

Cataract surgery: The most common



Sri Ganesh, MD



Nick Mamalis, MD



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Graham Barrett, MD



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“Today, cataract surgery is refractive surgery,” said **Sri Ganesh, MD**, chairman, Nethradhama Superspeciality Eye Hospital, Bangalore, India. The availability of newer technologies, from delivery systems to lenses, he said, has led to an increase in patients’ expectations. “Patients expect very good uncorrected vision and freedom from glasses after cataract surgery.”

Dr. Ganesh chaired a lunch symposium sponsored by Hoya Surgical Optics (HOYA Corporation, Tokyo) at the 26th APACRS Annual Meeting in Singapore focusing on refractive cataract topics.

While surgeons need to be comfortable with all the new technology, he said, safety is foremost. Surgeons need to be attentive to issues, such as postoperative inflammation, that affect outcomes and, ultimately, the ability to meet patients’ increasingly high expectations.

Toxic anterior segment syndrome (TASS) is therefore a topic that cannot be ignored. According to **Nick Mamalis, MD**, professor of ophthalmology, John A. Moran Eye Center, and director, Intermountain Ocular Research Center, Salt Lake City, TASS is acute, sterile postoperative inflammation. “What sets TASS apart from endophthalmitis is TASS occurs immediately after surgery,” said Dr. Mamalis. “Usually cases of TASS occur anywhere from 12 to 48 hours after surgery.”

Clinically, TASS is characterized by diffuse limbus-to-limbus corneal edema—this distinguishes the condition from more focal inflammation resulting from incisions or localized stress from instruments during surgery. Clinical findings may also include increased cell, increased flare, hypopyon formation, and even fibrin on the surface of the iris and in the anterior chamber.

Notably, TASS can potentially damage the iris and trabecular meshwork, leading to fixed, dilated pupils that don’t constrict well to light, or even, in the worst cases, secondary glaucoma, highlighting the importance of not just identifying and treating the condition as soon as it occurs, but preventing it from occurring in the first place.

“It’s critical to understand what can cause TASS and how we go about preventing it,” said Dr. Mamalis. The list of potential causative factors, he added, includes just about anything: “Anything that gets into the eye during cataract surgery or after cataract surgery is potentially a source of inflammation.”

Over the years as co-chair of the ASCRS TASS Task Force, Dr. Mamalis has seen outbreaks caused by a number of different factors, including endotoxins in balanced salt solution resulting from contamination during the manufacturing process, preservatives such as benzalkonium chloride in ophthalmic solutions, stabilizing agents such as sodium bisulfite and metabisulfite in epinephrine solutions, improperly mixed intracameral antibiotics and anesthetics, topical ointments used when a wound leak is present, and remnant OVD, especially in reused small-bore cannulas and instrument tips.

In a study of 1,500 cases of TASS out of 69,000 concomitant cataract cases, Dr. Mamalis and his colleagues found the most common factor involved with TASS to be poor instrument cleaning and sterilization—inadequate flushing of handpieces, use of enzymatic cleaners and detergents. “It’s critical that we clean and process our instruments properly,” he said. “Try and use single-use cannulas if you can; try not to reuse cannulas if you can avoid it.”

Another way surgeons can minimize the risk of TASS and other complications during surgery is by using preloaded injectors to implant IOLs after cataract

surgery. With preloaded injectors, said **Tetsuro Oshika, MD**, professor and chairman, Department of Ophthalmology, Faculty of Medicine, University of Tsukuba, Japan, IOL implantation is consistent, easy to manipulate, and safe—“Damage [to the lens] is avoided, and there is less chance of endophthalmitis and TASS, theoretically,” he said.

Dr. Oshika favors Hoya’s iSert preloaded IOL delivery system, calling it “the best preloaded product in the market.” The delivery system, he said, allows surgeons to implant IOLs through a 2.2-mm scleral tunnel incision; a screw-type plunger ensures very smooth, controlled implantation, avoiding the “explosive” IOL implantation that can occur with push-type plungers.

In addition, the inner surface of the system’s IOL cartridge is coated with hydrophilic macromolecules that provide lubrication such that, according to Dr. Oshika, there is no noticeable difference whether you fill the cartridge with viscoelastic material or plain balanced salt solution.

Dr. Oshika also highlighted the advantages of Hoya’s IOL design, which features soft PMMA haptic tips that aid visualization and prevent haptic-optic adhesion, and an optic material that stays “crystal clear for many years”—making the lens suitable, he said, even for pediatric cases.

