

# Cataract

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**CATARACT** - developmental or degenerative *lens opacity*.

## ETIOLOGY

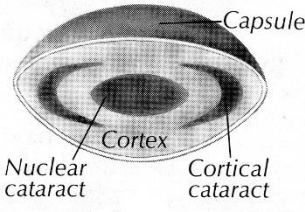
1. Aging (**SENILE CATARACT**) - leading causes of blindness in world!!!
2. **TRAUMATIC CATARACT** - secondary to blunt or penetrating ocular trauma.
3. Chronic exposure - X-ray, infrared (glass-blower's cataract), UV, electric shock.
4. Systemic disease (e.g. **diabetes mellitus!**, neurofibromatosis-2)
5. Chronic uveitis
6. Systemic medications (e.g. **chronic corticosteroids**).

## SYMPTOMS & SIGNS

- progressive, painless **VISION LOSS**.

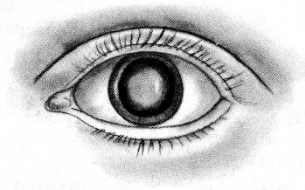
**CATARACTS**

**CROSS SECTION OF LENS**



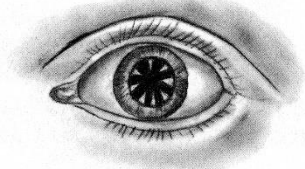
A cataract is an opacity of the lens and therefore can be viewed only through the pupil and on a deeper plane than corneal opacities. Cataracts may be classified in many ways—for example, by their causes, which are many, or by their locations within the lens. The most common cause of cataract is age—senile cataract. Two forms are illustrated, both with the pupils widely dilated so that only a narrow rim of iris shows.

**NUCLEAR CATARACT**



A nuclear cataract forms a central gray opacity, viewed here against a black background as you might see it with a flashlight. Through the ophthalmoscope it would appear black against the red reflex.

**PERIPHERAL CORTICAL CATARACT**



A peripheral cortical cataract produces spokelike shadows that point inward—gray against black as seen with a flashlight, or black against red with an ophthalmoscope.

**NUCLEAR CATARACT** (opacity in central lens nucleus) - excessive nuclear sclerosis and yellowing; nucleus can become very opaque and brown (**brunescant nuclear cataract**).

- clinical features:
  - gradual, progressive lens thickening → myopia develops in early stages (**myopic shift**) - presbyopic patient discovers that he can read without his glasses (temporary second sight).
  - **distance acuity** is decreased most (good near vision!).
  - if nuclear changes are concentrated in inner lens layers → refractile area occurs in lens center → **monocular diplopia**.
- correlation with *smoking*.
- histology - homogenous lens nucleus with loss of cellular laminations.

