Factors associated with atypical postoperative drift following surgery for consecutive exotropia

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PURPOSE To evaluate the associations of clinical and surgical factors with atypical postoperative drift following surgery for consecutive exotropia.

METHODS A total of 66 patients with consecutive exotropia ($\geq 10^{\Delta}$ at distance), after historical surgery for esotropia were retrospectively identified at a tertiary medical center. All patients underwent unilateral lateral rectus recession (on adjustable suture) with medial rectus advancement and/or resection. Immediate postoperative target angle was 4^{Δ}-10^{Δ} of esotropia at distance, anticipating mild postoperative exodrift. Actual postoperative drift was calculated as change in distance deviation from immediately postadjustment to 6 weeks. Typical drift was defined as 0^{Δ}-9^{Δ} of exodrift. Excessive exodrift was defined as $\geq 10^{\Delta}$. Esodrift was defined as 1^{Δ} or more. Univariate and multiple logistic regression analyses were performed to evaluate for associations with a wide range of clinical and surgical factors.

RESULTS Overall there was a median exodrift (4^{Δ}, quartiles 0^{Δ}-10^{Δ}). Of the 66 patients, 18 (27%) showed excessive exodrift; 15 (23%), esodrift. In multiple logistic analyses, larger preoperative distance exodeviation was associated with excessive exodrift ($P = 0.01$), and non-normal medial rectus attachment status (abnormal [stretched scar, pseudo-tendon], attached to pulley, or behind pulley) was associated with esodrift ($P = 0.02$).

CONCLUSIONS Approximately half of patients show atypical drift following unilateral surgery for consecutive exotropia, with larger preoperative distance exodeviation associated with exodrift and non-normal medial rectus muscle status with esodrift. Knowing these associations may help when counseling patients regarding surgical outcomes. (J AAPOS 2017;■:1-5)

Consecutive exotropia is an exotropia in a previously esotropic patient, most often developing after surgical intervention for esotropia. In surgical planning for consecutive exotropia, the typical immediate postoperative target angle is a small esodeviation because most patients are expected to experience postoperative exodrift. For some patients, exodrift occurs in excess of the anticipated magnitude, leading to recurrence of the exodeviation, whereas for others an unexpected esodrift occurs.[1] It is currently unclear why some patients show excessive exodrift or esodrift following surgery. The purpose of the present study was to describe the frequency of atypical postoperative drift (excessive exodrift and esodrift) and evaluate clinical and surgical factors associated with both excessive exodrift and any esodrift in patients undergoing surgery for consecutive exotropia.

Subjects and Methods

The procedures used in this study conformed to the Declaration of Helsinki and were approved by the Institutional Review Board of the Mayo Clinic, Rochester, Minnesota.

The medical records of all consecutive exotropia patients seen over a 20-year period (1995-2015) were reviewed to identify a cohort of patients who underwent surgery for consecutive exotropia of $\geq 10^{\Delta}$ by prism and alternate cover test at distance fixation (3 m, which is standard in our practice), after previous medial rectus recession (with or without lateral rectus resection) for concomitant esotropia. To study postoperative drift in a relatively homogeneous surgical cohort we only included patients undergoing unilateral medial rectus advancement (with or without resection) and lateral rectus recession on an adjustable suture.

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Previous surgery for consecutive exotropia was allowed, as was coexisting vertical deviation requiring vertical displacement of horizontal rectus muscle and/or simultaneous vertical or oblique muscle surgery on the same eye.

Included patients had distance prism and alternate cover test measurements at three time points: (1) immediately preoperatively, (2) immediately following tying of adjustable sutures, (3) at 6 weeks (window of 3-21 weeks, taking the examination closest to 6 weeks) postoperatively.

Pre- and Postoperative Clinical Data

The preoperative examination was reviewed to extract the following data: best-corrected visual acuity (converted to logMAR for analysis), horizontal angle of deviation at distance (3 m) and near (1/3 m) by prism and alternate cover test with measurements in up- and downgaze (distance fixation) where available, and refractive error (summarized as spherical equivalent for each eye). Based on review of the medical history, we also recorded the total number of previous strabismus surgeries. Distance and near horizontal prism and alternate cover test were recorded from the 6-week postoperative examination.

