

# Controversy continues over role of clear corneal incisions in rising rate of endophthalmitis

Cheryl Guttman  
in New Orleans

WHILE there has been an indisputable increase in the incidence of endophthalmitis following cataract surgery over the past 10 years, the association between that increased incidence and the wide adoption of clear corneal incisions (CCI) over the same time period remains controversial.

Speaking at the annual AAO conference during "Spotlight on Cataracts 2004: Cataract Controversies," Peter J. McDonnell III MD, Director, Wilmer Eye Institute, Johns Hopkins University School of Medicine, Baltimore, presented data from several studies conducted at his institution pointing to a rising risk of post-cataract surgery endophthalmitis and providing plausibility for a causal role of the CCI.

In follow-up, I. Howard Fine, MD, clinical professor of ophthalmology, Casey Eye Institute, Oregon Health & Science University, Portland, Oregon, presented evidence supporting the safety of the CCI that he introduced more than a decade ago. In addition, he pointed to potential flaws in studies suggesting a link between CCI techniques and an increasing rate of endophthalmitis and suggested alternative factors that may account for the phenomenon of the increasing number of endophthalmitis cases.

"We have performed over 7,000 clear cornea incision procedures over the last eight years without encountering a single case of endophthalmitis"

Howard Fine MD

As a bottom line, however, Dr Fine pointed out that careful incision construction and meticulous surgical technique are critical determinants influencing endophthalmitis risk, and he described his own protocol for maximising safety.

"We have performed over 7,000 clear cornea incision procedures over the last eight years without encountering a single case of endophthalmitis, and I don't think that record is just a matter of good luck. However, I am not here to sell the clear cornea incision since I believe surgeons should use whatever technique they can perform with the most reproducibly safe results. Not all clear cornea incisions are the same, and meticulous attention to detail is the basis for minimising endophthalmitis risk," Dr Fine said.

## Retrospective studies

Dr McDonnell presented results from two large studies conducted by ophthalmologists at Wilmer Eye Institute which demonstrate the rising incidence of endophthalmitis. In their systematic review of peer-reviewed, English language literature published between 1964 and 2002, Taban and colleagues found endophthalmitis rates after cataract surgery had increased since 1992. Taban and colleagues reported during the previous three decades.

Plotting rates of post-cataract surgery endophthalmitis, the researchers found there was a gradual downward trend between 1963 and 1991 that reversed thereafter. A separate analysis of endophthalmitis rates in penetrating keratoplasty procedures revealed an opposite pattern.

When cataract surgery papers from 1992-2003 were analysed for endophthalmitis rates based on incision type, the CCI was associated with a significantly higher risk (2.5 to 3-fold) compared with both scleral tunnel and limbal incisions, Dr McDonnell said.

Noting that various studies show IOP can change significantly in the immediate post-op period as a result of blinking or squeezing and that low IOP permits gaping of clear corneal wounds, Dr McDonnell postulated that CCIs might increase susceptibility to endophthalmitis by allowing ingress of pathogen-containing ocular surface fluid to the anterior chamber.

## The view from within the eye

To explore that hypothesis, he designed an experiment using a Miyake camera to examine eye bank eyes. A CCI was created and the iris and uveal tissue removed to allow better visualisation of the internal aspect of the wound. Then, India ink was applied to the

surface of the cornea. With application and release of digital pressure, particles of India ink could be seen entering into the anterior chamber. Histological studies showed the India ink tracked in along the incision and became trapped in the edges of the stromal lamella.

"The digital pressure manoeuvre simulates what might occur when a patient applies pressure to the lid when instilling medication postoperatively, and this study confirms the potential for surface fluid to traverse the CCI and reach the aqueous in some eyes prior to wound healing," Dr McDonnell said.

He noted that in a second study performed by Walter Stark MD, eyes undergoing cataract surgery through a CCI showed that although the incisions were non-leaking, when digital pressure was applied to the globe and released, blood from the limbal capillary could be seen entering the anterior chamber.

