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Endoscopic Approaches to Orbital Lesion: Surgical Reports

Orestes López Piloto[1*], Lismary Martínez Váldez[2], Tania Margarita Cruz Hernández[1], Norbery Rodríguez de la Paz[1], Duniel Abreu Casas[1], Misael Sánchez López[2], Wilson Pérez Nicolaes[2], Orestes López Ayala[3], Ernesto Torres Alvarez[3], Claudia Díaz Villalvilla[3] and Taimí López Cruz[4].

[*1] *Consultant professor of neurosurgery*
[2] *Fellowship in minimal invasive neurosurgery*
[3] *Neurosurgery Resident*
[4] *Medical Student*

[*] **Corresponding Author:** *Orestes López Piloto, Consultant professor of neurosurgery, Cuba.*

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Abstract

Orbital tumor could be approached by numerous surgical methods. The endoscopic endonasal approach could provide a feasible corridor for these tumors. The objective of the study is to present our cases of intraorbital lesions managed by means of endoscopic surgery both endonasal and minimally invasive transcranial approach. The study design used was retrospective review. We collected data on 8 intraorbital medially, laterally and inferior located lesions, all managed by means of an endoscopic technician. We retrospectively reviewed the technical details, symptoms, localization, histology, and clinical outcome. The endoscopic endonasal approach and keyhole supraorbital was effective in removing completely intraorbital extra-intraconal tumors in 4 cases, in performing parcial resection in 1 case with schwannoma for histological diagnosis. No major complications were observed; in particular, there was no optic nerve damage. Minor, temporary complications (diplopia) were seen in 3 cases; only 1 patient experienced a permanent diplopia related to medial rectus muscle impairment. With our results we can propose that the minimally invasive endoscopic approach both endoscopic route and transcranial route Keyhole, are techniques that can be managed with success and safety in cases with intraorbital tumors.

Key words: Orbit, Orbital Tumor, Minimal Invasive, Endonasal Endoscopic Approach

Introduction

Tumors that involve the orbit can also be classified into two major groups: primary tumors of the orbit and tumors that extend into the orbit from other sites. The most common primary orbital tumors in adults include cavernous hemangiomas, lymphoid tumors, and meningiomas whereas dermoid cysts, capillary hemangiomas, and rhabdomyosarcoma predominate in children. Endoscopic transnasal approaches have dramatically changed the way of management of many different pathologies of the midline skull base [1-3].

Among transnasal corridors, the transorbital one represents a valuable solution to manage the medial portion of the orbital spaces. Depending on tumor localization within the orbit, different kinds of external approaches (either trans- conjunctival or transcutaneous or even transcranial) have been proposed. Recently, minimally invasive techniques have been proposed as valid alternative to external approaches for selected orbital lesions. Norris and Cleasby firstly described the use of the endoscope in orbital surgery in 1981 [4]. Endoscopic management of orbital lesions was initially reported in 1985 by Norris et al [5,6].

Several authors have reported on different transnasal endoscopic approaches for orbital tumors removal, especially for intraconal lesions located inferiorly and medially to the optic nerve. Most surgeons performed "pure" endonasal approaches; some others described combined "open" orbital and endoscopic surgery. The endoscopic endonasal approach could provide a minimally invasive corridor to the skull base, extending from the cribriform plate to C2 [7]. The lateral skull base tumor involving the orbit and the pterygopalatine fossa could also be approached via an endoscopic endonasal approach, pioneered by Kassam AB et al. Herman first described the endoscopic endonasal approach for the removal of an orbital cavernoma in 1999 [8-10].

The endoscopic endonasal approach could provide an alternative corridor for the intraorbital lesions. Several studies demonstrated that this approach was suitable for the inferomedial orbital tumors, especially soft benign extraconal tumors. reported 23 intraorbital cavernous hemangiomas (CHs) transnasally resected with endoscopy in a single institution [11-13]. Paluzzi summarized an algorithm of "round-the-clock" surgical access to the orbit, in order to guide surgeons to choose the most appropriate approach [13,14].

