Orbitozygomatic approach

The orbitozygomatic approach (OZA), along with the pterional approach, is one of the most versatile anterolateral approaches to the skull base. The terms “unilateral transbasal” and “orbitozygomatic infratemporal” are synonyms of the term “orbitozygomatic”. Currently, orbitozygomatic approaches comprise a group of surgical approaches to the skull base that suggest involvement of elements of the orbital walls (superior and lateral) and zygomatic bone into the bone block formed during osteotomy. The OZA, which has integrated several limited basal approaches (pterional, supraorbital, zygomatic), is a combined anterolateral approach that perfectly matches the conceptual principle of skull base surgery — to minimize brain retraction. Like any other approach to the skull base, the OZA provides a wide view, short distance to the target region, direct approach, and opportunity to work at various angles, with injury to and retraction of critical neurovascular structures being minima.

Indications

Orbitozygomatic Approach Indications.

Pathology in the region of the basilar quad rifurcation, anterolateral midbrain, medial tentorium, and interpeduncular and ambient cisterns may be accessed anteriorly via an orbitozygomatic (OZ) craniotomy.
Although pterional craniotomy and its variants are the most used approaches in neurosurgery, few studies have evaluated their precise indications.

da Silva et al., from the Hospital das Clínicas evaluated the pterional (PT), pretemporal (PreT), and orbitozygomatic (OZ) approaches through quantitative measurements of area, linear, and angular exposures of the major intracranial vascular structures.

Eight fresh, adult cadavers were operated with the PT, followed by the PreT, and ending with the OZ approach. The working area, angular exposure of vascular structures and linear exposure of the basilar artery were measured.

The OZ approach presented a wider area (1301.3 ± 215.9 mm²) with an increase of 456.7 mm² compared with the PT and of 167.4 mm² to the PreT (P = 0.011). The extension from PT to PreT and OZ increases linear exposure of the basilar artery. When comparing the PreT and OZ, they founded an increase in the horizontal and vertical angle to the bifurcation of the ipsilateral middle cerebral artery (P = 0.005 and P = 0.032, respectively), horizontal angle to the basilar artery tip (P = 0.02), and horizontal angle to the contralateral ICA bifurcation (P = 0.048).

The OZ approach offered notable surgical advantages compared with the traditional PT and PreT regarding to the area of exposure and linear exposure to basilar artery. Regarding angle of attack, the orbital rim and zygomatic arch removal provided quantitatively wider exposure and increased surgical freedom. A detailed anatomic study for each patient and surgeon experience must be considered for individualized surgical approach indication.

The orbitozygomatic approach provides wide, multidirectional access to the anterior and middle cranial fossae, as well as to the upper third of the posterior fossa and clivus.

The technique eliminates the need for bone reconstruction of the orbital walls to prevent enophthalmos and minimizes the risk of injury to the frontal branch of the facial nerve.

The surgical technique of obitozygomatic craniotomy reported by Zabramski, et al. is an excellent procedure, facilitating wide surgical exposure, easy orbital reconstruction, and a satisfactory postsurgical esthetic outcome; however, it is anatomically complicated and technically difficult.

Kodera et al., introduce a simplified technique of Zabramski's orbitozygomatic craniotomy and present the anatomical and clinical findings with cadaveric photos, illustrations, and a video of surgery.

The orbitozygomatic craniotomy was performed on 20 sides of 11 cadaver heads, in which the cut between the inferior orbital fissure (IOF) and superior orbital fissure (SOF) was modified and simplified, and the shortest distance between them was measured. This technique was applied to 13 clinical cases, and craniotomy-associated esthetic and functional complications were evaluated.

The average of the shortest distance from IOF to SOF was 21.3 mm (range, 19 - 23 mm) on the 20 sides of the 11 cadaver heads. Orbitozygomatic craniotomy could be achieved in a short time while preserving the structure of the orbital wall in all 13 clinical cases. A hollow at the temple was noted in one patient, cerebrospinal fluid leak in two, and transient facial pain in one; however, no other craniotomy-associated esthetic or functional complications including enophthalmos were found in any of the 13 patients.
With this modified technique, Zabramski's ideal obitozygomatic craniotomy could be achieved easily with only minimal complications while realizing all advantages of the technique.

Pellerin et al. and Hakuba, et al. first described the orbitozygomatic approach (OZ) to the anterior and middle cranial fossae as well as to the upper third of the clivus and posterior fossa. Since then, various authors have reported a variety of modifications to enhance the exposure offered by the orbitozygomatic approach.

Increased bone removal from the skull base obviates the need for vigorous brain retraction and offers an improved multituded trajectory and shallower operative field. Modifications to the orbitozygomatic approach provide alternatives that can be tailored to particular lesions, enabling the surgeon to use the best technique in each individual case rather than a “one size fits all” approach.

**Modifications**

Currently, two classic OZA modifications are used: the one-piece (a bone flap includes the zygomatic process of the frontal bone, frontal process of the zygomatic bone, 1/2 or 1/3 of the zygomatic bone body, temporal process of the zygomatic bone, and zygomatic process of the temporal bone) and the two-piece OZA (an orbitozygomatic bone flap is supplemented by pterional and frontotemporal craniotomy). The two-piece OZA provides a better view of the basal portions of the frontal lobe and reduces the risk of enophthalmos and cosmetic defects.

