The Precaruncular Approach to the Medial Orbit

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Background: Most approaches to the medial orbit and lower provide suboptimal access and leave visible scars. The transcaruncular approach is an improvement over previous procedures, but disadvantages remain: there is no defined surgical plane through the caruncle; the caruncular tissue is highly vascular; and the approach may cause considerable postoperative morbidity. For these reasons, cadavers were studied to develop a surgical approach that would avoid the caruncle. A prospective outcome evaluation was then performed.

Materials and Methods: Two male and 2 female cadavers were studied to ascertain whether the plane medial or lateral to the caruncle provided optimal access to the medial orbit. Fifteen consecutive procedures were then prospectively evaluated using the medial approach.

Results: The “precaruncular” approach medial to the caruncle provided the most direct route to the medial orbit, with a clear, avascular path of dissection and improved exposure. In 15 consecutive procedures, there were no complications. The patients healed rapidly, with minimal postoperative morbidity.

Conclusions: The precaruncular approach was demonstrated on cadavers to be more efficacious than approaches directly through or lateral to the caruncle. This finding was confirmed in a prospective evaluation of 15 procedures, in which no complications occurred. More rapid healing was noted than with prior experience using the transcaruncular route. The precaruncular approach provides a preseptal plane to the medial orbit that can be extended to the orbital floor or roof as needed, and offers a direct connection between the posterior lacrimal crest and the tarsal plate for medial canthopexy.

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Surgical access to the medial orbit is necessary to treat a diverse range of pathologic conditions, including neoplasia, infection, trauma, and malposition or laxity of the medial canthal tendon. The majority of surgical approaches in use today, such as the Lynch incision, are transcutaneous and thus create scars. In addition to the cosmetic disadvantage of this location, incisions placed between the medial canthus and the nasal dorsum are prone to scarring and web formation. Furthermore, incisions in this area may provide poor surgical access, particularly during correction of laxity of the medial canthal tendon.

The transcaruncular approach has recently been gaining popularity for access to the medial orbit. Because the incision is made through the conjunctiva and caruncle (Figure 1), no cutaneous scars are formed. The exposure provided is also excellent and allows ample access that may be extended into a transconjunctival approach that reaches the orbit floor and/or roof as well.

In 1999, I began using this approach for medial canthopexy. As with the lateral canthal tendon, correction of laxity of the medial canthus requires tightening of the tendon in all 3 vectors (horizontal, vertical, and especially anteroposterior). This can only be accomplished using a posterior-superior approach with tightening of the posterior limb of the tendon (Figure 2). This procedure was found to provide a distinct advantage over the standard techniques of canthopexy that tighten only the anterior limb of the tendon and thus address only the horizontal and perhaps vertical vectors. The first 3 cases in which this was attempted provided the desired surgical correction but caused prolonged edema, erythema, and irritation in the caruncle, which lasted up to several weeks. Delayed healing has also been noted by Fante and Elner, who...
found that the edema persisted more than 2 months in some of their patients who underwent a transcaruncular approach. Furthermore, there is no defined surgical plane within the caruncle; landmarks for dissection within the structure are lacking; and the tissue is quite vascular. For these reasons, I decided to investigate the possibility of an alternative approach, avoiding incisions in the caruncle, with the purpose of developing an approach with improved landmarks and diminished postoperative edema. A cadaver study was planned to explore other options, and a prospective evaluation of the results was undertaken.