"We believe the CCI has made a significant contribution for the surgical correction of cataract. However, we also believe that attention should be directed to gaining better understanding of the dynamics of these incisions in the early postoperative period and of the mechanism for what we clearly believe is a rising incidence of endophthalmitis," Dr McDonnell said.

Commenting on the latter two studies, Dr Fine raised concern that the pinpoint pressure methods used for altering IOP did not result in physiological changes and so were not clinically relevant. Furthermore, he pointed out that the endothelial pump, which promotes sealing of the valve-like architecture of the CCI, would be absent in cadaver eyes.

"Both Brad Shingleton and I have found that IOP is less than 10 mmHg in 15% to 20% of eyes at two hours after surgery. However, despite the potential for significant IOP fluctuations in certain eyes, neither of us have experienced an increased incidence of endophthalmitis," Dr Fine stressed.

## Other factors may be responsible

Dr Fine proposed that changing patterns of bacterial resistance to perioperative antibiotics used for endophthalmitis prophylaxis might be a factor that has contributed to the increased risk. While Gram-positive endophthalmitis isolates were completely susceptible to the available fluoroquinolones during the late 1990s, complete resistance



Demonstration of self-sealing of clear corneal incision in the challenge of a blunt "knuckle" prior to application of pressure

Courtesy of I Howard Fine MD

developed over the next three years.

"In two studies, Swedish surgeons reported they encountered the lowest levels of endophthalmitis despite increased utilisation of CCIs. However, they were using intracameral cefuroxime for prophylaxis," Dr Fine said.

The fact that there is a learning curve for the CCI suggests faulty technique may lead to poorly constructed incisions that might pose an increased risk of endophthalmitis. A recent emphasis for reducing surgical time may compound that situation as well as lead to deletion of other surgical steps important in maximising safety.

"Attention to detail is critical, and even after many years, I still perform each case as if I were a beginner, adhering to the same careful regimen to reduce endophthalmitis risk," Dr Fine said.

His technique incorporates meticulous preparation of the surgical field, selection of an effective antibiotic prophylactic regimen, and attention to a variety of features influencing incision architecture so as to promote effective endothelial pumping and sealing.

In preparing the surgical field, Dr Fine uses 5% povidone-iodine to reduce the microbial flora load, everts the lashes, drapes the Meibomian orifices, and places a wick in the lateral canthus.

He advocates placing the CCI in the temporal corneal periphery as that location neutralises lid blink forces and nearly eliminates the chances of incision distortion. For the same reason, he expressed a preference for limbal relaxing incisions over steep axis incisions for astigmatic correction.

Dr Fine emphasised the use of viscoelastic that will maintain a stable firm eye and ensure reproducible incision construction. To assure proper architecture, he said the incision should be made in a single plane in the plane of the cornea using a trapezoidal blade, which will create an incision resistant to oar-locking and tearing. The preferred dimensions are at least 2-mm for length and between 2.5 and 3.5-mm for width.

During cataract removal, Dr Fine advised surgeons to avoid grasping the superior lip of the incision with a forceps, to always insert a cannula before placing instruments within the eye, and to select bevel tip instruments introduced bevelled sides down. To avoid compromising incision architecture during IOL implantation, he cautioned against stretching the incision aggressively, recommended using a fixation ring to stabilise the eye, and noted an injector is far superior to a forceps for introducing the lens.

In closing the incision, Dr Fine routinely performs stromal hydration of both the CCI and paracentesis. His other tips were to avoid over-pressuring the eye, place a bandage contact lens if the epithelium in the roof of the incision is abraded, suture if there is any question about the incision's self-sealing nature, and always test for leakage with fluorescein dye.

For antibiotic prophylaxis, Dr Fine uses a fourth generation fluoroquinolone administered four times a day, beginning three days preoperatively and continued after surgery.

Peter J. McDonnell III MD  
pmcdonn1@jhmi.edu

Howard Fine MD  
hfine@finemd.com