In terms of the optic itself, Hoya has introduced another innovation with a special line of IOLs. “Optimum quality vision is not just about resolution,” said **Graham Barrett, MD**, clinical professor, Lions Eye Institute and Sir Charles Gairdner Hospital, Nedlands, Western Australia. “Based on this concept, Hoya has produced a monofocal lens with an extended depth of focus.

“This lens has a unique aspheric design that produces a controlled amount of positive spherical aberration, constant for each lens power,” he added. “This provides about 1 D additional depth of focus.” The lens is manufactured using blue light-absorbing material and is compatible with the iSert delivery system.

Dr. Barrett began a study of the extended depth of focus (EDF) lens in February 2012 together with colleague **Yokrat Ton, MD**. They implanted the lens in 59 eyes (42 patients) in two clinical scenarios: one group with modest monovision, and another where emmetropia was targeted in both eyes. At the time of the symposium, all patients had been followed up for three months.

Patients in the monovision group achieved good near and excellent intermediate vision, and the distance vision was well preserved, with 6/9 Snellen equivalent. The emmetropic patients had excellent distance and good intermediate vision, and while their near vision was better than expected, they still required modest monovision to read unaided.

Corrected acuity was excellent for both groups, and within the first week Dr. Barrett said they realized that the quality of vision was not compromised.

Most interesting were the results of defocus curve testing, performed with distance correction in place and the addition of lenses in ± 0.5 D increments to demonstrate enhancement, if any, in the depth of focus.

In 18 patients acting as their own matched controls—a negative aspheric in one eye and an EDF lens in the other—defocus curve testing revealed an enhanced depth of focus equivalent to an additional one and a half lines of unaided near vision with the EDF lens. To provide patients receiving IOLs with better reading vision, traditional monovision is often used. However, said Dr. Barrett, overlap between the eyes is minimal, and some patients have problems adjusting to anisometropia. “That’s why I have always been an advocate of modest monovision,” he said. “By reducing the difference between the two eyes, aiming for -1.25 D, you do have some overlap between the two eyes.”

refractive procedure

Implanting an EDF lens in one eye, he said, does indeed extend the depth of focus, improving the vision to about 1–1.5 lines of additional acuity. “If the eye is targeted for modest monovision, there’s a greater overlap between the two eyes and an opportunity for blended vision.”

“This is even more apparent if you use an EDF lens in both eyes, where the overlap is substantial,” he added. “This then provides an extended depth of focus, less spectacle dependence, and better opportunity for binocular vision.”

The binocular defocus curve for two eyes implanted with EDF lenses, he said, is very much like the normal accommodative response. “It’s quite distinct from the defocus curve that you have with a diffractive multifocal, and the biggest difference is in the intermediate vision.”

Compared with multifocal IOLs, he said, patients receiving monovision with the EDF lens can expect perfect clarity at all levels—near, intermediate, and distance—“perhaps with a bit of blur at 40 cm, but that can be improved with glasses if required.” In addition, the extended depth of focus makes the lens less sensitive to small errors in prediction, especially compared with multifocals.

Dr. Barrett and his colleagues also tested reading acuity and stereoacuity, with results that were not significantly different and in some cases—e.g., reading for the EDF lenses versus corneal inlays—even better than those with other lenses and devices currently being used to treat presbyopia.

Overall, the results of Dr. Barrett’s study suggest that “the Hoya EDF monofocal lens should be considered an alternative in our universe of multifocal, monofocal, and accommodative lenses because it is indeed possible to extend the depth of focus, provide greater spectacle independence, and maintain optical quality.”

Of course, good outcomes also require optimal correction of refractive error—including astigmatism. “About 30% of patients have more than 1.0 D of keratometric astigmatism,” said **Geoff M. Whitehouse, MD**, senior consultant ophthalmologist, Manning Base Hospital and Gloucester Soldiers’ Memorial Hospital, New South Wales, Australia. “You need 0.5 D or less of refractive astigmatism to be truly spectacle independent.”

Dr. Whitehouse cited a 2013 study by Mencucci et al.¹ in which the visual refractive and aberrometric results of emmetropic patients receiving monofocal lenses were compared with those of patients with astigmatism who received toric IOLs. “Not only did [Mencucci et al.] show that the aberrometric side of things was very good, but the patients also reported that their quality of life was significantly improved if they had less astigmatism,” said Dr. Whitehouse.

