Cataracts and Cataract Surgery

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Case Vignette

An 80-year-old woman is bought in by her son for continuing care of mild nonproliferative diabetic retinopathy, cataracts, and geographic atrophy. She is a well-established patient and is familiar with the physician and the office staff. The ophthalmic technician notes that the patient required more assistance than usual to navigate to the exam chair. The son remarks that his mother had recently moved to an assisted living center. He feels that she is less involved with visually oriented tasks and is more socially withdrawn despite what he considers expanded social and occupational opportunities at the living center. The patient initially denies any problems, but after some discussion admits she has had increasing difficulty watching television and ambulating, particularly on uneven surfaces. She denies being sad or depressed as a cause of her social isolation but states her activities are impacted because her vision seems worse. The patient is apologetic about "complaining" and wary because her own mother had a poor outcome from cataract surgery years previously.

On evaluation, her objective visual acuity is stable at 20/250 and 20/100. Her responses are more hesitant than in her past visits. Her exam reveals progression from 2+ to 3+ nuclear cataracts with stable, moderate geographic atrophy OU and mild nonproliferative diabetic retinopathy OU.

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Patient Care

The patient care domain for cataract surgery includes the election of and timing of surgery, the eye selected for surgery, and the option to pursue cataract extraction in the second eye. The clinician needs effective communication with both the patient and the family to gather the information needed to make the decision for surgical intervention. Good communication defines the patient's needs and wishes as well as their current level of visual function. It is important to evaluate patients based on their functional ability and their desire for improvement, not on their chronologic age. Ageism, the tendency to limit access to care due to chronologic age, may come from the practitioner, the family or caregivers, or the patient themselves. Some elderly attribute their social isolation and declining involvement in activities of daily living (ADL) to age and not to disability or depression and thus may not seek needed medical assistance.

Nestam investigated the outcomes of cataract surgery on three age groups of patients, those under 84 years, 85 to 89 years, and 90 years and older. Patients were questioned on ability to read, watch TV, orient, and perform activities of daily life (ADL), as well as patient satisfaction and visual acuity. The most elderly had the worst vision and were the most dissatisfied preoperatively and had a larger improvement postoperatively though were also still statistically worse and more dissatisfied postoperatively than their younger counterparts. This was felt due to their age-related comorbid conditions. The majority of patients improved vision with surgery and improved in their reading, watching TV, orientation, ADL, and acuity. Age was also not felt to be a limiting factor for recommending surgery as 2/3 of patients 84–89 and 43% of patients aged 90 and over survived to follow-up 4 years postoperatively [1].

In a separate study, Mutoh reviewed cataract surgery in patients over age 90 and compared them to those under age 90. They found systemic disease (81% vs. 57.8%, $p < 0.05$) and senile dementia (14.3% vs. 0%, $p < 0.05$) to be significantly higher in the older age group. 47.6% of the older age group had intraoperative systemic changes (hypertension, restlessness, electrocardiogram abnormalities) compared to 2.2% in the under 90 age group ($p < 0.001$), though surgery was completed in all cases. There was worse preoperative vision in the older group but equal postoperative vision in both groups. There was a significant decrease in endothelial density in the over 90 age group ($p < 0.5$) but not the younger group. The severity of symptoms prompted the decision on two restless patients over 90 to defer surgery on their fellow eyes, as it was felt they could not be surgically controlled and were at significant risk for surgery in their second eye [2].

The current recommendations for the timing of cataract surgery are based on patient's self-reported difficulty with daily activities. Vision loss from cataracts has historically been measured with high-contrast Snellen acuity. Other factors such as contrast sensitivity, depth perception, binocularity, glare, and mesopic acuity have been shown to affect ADL and are currently accepted criteria in the decision to perform cataract extraction [3, 4]. In fact, contrast sensitivity has been proven more sensitive than Snellen acuity in detecting functional visual problems. Multiple

studies show an effect of contrast sensitivity on activities ranging from postural stability to flight simulation [5]. Contrast sensitivity is influenced by many age-related eye disorders. These conditions include not only cataract, glaucoma, and macular degeneration but also spherical aberration induced by age-related lenticular curvature changes [5].

