Cataract

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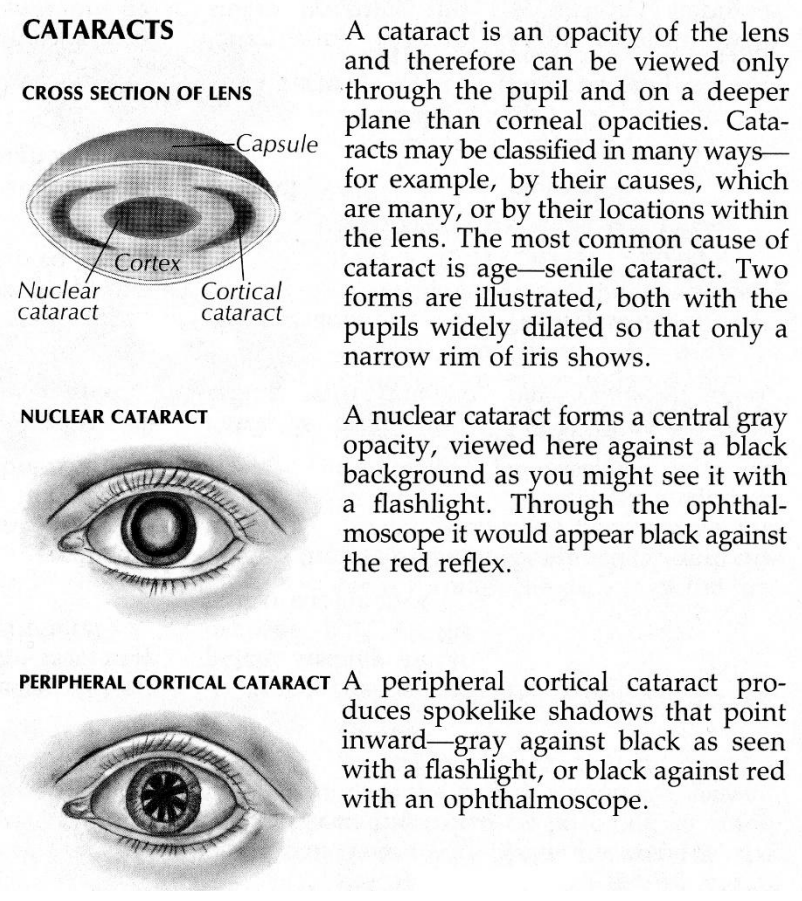
CATARACT - *developmental or degenerative* ***lens opacity***.

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***.



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

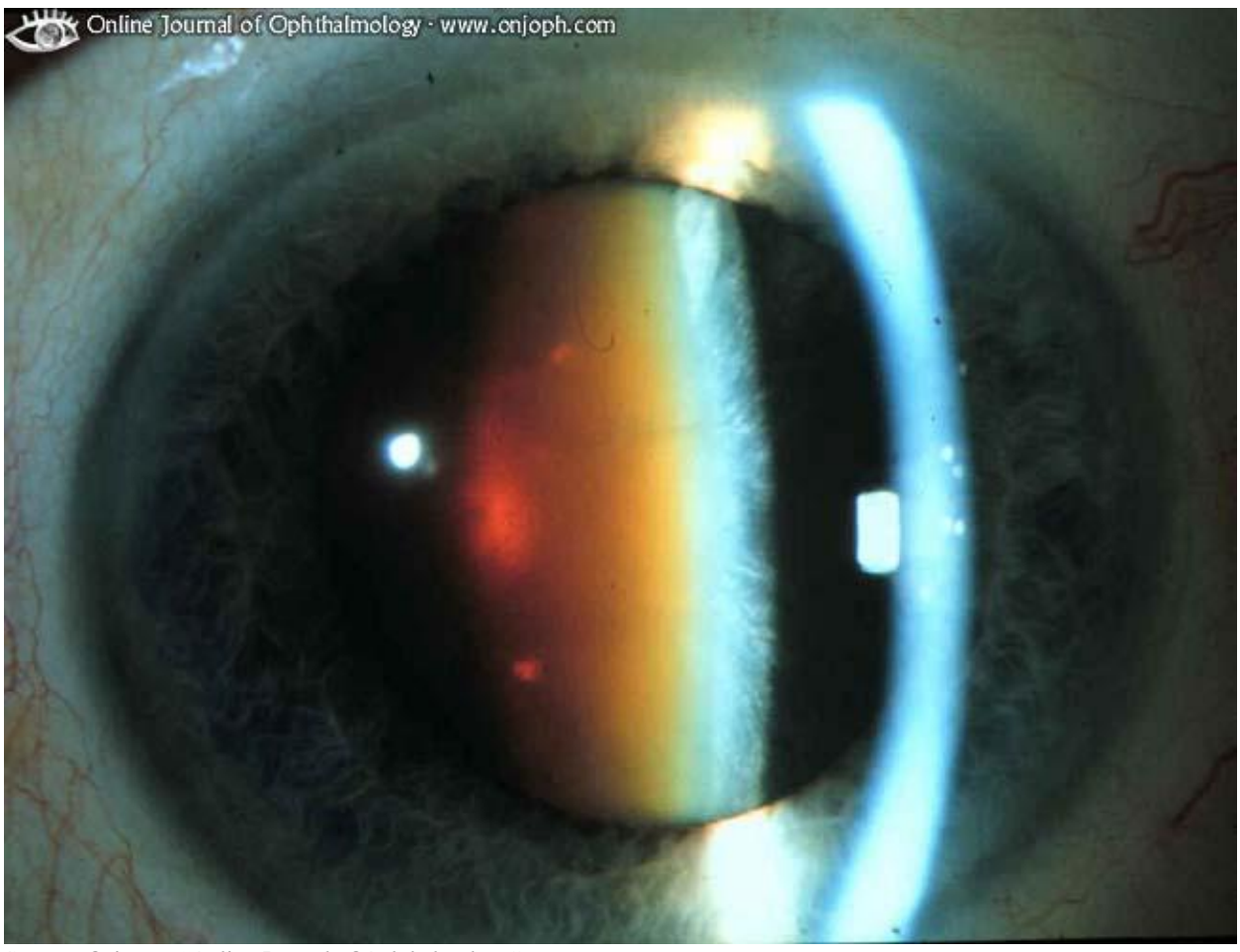
CORTICAL CATARACT - due to changes in ionic composition and hydration of lens fibers.

