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ORIGINAL PAPER

The 90-degree rule in posterior ptosis surgery

Deepak Sobti · Ankit B. Patel · Ronald Mancini

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Abstract To propose a guideline for ptosis clamp positioning to minimize the risk of globe injury during posterior ptosis surgery. Measurements of 20 consecutive patients, 40 eyelids, undergoing bilateral posterior ptosis repair surgery were taken; as a surrogate for needle tip position, measurement of the distance from the clamp base to the ocular surface was taken using a caliper with the clamp held at 90-degrees to the ocular surface and again at 45-degrees to the ocular surface. These measurements were compared to geometric predictions of the distance from the clamp base to the ocular surface. The average distance from the clamp base to the ocular surface when the clamp is held 90-degrees to the ocular surface was 7 mm, this distance decreases to 5 mm when the clamp is held 45° to the ocular surface. This coincides well with geometric predictions. Posterior ptosis surgery overall has an excellent safety profile; however, complications are possible, perhaps the most severe of which is inadvertent globe and/or corneal injury. The more acute the angle the ptosis clamp is held, the closer the clamp base, and subsequently the needle tip, is to the ocular surface as would be predicted geometrically. This coincides with closer proximity of the needle to the ocular surface during surgery. The theoretical risk of globe injury should decrease as the distance of the needle from the globe increases, and this distance is greatest when the clamp is held at a 90-degree angle to the ocular surface. This distinction becomes particularly important to consider in large eye morphology patients where the distance from the needle to the globe can approach 2 mm when the clamp is held at 45-degrees.

Keywords Blepharoptosis · Ptosis · Posterior ptosis surgery · Putterman clamp · Mullerectomy

D. Sobti · R. Mancini (✉)
Department of Ophthalmology, UT Southwestern Medical Center, 5323 Harry Hines Blvd., Dallas, TX 75390-9057, USA
e-mail: ronaldmancinimd@gmail.com

A. B. Patel
Department of Electrical and Computer Engineering, Rice University, Houston, TX, USA

Introduction

Both posterior and anterior eyelid surgical procedures are used to treat blepharoptosis. Putterman and Urist first described the posterior, or Müller's muscle-conjunctival resection (MMCR), approach in 1975 [1]. A variety of modifications have been proposed subsequently. Few of these have focused on increasing safety or lowering complications [2–5]. Putterman and Urist specifically comment on a commonly overlooked technical nuance, holding the clamp "straight up". They do not, however, elaborate on its clinical significance.

> *A 5–0 double-armed, plain catgut mattress suture runs, with clamp held straight up,*

1.5 mm below the clamp along its entire width in the temporal-to-nasal direction…. [1]

Overall complications are rare in MMCR; however they do occur. A review of the literature shows the most common reported complications are pain, corneal abrasion, suture granuloma, and persistent keratopathy [6–9]. The mechanism of corneal abrasions was hypothesized to be due to suture placement [7]. Other literature did not elaborate on the mechanism of corneal injury. Nevertheless, procedures on the posterior eyelid directly expose the anterior surface of the globe and cornea to injury and theoretical vision loss.

There is a theoretical risk of injury to the globe and corneal surface during MMCR due to surgical equipment positioning and the close proximity of the needle to the ocular surface. This paper seeks to put forward guidelines for clamp positioning and further elaborate on the importance of "straight up" clamp positioning eluded to by Putterman and Urist in their original manuscript [1].

Methods

A prospective study was conducted in which intraoperative measurements of 20 consecutive patients, 40 eyelids, undergoing posterior ptosis surgery were taken. We utilized the Bausch and Lomb Putterman Mullers Muscle-Conjunctival Resection Ptosis Clamp (Product Number: E2508). The distance from the clamp base to the ocular surface was measured using a caliper with the clamp held at 90° to the ocular surface and again at 45° to the ocular surface. Given the needle is passed just below the clamp base, it was used as a surrogate to mark the needle position and needle distance to the ocular surface. These measurements were compared to geometric predictions of the distance from the needle to the ocular surface.

Results

A theoretical triangle was conceptualized, shown in Fig. 1. We define L be the distance of the cornea to needle and a to be the distance to the cornea when less than 90°. Therefore, the distance a as a function of θ is $a(\theta) = L \sin \theta$. At $\theta = 90$, $a = L$ as expected. For all $\theta < 90$, $a < L$ *since sin* $\theta <= 1$ *for all* $\theta \in [0, 90)$. Therefore, the distance from the needle to the cornea steadily decreases as the angle decreases from 90° as predicted above.

