Endoscopic superior eyelid transorbital approach

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Endoscopic superior eyelid transorbital approach has garnered significant consideration and gained popularity in recent years. Several previous studies have attempted to quantitatively compare the traditional open anterolateral skull base approaches with transorbital exposure; however, these comparisons have been limited to the area of exposure provided by the bone opening and trajectory, and fail to account for the main avenues of exposure provided by subsequent requisite surgical maneuvers.

The authors quantitatively compare the surgical access provided by the frontotemporal-orbitozygomatic approach and the SETA following applicable periclinoid surgical maneuvers, evaluate the surgical exposure of key structures in each, and discuss optimal approach selection.

Methods: SETA and FTOZ approaches were performed with subsequent applicable surgical maneuvers on 8 cadaveric heads. The lengths of exposure of cranial nerves (CNs) II-VI and the cavernous internal carotid artery; the areas of the space accessed within the supratrochlear, infratrochlear, and supramaxillary (anteromedial) triangles; the total area of exposure; and the angles of attack were measured and compared.

Results: Exposure of the extradural CS was comparable between approaches, whereas access was significantly greater in the FTOZ approach compared with the SETA. The lengths of extradural exposure of CN III, V1, V2, and V3 were comparable between approaches. The FTOZ approach provided marginally increased exposure of CNs IV (20.9 ± 2.36 mm vs 13.4 ± 3.97 mm, $p = 0.023$) and VI (14.1 ± 2.44 mm vs 9.22 ± 3.45 mm, $p = 0.066$). The FTOZ also provided significantly larger vertical (44.5° ± 6.15° vs 18.4° ± 1.65°, $p = 0.002$) and horizontal (41.5° ± 5.40° vs 15.3° ± 5.06°, $p < 0.001$) angles of attack, and thus significantly greater surgical freedom, and provided significantly greater access to the supratrochlear ($p = 0.021$) and infratrochlear ($p = 0.007$) triangles, and significantly greater exposure of the cavernous internal carotid artery (17.2 ± 1.70 mm vs 8.05 ± 2.37 mm, $p = 0.001$). Total area of exposure was also significantly larger in the FTOZ, which provided wide access to the lateral wall of the CS as well as the possibility for intradural access.

Conclusions: This is the first study to quantitatively identify the relative advantages of the FTOZ and transorbital approaches at the target region following requisite surgical maneuvers. Understanding these data will aid in selecting an optimal approach and maneuver set based on target lesion size and location [1].

Proposed as a new minimally invasive technique for the treatment of skull base tumors, mostly extradural tumors.

They provide several corridors to reach lateral areas of the ventral skull base through the orbit.

An extended version of the mini-pterional craniotomy (EMPT) with those of the transorbital endoscopic approach (TOEA), were carried out in 5 latex-injected cadaveric heads, bilaterally (10 sides). For each approach, the area of exposure, surgical freedom, and angle of attack were obtained with neuronavigation and statistically compared.

No significant difference was found between the mean area of exposure of EMPT and TOEA at the anterior cranial fossa (ACF), and middle cranial fossa (P = .709 and .317, respectively). The mean exposure area at the ACF was of 13.4 ± 2.6 cm2 (mean ± standard deviation) and 13.0 ± 1.9 cm2 for EMPT and TOEA, respectively. Except for the crista galli, EMPT afforded a larger area of surgical freedom at all targets. EMPT also achieved significantly greater attack angles in vertical axis except to the crista galli. The horizontal attack angles to all targets were similar between approaches.

EMPT and TOEA offer a comparable area of exposure at the anterior cranial fossa and middle cranial fossa and MCF in the cadaver; however, the instrument maneuverability afforded by EMPT is superior. Further studies are necessary to better define their precise surgical application [2].

An anatomical dissection was performed in four freshly injected cadaver heads (8 orbits) using 0- and 30-degree endoscopes. First, an endoscopic endonasal medial orbital decompression was done to facilitate medial retraction of the orbit. An endoscopic transorbital approach through an eyelid incision, with drilling of the posterior wall of the orbit and lesser sphenoidal wing, was then performed to expose the sylvian fissure and crural cisterns. A stepwise anatomical description of the approach and visualized anatomy is detailed.

A superior eyelid incision followed by orbital retraction provided a surgical window of approximately 1.2 cm (range 1.0-1.5 cm) for endoscopic transorbital dissection. The superior (SOF) and inferior (IOF) orbital fissures represent the medial limits of the approach and are identified in the initial part of the procedure. Drilling of the orbital roof (lateral and superior to the SOF), greater sphenoidal wing (lateral to the SOF and IOF) and lesser sphenoidal wing exposed the anterior and middle fossa dura. A square-shaped dural opening provided visualization of the posterior orbital gyri, sylvian fissure and temporal pole. Intradural dissection allowed exposure of the sphenoidal portion of the sylvian fissure, M1, MCA bifurcation and M2 branches and lenticulostriate perforators. Dissection of the medial aspect of the sylvian and carotid cisterns with a 30-degree endoscope allowed exposure of the mesial temporal lobe and crural cistern.

The transorbital endoscopic approach allows successful exposure of the sphenoidal portion of the sylvian fissure and M1 and M2 segments of the middle cerebral artery. Angled endoscopes may provide visualization of the mesial temporal lobe and crural cistern. Although our anatomical study demonstrates the feasibility of intradural dissection and closure via an endoscopic transorbital approach, further studies are necessary to evaluate its role in the clinical scenario [3].

