

Cataract co-management

Professor Charles NJ McGhee MB, BSc, PhD FRCS, FRCOphth, FRANZCO
The Maurice Paykel Professor of Ophthalmology, University of Auckland

Learning Objectives

Cataract I

Knowledge of the causes, management, and health burden of senile cataract
Identify different types of cataract
Recognise when it is appropriate to refer to an ophthalmologist
Knowledge of the processes involved in pre-operative assessment
Understand the various methods of performing biometry

Cataract II

Define and describe the different types of cataract surgery
Knowledge of post-operative management in uncomplicated cases
Become familiar with common complications of cataract surgery
Understand the relative urgency of post-operative complications in terms of management.

Introduction

In New Zealand the majority of cataracts referred to the public/private hospital systems are initially identified by optometrists. There is therefore a key role, not only in identifying cataract, but also in referring appropriately. Following surgery, many patients return to optometrists for ongoing eye care and spectacle provision. However, with the advent of “one-stop” cataract surgery and very early discharge from hospital care, co-management of post-operative cataract can conceivably begin as early as one week, or even one day, post-surgery. Of course, although modern phacoemulsification cataract surgery has fewer unexpected complications than earlier techniques, no surgery is free from complications, and patients may initially present with these to their own optometrist. It is therefore incumbent on optometrists to be familiar with local criteria for referral and the expected outcome of cataract surgery, as well as having a familiarity with common complications and their relative urgency in terms of management.

Assessing the patient with cataract

In assessing a subject with lens opacities the underlying aetiology should always be considered. Although the majority of cataracts that will be identified by optometric review fall into the senile cataract category, a number of other aetiologies should be considered, particularly metabolic disorders such as diabetes, congenital or inherited cataract syndromes, toxic or drug-related cataract such as steroid cataract, irradiation induced (e.g. infrared, X-rays, radiotherapy) and secondary cataract e.g. associated with uveitis. It is therefore pertinent to take the family, occupational, and medical history, particularly when cataract is identified in subjects less than 60 years of age.

It must always be remembered that cataract does not occur in isolation and may be associated with a number of systemic and ocular co-morbidities. The Auckland Cataract Study (ACS), a prospective study of approximately 500 individuals undergoing cataract surgery in a public hospital service similar to, but preceding the UK NHS, highlights many of the associated conditions that may be encountered in the management of these patients (Table 1). In terms of assessment it is particularly important to note that more than half of these subjects will have some form of cardiovascular disease and 20% are diabetic.

Cataract: when to refer?

The timing of referral varies significantly with available local Healthcare funding or provision of private services and it is important that optometric professionals are cognisant of the local threshold for referral. However, many would consider that when vision falls to around 6/12, the essential driving requirement in many countries, this should trigger the consideration of referral

to the public hospital services. Other important factors must also be taken into account, such as ocular symptoms e.g. posterior subcapsular cataract may enable high contrast Snellen acuity of 6/6 yet produce intolerable glare, thus making driving difficult in a number of lighting conditions. Other ocular diseases, that require regular review, such as diabetes, may also require earlier

surgical intervention to enable a clearer view of the fundus. Indeed, any assessment of cataract, and the need for cataract surgery should be holistic and take into account systemic disease, visual requirements for social and work activities, independence, physical mobility, and driving demands.

Table 1. Reported co-morbid medical conditions in the Auckland Cataract Study. Only those with incidence greater than 1% are presented. Interestingly, only 95 (19.8%) subjects had no co-existing systemic medical disorder (N=480).

Medical Condition	Number	Percentage
Hypertension	220	46%
Diabetes mellitus	98	20%
Angina	78	16%
Asthma	54	11%
Cerebrovascular event	49	10%
Congestive heart failure	39	8%
Myocardial infarct	35	7%
Cardiac arrhythmia	34	7%
Obstructive airways disease	24	5%
Dysthyroid disease	25	5%
Peripheral vascular disease	14	3%
Current smokers	56	12%

Table 2. The Auckland Cataract Study: co-existing ocular disease in eyes listed for cataract surgery in a public hospital; system (n=488).

