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

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Abstract

Sixth cranial nerve palsy is a common cause of paralytic strabismus and frequently results in esotropia, diplopia, and limitation of abduction. Surgical management becomes particularly challenging in chronic cases and in patients with previous extraocular muscle surgery. Muscle transposition procedures have been developed to improve ocular alignment and abductive function while minimizing surgical morbidity. We report the case of a 63-year-old woman with persistent binocular diplopia and residual esotropia secondary to chronic left sixth nerve palsy despite previous horizontal muscle surgery and multiple botulinum toxin injections. Ophthalmologic examination demonstrated a 20-prism diopter esotropia in primary position, severe limitation of abduction in the left eye, and compensatory head posture.

The patient underwent partial Hummelsheim transposition combined with intraoperative injection of 5 IU botulinum toxin into the ipsilateral medial rectus muscle. In the immediate postoperative period, exotropia and transient adduction limitation were observed. Progressive improvement occurred during follow-up, with recovery of abduction and enhancement of abduction. At 6 months postoperatively, the patient achieved orthotropia in primary gaze, marked improvement in ocular motility, and complete resolution of compensatory head posture and diplopia. This case highlights the usefulness of partial Hummelsheim transposition combined with botulinum toxin as an effective and safe strategy for residual paralytic esotropia in reoperated patients, while preserving anterior segment circulation and reducing the risk of anterior segment ischemia.

Keywords: Paralytic Esotropia; Sixth Nerve Palsy; Hummelsheim Procedure; Muscle Transposition; Botulinum Toxin; Strabismus Surgery; Diplopia

Introduction

Sixth cranial nerve palsy is one of the most common causes of paralytic strabismus and is typically characterized by esotropia and limitation of abduction, frequently associated with diplopia and compensatory head posture. In chronic or complete palsy, conventional horizontal muscle surgery may provide limited functional recovery due to persistent lateral rectus weakness and secondary medial rectus contracture [1]. Muscle transposition procedures have become an important surgical alternative in these complex cases. Among them, the partial Hummelsheim transposition consists of splitting the superior and inferior rectus muscles and transposing their lateral halves toward the insertion of the lateral rectus muscle [2].

Compared with full-tendon transposition techniques, partial transposition preserves part of the anterior ciliary circulation, thereby decreasing the risk of anterior segment ischemia, which is particularly relevant in patients with previous ocular muscle surgery [3]. The use of botulinum toxin as an adjunctive treatment has also been described to temporarily weaken the ipsilateral medial rectus muscle, facilitating ocular alignment and improving postoperative motor balance [4]. We present a case of residual

paralytic esotropia secondary to chronic sixth nerve palsy successfully managed with partial Hummelsheim transposition combined with intraoperative botulinum toxin injection after failure of previous strabismus surgery.

Case Presentation

A 63-year-old woman presented with a several-month history of binocular diplopia and abnormal head posture. Ophthalmologic examination demonstrated a 20-prism diopter esotropia in primary gaze, near-complete limitation of abduction in the left eye, and compensatory head turn to the left side. Her ophthalmologic history was significant for previous surgery performed one year earlier for chronic left sixth nerve palsy, consisting of 4.5 mm recession of the left medial rectus muscle and 5.5 mm resection of the left lateral rectus muscle. In addition, she had undergone three previous botulinum toxin injections into the left medial rectus muscle with incomplete clinical improvement. Given the persistence of the deviation and severe abduction deficit, surgical management with partial Hummelsheim transposition was indicated.

The lateral halves of the superior and inferior rectus muscles were transposed toward the lateral rectus insertion. Intraoperatively, 5 IU of botulinum toxin were injected into the left medial rectus muscle. During the immediate postoperative period, the patient developed exotropia in primary position associated with limitation of adduction of the left eye. No anterior segment complications or ischemic signs were observed. Progressive recovery of ocular motility occurred during follow-up. At 6 months postoperatively, the patient achieved orthotropia in primary gaze, substantial improvement in abduction, recovery of adduction, and complete resolution of compensatory head posture and diplopia (Figure 1-3).

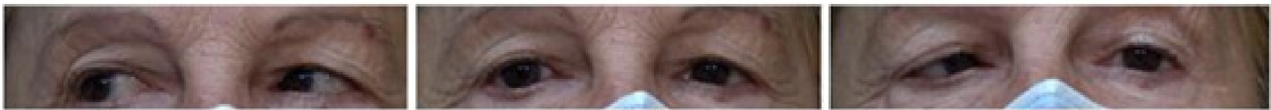

Figure 1: Preoperative findings showing severe limitation of abduction in the left eye.

