APACRS
ASIA-PACIFIC ASSOCIATION OF CATARACT & REFRACTIVE SURGEONS
30th Anniversary - 1987 - 2017

Principles of
Preferred Practice in
CATARACT SURGERY

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The Asia-Pacific Association of Cataract & Refractive Surgeons (APACRS) was founded in 1987 to facilitate the dissemination of rapidly accumulating knowledge in the fields of cataract and refractive surgery in the Asia-Pacific.

Thirty years on, through the annual meetings held in in conjunction with other regional organizations and through publications such as *EyeWorld Asia-Pacific* news magazine, the APACRS continues to be the leading forum for the region, serving the cataract and refractive surgery needs of over half the world's population.

FOREWORD

Cataract surgery is the most widely performed surgical procedure. Modern cataract removal techniques, lens implants, and investigations have developed leaps and bounds over the years and we are at a point where cataract surgeons are faced with a wide and often bewildering range of choices in preparing a patient for and actually carrying out the surgery. Even those of us working in major centers with access to international conferences and continuing medical education seminars are challenged in making these choices, what more the cataract surgeon in a remote rural area?

The original Principles of Preferred Practice for cataract surgery was written in 2006, more than a decade ago, and clearly needed updating. In conjunction with the 30th anniversary of the APACRS, we decided to update this evidence-based preferred practice pattern guide and distribute it widely in Asia. We believe this will be useful to cataract surgeons throughout Asia in planning and carrying out cataract surgery and this can only be better for our patients.

My grateful thanks to the editorial team especially Dr. Vaishali Vasavada for their sterling efforts in doing this work. I also acknowledge the education grant provided by Zeiss in supporting this publication.

We hope that you and your patients will benefit from this endeavor.

Ronald Yeoh
President, APACRS

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CONTENTS

STATEMENT OF INTENT

The Principles of Preferred Practice (PPP) guide was developed for ophthalmologists to provide up-to-date and evidence-based information on the management of cataracts.

Each ophthalmologist is ultimately responsible for the management of his unique patient on the basis of the clinical data and the diagnostic and treatment options available.

1 INTRODUCTION

1.1 Epidemiology of cataract

Despite advances in public and private healthcare all over the world, cataracts remain as one of the leading causes of blindness. According to data from the World Health Organization (WHO), cataract accounts for 33% of blindness globally. Furthermore, according to several reports from different countries in Asia, cataracts and uncorrected refractive errors are the two leading causes of blindness in most countries.

Cataract also remains the leading cause of vision impairment in most countries in the Western Pacific Region. However, in countries such as Japan and Australia, age-related macular degeneration (AMD) is the leading cause of blindness.[1]

Although the prevalence of cataracts is difficult to summarize, due to varying definitions and non-standardized examination techniques, the Tanjong Pagar Survey in Singapore reported a cataract prevalence of 35% in Chinese people 40 years and older.[2] Between 20 and 30% of people aged 65 to 74 years will develop lens opacities over a 5-year period. According to the U.S. National Health and Nutrition Survey, the prevalence of decreased vision (<6/9) for people aged 45 to 74 years was 14.7%.[3]

Today, cataract surgery is a highly successful and cost-effective procedure, which enhances both the vision and quality of life of patients. The WHO has suggested that an annual rate of 350 surgeries per 100,000 population is a useful target to tackle the burden of cataract blindness.

With changing healthcare and lifestyle paradigms, there is a change in the way we manage cataracts. Visual acuity alone should not be used as a criterion for planning cataract surgery, since visual acuity and function do not necessarily correlate. Therefore, there is a need to review our criteria for management.

1.2 Purpose and target audience of this guide

The purpose of this guide is to assimilate available peer-reviewed evidence and clinical experience to provide preferred practice guidelines that will help clinicians across the Asia-Pacific region to standardize practices and enhance the outcome of cataract surgery. These guidelines are meant for all practicing ophthalmologists. They also focus on specific practices and problems encountered in this part of the world.

LEVELS OF EVIDENCE AND GRADES OF RECOMMENDATION

Levels of Evidence

Level	Evidence
Ia	Evidence obtained from meta-analysis of randomized controlled trials.
Ib	Evidence obtained from at least one randomized controlled trial.
IIa	Evidence obtained from at least one well-designed controlled study without randomization.
IIb	Evidence obtained from at least one other type of well-designed quasi-experimental study.
III	Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case studies.
IV	Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities.

Grades of Recommendation

Grade	Recommendation
A (evidence levels Ia, Ib)	Requires at least one randomized controlled trial as part of the body of literature of overall good quality and consistency addressing the specific recommendation.
B (evidence levels IIa, IIb, III)	Requires availability of well-conducted clinical studies but no randomized clinical trials on the topic of recommendation.
C (evidence level IV)	Requires evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities. Indicates absence of directly applicable clinical studies of good quality.
GPP (good practice points)	Recommended best practice based on the clinical experience of the guideline development group.

