



Vision 2020 e-resource
- for eyecare management worldwide



CATARACT SERVICES

VISION
2020 
THE RIGHT TO SIGHT



ARAVIND EYE CARE SYSTEM

Introduction:

Cataract is the major cause of blindness worldwide and cataract surgery is the most frequently performed ophthalmic surgical intervention. More than 66 countries have established National Blindness Control Programs or committees, where cataract surgery is the major activity.

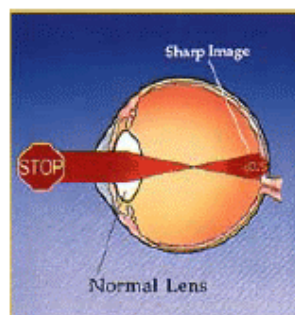
Cataract is an age-related disease and there are currently no effective preventive measures. On going services are therefore required, that are able to deal with existing (prevalent) as well as new cases (incident). The number of cataract cases is increasing rapidly because of population growth, increasing longevity and the growing desire of the patients to seek surgery in the early stages of visual disability.

The aim of cataract intervention programs is the provision of sufficient, successful and sustainable cataract services for all communities. Cost-efficient procedures and optimal utilization of resources is imperative because the cost of maintaining and expanding cataract services is becoming a major part of health costs in many countries.

Normal lens :

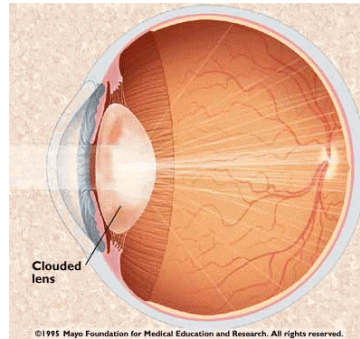
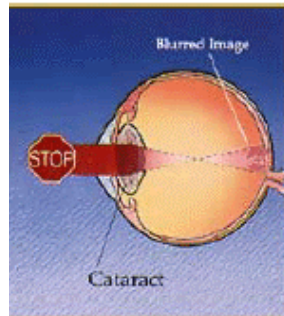
The normal crystalline lens is a transparent, biconvex structure whose functions are:

- To maintain its own clarity
- To allow light rays to pass through
- To help in visualizing both near and distant objects by changing its shape (accommodation)