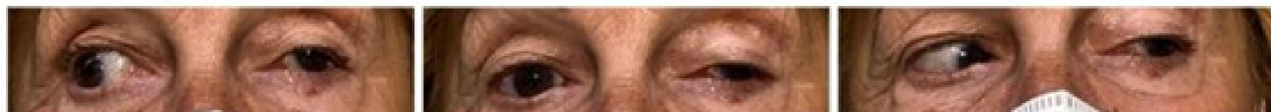

Figure 2: Three-month postoperative follow-up showing exotropia in primary position with limitation of addiction in the left eye.

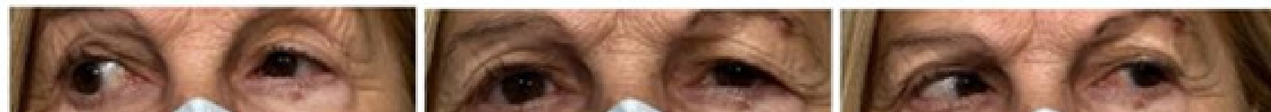

Figure 3: Six-month postoperative follow-up showing orthotropia in primary position and significant improvement in abduction of the left eye.

Results

The combined surgical approach resulted in satisfactory ocular alignment and functional improvement. Immediate postoperative overcorrection manifested as exotropia and transient adduction limitation gradually resolved over time. At the 6-month follow-up examination, orthotropia in primary position was achieved with significant improvement in abduction of the affected eye. Adduction recovered progressively after the temporary effect of botulinum toxin diminished. The compensatory head posture disappeared completely, and the patient reported resolution of binocular diplopia in primary gaze. No intraoperative or postoperative complications, including anterior segment ischemia, were identified.

Discussion

Sixth cranial nerve palsy remains one of the most challenging forms of paralytic strabismus, particularly in chronic or reoperative cases. Persistent dysfunction of the lateral rectus muscle combined with secondary contracture of the medial rectus frequently limits the effectiveness of isolated horizontal

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muscle procedures [1]. In the present case, previous recession–resection surgery and repeated botulinum toxin injections failed to achieve satisfactory ocular alignment. Similar findings have been reported in complete sixth nerve palsy, where the absence of effective lateral rectus function reduces the long-term efficacy of conventional horizontal surgery [5].

Muscle transposition procedures redirect vertical rectus muscle force vectors to augment abduction and improve alignment in primary position. The partial Hummelsheim technique offers the additional advantage of preserving part of the anterior ciliary circulation, reducing the risk of anterior segment ischemia compared with full-tendon transposition procedures [3]. This consideration is particularly important in patients with previous extraocular muscle surgery, as in our patient. Adjunctive use of botulinum toxin in the medial rectus muscle provides temporary weakening of the antagonist muscle and may enhance the effectiveness of transposition surgery [4].

Previous studies have shown that combining transposition procedures with medial rectus weakening improves motor outcomes and binocular alignment [5,6]. The transient postoperative exotropia and adduction deficit observed in this patient likely reflected temporary overcorrection secondary to botulinum toxin effect and redistribution of muscular forces. Progressive recovery over time with final orthotropia supports the reversible and modulatory role of botulinum toxin in this setting.

Alternative techniques such as the Nishida procedure have gained popularity because they avoid muscle splitting and disinsertion, potentially reducing ischemic risk further [7]. However, Hummelsheim transposition continues to demonstrate favorable outcomes with reliable correction of deviation and functional improvement [3,7]. The favorable clinical outcome achieved in this patient supports the role of partial Hummelsheim transposition combined with botulinum toxin injection as an effective strategy in complex reoperative sixth nerve palsy [8,9].

Conclusion

Partial Hummelsheim transposition combined with intraoperative botulinum toxin injection into the medial rectus muscle represents an effective and safe treatment option for residual paralytic esotropia secondary to chronic sixth nerve palsy, particularly in previously operated patients. This combined approach allows improvement of ocular alignment in primary gaze, enhancement of abductive function, and resolution of compensatory head posture while preserving anterior segment circulation. Temporary postoperative overcorrection may occur but can progressively resolve with favorable long-term functional outcomes.

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Ethical Statement

The project did not meet the definition of human subject research under the purview of the Institutional Review Board according to federal regulations and was therefore exempt.

Informed Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying clinical information.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Authors' Contributions

All authors contributed equally to the conception, drafting, revision, and final approval of the manuscript.

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