

KATHRYN E. BOLLINGER, MD, PhD

Cole Eye Institute, Cleveland Clinic

ROGER H. S. LANGSTON, MD

Cole Eye Institute, and Transplantation Center,  
Head and Neck Institute, Cleveland Clinic

# What can patients expect from cataract surgery?

## ABSTRACT

Cataract surgery has evolved into an outpatient procedure that requires minimal anesthesia and significantly improves visual function for about 90% of patients. With the help of their primary care physician and ophthalmologist, patients can decide when cataract surgery is appropriate for them. In addition, patients may have a choice about the type of synthetic lens implant that fits their visual needs.

## KEY POINTS

Known risk factors for cataract include age, family history, smoking, sunlight exposure, diabetes, trauma, and corticosteroid use.

Patients taking aspirin or other anticoagulant drugs do not need to change their regimen before undergoing cataract extraction. However, measures of control such as the international normalized ratio should be within the therapeutic range.

Any patient who develops pain and decreased vision 2 to 5 days after surgery requires an immediate evaluation by an ophthalmologist.

Improvements in cataract surgery include topical anesthesia and phacoemulsification—dissolving or emulsifying the lens through a small incision.

New multifocal intraocular lenses offer refractive correction and give some patients the ability to see both close up and at a distance without glasses after cataract surgery.

WHILE WE KNOW THAT HEREDITARY, environmental, and lifestyle factors promote clouding or opacification of the lens of the eye, we still do not know how to prevent it. Therefore, the management of cataract still consists of removing the clouded lens and implanting a synthetic one.

Fortunately, this is now a common outpatient procedure requiring minimal anesthesia. Patients referred for cataract surgery can expect a rapid recovery and substantial improvement in visual acuity. We present here a brief overview of cataract and current techniques to manage it.

## THE IMPACT OF CATARACT

Cataract is the most common cause of reversible vision loss worldwide,<sup>1</sup> and its prevalence is increasing as our population ages.

In the United States, several large population-based studies have examined the prevalence of visually significant cataract. The Framingham Eye Study<sup>2</sup> found that age-related cataract caused degradation of vision to 20/30 or worse in 15.5% of the population as a whole and in 45.9% of people over age 75. The Beaver Dam Eye Study<sup>3</sup> used a similar definition of vision loss and found the frequency to be 38.8% in men and 45.9% in women over age 74.

Each year, almost 1.5 million people in the United States have cataract surgery, at an estimated cost of \$3.4 billion. However, the cost of not treating cataract is much greater if one considers the effects of cataract-related vision loss on the ability to work and to function independently.

## ■ WHAT CAUSES CATARACT?

The lens tends to lose its clarity with age, as well as in association with certain genetic factors, developmental abnormalities, metabolic disorders, medications, and trauma. As yet, we cannot prevent or reverse the clouding.

Data from studies of families and twins provide strong evidence that heredity plays a role in age-related cataract formation. Genetic factors likely account for 50% to 70% of cataract cases and are important in the development of both nuclear and cortical opacities (see discussion of types of cataract below).<sup>4,5</sup> Other known risk factors are smoking, sunlight exposure, diabetes mellitus, and the use of corticosteroids.<sup>6-9</sup> Alcohol, nutritional supplements, and other drugs are also under study as possible risk factors for cataract.<sup>10</sup>

Public campaigns to encourage smoking cessation and protection from ultraviolet B light may be useful strategies for delaying the onset of cataract.<sup>11</sup> However, the population-attributable risk of these factors is quite low. In interventional trials, antioxidants have not shown clear efficacy in preventing cataract.<sup>12</sup> Therefore, in lieu of actually preventing cataract from developing, the focus is on preventing visual disability from cataract by detecting it early and treating it surgically.

## ■ TYPES OF CATARACT

There is no universal classification system for cataract. Many types of **congenital and developmental cataract** exist, and most are recognized in childhood or early adulthood. In contrast, most cases of **age-related cataract** fall into one of three categories: nuclear, cortical, and posterior subcapsular. Each type has a characteristic set of features and appearance, and two or more types may coexist in the same patient.

### Nuclear cataract

With aging, the center or nucleus of the lens hardens and becomes yellowed, owing to the addition of lens fibers. This process, called nuclear sclerosis, is normal. Nuclear sclerotic changes progress slowly over the course of years.