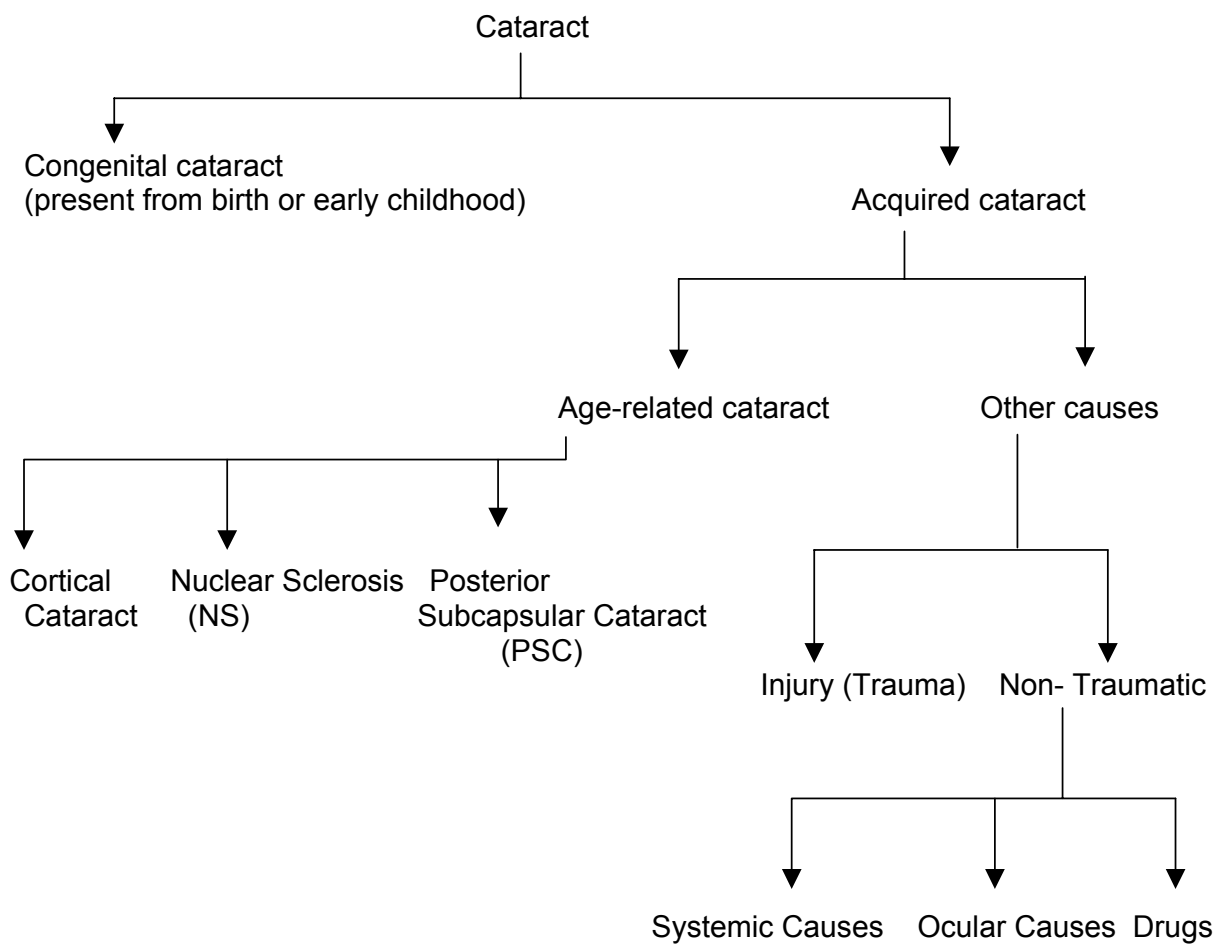


Definition of Cataract:

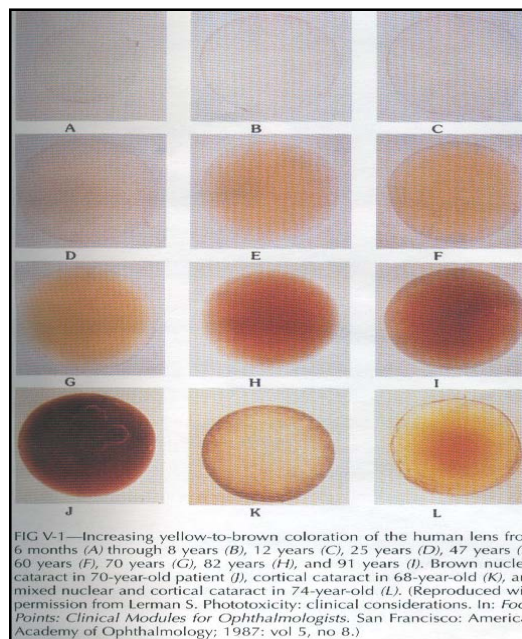
Cataract is defined as opacity of the crystalline lens or its capsule, which prevents the passage of the rays of light and causes significant visual loss.



Types of cataract



Age-related cataract



Age related cataract is the most common cause of visual impairment in older individuals. The prevalence of cataract is 50% in people between the ages of 65 and 74 and it increases to 70% in those over the age of 75.

As the lens ages, it increases in weight and thickness and decreases in accommodative power. As new layers of lens fibers are formed concentrically in the periphery of the lens the lens nucleus (central portion) undergoes compression and hardening. This reduces the transparency of the lens and scatters light rays.

