngology was indicated for the evaluation of alterations in the nasal mucosa and anatomical structures that could affect the nasal phase during surgery.

All patients had an ophthalmological evaluation that was performed by means of a preoperative computerized perimetry study to assess the degree of visual deficit secondary to tumor compression.

The endocrinological evaluation involved the determination of basal hormone concentrations in plasma, to establish the diagnosis of functioning and non-functioning pituitary adenomas.

A preoperative magnetic resonance imaging (MRI) study was performed in all patients to evaluate the tumor size, suprasellar extension, and cavernous sinus invasion.

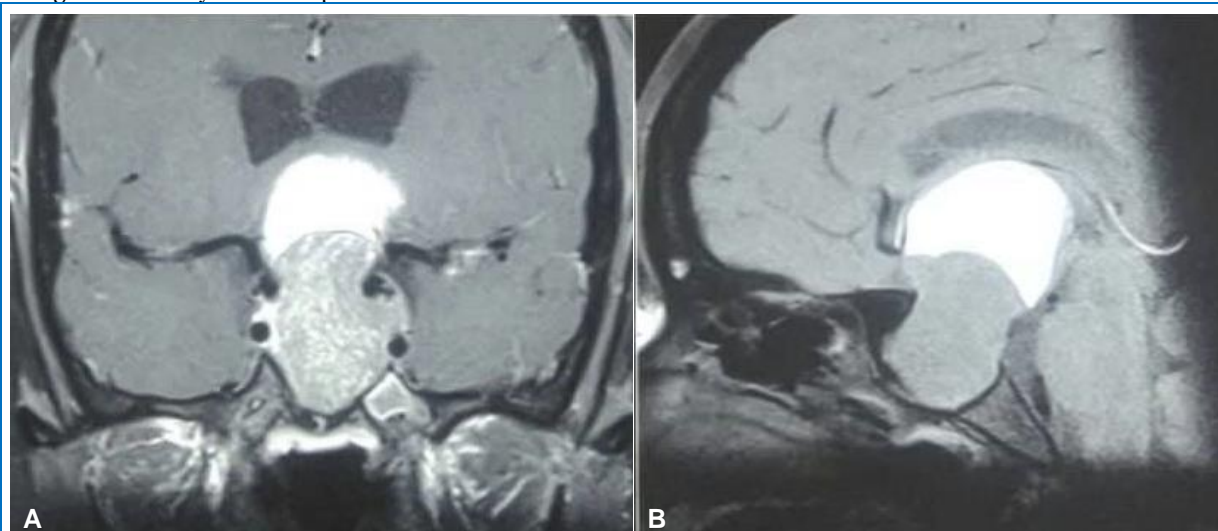


Fig 1. Magnetic Resonance Imaging (MRI) of a pituitary macroadenoma with a cystic component in (A) coronal section showing cavernous sinus invasion, and (B) sagittal section showing suprasellar expansion and sphenoid sinus invasion.