Ocular Condition	Number***	Percentage ***
Glaucoma	45	9.2%
Diabetic retinopathy	37	7.6%
ARMD affecting visual acuity	25	5.1%
Corneal disease	9	1.8%
Macular surgery	6	1.2%
Retinal vein/artery occlusion	3	0.6%
Previous retinal detachment	3	0.6%

*** Some eyes exhibited more than one co-existing ocular disease.
ARMD = age related macular degeneration

Informing the patient: contemporary small incision phacoemulsification

Cataract surgery, in the form of couching, has been around for more than 2000 years, and extracapsular cataract surgery was popularised by Dr Jacques Daviel as long ago as the 1750's. In the last century both intracapsular (ICCE) and extracapsular (ECCE) surgery were popular, with extracapsular surgery gaining the upper hand in the latter twenty-five years. Interestingly, although Ridley inserted the first intraocular lens (IOL) in the middle of the century, insertion of intraocular lenses did not gain universal acceptance until 30 years later.

In the last 10 years phacoemulsification has become the pre-dominant cataract technique in the developed world and with its emergence, IOLs have evolved from the original hard 6mm diameter PMMA designs, to foldable lenses of acrylic and silicone that pass through incisions of around 3.0mm. However, around 5% of cataracts, particularly dense cataracts, may still be treated by ECCE in some centres.

Small incision phacoemulsification (97.5%) with implantation of a foldable intraocular lens, under sub-Tenons local anaesthesia (95%), has become the favoured phacoemulsification technique in New Zealand and other westernised societies. Usually a stepped or uniplanar, non-sutured wound, approximately 3.0-3.4 mm wide, is used to facilitate phacoemulsification and IOL insertion. Although sub-Tenons anaesthesia is becoming increasingly popular in New Zealand, the United Kingdom and elsewhere, a recent assessment of trends in cataract surgery (1998), with respect to the USA, Japan and Denmark, suggested that only Ophthalmologists in Japan use predominantly sub-Tenons anaesthesia as frequently. Usually, contemporary cataract surgery is performed under local or topical anaesthesia as a day case procedure.

In the ACS study a higher proportion of clear corneal temporal incisions than superior scleral tunnel incisions was observed, highlighting local surgical preference. However, Riley et al (2001) have demonstrated that this elderly population exhibits a median refractive astigmatism of 1.2D that is against-the-rule in 50% of eyes, therefore, the choice of a temporal approach corneal incision may offer a minor beneficial effect on corneal astigmatism in appropriate cases. In the ACS study, 76.7% of subjects exhibited a 0.75D, or less, change in refractive astigmatism post small incision phacoemulsification. Initial concerns that clear corneal incision might produce significantly greater astigmatism than scleral tunnel incisions seems unfounded. Current techniques of clear corneal incisions produce similar astigmatic change to scleral tunnel incisions and, as noted previously, any such induced change may actually be beneficial in the older eye with against-the-rule astigmatism.

The New Zealand 2004 cataract and refractive survey generated a 92% response rate from 97 ophthalmic surgeons. Of those surveyed, 70 were performing cataract surgery, 17 were performing refractive surgery, subtenons anaesthetic was used for cataract surgery in 60%, clear corneal or anterior limbal incision in 86%, one-piece foldable intraocular lens in 65%

Common intra-operative and post-operative complications

Although 95% of cataract surgery is uncomplicated, optometrists must be fully aware of the spectrum of complications that can occur and the impact these may have on vision and their appropriate management. The design of the Auckland Cataract Study (ACS), where reporting of intra-operative complications by the operating surgeons was followed by a comprehensive postoperative independent ophthalmic examination, may have advantages in terms of accuracy and consistency over comparable studies of self-reporting alone. Interestingly, the observed rates of adverse surgical events are comparable to similar published studies, which have reported posterior capsular rupture rates of between 0% and 9.8% of cases and clinically-apparent cystoid macular oedema in 0.6% to 6% of eyes.

