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Transorbital Endoscopic Medial Orbitotomy and Decompression of the Optic Nerve in Patients with Endocrine Ophthalmopathy Complicated by Optical Neuropathy

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AIM OF STUDY: to improve the results of surgical treatment of patients with endocrine ophthalmopathy complicated by optical neuropathy. For this, medial orbitotomy and decompression of the optic nerve were performed for a patient with endocrine ophthalmopathy, CAS<3, OD=18 mm, OS=23 mm and visual acuity OD=1.0 OS=0.2, using transorbital transconjunctival endoscopic access. The first step was a retro caruncular incision. After that, we defined an access to the medial wall of the orbit with its subsequent resection. Then, we performed ethmoidectomy and approach to the optic nerve canal. Upon completion of bone decompression, we opened periorbitis.

RESULTS The postoperative period was uneventful. In the early postoperative period, regression of exophthalmos was observed OD=18 mm, OS=20 mm, improvement in visual acuity OD=1.0 OS=0.5. No complications were recorded. A satisfactory result was obtained.

CONCLUSION Transorbital endoscopic medial orbitotomy and optic decompression can be effectively used in the treatment of patients with endocrine ophthalmopathy complicated by optic neuropathy, refractory to conservative therapy. The technique is promising and requires further randomized studies.

Keywords: endocrine ophthalmopathy, orbit decompression , optical neuropathy

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CT — computed tomography
EO — endocrine ophtalmopathy

Endocrine ophthalmopathy (EO) in 4–6% of cases may be accompanied by the development of optic neuropathy [1–3]. This condition is based on the development of the “apex of the orbit” syndrome with an increase in the posterior third of the orbit of 2 or more extraocular muscles. The appearance of a pronounced decrease in object vision is caused not only by mechanical compression of the optic nerve by enlarged oculomotor muscles, but also by impaired volumetric blood flow in the orbital arteries and impaired venous outflow in the supraorbital vein, increased retrobulbar tissue [4, 5]. In addition to a decrease in visual acuity, optical neuropathy in EO is characterized by impaired color perception, the appearance of central and paracentral cattle, widening of the blind spot and narrowing of the field of vision [6].

The first line of treatment for patients with endocrine ophthalmopathy, the course of which was complicated by the development of optic neuropathy, is a complex drug therapy [7]. In case of ineffectiveness of conservative treatment, it is preferable to perform medial orbitotomy and decompression of the optic nerve [8]. Currently, a transnasal approach to the medial wall and optic nerve canal is widely used to achieve this goal. Postoperative improvement is observed in 75–90% of cases [9, 10]. Despite the good results, the use of transorbital approaches for medial decompression of the orbit in patients with endocrine ophthalmopathy and optic neuropathy is the subject of extensive discussion. At the same time, our earlier anatomical work aimed at comparing the transnasal and transorbital surgical approaches suggests the choice of the transorbital approach to the medial wall of the orbit and the optic nerve canal in comparison with the transnasal one [11].

In this article, we describe the result of the use in clinical practice of a transorbital endoscopic approach for surgical decompression of the orbit in a patient with endocrine ophthalmopathy and optic neuropathy at the Clinical Medical Center of the A.I. Yevdokimov Moscow State Medical University of Medicine and Dentistry.

THE TECHNIQUE OF SURGICAL INTERVENTION

To perform endoscopic medial orbitotomy and decompression of the optic nerve canal, we used a transorbital retrocaruncular approach, in which the incision of the conjunctiva after infiltration with local anesthetics was performed posteriorly from the lacrimal meatus, continuing it above and below the posterior border of the medial cantal ligament. Then, in the vertical plane, the periosteum was dissected immediately posterior to the posterior lacrimal crest and, together with the intraorbital structures, moved laterally. After this manipulation, visualization of the anterior portion of the medial wall of the orbit becomes available in the operating field. Then skeletonization of the medial wall was performed under endoscopic control. The upper boundary of the skeletonization of the orbital lamina of the ethmoid bone is the projection of the passage of the anterior and posterior ethmoid arteries, and the lower boundary is the bone "bridge" between the medial and lower walls of the orbit. Having reached the indicated boundaries of the view, the medial wall was resected using a high-speed bur and Kerrison punches (Fig. 1).

