Heading Off Acute Postop Endophthalmitis

Incision site and proper wound construction are key tools in the prevention of acute postoperative endophthalmitis.

Judith Springer Riddle
Associate Editor

THE TEMPORAL CLEAR CORNEAL incision for cataract removal and intraocular lens implantation is slowly but surely becoming the surgical technique of choice for many ophthalmologists.

Fifty-seven percent of physicians in the 2002 survey of the American Society of Cataract and Refractive Surgery say they perform clear corneal incisions—up from 47 percent in 2000. The surgical technique was preferred by 66 percent of surgeons performing more than 25 cataract procedures per month—up from 56 percent in 2000. Use of a temporal incision increased with cataract surgery volume.

Along with the gradual acceptance of temporal clear corneal incisions, however, recent studies report that they are associated with a higher risk of acute postoperative endophthalmitis.[1,2]

"Endophthalmitis is the most dreaded complication following cataract surgery," says Robert H. Osher, MD, professor of ophthalmology at the University of Cincinnati and medical director emeritus at the Cincinnati Eye Institute. "The only thing worse would be me dying in the operating room! Aside from this adverse event, endophthalmitis is right up there."

In this article, surgeons share their reactions to the reports of higher endophthalmitis risk associated with temporal clear corneal incisions and whether the findings affect their preference for performing the procedure. They also review the important steps to take in lowering its incidence: choosing the safest incision site and paying careful attention to wound construction.

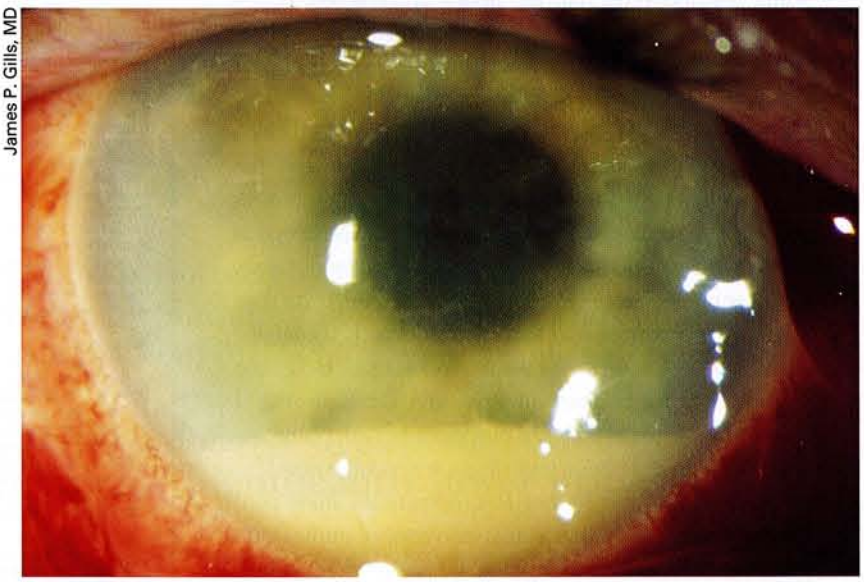
The Case for Clear Cornea

Studies report that endophthalmitis incidence following cataract surgery is relatively uncommon—between 0.08 percent and 0.30 percent. Trouble is, the research shows a disproportionately higher risk of the complication after temporal clear corneal procedures. Researchers at the Barnes Retina Institute in St. Louis saw a three-fold increased incidence of endophthalmitis following clear corneal incisions when compared to scleral tunnel wounds in a retrospective, case-control study.[3]

Still, many physicians remain loyal to the surgical technique.

