

### Accreditation Statement

This activity has been planned and implemented in accordance with the Essential Areas and policies of the Accreditation Council for Continuing Medical Education through the joint sponsorship of the American Society of Cataract and Refractive Surgery (ASCRS) and EyeWorld. ASCRS is accredited by the ACCME to provide continuing medical education for physicians.

### Educational Objectives

Ophthalmologists who participate in this course will:

- Identify conditions putting patients at higher risk for inflammatory reaction after cataract surgery and the clinician impact of this reaction;
- Develop perioperative strategies to better address ocular inflammation.

### Designation Statement

The American Society of Cataract and Refractive Surgery designates this live educational activity for a maximum of 0.5 AMA PRA Category 1 Credits.™ Physicians should claim only credit commensurate with the extent of their participation in the activity.

### Claiming Credit

To claim credit, participants must visit [www.CMESupplement.eyeworld.org](http://www.CMESupplement.eyeworld.org) to review expanded educational content and download the post-activity test and credit claim. All participants must pass the post-activity test with a score of 75% or higher to earn credit. Standard internet access is required. Adobe Acrobat Reader is needed to view the materials.

CME credit is valid through December 31, 2013. CME credit will not be awarded after that date.

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### Financial Interest Disclosures

The faculty have disclosed the following financial interest relationships within the last 12 months:



**Clara C. Chan, MD**, has received a retainer, ad hoc fees, or other consulting income from: Alcon, Bausch & Lomb, PRN, and Wyeth. She has received travel reimbursement from Alcon and is a member of Allergan's speakers bureau.



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**Bonnie An Henderson, MD**, has received a retainer, ad hoc fee, or other consulting income from: Alcon and ISTA.



**Edward J. Holland, MD**, has received a retainer, ad hoc fees, or other consulting income from and is a member of the speakers bureau of: Abbott, Alcon, Bausch & Lomb, Senju Pharma, and TearScience. He has received travel reimbursement from Alcon and Bausch & Lomb, and has received research funding from Alcon.

Staff member Laura Johnson has no financial interests to disclose.

## The impact of cataract surgery stress on ocular inflammation and refractive cataract outcomes

Introduction by Edward J. Holland, MD

**W**e know it is important to address inflammation in cataract surgery, particularly to prevent cystoid macular edema (CME). In a recent online survey of 36 surgeons, 82.9% said they would lengthen the duration of anti-inflammatory therapy postoperatively in patients with known risk factors for inflammation, and 51.4% said they would use different anti-inflammatory agents. When asked about the

acceptable level of inflammation on postoperative day one, 45.7% said trace to 1+ was acceptable, and the same percentage (45.7%) said 1+ to 2+ was acceptable. Additionally, 85.7% said their primary reason for using non-steroidal anti-inflammatory drugs was to prevent CME.

Although surgeons are split on the acceptable level of inflammation, I think eliminating clinically significant inflammation, especially in premium IOL cases,

is a better approach than trying to “catch up” and treat escalating inflammation. The goal for surgeons should be prevention of CME, not treating CME. Inflammation has a greater impact on patients and on visual acuity than many surgeons think.

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## The true impact of inflammation

by Bonnie An Henderson, MD

**M**any systemic and ocular conditions can predispose patients to inflammation and edema after cataract surgery. However, it is not always predictable. Ultimately, we are concerned about three things: cystoid macular edema (CME); corneal edema; and pain/discomfort.

CME is the most serious and sight-threatening type of inflammation, but it is also the most predictable.

The incidence of clinical CME is only approximately 1% to 2% in most studies; however, the incidence of angiographic CME is probably closer to 20% to 30%. CME has an impact on postoperative vision, and the effect can be long term or short term. It can also influence patient satisfaction (Figure 1).

### Case study

The impact of corneal edema was highlighted in a recent case of mine. A 77-year-old woman was referred to me by another physician. She was hyperopic with narrow angles and had laser peripheral iridotomies in both eyes. She had moderate cataracts in both eyes, and her best-corrected visual acuity was approximately 20/60.

She underwent uncomplicated routine cataract surgery in her left eye. Due to her short anterior chamber depth, the phacoemulsification energy was probably closer to the cornea than in a typical case.

On the day after surgery, she was unhappy. She was experiencing the usual postoperative symptom of foreign body sensation, and she stated that her vision was “like looking through glass.” In fact,

her vision was not great. It was 20/200, which improved to 20/60 pinhole vision. She had diffuse corneal edema with more edema centrally.