Surgical Data

All included patients underwent surgery by a single surgeon (JMH). The immediate postoperative target angle was 4^{Δ}-10^{Δ} of esotropia at distance, which has been our standard practice, in anticipation of small-magnitude postoperative exodrift. It is our practice to use a narrow range for the immediate postadjustment target angle (rather than a single target value of, eg, 10^{Δ}) because achieving a specific value might require multiple adjustments that may be poorly tolerated by some patients and a target range has been reported to be useful.[2] The surgical report was reviewed to extract the following data: lateral rectus tightness by positive forced duction testing to adduction (graded normal, mild restriction, or moderate restriction); dose of lateral rectus recession (millimeters); location of medial rectus attachment to sclera (for those with a scleral attachment), including connective tissue or scar tissue (millimeters from insertion); location of majority of medial rectus muscle fibers (millimeters from insertion); dose of medial rectus advancement (with or without resection) in millimeters; whether or not vertical transposition of the horizontal rectus muscles was performed; whether or not simultaneous vertical or oblique surgery was performed (on the same eye); and type of medial rectus muscle attachment (see following detail).

Classification of Medial Rectus Muscle Attachment Type

Data on medial rectus attachment type were included because we previously speculated that attachment type may influence surgical outcomes.[3] Based on the written description of the location of the distal end of the medial rectus and the appearance of the attachment, the muscle attachment was classified as follows: (1) normal, with medial rectus muscle fibers attached directly to sclera; (2) abnormal, with medial rectus muscle fibers attached to sclera via a stretched scar or pseudotendon with the distal end of the muscle in front of the orbital pulley; (3) pulley, with medial rectus muscle fibers attached to the pulley but not the sclera; (4) behind pulley, with distal end of the muscle fibers found behind the pulley, but not attached to the pulley; or (5) mixed, with features of a tenuous normal attachment but with muscle fibers also attached to pulley structures or located behind the pulley. In all cases the surgical report was written in sufficient detail to allow classification of attachment type, and all classifications were completed before any analyses were performed.

Analysis

The amount of postoperative drift was calculated as the difference in distance horizontal prism and alternate cover test (in prism diopters), from immediately after adjustment to 6 weeks postoperatively. Esodeviations were assigned a negative value; exodeviations, a positive value. The proportion of patients showing excessive exodrift ($\geq 10^{\Delta}$), and the proportion of patients showing any esodrift ($\geq 1^{\Delta}$) were calculated.

Separate univariate and multiple logistic regression analyses were performed to identify factors associated with (1) excessive exodrift (compared with $<10^{\Delta}$ of exodrift and no esodrift), and (2) any esodrift (compared with $<10^{\Delta}$ of exodrift). Preoperative clinical factors (continuous data) were as follows: horizontal prism and alternate cover test at distance and at near, adduction deficit in the operated eye, degree of hyperopia (most hyperopic eye), and number of prior strabismus surgeries. Preoperative factors (dichotomized data; yes/no) were presence of amblyopia (interocular visual acuity difference of at least 3 logMAR lines, with no other organic cause), presence of an A pattern (difference of $\geq 10^{\Delta}$ between up- and downgaze) or V pattern (difference of $\geq 15^{\Delta}$ between up- and downgaze), presence of hyperopic anisometropia ≥ 1 D (spherical equivalent). From postoperative examinations we included immediate postadjustment horizontal angle at distance and near. The following surgical factors were included: location of medial rectus muscle insertion (included for normal and abnormal scleral attachments only [mixed attachment type excluded]), amount of medial rectus resection and/or advancement, amount of lateral rectus recession, and location of medial rectus muscle fibers. For location of medial rectus muscle fibers, if the exact distance was not recorded (pulley or behind the pulley insertions only), we imputed values derived in a previously reported dataset,[4] (12 mm for pulley and 16 mm for behind pulley). The actual surgical dose was calculated including any postoperative adjustment. Additional factors included were whether only horizontal surgery was performed or whether simultaneous vertical transposition of horizontal rectus muscles, or vertical rectus or oblique muscle surgery was performed, lateral rectus tightness (normal, mild, moderate), and medial rectus attachment type.

Since medial rectus insertion location data were not applicable to patients with pulley or behind pulley attachments, we performed secondary univariate and multiple logistic regression analyses including only patients with normal and abnormal medial rectus muscle attachments.

For all univariate analyses, to reduce the possibility of missing possible associations for evaluation in multiple logistic regression