Standardized Suture Placement for Mini-invasive Ptosis Surgery

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Objective: To report a refinement of small-incision external levator advancement with a standardized method for suture placement for correction of acquired blepharoptosis and 1 surgeon’s results with this technique.

Methods: Retrospective medical record review of data from all patients with unilateral or bilateral acquired blepharoptosis who underwent small-incision external levator advancement from October 1, 2007, through January 31, 2011.

Results: Ninety-two eyelids from 66 patients with acquired blepharoptosis were treated with small-incision external levator advancement with uniform suture placement. Forty patients underwent unilateral surgery and 26 underwent bilateral surgery. The mean preoperative margin-to-reflex distance was 0.70 mm. The mean postoperative margin-to-reflex distance was 2.95 mm. Symmetry was achieved in 49 patients (74%) on the basis of a less than 1-mm difference in margin-to-reflex distance. When stratified by unilateral ptosis repair vs bilateral ptosis repair, bilateral ptosis repair achieved greater symmetry on average (81% vs 70%). Nine patients underwent revision. There were only 2 postoperative complications: one was postoperative upper eyelid bleeding and the other was exposure keratopathy.

Conclusion: The simplified method of suture placement for small-incision external levator advancement is an effective, safe, and efficient option for acquired ptosis correction.


THE APONEUROTIC APPROACH to blepharoptosis repair was first described by Ev erbusch1 in 1883, but this approach was not popularized until 1975 when it was reintroduced and further refined by Jones et al.1,2 This widely accepted technique was transformed by Liu3 with the single-suture ptosis repair and more recently adapted for use in situations of isolated blepharoptosis without concurrent dermatochalasis using the concept of small-incision blepharoptosis repair. Lucarelli and Lemke4 initially described their small-incision technique in 1999. Frueh et al5 further described a similar procedure including data on the reduced time to complete this procedure relative to its predecessors. Despite the literature on small-incision ptosis, there has not been a formulaic approach to precise suture placement with this technique. We describe our approach to small-incision ptosis repair with a specific manner of suture placement that can be universally applied and present our data on this technique.

Methods

We conducted a retrospective review of medical records to evaluate a technique that was developed for small-incision repair of aponeurotic blepharoptosis using precise suture placement. Western institutional review board approval was granted. Data from patients with unilateral or bilateral aponeurotic blepharoptosis from the practice of one of us (B.S.S.) were collected from October 1, 2007, through January 31, 2011. The patients included men and women with unilateral or bilateral aponeurotic blepharoptosis with no dermatochalasis or where dermatochalasis correction was not indicated for functional reasons. Exclusion criteria included history of upper-eyelid surgery, concomitant upper-eyelid or brow surgery, or nonaponeurotic ptosis.

All patients were examined preoperatively by the same physician who performed the surgery. We reviewed medical records and collected demographic data, such as age and sex, as well as examination findings and measurements, including preoperative margin reflex distance, levator function, lagophthalmos, and visual field testing results. Intraoperative data, such as operative time and complications, as well as postoperative information, including...
postoperative margin reflex distance, levator function, contour, symmetry, lagophthalmos, need for revision, and length of follow-up, were also collected. In patients with unilateral ptosis, preoperative assessment of the patient’s dominant eye and determination of whether there was any alteration in the height of the contralateral eyelid with elevation of the affected eyelid was performed. These factors were used to evaluate the risk of postoperative contralateral ptosis. Photographs were obtained preoperatively and postoperatively (Figure 1). On the basis of the consensus of prior literature, satisfactory postoperative symmetry was defined as a difference in margin reflex distance–1 (MRD–1) of 1 mm or less compared with the other eye3–8 and an MRD–1 of at least 2 mm.9,10 A paired t test was used to evaluate the difference between time and outcomes in unilateral and bilateral procedures. For the time calculation, the average time was used for bilateral procedures in order to have only independent observations as opposed to 2 sets of data for some patients and 1 set of data for others. A 2-tailed t test for independent samples (unpaired) was used to evaluate whether the data from the right eye or left eye would be included in order to have only independent observations as opposed to 2 sets of data for some patients and 1 set of data for others.