The most significant, common intraoperative complication of cataract surgery is rupture or tear of the posterior capsule with vitreous loss, this may be compounded by "dropped nucleus" or loss of cataract fragments into the vitreous cavity. The overall posterior capsular rupture rate in the ACS study was 4.9%, and there was no statistical difference between consultants and registrars under

supervision, however, assessment of complications by trainee surgeons of registrar grade in other large studies of phacoemulsification have highlighted an incidence of intra-operative posterior capsular rupture of up to 10%. A Royal College of Ophthalmologists (UK) report, by Desai et al (1999), noted a posterior capsule tear rate of 4.4% in a National Cataract Study, whereas, more recently, Ionides et al (2001), in a series of 1420 cataract procedures noted a similar overall capsular rupture rate of 4.1% in a major UK training hospital and in this series posterior capsule tears occurred in 5.3% of cases performed by surgeons in training.

Since posterior capsule tear occurs in around 5% of eyes, its sequelae are very important. Intraoperative capsule rupture may be associated with subsequent malposition of the intraocular lens, vitreous strands in the anterior chamber or to the wound, and cystoid macular oedema – complications which the optometrist must be familiar with and capable of identifying in the postoperative period. In the ACS study, automated anterior vitrectomy was performed in 75% of cases of capsule rupture and there was no clinical, or statistical, association between capsular tear and either cystoid macular oedema or a final BSCVA of less than 6/12. In contrast, Ionides et al, in a major UK study, noted that eyes with a posterior capsule rupture were 3.8 times more likely to have a final BSCVA less than 6/12.

Day 1 assessment post-phacoemulsification

A number of authors have debated the need for assessment on day one post phacoemulsification, however, it is still common practice and the day one review can be very important in detecting problems, initiating treatment of elevated IOP and allaying patient fears. Review should include symptoms, unaided vision (usually between 6/6 and 6/18) and pinhole or corrected vision, with an assessment of the cornea, pupil, intraocular lens position, media, and assessment of the macula.

Herbert et al (1999), have recently highlighted the importance of day one review, noting 1.5% of subjects with an IOP greater than 30 mmHg, 0.26% with painless iris prolapse and 1.8% that required modification of the topical steroid regime.

In the ACS study, day one review identified a single case of early endophthalmitis, but no other sight-threatening adverse events. However, it is notable that 4.3% of eyes had an IOP greater than 30mmHg. Overall, 1.9% of eyes required a suture for a wound leak. All of these eyes had undergone temporal approach, clear-corneal, phacoemulsification, whereas, no eyes with superior scleral tunnel approach demonstrated an aqueous humour leak. Although 16% of corneal incisions were sutured intra-operatively, 2.4% of corneal incisions required a suture to address wound leak on day one. This suggests that perhaps a lower threshold for intra-operative placement of a suture, or a modification of wound architecture, should be observed in this population when clear-corneal, sutureless phacoemulsification surgery is performed. However, this has to be balanced with the knowledge that all corneal sutures will require subsequent removal and 5.8% of eyes in this study exhibited more than 1.0D of suture-induced astigmatism, which was statistically associated with BSCVA of less than 6/12 in almost half of these eyes.

All patients undergoing cataract surgery must be warned about rare, but devastating complications such as endophthalmitis and choroidal haemorrhage - which may result in loss of vision or even loss of the eye. Uncontrolled choroidal haemorrhage can result in expulsive haemorrhage of all intraocular contents, including vitreous and retina! Fortunately this is less common with phacoemulsification compared to extracapsular surgery.

