A Limbus- or Fornix-Based Flap?

Five surgeons explain their preferences.

BY CYNTHIA MATTOX, MD; THOMAS W. SAMUELSON, MD; GEOFFREY T. EMERICK, MD; GARRY P. CONDON, MD; AND ALAN L. ROBIN, MD

CYNTHIA MATTOX, MD

Up until about 4 years ago, I always performed my combined phacoemulsification/trabeculectomy procedures with a fornix-based conjunctival flap and my straight trabeculectomies with a limbus-based flap. I liked the closure I used for each. Fellows would ask me, "Why the difference?" I was not entirely satisfied with the IOP-lowering effect of my combined procedures, but I wanted better exposure and quicker execution for the phacoemulsification/trabeculectomy. The blebs of my trabeculectomies with a limbus-based flap were more effective but more often localized with thinning, predisposing the eye to late bleb leaks and bleb-associated infections. Something had to change.

I thought, if I could just make my trabeculectomies with a fornix-based flap more effective and they behaved better long term, it would be the best of both worlds. After studying the technique of Peng Khaw, PhD, FRCS, FRCOphth,[1] I realized that I had not been aggressive enough in dissecting posteriorly alongside the superior rectus muscles. Once I began performing deep, spreading dissection to either side of the rectus, I developed larger, more diffuse blebs that lowered the IOP more consistently than my prior technique.

That is all it took. I did not incorporate any of Dr. Khaw's other techniques such as large peritomies and scleral flaps or adjustable sutures. I apply mitomycin C (MMC) with two halves of a cut corneal shield. I use two wing sutures to close, one a purse-string type and the other a horizontal mattress with a 10–0 nylon Ethicon 7707 (a vascular needle with a tiny cutting tip that is also used to close the scleral flap; Ethicon, Inc., Somerville, NJ). I quickly adopted fornix-based flaps for my straight trabeculectomies as well. My blebs are diffuse, elevated, and effective (Figure 1). I do occasionally observe an early leak along the limbus, but, managed promptly, the bleb develops nicely.

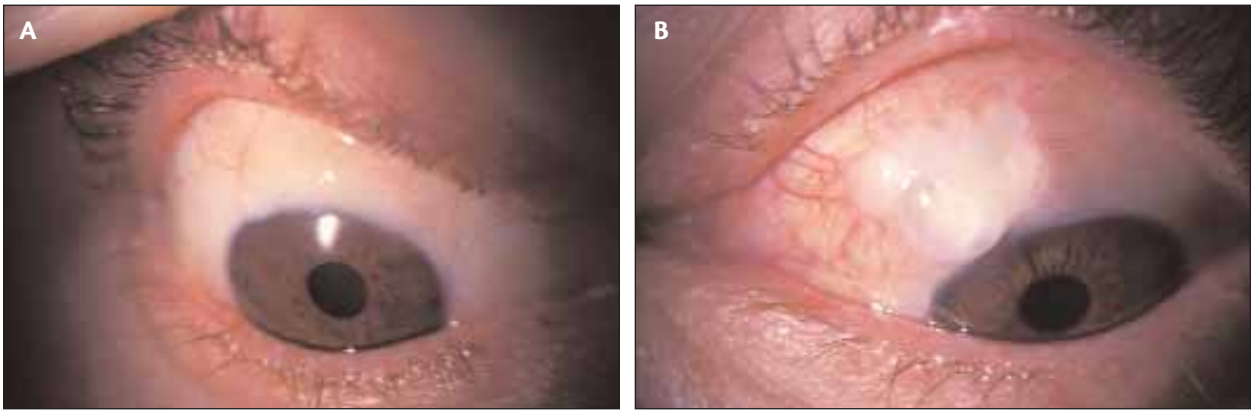
THOMAS W. SAMUELSON, MD

Surgeons have debated the relative merits of limbus- versus fornix-based flaps for as long as I have been involved in the specialty of glaucoma. I have seen swings in opinion each way. If we define a trend by comparing the relative number of converts moving away from one technique to adopt the other, there is clearly a current trend toward fornix-based flaps. Nevertheless, many surgeons remain loyal to the limbus-based flap. My own approach depends largely on the case at hand. I use both methods, depending on the clinical circumstance. Five years ago, I employed limbus-based flaps nearly 100% of the time for trabeculectomy. Currently, perhaps 70% of my cases are limbus based, and 30% are fornix based. Why the trend toward more fornix-based flaps? Basically, I am paying attention to what my colleagues are telling me. That is, many believe that the bleb with a fornix-based approach is morphologically more favorable. Specifically, they suggest that fornix-based blebs are more low lying and diffuse.

Although I have heard this argument for some time, I have been somewhat slow to change my approach, primarily because I have been able to generate similarly low-lying

(Courtesy of Cynthia Mattox, MD.)

Figure 1. Viewed up close, the bleb produced by a trabeculectomy with a fornix-based flap is diffusely elevated.



