Management of surgical overcorrections following surgery for Duane syndrome with esotropia in primary position

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SUMMARY Surgery for esotropic Duane syndrome may result in overcorrections. Managing these overcorrections can be challenging. We describe the most common over-correction scenarios and recommendations for their surgical management. (J AAPOS 2019;23:2-4)

Patients who undergo surgery for esotropic Duane syndrome may experience overcorrections in the early or late postoperative period.[1,2] Managing these overcorrections can be challenging.[3-5] Early-onset overcorrection may result from over-recession of the medial rectus muscle or from a tight transposition procedure; late overcorrection, from chronic passive tightening of the transposed muscles or the ipsilateral lateral rectus muscle or from scar tissue formation. Our recommendations for the most common overcorrection scenarios are based on both the initial procedure and when (early or late) the overcorrection appears. A good result is possible if interventions are timely and take into account the results of forced duction testing. Figure 1 depicts of our algorithm for managing postoperative exotropia in this context.

Overcorrection after Medial Rectus Recession

In cases of a single medial rectus muscle recession, misinnervation of the lateral rectus muscle can create a unique situation that can result in consecutive exotropia. In these cases, the medial rectus muscle is an active force opposing the effect of the anomalously misinnervated lateral rectus muscle. When a medial rectus muscle is recessed, fixation duress is created in adduction, resulting in increased innervation to the medial rectus muscle and a subsequent increase in the anomalous innervation to the lateral rectus muscle. This increased anomalous innervation can lead to increased contraction of the lateral rectus muscle, resulting in further limitation to adduction. Patients with severe misinnervation of the lateral rectus muscle may then be left with severe limitation to adduction and simultaneous divergence on attempted adduction after a medial rectus recession (Figure 2).

In cases of early overcorrection following medial rectus muscle surgery we first attempt to treat the patient with overminus glasses and patching. In patients with diplopia, temporary optical treatment also includes prisms or patching part of the lens. Early intervention is warranted mainly in patients with significant diplopia or cases of suspected muscle slippage.

If the patient underwent recession of the medial rectus muscle alone and the forced duction under anesthesia is negative, we explore and advance the medial rectus muscle. If the forced duction test is positive we prefer to recess the ipsilateral lateral rectus muscle and consider medial rectus muscle advancement. If the patient underwent recession of the medial rectus muscle in combination with the transposition, and the forced duction under anesthesia is negative, we explore and advance the medial rectus muscle. If forced duction testing is positive, we explore the previously transposed vertical rectus muscle(s) and advance the medial rectus muscle.

Case Study

Patient 1 presented with esotropic Duane syndrome and underwent medial rectus recession of 5 mm. Postoperatively, he was found to have an immediate severe limitation to adduction and exotropia (Figure 2) and underwent follow-up surgery within one week of the previous procedure. Intraoperative forced duction testing revealed no restriction to adduction. Therefore, the medial rectus was advanced 3 mm. Postoperatively, the patient was orthotropic in primary position. In cases where the lateral rectus muscle is tight, which is more frequent in later overcorrections, a lateral rectus muscle recession would be performed (Figure 3).

Overcorrection after Transposition Procedures

In cases of exotropia after transposition procedures, the transposition of the vertical rectus muscle creates a passive abducting force that opposes the adducting force of the medial rectus muscle. In these cases, a postoperative

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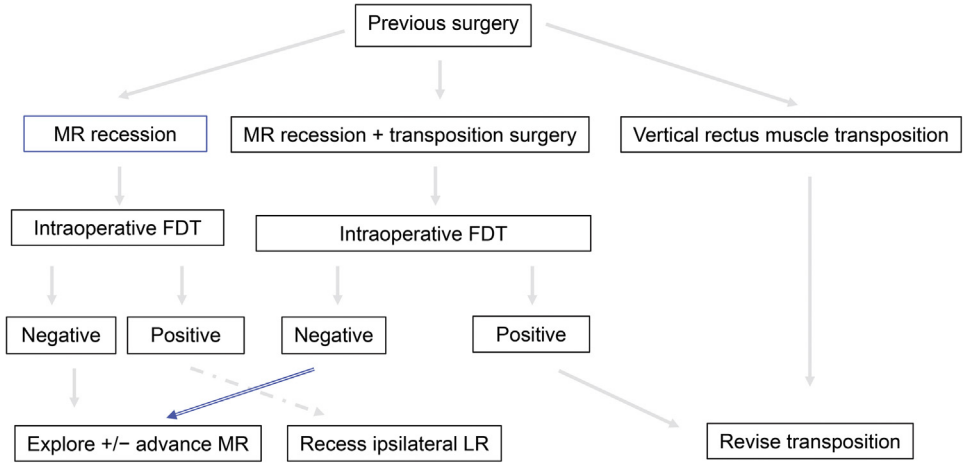

FIG 1. An algorithm for the management of secondary exotropia after surgery for unilateral Duane syndrome. *FDT*, forced duction test; *LR*, lateral rectus muscle; *MR*, medial rectus muscle.

