

Closing the Fornix-Based Flap

How I achieve a watertight seal.

By Garry P. Condon, MD



One of the most critical aspects of glaucoma surgery is the predictable and absolutely watertight closure of the conjunctival incision to ensure the creation of a functional filtering bleb. This article shares why I switched to a fornix-based flap and my technique for closing the conjunctiva.

WHY I SWITCHED

Historically, ophthalmologists believed that watertight closure was more easily achieved with an incision made in

the fornix rather than at the limbus. Like many others, I used this reasoning as the basis for my routine use of limbus-based conjunctival flaps throughout the first 10 years of my clinical practice. With this technique, the formation of avascular cystic anterior filtering blebs was fairly common. This lack of vascularity in conjunction with the growing popularity of mitomycin C (MMC) appeared to be responsible for the greater likelihood of late bleb leakage and the higher probability of late infection. In 1994, Reay Brown, MD, coined the term *blebitis*, which recognized the growing trend.¹ Around that time, James Wise, MD, described his technique for more effectively achieving the watertight closure of a fornix-based conjunctival flap.² By 2000, accumulating information suggested that the bleb's



Figure 1. The typical anatomical characteristics of a filtering bleb created using a limbus-based conjunctival flap and intraoperative MMC.



Figure 2. In the fellow eye of the same patient shown in Figure 1, fornix-based surgery resulted in a low, diffuse, posterior zone of filtration with a more durable bleb in which the fibrosis was limited to the site of the original incision along the limbus.

(Courtesy of R. Lehrer, MD.)

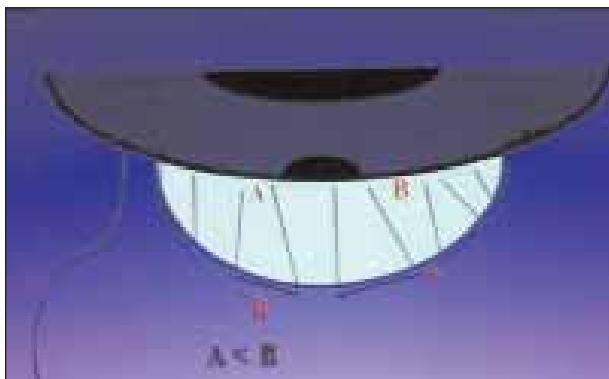


Figure 3. The principle of the Wise technique is creating suture bites (A) that are longer than the space between bites (B).



Figure 5. The scleral bites are made anterior to and underneath the anterior conjunctival lip without the incorporation of any part of that lip.

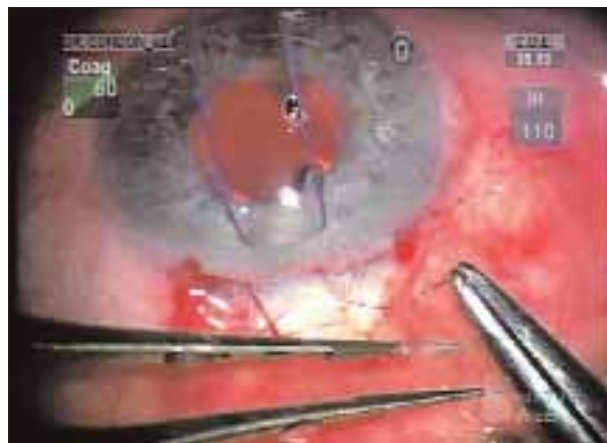


Figure 4. After the surgeon anchors the suture in the conjunctiva/sclera, the next pass of the suture is down through the edge of the conjunctival flap, 2 to 3 mm from that end of the incision.

morphology could be altered favorably with the use of fornix-based rather than limbus-based flaps. This evidence came primarily from Tony Wells, MD, and Peng Khaw, PhD, FRCOphth.³ By this time in my clinical practice, I had certainly seen my share of late bleb-related complications, including leakage, hypotony, and endophthalmitis. The information from Dr. Khaw convinced me that transitioning from a limbus-based to a fornix-based approach would indeed produce more favorable bleb morphology.