In designing a surgical approach to the medial orbit, the goal should be to encounter the posterior lacrimal crest (Figure 2). Approaching bone anterior to this structure places the posterior limb of the medial canthal tendon as well as the lacrimal sac at risk of injury. Approaching the orbital wall posterior to the posterior crest is suboptimal because of crowding of the orbital contents, and this type of approach may cause damage to structures of the medial orbit, such as the medial rectus muscle. Furthermore, a more posterior approach will fail to raise the periosteum of the anterior lamina papyracea, where fractures may be located. The most expeditious guide to this area is Horner’s muscle (the posterior-lateral limb of the medial canthal tendon), which can be followed medially to its insertion on the posterior lacrimal crest. By approaching immediately posterior to Horner’s muscle, the dissection is performed in the preseptal plane, which prevents herniation of the orbital fat during the procedure and allows a direct avascular path to the orbit floor, should extended access be required. At the medial aspect of the posterior limb of the canthal tendon, the septic tissue is a continuation of the superior orbital septum, where it inserts on the posterior lacrimal crest, while more laterally the septum originates on the inferior orbital rim and inserts on the anterior lacrimal crest. The surgeon can protect the lacrimal sac by dissecting behind Horner’s muscle and can protect the lacrimal canaliculi and retract the eyelids by keeping the lacrimal probes in place during the procedure. The question thus becomes whether the preseptal plane behind Horner’s muscle should be entered medial or lateral to the caruncle.

**METHODS**

**ANATOMICAL CADAVER STUDY**

Four fresh cadaver heads, 2 male and 2 female, were inspected to ensure that there were no visible abnormalities of the upper or lower eyelids. On each side (N=8), the following procedure was performed. Size 4-0 lacrimal probes were placed through the upper and lower canaliculi into the lacrimal sac and used for retraction of the upper and lower eyelids. To evaluate the proposed lateral approach, an incision was made with a No. 11 blade immediately lateral to the lacrimal caruncle through the conjunctiva of the plica semilunaris (Figure 1). A Wescott scissors was used to dissect along the lateral aspect of the caruncle inferiorly until Horner’s muscle was encountered. Horner’s muscle was then followed medially to its insertion on the posterior lacrimal crest. The periosteum of the medial orbit was then incised and elevated off the lamina papyracea to expose the medial wall.

To evaluate the medial approach, a No. 11 blade was used to make an incision medial to the caruncle at the border of the medial canthal skin. The incision was continued toward the inferior and superior aspects of the plica semilunaris. Horner’s muscle was identified immediately medial and deep to the conjunctiva at the medial apex and inferior limb of the incision, and a preseptal plane was developed posterior to the muscle by spreading the tips of the scissors. Horner’s muscle was then followed to its insertion on the posterior lacrimal crest, leaving the tissue isolated between the medial and lateral approaches attached to bone. The surgical exposure of the area of the posterior lacrimal crest and lamina papyracea was then compared by viewing medial and lateral to the caruncle and associated soft tissue.
PROSPECTIVE OUTCOME EVALUATION

The following data were collected prospectively on 15 consecutive procedures (13 patients): age, sex, diagnosis (in those patients with ectropion, an ectropion grading scale was used [Table 1]), additional procedures performed, any intraoperative difficulties, and perioperative complications. The exclusion criterion for the study was patient age younger than 18 years.

The surgical procedure was performed as follows (Figure 3). The patient was given intravenous sedation by the anesthesia service. One to 2 mL of 1% lidocaine hydrochloride with epinephrine (1:100,000) was injected through the plica semilunaris to the lamina papyracea and through the skin medial to the canthus, directed toward the anterior lacrimal crest. Topical tetracaine hydrochloride drops were placed on the conjunctiva. Size 4-0 lacrimal probes were then placed through the superior and inferior lacrimal puncta into the lacrimal sac. The probes were then taped to the skin of the forehead and cheek, respectively, both protecting the canaliculi from transection and providing retraction of the eyelids for exposure of the surgical field. A Wescott scissors was then used to make an incision between the caruncle and medial canthal skin at the mucocutaneous junction. The incision was carried laterally for additional access to the orbit floor (dark dashed line) or anteriorly for full access to the medial canthal tendon and tarsal plate (light dashed line).