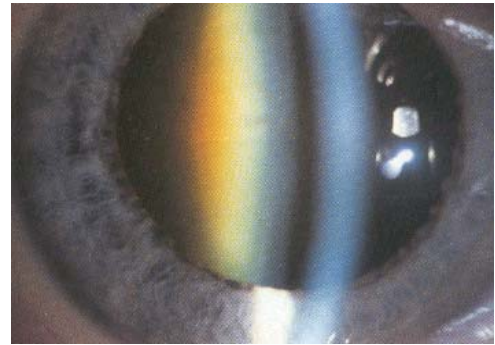
In general a certain NS is more common in older individuals while cortical cataract and PSC are more common in younger individuals.

Nuclear cataract

Early nuclear cataract



Advanced nuclear cataract



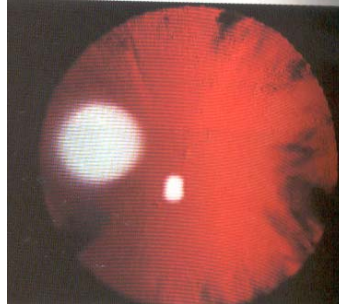
The lens takes on a yellow hue with advancing age. Some degree of yellowing is considered normal in adult patients past middle age. This condition interferes only minimally with visual function. An excessive amount of yellowing is called nuclear cataract, and it causes a central opacity. The degree of yellowing and opacification is evaluated with a slit-lamp biomicroscope and by examining the red reflex with the pupil dilated.

Features of Nuclear cataract

- Progress slowly
- Usually bilateral, though they may be asymmetric
- Greater impairment of distant vision than of near vision
- In the early stages, progressive hardening of lens nucleus in some cases, enables otherwise presbyopic individuals (people above 40 yrs of age who use reading glass) to read without spectacles. This is referred to as second sight.
- In advanced cases, the lens nucleus becomes opaque and brown and causes poor hue discrimination.

Cortical Cataract

Early Cortical Cataract



Opacities start from the periphery of the lens. They appear as white opacities when viewed with slit lamp biomicroscope.

Features:

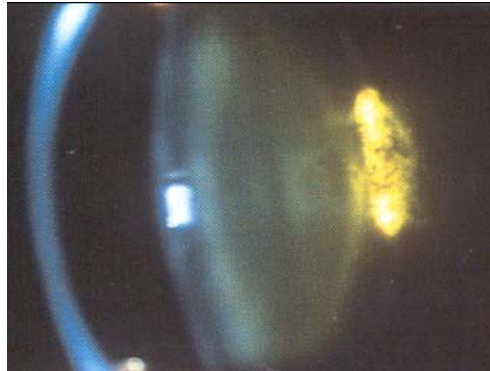
- Some opacities remain unchanged for prolonged periods, while others progress rapidly.
- Usually bilateral but are often asymmetric
- Their effect on visual function varies greatly depending on the location of the opacification. Common symptom is glare from intense light source. e.g.,. Car headlights.

Where the entire lens become white and opaque the cataract is said to be mature.

Mature Cataract



Posterior sub capsular cataracts



This type of cataract is seen in patients younger than those presenting with nuclear or cortical cataract. This can be age related or due to injury, drugs or inflammation. Patients complain of glare and poor vision under bright light. Near vision is reduced more than distant vision.

Trauma (Injury)

Traumatic lens damage can be

- Mechanical injury – blunt injury e.g. with a ball, fist,
 - penetrating injury with a sharp object
- Physical injury – radiation, electric current
- Chemical injury

Mechanical injury

A blunt injury may cause lens opacification either as an immediate event or a late sequale. This may involve a portion of the lens or the entire lens. A blunt trauma can cause partial displacement or total displacement of the lens from the visual axis due to damage to its supporting structures (zonules). There might be fluctuation of vision due to impaired accommodation, or double vision on seeing with the affected eye.