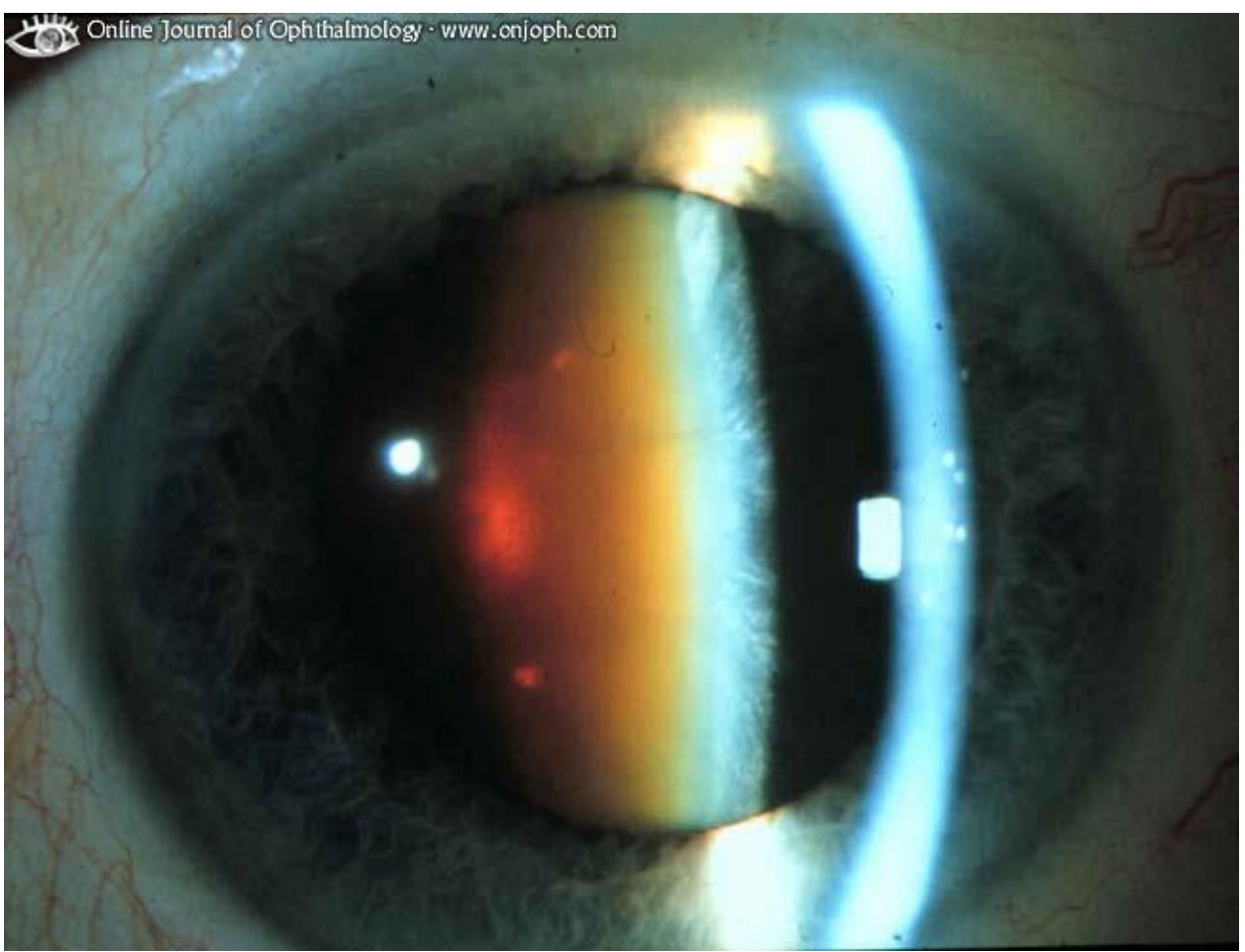
**CORTICAL CATARACT** - due to changes in ionic composition and hydration of lens fibers.

- clinical features:
  - *visual acuity long remains intact* until late stages when cortical spokes compromise visual axis.
  - mild glare is possible.
- correlation to solar UV exposure, diabetes, drug ingestion.
- histology - hydropic swelling of lens fibers with globules of eosinophilic material (morgagnian globules) seen in slit-like spaces between lens fibers.

