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CASE REPORT

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Medial transposition of a split lateral rectus muscle for complete oculomotor nerve palsy – a case study

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ABSTRACT

Complete oculomotor nerve palsy involves loss of function of as many as four out of six extraocular muscles, levator palpebrae superioris, and intraocular muscles, i.e. pupillary sphincter and ciliary muscle. Surgical treatment options are very limited as the superior oblique muscle and the lateral rectus muscle innervated by separate nerves are the only extraocular muscles whose function is not compromised. This article presents a case study of complete oculomotor nerve palsy following a neurosurgical procedure managed by medial transposition of the lateral rectus muscle with very satisfying outcomes.

KEY WORDS: third nerve palsy, paralytic strabismus, Y transposition of lateral rectus muscle.

INTRODUCTION

The most common causes of acquired oculomotor nerve palsy in adults include vascular disorders in conditions such as diabetes or arterial hypertension, brain aneurysms and head traumas [1]. The degree of palsy of the muscles innervated by the oculomotor nerve may vary depending on the location and etiology of the nerve damage. Complete oculomotor nerve palsy involves the loss of function by as many as four out of six extraocular muscles, levator palpebrae superioris, and intraocular muscles innervated by parasympathetic fibers of the oculomotor nerve, i.e. sphincter pupillae muscle and ciliary muscle [2]. In consequence, complete oculomotor nerve palsy is undeniably one of the most complex and surgically challenging types of paralytic strabismus. Literature describes many surgical techniques aimed to achieve orthotropia in the primary position [3-5], but the surgical outcomes proved unsatisfactory in the majority of cases.

This article presents a case study of complete oculomotor nerve palsy managed by medial transposition of a split lateral rectus muscle.

CASE STUDY

A 45-year old male patient was admitted to the Clinical Ophthalmology Department with left-side complete oculomotor nerve palsy. Patient's medical history and medical records revealed that the patient underwent a surgery for pituitary adenoma a few years back, complicated by damage to the left oculomotor nerve. Best corrected visual acuity of 1.0 in the right eye and 0.4 in the left eye on a Snellen chart was confirmed in ophthalmological examination. A dilated pupil unreactive to light and near vision, and complete ptosis were observed on the left side. Left globe was aligned in an abducted position (Figure 1), with complete loss of mobility. Strabology revealed strabismus angles in distant and near vision in Krimsky test of (d) = –45 Δ P/L 6 Δ, (b) = –45 Δ P/L 6 Δ, respectively.

The patient was determined to improve the globe position alignment and, following review of the overall clinical picture, he was qualified for a medial transposition of a split lateral rectus muscle. The lateral rectus muscle was isolated and carefully separated from the Tenon capsule and inferior oblique muscle via circular (360 degree) incision, in general anesthesia. The muscle was split along its fibers over around 18 mm up to the trochlea (the target split length varies from 18 to 24 mm, depending on the globe length). Two Vicryl 6.0 sutures were placed on each side of the half of the lateral rectus muscle at its insertion. At this point the muscle was cut from the tendon insertion. A Gass retinal detachment hook

Figure 1. Pre-surgery photograph in frontal gaze direction

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(with a hole in the head) (Figure 2) was passed under the superior oblique muscle and the superior rectus muscle from the nasal side. The sutures on the superior half of the lateral rectus muscle were passed through the hole of the Gass hook and in the direction of the medial rectus muscle insertion. In the same intraoperative maneuver, the sutures on the inferior half of the muscle were passed under the inferior oblique and inferior rectus muscle. Next, the sutures were tightened several times and the split muscle was passed behind the globe, and the muscle ends were reattached to the sclera 2 mm to the superior and 2 mm to the inferior border part of physiological insertion of the medial rectus muscle (Figure 3). The globe position was aligned intraoperatively to a slight convergent strabismus. No intra- and postoperative complications have been reported (Figure 4).

A stable globe position alignment was maintained during two months of follow-up. Exotropia decreased from –45 Δ to –6 Δ and hypotropia was reduced to 4 Δ (Figure 5) postoperatively. Compromised ocular motility in the left eye persisted. Orbital magnetic resonance imaging (MRI) 6 weeks postoperatively revealed the thinning of all muscles innervated by the left oculomotor nerve and the thickening of retro-orbital lateral rectus muscle with insertion in the medial part of the globe, which corresponded to the assumptions of the procedure. No globe deformations were visible in the examination.

The patient requires further interventions for complete ptosis. It should be noted that the absence of ptosis will lead to lateral gaze because of the lack of ocular motility. Due to the likelihood of post-surgery diplopia, the patient was informed he would need to use dedicated prosthetic lens with an opaque black pupil area.