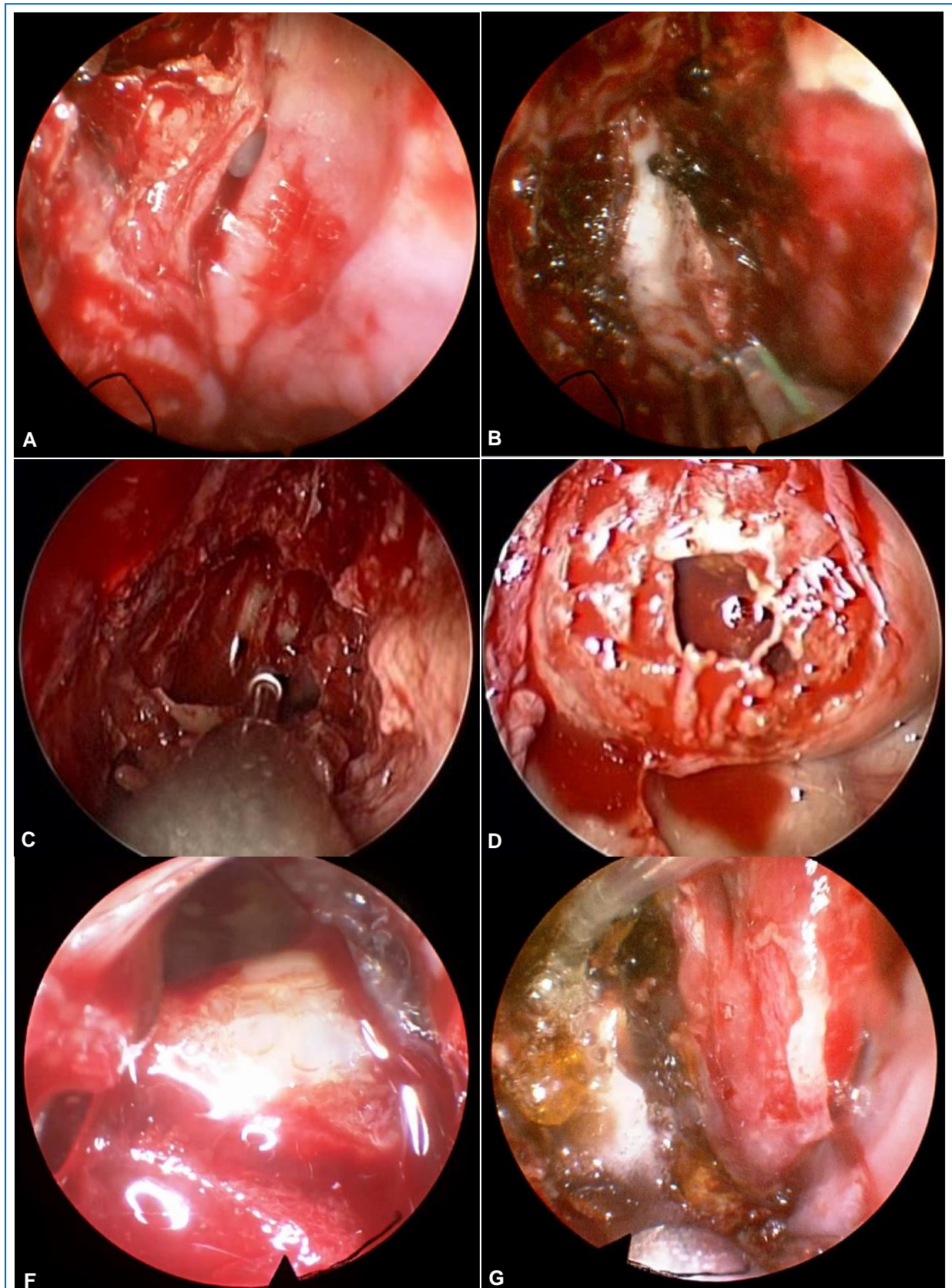


Fig 2. Intraoperative images of transsphenoidal endoscopic surgery. (A) The nasal phase of the surgery where the sphenoid ostium is exposed. (B) The nasal phase where the sphenoid crest is exposed. (C) In the sphenoid phase, the anterior sphenoidotomy is performed with the help of the drill, the sphenoid septa are removed and the sella turcica is exposed. (D) Sellar phase where the sella is opened, and the tumor is resected. (E) Sellar phase, exploration of the operative area is performed. (F) Sellar phase, exploration of the operative area is performed. (G) The phase of reconstruction of the defect by repositioning the nasoseptal flap and the application of biological glue.

Likewise, a computed tomography study of the sellar region was indicated for preoperative evaluation of the characteristics of the pneumatization of the sphenoid sinus and the floor of the sella turcica.

Surgical technique

Transsphenoidal endoscopic surgery was performed in most cases by neurosurgeons and otolaryngologists.

Due to logistical problems of our hospital, Neuronavigation, neuromonitoring, and intraoperative Doppler ultrasound were not used. Figure 1 shows the case of a 55-year-old male patient with a macroadenoma with a cystic component, who underwent surgery at the Cayetano Heredia National Hospital.

Initially, the patients were prepared by the anesthesiology team, after that, the patients were placed in the supine position with elevation, flexion, and lateralization of the head of approx. 10 degrees. The nostrils were undergoing asepsis and antisepsis procedures using the povidone-iodine solution, and then pieces of cotton soaked in epinephrine and 0.9% sodium chloride (50/50), were placed on both mucosae.

The procedure consists of three phases: a nasal phase, a sphenoid phase, and a sellar phase. During the latter, tumor excision is performed and culminates with a phase of closure and reconstruction of the cranial bone defect (Figure 2)

The surgeries were performed using a rigid 0° endoscope which was introduced through the right nostril. The normal anatomical structures were identified, and the middle turbinate was lateralized, which allowed broader access to the sphenoid region. A pedunculated nasoseptal flap was prepared for closure and reconstruction, also extracting the fascia lata from the right thigh.