**POSTERIOR SUBCAPSULAR CATARACT** (granular and plaquelike opacities beneath posterior lens capsule).

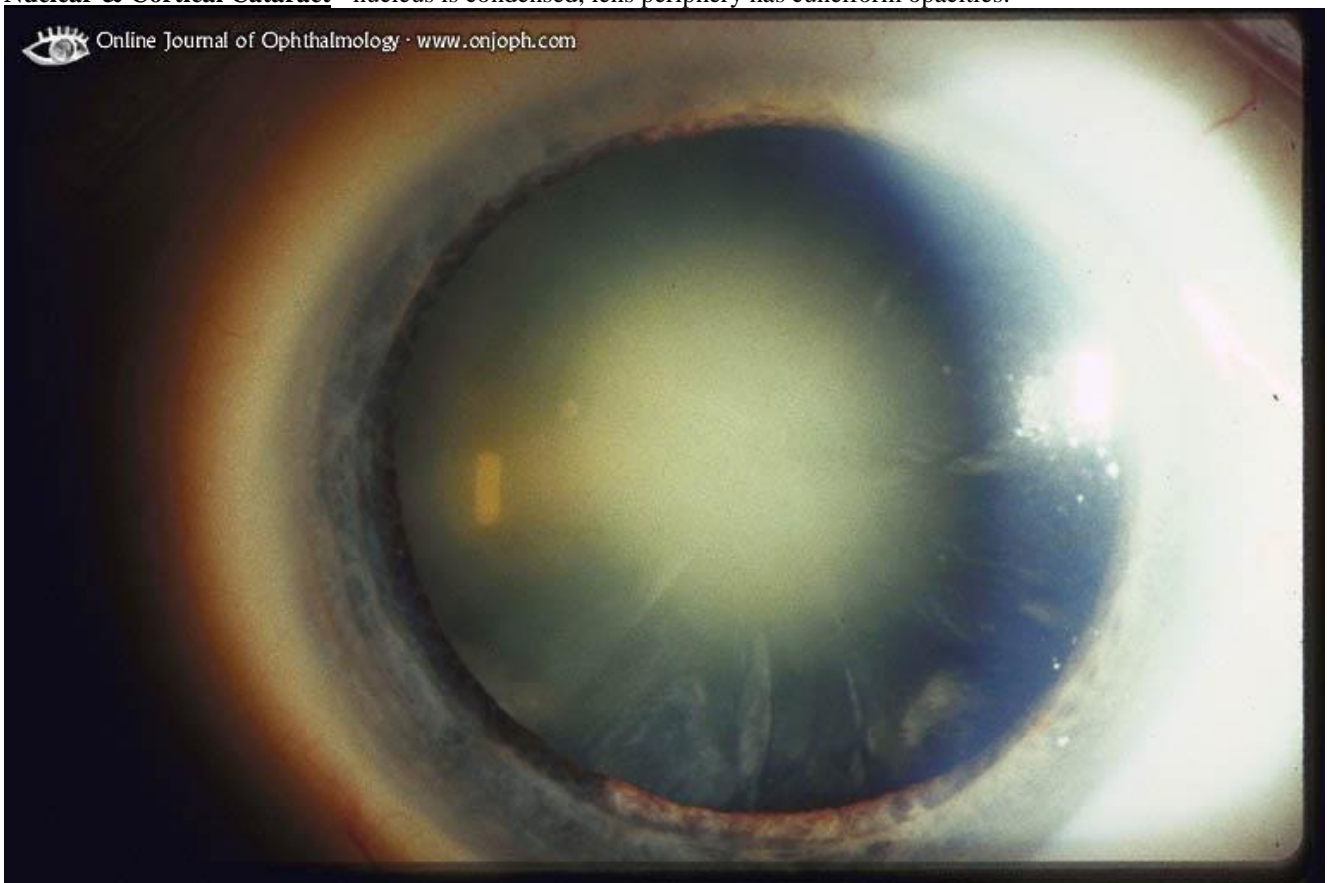
- correlation (≈ as cortical cataract) to solar UV exposure, diabetes, drug ingestion.  
N.B. if presents in children – may be specific feature of **neurofibromatosis-2**
- clinical features:
  - opacities are located at crossing point of light rays - disproportionately affects vision (esp. **near acuity!**).
  - particularly troublesome in bright light (disabling glare).
- histology - posterior migration of lens epithelial cells in posterior subcapsular area, with aberrant enlargement of epithelial cells (Wedl or bladder cells).

**Nuclear cataract** - dark brown nucleus that casts shadow on retroillumination:



Source of picture: "Online Journal of Ophthalmology" >>

**Nuclear & Cortical Cataract** - nucleus is condensed, lens periphery has cuneiform opacities:



**Posterior Subcapsular, Nuclear and Cortical Cataract**

*slitlamp* - opacities in anterior cortex, nucleosclerosis, posterior subcapsular changes:



Source of picture: "Online Journal of Ophthalmology" >>

*retroillumination* - shows subcapsular changes but only suggests nucleosclerosis:



Source of picture: "Online Journal of Ophthalmology" >>

- rarely, *cataract swells*, producing secondary glaucoma and pain.

Senile cataract PREVALENCE in general population  $\geq 75$  yrs:

- nuclear - 65.5%
- cortical - 27.7%
- posterior subcapsular - 19.7%

N.B. **alcohol** is associated with all cataract types!