(Courtesy of Geoffrey T. Emerick, MD.)

Figure 2. This 58-year-old man with primary open-angle glaucoma underwent trabeculectomies with MMC in both eyes. The surgeon created a fornix-based flap in the patient's right eye and a limbus-based flap in his left eye. Postoperatively, his IOP measured 8 mm Hg OD (A) and 10 mm Hg OS (B).

and diffuse blebs with a limbus-based flap simply by making certain that my conjunctival incision is far posterior and that the MMC exposure is broad. Moreover, many of my patients are referred from hundreds of miles away, and I abhor leaks. Limbus-based flaps simply do not leak during the early postoperative period (late leaks are a different discussion). That said, I have adopted the fornix-based method in an increasing percentage of my patients. These flaps are more amenable to topical anesthesia, and they require a smaller, less invasive conjunctival incision than limbus-based flaps. In addition, a fornix-based approach eliminates the fibrotic "ring of steel" as a barrier to posterior flow. Although I can significantly reduce the ring-of-steel effect by making my limbus-based flap more posterior, the effect is still evident in some patients in whom I use a limbal approach. With either approach, a watertight conjunctival closure is essential. I use an 8–0 Vicryl (Ethicon, Inc.) suture on a vascular needle to close limbus-based flaps and a 9–0 Vicryl suture on a vasectomy needle to close fornix-based flaps.

Time will tell if the fornix-based approach reduces late-term complications such as the bleb-related infections and late leaks that we all dread. If so, the limbus-to-fornix trend will continue.

GEOFFREY T. EMERICK, MD

Although I was trained to create limbus-based flaps, I switched entirely to fornix-based flaps several years ago (Figure 2). My reasons are the following, in order of importance.

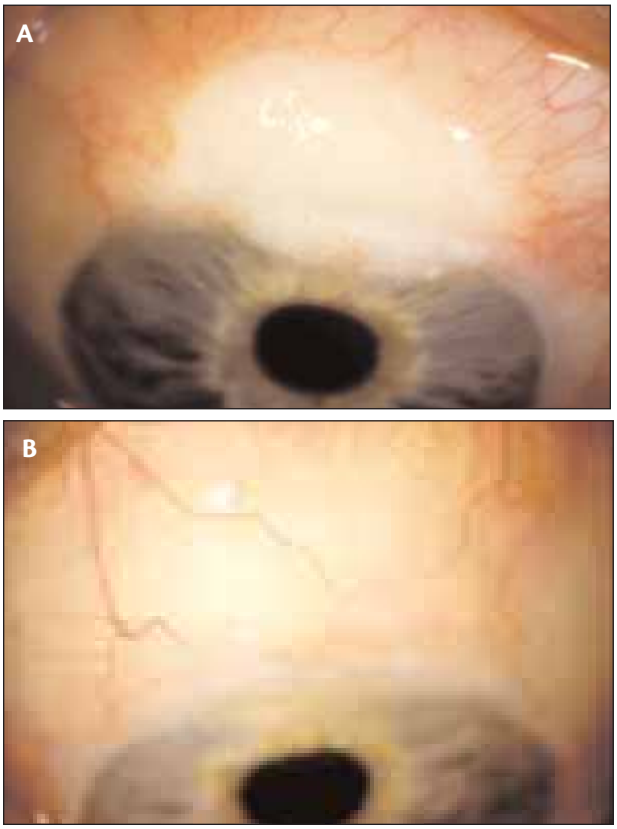
First, the fornix-based blebs function better. Avoiding a posterior suture line reduces the risk that a fibrotic ring of steel will form around the bleb. The incision and sutures, especially those made of polyglactin, create inflammation that predisposes the eye to this problem. A small bleb increases the ratio of flow to surface area as well as the likelihood of a high, uncomfortable, ischemic, leaky bleb. The larger the bleb's surface area is, the more "normal" the tissue remains.

Second, fornix-based flaps provide better surgical exposure. A limbal incision also avoids the need for a surgical assistant. I create a scleral flap to the level of the Tenon's insertion and then dissect a tunnel just into clear cornea. I no longer routinely perform a peripheral iridectomy, and an anteriorly placed sclerostomy may reduce the risk of iris incarceration. This approach is possible but more difficult with a limbus-based flap. I still perform an iridectomy in some phakic patients, especially those with crowded anterior segments or intraoperative floppy iris syndrome. Additionally, in deep-set or small eyes, it may be difficult to create a sufficiently posterior incision (at least 9 mm behind the limbus). As the incision heals and contracts, it may migrate forward, and, if exposed to sufficient aqueous flow, it is prone to breakdown and leakage.

Finally, fornix-based flaps are easier to close. A single wing 8–0 Vicryl mattress suture is usually sufficient to secure the conjunctival flap to the limbus. This closure is as fast as the running closure of a limbus-based flap and is nearly as resistant to leakage.