Another way to see this relationship without the properties of *sin* is the Pythagorean Theorem. With the hypotenuse being L and a and b are the lengths of the sides, the relationship is $L = \sqrt{a^2 + b^2}$. If the clamp is held at any angle more acute than 90-degrees, the distance to the cornea is decreased. When held at 45°, a and b are equal. (Fig. 1, Scenario 2).

This is confirmed with intraoperative measurements. The average distance from the clamp base to the ocular surface when the clamp is held 90-degrees to the ocular surface was 7 mm (Fig. 2); this distance decreases to 5 mm when the clamp is held 45° to the

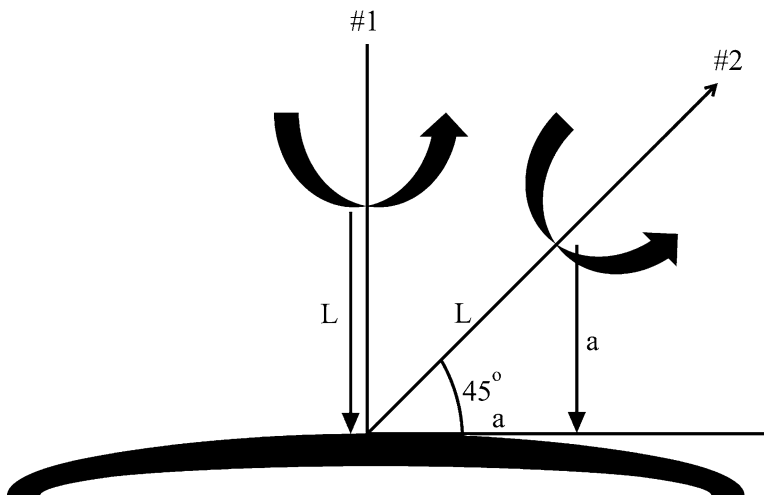


Fig. 1 *Scenario #1*: clamp held at 90°. *Scenario #2*: clamp held at 45°

Fig. 2 Clamp held at 45°

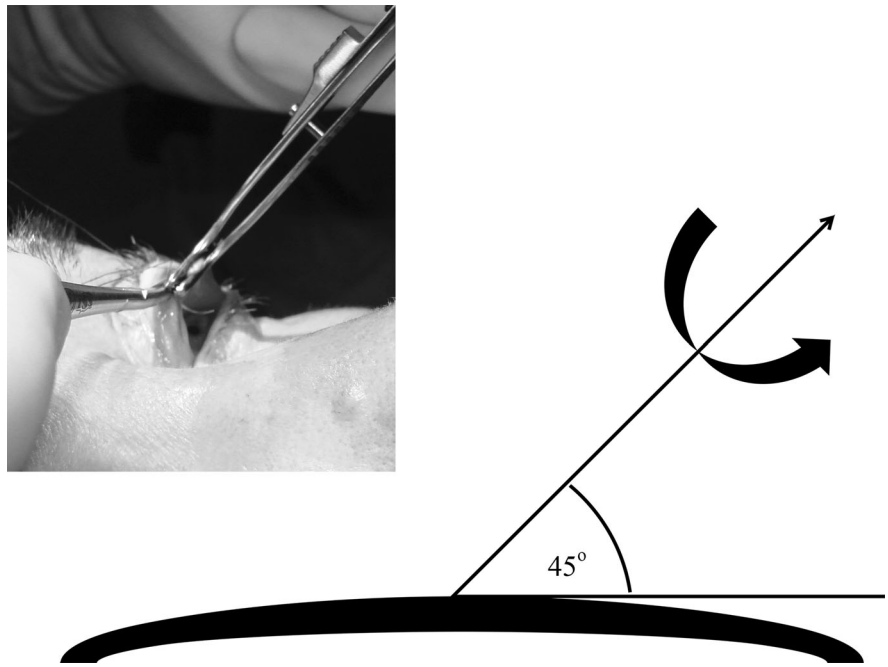
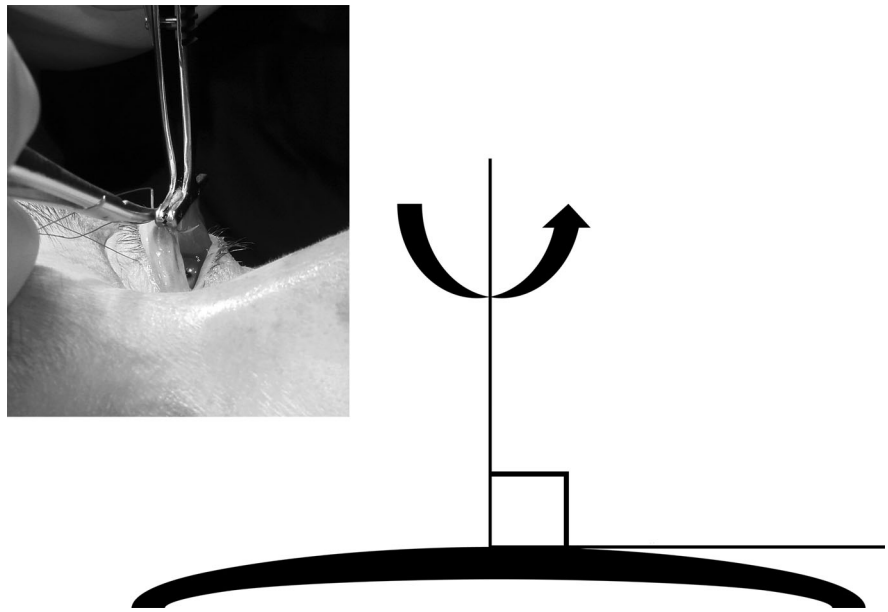