McGwin et al. studied patients aged 55 and older who elected to proceed with cataract surgery and compared them to those who elected observation. Patients completed preoperative and 1-year follow-up questionnaire of the Activities of Daily Vision Scale (ADVS), distance acuity, contrast sensitivity, and disability glare. The follow-up results in the ADVS subscales of the surgery group showed statistically significant improvement when compared with the no-surgery group correcting for initial differences between groups. The surgery group improved 15–21 points, whereas the no-surgery group remained unchanged at 1 year on the ADVS. The primary deficit reported by patients as a reason for surgery was driving [6].

The current recommendations for cataract surgery are therefore not limited by a specific visual acuity. A patient should perceive problems in their visual function or daily activities that are consistent with their cataract. They should be able to physically tolerate the procedure and should want to improve their vision by surgical means. If the patient meets these recommendations, they are a reasonable surgical candidate, independent of their chronologic age or Snellen acuity [3, 4] (Fig. 1).

It is important to document patient's problems with ADL. There are several patient questionnaires designed to determine functional visual disability. The more extensive National Eye Institute Vision Function Questionnaire was abbreviated to

Fig. 1 New technology allows more accurate calculation of intraocular lens power, decreasing the patient's postoperative spectacle dependence. (Optical biometry, in this case the IOLMaster)

a 25-item questionnaire (VFQ-25) that has been extensively studied for cataract and other ocular conditions and is summarized in Table 1. The VFQ-25 is translated into nine other languages, including Japanese, Turkish, and Italian, and also exists as the VFQ-25 plus appendix (VFQ-39) [7, 8]. This questionnaire is a public document, developed by RAND, funded by the NEI, and available without charge to researchers provided the source is cited [8]. The VFQ-25 measures not just visual function on the ADL but also the social and emotional impact that the vision has on the patient's global health. Loss of visual function on the NEI-VFQ has been proven to correlate with dense nuclear sclerotic cataract and also the need for cataract surgery [7]. Interestingly, the scores do not progress statistically with the progression of the density of cataract, suggesting that even milder forms of cataract can significantly interfere with visual functional [9]. The VFQ-25 and scoring instructions are available in English, Spanish, and Greek at http://www.rand.org/health/surveys_tools/vfq/. A separate 19-question survey, the Activities of Daily Living Scale (ADVS), measures difficulty with specific visual tasks and was designed to evaluate cataract surgical candidates [10].

Although cataract surgery is an elective procedure, there are situations in which the physician can preferentially promote surgery over observation. The patient

Table 1 Summary of 25 areas covered by the VFQ-25 [7, 8]

General ratings
Overall health
Eyesight
Concern about eyesight
Experience of periocular discomfort
Troubles caused because of vision
Difficulty with ordinary print
Difficulty with hobbies and near activities
Difficulty finding objects on a crowded shelf
Difficulty reading signs
Difficulty navigating uneven terrain
Difficulty seeing peripheral obstacles
Difficulty reading nonverbal cues in others
Difficulty selecting clothing
Difficulty engaging in social situations
Difficulty going to entertainment events
Effect on frequency and ease of driving
Effect on driving at night, or in weather, traffic, or unknown environments
Difficulty reaching goals because of vision
Difficulty with duration of work or activities
Difficulty with periocular pain or discomfort limiting activities
Influence on likelihood to stay at home
Influence on frequent frustration
Effect on loss of control over activities
Reliance on what others tell patient
Reliance on others for help
Concern will embarrass self or others

should be informed that in some cases there are increased risks inherent to observation. For example, a patient with an unusually narrow anterior chamber angle but with retention of moderately good vision may progress to phacomorphic glaucoma even after peripheral iridotomy. The more narrow the anterior chamber becomes, the more technically challenging the procedure and the higher the likelihood of corneal decompensation. The angle and anterior chamber may continue to narrow with progressive lens growth, and it may become necessary to encourage cataract extraction despite good vision and lack of functional complaints. A similar situation is seen with pseudoexfoliation cataracts. Although the majority of patients with pseudoexfoliation have uncomplicated surgery, there is potential for increased surgical difficulty with increasing lens density and worsening zonular integrity. Although lens extraction remains an elective procedure while the patient is functionally asymptomatic, in symptomatic cases with an undecided patient, the practitioner can discuss the potential for increased future surgical risk with continued observation.