FIG 2. Severe limitation to adduction and exotropia in a patient with unilateral left eye Duane syndrome following ipsilateral 5 mm medial rectus muscle recession. A, Preoperative esotropic Duane syndrome. B, Postoperative consecutive exotropia with marked limitation to adduction.

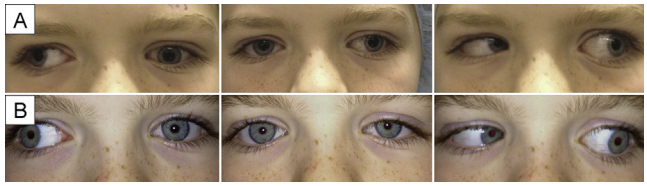

FIG 4. A, Exotropia following vertical rectus muscle transposition in a patient with a left eye esotropic Duane syndrome. Forced duction test revealed restriction to adduction. B, Augmentation suture removal and recession of the vertical rectus muscle resulted in orthotropia in primary position.

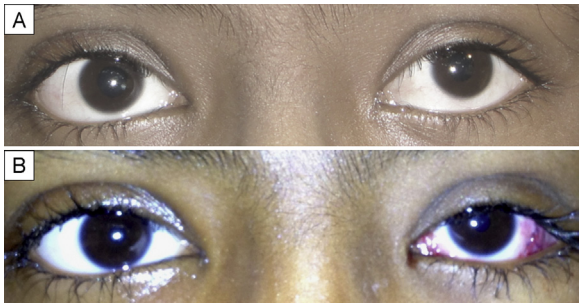

FIG 3. A, A patient with a unilateral left eye Duane syndrome who underwent left medial rectus muscle recession presented with a large-angle left exotropia 5 years later. Forced duction test revealed restriction to adduction in the left eye. B, Following medial rectus muscle advancement plus lateral rectus muscle recession.

exotropia my result from tightness of either the transposed muscle or the posterior fixation suture (Figure 4).

Although one cannot predict securely which patients are most at risk for overcorrection after surgery for esotropic Duane syndrome, several studies have identified risk factors for overcorrections following transposition of the vertical rectus muscle transposition, including less restriction to abduction, a smaller esotropia in adduction, and less preoperative esotropia at near.[2] For patients undergoing single medial rectus muscle recession, risk factors for consecutive exotropia are less well-defined. In our personal experience, overcorrections may be more likely to occur with large medial rectus recessions (>5 mm), although this was not shown to be significant risk factors in our previous study,[2] which included mostly patients who underwent small recessions (mean 4 mm). Other authors who reported consecutive exotropia after medial rectus recession for esotropic Duane syndrome included patients who underwent recessions of at least 6 mm.[3,4]

In cases of overcorrections after transposition procedures—alone or in combination with ipsilateral medial rectus muscle recession—we intervene within the first postoperative week because of the risk of scar tissue formation. When intraoperative forced duction testing is positive, we explore the previously transposed vertical rectus muscle(s). To eliminate the restriction to adduction, we remove the posterior fixation suture and, if suture removal alone does not eliminate the restriction, recess the previously transposed muscle, for which we recommend following the path of the transposition instead of

repositioning the muscle toward the original insertion. We also recommend repeating forced duction testing during each step of the procedure.

In patients with initially good alignment and progressive late overcorrection, we also recommend isolating the lateral rectus muscle when forced duction testing is positive. We have found tight lateral rectus muscles in patients with longstanding late overcorrections after either transposition procedures or single medial rectus muscle recessions (Figure 3). We recommend recessing the lateral rectus muscle in these cases prior to revising the transposition or the position of the medial rectus muscle.

Case Study

Patient 2 presented with esotropic Duane syndrome and underwent a vertical rectus muscle transposition with augmentation sutures. The patient was exotropic immediately after surgery and was reoperated within one week. Forced duction testing revealed restriction to adduction. The augmentation suture was removed, but repeat forced duction testing was persistently positive. Therefore, the vertical rectus muscles were each recessed 3 mm along the path of the transposition. The result was orthotropia in primary position (Figure 2).

References

1. Barbe ME, Scott WE, Kutschke PJ. A simplified approach to the treatment of Duane's syndrome. Br J Ophthalmol 2004;88:131-8.
2. Velez FG, Laursen JK, Pineles SL. Risk factors for consecutive exotropia after vertical rectus transposition for esotropic Duane retraction syndrome. J AAPOS 2011;15:326-30.
3. Kushner BJ, Chu FC, Elliot RL, Lee JC, McKeown CA, Wutanabe H. Grand rounds #25: A case of residual exotropia after revision of a modified Hummelsheim for Duane syndrome. Binocul Vis Strabolog Q 1992;7:32-6.
4. Kushner BJ, Arthur BW, Mazow ML, Medow NB, Young TL. Grand rounds #51: A case of consecutive exotropia after medial rectus recession for Duane syndrome. Binocul Vis Strabismus Q 1998;13:188-92.
5. Kekunnaya R, Kraft S, Rao VB, Velez FG, Sachdeva V, Hunter DG. Surgical management of strabismus in Duane retraction syndrome. J AAPOS 2015;19:63-9.