Establishing a preoperative strategy is no need to sacrifice the eye [18].

By biopsy with extemporaneously histopathology exam when the orbital periosteum is not tumor involved (proven the case with orbital extensions of the ethmoid tumor, wall of the orbit in the same time)

in following cases:

- Inferior orbital wall destruction its reconstruction is recommended in order to avoid malposition of the ocular bulb or eyelid skin.
- Stage III: invasion of medial rectus muscle, optic nerve, ocular bulb or eyelid skin.
- Stage II: tumor invasion of orbital fat
- Stage I: medial orbital wall erosion and destruction

Orbital clearance or orbital exenteration is recommended only if the degree of orbital invasion is in stage III. Histological studies have shown that tumor invasion is limited to the periorbit and therefore except third degree (level III) of orbital invasion it is recommended to keep the eyeball in all other cases of ethmoid tumor with invasion of the orbit and skull base [21]. In cases with inferior orbital wall destruction its reconstruction is recommended in order to avoid malposition of the ocular globe.

Reconstruction of inferior orbital wall is recommended in following cases:
- Orbital floor defects over 75%
- Multiple segmentation defects (orbital floor and another wall of the orbit in the same time)

Extremely well documented studies have shown that in the case with orbital extensions of the ethmoid tumor, when the orbital periosteum is not tumor involved (proven by biopsy with extemporaneously histopathology exam) is no need to sacrifice the eye [18].

Establishing a preoperative strategy

Clinical examination of the patient: presentation reasons, patient history, working conditions - toxic environment, life conditions - personal habits: smoking, drinking alcohol, pathological and physiological antecedents, ENT clinical examination.

Endoscopic examinations
- rigid endoscopes Hopkins 0, 30,45,70° (different lengths and diameters: 4, 2.7, 1.9 mm);
- flexible endoscope and video endoscope with “chip on the tip” modern technology;
- HD imaging and NBI technology – importance in delimitation of tumor margins.

Imaging examinations

Imaging has a key role in deciding the surgical approach in safety conditions getting a successful result [23]. Detailed anatomical landmarks highlighting and of reports between tumor lesions and vascular and bone structures is crucial for surgeon [1].

CT-Scan [12]: sinuses and orbit, native and with contrast substance[13]

- Multi-slice CT examination (MSCT) and volumetric CT examination (VCT) give a reliable anatomical picture because thin sections, under 1 mm and acquisitions of images at high speed, hundreds images per second, with a better highlight of vascular structures [2]. An exam with high specification is CT angiography with injection of contrast substance and processing with volumetric reconstruction (VR), with maximum intensity projection (MIP) and with multi-plane reconstruction (MPR) [3]. This method is of choice for highlighting tumor vascularization, relation between vascular and bone structures and bone integrity [1].

MRI : sinuses, orbit, neurovascular bundles, muscles

MRI angiography

1.5 or 3 tesla MRI imaging increase quality of image and the ability to distinguish tissue types and different structures especially at cerebral level.[14] 4 and 9 tesla devices are not standardly used. MR angiography is a method widely used, with or without contrast substance, preferably using the same type of images processing like in CT angiography. With this method the bone structures are not viewed, but permit an excellent viewing of vascular structures,
including those from cerebral and spinal levels. Intra and extra-cranial structures can be evaluated with MR angiography, useful investigation for patients with contraindications for iodine contrast substance administration (allergies, renal failure). At the patients with renal failure it must avoided also substances with paramagnetic load because the risk of renal fibrosis [1].

-Angiography with or without embolization with at most 72 h before surgery. Angiography with digital processing is not a routine investigation, but in cases with high risk of bleeding can highlight thin and important vessels or integrity circle of Willis. Also put indication of embolization in vascular malformation or in vascular tumor cases [2].

-Orbital Ultrasound – CT (Ultrasound - Tomography of the orbit )[24];
-Orbital Ultrasound[14].

If we plan to use system rhino-neuronavigation, CT acquisition should be performed in a manner of “high dosage” in order to have the best possible details. Both the CT scan and MRI should be performed with the step section as small, 0.6 mm and in a manner compatible with the rhino-neuronavigation system. In the literature are cited studies showing that up to 17% of cases rhino – neuronavigation system can not be used due to an incorrect acquisition, that does not ensure a compatibility with it. We must consider the possibility of mixing the MRI image with CT image (Fusion), which can perform all modern rhino-neuronavigation systems [4]. Note that the progresses recorded of this technology guidance surgical related to the programs like Virtual Reality and Augmented Reality, give us the possibility of a virtual surgical planning and real-time display of surgical risk elements, predetermined by the surgeon.

Preoperative Hystopathological and Immunochemistry exams – preoperative biopsy:

Interdisciplinary examinations: ophthalmology, neurosurgery; Conventional cardio-pulmonary radiology; Abdominal ultrasound; CT – Scan: thorax, head, Oral-maxillofacial surgery examination when the tumor is extended to alveolar rebord of maxillary sinus after imaging.

Forming a surgical team

Depending on preoperative exams (imaging and interdisciplinary examinations) the surgical team – ENT +/- eye surgeon, +/- neurosurgeon is established. It is very important to have an interdisciplinary team. Even if the preoperative evaluation does not find invasion elements at the orbit or skull base, we must have in all cases the possibility of “on call” eye surgeon and neurosurgeon because of possible complications related to orbit or skull base that can appear during such a complex surgery[5].