Fig. 3 Clamp held at 90°



ocular surface (Fig. 3). This coincides well with geometric predictions, calculated below.

Scenario #2 (Fig. 2):

Clamp at 45° and L at 7 mm:

$a(\theta) = 7$ mm sin 45.

$a(45) = 4.95$ mm.

Using Pythagorean Theorem:

$$7\,\text{mm} = \sqrt{a^2 + a^2} = \sqrt{2a^2} = \sqrt{2}a \Rightarrow a = 7/\sqrt{2} = 4.95\,\text{mm}$$

Both calculation methods yield a distance of 4.95 mm, which correlates well with our measurement of 5.0 intraoperatively.

Discussion

Posterior ptosis surgery overall has an excellent safety profile; however, complications are possible, perhaps the most severe of which is inadvertent globe and corneal injury. The more acute the angle the ptosis clamp is held at, the closer the needle tip is passed to the ocular surface as would be predicted geometrically (Fig. 1). The average distance of the needle to the ocular surface is greatest when the clamp is held 90-degrees to the ocular surface (average 7 mm in this study) and as predicted geometrically becomes smaller as the angle becomes more acute (average 5 mm at a 45-degree angle in this study). The theoretical risk of globe injury should decrease as the distance of the needle from the globe increases, and this distance is greatest when the clamp is held at a 90-degree angle to the ocular surface. This distinction becomes particularly important to consider in large eye morphology patients where in this study the distance from the needle to the globe can approach 2 mm when the clamp is held at 45-degrees. Though perforating globe and corneal injury from posterior ptosis surgery remains exceedingly rare in the literature, it remains a risk that can be better avoided using the 90-degree rule. This rule is of particular importance for trainees and more novice ptosis surgeons as the tendency is to hold the clamp at a more acute 45° angle to improve visualization of the needle pass when seated at the head of the bed in surgeon's view.

Compliance with ethical standards

Financial disclosures None.

Contribution of authors Design and conduct of the study (DS, AP, RM); collection, management, analysis, and interpretation of the data (DS, AP, RM); and preparation, review, or approval of the manuscript (DS, AP, RM).

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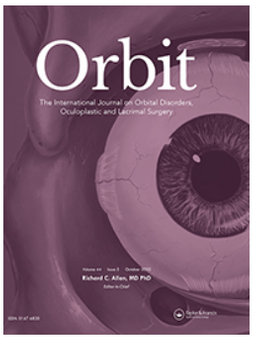

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A Case of Corynebacterium Bovis positive surgical site infection post-blepharoplasty

Patrick R. Ingraffia , Pooja Parikh , Liane Dallalzadeh & Ronald Mancini

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CASE REPORT

A Case of Corynebacterium Bovis positive surgical site infection post-blepharoplasty

Patrick R. Ingraffia, Pooja Parikh, Liane Dallalzadeh, and Ronald Mancini

Department of Ophthalmology, University of Texas Southwestern Medical Center, Dallas, Texas, USA

ABSTRACT

Corynebacterium bovis is principally a zoonotic pathogen and a causative agent of bovine mastitis. To date, there are only 20 documented cases of *C. bovis* infection in humans in the literature, and only 6 have involved the eye or adnexal structures. No ophthalmologic cases have been demonstrated post-operatively. Here, we present the first case of *C. bovis* preseptal cellulitis and abscess formation following lower eyelid blepharoplasty. Her infection was difficult to control until microbial susceptibility results became available. The patient made a full recovery from her surgery despite this infection.