A penetrating injury results in opacification of the lens at the site of injury and it progresses rapidly to complete opacification. This may require surgery as an emergency

Radiation – induced cataract

The lens is extremely sensitive to ionizing radiation; but it may take as much as 20 years after exposure before cataract becomes clinically apparent. Infrared radiations (seen in glass blowers) can cause peeling of the lens fibers. Ultraviolet radiation in the range of UV-B-290-320 nm can cause cataract. Microwave radiation doesn't have much effect on lens.

Chemical injury:

Alkali injuries are more likely to cause cataract than acid injuries. Metallic foreign bodies in the lens mainly iron and copper can also cause cataract.

Electrical injury

Cataract induced by electrical injury may regress, remain stationary or mature to complete cataract over months or years.

Other causes:

Systemic conditions:

1. **Diabetes** – Diabetic patients have an increased risk of age related cataract that occurs at a younger age than in patient without diabetes.
2. **Atopic dermatitis** – This is a skin disorder associated with severe itching and history of multiple allergies. Cataracts are bilateral and occur in the second to third decade.

Drug – Induced cataract:

1. **Corticosteroids** – are drugs, which can be given as tablets, injections or even sprays or drops. They are used mostly for severe asthma, organ transplant. (e.g. Kidney transplant) , allergies and indiscriminate use. They may cause posterior sub capsule cataract.

Ocular causes:

- Cataract often occurs secondary to inflammations in the eye (uveitis). This is usually a posterior sub capsular type of cataract.

Evaluation of cataract in Adults

Management of cataract is guided by the information obtained through examining the patient and weighing several factors. Each individual's situation will vary.

Evaluation of a patient with cataract is designed to obtain the following information:

- Does the lens opacity correspond to the degree of visual impairment?
- Does the patient's reduced ability to function warrant surgery?
- Is the cataract age related or secondary to a systemic or ocular condition?

Clinical history:

1. **Decreased vision:** A cataract is clinically relevant if it causes a significant decrease in visual acuity, either distance or near. Different types of cataract may have different effects on visual acuity. Posterior sub-capsular cataracts of even mild degree can severely reduce visual acuity especially in bright illumination. Nuclear cataracts are associated with good near vision and poor distant vision. Cortical cataracts maintain a good vision till the central portion of the lens is affected, and this occurs at a late stage in cataract progression. In general a PSC causes more disturbance in

effective functioning of an individual than a nuclear cataract even though, visual acuity measurement can be the same.

2. **Glare:** Cataract patients often complain of increased glare. This is particularly prominent with posterior sub capsular cataract but is also common with cortical cataracts. Glare is less characteristic of nuclear cataract. Many patients tolerate moderate levels of glare with little difficulty but some are very symptomatic and may require early surgical treatment for cataract.
3. **Contrast sensitivity:** This is a measure of the patient's ability to detect subtle variation in shading by using figures that vary in contrast. This is reduced in cataract patients.

Non-surgical management:

Several non-surgical approaches may be temporarily effective in improving visual function in patients with cataract.

- Careful refraction can improve spectacle correction for distance and near vision.
- Increased ambient illumination and increased spectacle add are also helpful in reading.
- Topical eye drops which dilate the pupil (part of the eye through which light ray pass) may improve vision in patients with central cataract (opacity involving the central portion of the lens)

Medical management of cataract is being aggressively researched. Although progress is being made no commercially available medication has been proved to delay or reverse cataract formation in humans.

Low vision aids for cataract:

An older individual with mild to moderate nuclear cataract will benefit from wearing glasses for distance.

Some patients with limited visual function from cataract may be helped by optical aids when surgical management is not appropriate. Handheld monoculars of 2.5x, 2.8x, and 4x facilitate spotting objects at a distance, while high add spectacles magnifiers and telescopic loupes are used for reading and close work. Since cataract reduces contrast and causes glare, use of an appropriate absorptive lens can minimize this disability.

Surgical Management**Indication for surgery:**

The most common indication for cataract surgery is the patients desire for improved visual function. The decision is not based on a specific level of visual acuity.