The preoperative surgical discussion includes documentation of the patient's preferred DNR status and their designated Medical Power of Attorney. Both the patient care and the professionalism domains for cataract surgery in the elderly allow the clinician to share their past professional experience and their clinical judgment on the patient's particular situation. Keeping abreast of the scientific literature allows the clinician to better educate the patient and the family on their care options. By recognizing and respecting the limitations of their own surgical experience and abilities, the clinician will provide better medical and surgical care in a more efficient and competent manner.

Preventative care and maintenance of health are important patient care parameters. Involving the patient's family practitioner and anesthesiology preoperatively addresses the unique needs of compromised elderly patients. The family and the residential care facility nursing staff are also part of the perioperative team and can address issues in postoperative compliance with medical treatment and follow-up. These preemptive efforts will coordinate the patient's perioperative medical regimen and recovery and allow a seamless transition of care. Finally, the clinician can consider referring elderly patients with limited vision potential for a postoperative low-vision rehabilitation evaluation in order to maximize the final visual function for the patient's desired activities of daily living. All of these components work in concert to meet the overall goal of patient-centered care.

Medical Knowledge

The literature describing the effects of cataract on ADL in the elderly is compelling. These studies show that the loss of visual function from cataracts negatively affects quality of life measures similar to chronic systemic disease [11]. Early cataracts decrease performance-based visual function, and self-assessed visual function becomes more compromised with age [12]. Increasing age and poor visual function are independently associated with the loss of independence, including the avoidance

of night driving and nursing home placement. Elderly patients with poor vision are more likely to have falls and fractures, suffer from a fear of falling, and need walking aids [13]. Decreased visual function has been shown to decrease visual confidence, socialization, and quality of life indicators [14].

Cataract surgery, however, has been associated with improved mood, anxiety, perceived health, cognition, and neuropsychiatric symptoms. Jeffries et al. studied cognition, mood, and visual hallucinations and confirmed other studies that show mood does not change significantly postoperatively. There was a statistically significant improvement in cognition in patients with preoperative normal and mildly decreased cognition, supporting the cognitive resource theory of freeing neural resources from dealing with visual impairment and allowing these resources to attend to other cognitive tasks. This was not felt to be directly due to acuity, as most of the improvement was found in nonvisual cognitive tasks. There was no improvement, however, in patients with more moderate cognitive impairment. Visual hallucinations resolved in two patients, with some progression in other patients, felt due to delirium and dementia; these changes were not statistically significant [15].

It is important to discuss the benefits of cataract extraction in older patients with visual disabilities. Surgical intervention for cataracts is known to increase visual function and independence. First-eye surgery in patients with bilateral cataracts has been shown to improve visual function (reading, IADL) and to decrease vision-related disability. Patients who improve their reading vision postoperatively also show improvement in their depression scores [16]. With the significant effect of cataract on visual function and the general good results of cataract surgery, cataract extraction has become the most common procedure performed worldwide among the elderly [17–19].

Although the outcomes of cataract surgery are overall favorable, results may vary by technique. Surgical success rates range in clinical studies from 50 to 95% [19, 20], with up to 89% of patients benefiting from improved quality of life [21]. A recent meta-analysis of randomized control trials found a spectacle-corrected visual acuity of 6/9 or better in 91% of individuals undergoing phacoemulsification and in 86% undergoing extracapsular cataract surgery (ECCE). Extracapsular surgery is increasing in developing nations due to a decrease in intracapsular surgery and an increase of manual sutureless small-incision extracapsular cataract surgery (SICS) [22]. One recent prospective, randomized trial showed that phacoemulsification and SICS provide equal immediate and long-term surgical outcomes, though SICS was significantly faster, less expensive, and less dependent on technology [23].