Proponents say clear corneal wounds heal quickly. They don't bleed, so the eye remains white after surgery. The technique is more comfortable postoperatively for patients and requires less

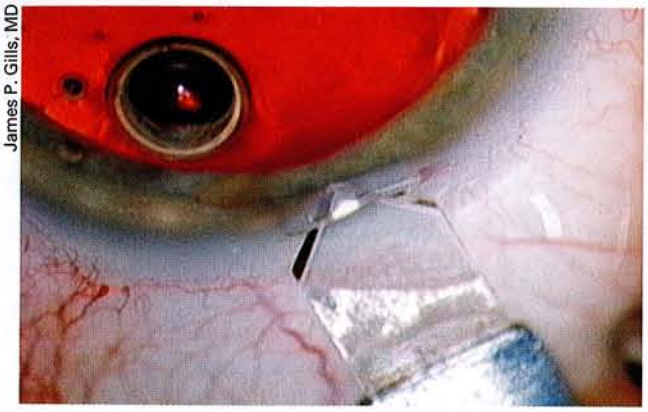
James P. Gills, MD



Acute postoperative endophthalmitis incidence following cataract surgery is relatively uncommon–between 0.08 percent and 0.30 percent.

operating-room time than scleral tunnel procedures. Physicians also say they have better anterior-chamber access, astigmatism control, the choice of topical anesthesia instead of retrobulbar or peribulbar blocks, and they don't have to cauterize, use scissors or forceps during the surgery.

"The theory that clear corneal incisions are more likely to lead to endophthalmitis is a big area of debate," says William Trattler, MD, an ophthalmologist at the Center for Excellence in Eye Care in Miami. "I don't believe that one incision type is better than another in avoiding endophthalmitis. Depending on who's doing the surgery, the rate of endophthalmitis can be



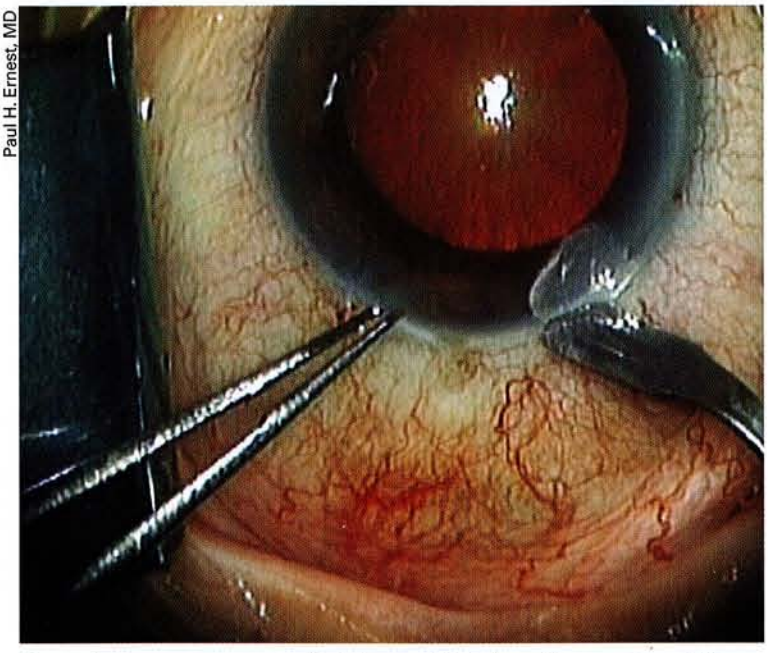
James P. Gills, MD

The clear corneal surgical technique is gaining in popularity among ophthalmologists. But studies show that clear corneal incisions are a risk factor for endophthalmitis.

20 times higher than that of another doctor [or center]. One big factor is wound construction. The clear corneal incisions that result in endophthalmitis are poorly constructed. If one study shows a higher rate, then we need to know how the incisions were created. It's possible to construct a very stable clear corneal wound. Attention to detail is important."

John F. Sciarrino, MD, an ophthalmologist at Northridge Eye Center in Ft. Lauderdale, Fla., says that because of the low endophthalmitis risk following clear corneal incisions, as indicated in the studies, widespread use of the technique is warranted. Dr. Sciarrino believes the studies don't really establish that clear corneal wounds are more prone to infection than scleral tunnel procedures, and that the evidence is conflicting and inconclusive. "Clear cornea is the predominant technique used by surgeons for cataract surgery," says Dr. Sciarrino. "I think if there were really a higher incidence of endophthalmitis, we wouldn't do it. This is a topic that's very controversial."