When this type of cataract becomes visually significant, it can result in a myopic (near-

sighted) shift in refraction. Therefore, many patients with nuclear cataract have a greater loss of distance vision than of near vision. Many retain the ability to read the newspaper but cannot pass the motor vehicle bureau vision test.

### Cortical cataract

Cortical cataract occurs when discrete opacities form within the outer fibers of the lens (the cortex). These aging changes typically are not visually significant unless they obscure the visual axis. Cortical cataract often causes glare and light scatter during activities such as driving.

### Posterior subcapsular cataract

In posterior subcapsular cataract, granular opacities develop within the posterior cortex of the lens. It often occurs in younger patients and causes greater difficulty with near vision than with distance vision. In addition, many patients describe difficulty with glare. This is the type of cataract associated with diabetes mellitus or with corticosteroid use.

## ■ WHEN IS IT TIME FOR SURGERY?

In general, patients with cataracts describe a gradual decline in vision over a period of months to years. Patients who present with a sudden change or decrease in vision should therefore be referred immediately to an ophthalmologist.

In rare cases, cataract surgery is necessary because the cataract causes glaucoma or uveitis. Cataract extraction is also indicated if the patient has a posterior segment condition such as diabetic retinopathy and the lens has become too opaque for the ophthalmologist to see the retina clearly.

In general, though, surgery is only performed when the patient's visual function has declined significantly. This is assessed by asking the patient whether decreased vision has affected his or her daily activities. Several questionnaires have been developed with the goal of improving the objectivity of this assessment; these include the Visual Function Index (VF-14)<sup>13</sup> and the Activities of Daily Vision Scale, but they are not routinely used by practicing ophthalmologists.

Cataract risk factors include smoking, sunlight exposure, diabetes mellitus

Surgery is appropriate when the problems associated with the cataract outweigh the (small) risk of a bad outcome. The situation is obviously different for a patient who works, drives, or is active in sports vs a patient with dementia who is in a nursing home. Years ago, cataracts had to reach a certain consistency or “ripeness” to maximize the chances for success, and the surgeon decided when to operate, but with current technology the procedure can be performed equally well at any point. Hence, the patient usually decides if and when to have the surgery, and the surgeon provides helpful advice.

## ■ PREOPERATIVE EXAMINATIONS AND COUNSELING

### Eye examination

Before cataract surgery, the patient undergoes a comprehensive ophthalmologic examination, including measurement of refraction, measurement of intraocular pressure, slit lamp examination, and examination of the retinal fundus with the pupils dilated. Other causes of impaired vision must be ruled out, such as glaucoma, age-related macular degeneration, and diabetic retinopathy.

Visual function is assessed by use of a vision chart that displays black letters on a white background. Glare effect can be measured by determining visual acuity under conditions of increased ambient lighting. In patients with coexisting eye problems, such as age-related macular degeneration, special testing and clinical judgment are needed to assess the potential value of cataract surgery.

### Medical examination

Most surgical centers require a comprehensive medical assessment and laboratory testing before eye surgery. However, the rate of serious perioperative complications requiring hospital admission and the rate of death are so low when local anesthesia with intravenous sedation is used that studies have not found routine laboratory testing to have any effect on the rates of these bad outcomes.<sup>14</sup>

In general, patients taking aspirin or other anticoagulant drugs do not need to change their regimen before undergoing cataract extraction. However, measures of control such

as the international normalized ratio should be within the therapeutic range.

The surgeon should be aware of other drugs the patient may be taking, such as tamsulosin hydrochloride (Flomax), which can cause iris instability and poor pupillary dilation.

### Selecting the type of intraocular lens

After obtaining preoperative informed consent, taking the medical history, and performing a physical examination, the ophthalmologist examines the patient’s eye with the specific goal of choosing the type of synthetic intraocular lens.

Modern intraocular lenses were first used by Ridley<sup>15</sup> in 1949. Designs and materials have since been refined, and implants can now improve and even correct a patient’s refractive error. To do this, the axial length and corneal curvature of the patient’s eye must be measured. Axial length is measured using ultrasonography, and corneal power is determined with keratometry. The choice of implant power determines whether the patient will be nearsighted, farsighted, or emmetropic after surgery, and this should be discussed with the patient beforehand.