Interpersonal and Communication Skills

The doctor and elderly patient relationship optimally includes the patient's family. The technical office staff are an invaluable resource for useful observations on the patient's visual functional status and general well-being. Because the contribution of cataract to vision loss is incremental and progressive, patients have difficulty differentiating the gradual limitations in ADL due to cataract from those due to other

aspects of aging. As a result, elderly patients may downplay the contribution of cataract and may be slow to pursue an elective surgical correction of their vision. The family may be more objective and are often better able to observe a change in visual function and ADL. These observations include a decrease in the ability to drive, to navigate uneven terrain, to travel to social functions, and to engage in favored activities such as reading, working puzzles, and watching television. The family thus may be the first to report a decline in visual function and is a helpful addition to the patient visit. When present, they can review the physician's recommendations with the patient.

The eye practitioner is uniquely able to evaluate the ocular contribution to an elderly patient's functional decline. The functional effect of vision loss is intertwined with a potential senescent decline in stamina, attention level, mental function, and general interest. There may be a coexistent decrease in cognitive activities due to depression or dementia. The ophthalmic surgeon can consider alternative causes for a loss of visual interest, particularly if the level of vision measured on exam would not prohibit involvement in previously enjoyed visual pursuits. The alternative causes of a decline in activities can be pursued in coordination with the primary practitioner and in some cases with formal neuropsychologic testing. One simple office test for dementia is to have the patient perform a clock drawing or to verbally interpret a complex visual scene [24]. The effect of and diagnosis of cognitive decline is further discussed in the section of this book on depression and dementia.

There is some evidence that cataract surgery can improve cognitive function in some patients and may slow progression of cognitive decline in others. Tamura prospectively studied the effect of cataract surgery on cognition. They found that 60 percent of patients with cognitive impairment increased their Revised Hasegawa Dementia Scale (HDS-R) score by at least 4 points, and this effect persisted with vision-dependent items factored out of testing. Although those with moderate cognitive impairment did not show improvement, they also did not show worsening, suggesting a stabilization of their cognitive impairment. The control group had no improvement, which confirmed that the cognitive improvement after surgery was not due to a learning effect on the postsurgery presentation of the HDS-R [25].

The ophthalmologist's final decision for surgery must weigh the often conflicting reports of visual disability from the patient, from the family, and from other caregivers, as well as from changes in the patient's eye examination.

Professionalism

Cultural, gender, and age-related differences affect the patient's perception of and use of the medical system, including their access to and pursuit of elective ocular procedures. One generational difference is seen in those elderly patients who grew up during World War II and the Great Depression. This elder generation of patients may be reticent about complaining about postoperative pain or accepting pain managment [26]. They may likewise view pursuing a functional ocular limitation as "needless

complaining." These patients have different expectations than the more medically and technically savvy Baby Boomer generation. The elderly may also base their own outcome expectations upon their parent's surgical experiences from years ago and may require additional chair time to dispel these fears. Although finding the additional time for an extended discussion with the reticent or confused elderly is difficult with today's rapid clinic patient turnover, professionalism requires placement of the patient's needs for education before the doctor's needs for efficiency.

Practice-Based Learning and Improvement

The adept clinician will practice self-reflection and constantly improve their own practice by critically reviewing and assimilating relevant material from the medical literature. This includes being aware of the specific population that they serve and applying to that population an understanding of the effect that cataracts have on the elderly locally, nationally, and internationally. It is likewise important to recognize the risk factors for and interventions against the development of cataract and the risks and benefits of cataract surgery in patients with comorbid eye disease.

Cataracts continue to be a leading cause of vision loss from the first world to the third world. A recent review of cataract epidemiology by Abraham shows that cataracts cause 47.8% of the world's 37 million blind, with 82% of cataract blindness occurring in those 50 years and older [20, 22]. Although 90% of those blind from cataracts live in developing nations, cataracts continue to be the leading cause of low vision both in US nursing home patients (37% of white and 54% of African-American subjects) and in other developed countries (78% of low vision in the Netherlands) [20]. The incidence of cataract is rising globally as the population ages. The world estimation of 20 million blind in 2007 is expected to rise to 40 million blind in 2020 [18, 20, 22]. There is therefore great interest in preventing cataracts, as delaying the onset of cataract formation by 10 years could decrease the need for surgery by 50% [20].