Investigators from the Barnes Retina Institute study concluded that results from retrospective case-control studies indicating an increased risk of endophthalmitis after clear corneal surgeries must be interpreted cautiously, and that their findings aren't necessarily an indictment of the technique.


Paul H. Ernest, MD

Research shows that anterior-limbal-corneal incisions offer greater stability than clear corneal wounds and are just as efficient and aesthetically designed.

So there's still a strong case to be made for clear cornea, says Mark Packer, MD, clinical assistant professor of ophthalmology at Oregon Health & Science University, and an ophthalmologist in private practice in Eugene, Ore. "We don't absolutely know whether there is a higher incidence of endophthalmitis," says Dr. Packer. "There are 2.5 million cataract surgeries done in the United States every year, half of which are clear corneal incisions, so that might be why it appears as though there is a higher incidence."

Incision Site

Some surgeons who don't embrace temporal clear corneal procedures say they're comfortable with using their current surgical technique—a scleral tunnel incision for instance—and refuse to switch. Others have abandoned the clear cornea in favor of limbus-based wounds and slight variations of the scleral tunnel maneuver that studies have shown are stronger, more stable and offer greater protection against postop endophthalmitis infection.

Paul H. Ernest, MD, a cataract surgeon and founder of TLC Eyecare & Laser Centers, in Jackson, Mich., has conducted numerous studies on wound construction and strength. Dr. Ernest's work has shown that anterior-limbal incisions offer greater stability than clear corneal wounds and are just as efficient and aesthetically designed.[4]

Anterior-limbus incisions also have been shown to heal faster than clear corneal wounds. An earlier multicenter trial, led by Dr. Ernest, compared the healing processes of avascular and vascular incisions. He reported that limbal wounds histologically sealed in a maximum of seven days compared to clear corneal incisions that took as long as 30 to 60 days to heal, leaving more room for endophthalmitis infection.[5]

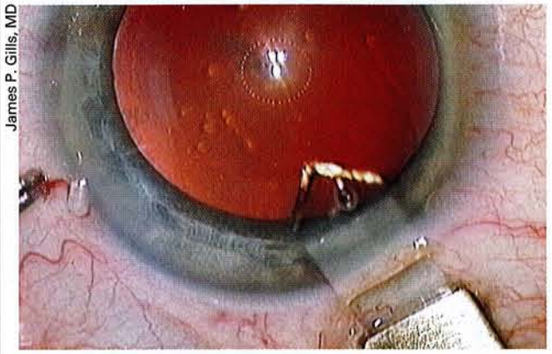
Studies also show that sclerocorneal-based procedures are associated with a lower endophthalmitis incidence. Results from a recent Japanese clinical trial reported that superior sclerocorneal wounds were 4.6 times less likely to result in a postop endophthalmitis infection than temporal clear corneal incisions.[1] A German study that evaluated the risk factors for endophthalmitis also found that there was a lower risk following sclerocorneal surgeries.[2]

James P. Gills, MD, clinical professor of ophthalmology at the University of South Florida, and founder/director of St. Luke's Cataract and Laser Institute in Tarpon Springs, Fla., performs what he calls scleral-limbal-corneal (SLIC), or near clear corneal incisions, to ensure a stable and well-sealed wound.

Dr. Gills says creating a watertight incision prevents most bacteria from entering the eye, which isn't always achieved in clear corneal surgeries. Entering through the sclera creates a conjunctival flap that speeds healing and protects against endophthalmitis. "The studies reporting a higher incidence of endophthalmitis following clear corneal incisions are truthful, he says. "The procedure is not always safe in everyone's hands. It requires a different set of surgical skills." The SLIC incision gives physicians all the benefits of a clear corneal wound, but offers more protection, says Dr. Gills.

