A FOCUS ON ANGLE CLOSURE
CLEAR LENS EXTRACTION FOR ANGLE-CLOSURE GLAUCOMA

by Dr Ivan Goldberg
Sydney, Australia

What is the value of clear lens extraction in angle-closure glaucoma? It is effective and safe, argued Dr Clement Tham (The Chinese University of Hong Kong) in a Point-Counterpoint debate during Glaucoma Sub-Specialty Day. As lens thickness and anterior location contribute directly to the closure, even if clear, such lenses are pathological.

Lens removal reduces both intraocular pressure (IOP) and reliance on medications significantly, the benefit persisting for many years. Pupil block is eliminated, as is risk of angle closure. Failure to extract leads to cataract with raised and fluctuating IOP, and damages outflow pathways with long-term adverse consequences and higher risks for later cataract extraction. Failure to extract leads to increased drug costs and even glaucoma surgery. Whenever surgery is considered in angle-closure glaucoma, lens extraction should be the first procedure, said Dr Tham.

Not so, countered Eye on AAO 2015 correspondent, Dr Tin Aung (National University of Singapore). While there are many mechanisms for angle closure,1 lens extraction only removes pupil block. Further, as what constitutes a “clear lens” is not standardized, many lenses may be removed unnecessarily. Such surgery is more risky than “routine” phacoemulsification, reminded Dr Aung, and at this time there is insufficient data to support its effectiveness and safety. In particular, there have been no cost-effectiveness assessments.

Reference

PERSPECTIVE

Removal of a visually significant cataract offers both visual and IOP benefits in eyes with angle closure. Benefits/risks in similarly affected eyes with clear lenses are not straightforward. These situations require patient involvement in the decision and need to be individualized.

Reference
A FOCUS ON ANGLE CLOSURE
SPOTLIGHT ON ANTERIOR SEGMENT EMERGENCIES: TREATMENT FOR ACUTE PRIMARY ANGLE CLOSURE

by Dr Tin Aung
Singapore

Acute primary angle closure (APAC) is an anterior segment emergency that requires timely management in order to prevent visual loss.

The conventional management of APAC is as follows:

1. First, lower the intraocular pressure (IOP) with systemic (eg, hyperosmotic agents, carbonic anhydrase inhibitors) and topical medical therapy. Laying the patient supine may also be helpful.

2. Once the IOP is lowered, pilocarpine can be used to constrict the pupil from its mid-dilated state and topical steroids added to reduce inflammation.

3. If the cornea remains hazy and oedematous, alternative strategies to clear the cornea include:

   a. Corneal indentation, which can mechanically open the angle.

   b. Anterior chamber paracentesis with a needle or blade, which may allow controlled drainage of aqueous from the anterior chamber. However, the procedure may be technically challenging with risk of complications and, thus, must be undertaken with caution.

   c. Argon laser peripheral iridoplasty, which involves applying laser burns to the peripheral iris, causing contraction of the iris stroma and mechanically pulling the angle open. In a randomized controlled trial, iridoplasty was found to lower IOP better than medical therapy at 15, 30 and 60 minutes after the institution of treatment for APAC.1

   d. Scraping of the oedematous corneal epithelium with a needle or blade, which can create an area of clear cornea through which a laser iridotomy may be attempted.

4. Definitive treatment of APAC is aimed at relieving pupil block by laser peripheral iridotomy (LPI) or phacoemulsification. Recent trials have found a lower incidence of chronic glaucoma in APAC eyes that underwent phacoemulsification compared to LPI.2,3 However, as phacoemulsification can be difficult to perform in such eyes, with risk of complications, the surgery should only be attempted by experienced surgeons.

References

A FOCUS ON ANGLE CLOSURE

ANGLE CLOSURE: LASER IRIDOTOMY

by Dr Ivan Goldberg

Sydney, Australia

Even though it is less common than open-angle glaucoma, primary angle-closure glaucoma (PACG) causes 50% of global blindness; over half of affected patients are in East Asia, reported Dr Shan Lin on behalf of Dr Mingguang He (University of Melbourne) at the Glaucoma Sub-Specialty Day. Laser iridotomy (LI) is the preferred initial treatment. When should it be done? To try to break an acute angle closure crisis and also prophylactically to widen a narrow opening, even though some angles may remain closed.