Many governmental agencies and industries have minimum standards of visual function for such tasks as driving, flying and operating complex equipment. A patient whose best-corrected visual acuity does not meet these visual requirements may need to consider cataract surgery.

Once the patient has decided to seek improvement of visual function through cataract surgery, however, the ophthalmologist must determine whether this step is warranted.

A patient with visually significant cataract is a candidate for surgery on the eye with the more advanced cataract. The decision to proceed must be individualized according to the patient's visual needs and potential. A reasonable time should separate the two procedures if cataract is seen in both eyes, to ensure the success and safety of the first operation.

Medical indication for cataract surgery:

In addition to restoration of visual acuity, medical indications for surgery include

- (i) Leaking lens or a swollen lens causing an increase in eye pressure.
- (ii) Opaque lens that obscures the view of the fundus and thus prevents necessary treatment in the retina such as lasers in diabetic retinopathy.
- (iii) Displaced lens.

Contra indication for cataract surgery.

The mere presence of cataract is not an indication for surgery.

Surgery is not done in the following condition.

- (i) Patient does not want surgery
- (ii) Glasses / visual aids provide satisfactory vision
- (iii) Patients lifestyle is not compromised
- (iv) Patient is medically unfit.

Pre-operative Evaluation:

When the doctor and patient have determined that cataract surgery is warranted, additional evaluation and information should be obtained prior to the procedure. Following are general guidelines, which should be tailored to the specific patients situation.

General health of the patient:

A complete medical history is obtained from the patient to rule out medical problems like diabetes, heart disease, lung disease, bleeding disorder, renal dysfunction (kidney failure) and drug allergies.

Pertinent ocular history:

History of eye trauma, inflammation, eye pressure or retinal disease should be obtained as any of these if present can affect the visual prognosis after surgery. If

the patient has had cataract surgery in the other eye, it is important to obtain information about the operative and post operative course of that eye.

If the patient has had refractive corneal surgery, it is helpful to obtain information about the type of procedure both in predicting the intraocular lens power and in determining the surgical approach.

In practice a long duration diabetic must be told of the possibility of diabetic retinopathy, which may be masked by the presence of the cataract.

Social status:

The decision to undertake cataract surgery is not based on the patient's visual acuity in itself but rather on the effect of reduced visual function on the individual. So the doctor should be aware of the patients occupation, lifestyle and any possible chemical dependencies as they relate to the post-operative recovery.

General examination:

Since 80% of cataract patients are otherwise healthy, a healthy cataract patient does not require a battery of extensive and expensive systemic tests before undergoing cataract surgery.

Two basic tests that are universally agreed upon are screening for diabetes and hypertension.

A routine urine examination for checking sugar is required .If it is positive then blood sugar is investigated and necessary treatment is initiated Blood pressure recording is mandatory to check for hypertension.

Patients with any other systemic disorders should be investigated accordingly.

Ocular investigations:

- (i) Visual acuity of the patient is to be recorded.
- (ii) The eyelids and the tear drainage systems are examined for any infection. If infection is present appropriate measures are taken and cataract surgery is postponed till infection subsides.

- (iii) All the anterior segment eye structures are examined with a slit – lamp with special reference to the density and nature of cataract.
- (iv) Retinal examination is a must for all patients undergoing cataract surgery. If the fundus is not seen or if the retinal function is found to be defective, the visual prognosis should be explained to the patient.
- (v) An ultra sonogram can be used in cases of cataract, which is not age – related.
- (vi) Intra ocular pressure is recorded to rule of co – existing glaucoma
- (vii) The power of the intra-ocular lens for each patient is estimated by using Keratometry and A – scan.

Patient preparation and informed consent:

After undergoing the above procedures and if the patient is found to be fit for surgery, then an informed consent is obtained from the patient.

The patient should have a clear idea about.