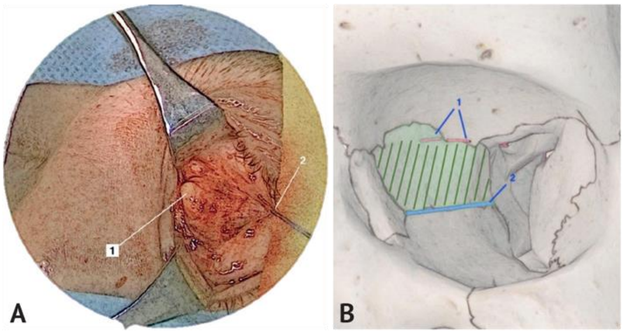

Fig. 1. The scheme of the stages of transorbital endoscopic medial orbitotomy and decompression of the optic nerve. A — incision of the conjunctiva with retro-caruncular access: 1 — lacrimal caruncle, 2 — the holder on the conjunctiva; B — the borders of the medial orbitotomy (highlighted by a dash): 1 — the anterior and posterior ethmoid arteries, 2 — the bone bridge between the medial and lateral walls of the orbit

The anterior wall of the main sinus becomes accessible after resection of the anterior and posterior ethmoid cells. After its opening, the optic nerve canal, the carotid tubercle and the optic-carotid recessus are identified. To achieve the maximum decompression effect, it is necessary to open the optic nerve canal in its front part in order to adequately dissect the periorbital in this area, which is extremely important. At the end of this stage, periorbitis is opened linearly, parallel to the location of the medial rectus muscle of the eye. The operation is completed by suturing the conjunctiva.

Clinical example

A 60-year-old male patient M., after consulting a neurosurgeon in September 2019, was admitted to the neurosurgical department of the A.I. Yevdokimov Moscow State Medical University of Medicine and Dentistry. Upon admission to the hospital, the patient complained of bulging left eyeball, double vision and decreased vision in the left eye. From the anamnesis of the disease it is known that in September 2018, diffuse toxic goiter (DTG) was diagnosed, and treatment with tyrosol was carried out. The manifestation of endocrine ophthalmopathy corresponded to the period of DTG development. The courses of pulse therapy with glucocorticosteroids reduced the inflammatory manifestations of EO, but dystopia of the eyeballs and visual impairment persisted. Ophthalmological examination before surgery: visual acuity OD = 1.0, OS = 0.2, exophthalmos (Hertel's exophthalmometer) OD = 18 mm, OS = 23 mm (Fig. 2). The result of the survey on the quality of life assessment scale (QOL) was less than 50% which corresponded to unsatisfactory quality of life.

Fig. 2. Appearance of patient M. before surgery. Left-sided exophthalmos is determined. Left eyelid retraction, limitation of the mobility of the left eyeball up

X-ray computed tomography (CT) of the orbits revealed left-sided exophthalmos, thickening of the oculomotor muscles, which had an inhomogeneous density with areas of hyperdense, and corresponded to the myogenic form of endocrine ophthalmopathy. Compression of the optic nerve by hypertrophied oculomotor muscles in the apex of the left orbit was noted (Fig. 3).

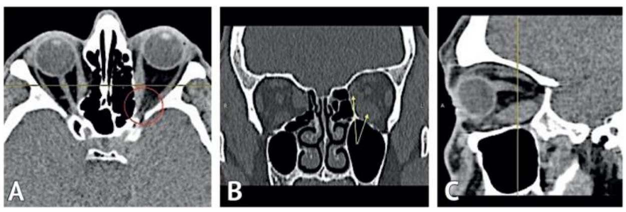

Fig. 3. Preoperative CT images of patient M. A — axial projection; B — front view; C — sagittal projection; the yellow arrows indicate the enlarged oculomotor muscles of the left orbit, the red circle indicates the area of compression of the optic nerve in the apex of the left orbit

Thus, in order to prevent further deterioration of vision, the development of keratopathy associated with lagophthalmos, and eliminate a cosmetic defect in a patient with endocrine ophthalmopathy, CAS less than 3, myogenic variant of the course of the disease with optic neuropathy, it was decided to perform transorbital endoscopic medial orbitotomy and decompression of the optic nerve.