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KEYWORDS
Corynebacterium bovis; blepharoplasty; surgical site infection; culture-derived antibiotic therapy

Corynebacterium bovis is a catalase-positive, lipophilic, nonsporulating, Gram-positive club-shaped rod.[1–4] It is most well-known as a causative agent of bovine mastitis, as it naturally resides in the bovine udder.[5] Several members of the cornebacteriaceae family are common constituents of the conjunctiva in healthy adults, though *C. bovis* is not among this group.[6,7] It rarely causes disease in humans, with only 20 published cases in the literature.[5,8–18] To date, only 6 cases have involved the eye or adnexal structures, and none developed in the post-operative period following eye or eyelid surgery.[8–11] Here, we present the first case of *C. bovis* infection following lower eyelid blepharoplasty.

Case presentation

A 75-year-old female presented with a past surgical history of bilateral upper eyelid blepharoplasty, bilateral lower eyelid blepharoplasty, and rhytidectomy in 1999. Additionally, she underwent revisional bilateral lower eyelid blepharoplasty 17 years later, with multiple previous treatments with botulinum toxin and hyaluronic acid gel fillers.

She underwent revisional bilateral upper and lower eyelid blepharoplasty. The bilateral lower eyelid blepharoplasty was performed via a transconjunctival approach to address the lower eyelid fat pads with skin pinch excision of excess infraciliary skin. Post-operatively, the patient was started on bacitracin-polymyxin B ointment for external application at all incisions, topical neomycin-polymyxin B-dexamethasone eye drops, and oral cephalexin.

At post-operative week 1, she was healing as expected without signs of infection. Due to moderate post-operative chemosis, she was continued on neomycin-polymyxin B-dexamethasone eye drops for an additional 2 weeks. Two weeks postoperatively, the patient noted increased chemosis of the right eye for which she self-treated with a previous and unrelated oral prednisone prescription for three days. The progressive chemosis was attributed to neomycin allergy; she was therefore switched to a two-week course of topical tobramycin-dexamethasone drops.

One month post-operatively, the patient endorsed progressive pain and swelling of the left upper and lower eyelids. On exam, the left periorbital region was noted to have edema and erythema with a tender fluctuant mass near the left lateral canthus concerning for preseptal cellulitis and lower eyelid abscess [Figure 1]. The abscess was incised, drained and sent for aerobic, anaerobic, and fungal cultures. She was initiated on oral clindamycin 150 mg three times daily (TID) and bacitracin-polymyxin B ointment with plan for follow up in 2 days. During this next visit, minimal improvement was noted [Figure 2].

Four days later, cultures returned with heavy growth of *Corynebacterium bovis*, as well as light growth of coagulase-negative staph. Given the rarity of a *C. Bovis* infection of the eyelid, the case was discussed with Infectious Disease and additional susceptibility testing was ordered to guide antibiotic management. The patient was started on oral amoxicillin/clavulanate 875/125 mg twice daily (BID) and

CONTACT Patrick R. Ingraffia patrick.ingraffia@utsouthwestern.edu Department of Ophthalmology, University of Texas Southwestern Medical Center, 5303 Harry Hines Blvd 6th Floor, Dallas, TX 75390, USA

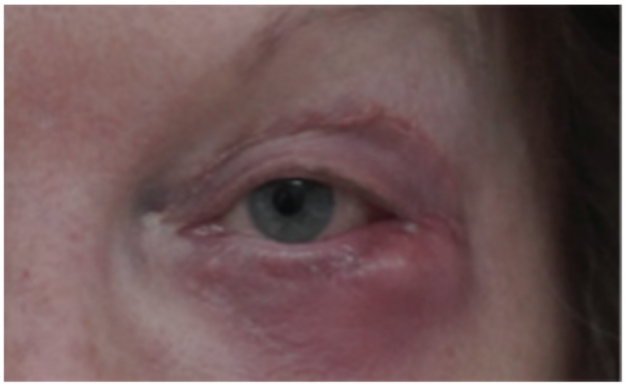

Figure 1. Left eye periorbital edema, erythema, and lower eyelid mass one month post-operatively.