Table 3: Day 1 review

Assessment	Normal	Action
Unaided vision	6/18 - 6/5	Refract if <6/12
Corrected vision	6/6 – 6/12	Exclude causes of reduced BSCVA if <6/12
Refractive error	+/-1.00D of intended	If greater than 1.50D deviation from intended endpoint contact ophthalmologist
Exclude wound leak	None	If spontaneous & AC compromised - refer
Wound appearance	Closed	exclude phaco burn, retraction, or leak
Goldman IOP	<24mmHg	If painful or >30mmHg Rx diamox or refer
Corneal striae or oedema	None/Minimal	Observe, should settle in few days
Anterior chamber activity	Flare+, cells + to ++	If marked activity consider endophthalmitis or secondary uveitis - refer
Pupil	Round, up to mid-dilated	If distorted: exclude iris prolapse, vitreous in AC or to wound, or IOL displacement - refer
IOL position	Well-centred in the bag	If greater than 1.0mm decentred - refer
Fundal examination	Clear view	Exclude haemorrhage, detachment

Although antibiotics are the topic of a separate lecture, in relation to endophthalmitis recent data from a survey of all Fellows and trainees of the Royal Australian and New Zealand College of Ophthalmologists are worth considering. The Ophthalmologists were surveyed about their cataract surgery practices and methods of chemoprophylaxis for the prevention of postoperative endophthalmitis. There were 731 respondents (82% response rate) and they reported on a total of 162,120 cataract operations and 92 cases of endophthalmitis in 2003, a cumulative incidence of 0.06% - lower than the 0.2% (1:500) rate generally anticipated. This self-reported incidence of endophthalmitis varied from 0.034% in Victoria to 0.56% in the Northern Territory. Topical antibiotics were used preoperatively by 46.7% compared with 97.4% postoperatively; while only 44.1% used subconjunctival antibiotics. However, the routine use of subconjunctival antibiotic halved the self-reported incidence of postoperative endophthalmitis

Day 7 or 28 reviews and visual outcome

Many surgeons recommend post-operative review at day 1 and day 28 alone, although some also encourage a day 7 review, which could obviously fall within the community optometry comanagement arena. Post-operative therapeutic regimes vary but a four times per day regime of steroid and antibiotic e.g. Predforte and Chloramphenicol, for 2-4 weeks is fairly typical. The majority of eyes have a stable refraction by four weeks post surgery. In the ACS study, two-thirds of eyes achieved 6/12 UAVA and 88% of eyes achieved a BSCVA of 6/12 or better after cataract surgery. However, if those eyes that had a poor visual prognosis pre-operatively, due to known co-existing ocular disease, are removed from analysis, the proportion with BSCVA of 6/12 or better increases to 94%. However, whilst the mean post-operative BSCVA was 6/7.5 for all eyes in the study, special consideration should be given to those patients (1.5%) who had lost lines of BSCVA, thought to be a consequence of the surgical intervention, at the latest follow-up.

The 28 day review should include those items addressed in day 1 with very careful consideration of those eyes that do not achieve 6/6 – 6/7.5 BSCVA and have no other ocular explanation for impaired BSCVA. In particular, cystoid macular oedema (CMO) should be excluded since it may

affect BSCVA in 1-2% of eyes and such cases should be referred back to an ophthalmic practitioner within a week. A longer follow-up period and treatment may show some further improvement in those with cystoid macular oedema in which BSCVA is significantly adversely affected (1.3% in the ACS study).

Only visual acuity and objective measures such as refraction have currently been reported in the ACS study, however, additional measures such as functional acuity, symptom score and patient satisfaction are also valuable ways of providing a more comprehensive assessment of outcome following cataract surgery. Indeed, the risk of dissatisfaction with outcome of cataract surgery is related to low visual acuity and age-related maculopathy in the better eye pre-operatively, whilst, overall, the post-operative BSCVA in the operated eye is the single most important factor in terms of patient satisfaction.