GARRY P. CONDON, MD

I prefer fornix-based conjunctival flaps to limbus-based flaps. One of the most critical aspects in performing glaucoma filtering surgery is the predictable and absolutely watertight closure of the conjunctival incision to promote a functional filtering bleb. Historically, it has been suggested that watertight closure is more easily achieved with an incision made in the fornix than at the limbus. I used this reasoning as a basis for my routine use of limbus-based conjunctival flaps throughout the first 10 years of my clinical practice. Around the year 2000, information presented by Dr. Khaw and his colleagues at



(Courtesy of Garry P. Condon, MD.)

Figure 3. The filtering bleb produced by a limbus-based conjunctival flap is anterior, relatively avascular, and cystic with a dense ring of fibrous tissue that limits the filtration zone (A). A fornix-based flap in the patient's contralateral eye created a low, diffuse, posterior zone of filtration, a more durable bleb, and limited fibrosis (B).

Moorfields Eye Hospital in London convinced me to change to fornix-based flaps. They suggested that moving from limbus- to fornix-based surgery would produce more favorable bleb morphology with a reduced risk for late bleb leakage and endophthalmitis.[2]

The key issue was the watertight closure of the incision. My closing technique is a modification of the Wise closure method.[3] The difference is that I leave approximately 0.5 mm of limbal conjunctiva at the corneoscleral junction when I make the anterior limbal incision. I utilize the Wise mattress suturing technique to attach the edge of the conjunctival flap directly to the corneoscleral tissue beneath this anterior lip of residual conjunctiva. The anterior lip of conjunctiva acts as a bolster to reduce the tendency for early leakage and to help promote rapid epithelialization at the wound.

I apply MMC for 1 minute in the majority of cases and vary the concentration from 0.2 to 0.4 mg/mL. The typical anatomical characteristics of a filtering bleb created using a limbus-based conjunctival flap and intraoperative MMC are

depicted in Figure 3A. The bleb is anterior, relatively avascular, and cystic with a dense ring of fibrous tissue demarcating the posterior aspect of the bleb and limiting the filtration zone. In the fellow eye of the same patient, fornix-based surgery resulted in a low, diffuse, posterior zone of filtration and a more durable bleb with fibrosis limited to the limbus, where the incision was made (Figure 3B).

In my hands, fornix-based surgery creates blebs with a drastically more favorable appearance, which I believe reduces the occurrence of long-term complications, including late leakage, late endophthalmitis, and ocular discomfort. These benefits can only be realized, however, if the surgeon predictably achieves an absolutely watertight closure of the conjunctiva and Tenon's capsule in every case. Otherwise, all bets are off.

ALAN L. ROBIN, MD

Both approaches have their advantages. Fornix-based flaps are simpler. There is less conjunctival dissection and less suturing when closing. As a result, the risk of a buttonhole is lower. In addition, visualizing the sclera is easier. These flaps probably cut the time of a trabeculectomy in half. I can perform a limbus-based procedure in an eye without prior scarring in approximately 20 minutes and a fornix-based flap in approximately 12 minutes.

Despite these benefits, I have favored a limbus-based flap for almost 30 years because of the major advantage it offers over a fornix-based flap: greater security against leakage at the wound's margin. This benefit outweighs all of the advantages offered by a fornix-based approach. If one makes a flap incision at least 8 mm posterior to the limbus, then there is little risk of a leak directly from the scleral flap to the fornix (Figure 4). Additionally, it is easy to close the wound tightly with a running, locking suture. The pressure from the upper lid causes a tamponade on the wound, preventing clinically significant leakage. Obviously, the posterior margin of the bleb is limited at least 8 mm posterior to the limbus, but this is no different than what one might find with a fornix-based flap. ❑

(Courtesy of Alan L. Robin, MD.)

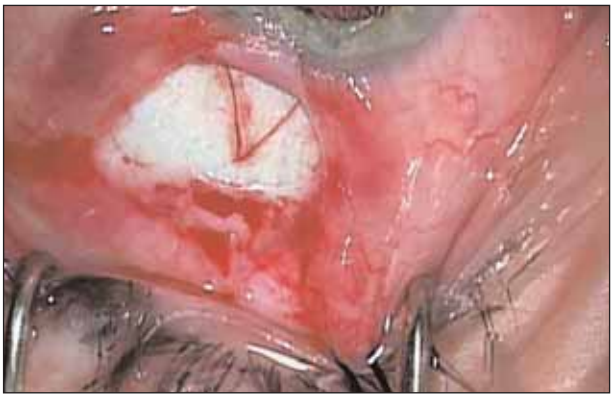


Figure 4. The surgeon creates a limbus-based conjunctival flap superonasally 10 mm posterior to the limbus. He has already applied MMC and performed irrigation. He has created the scleral flap with excellent exposure in this pseudophakic eye.

The use of MMC in glaucoma surgery is off label.

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