A filtering bleb created using a limbus-based conjunctival flap and intraoperative MMC is more anteriorly located than with a fornix-based approach. The bleb is relatively avascular and cystic, often with a dense ring of fibrous tissue demarcating the posterior aspect of the bleb and limiting the filtering zone to the anterior avascular area.

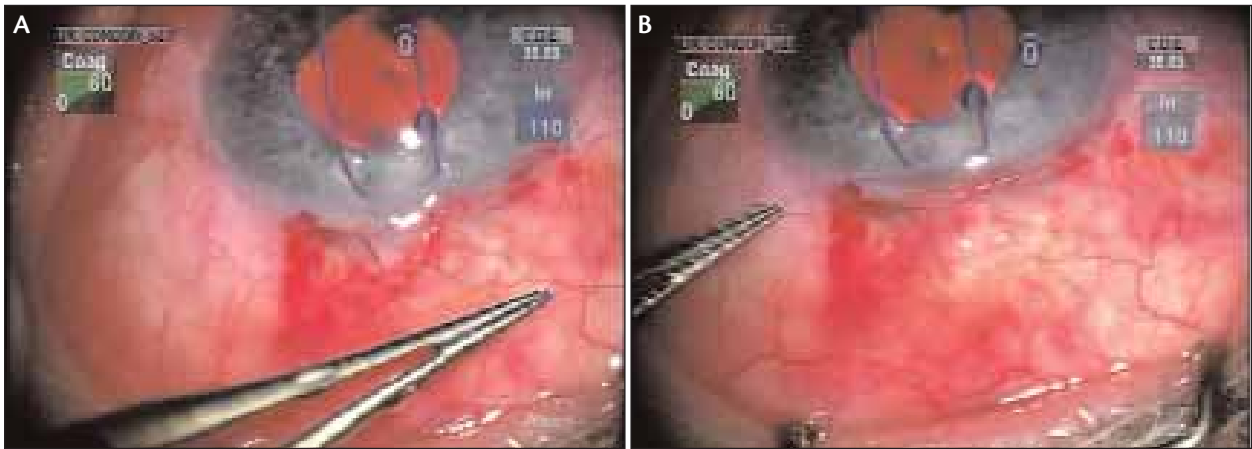


Figure 6. The conjunctiva beneath the suture is crimped and applied tightly against the cornea/sclera as the suture is pulled (A). The conjunctiva between the suture bites is stretched snugly to complete the alternating crimping/stretching effect for a robust, watertight wound (B).

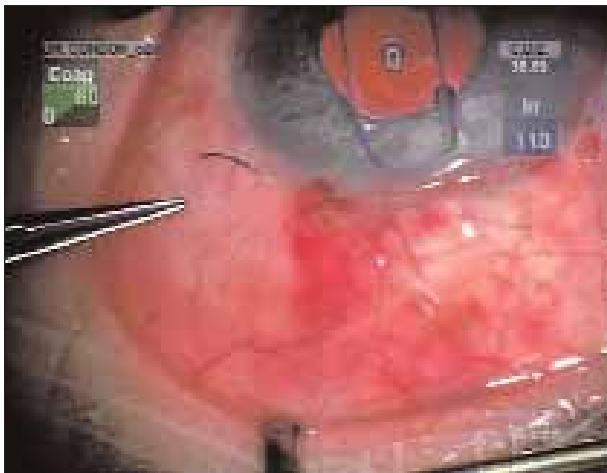


Figure 7. The final suture bite incorporates the redundant conjunctival fold along with the sclera, and the suture is tied to itself.



Figure 8. The appearance of the closed incision with the anterior and posterior conjunctival edges firmly abutting each other.

Referred to as the *ring of steel*, this fibrous tissue typically occurs when the surgeon makes a full-thickness incision through the conjunctiva and Tenon's capsule, resulting in a dense cicatrix fusing the conjunctiva to the episclera with limitation in the zone of filtration (Figure 1). In contrast, fornix-based surgery produces a more durable bleb, in which fibrosis is limited to the original site of the incision along the limbus (Figure 2). In my hands, fornix-based surgery has created a drastically better-looking bleb with fewer late-term complications. Staunch supporters of the limbus-based flap often contend that they can achieve the same favorable bleb morphology through more posterior dissection and a broader area of exposure to MMC.