Where should it be located? To minimize risk of post-laser ghosting, place the iridotomy either superiorly beneath the upper lid or temporally, avoiding the superior tear meniscus.

How large? Patency is essential: long-term patency depends on size, said Dr Lin. 150 microns, he said, would be likely to persist.

PERSPECTIVE

The primacy of LI in the management of angle closure and angle-closure glaucoma is undoubted. Identifying angle closure suspects is a major challenge, but when identified, an equal challenge is recognition of which individuals would benefit from prophylactic LI – there are too many people with narrow angles to all receive LIs and, even though safe, an LI has possible complications. Ongoing research, such as the Zhongshan Angle-closure Prevention (ZAP) Study, should help us to answer these challenges.

References
CORNEAL BIOMECHANICS

by Dr Tim Roberts

Sydney, Australia

Dr William Dupps (Cleveland Clinic) presented the keynote lecture during Refractive Surgery Sub-Specialty Day and addressed the important question, “How will leveraging biomechanics improve the future of corneal and refractive surgery?”

Currently there is a precision gap in the clinical pathway from ‘high-precision workup’ to ‘decision/treatment algorithms’ to ‘high-precision treatment delivery.’ Highly precise pre-operative workup (optical and refractive characterization; corneal sharp imaging; and corneal sub-layer imaging) and treatment delivery (wavefront- and topography-informed algorithms; alignment registration and tracking; and sub-micron pulse precision) is achievable. However, decision-making and treatment algorithms currently lack this precision. They do not leverage all patient-specific structural features; are unavailable for new, combined and re-treatments; and do not leverage Big Data.

“Simulation-based medicine using advanced corneal biomechanics will allow virtual individual trials and the possibility of highly personalized and exceptionally precise surgical planning.”

Dr Dupps explained that the cornea is an ideal target for simulation-based planning and treatment due to the exquisite structure-function relationship, accessibility for measurement, and clinical applications (refractive surgery, keratoconus, cross-linking and presbyopia). He argued that current paradigms for optimizing outcomes are retrospective, probabilistic and population-based and that new paradigms reflecting a better understanding of biomechanics will be prospective, deterministic and personalized.

This should lead to 1) safer surgery, with enhanced preoperative screening by quantifying risk on a structural continuum, and the availability of information-driven, computationally assisted information to help rule patients in or out; and 2) more predictable and optimized outcomes, with virtual prediction of mechanical and optical outcomes for a broad array of existing procedures and de novo applications (especially where nomograms fail).
JACKSON MEMORIAL LECTURE: USING BIG DATA TO MAKE DISCOVERIES ABOUT CATARACT SURGERY

by Dr Ivan Goldberg
Sydney, Australia

In the 2015 Jackson Lecture, Dr Anne Coleman (UCLA Stein Eye Institute) set out how use of Big Data could impact positively on clinical outcomes.¹ Using cataract surgery as her example, Dr Coleman reminded us that results have changed from couching with a 22% vision of 6/60 or better to 2013 European data of 99%, 6/60 or better and 61%, 6/6 or better. She asked why is 6/6 not achieved more often?

One reason is endophthalmitis. Because it is rare (<1/1,000), only a tool like Big Data allows understanding with observation and tracking, with a broad range of parameters (eg, visual fields, disc imaging) and in real time.

While US Medicare data for 2010–2013 revealed an endophthalmitis rate of 0.14%, for 2013–2014, the Academy’s IRIS Register revealed 0.08%; why the difference? Different populations (IRIS group younger), ascertainment bias (complications possibly handled by non-IRIS–registered clinicians) and lack of laterality in Medicare (was the endophthalmitis in the operated eye?).

Cautions: associations are demonstrated, not causation; interpreters can correct only for recorded confounders; and clinical insight is essential for valid interpretation. Data breaches are possible.

Knowledge is power, declared Dr Coleman. Appropriate use of Big Data allows us to improve our care immediately. It is a tool: it is up to us how to use it.