The surgery was performed under general anesthesia. The operation began with the incision of the conjunctiva according to the retrocaruncular access on the left. After dissection of the periorbitis and its displacement, the medial wall of the orbit was visualized (Fig. 4).

Skeletonization of the orbital lamina continued upward until the anterior and posterior ethmoid arteries were visualized, downward until the transition to the inferior wall of the orbit (Fig. 5).

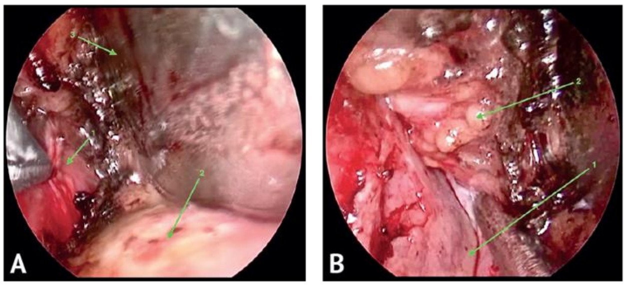

Fig. 4. Intraoperative photo of patient M. (left orbit): A — dissection of the periorbit, 1 — periororbitis, 2 — periorbital tissue, 3 — retractor, displacing the eyeball laterally; B — visualization of the medial wall of the left orbit, 1 — medial wall of the orbit, 2 — periorbital tissue

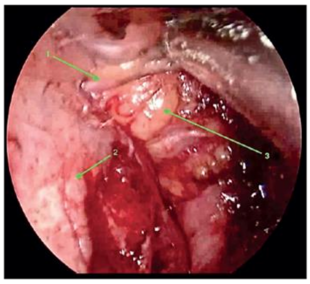

Fig. 5. Intraoperative photo of patient M. (left orbit), skeletonization of orbital lamina, 1 — anterior ethmoid artery, 2 — orbital lamina, 3 — periorbital tissue

Then we proceeded to resection the medial wall of the orbit using a high-speed bur with a diamond cutter (Fig. 6).

After removing the orbital lamina of the ethmoid bone, the walls of the anterior and posterior cells of the ethmoid bone were removed without penetration into the nasal cavity until the main sinus was reached, which was entered after trepanation of its anterior wall (Fig. 7).

After entering the main sinus, the optic canal, the tubercle of the internal carotid artery, and the opticocarotid recessus were verified, and the opening of the optic nerve canal was initiated (Fig. 8).

The dissection of the periorbit was performed linearly, as close as possible to the projection of the location of the Zinn circle (Fig. 9).

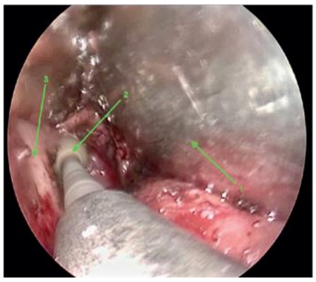

Fig. 6. Intraoperative photo of patient M. (left orbit), resection of the medial wall of the orbit, 1 — retractor, displacing the eyeball laterally, 2 — high-speed bur, 3 — medial wall of the orbit

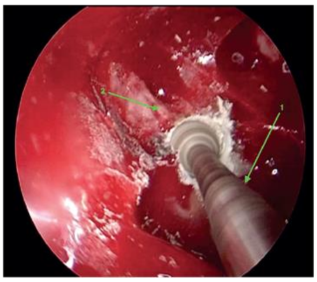

Fig. 7. Intraoperative photo of patient M. (left orbit), trepanation of the anterior wall of the main sinus, 1 — high-speed bur, 2 — anterior wall of the main sinus