3 | GENERAL RECOMMENDATIONS

GPP The decision to perform cataract surgery should be made based on the clinical severity of the cataract and the degree of visual impairment of the patient.

C Snellen visual acuity alone cannot be used to plan cataract surgery. Tests such as glare and contrast sensitivity[4] may be used in specific situations to assess the visual impact of cataract in the patient. **Grade C, Level IV**

C Bilateral simultaneous cataract surgery is generally not recommended since it has the risk of bilateral blindness.[5] **Grade C, Level IV**

A Current options for cataract surgery include extracapsular cataract extraction (ECCE), manual small incision cataract surgery (MSICS), phacoemulsification, and femtosecond laser-assisted cataract surgery. Any of these techniques may be used and, if possible, the patient should be given the option to choose.[6-10] **Grade A, Level Ia**

B At least 90% of patients undergoing cataract surgery should regain a vision of 6/12 or better in the absence of an ocular comorbidity.[11,12] **Grade B, Level III**

PREOPERATIVE ASSESSMENT AND DECISION MAKING

4

4.1 When to perform cataract surgery: Timing of surgery

GPP Cataract surgery should be performed when the patient is likely to benefit from it.

In cases of mature or intumescent cataracts, cataract surgery should be undertaken as early as possible.

Generally, cataract surgery is performed when the visual acuity deteriorates below 6/12. Today, cataract surgery may be planned even at better visual acuities.[13] In these cases, specific reasons for doing so such as glare, anisometropia, monocular diplopia, loss of contrast sensitivity, and difficulty in performing tasks of daily life should be documented.

GPP Patient's functional vision should be considered, not only the Snellen visual acuity.

GPP In general, cataracts should not be operated on if the patient has no perception of light in that eye. The exceptions are when the cataract becomes intumescent or for cosmetic reasons. The poor prognosis for any visual recovery has to be made known to the patient.

In certain situations, there is justification for carrying out cataract surgery even in the presence of preexisting retinal or optic nerve pathology which may limit the ultimate postoperative visual function. In these patients, the visual field may improve but the visual acuity may not. This must be clearly explained to the patient.

Overall, it is fair to say that the surgeon should exercise clinical judgment and consider the patient's wishes as well as needs prior to deciding on cataract surgery. For example, an 80-year-old retired person may be comfortable with a vision of 6/18, but the same vision may cause difficulty with daily activities in an individual who is 35 years old and leads an active lifestyle.

4.2 Expanding indications for early cataract surgery

With new medical evidence becoming available, two new indications for early cataract removal or sometimes even clear lens extraction are being advocated:

Angle closure glaucoma/glaucoma suspect

A There is emerging evidence[14] that the crystalline lens plays an important role in primary angle closure. Removal of the clear or early cataractous lens in primary angle closure/primary angle closure glaucoma reduces the forward bulge on the iris and leads to deepening of the anterior chamber, opening up of the angles and improving the long-term control of intraocular pressure (IOP) in these eyes.[14-16] **Grade A, Level Ib**

Removal of the lens is also more cost effective than primary laser peripheral iridotomy.[17] However, the patient should be counseled regarding the risks associated with intraocular surgery.

A Early cataract surgery may be considered as initial treatment for angle closure glaucoma. **Grade A, Level Ib**

Refractive lens exchange

As patients' desire for spectacle independence both for distance and near increases, clear lens extraction with implantation of presbyopia-correcting IOLs (accommodative or multifocal) is often performed as refractive surgery. However, just like any other cataract surgery, there is a risk of complications including endophthalmitis, which should be explained to the patient. Further, since many of these patients are myopic and of a younger age, they are at a higher risk of retinal detachment following lens removal surgery.[18,19]

At this point, since there are different opinions and practice patterns, a case-by-case assessment and clinical judgment with due informed consent from the patient must be done. **Level IV**

4.3   Contraindications to cataract surgery

Although there are no absolute contraindications for cataract surgery, the following are situations in which cataract surgery might not be performed unless there is a very compelling reason to do so:

- The patient does not desire surgery (provided the cataract is not at risk of developing hypermature complications);

- The patient does not require cataract surgery;

- Spectacles or other visual aids improve vision to the satisfaction of the patient;

- The patient's lifestyle is not affected by the cataract;

- The patient's systemic condition is such that the surgical risks outweigh the potential benefits of surgery.

4.4   Assessment of cataract severity: Clinical examination and investigations

C   The assessment of the severity of the cataract should include all or some of the following, depending on the patient and his/her ocular status. Although the ophthalmologist is responsible for the examination and review of the data, certain aspects of data collection may be conducted by another trained individual under the ophthalmologist's supervision.[20,21] **Grade C, Level IV**

4.4.1 Vision assessment

GPP   A documented visual acuity assessment on the Snellen/logMAR/decimal chart is a must prior to any cataract surgery. However, this is not the sole criterion for planning cataract surgery.

