Case Report

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Residual Paralytic Esotropia after Sixth Nerve Palsy: Management with Partial Hummelsheim Transposition Combined with Botulinum Toxin

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ABSTRACT

Sixth cranial nerve palsy is a common cause of paralytic strabismus, often leading to esotropia and limitation of abduction. Management of residual esotropia can be particularly challenging in long-standing cases or in patients with previous strabismus surgery.

We report a case of a 63-year-old woman presenting with binocular diplopia and residual esotropia following prior surgery for left sixth nerve palsy. Clinical examination revealed a 20 prism diopter esotropia in primary gaze, severe limitation of abduction, and a compensatory head turn. A partial Hummelsheim transposition combined with intraoperative botulinum toxin injection into the medial rectus muscle was performed.

In the immediate postoperative period, exotropia with adduction limitation was observed, which gradually improved over time. At 6 months, the patient achieved orthotropia in primary position, with significant improvement in ocular motility and complete resolution of the compensatory head posture.

Partial Hummelsheim transposition combined with botulinum toxin represents an effective and safe option for the management of residual paralytic esotropia, particularly in previously operated patients, as it allows satisfactory ocular alignment while preserving anterior segment circulation.

Keywords

Paralytic esotropia, Sixth nerve palsy, Muscle transposition, Hummelsheim procedure, Botulinum toxin, strabismus, Strabismus surgery, Diplopia.

Introduction

Sixth cranial nerve palsy is a frequent cause of paralytic strabismus, typically characterized by esotropia and limitation of abduction, often resulting in diplopia and compensatory head posture. In cases of complete lateral rectus paralysis, conventional horizontal muscle surgery may be insufficient, particularly in long-standing cases or in patients with prior surgical interventions [1].

Muscle transposition procedures have emerged as an effective alternative in such scenarios and are widely described in the surgical management of paralytic strabismus [2]. The partial Hummelsheim transposition involves splitting the vertical rectus muscles and transposing their lateral halves toward the lateral rectus insertion [3]. The partial Hummelsheim transposition involves splitting the vertical rectus muscles and transposing

their lateral halves toward the lateral rectus insertion [3]. Compared to full-tendon transpositions, this technique preserves part of the anterior ciliary circulation, thereby reducing the risk of anterior segment ischemia, which is especially relevant in reoperated patients [4].

Case Report

A 63-year-old woman presented with a several-month history of binocular diplopia. Ophthalmologic examination revealed a 20 prism diopter esotropia in primary position, near-complete limitation of abduction in the left eye, and a compensatory head turn to the left.

Her medical history was notable for previous surgery performed one year earlier for long-standing left sixth nerve palsy, consisting of a 4.5 mm recession of the left medial rectus and a 5.5 mm resection of the left lateral rectus. Additionally, she had received three prior botulinum toxin injections into the left medial rectus muscle.

Due to persistent deviation, a partial Hummelsheim transposition was performed, combined with intraoperative injection of 5 IU of botulinum toxin into the left medial rectus muscle.

In the immediate postoperative period, the patient developed exotropia in primary position associated with limitation of adduction in the left eye. During follow-up, a progressive improvement in ocular motility was observed.

At 6 months postoperatively, the patient achieved orthotropia in primary position, significant improvement in abduction, recovery of adduction, and complete resolution of the compensatory head posture.

Discussion

Sixth cranial nerve palsy represents one of the most common causes of paralytic strabismus in adults and poses a significant surgical challenge, particularly in long-standing cases or after previous interventions [1]. In such situations, medial rectus contracture and lateral rectus dysfunction often limit the effectiveness of conventional recession–resection procedures.

Muscle transposition techniques have become a well-established alternative, especially in cases with severe abduction deficit. Among these, the partial Hummelsheim procedure allows redirection of vertical rectus muscle forces while preserving anterior segment circulation, thereby reducing the risk of ischemia compared to full-tendon transpositions [5].

In the present case, the patient had previously undergone horizontal muscle surgery and multiple botulinum toxin injections without achieving satisfactory alignment. This is consistent with previous reports indicating that isolated horizontal procedures are often insufficient in complete sixth nerve palsy due to the absence of effective lateral rectus function [6]. Therefore, the indication for a transposition procedure was appropriate.