## ■ ANESTHESIA FOR CATARACT SURGERY

Nearly all cataract operations are performed with sedation, not with general anesthesia. Local and topical anesthesia are almost always more time-efficient and cost-efficient.<sup>16</sup>

### Retrobulbar and peribulbar injection: Higher risk of complications

Throughout most of the 20th century, anesthesia of the eye was accomplished by injecting lidocaine (Xylocaine), bupivacaine (Marcaine), or both into the retrobulbar space, ie, behind the eyeball. This procedure demands considerable training and technical skill to perform safely, as one cannot see the tip of the needle and must avoid orbital structures such as the optic nerve and the eye itself. Complications can include brainstem anesthesia, oculocardiac reflex, perforation of the globe, and retrobulbar hemorrhage.<sup>16–20</sup> Of these, retrobulbar hemorrhage is the most common; the reported incidence rate has ranged from as low as 0.44% to as high as 3%.<sup>19,20</sup>

**If and when to have cataract surgery is usually up to the patient**

Peribulbar injection, a second type of regional anesthesia, involves injecting lidocaine or bupivacaine outside the muscle cone. This method also provides excellent anesthesia and is thought to have a lower risk of perforating the globe or penetrating the optic nerve.

#### Topical anesthesia now used most often

Topical anesthesia with eyedrops is now the most frequently used type of anesthesia for cataract surgery, specifically in cooperative patients undergoing phacoemulsification (see below). The advantages: fewer vision-threatening complications occur than with retrobulbar or peribulbar injections.<sup>16-21</sup> Most patients need less sedation and therefore have fewer systemic postoperative problems such as nausea and vomiting. Also, topical anesthesia does not affect vision and does not cause akinesia (temporary paralysis) of the eye, so many patients have useful and improved vision immediately after surgery.

However, the patient must be able to cooperate during the procedure. Another disadvantage of topical anesthesia is greater patient awareness of surgical manipulation, because the area of local anesthetic effect is smaller than with retrobulbar block. In addition, it does not provide akinesia, so the surgeon has less control of the operating environment.

Rarely, general anesthesia may be appropriate in patients who cannot cooperate because of advanced age, poor mental status, or severe claustrophobia.

#### ■ CURRENT SURGICAL TECHNIQUES

The three main techniques for cataract extraction today are extracapsular extraction, phacoemulsification, and intracapsular extraction.

**Extracapsular cataract extraction** involves removing the opacified lens but leaving the capsule of the lens and its zonular attachments intact. The capsular bag then provides a scaffold for implantation of a synthetic lens.

One method of extracapsular cataract extraction involves removing the entire nucleus through an 11-mm incision at the corneal-scleral junction. This procedure is used more often for dense, more advanced cataracts.

**Phacoemulsification** is currently the most commonly used procedure for cataract extraction in the United States.<sup>22-24</sup> This is a less-invasive version of extracapsular cataract extraction, developed by Kelman<sup>22</sup> in 1967, in which the lens nucleus is emulsified within its capsule using an ultrasonic probe inserted through a small (3-mm) incision.

The advantages of phacoemulsification compared with regular extracapsular extraction are that the incision is smaller, the rates of intraoperative complications such as vitreous loss and iris prolapse are lower, the procedure time is shorter, and the time to visual recovery is faster. As with the other extracapsular approach, the capsular bag is maintained, allowing for easy placement of a synthetic lens implant.

**Intracapsular cataract extraction** is the removal of the entire lens including the capsule, after which the patient must wear special (ie, aphakic) eyeglasses. This procedure is no longer used in developed countries except in rare cases such as a partly dislocated lens, although it is still used in the developing world. It has a high rate of intraoperative and postoperative complications.<sup>21</sup>

#### ■ POSTOPERATIVE COMPLICATIONS

The most feared complication of cataract surgery is intraocular infection, or endophthalmitis. Acute endophthalmitis generally develops 2 to 5 days after surgery and can cause severe, permanent vision loss. Fortunately, the frequency of endophthalmitis is low (0.08% to 0.1%). However, any patient who develops pain and decreased vision 2 to 5 days after cataract surgery should be evaluated immediately by an ophthalmologist.<sup>25-27</sup>

The most common postoperative complication of extracapsular cataract extraction is posterior capsular opacification. This results from proliferation of residual lens epithelial cells within the lens capsule, causing opacification and decreased visual acuity. Posterior capsular opacification occurs after approximately 25% of surgeries within 5 years after surgery. The risk is higher in younger patients (because of greater activity of lens epithelial cells in younger people) and with certain intraocular lens designs.<sup>28,29</sup> Treatment con-

**The norm is sedation with local anesthesia, not general anesthesia**

sists of laser capsulotomy using a neodymium-yttrium-aluminum-garnet (Nd-YAG) laser, a simple office procedure.