Patients and Methods

Patient Population

A retrospective study of 8 cases of intraorbital tumors from June 2017 to December 2022 was conducted, all of which were surgically resected via a purely endonasal endoscopic approach in the Department of Neurosurgery, Institute of Neurology and Neurosurgery. Medical records and radiological images were reviewed. Surgical approaches, complications, cranial nerve outcomes, and follow-up were analyzed. All the patients were fully informed with written consent after approval by the Institute of Neurology and Neurosurgery Institutional Review Board.

Surgical Technique

The patient was placed in the supine position with the head slightly rotated toward right and the chin tilted toward the surgeon. Magnetic resonance image (MRI) and CT scan guided neuro-navigation was applied during the operation. A four-hand bi-nostril technique was applied with a 0° or 30° endoscope (Karl Storz, Germany), and the ipsilateral middle turbinate was resected to expand the surgical corridor. The initial steps to expose the entire medial and inferior orbital walls include a complete uncinectomy with wide maxillary antrostomy, anterior and posterior ethmoidectomies, and sphenoidotomy. Removal of the orbital floor is limited by the course of the infraorbital nerve.

A binarial approach provides more room for manipulating the instruments when dissection of the orbital apex or intraconal work is required. In this case the middle turbinate ipsilateral to the pathology is removed together with the posterior nasal septum, and the sphenoid sinus rostrum is opened widely. The septum is limiting when using the contralateral nostril for introduction of instruments except when working at the orbital apex. To limit septum resection, anterior pathologies are best accessed entirely through the ipsilateral nostril. The lamina papyracea is removed to provide access to the medial orbit, and the optic nerve. For inferiorly located (4–7 o'clock) extraconal tumors, a medial maxillectomy is extended anteriorly to give access to the floor of the orbit, inferior rectus muscle, and the orbital contents above.

For posterior medial/inferior intraconal lesions, the endonasal dissection corridor is between the medial and inferior rectus muscles. The periorbita is opened parallel to the medial rectus muscle. The extraconal fat can be cauterized with bipolar diathermy if it herniates into the field and the rectus muscles are identified. A cotton-tipped applicator can serve as an excellent retractor of orbital fat endonasal as well.

We often reconstruct the medial orbital wall using a pedicled nasoseptal mucoperichondrial flap to prevent excessive scarring around the rectus muscles resulting in restriction of movement and diplopia. The orbital fat is placed over the extraocular muscles to prevent scarring above the muscle. No bony reconstruction was performed; only in cases of wide access to orbital content with aggressive intraorbital dissection, we do advocate reconstruction usually with fascia lata and stitches. No ethmoidal packing was placed [2].

Postoperative Examination and Follow-up

After the surgery, antibiotics were prescribed for 48h. The visual acuity and visual field were examined by the ophthalmologists and neurosurgeons postoperatively, and the head MRI and CT scan was performed before discharge for most cases. The patients were scheduled with a follow-up MRI 3 months after the surgery. Surgical complications were identified through the operative reports and postoperative clinic notes.

Result

A total of 8 transnasal intraorbital o transcranial endoscopic procedures were collected. Among these, five were performed for intraconal disease. Detailed data are given in Table 1. Seven patients underwent surgery with radical intent: a complete resection was obtained in four patients. Three of these cases were located in the intraconal space. Among these, four were cavernous angioma and two atypic meningioma tumors and one case with osteoid osteoma. One patient underwent a second surgical procedure.

From a clinical viewpoint, the most common symptoms were proptosis, visual impairment, local pain and diplopia (see Table 1). With regards to histology, we observed that in cases of angioma (2 extraconal, 2 intraconal) or atypic meningioma tumor (1 extraconal and 1 intraconal) we reached a subtotal resection in the latter two and in one case of cavernous angioma. In the case of optic nerve schwannoma, only partial resection was possible.

With respect to the visual outcome, we underline that, among 3 patients with pre-op visual impairment, 3 underwent a diagnostic procedure. No patient experienced visual worsening due to surgical aspects. In 1 out of these 3 patients, a complete resection of the lesion was reached. In such cases, an improvement of the visual ability was noted during follow-up. Lastly, in the case of partial resection (optic nerve Schwannoma) visual function remained stable.

Regarding the complications rate, we observed a transient diplopia in two patients, completely resolved in a few weeks. No major complications were noted. In no case there was evidence of optic nerve injury. Only one patient experienced a permanent diplopia related to medial rectus muscle palsy, probably related to muscle damage.