RESULTS

ANATOMICAL CADAVER STUDY

The goal of this access procedure is to enter, in the safest and most direct fashion, the preseptal plane posterior to Horner’s muscle and follow it directly to the posterior crest of the lacrimal bone. I found that approaches both lateral and medial to the caruncle provided distinct surgical planes. There was a consistent small branch of the medial palpebral artery at the central medial aspect of the caruncle that had to be cauterized with the medial approach, but this did not cause problematic bleeding. The exposure offered by the medial approach was superior, however, because it allows the caruncle to be retracted laterally with the globe, increasing the width of surgical exposure. In addition, there is a more direct, linear path to the posterior lacrimal crest, which is ben-
official in procedures to tighten the medial canthal tendon. Furthermore, Horner’s muscle was reached immediately below the incision, with less dissection. For these reasons, the medial approach was chosen for clinical use.

### PROSPECTIVE OUTCOME EVALUATION

Fifteen consecutive procedures in 13 patients (5 female, 8 male; average age, 61 years) in which the precaruncular approach was used were analyzed ([Table 2](#table2)). The indications for surgery included medial canthal instability (n = 11) (entropion or ectropion), drainage of orbital abscess and removal of bullet (n = 1), orbital fracture (n = 2), and medial cantholysis (n = 1) for lower eyelid reconstruction.

The surgical approach required minimal dissection and provided excellent exposure in this series of patients. For patients undergoing medial canthal tightening, there was ample space for placing a screw at the superior aspect of the posterior lacrimal crest, to which the medial aspect of the tarsus was fixed. The safety of the procedure was ensured by placement of the lacrimal probes and fixing them to the skin of the forehead and cheek, which provided excellent tissue retraction, while ensuring that the canaliculi would not be inadvertently transected. Furthermore, dissecting posterior to Horner’s muscle ensured that the lacrimal sac would not be damaged. The surgical plane was easily entered and directed the dissection to the desired site, without ambiguity. In all cases, excellent visualization was provided by the surgical approach. The surgical access was more than adequate for all surgical procedures performed, including the placement of resorbable fixation screws for medial canthoplasty and the placement of resorbable mesh (Macropore Inc, San Diego, Calif) for medial wall or orbital floor fracture repair. By operating in the preseptal plane, herniation of orbital fat into the operative field did not occur, and the width of exposure made lateral canthotomy/cantholysis unnecessary.

There were no complications in the series. In no instances did patients complain of persistent irritation of the surgical site, and in most cases the edema resolved within 24 to 48 hours after surgery. One patient (No. 11, Table 2) who underwent unilateral medial canthopexy complained of bilateral diffuse itching and erythema of the conjunctiva, but these symptoms rapidly responded to the instillation of 0.5% loteprednol etabonate drops.