- (i) Risks and benefits of cataract surgery
- (ii) Indications for and alternative, to surgery.
- (iii) Risks of common operative and post operative complication
- (iv) Anticipated time course for activity limitations.
- (v) Role of pre – existing ocular and Medical disorder in visual outcome.
- (vi) Desired post – operative refractive status
- (vii) When the final optical correction will be given
- (viii) Amount and duration of post – operative eye medications

Surgical Techniques

Evolution of cataract surgical Techniques.

Couching (800 Bc)	Pros	Cons
Intra capsular Cataract extraction (ICCE) With aphakic glasses (Early 19 th century)	<ul style="list-style-type: none"> (i) No other available procedure then. (ii) Simple procedure (iii) Not dependent on operating microscope (iv) sight restored with spectacles (v) Still used in removal of partially displaced lens (subluxated lens) 	<ul style="list-style-type: none"> (i) Very high complication rate (ii) Performed by non – professionals with no follow-up (iii) Still very poor vision (iv) Good best corrected vision but poor in quality (v) Patients blind without spectacles (vi) Spectacles are heavy and inconvenient with distortion (vii) 50% have lost or broken spectacles in 2 years.
ICCE with Anterior chamber Intra – ocular Lens (1970's)	<ul style="list-style-type: none"> i) Simple instrumentation ii) No need to learn extra – capsular cataract extraction. 	<ul style="list-style-type: none"> (i) Requires operating microscope (ii) More skill than ICCE (iii) Higher incidence of late complication (iv) Eyes are less tolerant to AC IOL
Manual extra Capsular cataract Extraction with Posterior	<ul style="list-style-type: none"> (i) Safer than ICCE (ii) Better visual functioning and quality of life 	<ul style="list-style-type: none"> (i) Suture related complication (Irritation , discomfort, Infection)

chamber intraocular lens (early 1980's)	<p style="text-align: center;">Pros</p> <ul style="list-style-type: none"> (iii) Better uptake of IOL than spectacles (iv) Requires a relatively shorter learning curve (v) Simple Instruments and equipment. 	<p style="text-align: center;">Cons</p> <ul style="list-style-type: none"> (ii) Delayed wound healing (1 to 2 months) (iii) Repeated follow-up visits (iv) Glass correction for reading cannot be given immediately. (v) Suture expensive
Manual sutureless Cataract Surgery (Late 1980's)	<ul style="list-style-type: none"> (i) No suture – related complication (ii) Minimal discomfort to the patient (iii) Quick and good rehabilitation (iv) Only one follow – up after 1 month for reading glasses (v) Simple instrument and equipment (vi) Low cost (vii) Quick Procedure (viii) More affordable and sustainable than phaco emulsification with similar results 	<ul style="list-style-type: none"> (i) Longer learning curve (ii) Difficult in complicated cases
Suture less Phacoemulsification (scleral incision early	<ul style="list-style-type: none"> (i) No suture – related complications 	<ul style="list-style-type: none"> (i) Expensive technology costly breakdown

1990's)	Pros	Cons
Phacoemulsification With clear corneal Incision and foldable PC – IOL or Multifocal IOL (mid – 1990's)	<ul style="list-style-type: none"> (ii) Better quality of vision (iii) Minimal discomfort (iv) Fast rehabilitation (v) Less tissue handling <ul style="list-style-type: none"> (i) can be done with topical anesthetic eyedrops and so no injections need to be given (ii) Allows return of vision immediately following surgery (iii) No need for patching eye after surgery (esp. in oneeyed patients) (iv) Less tissue handling (v) Reduces risk of bleeding (esp. for patients with bleeding disorders) (vi) Better quality of vision (vii) Multi focal IOL used for near vision also so no reading glasses needed. 	<ul style="list-style-type: none"> (ii) More difficult in advanced nuclear and mature cataracts (iii) Complication more difficult to manage <ul style="list-style-type: none"> (i) Greater degree of technical difficulty (ii) possible corneal burn (iii) Multifocal IOL should be properly placed or else there will be discomfort in vision. (iv) Costs more

Out comes of cataract surgery

Contemporary cataract surgery has an excellent success rate both in terms of improving visual acuity and enhancing subjective visual function. More than 90% of otherwise healthy eyes achieve good vision.