4.4.2   Contrast sensitivity

C   Assessment of contrast sensitivity,[22] glare,[22,23] and brightness acuity testing give more clues to the overall visual disability due to the cataract. **Grade C, Level IV**

4.4.3   Clinical evaluation

Undilated as well as a fully dilated slit lamp evaluation are the standard of care for cataract diagnosis.

The type and severity of the cataract should be graded, preferably using standardized scoring systems such as the Lens Opacity Classification System (LOCS) III.[24]

Evaluation of eyelid margins and ocular surface is mandatory before planning cataract surgery.

The corneal surface as well as endothelium should be evaluated. If a specular microscope is not available, performing specular reflection with the slit lamp will allow the surgeon to assess the health of the corneal endothelium.

Central and peripheral anterior chamber depth is an important examination, both to plan surgery and anticipate surgical difficulties.

Evaluation of the retina including the optic nerve head, macula, and peripheral retina is mandatory, whenever possible.

Comorbidities such as high myopia, glaucoma, macular diseases, pseudoexfoliation, and poorly dilating pupil should be looked for.

4.5   Preoperative investigations

- Biometry – can be performed using optical laser interferometry biometry (OLIB), ultrasound A-scan, or optical coherence tomography (OCT)

- Keratometry – manual or automated

- Ultrasound B-scan – in cases where a clear view of the retina is not possible

- Corneal topography – assessment of the magnitude, axis, and regularity of corneal astigmatism is important to decide if toric IOLs are indicated

- Aberrometry and retinal optical coherence tomography (OCT) – may be used if available

- Visual function questionnaires – in select situations

- Patient's general health evaluation (e.g. ability to lie flat, cooperate, and communicate)

4.6   Special considerations for cataract surgery in one-eyed patients

Cataract surgery in functionally uniocular patients is no different from other patients.

Cataract surgery in these patients leads to an improvement in functional vision.[25]

These eyes may have associated comorbidities, which should be carefully looked for. Further, the risks of surgery should be clearly explained to the patient.

B   Delaying surgery excessively in these eyes may lead to advanced cataracts which may, in turn, increase the risk of surgical complications and even hamper visual recovery. **Grade B, Level III**

Additional peri- and intraoperative precautions are warranted.

4.7　Second eye surgery

Clinical studies provide convincing evidence that binocular summation occurs in individuals who have similar visual acuities in both eyes.[26-31]

Patients with dissimilar vision in each eye (anisometropia or one eye pseudophakic and the other eye with a cataract) demonstrate binocular inhibition.[31]

Further, patients who have had cataract surgery done in both eyes show higher levels of satisfaction and functional vision.[32-37] **Level Ib**

The decision for second eye surgery depends on several factors such as the fellow eye's vision and functional status, the patient's visual needs and desires, and the presence of ocular comorbidities.

GPP　Before performing the second eye surgery, the first eye's refractive error should be determined in order to better determine the IOL power for the second eye.[38,39]

4.8　Bilateral simultaneous cataract surgery

Most ophthalmologists do not perform bilateral simultaneous cataract surgery.

With improving surgical outcomes, there has been some interest in bilateral cataract surgery on the same day, particularly in regions where there are long waiting lists in the healthcare delivery system.[41-45]

Some prospective studies have compared bilateral simultaneous cataract surgery with delayed sequential cataract surgery. These have shown some short-term functional benefit, as well as cost effectiveness.[43,46,47] **Level IIa**

B　In case bilateral surgery is performed on the same day, the second eye of the patient should be treated like an eye of a separate patient. This means having separate instrumentation, medications, and surgical

preparation; even the surgeon and assisting team should scrub between eyes. There have been reports of bilateral endophthalmitis after bilateral surgery was performed without adhering to strict guidelines.[48-51] Further, if a complication occurs during the first eye surgery, surgery on the second eye should not be done on the same day. **Grade B, Level III**

Currently, there is much controversy regarding this issue. Proponents of this approach report that the greatest fear has been possible simultaneous bilateral endophthalmitis, which did not occur in a series of nearly 100,000 cases analyzed and only occurred when complete separation of the two eyes and strict aseptic protocol were not followed.[44] On the other hand, a large majority of surgeons strongly feel that the few benefits of simultaneous surgery are greatly outweighed by the risk of bilateral complications, inability to foresee refractive outcome, inability to alter IOL choice, and possible increased legal ramifications.[45]

C Based on current evidence, bilateral simultaneous cataract surgery cannot be recommended as the standard of care as it carries a small but significant risk of bilateral endophthalmitis that could lead to total blindness.[5] **Grade C, Level IV**

4.9 Choice of cataract surgery technique

Currently practiced techniques for cataract surgery with intraocular lens (IOL) implantation include:

- Extracapsular cataract extraction (ECCE)

- Manual small incision cataract surgery (MSICS)

- Phacoemulsification

- Femtosecond laser-assisted cataract surgery

The choice of surgical technique depends on the surgeon, based on their expertise and comfort, as well as availability of technology.[6-10] **Level Ia**

An IOL should be implanted in most cases, preferably in the capsular bag. However, in the event of inadequate posterior capsule support, the IOL can be fixated in the ciliary sulcus, the anterior chamber or be sclera fixated.