### Table 2. Patient Data

<table>
<thead>
<tr>
<th>Patient No./Sex/Age, y</th>
<th>Diagnosis</th>
<th>Primary Procedure</th>
<th>Ancillary Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/M/77</td>
<td>Ectropion</td>
<td>Left PMC</td>
<td>Bilateral LTC, FTSG of lower eyelid</td>
</tr>
<tr>
<td>2/M/49</td>
<td>Intraorbital bullet fragment</td>
<td>Removal of bullet</td>
<td>Drainage of orbital abscess</td>
</tr>
<tr>
<td>3/M/85</td>
<td>Facial paralysis</td>
<td>Left PMC</td>
<td>LTC, endoscopic brow-lift, gold weight</td>
</tr>
<tr>
<td>4/F/83</td>
<td>Cicatricular ectropion</td>
<td>Left PMC</td>
<td>LTC, FTSG</td>
</tr>
<tr>
<td>5/F/41</td>
<td>Facial paralysis</td>
<td>Left PMC</td>
<td>LTC, hypoglossal-facial neuremphrophy and cross-facial nerve grafting</td>
</tr>
<tr>
<td>6/F/74</td>
<td>Facial paralysis</td>
<td>Right PMC</td>
<td>Endoscopic brow-lift</td>
</tr>
<tr>
<td>7/F/79</td>
<td>Facial paralysis</td>
<td>Right PMC</td>
<td>Open brow-lift</td>
</tr>
<tr>
<td>8/M/57</td>
<td>Pan-facial fractures</td>
<td>ORIF of right orbit</td>
<td>ORIF of multiple facial fractures</td>
</tr>
<tr>
<td>9/M/37</td>
<td>Orbital fractures</td>
<td>ORIF of right orbit</td>
<td>None</td>
</tr>
<tr>
<td>10/M/45</td>
<td>Facial paralysis</td>
<td>Right PMC</td>
<td>Right LTC</td>
</tr>
<tr>
<td>11/M/74</td>
<td>Bilateral entropion</td>
<td>Bilateral PMC</td>
<td>Bilateral LTC, lower retractor reinsertion</td>
</tr>
<tr>
<td>12/M/40</td>
<td>Facial paralysis</td>
<td>Left PMC</td>
<td>Hypoglossal-facial neuremphrophy</td>
</tr>
<tr>
<td>13/F/55</td>
<td>Bilateral cicatricular ectropion</td>
<td>Bilateral PMC</td>
<td>Bilateral LTC</td>
</tr>
</tbody>
</table>

Abbreviations: PMC; precaruncular medial canthopexy; LTC, lateral transorbital canthopexy; FTSG, full-thickness skin graft; and ORIF, open reduction and internal fixation.

The transcaruncular approach to the medial wall of the orbit appears to have definite advantages over other previous approaches because of the direct access provided and the lack of visible scarring. In my experience, the disadvantages of the transcaruncular approach are persistent edema and irritation of the surgical site. These complications are understandable, given that the caruncle is a complex tissue consisting of nonkeratinized squamous and conjunctival epithelium, with multiple cutaneous and conjunctival elements, serous and sebaceous glands, hair follicles, and inflammatory cells. As such, it is apparent that an incision through this structure could induce significant inflammation and would probably be suboptimal for surgical dissection. I found this to be true in performing transcaruncular surgery.

The cadaver study showed that there were no technical impediments to performing an approach medial to the caruncle. Furthermore, by retracting the caruncle laterally and dissecting in the preseptal plane a better exposure of the posterior lacrimal crest and lamina papyracea could be achieved with the medial approach than with an approach lateral to the caruncle.

In the evaluation in the operating room, I found that proceeding medial to the caruncle decreased operating time, created less bleeding, and placed the surgical dissection closer to the anatomical guideposts used in reaching the area to be corrected.

The goal of this approach is to enter the preseptal plane posterior to Horner’s muscle and follow it directly to the posterior crest of the lacrimal bone. The preseptal approach prevents fat herniation, while allowing extension of the dissection to the orbital floor in the same plane. Dissection posterior to the Horner muscle prevents damage to the lacrimal sac and exposes the length of the pos-
terior limb of the medial canthal tendon for canthopexy, should this be necessary. Placement of lacrimal probes prevents damage to the lacrimal canaliculi and common canal. Placement of a corneal protector will prevent corneal abrasion.

CONCLUSIONS

The transcaruncular approach is a significant improvement over previous procedures in that it eliminates visible scars and provides direct access to the medial orbit. In my experience, however, incisions through the caruncle may cause prolonged postoperative discomfort and healing time.

Through cadaver dissections, I determined that the optimal way to avoid a transcaruncular incision is to place the incision medial to the caruncle at the apex of the medial canthus, at the junction of the conjunctiva and skin. By entering into the preseptal plane behind Horner’s muscle through this incision, the medial orbit can be exposed with the least possible dissection, minimal blood loss, and excellent exposure for the desired surgical correction. The efficacy of this procedure was confirmed by the minimal amount of postoperative edema or discomfort and the lack of surgical complications in a prospective analysis of 15 procedures.

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REFERENCES