**Keyholes**

The one-piece orbitozygomatic (OZ) approach is traditionally based on the McCarty keyhole. Spiriev et al., present the use of the sphenoid ridge keyhole and its possible advantages as a keyhole for the one-piece OZ approach. Using transillumination technique the osteology of the sphenoid ridge was examined on 20 anatomical dry skull specimens. The results were applied to one-piece OZ approaches performed on freshly frozen cadaver heads. We defined the center of the sphenoid ridge keyhole as a superficial projection on the lateral skull surface of the most anterior and thickest part of the sphenoid ridge. It was located 22 mm (standard deviation [SD], 0.22 mm) from the superior temporal line; 10.7 mm (SD, 0.08 mm) posterior and 7.1 mm (SD, 0.22 mm) inferior to the frontozygomatic suture. The sphenoid ridge burr hole provides exposure of frontal, temporal dura as well as periorbita, which is essential for the later bone cuts. There is direct access to removal of the thickest (sphenoidal) part of the orbital roof, after which the paper-thin (frontal) part of the orbital roof is easily fractured. The sphenoid ridge is an easily identifiable landmark on the lateral skull surface, located below the usual placement of the McCarty keyhole, with comparative exposure.

**Indications**

The approach has been widely adopted by skull base centers for the management of neoplastic lesions, but has seen only limited use in vascular surgery.

The orbitozygomatic approach (OZA) has been useful in accessing basilar apex aneurysms, especially in cases where it is in a high position, because this approach can facilitate upward and oblique viewing from below through the wide operative space.

However, the OZA needs additional removal of the orbital rim and zygomatic arch, in addition to standard pterional craniotomy, which increases invasiveness, the risk of facial nerve palsy, temporal...
muscle atrophy, and deformity after surgery, and results in an extended operative time. Appropriate selection of the OZA requires indications that have yet to be established. The trajectory to BX aneurysms in the interpeduncular or prepontine cisterns has been suggested to be related to not only the height of the apex of the basilar artery (BA), but also the height and lateral breadth of the bifurcation of the internal carotid artery (ICA).

Simulation using 3D-CTA appears to be important for planning the surgical approach for the treatment of BX aneurysms.

Sphenoid wing meningiomas undergoing extensive skull base approach (FTOZ) and gross total resection (GTR) had a low recurrence rate and higher recurrence-free (RFS) survival. Even though FTOZ with GTR is preferable to resect the sphenoid wing meningiomas, the procedure should be tailored to each patient depending on the risks and surgical morbidity.

Reconstruction

The reconstruction after the OZ approach is as important as the performance of the surgical technique. Attention to anatomical details and the stepwise reconstruction are a prerequisite to the successful preservation of function and cosmesis.

Complications

Oculocardiac reflex OCR occurs in nearly one-third of patients who undergo the OZ approach. However, simple cessation of orbital manipulation is sufficient to normalize the patient's heart rate. Rarely is medical management required or does there appear to be any significant postoperative ramifications.

The mini-pterional and mini-OZ approaches, as currently performed in select patients, provide less tissue traumatization (i.e., less temporal muscle manipulation, less brain parenchyma retraction) from the skin to the aneurysm than standard approaches. Anatomical quantitative analysis showed that the mini-OZ approach provides better exposure to the contralateral side for controlling the contralateral parent arteries and multiple aneurysms. The mini-pterional approach has greater surgical freedom (maneuverability) for ipsilateral circle of Willis aneurysms.

Case series

2016

Twenty-seven patients had vascular lesions and twenty-two suffered for intracranial skull base tumors. The vascular lesions varied from cavernous angiomas inside the mesencephalum, high bifurcation basilar tip aneurysms, superior cerebellar arteries aneurysms and arteriovenous malformations in the interpeduncular cistern. Skull base tumors as meningiomas, interpeduncular hamartomas and third ventricle floor gliomas were among the neoplastic lesions approached. We had no permanent injuries and minimal transient complications had occurred.

It is a descriptive text, organized in the sequence of the main stages in which such a craniotomy is performed, describing in details the technique in which this group of evolutionarily authors came to accomplish the task.
1998

In 1998, J. Zabramski et al. presented a large study (83 cases) on the use of their own OZA modification, in which the bone block was separated with a minimal bone loss, which enabled full restoration of the facial skeleton contours at the end of surgery.

At a follow-up evaluation after a period averaging 14 months, all patients were pleased with the cosmetic results of this approach.\[16]\)

Case reports

A **nasopharyngeal carcinoma** arose in a 52-year-old patient and occupied the right middle skull base extending to the ICA. We first identified and dissected the ICA from the posterolateral part of the tumor using a transcervical approach. Then, the tumor was approached and removed by an orbitozygomatic technique with hemifacial dismasking. The surgical defect was filled using a temporal muscle flap, which was divided into two parts according to the blood supply from either the anterior or the posterior deep temporal artery.

The postoperative course was uneventful and favorable cosmetic results were obtained. The patient has been free of carcinoma for more than 40 months after the surgery.

This new combined approach might be a good option for selected patients with nasopharyngeal tumors.\[17]\)

A 52-year-old male with progressive, marked unilateral proptosis due to a multilobulated orbital mass, secondary to biopsy-proven plexiform neurofibroma (PN). Acute worsening of proptosis leading to corneal abrasion, diplopia, and pain required debulking surgery, for which an orbitozygomatic approach was utilized. Genetic testing for NF-1 revealed no mutation. This rare case of NF-negative orbital PN and multidisciplinary treatment considerations for expansile orbital tumors are discussed.\[18]\)

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