There are rare instances in which primary IOL implantation may not be the preferred choice, such as in severe persistent uveitis or in an extensive posterior capsule rupture in high myopes.

4.10 Phacoemulsification versus manual cataract surgery (ECCE/MSICS)

Manual cataract surgery is usually performed with non-foldable IOL, which is cheaper than a foldable IOL.

The equipment and consumable costs in manual cataract surgery are lower than in phacoemulsification.

ECCE requires multiple sutures; therefore, visual rehabilitation is slower and healing takes 6 to 8 weeks.

It is fair to say that around the world, even in developing countries, phacoemulsification is the most popular among ophthalmologists and patients. This is despite certain studies which have shown similar complications and visual rehabilitation with MSICS.[10,52] **Level Ia**

4.11 Femtosecond laser-assisted cataract surgery

Femtosecond laser-assisted cataract surgery (FLACS) is currently approved for the creation of corneal incisions, corneal astigmatism treatment, anterior capsulotomy, and nuclear fragmentation. It is used today for conventional cataracts as well as in challenging case scenarios such as posterior polar cataracts, subluxated lenses, and pediatric cataracts.[53-55]

There is much literature regarding the advantages and drawbacks of this technology over conventional phacoemulsification.[56-78] However, at this

time, the published results do not show any clear-cut benefit of FLACS over conventional phacoemulsification in terms of visual outcomes, refractive outcomes or intraoperative complications.[57,79-81] In fact, a recent large case-control study even showed a higher rate of early postoperative complications with FLACS as compared to conventional phacoemulsification.[79] **Level IIa**

Thus, according to currently available evidence, both FLACS and conventional phacoemulsification provide excellent visual and refractive results with a low rate of intra- and postoperative complications; FLACS did not yield better results compared to conventional phacoemulsification. **Level IIa**

Currently, FLACS is not as cost effective as conventional phacoemulsification, particularly in developing countries and countries where the healthcare costs are borne entirely by the public health system.[82,83] **Level IIb**

4.12 Cataract surgery outcomes

Based on recent studies, at least 90% of the patients undergoing cataract surgery obtain a postoperative visual acuity of 6/12 or better in the absence of coexisting ocular pathology.[12,84,85] **Level III**

Predictors of a better outcome have been identified by a study as: younger age (less than 65 years), fewer comorbidities, higher cataract symptom score, and a worse visual function questionnaire score (VF-14).[86] Snellen visual acuity in isolation does not predict improvement in visual function.

4.13 Choice of intraocular lens

C IOL implantation in the capsular bag is the desired outcome after uneventful cataract surgery, unless there are specific contraindications.[87,88] **Grade C, Level IV**

Foldable IOLs are now the most commonly used IOLs. These may be manufactured from hydrophilic acrylic, hydrophobic acrylic, silicone or copolymer materials. Rigid polymethyl methacrylate (PMMA) IOLs are also being used in conjunction with ECCE.

The factors to consider when choosing an IOL for a patient include IOL material, design, mode of focus, ease of implantation, and uveal and capsular biocompatibility.

IOL material

Hydrophilic and hydrophobic acrylic and silicone material have been shown to have good uveal and capsular biocompatibility (low rates of posterior capsule opacification) as well as ease of implantation.[89-92] Choice of IOL material is generally the surgeon's personal preference. However, silicone material should be avoided in patients with posterior segment pathology or who are likely to require vitreoretinal surgery with silicone oil or expandable gas as it may hamper the surgeon's view during vitreoretinal surgery. Most IOLs today have ultraviolet light blocking properties, and some have varying wavelengths of blue light attenuation. However, there is some controversy in the literature as to whether or not blocking certain wavelengths of blue light may be beneficial in preventing damage to the macula.[93,94]

IOL design

IOL design is important for the prevention of posterior capsule opacification (PCO) as well as for IOL stability. A square-edged IOL has been shown to be beneficial in reducing PCO rates.[95] However, square edge designs may be associated with dysphotopsias.

The preferred site for IOL implantation is the capsular bag. However, in certain situations, there may not be adequate posterior capsule support available. In these cases, options for IOL fixation include anterior chamber, retro-iris fixation, ciliary sulcus implantation, sutured scleral fixation, and glued or glueless intrascleral fixation. Whenever implanting an IOL in the ciliary sulcus, the dioptric power of the IOL should be adjusted (typically reduced by 0.5 to 1.0 diopter (D)).