The combination of partial Hummelsheim transposition with intraoperative botulinum toxin injection into the medial rectus muscle aims to enhance the abducting force while simultaneously weakening the antagonist muscle. This combined approach has been shown to improve motor outcomes and alignment in primary gaze [6,7]. In addition, augmentation techniques such as posterior fixation sutures (Foster modification) have been described to further increase the effectiveness of muscle transposition procedures [8]. Furthermore, botulinum toxin provides a temporary and adjustable weakening effect, which is particularly useful in cases at risk of overcorrection [4].

The immediate postoperative exotropia with adduction limitation observed in this patient can be interpreted as an expected transient effect of the combined treatment, likely due to temporary over-

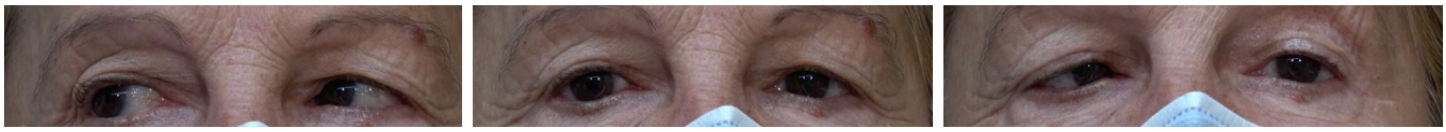

Figure 1: Preoperative findings showing severe limitation of abduction in the left eye.

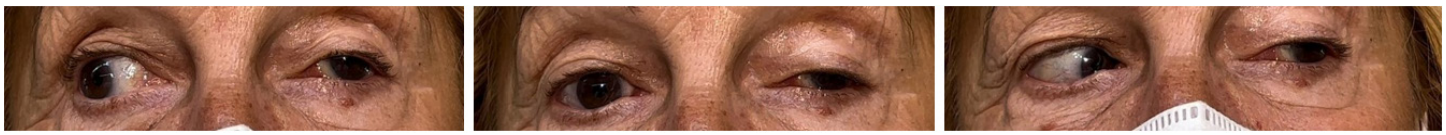

Figure 2: Three-month postoperative follow-up showing exotropia in primary position with limitation of adduction in the left eye.

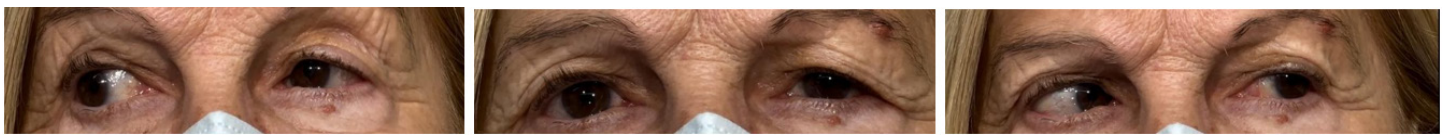

Figure 3: Six-month postoperative follow-up showing orthotropia in primary position and significant improvement in abduction of the left eye.

weakening of the medial rectus muscle and redistribution of muscular forces. The subsequent progressive recovery of adduction and final orthotropia suggest appropriate sensorimotor adaptation and resolution of the toxin effect.

Another important consideration is the history of prior surgery, which increases the risk of anterior segment ischemia. In this context, partial transposition techniques such as Hummelsheim offer a safer alternative by preserving part of the anterior ciliary vessels, making them particularly suitable for reoperative cases [5].

Although newer techniques, such as the Nishida procedure, have gained popularity due to the avoidance of muscle disinsertion and further reduction of ischemic risk, the outcomes achieved with Hummelsheim transposition remain comparable in terms of deviation correction and functional improvement [5,9]. Ultimately, the choice of technique depends on surgeon experience and specific case characteristics.

The favorable outcome at 6 months, including orthotropia, improved motility, and resolution of compensatory head posture, supports the effectiveness of the chosen approach. This case highlights the usefulness of combining muscle transposition with botulinum toxin in complex reoperative scenarios, where conventional strategies are often insufficient.

Conclusion

Partial Hummelsheim transposition combined with intraoperative botulinum toxin injection into the medial rectus muscle represents an effective option for the management of persistent sixth nerve palsy following previous surgery. This approach allows improvement in primary position alignment, enhancement of abductive function, and resolution of compensatory head posture, even in complex cases with underlying muscle fibrosis.

The initial postoperative overcorrection may represent part of the expected clinical course, with progressive resolution and functional recovery over time, supporting the role of botulinum toxin as a modulatory adjunct.

Overall, this combined strategy appears to be a safe and effective alternative, particularly in reoperated patients or in those at increased risk of anterior segment ischemia.

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