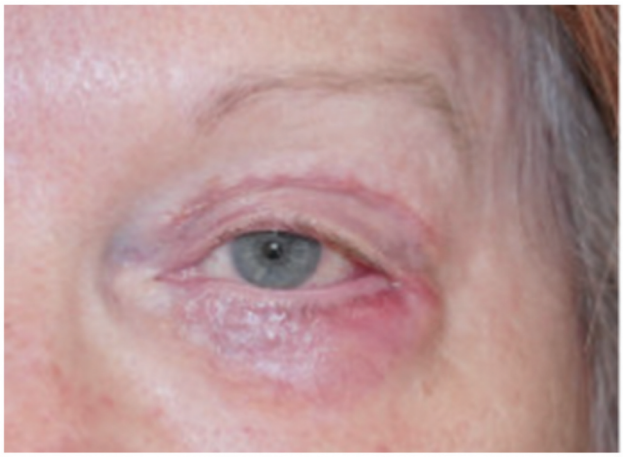

Figure 2. Minimal improvement of left eye periorbital edema, erythema, and lower eyelid mass.

instructed to increase her clindamycin to 300 mg TID. Despite 2 weeks of dual antibiotic therapy, she had incomplete treatment response. Her antibiotic regimen was changed to oral trimethoprim/sulfamethoxazole 800/160 mg BID for 1 week, based on susceptibility testing, which resulted in rapid resolution of the cellulitis [Figure 3]. Notably, susceptibility testing did demonstrate resistance to clindamycin and only intermediate susceptibility to penicillin derivatives [Table 1].

In total, the patient received 6 days of oral clindamycin 150 mg TID, 14 days of oral clindamycin 300 mg TID, 14 days of 875/125 mg of oral amoxicillin/clavulanate BID, and 7 days of oral trimethoprim/sulfamethoxazole 800/160 mg BID. After completing a total of 27 days of treatment with systemic antibiotics, the infection resolved with rapid and notable improvement after initiation of trimethoprim/sulfamethoxazole [Figure 4]. Despite this infection, the surgical reconstruction was successful.

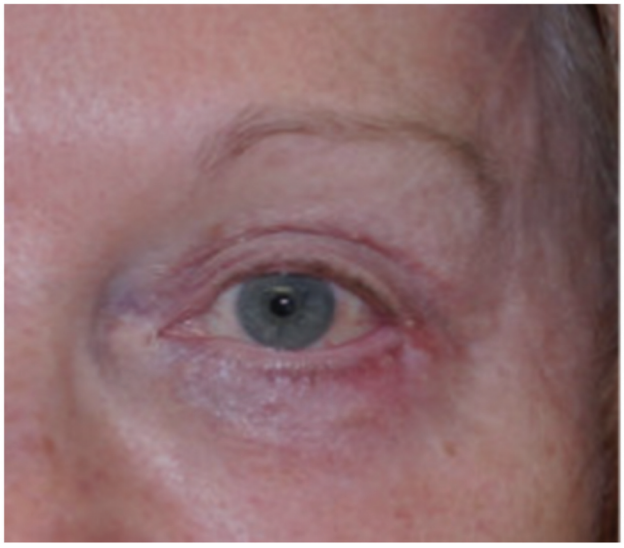

Figure 3. Post-operative month 2 photograph, one week after culture-driven trimethoprim/sulfamethoxazole therapy. Note the rapid resolution of the left eyelid edema and erythema. No abscess is evident. The eyelids continue to heal from her bilateral upper and lower eyelid blepharoplasty, and the surgical reconstruction was successful.

Discussion

Several corynebacteria are well established as causes of disease in humans.[1,2] *C. diphtheria* is the most well-known of this group.[4] Non-diphtheria corynebacteria are known amongst the biomedical community as diphtheroids. They are either aerobic or facultatively anaerobic bacteria and constitute part of the normal microflora of the skin and mucous membranes in humans.[1,6] When isolated from clinical specimens, they may be considered as contaminants.[4,19] However, there is recent strong evidence supporting diphtheroids as an important cause of human disease, including multidrug-resistant and nosocomial infections.[1,3,4,6,19]

C. bovis is principally a zoonotic pathogen.[20] It is a common cause of bovine mastitis and was first discovered by Evans in 1916 from aseptic cow's milk.[20,21] Indeed, the resulting decreased bovine milk production is an important cause of economic strain in dairy farms.[20,22] Recently, it was demonstrated that genetic

Table 1. C. bovis susceptibility testing (MIC = mean inhibitory concentration; S = susceptible, I = intermediate, *R* = resistant).

Antibiotic	MIC (ug/mL)	Susceptibility
Ceftriaxone	≤4	S
Meropenem	≤2	S
Penicillin	1	I
Vancomycin	1	S
Linezolid	≤2	S
Clindamycin	>2	R
Trimethoprim-Sulfamethoxazole	2/38	S