Mean hospital stay was ± 5 days (range 2–7 days) and all the patients regained their previous lifestyle. Patients with post op diplopia were followed by experienced surgeons skilled in strabismus management. The excellent vision offered by the endoscope allows for an in-deep evaluation of the critical structures. A navigation system was used in all patients.

Table 1: Clinical data of the 8 orbital tumors

GTR complete resection, STR subtotal resection, PR partial resection, EEA extended endoscopic approach.

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No	Gender/ Age	Symptoms	Intraconal/ extraconal	Localization	Approach	Histology	Clinical outcome	Resection
1	f/53	Pain	intraconal	superior	Keyhole supraciliar	Cavernous angioma	Imporved	GTR
2	m/25	Blurry vision, proptosis, ptosis	intraconal	Apex	EEA	Schwannoma	vision unchanged, improving ptosis	PR
3	m/45	proptosis, diplopia	extraconal	Lateral	Lateral orbitotomy	Cavernous angioma	proptosis improved	GTR
4	f/63	Optic neuropathy, increase lacrimation, ptosis	intraconal	Medial	EEA	Atypic meningioma	vision improved	STR
5	m/19	proptosis	extraconal	Superior	Keyholer supraciliar	Cavernous angioma	proptosis improved	STR
6	m/67	Pain, proptosis, diplopia	intraconal	Inferior	EEA	Cavernous angioma	imporved	GTR
7	m/34	proptosis, amaurosis	intraconal	Medial	EEA	Orbital osteoma	improved	GTR
8	m/25	proptosis, diplopia, ptosis	extraconal	Medial	EEA	Atypic meningioma	unchanged	STR

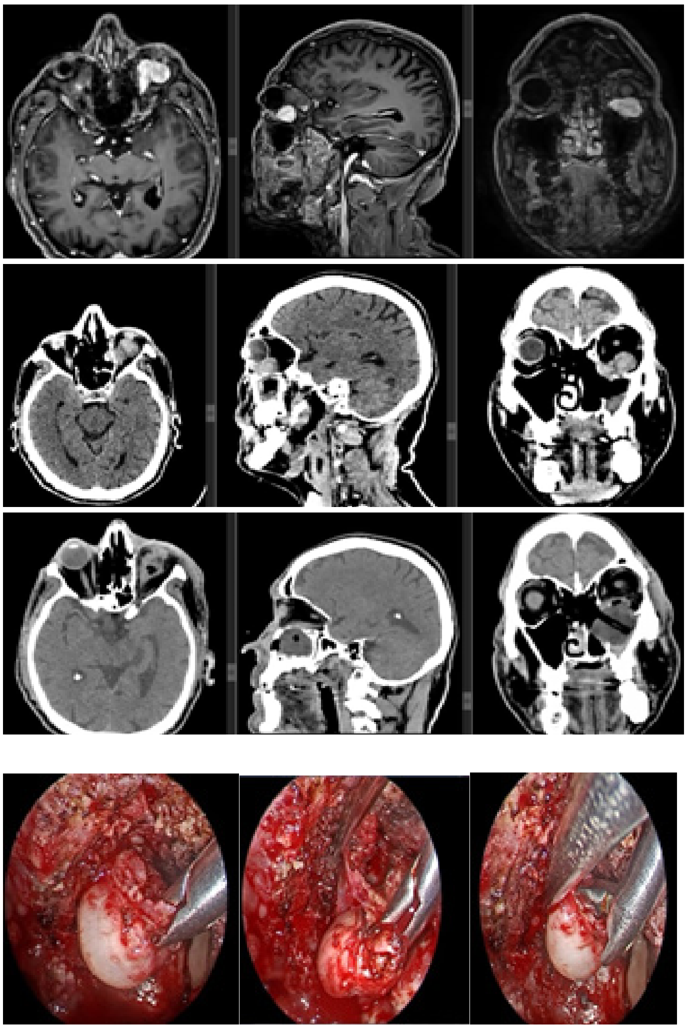

Figure 1.(A): Contrasted Mri Study, Lesion Is Observed in the Lower Wall of the Orbit on the Left Side.