“Currently in the IRIS Registry, we can see how we are doing compared to national benchmarks. This information is provided confidentially to us and it is a powerful tool for an ophthalmologist to determine if our practice and surgery are consistent with others in the United States.”

PERSPECTIVE

If the results from Big Data are interpreted with appropriate care and integrated with results from other research strategies (randomized controlled trials, other big databases), its use offers great promise for the improvement of clinical outcomes.

Reference

A DAY IN THE CLINIC:
A PATIENT WITH CATARACT, ELEVATED IOP AND MODERATE VISUAL FIELD LOSS ON MULTIPLE MEDICATIONS:
PHACOTRABECULECTOMY, OR CATARACT SURGERY AND TRABECULECTOMY SEPARATELY?

by Dr Prin Rojanapongpun
Bangkok, Thailand

For discussion was a case of a 79-year-old with primary angle-closure glaucoma presenting with elevated intraocular pressure (IOP) of 28-44 mmHg OS, on topical prostaglandin, brimonidine and fixed dorzolamide/timolol with 2+ nuclear sclerosis and 0.65 c/d ratio. The right eye had a history of central retinal vein occlusion (CRVO) and multiple surgeries with Count Fingers (CF) vision.

Dr Vikas Chopra (University of California, Los Angeles) proposed phacotrabeculectomy for a definitive long-term IOP control and to prevent post-op IOP spikes on a functionally monocular eye. He pointed out that ‘very high’ IOP indicates the need for a concurrent glaucoma procedure, since IOP lowering achieved by cataract surgery alone is simply not enough.1 Though there may be short-term equivalency in IOP control, phacotrabeculectomy achieves lower IOP over time2 with significantly fewer glaucoma medications needed.3

Dr Lama A Al-Aswad (Columbia University) countered that phaco alone will better widen the angle4 and avoid the additional complications of trabeculectomy. Based on a Cochrane review of nine randomized controlled trials (RCTs), phacotrabeculectomy decreases IOP by only 1.62 mmHg and results in a reduction of one medication.5

The audience response vote after the debate was 51.1% for phacotrabeculectomy versus 48.9% for separate cataract surgery and trabeculectomy.

References

PERSPECTIVE

Controversy over phacotrabeculectomy will go on as long as we do not have good enough evidence that segregates the different groups of glaucoma patients with specific characteristics. The available RCTs may not tell us what to do with the individual patient we have to deal with. Specific considerations, like one functional eye, history of CRVO in the fellow eye, and high IOP despite maximum medication, must be composed and a customized decision made. Oftentimes, having patient and family informed and involved in the decision-making is the way to go.
FEMTOSECOND LASER-ASSISTED CATARACT SURGERY (FLACS) – CONTINUING EVOLUTION AND IMPROVEMENT

by Dr Ronnie George
Chennai, India

Eye on AAO 2015 correspondent, Dr Tim Roberts (Vision Eye Institute, Sydney), presented data on anterior capsule (AC) tear rates during FLACS in a large prospective series of 3,842 consecutive cases performed at the Vision Eye Institute. Rigid curved patient interface was used in 734 cases and the SoftFit™ (Alcon) in the subsequent 3,108 cases. A break in the AC rim occurred in 0.2% of all cases, but was significantly lower with the SoftFit™ (0.08%; p=0.007).

Concerns have been raised regarding the safety of laser-cut capsulotomies following one study which found a high rate of AC tears, which led the authors to hypothesize that there may be a germinative weakness in a laser-cut capsule.1 However when we look at studies such as that by the Moorfields group2 and Dr Roberts’ group,3-5 these groups with very large numbers aren’t finding these rates of AC tears, but rather rates of around 1 per 1,000. Dr Roberts’ group uses the LenSx system and the Moorfields group uses the Catalys, which would suggest that the previous results are not platform-specific, but related to individual laser settings and surgical technique.

We can take comfort that, with advances in technology and surgical technique, large prospective studies now demonstrate accurate centration, sizing and circularity, with a very low rate of AC tears following femtosecond laser capsulotomy, and no clinical evidence to suggest intrinsic weakness of the capsulotomy, prolonged learning curve, or safety concerns for capsular integrity.