There are a number of cataract risk factors that can be modified. Smoking is associated with nuclear sclerosis [NSC] and posterior subcapsular [PSC] cataracts, diabetes with cortical opacities [CO] and PSC, UV light exposure with CO and PSC, and myopia possibly with all types of cataract. Oral corticosteroids are linked to PSC cataracts and to a lesser degree are inhaled steroids [22].

Vision loss from cataracts is also related to gender and age. Women are more likely than men to lose vision from cataracts when age matched, though worldwide surgery is often provided preferentially to men [22]. The incidence of vision loss from cataract is known to increase with advancing age. Postmenopausal hormone changes, genetics, and serum markers of inflammation are all under investigation for their role in cataract formation. Finally, there is conflicting data on the role of antioxidants and cataract formation. Studies of nutritionally deprived populations are currently ongoing [20].

Comorbid eye disease can significantly impact the risks and the benefits of cataract surgery. The clinician can use advances in technology to facilitate access to the medical literature about ongoing studies and techniques to maximize the outcome

in at-risk eyes. This new knowledge will optimally be used to educate not only themselves but also their patients and their ophthalmic colleagues. The physician should draw on their past experience of treating patients with similar comorbid diseases, intertwining this with the literature evaluating cataract surgery in patients with multiple ocular diagnoses. They should use this information to continuously update their surgical and medical practice and council their patients with comorbid disease.

Gray et al. found comorbid eye disease in 39% of British cataract patients, including glaucoma in 14%, age-related macular degeneration in 13%, and diabetic retinopathy in 4% [18]. Naeim et al. showed that cataract extraction was beneficial and cost-effective in 75% of patients who preoperatively were felt to have less than 30% chance of benefiting from surgery. The benefit and cost-effectiveness of cataract surgery in these patients were measured comparable to influenza and pneumococcal vaccination in patients over 65 years of age, lovastatin for cholesterol reduction, and radiation after breast-conserving surgery [19]. A study by Ma et al. evaluated cataract surgery in 60 eyes of 51 patients with advanced age-related macular degeneration (AMD) to see if cataract surgery is still beneficial to vision-related quality of life in these patients. They found a statistically significant improvement in postoperative corrected vision. Vision improved in 56.67%, and the quality of life (QOL) questionnaire improved significantly in 72% of patients. QOL subsets that showed the most improvement were general vision and lighting, mobility (100% of subsets of mobility showed improvement), psychological adjustment, reading, fine work, and activities of daily living. The most improvement in QOL was found in patients with the worst preoperative vision. It was felt that these findings indicated enough of an improvement that these patients with AMD would be able to live independently and care for themselves [27].

The outcomes of these studies overall support the performance of elective cataract surgery in patients with visual limitations, despite the presence of other eye conditions that may limit their expected improvement.

Systems-Based Practice

The national financial costs of cataract surgery in the elderly population are high; the benefits both to the individual and to society are likewise significant. Cataract extraction is the most common surgical procedure performed on patients 85 and older [23]. In the 1990s, 60% of Medicare expenditures was spent on cataract surgery and related care, costing $3.4 billion annually [20, 28]. The economic benefits of cataract surgery outweigh the financial costs of surgery, however. The savings occur in quality of life improvement for the individual as well as in the release of family care duties for relatives of the visually impaired [18, 22]. The demand for cataract surgery thus continues to rise both in the United States and abroad [17, 18, 20].

There is interest in the United States and abroad to determine the cost-effectiveness of second-eye surgery. One-third of all cataracts removed in the United Kingdom and 30–45% of cataract surgeries performed in the United States are second-eye surgeries. Recent recommendations support improved patient outcomes

with rapid, successive surgeries [18, 28]. Second-eye visual impairment causes poor binocular acuity, stereoacuity, and even abnormal motion perception; one cataractous eye can induce binocular inhibition of the visual input from a pseudophakic, rehabilitated first eye. Second-eye surgery dramatically improves both self-assessed visual function and stereoacuity [28], decreases self-assessed visual impairment, and improves not only mobility but also routine daily and leisure activities [17] in levels comparable to first-eye surgery [18]. Current research therefore supports second-eye surgery assuming that the same difficulties with visual function and quality of life indices are met as with first-eye surgery [18, 28].