The sphenoid ostium was identified, and the anterior wall of the sphenoid sinus was opened by drilling with continuous irrigation and the use of Kerrison. Then, intrasphenoidal septa were resected, which may show wide variability, and anatomical landmarks were identified such as the saddle floor in the center, the sellar tubercle superiorly, the clivus recess, and carotid prominences. The sellar phase began by opening the Sella turcica and dura mater for tumor resection, finally inspecting the tumor bed, always trying to preserve the pituitary gland.

Finally, during the reconstruction stage, the presence or absence of a CSF fistula was verified. Closure of the defect was performed by placing a subcutaneous tissue graft, fascia lata, and by repositioning the pedicled nasoseptal flap. The flap was fixed, using a biological rubber (Bioglue®) and the balloon of a Foley catheter to avoid its displacement. The Foley catheter also served as an additional mechanism of hemostasis in case of mucosal bleeding.

Postoperative studies

At the end of surgery, the tumor tissue samples were sent to the pathological anatomy department and the patients were transferred to the intensive care unit for strict neurological monitoring, urine output and internal environment control.

Likewise, all patients underwent a brain tomography in the postoperative period.

Statistical analysis

As a descriptive study of a series of cases, the results are presented in statistical tables based on the number and percentage of cases.

RESULTS

From January 2016 to August 2018, a total of 20 patients with pituitary tumors were operated on by transsphenoidal endoscopic resection. The main pathology was pituitary macroadenomas with 8 cases representing 40%, followed by giant pituitary adenomas with 7 cases representing 35%, while 02 pituitary microadenomas were resected, constituting 10%; 1 case of chordoma, 1 case of craniopharyngioma, and 1 case of an epidermoid tumor were also operated. The diagnosis of these tumor lesions was made through pathological anatomy studies (Table 1)

Table 1: Pituitary tumor pathologies treated by transsphenoidal endoscopic surgery, at the Cayetano Heredia National Hospital, Lima Peru, 2016-2018.

TUMOR PATHOLOGY	Patients	
	N	%
Pituitary microadenoma	02	10%
Pituitary macroadenoma	08	40%
Giant pituitary adenoma	07	35%
Cordoma	01	5%
Craniopharyngioma	01	5%
Epidermoid tumor	01	5%
TOTAL	20	100%

Source: Data from Cayetano Heredia National Hospital Neurosurgery Department

Sociodemographic characteristics

The sociodemographic characteristics are shown in Table 2, where it can be seen that, in relation to the sex of the patients, 11 cases were male (55%) and 9 cases were female (45%).

Regarding age, it was found that the age groups from 26 to 45 years and from 46 to 65 years were the most frequent with 14 patients, most of them were macroadenomas and

Table 2: Demographics characteristics of patients with pituitary tumor pathology operated by transsphenoidal endoscopic surgery at Cayetano Heredia National Hospital, Lima Peru, 2016-2018.

	TUMOR PATHOLOGY						Total	
	Microadenoma	Macroadenoma	Giant Adenoma	Cordoma	Craneofaringioma	Epidermoid Tumor	N	%
Sex								
Male	--	05	04	01	01	--	11	55%
Female	02	03	03	--	--	01	09	45%
Age (years)								
15 – 25	--	--	--	--	--	01	01	5%
26 – 45	01	02	03	--	01	--	07	35%
46 – 65	01	02	03	01	--	--	07	35%
> 66	--	04	01	--	--	--	05	25%
Instruction								
Primary	--	04	03	--	--	--	07	35%
Secondary	02	04	03	01	01	01	12	60%
Superior	--	--	01	--	--	--	01	5%

Source: Data from Cayetano Heredia National Hospital Neurosurgery Department

giant pituitary adenomas; It can also be seen that in the group <25 years of age, 1 case of an epidermoid tumor was operated, while in the group of > 66 years there were 04 cases of macroadenomas and 1 case of giant pituitary adenoma.

The degree of education of the patients was mainly secondary level with 12 patients constituting 60% and 7 patients with primary level representing 35%.

