Orbital decompression in Graves' orbitopathy: state of the art and novel perspectives

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Small Versus Coronal Incision Orbital Decompression In Graves’ Orbitopathy

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Abstract
Ideally the planning of decompression surgery should be adequate to the severity of the orbitopathy, its possible “lipogenic” or “myopathic” variants, the patient’s specific orbital osteology and possible previous surgeries. Due to surgeon’s experience and local traditions, however, a standardized rather than a tailored approach is often offered to the patient.

An inferior fornix incision can be used for infero medial bony decompression and/or for removing fat from the medial and lateral inferior orbital quadrants. Through the same route a lateral osteotomy can also be performed although an upper skin crease incision offers a wider access to the lateral orbital wall. As an alternative the swinging eyelid technique, offering an adequate access to the bony orbit and to the orbital fat compartments is a versatile technique that can virtually be used as a standard approach for the greatest majority of patients needing decompression surgery.

Orbital decompression by coronal incision is an invasive technique and for this not to be used as a standard approach to orbital decompression. Nevertheless, it is not to be abandoned as it can be an additional tool in surgeons’ hands when dealing with patients who can better benefit out of a particular, tailored rather than a standardised approach.

Many are the circumstances in which this may happen.

Major complications associated with the coronal approach have been mainly described in small series, where only a few patients per year were operated. In this respect it is therefore unavoidable to emphasize that each technique has its own learning curve and it may be difficult to differentiate the effects of each technique from the experience of the surgeon.
For almost one century decompression surgery has been used to treat Graves’ orbitopathy (GO), and through the years it has been subjected to a paradigm shift in respect to indications, approaches, and surgical routes. This has been largely due to a better understanding of the multifaceted nature of the disease, a constant attempt to implement the beneficial effects of this type of surgery simultaneously decreasing the aesthetic impact of surgical scars, hospitalisation time, reconvalescence periods and risks for iatrogenic complications in general, and consecutive strabismus in particular. Patients’ increased expectations and a more critical attitude towards surgical interventions are also not negligible aspects that have driven the shift of orbital decompression surgery.

Orbital decompression was first used only to address sight threatening conditions, such as optic neuropathy refractory to medical therapy, or exposure keratopathy unresponsive to local measures and/or to minor eyelid surgeries. More recently the indications for orbital decompression were extended to the treatment of disfiguring exophthalmos and symptoms. Eyeball subluxation, which may be a possible cause of acute optic neuropathy and exposure keratopathy, postural visual obscuration in patients with congestive inactive GO and choroidal folds due to eyeball indentation by enlarged extraocular muscles represent other, more recently recognised functional indications for decompression surgery.1

Expansion of the bony orbital boundary and fat removal had been the surgical methods to reduce the raised intra-orbital pressure. The two approaches, which developed through parallel routes up until recently, are no longer to be considered alternatives, but complementary possibilities concurring in tailoring the most adequate treatment to the specific patient’s needs.2

As indications and approaches also surgical routes to orbital decompression have been changed through the years. In the 1950s, when decompression surgery started to be used routinely for functional purposes or rehabilitation of patients with GO, transbuccal incisions were preferred to former visible and more invasive periorbital trans-cutaneous incisions. The coronal approach to orbital decompression introduced by Tessier (1969)3, used by Krastinova and Rodallec (1985)4 and later popularized by Leo Koornneef and his fellows beginning in the 1980s5-8, although virtually invisible in patients who do not present baldness, is a rather invasive access to the orbit. It is a common incision for plastic, maxillofacial and neurosurgical procedures, which gives a wide access to the bony orbit, but in general is not the surgical access to the orbit preferred by ophthalmologists, who are
more accustomed to microsurgery. There is no doubt that the coronal incision is a technique that requires more surgical skills and anatomical knowledge and a longer learning curve as compared with less invasive periorbital surgeries. However, once the technique is mastered the bicoronal flap dissection, the exposure of the orbital walls, the completing of the osteotomies, and the closure of the surgical site are usually rapid and the duration of surgery is comparable with that required for decompressions through periorbital incisions. In males with prominent upper orbital frame, the elevation of the periostium can prove difficult, in fact slightly prolonging the surgical time.