One week after surgery, she was better (1+ corneal edema and folds) but still had foreign body sensation and was not happy with her vision.

At this time, her vision was 20/80, and her cornea had persistent edema. It took approximately two months for her cornea to clear, and she was not happy with the long, drawn-out postoperative course.

This case shows that even in standard uncomplicated surgery, some eyes will become very inflamed. This inflammation can delay visual recovery, which may delay the ability to return to normal activities.

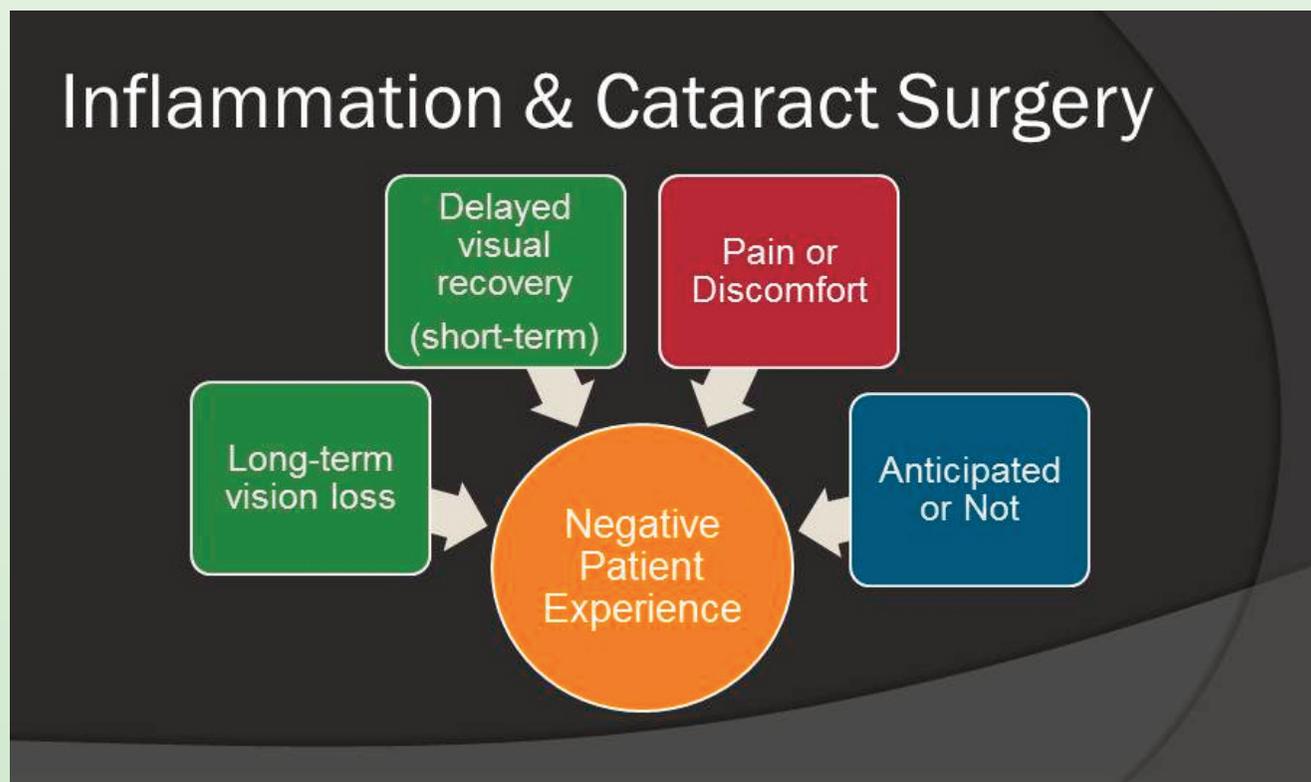


Figure 1. Inflammation after cataract surgery can ultimately result in a negative patient experience.

# Understanding surgical stress and the inflammatory cascade

by Clara C. Chan, MD

**S**urgical stress begins prior to incisions and is influenced by many factors during surgery, some of which are beyond the surgeon's control. This stress triggers a cascade of metabolic events that results in increased inflammation. Nonsteroidal anti-inflammatory drugs (NSAIDs) and corticosteroids act at different and synergistic parts of the inflammatory cascade, thus they can be effective when used in combination.

## Sources of surgical stress

There are three sources of surgical stress: the incision, epithelial trauma, and endothelium loss. Epithelial trauma is caused by dilation and anesthetic drops and the povidone iodine preparation. Additionally, there is endothelium loss. There is more endothelial cell loss if the axial length is shorter or if the phaco time is longer. The type of incision (scleral tunnel or clear corneal incisions) also plays a role in the amount of endothelium loss.

