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Treatment of exophthalmos and strabismus surgery in thyroid-associated orbitopathy

A. Imburgia[1], G. Elia[2], F. Franco[1], P. Perri[1], E. Franco[1], M. Galiè[2], L. C. Clauser[2]
[1]Clinic of Ophthalmology, St. Anna Hospital and University, Ferrara, Cona, Italy; [2]Unit of Cranio-Orbito-Maxillofacial Surgery, St. Anna Hospital and University, Ferrara, Cona, Italy

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Abstract. Endocrine orbitopathy (EO) can have important consequences, such as exophthalmos and restrictive strabismus. A retrospective study was performed of 35 patients with EO who underwent orbital decompression surgery and restrictive strabismus correction. Two surgical techniques for orbital decompression were analyzed: fat decompression by Olivari technique and three-wall bony expansion with fat decompression. Strabismus surgery was performed using adjustable or non-adjustable sutures under topical anaesthesia. Patients were divided into two groups according to the type of intra-orbital decompression performed, and the postoperative values resulting from the different fat decompression techniques were recorded. The preoperative and postoperative mean degrees of exophthalmos were 22.3 and 19.9 mm, respectively, for the fat decompression group, and 24.3 and 19.8 mm, respectively, for the bony expansion with transpalpebral fat decompression (combined form) group. The difference in residual prism dioptres between adjustable and non-adjustable suture techniques in patients who had previously undergone combined decompression was statistically significant. The management of patients with EO requires a multidisciplinary approach based on the collaboration of maxillofacial surgeons, ophthalmologists, and orthoptists. These results will allow the development of a more adequate strategy for the surgical treatment of restrictive strabismus in EO patients.

Key words: endocrine orbitopathy; orbital decompression; strabismus surgery; adjustable sutures; restrictive strabismus; thyroid associated ophthalmopathy.

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Graves' disease is an autoimmune disease in which self-immunoglobulin G (IgG) antibodies bind to thyroid-stimulating hormone (TSH) receptors stimulating the production of thyroid hormones. It most frequently affects women between the fourth and sixth decades of life. Endocrine orbitopathy (EO) occurs in 25–50% of patients with Graves' disease and can lead to important consequences such as exophthalmos and restrictive strabismus secondary to fibrosis of the extraocular muscles.[1]

In the acute phase, high levels of thyroid hormones determine the formation of a polymorphous cellular infiltrate (lymphocytes, macrophages, plasma cells, and fibroblasts) with secretion of glycosaminoglycans and osmotic oedema, both at the expense of the extraocular muscles—which increase in size, in some cases up to eight times their normal size[2]—and of the interstitial tissues, orbital fat, and lachrymal glands, with a consequent increase in orbital content. In the final stage there is a restrictive fibrosis of the extraocular muscles mediated by fibroblasts, with total loss of elasticity of the

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muscles, which assume the appearance of fibrotic cords.[3]

About 15% of EO patients have problems with ocular motility. The muscles most frequently involved are the inferior rectus and medial rectus muscles, with consequent eso-hypotropia. However, the disease involves all the muscles bilaterally and asymmetrically.[4] Exophthalmos can affect eyelid closure and lead to serious complications such as exposure keratopathy, corneal ulcers, and infections.

Surgery of restrictive strabismus in EO patients has unpredictable results: more than one surgery is needed to correct the ocular deviation in 17–45% of cases.[4] Several studies have shown that adjustable suture surgery yields better results than fixed suture surgery, with more precise correction of strabismus and fewer cases needing reoperation.[2,4–8]

Our experience is based on the close collaboration of maxillofacial surgeons, ophthalmologists, and orthoptists. This study included 35 EO patients submitted to orbital decompression surgery and to the correction of restrictive strabismus by recession of the fibrotic muscles under topical anaesthesia. The greatest risk of strabismus surgery is the unpredictability of the outcome postoperatively. Topical anaesthesia protects the innervational component of the muscles depending on fixation and the waking state, whereas under general anaesthesia this component can often bring about less predictable surgical results. Intraoperative orthoptic evaluation based on the prism cover test, performed after each muscle recession or resection, allows the surgery to be modulated and essentially 'customized' as it proceeds.[6]

This study was performed to evaluate the surgical outcomes of 35 patients undergoing orbital decompression and restrictive strabismus surgery using different surgical techniques, highlighting the importance of the use of adjustable sutures and topical anaesthesia in restrictive strabismus surgery in patients previously treated with orbital fat decompression, or fat and bony decompression. The data analysis showed statistically significant differences between the different techniques, with postoperative results varying in terms of residual exophthalmos, residual prism dioptres, and the need for re-intervention.