With the coronal approach the exposure of the lateral orbital wall and the possibility of its manipulation are superior to any other orbitotomy. The medial wall is addressed from above in a centrifuge fashion in respect to the lamina cribrosa, virtually reducing the risk to damage the latter and to induce leakage of cerebrospinal fluid. On the other hand, the access to the orbital floor through a coronal approach can be sub-optimal depending on orbital osteology and compliance of the soft orbital tissue (Figure 1).

**Figure 1.** Coronal projections taken at the level of the middle orbit in two patients with Graves’ orbitopathy. Differences in osteology are highlighted. To approach the orbital floor by a coronal incision in a patient with an obtuse angle between the medial wall and the floor (top) may be less difficult than in a patient with an almost square angle at the same level (bottom). This concept may apply also within the same orbit as, in general, such an angle becomes more obtuse the deepest is the orbit.
The coronal incision continues to be used as the standard approach for orbital decompression in some centres, while only for selected patients in others. Because of its invasiveness and technical difficulties, not rarely, issues of concern are raised at meetings on whether or not this technique is to be abandoned, and if it can be fully replaced by other less invasive, but equally effective approaches. Based on the current literature, it is difficult to establish if the coronal approach continues to have a place in modern decompression surgery. My opinion can neither aim at increasing the level of evidence on the argument nor, due to my education as a fellow of Leo Koornneef, may it be a totally unbiased overview on the issue. Thus acknowledging these shortcomings, I hope that my experience with the coronal approach orbital decompression may result useful to highlight its possible advantages and limitations. The literature regarding the use of the coronal route to orbital decompression is limited, and only a few papers compare the coronal approach to other less invasive incisions. In addition, the evidence of the current literature on decompression surgery is impaired by its retrospective nature, the heterogeneity of the patient populations included in the published case series, the inhomogeneous perioperative medical regimens, which may or may not include glucocorticoids, the use of various surgical techniques which, thus falling under a given definition, (e.g., coronal incision) are virtually different concerning planes of dissection and, therefore, potentially connected with a different morbidity. As a result, most of the speculations available in the current literature regarding reliability and effectiveness of different techniques for decompression surgery are not proven conclusively.

In an attempt to estimate the effectiveness of various surgical techniques, a prospective comparison of different treatment modalities along with different decompression surgeries, using a powerful tool, such as the Graves’ orbitopathy quality-of-life questionnaire (GO-QoL), has been advocated, and recently published by the EUGOGO consortium. The study showed that, except in rare cases where a tailored approach was offered to the patients, the choice of surgical technique continues to be based on personal experience and local tradition.

With such an attitude, exophthalmos reduction, complications, side effects, and patient satisfaction resulted grossly comparable and independent from the chosen technique. In light of this, if one technique should fit all, and personal experience and local tradition are the factors which regulate the choice of technique in decompression surgery, there is no
doubt that minimally invasive approaches are to be preferred to more invasive ones. However, to force patients into standardised surgical frames is suboptimal. Although on average results may be grossly comparable despite the used surgical technique, a standardised approach may be inadequate to the specific needs, and to the anatomic and pathologic substrate of the single patient. Ideally the planning of decompression surgery should be adequate to the severity of the orbitopathy, its possible “lipogenic” or “myopathic” variants, the patient’s specific orbital osteology, and possible previous surgeries.²

In clinical practice, this desirable approach to orbital decompression, which may imply the use of several different surgical techniques, is possible only in centres where adequate referral and a long-lasting tradition in orbital surgery favour transmission of expertise, warrant adequate back-up whilst giving the possibility to develop new techniques or to master ongoing variations of others. As this cannot be the case in most of the centres dealing with GO, the use of a standardised versatile approach is to be regarded as an acceptable although suboptimal alternative.