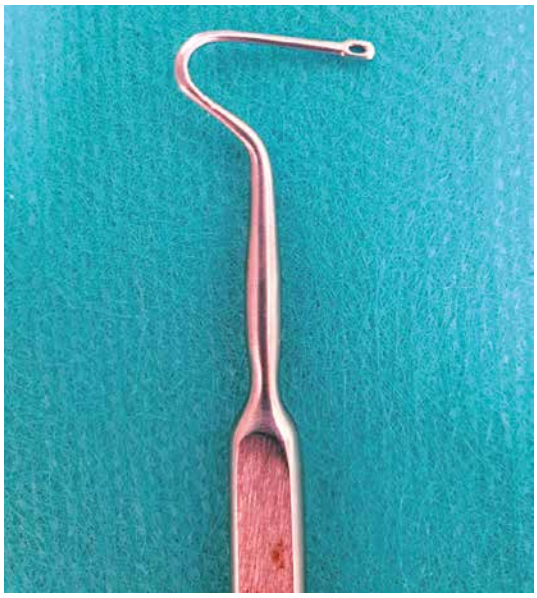

Figure 2. Gass hook

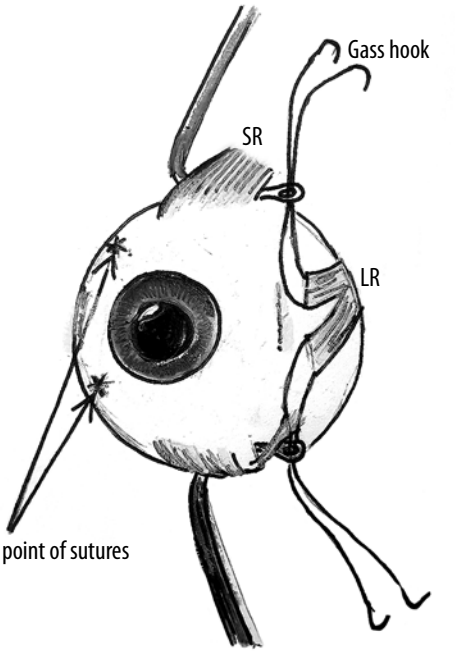

Figure 3. Diagram of split lateral rectus muscle and fixation point

DISCUSSION

Complete oculomotor nerve palsy, preserved function of the lateral rectus muscle and the superior oblique muscle innervated by separate nerves, and the loss of function of antagonistic muscles results in an abducted position of the globe, with slight depression and intorsion. Globe motility is completely lost or very limited. These disfunctions are accompanied by ptosis, pupil dilatation and accommodation disorders in the affected eye, resulting from the disfunction of parasympathetic components of the oculomotor nerve.

In the discussed case, the patient suffered from oculomotor nerve damage, which was manifested by all of the symptoms mentioned above. Two surgical techniques were taken into consideration during presurgical planning: Y transposition of the lateral rectus muscle and – in case of intraoperative difficulties resulting from modifications of the muscle itself – fixation of the globe to the periosteum of the medial orbital wall.

The surgical management of complete oculomotor nerve palsy presents a significant challenge, and many of the attempts proved unsuccessful. A conventional recession – resection surgery, even at the maximum range, failed to deliver the desired outcomes [6]. A number of alternative methods has been proposed, including weakening surgery of the lateral rectus muscle by incisions, transposition of the superior oblique muscle to the medial insertion of the superior rectus muscle with a large recession of the lateral rectus muscle, or transposition of the lateral rectus muscle [7]. In long-term paralytic strabismus, a surgical treatment of the lateral rectus muscle may not be possible because of its long-term contracture. In this case, fixation of the globe to the periosteum of the medial orbital wall is one of the most effective therapeutic options [8, 9]. Although this method is commonly perceived as difficult, there are many cases of this surgical technique presented in the literature, using various autogenous or allogeneic materials [9-11]. This method is highly invasive and involves other limitations, such as difficulty in calculating the