Clinical presentation

In our study, of the total of 20 patients, 4 cases had arterial hypertension as comorbidity or associated pathology, 4 cases had diabetes mellitus and 3 patients had a history of hypothyroidism. The main clinical symptom of pituitary tumors was headache present in 14 patients, which represents 70%, followed by a decrease in visual acuity, present in 07 patients constituting 35%, and 4 patients presented nausea and vomiting. (Table 3)

The main hormonal alteration was evidenced in the measurement of GH plasma dosages in 3 patients and of TSH also in 03 patients, while 10 patients did not present any endocrinological alteration, which represented 50%.

Complications

In our entire series, complications were grouped into 2 groups: intraoperative complications and postoperative complications. There were only 2 types of intraoperative complications, the most frequent being hemorrhage, defined as bleeding greater than 500 ml, which occurred in 06 patients, representing 30%, and severe electrolyte alteration, present only in one patient, which means 5%.

Likewise, in relation to postoperative complications present in the first days after surgery, it was observed that 4 patients did not present any complications.

Table 4: Intraoperative and postoperative complications of patients with pituitary tumors operated by transsphenoidal endoscopic surgery at Cayetano Heredia Hospital, Lima Peru, 2016-2018.

	Patients	
	N	%
INTRAOPERATIVE COMPLICATION		
Bleeding ≥ 500 cc	06	30%
Carotid artery injury	--	--
Hydroelectrolytic disturbances	01	5%
Death	--	--
POSTOPERATIVE COMPLICATION		
Leakage of CSF	01	5%
Neumoencephalus	04	20%
Hydrocephalus	01	5%
Insipidous diabetes	09	45%
Sepsis (Deceased)	01	5%
None	04	20%

Source: Data from Cayetano Heredia National Hospital Neurosurgery Department

Table 3: Comorbidity, clinical and hormonal disturbances in patients with sellar and suprasellar pathology operated by transsphenoidal endoscopic surgery at Cayetano Heredia Hospital, Lima Peru, 2016-2018.

	TUMOR PATHOLOGY						Total	
	Microadenoma	Macroadenoma	Giant Adenoma	Cordoma	Craneofaringioma	Epidermoid Tumor	N	%
Comorbidity								
Diabetes Mellitus	01	01	02	--	--	--	04	20%
Hypertension	01	01	02	--	--	--	04	20%
Hypothyroidism	01	02	--	--	--	--	03	15%
Clinical								
Headache	02	04	05	01	01	01	14	70%
Nausea, vomiting		01	02			01	04	20%
Decreased vision	01	03	02			01	07	35%
Decreased of consciousness		02	02				04	29%
Volume increase		01	02				03	15%
Seizures				01			01	5%
Hormonal disturbances								
Prolactin	01	01	--	--	--	--	02	10%
GH	--	01	02	--	--	--	03	15%
Cortisol	01	--	01	--	--	--	02	10%
TSH	01	01	01	--	--	--	03	15%
None	--	--	--	--	--	--	10	50%

Source: Data from Cayetano Heredia National Hospital Neurosurgery Department

While the main complication was diabetes insipidus, which occurred in 9 patients (45%), followed by cases of pneumocephalus that occurred in 4 patients (20%); Likewise, there was 1 case of hydrocephalus and 1 case of sepsis, which died in the intensive care unit weeks after surgery. (Table 4)

Surgical results

In relation to the surgical results obtained, the evaluation of the resection was carried out by direct endoscopic inspection of the operative bed during surgery, as well as computed tomography studies of the brain and the sellar region in the immediate postoperative period.

The degree of resection was defined according to the bibliographic review as total or complete if the resection was 100%, subtotal resection if the resection was between 81 and 99%, partial resection if it was between 10 and 80%, and biopsy if resection was less than 10%. Due to the unavailability of Nuclear Magnetic Resonance Imaging in our hospital, this study was carried out in only one group of patients in the months after surgery.

Thus, according to direct intraoperative endoscopic evaluation and computed tomography imaging, a total and subtotal resection was performed in 16 patients, which

represents 80% of the cases, while in 04 patients a partial resection was performed, representing 20%.

Likewise, in no case was only a biopsy of the tumor lesion performed. (Table 5).

Table 5: Degree of tumor resection in patients with pituitary tumors operated by transsphenoidal endoscopic surgery at Cayetano Heredia National Hospital, Lima Peru, 2016-2018.

DEGREE OF TUMOR RESECTION	PATIENTS	
	N	%
Total and subtotal resection	16	80
Partial resección	04	20
Biopsy	--	--
TOTAL	20	100

Source: Data from Cayetano Heredia National Hospital Neurosurgery Department

DISCUSSION

Pituitary tumors are a group of lesions that occupy the Sella turcica, and the pituitary adenoma is the most common lesion of this anatomical region. Clinically, they are manifested by symptoms of compression of neighboring structures and by hormonal hyper or hypofunction.