- 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).

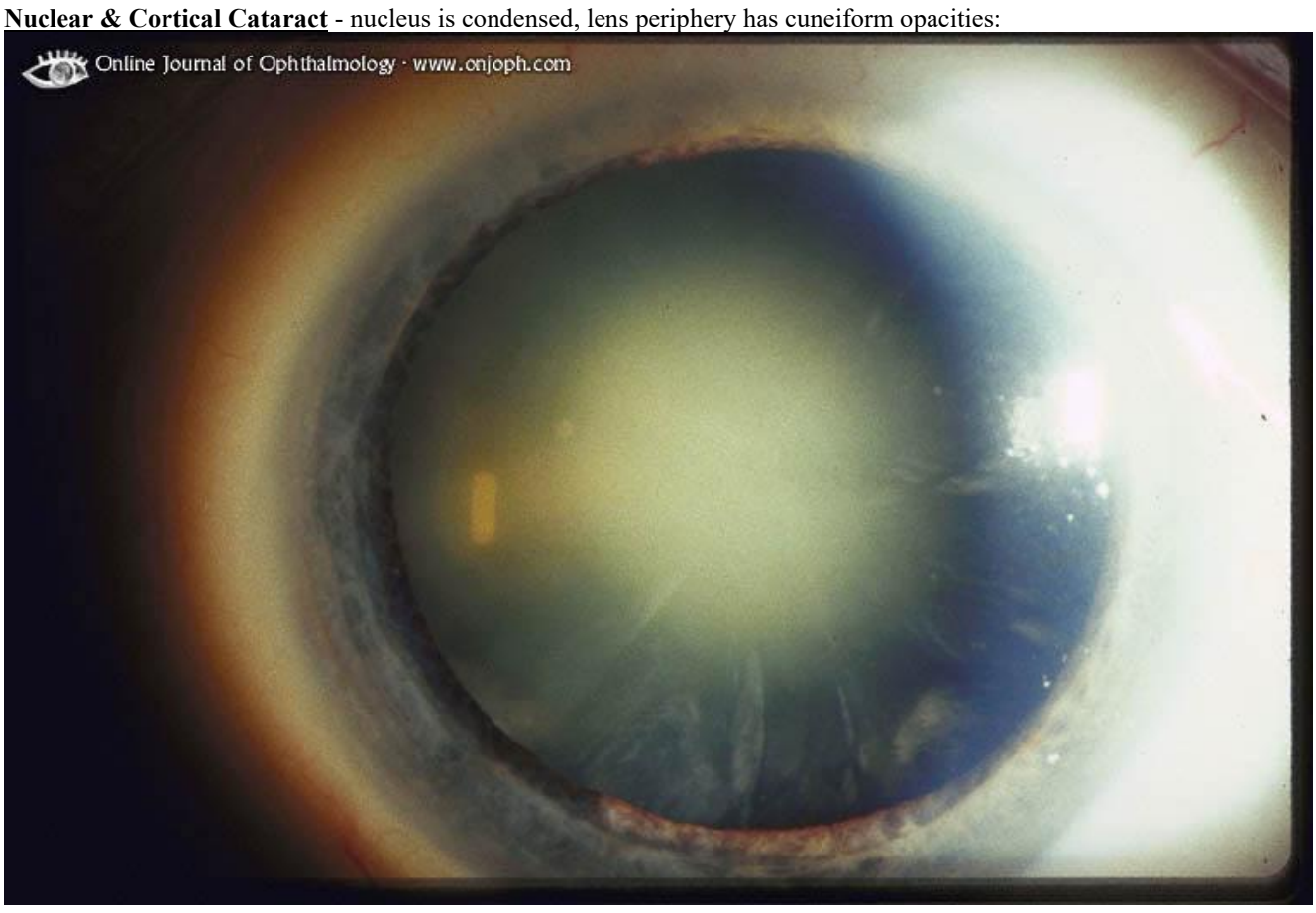
- correlation (≈ as cortical cataract) to solar UV exposure, diabetes, drug ingestion.
  N.B. if presents in children – may be specific feature of neurofibromatosis-2
- clinical features:
  - opacities are located at crossing point of light rays - disproportionately affects vision (esp. **near acuity**!).
  - 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" >>