An incision was made along the previously marked eyelid crease using a Bard Parker blade (#15; BD Medical). Dissection was performed using a Bovie electrocautery (Bovie Medical Corporation) with a Colorado needle (Colorado Biomedical). The dissection was carried through the orbicularis muscle down to the anterior surface of the tarsal plate. The superior third of the tarsus was carefully cleaned extending to the width of the 2 marked areas. Next, the conjunctival fascia (fusion of septum and levator aponeurosis) was grasped with forceps and retracted toward the eyelid margin. The superior aspect of the incision was then grasped and retracted superiorly toward the brow to place the tissue under tension. Dissection was performed carefully through the orbicularis and septum and around the preaponeurotic fat pad until the levator aponeurosis was visualized. The undersurface of the preaponeurotic fat was cleaned off thelevator aponeurosis and muscle using the electrocautery, scissors (Westcott), or a cotton-tipped applicator. The eyelid was manually elevated off of the globe when passing sutures. One 6-0 polypropylene suture (Surgipro II; Syneture) with a p-13 cutting needle was placed partial-thickness through the superior third of the tarsus in the area corresponding to the medial pupil mark. This suture was then passed in a planar fashion through the levator aponeurosis at the juncture of the aponeurosis and the levator muscle (approximately 7–9 mm superior to the inferior cut edge of the levator aponeurosis). A second 6-0 polypropylene suture was then passed in an identical fashion in the area corresponding to the lateral limbus mark (Figure 3). An identical procedure was performed on the other upper eyelid in bilateral cases.

The eyelid position was then tested by waking the patient and having him or her look up, down, and straight ahead to determine the eyelid height, contour, and symmetry. The sutures were adjusted by tightening or loosening them. Occasionally, a suture needed to be replaced and passed further up through the levator muscle or down on the tarsus if additional lift was required. Moving the suture down the tarsus achieves greater lift relative to placing the suture further up the levator muscle, although it can be associated with more “peaking” of

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**Figure 1.** Preoperative and postoperative photographs of a patient with bilateral aponeurotic ptosis. A, Preoperative photograph of a patient with bilateral aponeurotic ptosis with low margin reflex distance–1 and high eyelid crease. B, Postoperative photograph of the patient with improved eyelid height.

**Figure 2.** Photographs demonstrating appropriate eyelid marking for standardized suture placement. A, Preoperative marking of the patient with marks corresponding to the medial aspect of the pupil and the lateral aspect of the limbus. B, Preoperative marking demonstrating the suture placement marks and eyelid crease mark.
the contour. If there is too much medial peaking, the suture may be moved laterally, and if there is too much lateral peaking, the suture may be moved medially. This was not required with any patients in this series but may be performed if needed.

Once the appropriate height, contour, and symmetry had been achieved, the sutures were tied down in a permanent fashion. If the sutures were tight, they were simply tied using a forceps and empty needle holder. If the suture was floating, the surgeon held up the suture ends to expose the knot, the assistant placed an empty needle holder on the knot, and the sutures were tied down on top of the needle holder. Once the sutures were tied down, the eyelid position was verified. The skin was then closed using 3 interrupted 6-0 prolene sutures. The middle suture was placed through the levator aponeurosis midway between the advancement sutures to reform the eyelid crease and facilitate in-office revision if needed.

Figure 3. Surgeon’s view. Intraoperative photograph demonstrating the appearance of the sutures after placement before being permanently tied down.

RESULTS

Ninety-two eyelids of 66 patients with demonstrable blepharoptosis who underwent small-incision ptosis repair with standardized suture placement from October 1, 2007, through January 31, 2011, met criteria to be included in the study. The mean (SD) patient age was 60 (17) years (range, 16-92 years). There were 43 women (65%) and 23 men (35%). Twenty-six patients (39%) underwent bilateral ptosis repair and 40 patients (61%) had unilateral ptosis repair.