B. Tomography Study Where the Lesion is Visualized**.**

C. Postoperative Tomographic Study with Total Resection of the Tumor Lesion.

D. Transoperative Endoscopic Image of Tumor Resection.

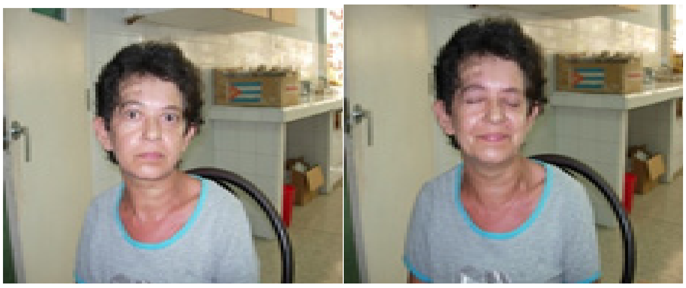

Figure 2.(A): Simple Tomographic Study with Upper Intraconal Tumor Lesion.

B.Total Resection of the Lesion.

C.Endoscopic Supraorbital Approach Without Lesion of the Frontal Branch of the Facial.

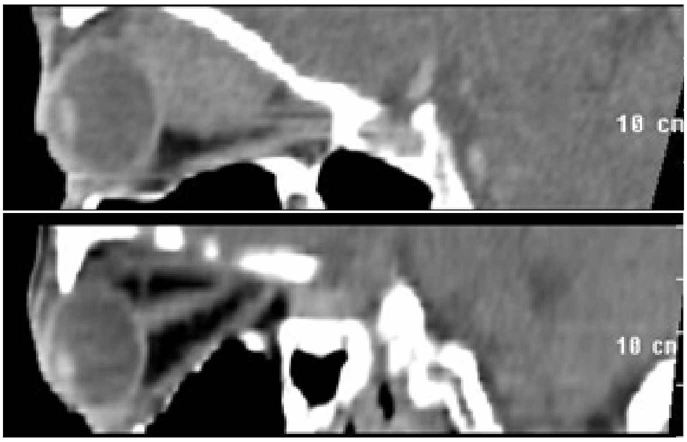

Fig.3.(A): Simple tomographic study with upper intraconal tumor lesion.
B. Total resection of the lesion thought Endoscopic supraorbital approach.

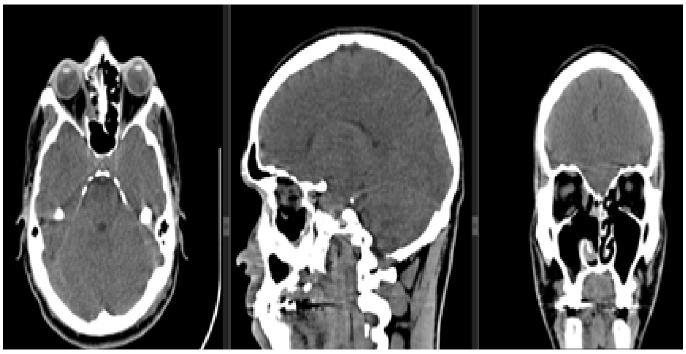

Fig.4. A. Osteoma Osteoid internal wall of right orbit. B. GTR by Endoscopic Endonasal Approach.

Discussion

Intraorbital tumor is a variety of conditions that may need surgical resection. However, the surgical approach to the orbit is still controversial. External approaches and transcranial approaches have been used in the resection of intraorbital tumors, especially for those located superior or anterior to the orbit. However, the endoscopic endonasal approach provides a corridor for minimal invasive surgery of the skull base tumor, which has been developed over the last decade [15].

The location of the pathology within the orbit, relative to the optic nerve, should dictate the choice of approach. This is the key guiding principle for orbital approaches. When addressing lesions located superior and lateral to the optic nerve and orbit, traditional neurosurgical approaches like a frontotemporal craniotomy with or without orbitozygomatic osteotomy provide excellent exposure. A lesser variant of this approach is the lateral micro-orbitotomy that is reserved for lesions lateral to the optic nerve and apex. When it comes to pathologies situated very anterior in the orbit and medially, ophthalmologists are more familiar with the anterior medial "orbitotomy," which uses a transconjunctival approach that does not require an osteotomy. This approach, however, is limited to lesions located anterior to the posterior plane of the globe [3]. When approaching lesions located in the proximity of the orbital apex, the exposure is often significantly limited by the intraorbital soft tissues. A helpful maneuver in these difficult cases involves detaching the medial rectus muscle and mobilizing the cone via a lateral orbitotomy. In spite of this, the surgical field often ends up being a deep cone-shaped area with suboptimal visibility in the depth at the tumor [3].