Visual acuity is but one measure of the functional success of cataract surgery. Research tools have been developed to assess how cataract progression and cataract surgery affect visual function. One of these is a questionnaire administered to patient to measure functional impairment related to vision before and after cataract surgery.

Prospective studies using these tools show that patients who under go cataract surgery have significant improvement in many quality-of-life parameters, including community, and home activities, mental health, driving and life satisfaction.

In the typical post operative regimen the patients are given antibiotic and steroid eyedrops with cycloplegics for month and are all examined 1 day, 1 week and one month and about 3 months after surgery. More frequent examinations are indicated if unusual clinical findings are noted or if complications occur. During the post – operative examination the ophthalmologist evaluates the patients visual acuity and eye pressure and performs a slit – lamp examination.

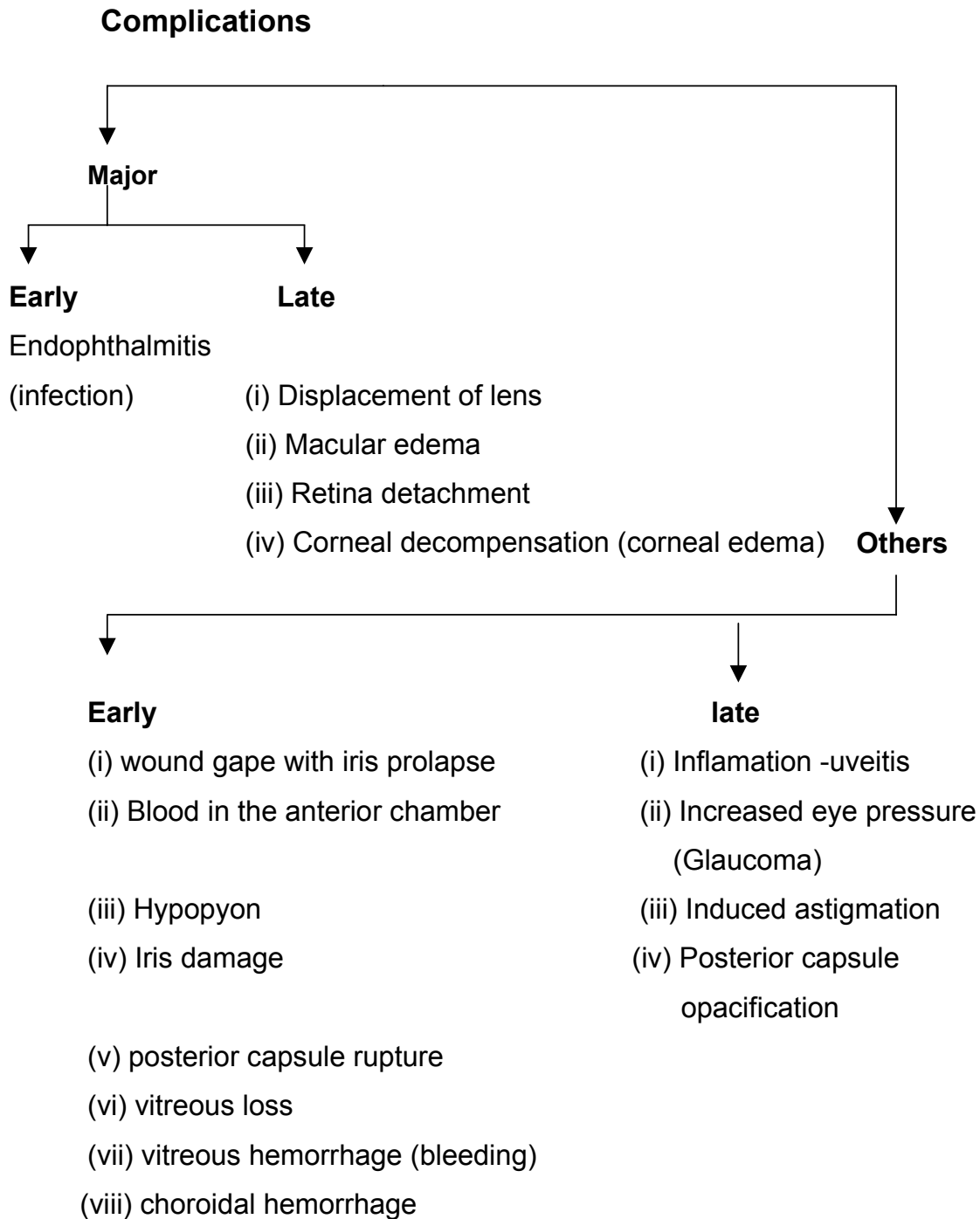
Variability in the refractive state of the eye is a normal post – operative finding as wound healing occurs. If sutures are present as in ECCE they may be cut or removed. Refractive error usually stabilizes within 6 – 12 weeks after surgery and glasses can be prescribed at that time. Although refractive stability is achieved more rapidly after small – incision sutureless cataract surgeries and phacoemulsification, the visual outcome at 3 months is comparable.