The mean preoperative MRD-1 was 0.70 mm (range, -2.00 to 2.50 mm) (95% CI, 0.48-0.91 mm). All patients had symptoms correlating with obscuration of the superior visual field. The minimum levator function was 9 mm with a mean (range) of 12 (9-14) mm. There was minimal to no dermatochalasis present in patients preoperatively. The mean (SD) preoperative superior visual field was limited to 11.49 (9.12) degrees centrally. The mean (SD) operative time per eyelid was 17 (5) minutes (range, 9-29 minutes). The mean (SD) operative time for bilateral ptosis repair for 20 patients was 15 (4) minutes (range, 9-27 minutes), whereas unilateral ptosis repair for 33 patients was longer at 20 (4) minutes (range, 11-29 minutes), which was statistically significant (P < .001). There were no intraoperative complications.

The mean (SD) postoperative MRD-1 was 2.95 mm (range, 0.65-5.05 mm) (95% CI, 2.71-3.18 mm). The mean (SD) improvement in eyelid height (2.25 [1.13] mm) for 66 patients was significant relative to baseline (P < .001). Twenty patients (30%) had contour abnormalities, asymmetry, or both. Postoperative contour abnormalities occurred in 6 eyelids (7%) operated on in 5 patients (8%). Two were flat nasally, 2 were flat laterally, 1 was peaked nasally, and 1 was peaked laterally. The mean of the absolute value of the difference between the MRD-1 of the right and left eyelids was 0.77 mm (95% CI, 0.55-0.98 mm). Symmetry was achieved in 49 patients (74%) on the basis of a less than 1-mm difference between the eyelids. Seventeen eyelids (18%) in 16 patients (24%) were undercorrected and 1 eyelid (1%) in 1 patient (2%) was overcorrected. When stratified by unilateral ptosis repair vs bilateral ptosis repair, bilateral ptosis repair achieved greater symmetry on average (81% symmetry in the bilateral group vs 70% symmetry in the unilateral group). The mean difference of MRD-1 between the eyelids in the bilateral group of 26 patients was lower (0.65 mm) than in the unilateral group of 40 patients (0.84 mm), with a t test score of -0.82525 with 65 df. This finding was not statistically significant (P = .41). There was no significant postoperative asymmetry attributed to the Hering effect. Overall, 3 patients (12%) in the bilateral surgery group had asymmetry alone, 2 (8%) had contour abnormalities alone, and 2 (8%) had contour abnormalities and asymmetry. In the unilateral group, 12 (30%) had asymmetry alone and 1 (2%) had abnormal contour alone. There were no instances of late recurrence of ptosis.

Ten eyelids (11%) in 9 patients (14%) underwent surgical revision. Six of the patients had undergone bilateral ptosis repair and 3 had undergone unilateral ptosis repair. Of the 6 patients in the bilateral group requiring revision, only 1 patient had both eyelids revised; the other 5 had only 1 of the 2 eyelids revised. Six of the 17 patients (35%) with asymmetry greater than 1 mm underwent revision; 1 of these patients also had contour abnormalities involving both eyelids, and 2 others also had contour abnormalities involving 1 eyelid. The 3 other patients who underwent revision included 2 who were symmetric but had contour abnormalities and 1 who was symptomatic from exposure. Unilateral external ptosis repair resulted in asymmetry more frequently (30%) than with bilateral surgery (19%), but a higher proportion of patients who underwent bilateral surgery elected to have revision surgery (23% vs 8%). Of the 20 patients with suboptimal outcomes, 6 of 7 patients in the bilateral group (86%) elected to have revision surgery and 3 of 13 patients in the unilateral group (23%) underwent revision. Five eyelids in 4 patients were revised in the office. Five patients had repeated external levator advancement in the operating room, including 2 with previous in-office revision. Two additional patients had a subsequent anterior tarsectomy. The mean (SD) duration of follow-up was 4 (3) months (range, 1-19 months). There were only 2 postoperative complications: postoperative upper eyelid bleeding that resolved with pressure and exposure keratopathy that was corrected by revision to lower the eyelid.

