How I Do It

How to Prevent Diplopia in Endoscopic Transnasal Resection of Tumors Involving the Medial Orbital Wall

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INTRODUCTION

Removal of the medial orbital wall and periorbit during endoscopic endonasal procedures for malignant tumors or during endoscopic transoral procedures for intraorbital tumors may cause transient or permanent diplopia, enophthalmos, and strabismus1,2 (Fig. 1). Here, we present a simple technique that prevents these complications and allows for a spontaneous reconstruction of the medial orbital wall without the need for synthetic materials.

MATERIALS AND METHODS

This is a retrospective study of three cases of tumors involving the sino-orbital interface, treated at a tertiary care center between 2011 and 2013. Clinical charts were reviewed for demographics, clinical presentation, tumor extension based on nasal endoscopy, preoperative imaging, surgical approach, and follow-up.

Preoperative Assessment

Tumor extension was assessed preoperatively by nasal endoscopy, computed tomography (CT), and magnetic resonance (MR) imaging. After imaging evaluation, a biopsy under endoscopic control was performed, whenever possible, under local anesthesia. Ophthalmologic examination was performed in all patients prior to surgery. All patients had normal eye motility. Treatment strategy was approved in the interdisciplinary Tumor Board conference.

Technical Note

Once the intranasal part of the lesion is debulked, and a large antrostomy and ethmoidosphenoidectomy is performed, the mass is followed in the orbit after the complete removal of the lamina papyracea. The periorbital layer is then opened as anteriorly as necessary and elevated together with the tumor remnant from the orbital content. Frozen sections of the periorbital margins are performed in cases of malignant tumors. Intraorbital dissection of the mass is performed with cotonoids and blunt or sharp instruments using 3-, 4-, and even 5-hands surgery, with a retractor being held on the orbital fat by an assistant. If the tumor is in close contact with the muscles and they are not invaded, careful and gentle dissection allows the tumor to be to be medialized and freed.

At the end of the procedure, a thick silastic sheet is placed in an inverted U-shape in the nasal cavity with one side against the nasal septum (or the contralateral lateral nasal wall when the septum is removed for oncological reasons) and with the other side against the orbital content, like an “arch”, to ensure the maintenance of the orbital content within the orbit without herniation in the nasal fossa (Fig. 2). The silastic is left in place for 1 month to allow for the spontaneous development of a new fibrotic medial orbital wall.

Follow-up

Postoperative follow-up was performed with nasal endoscopy, CT or MR, and ophthalmological examination in all cases. The study met the approval of the local board of medical ethics.

RESULTS

Three patients with lesions involving the medial orbital wall and extending into the orbit were surgically treated in our institution using the U-shaped silastic sheet technique for orbital medial wall reinforcement. Symptoms, tumor extension, surgical approach, and follow-up are reported in Table I. There was one case of...
osteoma (extra-intraconal) (Fig. 3 and Suppl Fig. 1), one low-grade leiomyosarcoma (extraconal) (Fig. 4) and one recurrent epithelial-myoepithelial carcinoma (extraconal) (Suppl Fig. 2). The two patients with malignant tumors refused exenteration of the orbit. In all three cases, the tumor involved the lamina papyracea. The periorbit was invaded in both cases of malignant tumors, whereas the

Fig. 1. Postoperative MR imaging T1 with gadolinium after surgery for esthesioneuroblastoma invading the left orbit. Extensive removal of the left medial orbital wall and periorbit caused orbit fat herniation (white arrow) with enophthalmos and permanent diplopia due to the protrusion of the medial rectus muscle into the nasal cavity.

MR = magnetic resonance.

MR

Fig. 2. Postoperative CT scan performed 2 weeks after removal of a right intraorbital osteoma. The silastic sheet (white arrows) is placed in an inverted U-shape in the right nasal cavity with one side against the nasal septum and the other side against the orbital content, like an “arch,” to ensure that the orbital content is maintained within the orbit without herniation in the nasal fossa. CT = computed tomography.

TABLE I.

Clinical Data of the Three Intraorbital Tumors.