The swinging eyelid technique described first by McCord in the early 1980s¹⁶, with the conjunctival incision that can be extended medially as much as necessary, offering an adequate access to the bony orbit and to the orbital fat compartments is a versatile technique that can virtually be used for the vast majority of patients needing decompression surgery, independently from the orbital osteology and the compliance of the orbital soft tissues. As an alternative inferior fornix and upper skin crease incisions can be used separately or in association.

Sasim and co-authors in their retrospective survey of 2005¹² showed that the use of the swinging eyelid technique in 28 patients or coronal incision in 46 as a standardised approach for rehabilitative three wall orbital decompression could produce similar effects in terms of reduction of exophthalmos, induction of new onset diplopia and patient satisfaction. In a preceding series the incidence of diplopia following coronal and trans-lid orbital decompression was also not different.¹¹

In 2003 Cruz and Leme had questioned if coronal approach continues to have a role in orbital decompression and concluded that there is little, if any need for this technique.¹⁰ Although the study design and the results of this paper could not offer a strong support to its conclusions, it is conceivable to share with Cruz and Leme their doubts with respect to
using an invasive approach, such as the coronal incision, as a standard route for orbital decompression. Nevertheless the coronal incision is not to be abandoned as it can be an additional tool in surgeons’ hands when dealing with patients who can better benefit out of a particular, tailored rather than a standardised approach. Many are the circumstances in which this may happen.

The coronal incision can be easily performed also in those GO patients presenting remarkable periorbital swelling or conjunctival chemosis in whom periorbital routes, including the swinging eyelid, may result inconvenient (Figure 2). The same applies to those patients in whom previous surgery might have adversely interfered with the periorbital lymphatic drainage. Possible scarring at the outer canthus, as it can occur with the swinging eyelid technique, can cause a complete impairment of the lymphatic drainage of the lower lid if a previously performed direct excision of lower lid bags, had already interrupted the lymphatic drainage towards the submandibular lymph nodes (Figure 3).

The coronal incision may be useful to minimise the number of periorbital incisions which may be necessary to accomplish a full rehabilitation in those patients, whose initial severe clinical picture suggests the necessity of multiple surgeries. This may result particularly advantageous in young or black patients who are more prone to develop evident scars. Through a coronal incision frontal lift, correction of glabellar rhytids or brow plasty, which are often necessary in patients with GO, can be performed simultaneously with orbital decompression and thus contribute to earlier surgical rehabilitation. Another elective use of the coronal incision is when extensive manipulation of the lateral wall is necessary or when the lateral wall including the lateral orbital rim is completely removed. The coronal approach implies the elevation of a periorbital subperiosteal plane which, different than with any direct periorbital incision, does not disrupt, full-thickness, the anatomical planes of the region. Consequently, depressed disfiguring iatrogenic scars due to adhesions between deep and more superficial layers, which are possible with periorbital incisions (Figure 4), are prevented by the use of a coronal approach (Figure 5).
Figure 2. Preoperative (top) and postoperative (bottom) aspect of a patient affected by dysthyroid optic neuropathy, with remarkable periorbital swelling and conjunctival chemosis treated with a three wall orbital decompression by a coronal approach.

Figure 3. A patient presenting with scarring at the lateral canthus, left side after a three wall orbital decompression by swinging eyelid approach. The patient who had bilateral direct excision of lower lids bags eighteen months prior to decompression, continued to present persistent lower eyelid edema, eight months after decompression, as a result of the interruption of residual lymphatic drainage to the preauricular lymph nodes.
Figure 4. A patient with Graves’ orbitopathy, who visited our clinic after being treated elsewhere with a complete lateral wall removal orbital decompression by a direct periorbital incision. The iatrogenic deformity caused to the lateral orbital rim is evident.