Materials and methods

Study design

This retrospective study included patients with Graves' orbitopathy who had undergone surgery in the craniomaxillofacial surgery unit of a university hospital in Ferrara, Italy.

The surgical results of 35 patients operated on between March 2008 and June 2014 were analyzed; 14 were males and 21 were females, and their average age was 63.7 years (range 47–82 years). All patients had bilateral exophthalmos and diplopia with restricted ocular motility. The interventions were carried out using different surgical techniques. Patients who subsequently underwent other decompression interventions and/or muscle recessions or resections were excluded from the study. Strabismus surgery was performed on euthyroid patients with exophthalmos <26 mm who exhibited no change of the angle of deviation in the 6 months following the decompression, as shown by Hess screen. In general, it takes between 6 and 8 months for muscle dynamics to stabilize in EO patients after orbital decompression. In the authors' experience, 6 months represents the minimum time before proceeding to strabismus surgery. During this period, there was stabilization of muscle dynamics for all patients included in the present study.

All orbital decompressions were performed by a single surgeon (L.C.C.). Strabismus surgery was also performed by a single surgeon (F.F.). Surgical results were not influenced by the surgeon.

This study was approved by the local ethics committee. Written informed consent was provided by all patients.

Surgical techniques

The surgical techniques of orbital decompression considered were fat decompression and combined fat and bone decompression, depending on the clinical form of the Graves' orbitopathy (excess fatty tissue or a predominance of muscle hypertrophy).

Orbital fat decompression by Olivari technique was used for patients with excess fat tissue (Fig. 1).[9] An incision was made on the upper eyelid, extending to the orbicularis muscle and the orbital septum, which was then incised, removing the fat both deeply and forward around each extraocular muscle. Only a thin layer of fat was left around the muscles to maintain lubrication and muscle function. The approach to the orbital floor was performed by transconjunctival or subciliary incision by opening the orbital septum and exposing the inferior orbital contents. The fat was separated from the inferior oblique muscle and subsequently removed.[10]

Three-wall bony expansion with fat decompression (combined form) is the procedure of choice for mixed forms of EO, in which there is significant muscle hypertrophy in addition to the presence of fat tissue. Three orbital walls (lateral, medial, and floor) were removed, along with the fat tissue, with an upper eyelid incision and an inferior transconjunctival/subciliary incision[11,12] (Fig. 2).

Restrictive strabismus surgery can be performed on patients who have undergone prior orbital decompression when the

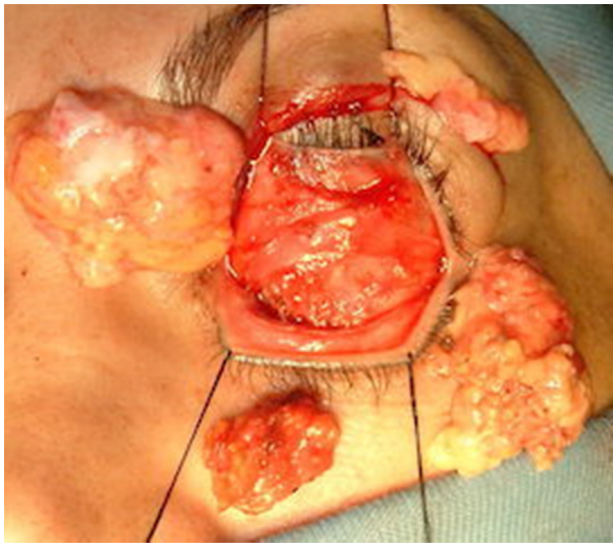

Fig. 1. Four-quadrant fat decompression according to the Olivari technique. Fatty tissue is removed from the upper medial, upper lateral, lower medial, and lower lateral orbital compartments. All the fat must be removed intraconally in order to obtain a reasonable reduction of exophthalmos.