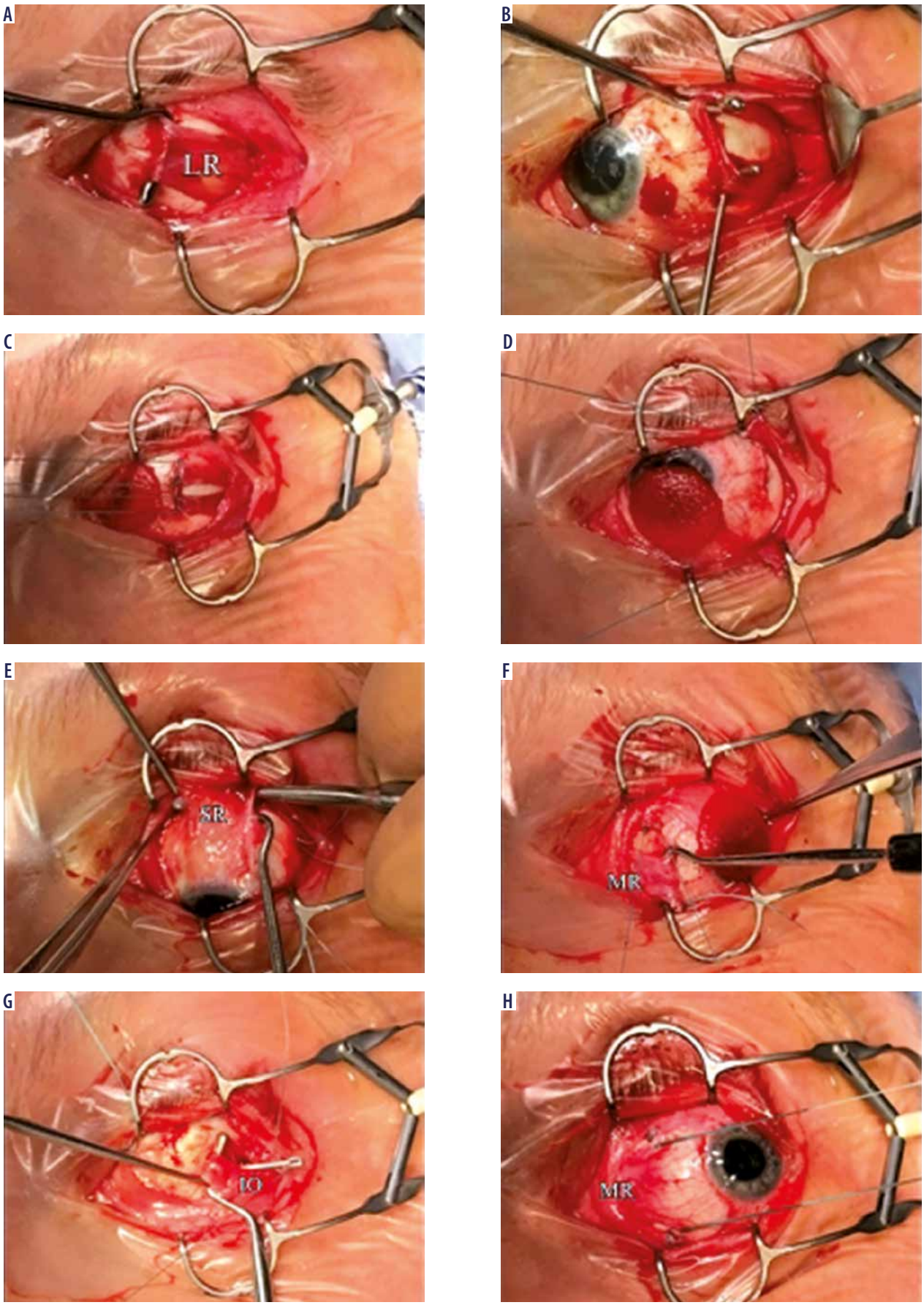

Figure 4. Surgical procedure. **A**) Isolated lateral rectus muscle (LR); **B**) Separation of LR fibers into two halves; **C**) Sutures applied to each LR half; **D**) LR cut from the insertion; **E**) Transposition of superior LR fibers under the superior rectus muscle (SR) and the superior oblique muscle; **F**) Medial transposition of LR fibers; **G**)Transposition of fibers under inferior oblique muscle (IO) and the inferior rectus muscle; **H**) Medial attachment of LR fibers

length of prothesis and – in case of allogenic materials – introduction of a foreign body to the orbit or unsuitability of this method in pediatric patients.

Nasal transposition of the lateral rectus muscle passed under the superior rectus muscle and its fixation to the superior-nasal part of the globe was first performed by Taylor [12]. This method significantly reduced exotropia but increased incyclotropia. Kaufmann modified this technique [13] by splitting the fibers of the lateral rectus muscle into two equal halves passed behind the equator of the eye (one half superiorly and the other one inferiorly) and attached near the vortex vein, to deliver promising outcomes by reducing the risk of incyclotropia. Gokyigit's modification of the technique [14] consisted in the attachment of split fibers near the medial rectus muscle insertion. The Gokyigit's method can be regarded as safer. The risk of globe perforation is relatively low as the muscle fibers are attached to the a well exposed and easily accessible fixation point – next to the muscle insertion, away from the vortex vein, which translates into a lower risk of complications in the posterior pole of the globe, such as serous retinal detachment. As many as 33.3% of patients suffered from serous retinal detachment resulting from elevated pressure in vortex veins secondary to Kauffman's procedures [15]. Gokyigit did not report any cases of this complication. Because this is a one-muscle operation, there are no cases of anterior segment ischemia in this technique [14].

CONCLUSIONS

Loss of function by as many as four out of six extraocular muscles means there are limited treatment options for paralytic strabismus secondary to oculomotor nerve palsy.

Figure 5. Surgical outcome A photograph taken two months after surgery, in frontal gaze direction

The goal of surgical techniques is to correct hypotropia and large-angle exotropia, followed by ptosis correction at later stages of the surgical procedure. Y transposition of a split lateral rectus muscle to the medial rectus muscle insertion appears to be delivering satisfying orthotropia results in patients with complete oculomotor nerve palsy. Careful patient selection appears to be the key issue as lateral rectus muscle contracture, excess scarring or adhesions following strabology surgeries reduce the likelihood of successful outcome [1].

It should be borne in mind that, although the surgery does not restore full ocular motility, it nevertheless improves the esthetic effects and the resulting patient's self-esteem. But more importantly, it restores the function of an eye affected by oculomotor nerve palsy in the future, in the event of vision loss in the other healthy eye. In conclusion, a proper clinical evaluation and careful surgical planning in combination with establishing realistic patient's expectations can provide a basis for effective surgical treatment.

DISCLOSURE

The authors declare no conflict of interest.

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