## ■ OUTCOMES

Outcomes of cataract surgery are generally very good: 90% of patients achieve a “best-corrected vision” (ie, vision corrected with glasses or contact lenses) of 20/40 or better. This includes patients with diabetes and glaucoma. If patients with these conditions are excluded and only those with otherwise-healthy eyes are analyzed, the percentage of patients gaining 20/40 or better vision increases to 95%.<sup>30–33</sup>

### Cataract surgery in the very elderly

The results of cataract surgery in people over age 85 are not quite as good: only 85% have a significant improvement in vision. This lower rate is probably due to unrecognized comorbidity.

### Cataract surgery in diabetic patients

Diabetic patients undergoing cataract extraction require special consideration. Visual acuity after surgery may not be as good in patients with advanced diabetic retinopathy as it is in those with mild retinopathy.<sup>31–33</sup> In particular, macular edema is likely to persist after cataract surgery and affect final visual acuity.<sup>34</sup>

If the cataract does not prevent it, pre-treatment of diabetic eye disease is appropriate. Adjunctive treatment such as intravitreal injection of triamcinolone acetate at the time of surgery may also be useful, as may topical nonsteroidal anti-inflammatory drugs.

### Cataract surgery in patients with age-related macular degeneration

Age-related macular degeneration is the most frequent cause of irreversible blindness in the United States for patients older than 65 years.<sup>35</sup> Because our population is aging, this condition—and cataract surgery—are likely to become even more common.

Studies have shown that patients with age-related macular degeneration experience significant improvement in vision and quality of life after cataract surgery.

However, some studies suggest that, over the long term, cataract extraction can induce the development of age-related macular degeneration or accelerate its progression.<sup>36</sup> This could occur through postoperative inflammatory mechanisms. In addition, photo-oxidative retinal damage is known to play a role in age-related macular degeneration.<sup>37–39</sup> Therefore, intraocular lenses that block light within the wavelength range proven to cause phototoxicity (“blue-blocking” lenses) may be beneficial in patients susceptible to age-related macular degeneration (eg, whites, patients with a family history of macular degeneration). A randomized clinical trial is needed to study the ability of blue-blocking lenses to prevent this condition. Well-designed large longitudinal studies of older patients undergoing cataract surgery are also needed to more accurately address the risk of developing age-related macular degeneration after cataract surgery.

### Cataract surgery in patients who have undergone refractive surgery

In patients who have previously undergone refractive surgery, selecting the appropriate intraocular lens implant can be challenging, because refractive surgery may change the shape of the cornea so that measurement of its refractive power is less reliable. In these patients, the ophthalmic surgeon performs additional tests and may obtain records of the patient’s corneal power measurements before refractive surgery in order to compare these with the patient’s current refraction.<sup>1</sup>

## ■ INNOVATIONS IN CATARACT SURGERY: MULTIFOCAL LENS IMPLANTS

As people age, their eyes lose the ability to accommodate to view objects at close distances, a condition called presbyopia. For this reason, most older adults need glasses or bifocals for near tasks such as reading.

New multifocal intraocular lenses allow some patients to see clearly both at distance and close up without glasses after cataract surgery. The standard intraocular lens is monofocal, ie, it has a single focal length. Multifocal intraocular lens implants have multiple focal lengths through the use of zones

**Diabetic and very old patients have slightly worse outcomes**

of differing refractive power. So far, three multifocal intraocular lenses have been approved by the US Food and Drug Administration. They provide better near vision than standard monofocal lenses.

However, the improvement in near vision and increased freedom from wearing glasses may come at the price of adverse effects. Some patients with multifocal lenses report reduced contrast sensitivity and more halos around lights compared with patients who receive

monofocal implants.<sup>40</sup> Patients should be counseled about the benefits and possible risks of multifocal lenses, and the surgeon should take the patient's preferences into account.

Medicare has approved the requirement of an additional cash payment from patients who undergo implantation of a multifocal lens or the newly available astigmatism-correcting lens. This is intended to offset the increased cost of the lens and the time to evaluate and counsel the patient. ■

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ADDRESS: Roger Langston, MD, Cole Eye Institute, i32, Cleveland Clinic, 9500 Euclid Avenue, Cleveland, OH 44195; e-mail langstr@ccf.org.