B   Single-piece foldable IOLs are generally meant for implantation in the capsular bag. In the event of a posterior capsule rupture, these single-piece foldable IOLs should never be placed in the ciliary sulcus.[96, 97] **Grade B, Level III**

These IOLs, if placed in the ciliary sulcus, are known to cause complications such as iris chafing, glaucoma, inflammation, hyphema, and macular edema.[96, 97] **Level III**

IOL mode of focus

Traditional IOLs are monofocal IOLs. These may require the patient to depend on spectacles for distance, intermediate, and near vision depending on the residual refractive error. Today, both spheric and aspheric optics are available. Aspheric IOLs have the advantage of providing better contrast and sharpness of vision by reducing spherical aberrations, particularly in mesopic conditions.[98-102] However, their efficacy may be affected by pupil size, preexisting corneal aberrations, and centration of the IOL.

A   Correction of corneal astigmatism is gaining greater importance. Several modalities allow astigmatism correction, including limbal relaxing incisions (LRIs), toric IOLs, and femtosecond astigmatic keratotomies. Toric IOLs provide predictable and precise correction of regular corneal astigmatism and have been shown to be effective in a number of studies around the world.[103-106] **Grade A, Level Ia**

Toric IOLs also reduce spectacle dependence as compared to monofocal IOLs in patients with regular corneal astigmatism.[107,108]

Presbyopia-correcting IOLs are becoming popular among patients and surgeons. Several designs such as accommodative IOLs, dual-optic IOLs, and diffractive and refractive multifocal IOLs are available. Most multifocal IOLs available today are diffractive in nature.

B   It is important to recognize and also make the patient aware that most designs of multifocal IOLs are associated with varying degrees of

loss of contrast sensitivity, glare, haloes, and waxy vision. A recent study[109] reported that dissatisfaction following multifocal IOL implantation was the second most common cause for IOL exchange surgery. Therefore, careful patient selection and preoperative counseling are very important. **Grade B, Level III**

Based on a literature review of 20 randomized clinical trials comparing outcomes between monofocal IOLs and various types of multifocal IOLs[110] as well as another review of multifocal IOL literature,[111] the authors concluded that distance vision was comparable between monofocal and multifocal IOLs. Near vision is likely to be better in people with multifocal IOLs; however, the incidence of adverse events such as glare, haloes, and the rate of IOL explantation was also higher with multifocal IOLs. **Level Ia**

Multifocal IOLs are also available with a lower near add power in order to provide a better range of distance and intermediate vision, with a lower incidence of glare and haloes.[112,113]

Accommodative IOLs change their refractive properties with accommodative effort and offer varying levels of accommodative potential. However, unlike traditional multifocal IOLs, there is no loss of contrast, glare or haloes with these IOLs.[114-117]

Monovision and mini-monovision using monofocal IOLs have been successful in reducing dependence on spectacles for distance and near. In monovision, one eye is targeted for emmetropia and the other for varying degrees of myopia (–1.0 to –2.5 D, usually). It has been reported with this procedure that distance vision is as good as with traditional monofocal IOLs but intermediate vision is better. However, spectacle independence may be higher with multifocal IOLs as compared to pseudophakic monovision.[118]

4.14 Biometry and IOL power calculation

B Accurate keratometry and biometry along with the use of an appropriate IOL power calculation formula are crucial to achieving targeted refractive outcomes. **Grade B, Level III**

Both ultrasound A-scan and optical biometry are valid methods of measuring the axial length and other biometric parameters of the eye.

Optical biometry is a non-contact, high-resolution, user-friendly method of capturing axial length as well as other biometric parameters of the eye such as keratometry, anterior chamber depth, lens thickness, horizontal corneal diameter, and central corneal thickness. Partial coherence interferometry and swept-source OCT technologies allow precise measurement of the refractive axial length of the eye as opposed to the anatomical axial length measured by ultrasound A-scan.

B Optical biometry is superior to contact A-scan[119-121] and at least as good as immersion A-scan in the measurement of axial length. Studies have shown that the actual postoperative refraction is as close to the targeted refraction using optical biometry as compared to ultrasound A-scan.[122-124] **Grade B, Level IIa**. Thus, wherever possible, this technology should be preferred for biometry. However, particularly in developing countries, availability of this technology may not be universal. In addition, in situations with advanced cataracts and where patients cannot fixate, optical biometry may not be possible.

B Ultrasound A-scan may be performed using the contact or the immersion technique. The contact technique is highly dependent on operator skills and experience.[119,125,126] Contact A-scan can also cause an artificial shortening of the axial length due to variable corneal compression. Immersion ultrasound A-scan is more accurate for the determination of axial length as compared to contact ultrasound A-scan.[127] **Grade B, Level III**

GPP Particular attention should be paid and double checks performed when the measured axial length is <20 mm or >30 mm, or in situations such as in silicone oil-filled eyes or in post-refractive surgery IOL calculations.