Complication rates of cataract surgery are very low. Opacification of the posterior lens capsule is the most common but less serious complication. The incidence rate of this varies and depends on whether the end – point is clinically significant capsular opacification or any detectable opacification.

Contemporary cataract surgery is remarkably successful in improving sight and restoring visual function to patients. However complication can occur, and the operation should not be regarded as a “risk free” procedure

Complications of Cataract surgery.

Complication of cataract surgery are varied in timing as well as scope. Therefore it is necessary to observe the postoperative cataract patient at periodic intervals. A typical post – operative regimen consists of examining the patient 1day, 1 week, about a month and 3 months following cataract surgery.



Posterior capsule opacification (PCO)

PCO is one of the inherent complication of modern cataract surgery. The Posterior capsule which is used as an anchor for the IOL may opacify over time. Fortunately this is amenable to treatment by means of Nd: YAG laser posterior capsulotomy.

Factors influencing PCO include

- (i) Age of the patient.
- (ii) History of intraocular inflammation
- (iii) Presence of pseudo exfoliation (white dandruff like material over iris and lens)
- (iv) Lens implant design
- (v) Lens surface modification
- (vi) Lens optic material
- (vii) Time elapsed since surgery

Nd: YAG laser capsulotomy

Indication

1. Best corrected visual acuity symptomatically decreased as a result of hazy posterior capsule.
2. A hazy posterior capsule preventing the clear view of the ocular fundus required for diagnostic or therapeutic purposes.
3. Uni ocular double vision or glare caused by posterior capsule wrinkling
4. Contraction of the anterior capsule margin.

Procedure:

It is usually painless and is performed as an outpatient procedure. Lowest effective laser energy is used to puncture the posterior capsule.

Complication:

Though the complication rate following ND: YAG laser capsulotomy is very less the following complications have been reported.

1. Transient elevation of eye pressure. So it is appropriate to prophylactically treat with a topical pressure-lowering drop.
2. Bleeding
3. Risk of Retinal detachment
4. Macular edema

5. Dislocation of intra-ocular lens into the vitreous cavity. This complication is more likely to occur with plate haptic silicone implants. Hence laser capsulotomy should be delayed for 3 months following cataract surgery to allow for capsule fibrosis.

The future offers increasing opportunity for better visual outcome following cataract surgery through improved surgical technique, modifications of lens design and materials and perhaps pharmacological intervention.

Though the incidence of complications with modern cataract surgery is less, a zero percent complication rate is the ultimate surgical goal.

Suggested Reading:

1. Lens & Cataract: The foundation of the American Academy of Ophthalmology.
2. Steinert: Cataract Surgery; Technique, Complication & Management.