References

“From a surgeon’s perspective, the important question is not whether there are ultrastructural differences between manual and laser-cut capsulotomies, but what, if any, are the clinical implications of these differences?”

Laser-cut capsulotomy (Image courtesy of Dr Tim Roberts)

PERSPECTIVE

Dr Tim Roberts

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EVALUATION OF VISION-SPECIFIC QUALITY OF LIFE IN GLAUCOMA PATIENTS USING OCT

by Dr Tin Aung
Singapore

Glaucoma is the leading cause of irreversible blindness worldwide. The disease causes progressive visual field loss and, thus, the treatment of glaucoma is aimed at slowing this visual loss, in order to preserve patients’ quality of life (QOL). Currently, the diagnosis and monitoring of glaucoma relies on visual field assessment by standard automated perimetry, but such visual field testing is subjective and may be challenging for many patients. Tracking a patient’s visual field and vision-related QOL based on non-invasive structural imaging tests, such as optical coherence tomography (OCT), would, thus, be advantageous.

“OCT evaluation will become a useful addition to visual field testing in predicting the vision-related QOL of glaucoma patients.”

In this poster, Dr Shiho Kunimatsu-Sanuki (Tohoku University) and colleagues evaluated vision-related QOL in glaucoma patients using OCT scanning (3D OCT 2000, Topcon) of the macula as assessed by measurement of the ganglion cell complex (GCC) thickness. Vision-related QOL was evaluated by the 25-item National Eye Institute Visual Function Questionnaire (VFQ25) score. The authors devised a new method to scan a wide area of the GCC in the macula that corresponds to the test points of the Humphrey visual field 24-2 program.

The study results showed that the OCT parameters were accurate predictors of vision-related QOL in glaucoma patients; of note, driving and mental health as assessed by VFQ25 were strongly correlated with GCC thickness. Ophthalmologists should be aware that changes in OCT macula parameters may soon be a surrogate marker of both glaucoma damage as well as patients’ vision-related QOL.
NANOTECHNOLOGY IN THE DIAGNOSIS AND TREATMENT OF OCULAR DISEASES

by Dr Ivan Goldberg
Sydney, Australia

Nanotechnology is science on the scale of 1 to 100 nanometers, akin to intracellular structures. In ophthalmology, it is being explored for drug delivery systems and for glaucoma, macular degeneration and tumors.

Pharmacologically, Dr Uday Kompella (University of Colorado Denver) explained that nanosystems promise delayed clearance, sustained drug delivery (nanoparticles, dendrimers, polymers and liposomes), and enhanced cell/tissue uptake. Chemical engineering of these varying modalities varies solubility, penetration, tissue distribution and duration of action.

For glaucoma, Dr Marianna Foldvari (University of Waterloo) spoke to non-viral (safer than viral) gene delivery systems for neurotrophic factors to support retinal ganglion cells with neighbouring cells (Muller’s cells, astrocytes) also benefitting. In her laboratory, gemini nanoparticles (twin particles joined by a spacer molecule) – injected or, with modification, even applied topically – reach the retina in therapeutic concentrations. Gene expression in target cells leads to neurotrophic factor release.

Dr William F Mieler (University of Illinois) outlined his team’s work with microsphere hydrogels to prolong delivery of anti-VEGF agents from the current 4–6 weeks’ duration through to 4–6 months. This changes the highly pulsatile nature of current drug delivery (over- then under-concentrations) to a more steady therapeutic level.

With multifunction nanoparticles, said Dr Emmanuel Y Chang (Beaumont, TX, USA), cellular-sized artificial photoreceptors become feasible (allowing vastly improved artificial eye visual resolution) as well as artificial free-radical scavengers, which could prove more protective of retinal cells than biological systems.

PERSPECTIVE

The potential of nanotechnologies diagnostically and therapeutically is unlimited. We are in an exciting evolution in laboratory science with translational research promising reasonably rapid clinical applications. Ensuring safety will be an overriding priority.