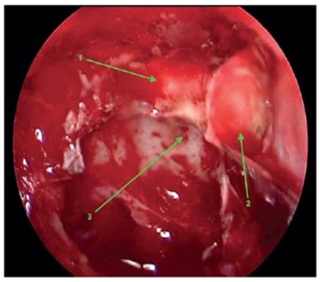

Fig. 8. Intraoperative photo of patient M. (left orbit), opening of the optic nerve canal, 1 — optic nerve canal, 2 — optic nerve, after resection of the anterior part of the optic nerve canal, 3 — opticocarotid recessus

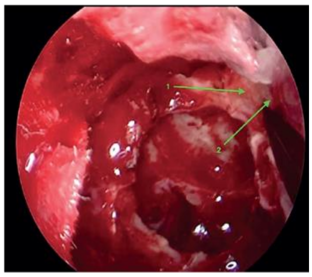

Fig. 9. Intraoperative photo of patient M. (left orbit), dissection of periorbit, 1 — optic nerve, 2 — periororbitis, in the projection of the Zinn ring

At the resting stages of the surgical intervention, the periorbital tissue was mobilized to facilitate its displacement into the formed bone window and achieve a higher decompressive effect. The operation was completed with continuous suturing of the conjunctiva.

The postoperative period was uneventful. On the 7th day after the operation, the exophthalmos was OD = 18 mm, OS = 20 mm, and 3 months after the operation - OD = 18 mm, and OS = 19 mm. Indicators of visual acuity on the 7th day after the operation were OD = 1.0, OS = 0.5, and - OD = 1.0, OS = 0.6 3 months after the operation.

According to CT of the orbits, adequate displacement of the medial rectus muscle of the eye into the formed bony window of the medial wall of the left orbit, the preservation of the mucous membrane of the nasal cavity and the walls of maxillary sinus (Fig. 10).

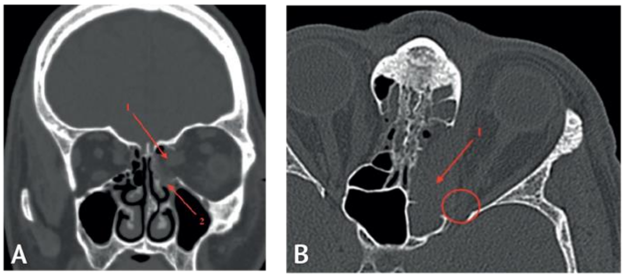

Fig. 10. Post-surgery computer tomograms of the patient M. A — frontal projection; B — axial projection; 1 — displaced hypertrophied medial rectus muscle of the eye into the formed bone window of the medial wall of the orbit; 2 — the preserved part of the cells of the ethmoid bone between the orbit and the nasal cavity; the red circle is the area of decompression of the optic nerve in the region of the apex of the left orbit

DISCUSSION

Optic neuropathy is one of the most severe manifestations of endocrine ophthalmopathy. Its pathogenesis is multifactorial, and one of the most common causes is the mass effect of hypertrophied oculomotor muscles on the optic nerve in the apex of the orbit. Pulse therapy may achieve significant improvement in 70–85% of patients. However, in 15–30% of cases, glucocorticosteroid therapy may be ineffective. Such a group of patients requires orbital decompression, which can be performed through external transcutaneous or endoscopic approaches [12]. Thus, Kazim et al. showed a high efficacy of internal orbital decompression in optic neuropathy [13]. In terms of effectiveness, the results of Choe et al. are comparable to medial orbitotomy [14], where the authors used a lateral orbitotomy. In exceptional cases, when three-walled decompression orbitotomy is ineffective, transcranial resection of the superior wall of the orbit is used in the treatment of patients with optic neuropathy [15]. Despite the above, endoscopic transnasal medial orbitotomy and decompression of the optic nerve is the most effective method of decompression in optic neuropathy caused by apex syndrome, which makes it possible to achieve a significant improvement in patients' condition in 75–90% of cases [9, 10]. The main advantages of this method are the absence of visible skin scars, direct access to the medial wall of the orbit and the optic nerve canal [12]. Nevertheless, this technique doesn’t lack disadvantages. In particular, it is associated with polysinusotomy, when the natural structures of the maxillary, frontal and main sinuses are destroyed. In some cases, partial resection of the middle turbinate is required. In 17.6% of cases after such an operation in patients in the early postoperative period, various inflammatory diseases of the paranasal sinuses are formed [12]. The incidence of postoperative diplopia, absent before surgery, after transnasal endoscopic medial orbitotomy and optic nerve decompression varies from 17 to 80% [16–19]. Due to prolapse of periorbital tissue, obstruction of the paranasal sinuses occurs with a frequency of 4.6 to 20% [16, 18, 20, 21].

