

Case Report

Surgical Treatment of a Large-Angle Post Traumatic Hypertropia by The Inverse Knapp Procedure: A Case Report

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Citation: Dohvoma VA, et al. Surgical Treatment of a Large-Angle Post Traumatic Hypertropia by The Inverse Knapp Procedure: A Case Report. J Ophthalmol Adv Res. 2024;5(2):1-4.

<https://doi.org/10.46889/JOAR.2024.5204>

Received Date: 22-05-2024

Accepted Date: 11-06-2024

Published Date: 19-06-2024



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Abstract

Purpose: To report the case of a patient treated successfully by the inverse Knapp procedure for persistent vertical diplopia, despite 2 orbital reconstruction surgeries following orbital trauma. **Report:** A 40-year-old patient was referred to us for a 10-months history of vertical diplopia which started after a road traffic accident. The initial CT scan had revealed right maxillary sinusitis, fracture of the orbital floor and muscle incarceration; for which he had undergone 2 orbital surgeries before referral. Ocular motility revealed a 30 Prism Diopters (PD) hypertropia and limited depression of the right eye. Lancaster test showed inferior rectus palsy of the right eye. Persistent diplopia despite 4 months of continuous patching of the left eye was the indication for surgery. The inverse Knapp procedure was done under general anaesthesia. Post operatively, the patient was free of diplopia without the use of prisms in primary gaze and in near vision.

Conclusion: The inverse Knapp procedure is an uncommon operation in strabismus surgery which gives good results in inferior rectus palsy from orbital trauma.

Keywords: Hypertropia; Orbital Fracture; Diplopia; Inferior Rectus; Inverse Knapp

Introduction

The most common causes of hypertropia in adults are fourth nerve palsy and thyroid eye disease [1]. Hypertropia may also occur following orbital trauma. Resulting vertical diplopia may resolve spontaneously in most cases or after orbital fracture surgery. A few patients will require prisms and/or strabismus surgery [2]. Diplopia can be due to muscle entrapment, muscle damage or nerve compromise. Muscle entrapment can be resolved with orbital surgery, although muscle damage (from trauma or surgery) could be responsible for persistent diplopia.

Rarely, diplopia can persist or worsen after orbital fracture surgery [3]. Compromise to the nerve function may possibly result in the development of a neurogenic cause of diplopia [4].

About a third of patients with persistent vertical diplopia after surgical repair of orbital fracture will require strabismus surgery [5]. The type and amount of surgical correction of vertical strabismus is determined by the type of ocular motility pattern. The inverse Knapp procedure is an uncommon strabismus operation recommended for marked Inferior Rectus (IR) weakness. We report the case of a large angle hypertropia resulting from IR weakness despite several orbital reconstruction surgeries following orbital trauma, which was treated successfully by the inverse Knapp procedure.

Case Presentation

A 40-year-old male patient was referred to us by a maxillofacial surgeon for persistent vertical diplopia. He was involved in a road traffic accident 10 months before and had been complaining of diplopia since then. This had kept the patient out of work

and most of his social life. His past medical history was non-remarkable. On initial evaluation following the trauma, an orbital CT scan revealed fracture of the right maxillary hem sinus, orbital floor and muscle entrapment. Orbital repair surgery was initially done by an otorhinolaryngologist. Due to persistent diplopia, he was referred to a maxillofacial surgeon who did a second orbital repair 2 months later; during which entrapped tissue was removed and reconstruction material applied.

Ophthalmic examination revealed hypertropia of the right eye in primary gaze (Fig. 1). The deviation was measured to be 30 PD. Ductions and versions showed limited depression of the right eye (Fig. 1) and normal elevation (Fig. 1). The Lancaster red-green test showed limited depression of the right eye with marked under-action of the IR muscle and marked overaction of the contralateral superior oblique muscle. This confirmed the diagnosis of right IR palsy.

Conservative management with patching of the left eye was implemented. No improvement was noticed after 4 months, hence the indication for surgery. Surgery was carried out under general anaesthesia. During surgery, forced ductions were normal and a full transfer of the horizontal recti in the right eye to the level of the IR muscle was done. The cut ends of the muscles lied along the spiral of Tillaux as shown in Fig. 2. There was good post-operative ocular alignment with orthotropia and no diplopia in primary gaze and reading position. This remained stable at the 3 months post-operative visit as shown in Fig. 3.