Whenever ultrasound energy is used, there is the potential for wound burn. My colleagues and I published a study to determine the risk factors for wound burn.<sup>1</sup> We found that the risk of wound burn decreased 45% with a doubling of surgical volume. Additionally, exothermic viscosurgical devices (dispersive viscoelastics) seem to create more heat production than the cohesive forms. Phaco techniques also play a role. Divide-and-conquer takes more time and

uses more energy than chopping techniques. Therefore, the risk of wound burn with divide-and-conquer is higher. Risk was not found to be related to the machine used.

Foreign substances also have an effect. For example, povidone iodine is toxic if it inadvertently enters the anterior chamber. Toxic anterior segment syndrome has been reported with the use of the generic form of trypan blue. Intracameral antibiotics can also cause surgical stress, if there is dilution error or the wrong pH level. This has been reported with the intracameral use of both cefuroxime and vancomycin.

Surgical difficulties—dense nucleus, broken capsule, retained nucleus or cortex, iris turbulence and trauma, floppy iris syndrome or zonular damage, intraoperative miosis—can also cause surgical stress.

## The inflammatory cascade

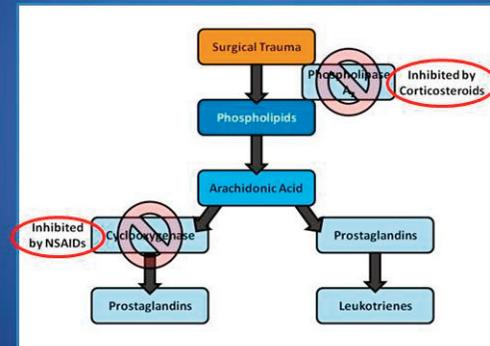
Certainly, prostaglandins are the biggest mediator. They have been shown to increase leukocyte migration, pain stimulation, miosis, vasodilation, vascular permeability, and disruption of the blood-aqueous barrier causing increased cell and flare reaction.

There are two strategies to avoid the synthesis and release of pro-inflammatory mediators: use steroids to stop it early in the cascade and use NSAIDs to stop it later in the cascade.

Steroids inhibit phospholipase A2 early on in the inflammatory cascade to

## Defensive Tactics to Prevent Inflammation

Strategies to avoid synthesis and release of pro-inflammatory mediators



Demonstration of how corticosteroids and NSAIDs can inhibit different parts of the inflammatory cascade

prevent the release of arachidonic acid from cell membrane phospholipids.

Later in the cascade, NSAIDs can act on the cyclooxygenase pathway (COX-1 and COX-2) to inhibit conversion of arachidonic acid to prostaglandins.

Certainly, a comprehensive strategy is better than just a single tactic. Because NSAIDs and corticosteroids act at different and synergistic parts of the inflammatory cascade, they can be very effective when used in combination.

## Reference

1. Sorensen T, Chan CC, Bradley M, Braga-Mele R, Olson RJ. Ultrasound-induced corneal incision contracture survey in the United States and Canada. *J Cataract Refract Surg.* 2012;38(2):227-233.

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continued from page 1

## Changing Patient Needs

<ul style="list-style-type: none"> <li>○ Then</li> <li>● Retired</li> <li>● Minimal to no driving</li> <li>● Not on computer</li> <li>● Expectation of recovery time</li> <li>● Needed glasses p/o</li> </ul>		<ul style="list-style-type: none"> <li>○ Now</li> <li>● Working</li> <li>● Independent</li> <li>● Use cell phone, computer</li> <li>● Need good functional vision as quickly as possible</li> <li>● Paying for premium IOL</li> </ul>	
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Figure 2. Our patient profile is much different than it was 30 years ago.

## Postoperative pain and inflammation

Patients with certain pre-existing conditions (diabetes and autoimmune dis-

eases) are more likely to experience postoperative inflammation.

Postoperative pain can range from a foreign body sensation to moderate to severe pain. A study surveyed 306 patients

about their pain immediately after cataract surgery.<sup>1</sup> Interestingly, 37% of those surveyed had mild to moderate pain in the recovery room immediately postoperatively, and the postoperative pain was the most significant predictor of how satisfied they were with their care. Postoperative pain was associated with low ratings of the quality of the surgical experience.

Today, speedy visual recovery is more important than ever. Compared to 30 years ago, people are living longer and working longer, everyone has a cell phone, and everyone uses a computer, so patients require fast visual recovery (Figure 2).