The undesirable consequences of transnasal endoscopic medial orbitotomy contribute to the development of other, alternative methods that would allow to achieve higher functional and cosmetic results. One of the solutions was the transorbital endoscopic medial orbitotomy and optic nerve decompression that we developed. This technique is designed to ensure adequate achievement of the decompression effect by access through the orbit, reducing the risk of postoperative complications and avoiding trauma to the paranasal structures, which was shown in the presented clinical example. Of course, further recruitment of patients and a statistical analysis of the results are required to finally determine the advantages and disadvantages of a particular technique. However, already at this stage, the impression is formed that for patients in the inactive phase of the course of endocrine ophthalmopathy with clinical manifestations of optic neuropathy, preference should be given to the transorbital transconjunctival endoscopic approach. In cases of the active phase of the disease with inflammation of the conjunctival membrane, it is advisable to use a transnasal endoscopic access.

REFERENCES

1. Victores AJ, Takashima M. Thyroid eye disease: optic neuropathy and orbital decompression. *Int Ophthalmol Clin*. 2016;56(1):69–79. PMID: 26626933 https://doi.org/10.1097/IIO.0000000000000101
2. Neigel JM, Rootman J, Belkin RI, Nugent RA, Drance SM, Beattie CW, et al. Dysthyroid optic neuropathy. The crowded orbital apex syndrome. *Ophthalmology*. 1988;95(11):1515–1521. PMID: 3211460 https://doi.org/10.1016/s0161-6420(88)32978-7
3. Ben Simon GJ, Syed HM, Syed H, Douglas R, Scbwartz R, Goldberg RA, et al. Clinical manifestations and treatment outcome of optic neuropathy in thyroid-related orbitopathy. *Ophthal Surg Las Im.* 2006;37:284–290. PMID: 16898388 https://doi.org/10.3928/15428877-20060701-04
4. Tranquart F, Bergès O, Koskas P, Arsene S, Rossazza C, Pisella PJ, et al. Color Doppler imaging of orbital vessels: personal experience and literature review. *J Clin Ultrasound.* 2003;31(5):258– 273. PMID: 12767021 https://doi.org/10.1002/jcu.10169
5. Sorrentino D., Taubenslag KJ, Bodily LM, Stefko N, Yu JU. Superior ophthalmic vein thrombosis: A rare complication of Graves’ orbitopathy. *Orbit.* 2018;37(3):175–178. PMID: 29053044 https://doi.org/10.1080/01676830.2017.1383467
6. Korkmaz S, Konuk O. Surgical treatment of dysthyroid optic neuropathy: long-term visual outcomes with comparison of 2-wall versus 3-wall orbital decompression. *Curr Eye Res.* 2016;41(2):159–164. PMID: 25835051 https://doi.org/10.3109/02713683.2015.1008641
7. Wakelkamp IM, Baldeschi L, Saeed P, Mourits MP, Prummel MF, et al. Surgical or medical decompression as a first-line treatment of optic neuropathy in graves’ ophthalmopathy? A randomized controlled trial. *Clin Endocrinol (Oxf)*. 2005;63(3):323–8. PMID: 16117821 https://doi.org/10.1111/j.1365-2265.2005.02345.x
8. McCord CD Jr, Putnam JR, Ugland DN. Pressure-volume orbital measurement comparing decompression approaches. *Ophthalmic Plast Reconstr Surg.* 1985;1(1):55–63. PMID: 3940104 https://doi.org/10.1097/00002341-198501000-00009
9. Hallin ES, Feldon SE, Luttrell J. Graves’ ophthalmopathy: Iii. Effect of transantral orbital decompression on optic neuropathy. *Br J Ophthalmol*. 1988;72(9):683–687. PMID: 3179256 https://doi.org/10.1136/bjo.72.9.683
10. Schaefer SD, Soliemanzadeh P, Della Rocca Da, Yoo G-P, Maher Ea, et al. Endoscopic and transconjunctival orbital decompression for thyroid-related orbital apex compression. *Laryngoscope*. 2003;113(3):508–513. PMID: 12616205 https://doi.org/10.1097/00005537-200303000-00021
11. Kalandari AA, Levchenko OV, Zakondyrin DE, Kutrovskaya NY. Anatomical study of the possibilities of endoscopic transnasal and endoscopic transorbital medial orbitotomy and decompression of the optic nerve. *Russian Journal of Neurosurgery*. 2019;21(3):52–57. (In Russ.) https://doi.org/10.17650/1683-3295-2019-21-3-52-57
12. Zah-Bi G, Abellion-du Payrat J, Vie A, Bournaud-Salinas C, Jouanneau E, Berhouma M. Minimal-access Endoscopic endonasal management of dysthyroid optic neuropathy: The Dysthone study. *Neurosurgery*. 2019;85(6):E1059–E1067. PMID: 31393984 https://doi.org/10.1093/neuros/nyz268
13. Kazim M, Trokel SL, Acaroglu G, Elliott A. Reversal of dysthyroid optic neuropathy following orbital fat decompression. *Br J Ophthalmol*. 2000;84(6):600–605. PMID: 10837384 https://doi.org/10.1136/bjo.84.6.600
14. Choe CH, Cho RI, Elner VM. Comparison of lateral and medial orbital decompression for the treatment of compressive optic neuropathy in thyroid eye disease. *Ophthalmic Plast Reconstr Surg*. 2011;27(1):4–11. PMID: 20736873 https://doi.org/10.1097/IOP.0b013e3181df6a87