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Sex/Age</th>
<th>Symptoms</th>
<th>Tumor Extension</th>
<th>Relation With Intraocular Muscles</th>
<th>Surgical Approach</th>
<th>Pathological Findings</th>
<th>Follow-up (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F/54</td>
<td>Left nasal obstruction; epiphora; esophthalmos</td>
<td>Anterior ethmoid; posterior ethmoid; erosion of the lamina papyracea; compression of the orbit</td>
<td>Extraconal</td>
<td>Endoscopic transnasal intraorbital resection</td>
<td>Low-grade leiomyosarcoma</td>
<td>26</td>
</tr>
<tr>
<td>2</td>
<td>F/56</td>
<td>Recurrence; previously treated 20 years ago in another institute</td>
<td>Inferomedial quadrant of the orbit</td>
<td>Extraconal</td>
<td>Endoscopic transnasal intraorbital resection</td>
<td>Epithelial myoepithelial carcinoma</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>M/30</td>
<td>Right esophthalmos</td>
<td>Anterior ethmoid; lamina papyracea; superomedial quadrant of the orbit</td>
<td>Intraconal and extraconal</td>
<td>Endoscopic transnasal intraorbital resection</td>
<td>Osteoma</td>
<td>10</td>
</tr>
</tbody>
</table>
osteoma had crossed the periorbit to develop in the intraconal space. All patients presented with proptosis, and eye movements remained strictly normal. The periorbit was removed, together with the lamina papyracea, in all three cases to permit intraorbital dissection of the lesions. In one case (osteoma), the superior oblique muscle was entrapped by the mass and dissected endoscopically while external compression was applied on the lesion. In one case (low-grade leiomyosarcoma), the tumor was in close contact with the medial rectus and superior oblique muscles but could be completely detached by sharp dissection (Fig. 5). This patient, as well as the patient with recurrent epithelial-myoepithelial carcinoma (Suppl Fig. 3), was subsequently submitted for radiation treatment.

In all patients, the U-shaped silastic sheet was removed 4 weeks after surgery. No major intraoperative and postoperative complications were observed, and eye movements were preserved without double vision or enophtalmos. Follow-up ranged from 10 to 26 months. No evidence of disease was observed at the patients’ most recent examination. All patients experienced a resolution of their initial ophthalmological symptoms, which was supported by postsurgical ophthalmological examination.

**DISCUSSION**

Through the years, endoscopic endonasal orbit decompression has become an accepted treatment for thyroid eye disease. The technological advances and surgical skills in endoscopic sinus and skull base surgery have extended this orbital approach to the management of lesions involving the sino-orbital interface or localized in the infero-medial intraconal space.

It has been known for years that removal of the lamina papyracea, or even of the medial wall of the orbit, does not affect eyeball position and movements, as long as the periorbit is preserved. Thus, function is preserved. The vast number of cases reported by Nicolai et al. in the management of the orbit in cases of sino-nasal malignancies clearly support this assertion.

Nevertheless, removal of the periorbit and additional fat dissection results in orbit fat herniation that can lead to enophtalmos and medial displacement of the eyeball, with subsequent diplopia (Fig. 1). The

Fig. 3. Preoperative CT scan of a right intraorbital osteoma in the coronal plane. The intraconic and extraconic components of the osteoma can be observed with protrusion of the eyeball. The osteoma is also extending into the right ethmoid sinus. CT = computed tomography.

Fig. 4. Preoperative MR imaging T1 with gadolinium of a low-grade sinonasal leiomyosarcoma extending into the left orbit, in contact with the medial rectus and superior oblique muscles and causing exophthalmos. MR = magnetic resonance.

Fig. 5. Postoperative MR imaging T1 with gadolinium after resection of a low-grade sinonasal leiomyosarcoma, performed 12 months after surgery with no evidence of disease and with a well-healed surgical cavity. The left medial orbital wall is replaced by scar tissue, which avoids herniation of the orbital content in the nasal cavity. MR = magnetic resonance.
extraocular muscles are connected via a system of connective tissue septae and pulleys within the orbital fat such that fat prolapse resulting from orbital decompression by any method can alter ocular motility with a postoperative increase in strabismus. Castelnuovo et al. reported an important finding in the transnasal management of intraorbital lesions. Among 16 patients, only two had persistent diplopia. This result suggests that orbital stability is more related to the intraorbital septa than to the periorbit. However, for some authors, a periorbital reconstruction is required in cases of significant disruption to the peri orbital layer. According to our experience with benign and low-grade malignant tumors extending into the orbit, wide removal of the periorbit, combined with extensive intraorbital dissection, does not require an orbital reconstruction. The placement of a thick silastic sheet in an inverted U-shape in the nasal cavity is sufficient to ensure spontaneous reconstruction of the medial orbital wall together with its reepithelization. In our experience, no postoperative orbital complications were observed, and no secondary reconstructive or corrective surgeries for ophthalmological complications were needed. However, the present study is limited by the small cohort of patients.

Notably, in our set of cases, two patients had malignant tumors and may have required orbital exenteration. Both patients refused this surgery, and endoscopic removal was only performed as a secondary alternative, with subsequent radiation therapy and strict follow-up. Although wide surgical excision with clear margins remains the treatment of choice because of the tumor’s tendency to infiltrate locally, our results at 18 and 26 months may support this more conservative approach in the presence of low-grade malignant tumors invading the orbit. Nevertheless, additional reports on this topic are necessary.

CONCLUSION
In patients without preceding diplopia, the ocular motility disturbance after removal of the medial orbital wall during endoscopic endonasal and transorbital approaches is likely to be caused by both the displacement of the globe and the involvement of the orbital connective tissue pulley system in the prolapsing fat. Placement of a silastic sheet as a protection to push the orbital content into the orbital cavity may be sufficient to avoid postsurgical orbital complications and the need for secondary interventions.

BIBLIOGRAPHY