Many people have unrealistic expectations because they have heard from friends that cataract surgery is not a big deal, they will see well immediately after surgery, and there should not be any pain. If the patient's experience is different than this scenario, he or she is often convinced that something went wrong.

In summary, corneal edema is unpredictable and can have an effect on

cataract patients' postoperative recovery. Postoperative surgical pain is common, and even low levels of pain negatively affect patients' perceptions of their surgery.

## Reference

1. Fung D, Cohen MM, Stewart S, Davies A. What determines patient satisfaction with cataract care under topical local anesthesia and monitored sedation in a community hospital setting? *Anesth Analg.* 2005;100(6):1644-1650.

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# Perioperative strategies to prevent inflammation

by David A. Goldman, MD

**A**ny inflammation reduces patient satisfaction, so our goal should be to eliminate, not just reduce, inflammatory side effects of cataract surgery. We need to use the most potent therapies available and adapt a regimen to encourage compliance.

Surgeons need a multi-pronged strategy that starts with preoperative prevention. This includes the use of topical nonsteroidal anti-inflammatory drugs (NSAIDs) in high-risk cases and pulsed topical corticosteroids on the day of surgery. It is also important to use a surgical technique that minimizes trauma and a postoperative regimen that maximizes patient compliance and outcomes.

## Medication strategies

I only use NSAIDs before the day of surgery and only in high-risk patients. They are valuable if they prevent miosis and allow surgeons to avoid iris hooks. They are also useful in cases where there is a high risk for inflammation. However, I typically don't use NSAIDs preoperatively for routine cataract surgery because most patients are only willing to use one bottle of medication, and I would rather that they extend the NSAID therapy postoperatively.

I do not use steroids or antibiotics preoperatively. Steroid use without antibiotics can increase bacterial overgrowth on the ocular surface, and antibiotic use can select for resistant strains preoperatively.

## My regimen

On the day of surgery, patients receive NSAIDs in the preoperative area. Patients receive one drop of difluprednate in the operating room at the end of the case and another drop in the recovery area. I then instruct them to instill another drop when they get home. This pulsed dose helps their eyes to be clear and comfortable by dinner time.

Postoperatively, patients use difluprednate once a day in the morning and nepafenac once a day in the evening. If patients have corneal edema on postoperative day one, I give them an extra drop of difluprednate in the clinic.

Typical postop regimens include a tapering dose of steroids over several weeks and an NSAID regimen until the

bottle is gone. Patients appreciate the ease of my regimen because it is one drop in the morning and one drop in the evening for the entire course of treatment. I think all patients benefit from a less frequent dosing regimen. They can leave their drops at home and not be concerned about it during the day.

There are advantages and disadvantages to all of the currently available steroids. However, only difluprednate and loteprednol are available as emulsions. Steroids that are available as suspensions must be shaken before use, and studies have shown that, even when shaking the drops, the dose is variable. Some doses are 50% of the label claim, while other doses are 200% of the label claim. In contrast, an emulsion will have the same amount of medication every time.

All NSAIDs can have corneal toxicity. One of the biggest concerns with NSAIDs is keratitis, and this may be due to the analgesic effect that the NSAID has on the ocular surface. I prefer to dose the NSAID in the evening before patients go to sleep so that their eyes are closed after instillation.

The advantage of using both a steroid and an NSAID is the synergistic effect on the inflammatory pathway. Because of this synergistic effect, we are able to use less of each medication, reducing the chance of an IOP spike and keratitis, respectively. Additionally, steroids and NSAIDs are more effective than steroids alone in preventing CME, and preventing CME is much better than treating CME in terms of visual outcomes.