15. Bingham CM, Harris Ma, Vidor Ia, Rosen CL, Linberg JV, et al. Transcranial orbital decompression for progressive compressive optic neuropathy after 3-wall decompression in severe graves' orbitopathy. *Ophthalmic Plast Reconstr Surg*. 2014;30(3):215–8. PMID: 24759290 https://doi.org/10.1097/IOP.0000000000000052
16. Chu EA, Miller NR, Lane AP. Selective endoscopic decompression of the orbital apex for dysthyroid optic neuropathy. *Laryngoscope*. 2009;119(6):1236–1240. PMID: 19418538 https://doi.org/10.1002/lary.20240
17. Roberts CJ, Murphy MF, Adams GG, Lund VJ. Strabismus following endoscopi orbital decompression for thyroid eye disease. *Strabismus*. 2003;11(3):163–171. PMID: 14710474 https://doi.org/10.1076/stra.11.3.163.16652
18. Nadeau S, Pouliot D, Molgat Y. Orbital decompression in graves' orbitopathy: a combined endoscopic and external lateral approach. *J Otolaryngol*. 2005;34(02):109–115. PMID: 16076409 https://doi.org/10.2310/7070.2005.04024
19. Paridaens D, Lie A, Grootendorst RJ, van den Bosch WA. Efficacy and side effects of "swinging eyelid" orbital decompression in Graves' orbitopathy: a proposal for standardized evaluation of diplopia. Eye (Lond). 2006;20(2):154–162. PMID: 15746952 https://doi.org/10.1038/sj.eye.6701827
20. Graham SM, Carter KD. Combined-approach orbital decompresion for thyroid- related orbitopathy. *Clin Otolaryngol Allied Sci*. 1999;24(2):109–113. PMID: 10225154 https://doi.org/10.1046/j.1365-2273.1999.00219.x
21. White WA, White WL, Shapiro PE. Combined endoscopic medial and inferior orbital decompression with transcutaneous lateral orbital decompression in Graves' orbitopathy. *Ophthalmology*. 2003;110(9):1827–1832. PMID: 13129884 https://doi.org/10.1016/S0161-6420(03)00566-9

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