Figure 5. Preoperative (top) and postoperative (bottom) aspect of a patient affected by dysthyroid optic neuropathy, treated with an extensive 3-wall orbital decompression by a coronal approach, which included the total removal of the lateral orbital wall. No deformities of the lateral canthus or of the lateral orbital rim are evident in spite of the fact that the bony lateral frame was removed.
The complete removal of the lateral orbital wall including the lateral orbital rim is an extreme procedure that may become necessary for functional (Figure 5) or more rarely for rehabilitative decompressions. In the case of severe infiltrative orbitopathy with elevated intraorbital pressure, the forces exerted by retractors in an attempt to reach and remove the deepest part of the medial orbital wall can increase the already high retrobulbar pressure up to critical levels for the optic nerve fibres and vasculature. The preventive removal of the lateral orbital wall permits to address more smoothly the orbital apex, reducing in fact, the risk to add an iatrogenic component to the pathologically high orbital pressure.

For obvious reasons, this approach may be extremely convenient when decompression has to be performed on an urgent basis for dysthyroid optic neuropathy or for severe corneal exposure if a descemetocele with impending risk for eyeball perforation is present. The endoscopic transnasal approach as first proposed by Kennedy et al.\textsuperscript{19}, addressing the orbital apex without any substantial increase of the intraorbital pressure can be a valid alternative, although offering an inferior decompression effect if not associated with additional transcutaneous surgery which, in most of the cases, implies a multidisciplinary approach.

Finally, in course of rehabilitative orbital decompression, the presence of a shallow orbit, a small anterior orbital aperture, a myopic eyeball, a prolapsed lacrimal gland surrounded by a consistent amount of orbital fat also prolapsed (exorbitism), a partial dislocation of the eyeball in front of the lateral orbital rim in the case of extreme degrees of exophthalmos, may be situations that singularly or in different combinations can benefit by a total removal of the lateral orbital wall including its rim for optimizing the decompression effect.

Independently from whatever approach was used, a given number of possible common complications have been reported to affect decompression surgery. In this regard, the largest series reporting on coronal approach do not grossly differ from those in which more conservative periorbital incisions are used. Regarding the surgical route itself the possible complications connected with the coronal approach are different from those that may be related to periorbital incisions. The coronal approach leaving the eyelid undisturbed less likely than periorbital incisions can create complications which may potentially be harmful to the eye. Periorbital scarring, eyelid margin malpositions, lid retraction and ptosis, although rare events, are more likely to occur in decompression surgery periorbital incisions (Figure 6). On the other hand, temporal bossing, damage to the frontalis nerve,
scarring and alopecia at the site of scalp incision, or affecting ischemic areas of the frontal flap after healing by secondary intention, may complicate the coronal approach (Figure 7). Major complications connected with the coronal approach have been mainly described in small series where three\textsuperscript{10} or less\textsuperscript{13} patients per year were operated. In this respect it is therefore unavoidable to emphasize that each technique has its own learning curve and it may be difficult to differentiate the effects of each technique from the experience of the surgeon.\textsuperscript{10}

Besides the patient’s determination to accept major surgeries, and surgeon’s skills to perform them, the possibility of aiming at attaining only partial results should always be weighed in light of patients’ characteristics such as age, general health conditions, profession, education and psychosocial environment. Often conservative surgery is of maximal benefit to the patient in spite of modest final results that may be unattractive to the surgeon.\textsuperscript{20}
Figure 6. A patient one month after insufficient orbital decompression by upper skin crease incision performed in a not ophthalmologic setting (top). Lagophthalmos and extensive corneal damages due to entrapment of the orbital septum into the surgical scar are evident (bottom).

Figure 7. A patient decompressed by coronal approach. One month after surgery, an extended area of the frontal flap is granulating after an escharotomy. Scarring and alopecia of the area are to be expected.
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References