Finally, there is interest in the effect of cataract surgery on both the mental health function and the physical well-being of elderly patients. Gray et al. reviewed several studies that looked at the effect of cataract surgery in dementia and depression. They found an improvement in the patient's perception of their health and a decrease in anxiety and depression simply from scheduling the patient for cataract surgery. There are improvements in MMSE scores postoperatively in both first- and second-eye surgeries in patients who did not have significantly depressed initial MMSE. Additional studies have showed an improvement in cognition, though others showed no improvement in depressive symptoms [18]. Owsley compared nursing home cataract patients who elected to undergo surgery with those who declined surgery on scales of depression and health-related quality of life. The surgery group had a statistically significant improvement in vision ($p < 0.001$), and the Nursing Home Vision-targeted Health-Related Quality of Life showed an age-corrected improvement in subscales of vision ($p = 0.005$), reading ($p = 0.001$), psychological distress ($p = 0.015$), and social interaction ($p = 0.33$). The VF-14 improved as well ($p = 0.004$), though there was no statistical change in the Medical Outcomes Study Short-Form 36, Geriatric Depression Scale, or Cataract Symptom Score. This showed that acuity, quality of life, and psychosocial factors improved but supported other studies that do not show an improvement in depression [29].

Cataract surgery can likewise affect the physical well-being of the patient. Studies have demonstrated that 25% of patients over 65 years old fall yearly and that visual impairment (by decreased acuity, contrast sensitivity, visual field, PSCC, and nonmiotic glaucoma medication) contributes to falling [14]. First- and second-eye cataract surgeries in elderly patients with cataract-related visual loss have been shown to significantly decrease the postoperative risk of falls. Risk factors that amplified the risk of falling preoperatively were older age, use of more than four medications, and a past fall, though these risk factors were nullified after cataract surgery [14]. Foss et al. hypothesized that earlier second-eye surgery (1 month) would decrease the fall rates compared with the then standard surgical timing of the second eye (1 year). Although this study did not reach enrollment due to changes in second-eye timing policy, there were statistically significant improvements in visual function (acuity, contrast sensitivity, stereopsis), in patient confidence regarding falling, and in existing visual disability [30]. It is unfortunate that despite all the benefits of cataract surgery in the elderly, the access to medical care, insurance status, and ability to speak English still all affect the rate of appropriate cataract surgery in the United States [20].

Case Resolution

The family involvement in this clinical case proves to be very beneficial to the patient. The son accompanies his mother on this visit and provides an accurate and objective assessment of his mother's declining visual function. He reminds his mother of her past interests, leading into a lengthy discussion with the clinician on the option of cataract surgery. The clinician shares their past observations of the outcomes of other patients with similar comorbid ocular conditions, the recommendations of the medical literature, and the anticipated limitations of best corrected vision due to the patient's degree of macular degeneration. She is reassured in the potential visual benefits despite her expected limitation of vision. The clinician reviews the many advances in surgical technique since the patient's mother's procedure, relieving her fears about the surgery and the postoperative care period. The patient defines her goals to be improved contrast sensitivity, ambulation, and brightness. She chooses to try her best eye first, claiming that "the other one isn't worth anything," and becomes very enthusiastic about proceeding rapidly to surgery. The ophthalmologist contacts her primary care physician, arranging for them to maximize her diabetic and hypertensive control preoperatively, and additionally sends preoperative information to the skilled care facility where she lives.

The patient undergoes uncomplicated cataract extraction with lens implantation. She subsequently proclaims that her vision is "100 percent improved" at 20/80, including both improved brightness and increased clarity of vision. Her son interjects that she has spent more time watching television and has become involved with a local coffee group. She elects to proceed with her second eye, feeling it is now relatively "dim and yellow vision" when compared with her pseudophakic eye. The physician discusses the benefits of second-eye surgery and the anticipated improvement in her daily function over unilateral cataract surgery. They arrange for her to see a low-vision consultant postoperatively, as she hopes to acquire a closed circuit low-vision device for use at the living facility.

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