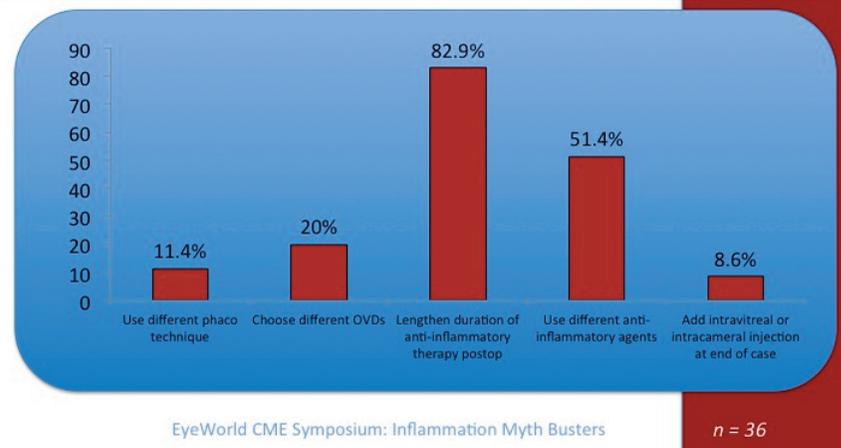
## Surgical technique

Surgical technique is also important. We want to minimize phaco energy. We want to try to keep the phaco tip away from the endothelium as much as possible because it's not just how much energy is used but where it is being used. If a patient has endothelial compromise, a soft-shell technique is very effective, and it is important to make sure to remove all of the lens material.

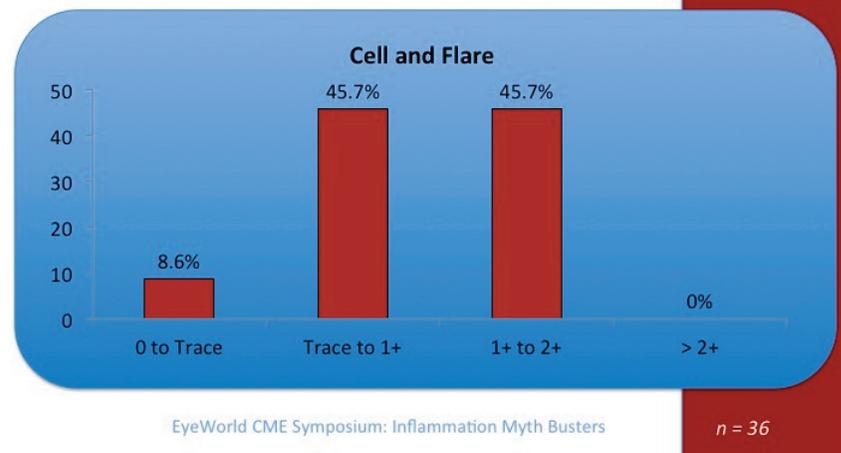
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# Data from a survey of pre-registrants to this ASCRS inflammation symposium

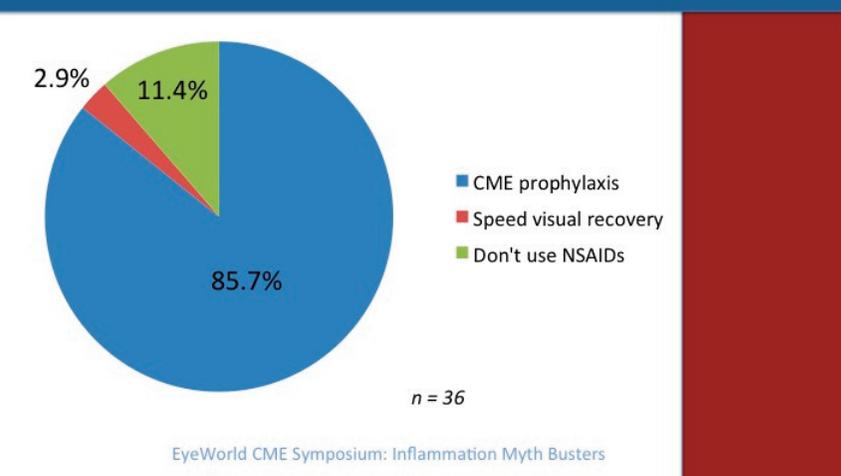
## What do you alter in cases with known inflammation risk factors?



## What is an acceptable level of inflammation on postop day 1?



## What is the primary reason you use NSAIDs after cataract surgery?



## CME Questions (Circle the correct answer)

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- 1. According to Dr. Henderson, the incidence of clinical CME is approximately 1-2%; however the incidence of angiographic CME is closer to:**
  - a. 5-10%
  - b. 10-20%
  - c. 20-30%
  - d. >30%
- 2. Studies have shown that the dosing after shaking suspension steroids is consistent.**
  - a. True
  - b. False
- 3. According to a study surveying cataract patients, what was the most significant predictor of their satisfaction with care?**
  - a. Visual acuity in recovery room
  - b. Postoperative pain
  - c. Length of visual recovery
  - d. Ability to read cell phone easily
- 4. Which of the following are the benefits of using a steroid and NSAID together to address the inflammation pathway?**
  - a. Less medication used
  - b. Reduce the chance of an IOP spike and keratitis
  - c. Increase the likelihood of preventing CME
  - d. All of the above

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