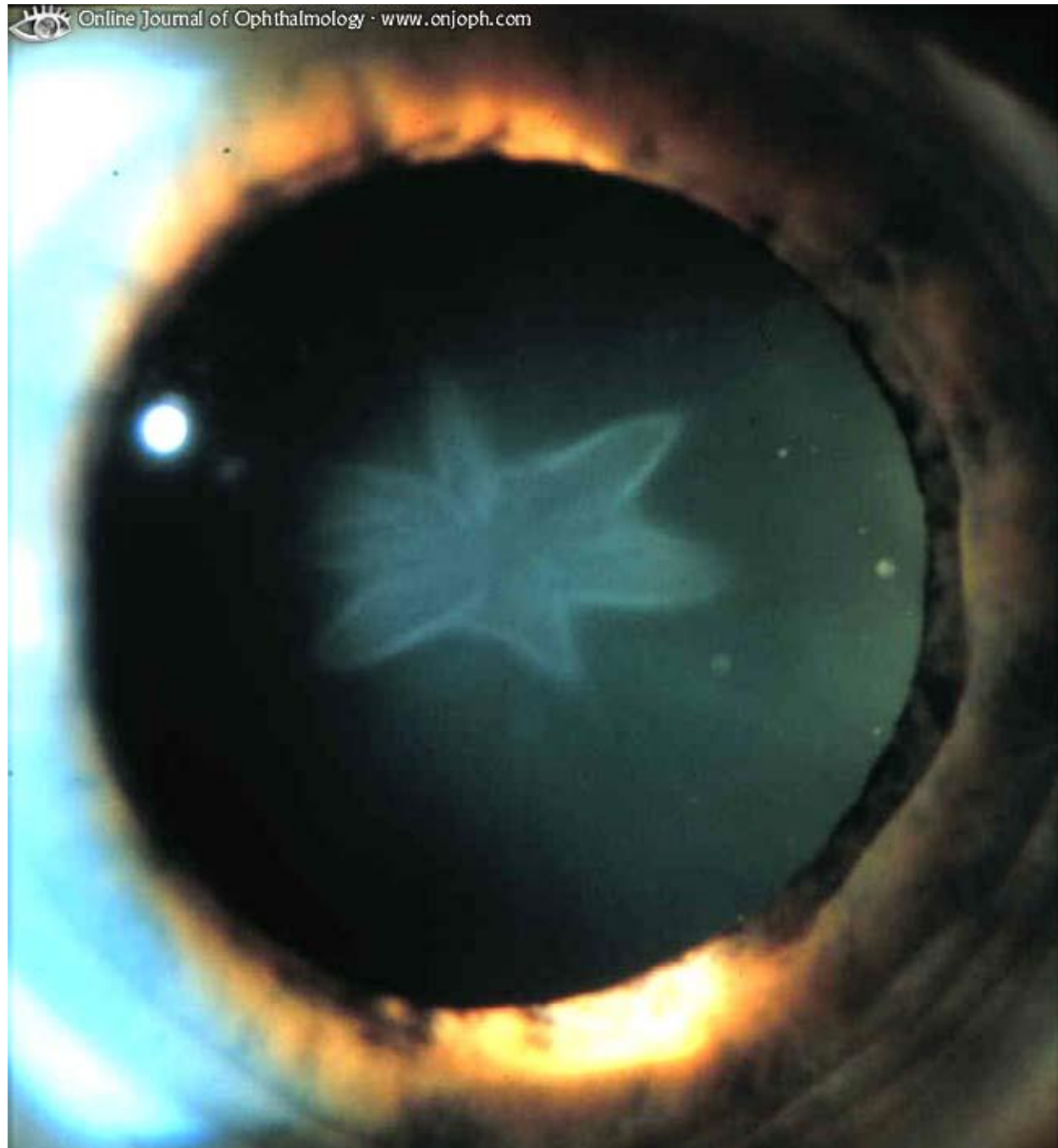
#### TRAUMATIC cataracts:

**Blunt trauma** classically forms stellate- or rosette-shaped **POSTERIOR AXIAL** opacities:

- may be stable or progressive.

**Penetrating trauma** (disruption of lens capsule) forms **CORTICAL** changes; may remain focal (if small) or may progress rapidly to total cortical opacification.

#### Blunt trauma:



Source of picture: "Online Journal of Ophthalmology" >>

#### Siderosis lentis:



Source of picture: "Online Journal of Ophthalmology" >>

## DIAGNOSIS

### OPHTHALMOSCOPY

N.B. before pupils are dilated for ophthalmoscopy, **increased intraocular pressure and shallow anterior chamber must be ruled out!**

- gray / yellow-brown opacities in lens.
- examination of dilated pupil with ophthalmoscope held 30 cm away discloses subtle opacities - as dark defects in red reflex; large cataract obliterates red reflex.