GPP As for the formulas for IOL power calculation, newer theoretical IOL calculation formulas such as SRK-T, Holladay 1, and Hoffer Q should be used.[128-133] Newer formulas such as the Haigis-L, Olsen, Holladay 2, Barrett's Universal formula, and the Hill RBF formula

require additional data such as anterior chamber depth, lens thickness, and white-to-white corneal diameter to predict the effective lens position better.[134-136] Barrett's formulae as well as the Hill RBF formula are available online at www.apacrs.org and www.ascrs.org, respectively. Using these newer formulae, IOL calculations in special situations such as post-refractive surgery and extremes of axial length are more accurate and predictable.

4.15   Choice of anesthesia

Options for anesthesia include general, topical, and regional anesthesia. The choice of anesthesia usually depends on surgeon and patient factors, but regional or topical anesthesia is preferred due to the inherent risks of general anesthesia. However, control of systemic conditions, particularly hypertension, diabetes, and breathing disorders should be done prior to surgery. Most surgeons do not discontinue antiplatelet medications. However, in select cases, anticoagulant medications may be discontinued in consultation with a physician.

Cochrane reviews comparing randomized clinical trials of peribulbar and retrobulbar anesthesia found no difference between the efficacy of the two techniques.[137,138] Another review comparing topical and sub-Tenon's anesthesia found that although intraoperative pain was greater, 24 hours postoperative pain was less in topical anesthesia.[139] **Level Ia**

A   The type of regional anesthesia should be chosen together by the patient, surgeon, and anesthesiologist, taking into account multiple factors. There is no clear-cut benefit of one specific technique over another in the literature today. **Grade A, Level Ia**

4.16   Post cataract surgery follow-up and medications

A   The postoperative follow-up of a cataract surgical case is generally recommended to be at day 1, and thereafter between 1 and 4 weeks postoperatively, based on the accessibility to healthcare and protocols followed by the practice.[140] However, there are studies in which

omitting follow up on postoperative day 1 after uncomplicated cataract surgery was not associated with a higher risk of complications.[141-144] **Grade A, Level Ib**.

B It is the duty of the surgeon to explain to the patient and their caregivers the symptoms warranting immediate consultation. **Grade B, Level III**

With ECCE, suture removal is usually done 4 to 6 weeks following surgery, if necessary. Final spectacle prescription may be given any time after that.

Final spectacle prescription following phacoemulsification may be given by an optometrist or ophthalmologist 2 to 4 weeks following surgery since the corneal astigmatism is reported to stabilize by 2 weeks.[145,146]

Additional follow-up visits may be tailored depending on comorbidities, complications, ocular status, and refractive stability.

GPP There is no consensus on the use of postoperative topical antibiotics, steroids, nonsteroidal anti-inflammatory agents or even oral analgesics. However, most surgeons prefer to start topical antibiotic and steroid drops immediately following completion of surgery, and continue them for 2 to 4 weeks postoperatively. Fourth generation fluoroquinolones and prednisolone or dexamethasone eyedrops are usually preferred. However, depending on the economic status and practice preference, different surgeons may use different topical medications.

4.17 Cataract surgery complications

There are several potential complications, both intraoperative and postoperative. The most sight threatening are posterior capsule rupture (PCR), infectious endophthalmitis, toxic anterior segment syndrome (TASS), retinal detachment, suprachoroidal hemorrhage, cystoid macular edema (CME), and persistent corneal edema.

It is important that every surgeon closely monitor patients with intraoperative and postoperative complications. Specific complications are discussed below.

4.17.1 Posterior capsule rupture

Reported rates of PCR in literature vary from 2% of eyes during uncomplicated phacoemulsification to as high as 9% in high-risk eyes.[147-151]

Risk factors for PCR include but are not limited to white cataract, dense brunescent cataract, pseudoexfoliation, posterior polar cataract, inability to visualize posterior segment preoperatively, high-axial myopia, coexisting morbidities, intraoperative floppy iris syndrome (IFIS), older age, and resident-performed surgery.[152,153]

In case of an intraoperative PCR, cataract surgeons should be equipped to perform a limited anterior vitrectomy, preferably with an automated vitrector. Backup IOL options in the absence of adequate capsular bag support should be available.[154-158]

GPP   Following a PCR with or without anterior vitrectomy, the patient should be followed up more closely, specifically to look for glaucoma and retinal detachment. The patient should be instructed about warning signs of retinal detachment, mainly flashes, floaters, and sudden dimness of vision. For this, it is important that the patient be followed up closely in the immediate postoperative period and then around 4 to 6 weeks later.