The key issue remains the watertight closure of the incision.

HOW I CLOSE THE INCISION

My technique is a modification of the Wise closure method that differs in two main ways. First, I leave approximately 0.5 mm of limbal conjunctiva attached at the corneoscleral junction when I make the incision along the limbus. Second, I anchor the suture in conjunctiva and sclera rather than clear cornea outside the confines of the conjunctival incision. As Dr. Wise suggested, I use only the VAS 100-4 needle manufactured by Ethicon Inc. (Somerville, NJ). It is readily available on 9-0 nylon, but I prefer the special-order 9-0 monofilament Vicryl (model D-8760; Ethicon Inc.). I use the Wise mattress-suturing pattern to attach the edge of the conjunctival flap directly to the corneoscleral tissue beneath the anterior lip of the residual conjunctiva. The



Figure 9. Epithelialization at the wound is rapid, with the fibrotic process anterior to the diffuse bleb.

critical aspect of his suturing pattern is keeping all of the suture bites *longer* than the space between any suture bites (Figure 3).

I am a right-handed surgeon. The suturing starts with a solid bite that incorporates sclera and conjunctiva just to the right of the extent of the conjunctival opening near the limbus. I anchor the suture by tying it to itself. The next pass is down through the edge of the conjunctival flap, about 3 to 4 mm from the right corner of the incision (Figure 4). I then place the needle to the far right of the incision's opening and make a long (3- to 4-mm) pass tangentially through cornea/sclera, along the limbus, underneath the small lip of anterior conjunctiva, and as far anteriorly as possible. Importantly, the anterior lip is *not* incorporated in any of the needle's passes (Figure 5). After exiting the cornea/sclera, the needle passes up through the edge of the conjunctival flap about 2 mm from the first downward pass. Next, I make another downward pass 3 to 4 mm farther left, followed by a corneoscleral pass started 2 to 3 mm away from the exit point of the first corneoscleral pass. Drawing the suture taut at this point reveals an alternating pattern of crimped conjunctiva under the surface bites and a stretched portion of conjunctiva between the surface bites; the result is a tight application of the flap to the cornea/sclera (Figure 6). The pattern is repeated as needed until the needle exits the left end of the incision, up through the conjunctiva, beyond the confines of the incision. My final pass generously incorporates the redundant corner of conjunctiva and underlying sclera and leaves a loop of suture that can be tied to itself after I carefully tighten the entire suture line (Figure 7).

It is critical that the entire flap be tightly applied to

the cornea/sclera under the anterior conjunctival lip. As long as the Wise suture-bite architecture and length relationships are maintained, closure is secure, with the edge of the conjunctival flap buttressed against the small lip of limbal conjunctiva. The resulting appearance is of tightly pursed lips along the limbus (Figure 8). The anterior lip acts as a bolster to create a robustly water-tight closure and reduce the tendency for early leakage. It also helps to promote rapid epithelialization at the wound (Figure 9). It is important to keep any Tenon's capsule attached to the undersurface of the conjunctiva and to perform posterior sub-Tenon's blunt dissection to enhance the wound's closure and posterior flow.

CONCLUSION

Over the past 8 years, I have found the conjunctival incision and closure technique I have described to produce a bleb with a desirable appearance. They have also greatly reduced the tendency for the filtering bleb to migrate into the cornea, as many ophthalmologists have experienced with limbus-based surgery. I recently retrospectively reviewed and compared my rates of reoperation for early wound leaks in my last consecutive 100 limbus-based cases versus my first 200 consecutive fornix-based cases using the technique described herein. The rate was less than 2% for both techniques, with no significant difference between them. □

A video demonstration of this technique is available at <http://www.eyetube.net/videos/default.asp?gehotu>.



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