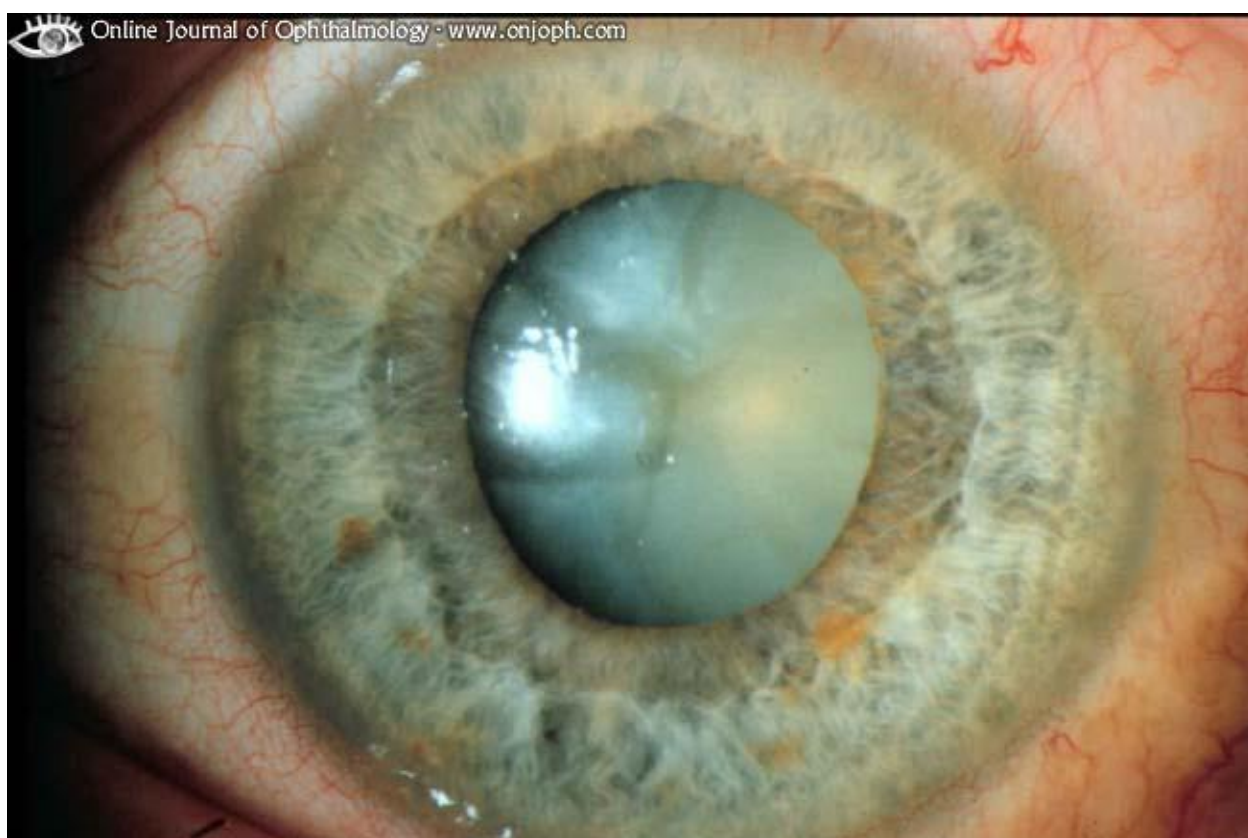
SLIT-LAMP EXAMINATION provides more details.

### STAGING

- based on **VISUAL ACUITY**:

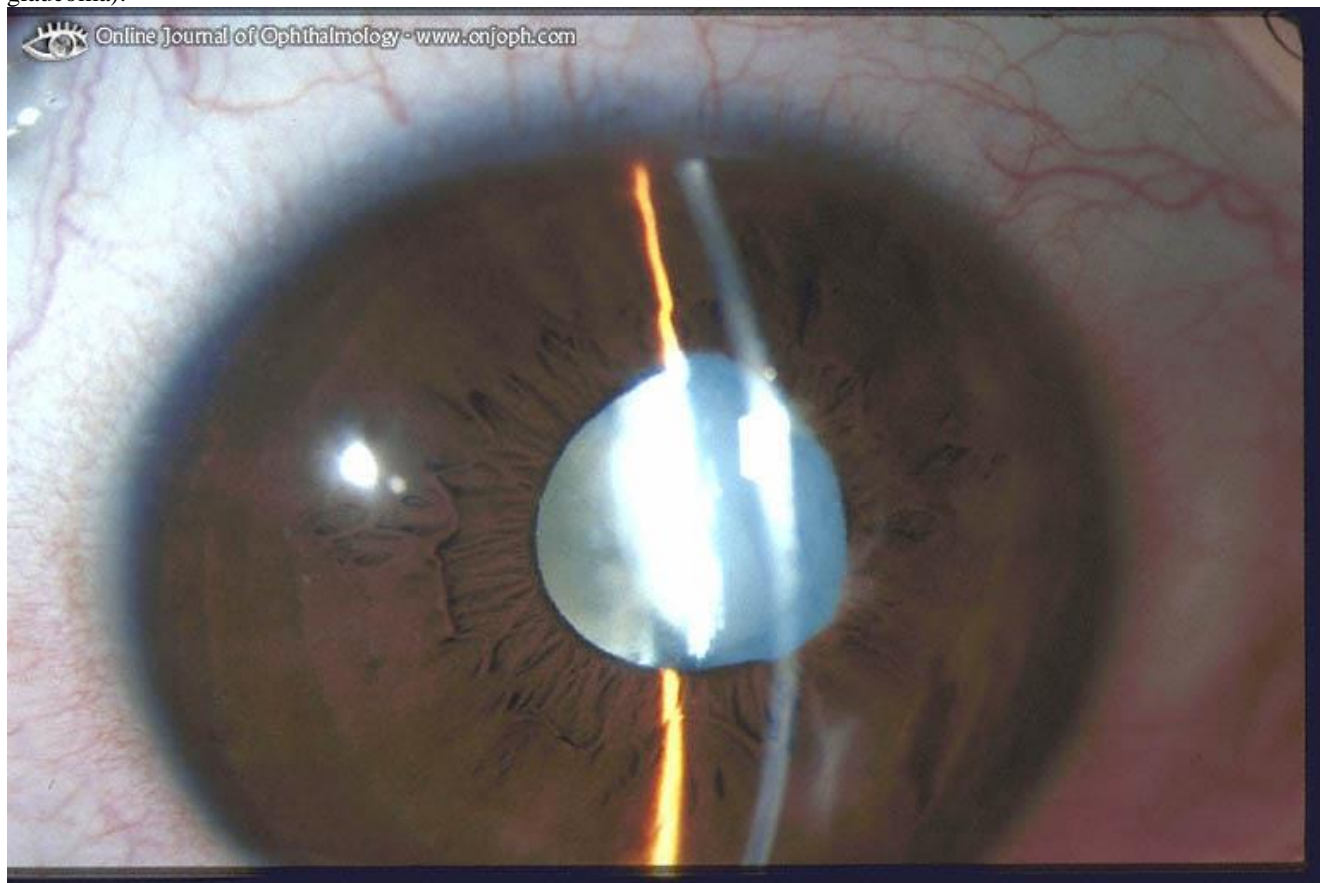
- acuity  $< 20/200$  - **mature** cataract.
- acuity  $> 20/200$  - **immature** cataract.
- can still read at 20/20 but lens opacity confirmed by slit lamp - **incipient** cataract.