Figure 1: Preoperative ocular alignment showing hypertropia in primary gaze (b); normal elevation (a) and limited depression (c).

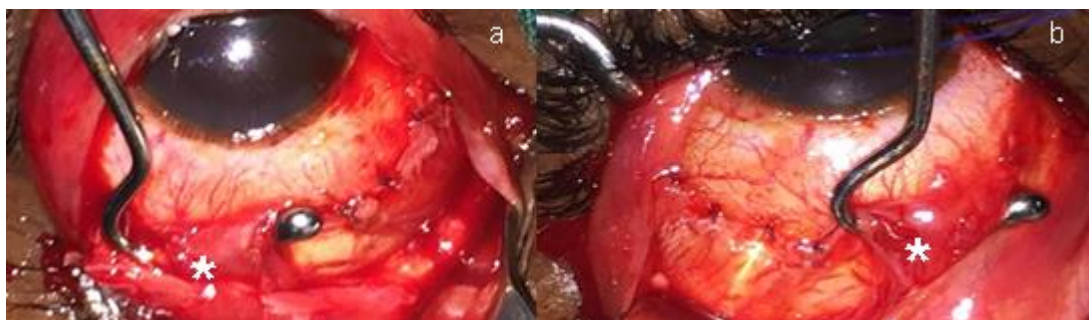


Figure 2: Inferior rectus on muscle hook; transposed medial rectus (a) transposed lateral rectus (b).



Figure 3: Corneal reflexes are centred in both eyes post-operatively at day 1 (a) and at 3 months (b).

Discussion

To the best of our knowledge, this case is the first reported case with the largest amount of vertical deviation following orbital fracture to be treated successfully with a single strabismus procedure. The inverse Knapp procedure is an uncommon procedure which is usually indicated for double depressor palsy and congenital or acquired IR palsy. It is reserved for marked to severe isolated IR weakness without mechanical restriction [6]. Our patient had a large angle hypertropia, diplopia in primary and downgaze and showed an IR palsy pattern on ocular motility, justifying the use of this procedure.

Maurino, et al., published the largest case series on this procedure in 17 patients, amongst whom were 9 cases of orbital trauma with a mean hypertropia of 14.3 PD (range 3 to 24 PD) [7]. The mean hypertropia improved to 4.4 PD in primary gaze. Lipton, et al., published a series on 9 patients treated by the inverse Knapp for down gaze diplopia. Although they did not report the mean vertical deviation, they noted an increase in the field of binocular single vision following the procedure [8].

Loba, et al., in their study on the management of persistent diplopia after the surgical repair of orbital fractures, divided their patients into 4 groups based on the type of ocular motility impairment: IR paresis, IR restriction, inferior oblique involvement, IR paresis plus restriction [5]. For the IR paresis group, they followed the paresis-counter-paresis rule with contralateral IR recession supported by contralateral IR Faden. This procedure might be complicated by inferior lid retraction. The large deviation in our patient should have required a large recession and resulted in greater lid retraction. Therefore, this was not the procedure of choice for our patient. Recession of the IR and resection of the superior rectus would have resolved hypertropia in primary gaze but would not help in the dynamics of downgaze. With a severely weakened IR, there might be persistent diplopia in reading and downgaze. Other procedures for small deviations reported by other authors include ipsilateral recession of a taut IR, ipsilateral superior rectus recession and weakening of the contralateral synergistic muscle (superior oblique) [9,10].

This case report is limited by the unavailability of details of the first orbital repair surgery. Also, an objective measurement of the field of binocular single vision before and after the inverse Knapp procedure would have shown the impact of this procedure not just on diplopia but also on the field of binocular single vision.

Conclusion

In conclusion, diplopia may occur as a complication of orbital fractures and may persist even after orbital wall reconstruction surgery. Diplopia may have far-reaching psychological and socio-professional consequences on the patient. It is therefore important to raise awareness among other health professionals and foster a multidisciplinary team approach in the management of such patients.

Conflicts of Interest

The authors declared no conflicts of interest with respect to the publication of this paper.

Data Availability

The patient's medical report is available.

Consent of Patients

Although pictures have been cropped as not to reveal patient identity, informed written consent was obtained regarding the publication of the figures.

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