COMMENT

External ptosis repair has been transformed by Liu4 with the single-suture ptosis repair concept, Meltzer et
al\textsuperscript{11} with the adjustable single suture, Lucarelli and Lemke\textsuperscript{3} with small-incision ptosis repair, and Frueh et al\textsuperscript{10} with minimized dissection in the small-incision ptosis repair. The advantages of the small-incision technique over traditional external ptosis repair have been detailed in the literature previously and include improved accuracy due to reduced dissection, tissue edema, and hemorrhage.\textsuperscript{3,4,12} The technique is tissue sparing and preserves anatomic structures, enabling all ptosis repair techniques to be options if further correction is required. Postoperative suture adjustment or revision in the early postsurgical period is a distinct advantage of external ptosis repair and can be performed in ease in the office following the small-incision technique.\textsuperscript{3,3-12} This revision concept was taken from a technique used in strabismus surgery described by Jampolsky\textsuperscript{16} and applied to ptosis surgery initially by Berris,\textsuperscript{17} Jordan and Anderson,\textsuperscript{18} Dortzbach and Kronish,\textsuperscript{15} and Mauriello and Abdelsalam.\textsuperscript{19} Meltzer et al\textsuperscript{12} used this technique with a single adjustable suture and had significant success with early postoperative adjustment.

Subsequent studies have reinforced the safety and efficacy of small-incision ptosis repair, but to our knowledge, no studies to date have used a clear and reproducible tenet for suture placement. Lucarelli and Lemke\textsuperscript{3} determined suture placement intraoperatively using a toothed forceps to gauge appropriate placement. They placed 1 suture in most patients, with approximately 7% requiring an additional suture.\textsuperscript{3} Frueh et al\textsuperscript{10} drew a vertical line through the center of the pupil to dictate suture placement, but 30% of patients required additional sutures to achieve appropriate contour. Baroody et al\textsuperscript{12} had a large series and used a technique with levator aponeurosis excision and placement of 2 to 3 sutures with no precise manner for dictating their placement. Bernardini et al\textsuperscript{10} described good results with small-incision ptosis repair using single-suture placement but no specific suture placement algorithm. Our technique involves procedural elements previously described with the novel addition of a standardized suture-placement protocol. Another feature that distinguishes our technique is that the marks for suture placement dictate where the incision is placed in the eyelid crease, not the other way around. This technique facilitates a more straightforward operative experience with improved operative time. The technique under discussion reduces surgical time compared with that of Frueh et al\textsuperscript{10} by 33% (17 vs 25 minutes) with comparable contour and height, relative to the literature. The reduction in surgical time is particularly beneficial given the current emphasis on cost-effective practice. Suture placement should not affect height and contour outcome regardless of whether the sutures are tied down or hung back.

There are other distinct advantages to our particular procedure. One reason internal ptosis repair is sometimes favored over external ptosis repair is the less complex anatomy and dissection involved and the relatively straightforward technique. The addition of a standard suture-placement protocol further streamlines the external procedure and may make this more appealing. We have found that if the patient is under sedation there is often conjugate gaze, making the suture placement in the absence of preplaced marks difficult. The technique of marking the suture placement while the patient is alert, orthotropic, and in a primary gaze position eliminates the need for this intraoperative guesswork. In addition, with this procedure, as with other external ptosis procedures, there is no pretesting with phenylephrine required, less need for bandage contact lens postoperatively, and more safety for patients with dry eye and patients with a sensitivity to dissolving suture material. There is also less potential disruption of tear-producing structures, which is a debatable possibility with internal ptosis repair.\textsuperscript{3} Another benefit of the external approach is that overcorrection is easily addressed in the early postoperative period with an in-office adjustment, although postoperative adjustment following internal ptosis repair has also been described.\textsuperscript{20} In addition, external techniques have more versatility because they can address a wide range of ptosis severity with a single technique and can be used in the ptosis repair combined with blepharoplasty and fat removal. Minimal violation of the septum and limited dissection with straightforward suture placement may reduce postoperative swelling and operative time in that situation as well.