Currently, there are different surgical modalities for the surgical treatment of pituitary tumors such as transcranial, microscopic transsphenoidal and endoscopic transsphenoidal approaches.^{3, 5}

In relation to the microscopic transsphenoidal technique, it is mentioned that it may be limited by the narrow corridor offered by the nasal retractor (speculum), offering a conical vision and in a straight line towards the Sella. Thus, while the sellar region can be seen clearly, other regions such as the suprasellar or parasellar area are often hidden from our view. On the other hand, the endoscopic approach offers greater advantages and is considered more anatomical since it does not require the use of nasal retractors, allowing adequate manipulation of nasal structures that will be useful to facilitate the approach.^{3, 6}

The main advantage of using the endoscope in transsphenoidal surgery is the better visualization, obtaining a panoramic view of the surgical field, with a better appreciation of the parasellar and suprasellar area. In the review of a meta-analysis that compares the microscopic transsphenoidal approach with the purely endoscopic one, it is concluded that the endoscopic approach has comparable success to the microscopic one in terms of complete tumor resection and may be superior in the case of macroadenomas.

Regarding complications, the main cause of morbidity in transsphenoidal surgery is cerebrospinal fluid (CSF) fistula, and the risk is similar in both techniques (19.5% endoscopic vs. 14.4% microscopic).⁷

Another advantage of the use of endoscopy is the better visualization of the normal pituitary tissue, allowing greater preservation of pituitary function, as well as providing greater anatomical details of neurovascular structures.

One of the factors that greatly affect the resection of pituitary tumors is the invasion of the cavernous sinus. This infiltration represents a negative prognostic factor, reducing the probability of success in surgical treatment.⁸

Standard transsphenoidal endoscopic surgery is associated with a CSF leak risk of 0.5-10%. In the case of extended approaches, it increases to 5-30%. When a CSF fistula occurs, the most appropriate is an early surgical revision during the first 48 hours, due to its important impact on reducing the rate of postoperative meningitis.⁹

Endocrinological complications are an important aspect of pituitary tumor surgeries, with an incidence of 17.9% being described in the literature.

The decision to perform a pituitary tumor resection surgery using a transsphenoidal or transcranial approach includes the assessment of factors such as age, health status, symptoms, the direction of tumor growth, the experience of

the surgeon, and the availability of appropriate surgical instruments microscopic or endoscopic.⁹

Transcranial surgery may be reserved for the otherwise healthy patient whose tumor has grown eccentrically below the temporal lobe or anteriorly below the frontal lobe. Posterior-superior growth can be successfully treated through the transsphenoidal route. A craniotomy may be considered when a transsphenoidal procedure has not achieved complete removal of the tumor.

In relation to the postoperative evaluation of pituitary tumors after transsphenoidal endoscopic surgery, magnetic resonance imaging is the technique of choice for the detection of residual or recurrent tumors, determining through this study total and subtotal resection when it is greater than 80% and partial resection if it is less than 80%.

CONCLUSIONS

The transsphenoidal endoscopic approach offers a direct extracerebral route to the sellar region, through the nostrils which are real cavities that do not require dilation. The endoscopic technique also offers other advantages such as adequate lighting, a panoramic view of the surgical field, minimal trauma, low percentage of complications, greater patient comfort, and shorter hospital stay.

On the other hand, transsphenoidal endoscopic surgery requires a learning curve and special instruments for this procedure to achieve optimal results.

In Peru, the Cayetano Heredia National Hospital is a pioneer institution in this type of surgery and has been performing this technique since 2008. The results presented correspond only to a short period of 2 years, so a study with a greater number of cases is required to show results with statistical significance.

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Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Authors Contributions

Conception and design: All the authors. *Drafting the article:* Garay J. *Critically revising the article:* Flores J, Alaba W. *Reviewed submitted version of manuscript:* Garay J. *Approved the final version of the manuscript on behalf of all authors:* Garay J.

Correspondence

Juan Carlos Garay Huerto. Department of Neurosurgery. *Cayetano Heredia National Hospital.* 262 Honorio Delgado Ave. SMP. Lima 31, Peru. *E-mail:* juanco.gh@gmail.com