**Mature cataract:**



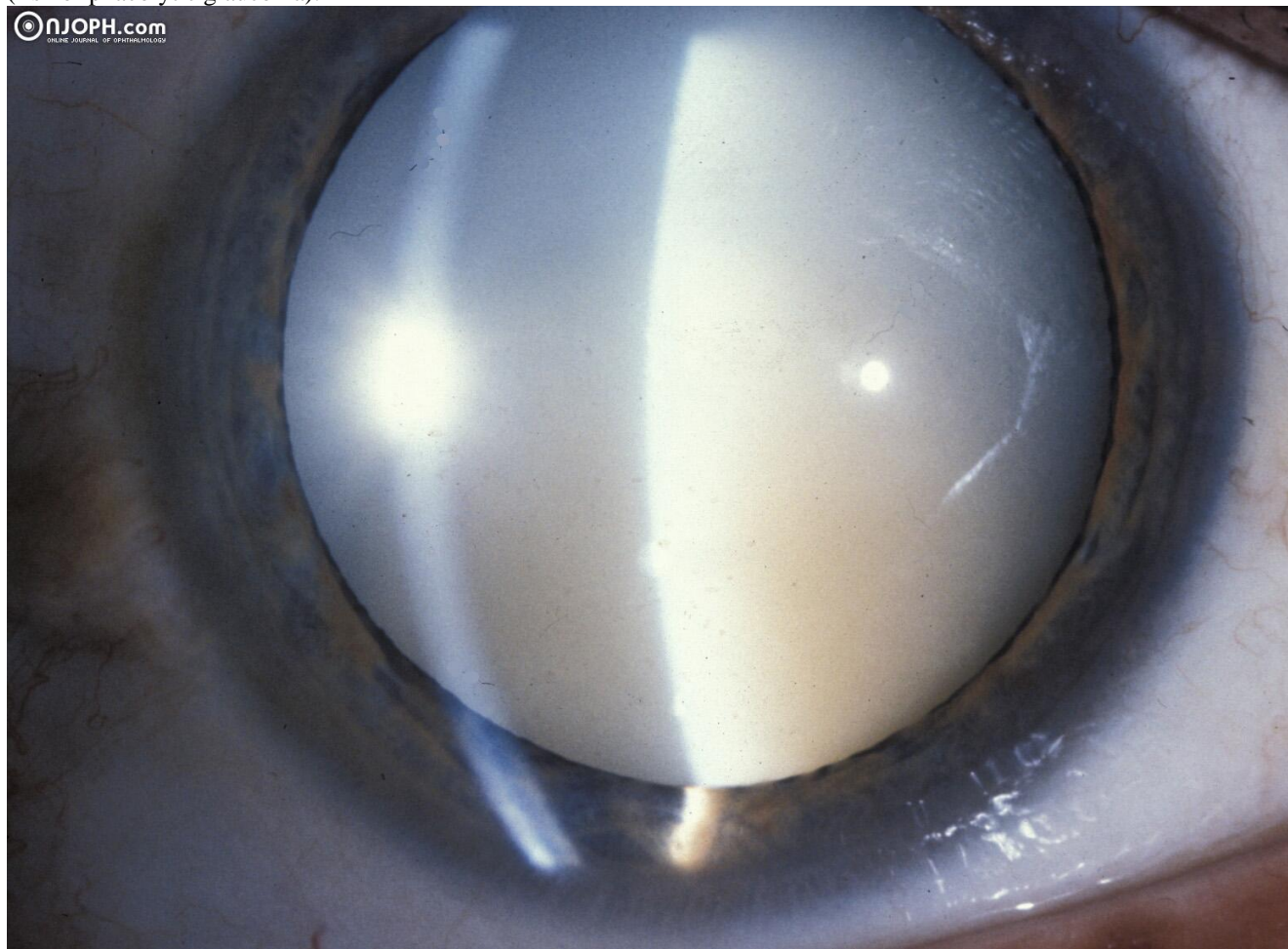
Source of picture: "Online Journal of Ophthalmology" >>

**Mature cataract:** whitish opacification of whole lens with bulging of lens material in pupillary area (imminent phacolytic glaucoma):



Source of picture: "Online Journal of Ophthalmology" >>

**MORGAGNI cataract - hypermature** cataract in which brown nucleus gravitates within liquefied milky-white capsule (risk of phacolytic glaucoma):



Source of picture: "Online Journal of Ophthalmology" >>

## TREATMENT

No proven medical treatment exists to delay, prevent, reverse development of senile cataracts!

- frequent **refractions & eyeglass changes** maintain vision during cataract development.

- **chronic pupillary dilation** is helpful for small lenticular opacities.
- **UV-coated glasses** must be worn in sunlight.
- investigated medications:
  - 1) aldose reductase inhibitors, sorbitol-lowering agents
  - 2) aspirin
  - 3) glutathione-raising agents
  - 4) antioxidant vitamins C and E.

### SURGERY

- indications:
  - a) maximally corrected **vision**  $\leq 20/50$  (6/15)
  - b) subjective visual impairment that **prevents activities** (e.g. driving, reading, occupational activities).
  - c) **disabling glare** (most common with *posterior subcapsular cataracts*).
  - d) **lens-induced diseases** (e.g. PHACOLYTIC GLAUCOMA, PHACOANTIGENIC UVEITIS).
  - e) **need to visualize fundus** for management of diseases (e.g. DIABETIC RETINOPATHY, GLAUCOMA).
- 30-60 min prior operation instill 1 gtt 2,5% **PHENYLEPHRINE** to achieve good mydriasis.
- local anesthesia + IV sedation.