Today’s toric lenses, he added, are “safe, they’re predictable, completely reversible, very easy, and very quick. At most they add 2–3 minutes to a case.”

In his clinic, Dr. Whitehouse routinely uses a toric IOL in patients with more than 0.75 D of astigmatism. “Our target is less than or equal to 0.5 D of residual refractive astigmatism,” he said.

When Hoya’s toric IOLs first came out, Dr. Whitehouse said they reached target in 86% of cases with more than 1.0 D of astigmatism; 93% had less than 0.75 D of residual refractive astigmatism.

There are, however, contraindications—irregular or unpredictable corneal astigmatism and capsular bag instability among them.

Once you’ve decided on using a toric, there remains the matter of selecting what toric IOL to use. Dr. Whitehouse suggested there may be an advantage to hydrophobic acrylic materials, being the stickiest and therefore theoretically allowing less rotation, providing more stability than other materials. Current haptic designs, whether plate or loop, do not seem to present any problems. “You need to look at other lens issues when you’re deciding on the lens: the wound size you use, loading reliability, and material reliability,” said Dr. Whitehouse.

Implantation at present, he added, is in a practical sense a two-stage procedure. “You need to mark the horizontal axis with the patient sitting up prior to surgery, and then lie them down and use something like a Mendez gauge intraoperatively.”

There are also automated systems available to help with marking, but these are expensive and not in common use, said Dr. Whitehouse.

Surgeons should be wary of calculation errors. “You can have problems with your corneal measurement,” said Dr. Whitehouse. “You need to be consistent whether you use manual, IOLMaster [Carl Zeiss Meditec, Jena, Germany], or

topographic keratometry for your preoperative measurements, and you need to look at the calculator you’re using and how it calculates.” Other factors to consider include anterior chamberdepth and posterior corneal curvature.

Accuracy is critical: Every degree that a toric lens is rotated off the correct axis equates to a 3.3% loss in the final effect. “The closer you get to where you’re aiming, the better,” said Dr. Whitehouse.

All the advances described thus far illustrate the change taking place in the field of cataract surgery—it is becoming the most common refractive surgery on the market, according to **Rohit Shetty, MD**, vice chairman and senior consultant, neuro-ophthalmology, refractive surgery, and electrophysiology services, Narayana Nethralaya, Bangalore, India.

According to Dr. Shetty, standards and expectations for cataract surgery these days are no different from those for LASIK. But while the statistical parameters of efficacy, predictability, safety, and stability might match between the two procedures, patient expectations can be completely different from realistic expectations. “That sometimes is very difficult to match,” he said. “That’s where the challenge is.”

Being primarily interested in optics, Dr. Shetty has tried to “decode” the unhappy patient.

Dr. Shetty believes that the perfect cataract and refractive surgery—the kind that makes patients happy—begins with diagnostics. “Over time, everybody becomes good with the surgery, but what ultimately helps you to get the optimal results is the diagnostics,” he said.

When analyzing the error that needs correction—essentially, seeking the origin of the visual complaint—Dr. Shetty said that aberration can be divided into corneal, lenticular, and total (involving the entire visual system). “It’s always important to know the culprit,” he said. “Once you know that then the rest becomes easy.”

For example, focusing on the corneal level, spherical aberration can change the axis, cylinder, and sphere of the patient; in this case, the surgeon’s measurements are affected by the axis of the pupil and the axis of the refractive error. “As the pupil size changes, the whole refraction changes,” he said. “This is what induces more of a night myopia ... this happens when the patient has more of a spherical aberration on the corneal surface.”

The problem is compounded when a patient who has had previous LASIK surgery comes in a decade or so later with cataract. In these cases, Dr. Shetty is exploring the possibility of customizing the cornea—performing topography-guided surface ablation not to correct the refractive error but to make the cornea more regular—before implanting an IOL.

“Why we need to do that is because [in] these patients, the ablation and the amount of aberration is so high, so they will end up with a problem,” said Dr. Shetty.

“Ultimately, all this brings us to one thing: The patient should see the benefit,” he concluded. “That should be the ultimate goal.”

Reference

1. Mencucci R, Giordano C, Favuzza E, Gicquel JJ, Spadea L, Menchini U. Astigmatism correction with toric intraocular lenses: Wavefront aberrometry and quality of life. *Br J Ophthalmol*. 2013 May; 97(5):578-82.

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