Although phacoemulsification has a lower risk of retinal detachment than conventional extracapsular surgery, a series of 1418 phaco-emulsification procedures, with approximately onethird having undergone Nd:YAG laser capsulotomy, recorded a long-term risk of retinal detachment of 0.4%. Due to the limited follow-up, only to the point of outpatient discharge, longer-term complications, such as retinal detachment, or the requirement for Nd:YAG laser posterior capsulotomy, were not identified in the ACS prospective study, however, it is mandatory to perform a dilated pupil review of the fundus to exclude retinal detachment before discharging patients from followup. Retinal detachment or retinal tears/holes should be referred immediately to the operating surgeon

Table 4. Intra-operative and postoperative adverse events in the Auckland Cataract Study prospective study of 488 consecutive cataract procedures in a public hospital setting.

	Number	%
Intra-operative (n=488)		
Posterior capsule tear	24	4.9%
Iris prolapse / iris trauma	21	4.3%
Wound retraction/burn *	19	3.9%
Manipulation of small pupil	14	2.9%
Subject unable to lie still	13	2.7%
Incomplete capsularhexis	11	2.2%
Dropped lens fragment	4	0.8%
First day post surgery (n=483)		
Intraocular pressure (>30mmHg)	21	4.3%
Wound leak requiring suture	9	1.9%
Minimal wound leak	6	1.2%
Vitreous in anterior chamber	6	1.2%
Decentered IOL*	5	1.0%
Endophthalmitis	1	0.2%
Four weeks post surgery (n=476)		
Suture-induced astigmatism (>1.0D)	28	5.8%
Cystoid macular oedema	18	3.8%
Anterior chamber cells (≥ 2+)**	15	3.2%
Anisometropia	2	0.4%
Corneal decompensation	2	0.4%
Aphakia	1	0.2%

No choroidal haemorrhage or retinal detachments were reported. IOL = intraocular lens, + All wound retractions/phaco-burns were mild and treated only by intra-operative suture * Required surgical manipulation (n=2), **Anterior chamber cells = post-surgical mild anterior uveitic response

References

- Riley AF, Malik TY, Grupcheva CN, Fisk MJ, Craig JP, McGhee CN.
The Auckland cataract study: co-morbidity, surgical techniques, and clinical outcomes in a public hospital service. *British Journal of Ophthalmology* 2002 Feb;86(2):185-90.
- Thompson AM, Sachdev N, Wong T, Riley AF, Grupcheva CN, McGhee CN.
The Auckland Cataract Study: 2 year postoperative assessment of aspects of clinical, visual, corneal topographic and satisfaction outcomes. *British Journal of Ophthalmology* 2004 Aug;88(8):1042-8.
- Elder M, Leaming D, Hoy B. New Zealand cataract and refractive surgery survey 2004.
Clinical and Experimental Ophthalmology 2006 Jul;34(5):401-10.
- Grupcheva CN, Riley AF, Craig JP, Malik TY, McGhee CN.
Analyzing small-incision cataract surgery by Orbscan II fourth-dimensional pachymetry mapping. *Journal of Cataract and Refractive Surgery* 2002 Dec;28(12):2153-8.
- Riley AF, Grupcheva CN, Malik TY, Craig JP, McGhee CN.
The Auckland Cataract Study: demographic, corneal topographic and ocular biometric parameters. *Clinical and Experimental Ophthalmology* 2001 Dec;29(6):381-6.
- Riley AF, Grupcheva CN, Malik TY, Craig JP, McGhee CN.
The waiting game: natural history of a cataract waiting list in New Zealand. *Clinical and Experimental Ophthalmology* 2001 Dec;29(6):376-80.
- Rosha DS, Ng JQ, Morlet N, Boekelaar M, Wilson S, Hendrie D, Semmens JB.
Cataract surgery practice and endophthalmitis prevention by Australian and New Zealand ophthalmologists. *Clinical and Experimental Ophthalmology* 2006 Aug;34(6):535-44.
- Polkinghorne PJ, Craig JP.
Northern New Zealand Rhegmatogenous Retinal Detachment Study: epidemiology and risk factors. *Clinical and Experimental Ophthalmology* 2004 Apr;32(2):159-63.