Michael McFarland, MD, an ophthalmologist in private practice in Pine Bluff, Ark., is a strong supporter of scleral-limbal-based incisions in light of the possible increased endophthalmitis risk associated with clear corneal procedures. He says the safest place to make an incision is in the limbus. "It's watertight without hydration," says Dr. McFarland. "It doesn't induce astigmatism, and the conjunctiva provides a natural barrier to infection. There's no reason to go through the cornea. The sclera is so much more forgiving. It has a blood supply so it heals quickly. The cornea doesn't, so it takes longer to heal."

Eric Donnenfeld, MD, co-chairman of cornea and external disease at Manhattan Eye, Ear and Throat Hospital in New York City, advocates using a superior clear corneal incision over the temporal location to lower endophthalmitis risk. "There may be less chance for an infection with a superior incision because the wound isn't bathed by the tear


James P. Gills, MD

Scleral-limbal-corneal incisions (SLIC) ensure a stable and well-sealed wound.

lake at the lower lid like the temporal wound," he says. "Because the temporal incision sits in that layer of tears, it's easier for the organisms to enter the eye. The superior incision is above the tear lake and, therefore, is sequestered away from the organisms."

Wound Construction

Beyond the location of the incision, the stability of the wound is another important step in preventing endophthalmitis, says Dr. Ernest. The key to proper wound construction is making your incision as square as possible whether you choose the clear corneal, scleral- or limbus-based technique.

Dr. Ernest's research shows that if you construct a square incision in any of these locations, you'll obtain a watertight, stable wound that can withstand external pinpoint pressures up to 525 pounds per square inch. So normal reflexes like rubbing or blinking the eyes won't cause incision leakage and infection.

Other studies show that poorly constructed wounds are a statistically significant risk factor for postop endophthalmitis. In an earlier cadaver model, researchers reported that clear corneal incisions at least 2 mm in length were less likely to develop wound abnormalities such as leaking, gaping, dehiscence and necrosis than shorter incision lengths.[6]

Dr. Ernest makes his wounds 2.75 mm wide by 2.50 mm long. "If the width of your incision is twice as wide as it is long, that's a problem," he says. "Your width relative to your length should be less than 2 to 1. You want mechanical stability before the fibroblasts seal the wound in seven days. If you don't do this, you're setting yourself up for endophthalmitis."

"Wound strength and wound stability are critical," says Dr. Packer, who prefers bimanual phacoemulsification when doing clear corneal incisions that are just anterior to the margin of the limbus. "We're making two incisions that are each 1.2 mm wide, 2.0 mm long and 0.7 mm internally, so that the wound is funnel shaped. We believe that smaller incisions add to the safety of clear corneal surgery and may reduce the rate of endophthalmitis infection."

Dr. Gills keeps the wound "as small as possible and with as long a bed as possible. For total wound sealing, the corneal bevel should be 2- to 2.5-mm deep and 2.5- to 2.75-mm long," he says. "You have to ask yourself, 'How intact is the endothelium?' 'Does the cornea act as a trap door to allow bacteria inside the wound?' Endophthalmitis is a direct result of poor wound construction."

While creating a square wound or inserting an IOL, Dr. Donnenfeld warns against making radial tears. "The width of the incision should be as wide as the IOL you insert. You should try to make the incision as small as possible to get the lens in."

Dr. Osher says he produces a tightly sealed near clear corneal incision by making a three-plane construction between 1.5 mm [microphaco] and 3.2 mm in length and dissecting about 2 mm anteriorly. The better the wound construction, the better the prophylaxis, he believes.

The Smaller IOL

The desire to perform cataract surgeries through smaller incisions is spawning new IOL technologies, materials and designs that will allow physicians to insert lenses through incision widths of 1.5 mm or less, says Dr. Packer.

Dr. Gills agrees. "Everyday we try to make cataract surgery a little better than before. And we'll continue to do so as the trend toward smaller incisions continues to grow."

A Comprehensive Plan of Prevention

While incision site and wound architecture are critical in the prevention of endophthalmitis, the battle against infection begins with the use of a complex series of sterile techniques administered preoperatively and postoperatively.