Orbital complications

Orbital lesions have devastating potential for patient quality of life. Early complications can be vascular, of muscle or nerve. Orbital fat damage can lead to diffuse venous bleeding, but generally ethmoid artery bleeding is the main source of vascular complications to the orbit. This bleeding leads to the formation of orbital hematoma that lead intraocular pressure increasing. This can compromise the optic nerve or retina. Trans-nasal endoscopic orbital decompression or lateral cantotomy must be effectuated to decrease intraocular pressure, accompanied by the administration of mannitol and intravenous steroids. Optic nerve damage can occur indirectly, through a compression due to orbital hematoma or directly by surgical instruments. Diplopia and enophthalmos are direct consequences of injuring of right medial and inferior muscles. Enophthalmos can occur only after orbital hematoma or peribordial edema resorption. Right medial muscle damage can occur in the percentage of up to 0.5% during FESS interventions. In this case there are repairing procedures, transposition flaps or other advanced techniques which can be carried out.

Sinus complications

Secondary sinusitis can occur after skull base surgery if during reconstruction the sinus ostium is blocked. In this case a second intervention is necessary to drain the collection and to ensure patency of sinus ostium and of pharyngeal orifice of the Eustachian tube. During surgery of ethmoid sinuses the anterior [8] and posterior ethmoid arteries (located in the ethmoid ceiling) can be intercepted [9]. The bleeding is stopped identifying the source of bleeding and artery bipolar electrocoagulation. The anterior ethmoid artery has no bone shell at 66% of people. If the bleeding is not controlled this artery can re rarely in the orbit and form an orbital hematoma. Olfactory epithelium can be damaged during tumor resection, but the oncological principles will be first before keeping the smell. Blocking sphenoid sinus ostium is a common problem after the pituitary surgery or after using nasoseptal flap during reconstruction. There have been described fungal and bacterial sphenoid sinusitis after nasoseptal flap reconstruction [7]. A dehiscent internal carotid artery or a dehiscent optic nerve can be injured during tumor dissection or during reconstruction [10]. Performing a large sphenoidotomy you can dissect a septal artery ram of the sphenopalatine artery for finally getting a mucopericondral viable flap[11].

Intracranial complications

CSF fistulas after tumor resection or during skull base reconstruction surgery, pneumoencefal, encephalitis, meningitis and / or cerebral abscess or cerebral vascular lesions with intracranial hemorrhage.

The surgical team must be very well trained so that can manage possible extensions of tumor lesions and also all possible complications, some of them anteriorly described.

Clinical selected case

Patient L.G., 38 years old, from rural, worker in a dust environment – toxic environment (he processes brick and ceramics). He was admitted in hospital for: left nasal obstruction, left epistaxis, left exophthalmos.

Imagistics show left naso-ethmoido-maxillo-fronto-sphenoid tumor with extension to the orbit (posterior pol, tumor contact with right medial muscle) and skull base. (fig.1, 2). According to preoperative imagistic findings we decided to perform a combined surgical approach, (external approach (fig.3) with video endoscopic control (fig.4)). Video assisted control gave us many advantages.

Fig. 1 Imagistics – Tumor extension to Sphenoid sinus
1. We were able to "clean" tumor fragments adherent to orbital content (orbital fat) – intraoperative findings revealed orbital bone lysis with invasion of the orbital peristeum and also those adherent to skull base (bone lysis at this level two) – after removing tumor remained pulsatile denuded dura area between two bone intact limits, without CSF-leak. 2. We succeeded in excision of the tumor extension from posterior pole of the orbit. 3. Removed tumor from left sphenoid and posterior ethmoid sinuses. We used 0, 30 and 70° rigid endoscopes Hopkins, radiofrequency, shaver and surgical drill. Radiofrequency helped us to clean the small tumor pieces from skull base [12]. Coblation could be also used for the same purpose [6]. Drilling was necessary for removing the bone structures from proximity of the tumor after its excision, for open the frontal sinus and drill the tumor “bed” after its removal (fig.5, 6) and for getting tumor free bony columns to sustain the content of the orbit at the end of surgery (fig.7) [12]. Even if the orbit periosteum and orbit fat was tumor involved we decide to keep the ocular globe and to try to clean orbit tissues as much we could because we had not the patient consent for exenteration or orbital clearance. Reconstruction of the bony, subcutaneous and cutaneous plans was done, after total macroscopic excision of the tumor (fig.8), with statics conservation of the ocular globe (fig.9, 10). The hystopatological result was poorly differentiated carcinomas G3 with necrotic areas [15]. The patient will follow radiotherapy.

Conclusions

Ethmoid tumors extended to the orbit and skull base are a permanent challenge for a surgical team that must be
very well trained. The best approach for ethmoid tumor extended to the orbit is the combined approach that allows both accuracy identifying of orbital tumor invasion and the use of all modern technologies [12] for macroscopic tumor lesions ablation preserving the oculoc orbital especially when orbital periestem has not tumor invasion. These tumors have a great variability in terms of evolution and extension in neighboring areas, risk areas[17] – the therapeutically strategy generally, but especially the surgical one is adapted to each case depending on preoperative investigations ( endoscopy, Imagistics and hystopatological exam)[16].

The precise identification of tumor invasion front to be made by Hystopathological and Immuno-chemistry exams of intraoperative sampling from the orbital tissues at the resection limits. Even when after a precise surgery in postoperative laboratory findings the patient has microscopic tumor invasion of orbit tissue there are cases when is not accepted oculoc exenteration so the surgeon must conserve oculoc globe trying to clean all tumor invaded tissue from the orbit followed by radiotherapy for whole area and polichemo therapy[26]. It is underlined the importance of establishing a preoperative strategy (whenever it is possible with Hystopathological and Immunochemistry exams) [22] and forming a surgical team that includes also an eye surgeon knowing that the oculoc exenteration (when is necessary) is made (according to our country legislation) by him. From the casuistry of I.F.A.C.F – ORL “Prof. Dr. D. Hociota” we selected an illustrative case for showing how to deal with this kind of tumor pathology.

References

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