The results of our study are comparable with prior literature on small-incision external ptosis repair. Overall, the eyelids of 74% of patients were corrected within 1 mm of the contralateral eyelid. This result is higher than that reported by Frueh et al\textsuperscript{10} (66.7%), although Frueh et al used stricter criteria of a less than 0.5-mm difference in eyelid height and MRD-1 of 2 to 4 mm for symmetry. Our results demonstrate less symmetry than the 89% reported by Lucarelli and Lemke\textsuperscript{3}; however, we had 60% of unilateral cases compared with their 35%, which favors a lower success rate. Baroody et al\textsuperscript{12} also reported fewer patients with asymmetry postoperatively. They excised the thinned levator aponeurosis, which may explain the fewer undercorrections but more numerous overcorrections. In addition, they had the patient sit up during inoperative adjustment, possibly indicating an increased level of patient alertness and improved accuracy. Our findings are consistent with prior external ptosis repair studies with success rates ranging from 54% to 96%,\textsuperscript{1,3-6,8-11,14,21} In contrast with prior studies, no additional sutures needed to be added with our technique, which differs from those where 1 suture was placed and then other sutures were added depending on contour. To our knowledge, no study has quantified the number of times sutures required replacement, possibly adding to surgical time. There were no complications of hematoma or infection, but 1 patient experienced postoperative bleeding that self-evacuated and did not form a collection or compromise the ultimate outcome.

In addition to overall reduction in time with this technique, when stratified by bilateral vs unilateral, the bilateral procedures were faster (15 minutes per eyelid) than unilateral procedures (20 minutes), which may be attributed to the need to account for the Hering effect in the unilateral situation and a common portion of the surgery in the bilateral cases. The 15-minute time for bilat-
eral surgery is much more comparable with the 10-minute rate reported by Fasanella and Servat for internal ptosis repair, which was preliminary data from only 4 patients. In fact, the range of time in this study was as quick as 9 minutes. McCulley et al determined that bilateral external ptosis repair had a higher need for reoperation than unilateral ptosis repair. This finding is consistent with the results of our study. Interestingly, although unilateral external ptosis repair resulted in asymmetry more frequently (30%) than did bilateral surgery (19%), a higher proportion of patients having undergone bilateral surgery elected to have repeated surgery (23% vs 8%). This may be due to the fact that patients who underwent unilateral surgery had some asymmetry at baseline and are therefore more tolerant of subsequent asymmetry, particularly because all the patients experienced some improvement in eyelid height and none were lower postoperatively. Of the 20 patients with suboptimal outcomes, 6 of 7 patients (86%) in the bilateral group elected to have repeated surgery, but only 3 of 13 patients (23%) in the unilateral group underwent revision.

Late recurrence was not seen in our study. This is consistent with prior literature by Doxanas who determined that if a patient was not ptotic at 1 week postoperatively, he or she will not develop subsequent ptosis. His follow-up period extended from 3 to 5 years. Linberg et also found that the result at 1 week approximated the findings at 3 months, which supports the early revision option. The findings by Liu were consistent with those of Linberg et al and Doxanas, with an average follow-up of 5 years. The prior findings of late recurrence of ptosis have been attributed to the use of absorbable suture.

Limitations of our study include the retrospective nature and limited sample size. Also, the specific marking pattern involved in our technique may be influenced by strabismus and is dependent on pupil size; however, attempting to mark in the same ambient light helps to reduce pupil variation. Theoretically, the use of a small incision may potentially alter the position of 1 part of the eyelid crease. In addition, observations regarding postoperative contour were made during the visit and documented as opposed to having a masked observer review photographs prospectively. Intraoperative adjustment with replacement of sutures for greater lift was not documented. Another possible limitation is that postoperative adjustment was performed at a later time (2 weeks postoperatively) compared with other studies, and methylprednisolone (Medrol dosepak; Pfizer) was given adjuvantly in the patients needing revision, which may have influenced the outcomes and need for additional revision in 2 patients.

Our study is consistent with the findings of safety and efficacy in prior small-incision ptosis repair studies. The addition of a standardized suture-placement protocol reduces operative time and the number of variables in the intraoperative decision-making process, possibly increasing the appeal of this option for ptosis correction. The simplified method of suture placement for small-incision external levator advancement is an effective, safe, and efficient option for acquired ptosis correction.

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