### Extraction techniques

- A) **INTRACAPSULAR CATARACT EXTRACTION** (now rarely performed) - removing cataract in one piece (i.e. *extraction of entire lens*, including posterior capsule).
- no need to worry about subsequent development of capsular opacity.
  - less sophisticated equipment needed.
  - uses **larger limbal incision** (often 160-180°) - following risks: delayed healing, significant against-the-rule astigmatism, iris incarceration, postoperative wound leaks, vitreous incarceration, corneal edema.
  - because posterior capsule is not intact, IOL must be implanted either in anterior chamber or sutured to posterior chamber (both are more difficult than simply placing IOL in capsular bag).
  - indication - severely impaired zonular integrity (doesn't allow successful extracapsular lens removal and IOL implantation).
  - absolutely contraindicated in children & young adults, cases with traumatic capsular rupture.
- B) **EXTRACAPSULAR CATARACT EXTRACTION (ECCE)** - removing **hard central nucleus** in one piece (through opening in anterior capsule), then removing **soft cortex** in multiple small pieces; *retention of posterior capsule integrity*.
- smaller incision is required; *less short and long-term complications*.
  - better anatomic IOL placement (in capsular bag).
  - intact posterior capsule also reduces iris & vitreous mobility that occurs with saccadic movements (*endophthalmodonesis*).
  - main requirement is **zonular integrity**.
- C) **PHACOEMULSIFICATION** - dissolving **hard central nucleus** within eye by ultrasound, then removing **soft cortex** in multiple small pieces.
- differs from standard ECCE by method of nucleus extraction - ultrasonically driven needle fragments nucleus and aspirates lens substrate through needle port.
  - uses smallest incision ( $\approx 4$  mm)!!!
  - with advent of phacoemulsification, patients are *advised against delaying lens extraction* to point when cataract is hard and mature and likelihood of postoperative complications increases.

**Intraocular lens (IOL)** - plastic or silicone; implanted intraocularly (such eye is called **PSEUDOPHAKIC**):

- a) in front of iris (**anterior chamber IOL**)
  - b) attached to iris and within pupil (**iris plane IOL**) - now rarely used (high frequency of postoperative complications).
  - c) behind iris (**posterior chamber IOL**) - most common placement.
- IOL power must be compatible with refractive error of fellow eye to avoid postoperative anisometropia.

**APHAKIA** may be better choice in *highly inflamed eyes* and *young children*; they experience better outcomes if lens implantation is deferred;

- *if IOL is not implanted*, **contact lenses / thick glasses** are needed.

Postoperative period:

- eye shield for a few hours after; then wear shield while sleeping;
- tapering schedule of **topical antibiotics & topical corticosteroids** for 4 wk.
- avoid Valsalva maneuver, heavy lifting, bending forward too far, eye rubbing.
- refraction is stable at 6-8<sup>th</sup> postoperative week - corrective lenses can be prescribed.
- 95% eyes achieve vision  $\geq 20/40$  (6/12).

Complications of cataract surgery: retinal detachment, cystoid macular degeneration, bullous keratopathy, choroidal hemorrhage (causing intraocular contents to be expelled through incision), endophthalmitis, posterior capsular opacification (treatable with YAG laser), glaucoma.

## CONGENITAL CATARACT

1. **Chromosomal abnormalities** - trisomies (Down, Edward, Patau syndromes).
2. **Metabolic disease** (e.g. galactosemia [classic "oil droplet" cataract], hypoglycemia, dystrophia myotonica)
3. **Intrauterine infection** (toxoplasmosis, rubella, cytomegalovirus, herpes simplex [i.e. TORCH])
4. **Maternal disease** during pregnancy.

- may present as **irregular red reflex**, nystagmus, squint, amblyopia.
- if opacity is *in visual axis*, it is considered visually significant and may lead to blindness (*deprivation amblyopia*)!  
if cataract is *small*, in *anterior lens portion*, or *in periphery*, no visual loss may be present.
- treatment - *visually significant cataract* must be removed within first 17 weeks (ideally < 2 months);
  - **EXTRACAPSULAR extraction with primary\* posterior capsulectomy and anterior vitrectomy** is procedure of choice!  
\*young eyes develop capsular opacification very quickly necessitating primary capsulectomy at time of cataract extraction;  
INTRACAPSULAR extraction in children is contraindicated (because of vitreous traction and loss at Wieger capsulohyaloid ligament).
  - **IOL routinely is not placed!**
  - postoperative visual correction with spectacles / contact lenses / epikeratophakia (suturing of human cornea, lathed like contact lens, onto recipient's cornea) is difficult but necessary to achieve good vision.
- in **UNILATERAL** cases, *refractive amblyopia is serious risk!* (even after cataract is removed – because quality of image in operated eye is inferior to that in normal eye).

- postoperative - many years of *refractive correction* (contact lenses or aphakic glasses), possible patching for amblyopia, frequent *glaucoma screenings* throughout life!

BIBLIOGRAPHY for ch. "Ophthalmology" → follow this [LINK >>](#)