Every surgical approach to the orbital content must provide maximum safety and optimal visualization. Certainly, the choice of the approach depends on the size and location of the lesion within the orbit, the relationship with the adjacent structures and should certainly be customized to the needs of the patient. The experience of the surgeon is usually another critical factor that influences the choice of the surgical approach [2]. As a whole, different approaches to medial retrobulbar spaces have been described, with the orbitotomy and transconjunctival ones probably the best known. As an alternative, transnasal procedures seem to offer a direct and effective route to the medial orbital spaces [2].

Some surgeons summarized a 360° "round-the-clock" surgical access to the orbit, and they suggested the endoscopic endonasal approach for lesions at the mid or posterior orbit or orbital apex from 1 to 7 o'clock. The orbital tumor with lateral extension to the optic nerve is not a contraindication for the endoscopic endonasal approach, regarding the outcome, preservation of the cranial nerve is the top priority for the surgery of intraorbital tumor. Cranial nerves should be monitored during the surgery. Optic damages are often caused by direct damage, inappropriate traction, or vascular supply impairment during the dissection [15]. Neuro-navigation is recommended during this approach [15].

It is believed that removal of the lamina papyracea or even the medial wall of the orbit does not cause eyeball disposition. However, removal of the periorbita or additional fat dissection may result in orbital fat herniation that can lead to permanent or transient diplopia, enophthalmos, and strabismus. Some surgeons suggested reconstruction of the medial orbital wall with bone and nasoseptal flap in case of large defect. It was reported to use a thick silastic sheet in the nasal cavity to prevent orbital content herniation then remove 4 weeks after the surgery [15-17].

Disadvantages of the EEA include nasal morbidity and the need for two experienced endoscopic surgeons familiar with the anatomy of the orbit. In some cases, three surgeons might be required, particularly when dealing with intraconal tumors, a limitation of the EEA for orbital pathologies is also the absence of effective and nontraumatic endonasal muscle retractors [3,18].

In University of Pittsburgh Medical Center with experience in both external and endonasal to orbital pathologies, were designed a simple algorithm that should guide the selection of the most appropriate approach. as explained earlier, the orbit (right side) is compared with a clock with the optic nerve at its center, In this model, the initial gross distinction is between lesions located lateral or medial to the optic nerve [18]. For purely lateral lesions (8-10 o'clock), the lateral micro-orbitotomy is the preferred approach. If an inferior lateral extension is needed, a zygomatic osteotomy can be added (6-8 o'clock). If the lesion has superior lateral (9-1 o'clock) or intracranial extension, a frontotemporal craniotomy provides better access. For lesions located medial to the optic nerve, consideration should be given to their anterior-posterior extension before choosing the approach. Medial lesions situated in the anterior orbit (1-6 o'clock) can be accessed via the anterior medial micro-orbitotomy approach. However, medial lesions that extend posteriorly are more challenging and are ideally suited for EEA access (1-7 o'clock). In the end, the approaches should not be considered in isolation but often need to be combined to provide 360-degree access to the entire intra- and extraconal orbit. As such, the team should be comfortable with applying all approaches to offer the best option for a given pathology and patient [3].

Conclusion

The endoscopic endonasal approach is applicable for selected intraorbital tumors both medially, inferior and laterally located. The pathology of the lesion and adhesion to adjacent neurovascular structures should also be considered to determine the most appropriate approach. Full effective access to the orbit requires proficiency with a multitude of approaches. The complexity of the orbit and its relationships with surrounding structures necessitates the ability to access it from many different angles. The same general dissection and resection techniques can and should be applied throughout.

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Conflict of Interest

Authors declare that there are no source of funding and no conflicts of interest in this work.

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