William J. Oktavec, MD, an ophthalmologist at San Augustin Eye Foundation in St. Augustine, Fla., says he begins his fight against endophthalmitis by equipping his operating rooms with ultraviolet radiation units that run 24 hours a day. The ultraviolet machines boast electrostatic filters that kill mold and bacteria. They stand 3 feet tall, measure 6 inches wide and conveniently plug into the wall. "The ultraviolet radiation keeps the environment as sterile as possible," says Dr. Oktavec.

A comprehensive course of preop antibiotics is the first line of defense for physicians who don't have ultraviolet radiation units. "My patients use moxifloxacin (Vigamox, Alcon) and gatifloxacin (Zymar, Allergan) eye drops four times a day for three days before surgery," says Dr. Oktavec. "One final drop is instilled in the patient's eyes right before he comes into the surgery center. The rest of the medication is used three to four times a day for 10 days postop."

Ultraviolet lighting systems are also installed in the ORs at St. Luke's Cataract and Laser Institute in Tarpon Springs, Fla. Founder and director James P. Gills, MD, uses ofloxacin (Ocuflox 0.3%, Allergan) preop and postop to ward off infection.

Robert H. Osher, MD, professor of ophthalmology at the University of Cincinnati, and medical director emeritus at the Cincinnati Eye Institute, prefers to give his patients levofloxacin (Quixin, Santen) preop and postop. "Levofloxacin eye drops really give you an outstanding solubility, penetration, safety profile, and broad coverage against gram negative and positive bacteria," he says.

To further reduce the risk of infection, many ophthalmologists routinely use various concentrations of the topical antiseptic povidone iodine in their patients' eyes prior to surgery. It's used to sterilize the surgical field when isolating the eye lashes (a major source of bacteria) with a plastic drape and eyelid speculum. "If you cover the lashes and get them out of the way, you'll have a more sterile and safer surgery," says Dr. Osher. A recent study reported that 5% povidone iodine was more effective at decreasing the conjunctiva bacterial load than the 1% concentration.[7]

Andrew O. Lewicky, MD, assistant professor of ophthalmology at Rush University, and founding partner of Chicago Eye Institute, goes one step further. He instills a 5% concentration of the antiseptic on the cornea and conjunctiva immediately after the surgery. So does Dr. Gills. "Doing this while the patient is still on the table is more effective drop for drop than any antibiotic," says Dr. Lewicky. "I use an anesthetic drop before putting it in the eye, because it does burn."

Following the surgery, Dr. Gills also administers an anterior chamber antibiotic/anti-inflammatory injection for added protection against a wide range of bacteria that may enter the eye.

1. Nagaki Y, Hayasaka S, Kadoi C, et al. Bacterial endophthalmitis after small-incision cataract surgery: Effect of incision placement and intraocular lens type. J Cataract Refract Surg 2003;29:20-6.
2. Schmitz S, Dick HB, Krummenauer F, et al. Endophthalmitis in cataract surgery: results of a German survey. Ophthalmology 1999;106:1869-77.
3. Cooper B, Holekamp NM, Bohigian G, et al. Case-control Study of Endophthalmitis After Cataract Surgery Comparing Scleral Tunnel and Clear Corneal Wounds. Am J Ophthalmol 2003;136:300-05.
4. Ernest PH, Neuhann T. Posterior limbal incision. J Cataract Refract Surg 1996;22:78-84. Kurt Buzard, Miles H. Friedlander, Jean-Luc Febbraro, *The Blue Line Incision and Refractive Phacoemulsification,* Chapter 3: "Incision Wound Healing," Slack Incorporated., Thorofare, NJ.
5. Ernest P, Tipperman R, Eagle R, et al. Is there a difference in incision healing based on location? J Cataract Refract Surg 1998;24:482-6.
6. Mackool RJ, Russell RS. Strength of clear corneal incisions in cadaver eyes. J Cataract Refract Surg 1996;22:721-5.
7. Ferguson AW, et al. Comparison of 5% povidone-iodine solution against 1% povidone-iodine solution in preoperative cataract surgery antisepsis: a prospective randomised double-blind study. Br J Ophthalmol 2003;87:163-7.