There has been marked evolution in techniques in skull base surgery including the development of minimally invasive endoscopic supraorbital, transnasal, and more recently, transorbital approaches.

Access to the intraorbital optic nerve segment can be facilitated via a transcranial approach that allows access to the entire orbital cavity.

The endoscopic endonasal approach (EEA) combined with a transconjunctival-medial orbitotomy represents an alternative technique to achieve the same goal.

Koutourousiou et al. report a surgical technique that allows total resection of the intraorbital optic nerve with minimal trauma and excellent results. Further extend and define the limits and indications of the EEA to orbital surgery.

A patient with rapidly progressive, but asymmetric, vision loss underwent EEA for optic nerve biopsy. Due to the undetermined histopathological diagnosis and complete unilateral vision loss, diagnostic total optic nerve resection was indicated. The entire intraorbital length of the nerve was resected via an endoscopic endonasal transorbital approach combined with transconjunctival-medial orbitotomy.

A 2-cm intraorbital nerve segment was sent for pathological examination. The patient maintained normal extraocular movements and experienced no complications. The postoperative course was uneventful and the patient was discharged the next day.

The EEA provides another option for access to the entire optic nerve. It is a safe and effective technique lacking cosmetic defects and providing an alternative corridor to traditional transcranial approaches to the orbit [4].

On 5 cadaveric specimens and 4 preliminary clinical experiences with the combined transnasal transorbital multiportal endoscopic approach for the management of selected complex skull base pathologies. The technical feasibility and safety of this combined approach were evaluated in the preclinical study. The applicability in vivo of such an approach, together with early and late complications, specific morbidity, and hospitalization time were analyzed in the preliminary clinical experiences.

The transnasal endoscopic extended approach combined with the transorbital endoscopic approach offered greater visualization and tissue handling than a single approach alone could. The multiportal combined transorbital transnasal endoscopic approach was used effectively in vivo to resect 1 case of malignant schwannoma arising from the second branch of the trigeminal nerve and 3 cases of spheno-orbital meningioma without significant complications and with minimal morbidity for the patients.

The multiportal combined transorbital transnasal endoscopic approach is a safe and effective procedure for management of selected complex skull base lesions that is able to capitalize on the

advantages and overcome the limitations of each single approach. This combined approach offers a multiperspective view of the spaces and allows for a more synergized procedure, especially when dealing with multicompartmental lesions [5].

Lateral Transorbital Endoscopic Approach

Lateral Transorbital Endoscopic Approach

See Inferolateral transorbital endoscopic approach.

Indications

Endoscopic superior eyelid transorbital approach indications.

Case series

In 2017-2018, Golbin et al. operated on 12 patients with skull base lesions using transorbital endoscopic approaches. The series included ten female and two male patients. The patient's age varied between 24 and 78 years. All patients were admitted for the first time. Half of them underwent biopsy, while the other half underwent tumor resection. The upper-lateral transorbital approach with an eyebrow incision was used in most (8/12) patients; the retrocaruncular approach was used in two cases; the lateral retrocanthal approach was applied in one case; the upper-medial approach with an eyebrow incision was used in one patient.

The histological diagnosis was established in all six biopsies: 3 pseudotumors, 2 WHO Grade I meningiomas, and 1 clear-cell kidney cancer. Tumor resection was successful in 5 out of 6 patients; repeated surgery was required in one patient. In one case, the transorbital approach was combined with the transnasal one for treatment of supraorbital mucocele. One patient developed a persistent neurological deficit (dysfunction of the fifth and sixth nerves) after upper-lateral transorbital surgery. There were no poor cosmetic results in the series.

Transorbital neuroendoscopic surgery needs an interdisciplinary approach and a sufficient amount of surgical experience. Surgical skills setting includes microsurgical and endoscopic tumor resection, harvesting and positioning of free and vascularized grafts for skull base reconstruction and prevention of postoperative enophthalmos, and facial incisions and their cosmetic closure. Implementation of new local vascularized flaps may significantly improve the results of transorbital endoscopic procedures and extend the spectrum of indications [6].

One hundred seven patients (aged 6-83 years) underwent orbital or transorbital endoscopic surgery for 6 different indications. Seven incisions were used. Endoscopic orbitotomies were made through all 4 orbital walls to access surrounding structures. Intraoperative goals were achieved endoscopically in 106 patients. Mean follow-up was 3 months (mean ± SD, 3.0 ± 3.5). No complication was directly

related to surgical approach or use of endoscopy. Seventeen complications were detected in 2 categories: persistent diplopia and persistent vision change. No patient had vision loss. No nonfracture patient suffered a complication. Subgroup analysis demonstrated no difference in surgical success rates when compared with transnasal and transantral medial orbital wall and orbital floor repair and cerebrospinal fluid leak repair. Endoscopic visualization was advantageous in several respects: superior visualization and lighting, particularly posterior to the equator of the globe; image magnification; and video monitoring for education and operating room staff involvement. It also facilitated surgical navigation and computer-aided reconstruction.

Orbital and transorbital endoscopy are versatile, effective, and safe approaches useful for addressing diverse urgent and elective problems. In appropriate clinical situations, these procedures may offer better access and visualization than open or transnasal approaches [7].

1)
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