4.17.2 Cystoid macular edema

With modern small incision cataract surgery, the incidence of clinically significant CME is as low as 1 to 3%.[148,159,160] Often, CME responds well to topical anti-inflammatory medication; however, recalcitrant cases may be associated with permanent impairment of central visual acuity. Risk factors for CME include previous uveitis, posterior capsule rupture with vitreous loss, diabetic retinopathy, previous vitreoretinal surgery, and a history of pseudophakic CME in the fellow eye. At present, there is no firmly established protocol for preventing postsurgical CME.

The perioperative prophylactic use of NSAIDs for the prevention of CME in routine cases has not been substantiated, although this may be beneficial in high-risk eyes. **Level IV**

4.17.3 Endophthalmitis and its prophylaxis – current trends

Ocular pain, redness, blurry vision, and eyelid edema are the cardinal symptoms of endophthalmitis. Every patient should be warned about these symptoms and instructed to contact the healthcare facility if any of them are experienced. Signs include corneal edema, hypopyon, severe ciliary congestion, and vitreous exudates. The condition should be differentiated from toxic anterior segment syndrome (TASS) since the treatment will differ.

A Whenever endophthalmitis is recognized or suspected, an anterior chamber tap and/or vitreous tap for microscopy and microbiological cultures must be done expediently, followed with the concurrent injection of antiobiotics intravitreously. The Endophthalmitis Vitrectomy Study recommends a combination of intravitreal injection and intravitreal tap in patients who present with visual acuity of hand motion or better. For patients presenting with a visual acuity worse than hand motion, pars plana vitrectomy should be performed.[161] **Grade A, Level Ia**

The rate of endophthalmitis is low, with a reported incidence of between 0.04% and 1.6%, globally.[162-173]

Risk factors for endophthalmitis include posterior capsule rupture, vitreous loss, prolonged surgical time, resident-performed surgery, immunocompromised patient, improper incision construction with wound leakage, topical anesthetic gel application prior to povidone iodine, and older patient age.[162,164,173-176] **Level III**

GPP Prevention of endopththalmitis is of paramount importance. Proper attention should be paid to ocular adnexa, particularly nasolacrimal duct obstruction with infection and meibomian gland disease prior to cataract surgery.

A   Instillation of 5% povidone iodine in the conjunctival cul-de-sac for at least 2 minutes prior to cataract surgery is proven to reduce the load of microbiological flora in the cul-de-sac and thereby reduce the incidence of infection.[177-179] **Grade A, Level IIa**

B   Meticulous wound construction and watertight wound closure with or without sutures is extremely important since it has been shown that leaky incisions increase the risk of infection.[180] **Grade B, Level III**. Instillation of lignocaine gel prior to povidone iodine application reduces its efficacy.[180]

Although some studies have shown a greater incidence of endophthalmitis following ECCE as compared to phacoemulsification,[163,181-183] the type of surgery may not affect the incidence of endophthalmitis if there is meticulous wound closure. **Level III**

IOL material has no correlation with endophthalmitis.[181,183-186] However, polypropylene material which is found in IOL haptics does have a greater propensity for bacterial adherence compared to other materials. Contact between the IOL and the ocular flora during implantation can be a source of infection.[187] Injector-based delivery systems reduce this possible contamination by eliminating potential contact between the IOL and the ocular surface.

Currently, there is some controversy regarding the use of intracameral antibiotics during cataract surgery. One of the landmark trials evaluating the role of topical and intracameral antibiotics was the ESCRS Endophthalmitis Study. This study included more than 13,000 eyes and found that the odds ratio for developing endophthalmitis was 4.59 in the group that did not receive intracameral cefuroxime.[171,185] **Level Ib**. Although a commercial preparation of cefuroxime for intracameral use is now available in certain countries, the ad-hoc contemporaneous preparation of antibiotic solutions not commercially formulated for intracameral use carries the risk of dilution and compounding errors with potentially severe toxicity.[188-193]

Subsequently, several studies[171,181,183,185,186,194-208] have shown a reduction in the risk of endophthalmitis with different intracameral antibiotics (cefuroxime, moxifloxacin, and cefazolin). The use of intracameral vancomycin is currently not recommended following reports of hemorrhagic occlusive retinal vasculitis (HORV) with this drug.[209] On the other hand, many studies support the safety and efficacy of intracameral preservative-free moxifloxacin.[194,181,200,208,210-212] **Level Ia**

The role of antibiotics in the irrigating solution in reducing infection is not proven. Further, their concentration and duration may be variable.[213] **Level III**. Similarly, there is no strong evidence favoring the use of subconjunctival antibiotics or topical antibiotics initiated prior to cataract surgery.

It has been shown that topical antibiotic instillation may be more protective when initiated on the day of surgery instead of on the first postoperative day.[175]

In summary, due to the lack of sufficiently large prospective clinical trials and the impracticality of conducting such trials, there is insufficient evidence to recommend a specific antibiotic or method of delivery for endophthalmitis prophylaxis. However, two interventions which have been found to reduce the risk of endophthalmitis in randomized clinical trials are:

a) Intracameral antibiotic use;

b) Preoperative 5% povidone iodine instillation in the conjunctival cul-de-sac.

4.17.4 Toxic anterior segment syndrome (TASS)

Toxic anterior segment syndrome (TASS) is a sterile postoperative inflammatory reaction. The biggest diagnostic difficulty is distinguishing between TASS and infectious endophthalmitis. TASS usually manifests 12 to 48 hours after surgery. Clinical findings in TASS are: diffuse limbus-to-limbus corneal edema, severe anterior chamber cells and flare, fibrinous reaction, and hypopyon.[181] Severe pain is usually not a prominent feature and the posterior segment is usually not involved as seen on

fundus examination or ultrasound B-scan evaluation. TASS usually responds to anti-inflammatory medication, but if there is suspicion of an infectious etiology, cultures of the anterior chamber and vitreous should be obtained to test for infectious etiologies and antibiotic treatment should be initiated.[186]

The most common factors associated with TASS were related to inadequate cleaning and sterilization of ophthalmic instruments: inadequate flushing of phacoemulsification and irrigation/aspiration handpieces and inappropriate use of enzymatic cleaners, detergents, and ultrasound baths for cleaning and sterilizing instruments.[175] Powdered gloves have also been implicated in TASS causation and, therefore, the U.S. Food and Drug Administration (FDA) has banned powdered gloves for use in ophthalmic surgery.

TRAINING AND CERTIFICATION

Training is an important issue and requires the cooperation of both the trainer and the trainee. There are large variations in the pattern of cataract surgical training in different parts of the world, as well as within each region. It is therefore difficult to give specific recommendations.

However, prior to beginning surgical training, it is important that trainees perform simulated surgeries on simulators or in the wetlab, depending on availability. They should also assist in several cases of cataract surgery before they start operating on their own. They should also have a complete theoretical and practical understanding of the operating microscope, as well as the phacoemulsification machine.

The number of cataract surgeries and the type of cataract surgeries required of the trainee vary from region to region, and from one training center to another. What is more important is to start performing surgery in a step-wise manner, under the supervision of an experienced trainer.

Complications and surgical logs should be maintained by all trainees and ideally should be audited and supervised periodically by the trainers.

6 RECOMMENDATIONS FOR THE EVALUATION OF SURGICAL OUTCOMES

Every patient should have a record of the following within 3 months of surgery:

a) Visual acuity (unaided and best spectacle corrected);

b) Measurement of the refractive error and its deviation from the intended postoperative refraction;

c) Incidence of intraoperative or postoperative complications;

d) Return to the operating room for any secondary surgical intervention.

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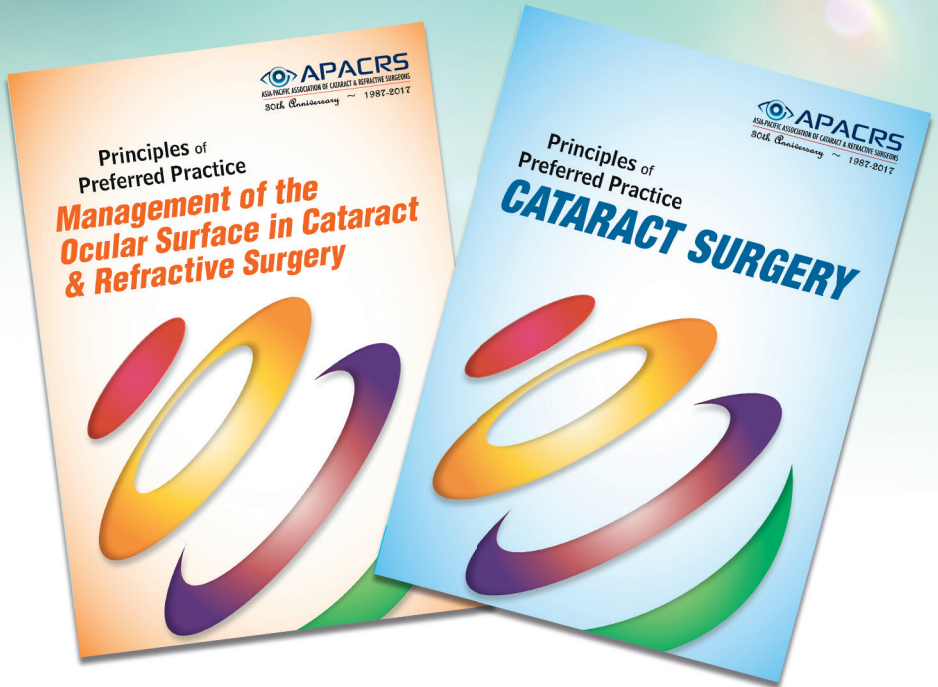
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