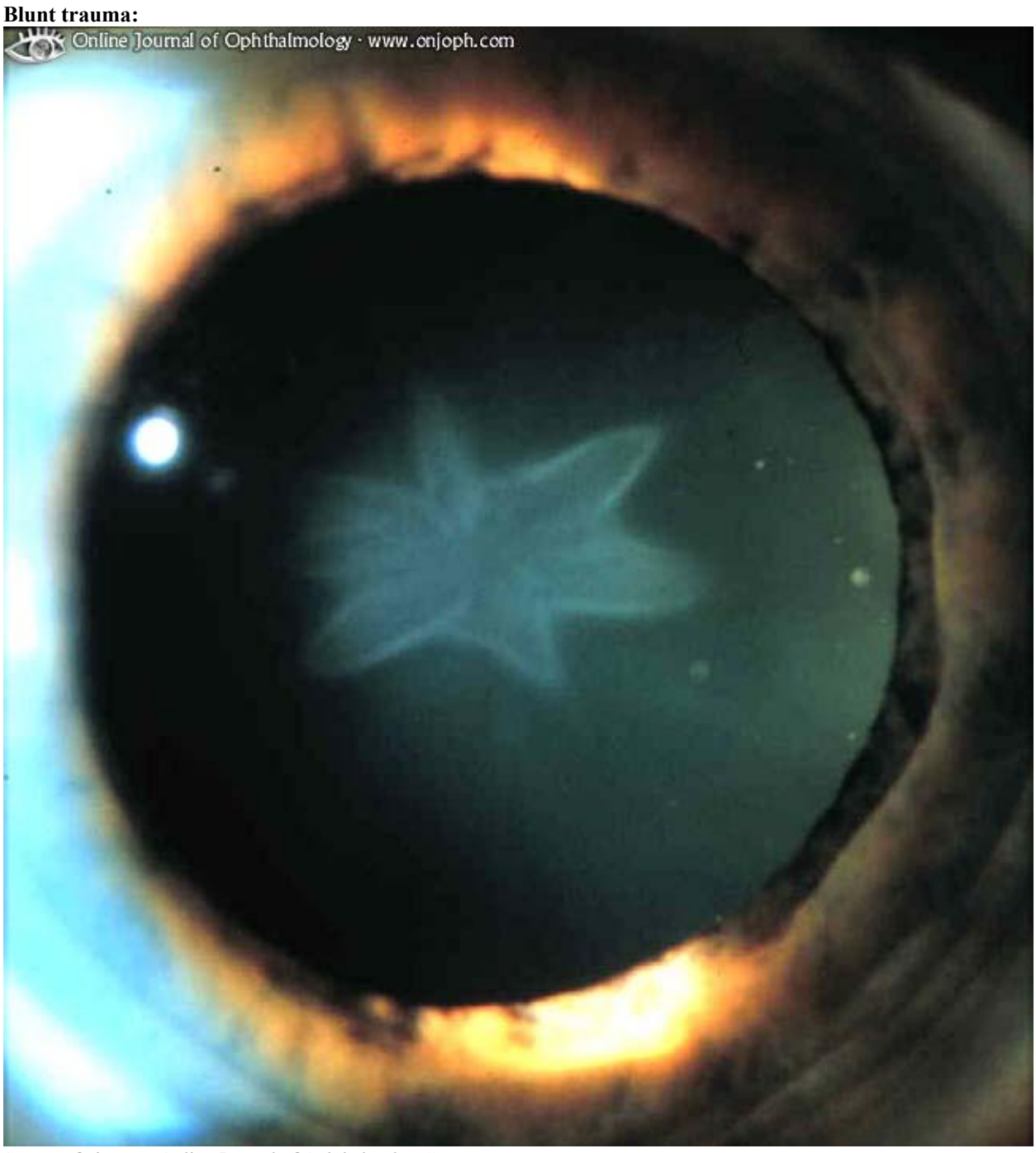
- rarely, *cataract swells*, producing secondary glaucoma and pain.

Senile cataract PREVALENCE in general population ≥ 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:



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Siderosis lentis:

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DIAGNOSIS

OPHTHALMOSCOPY

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

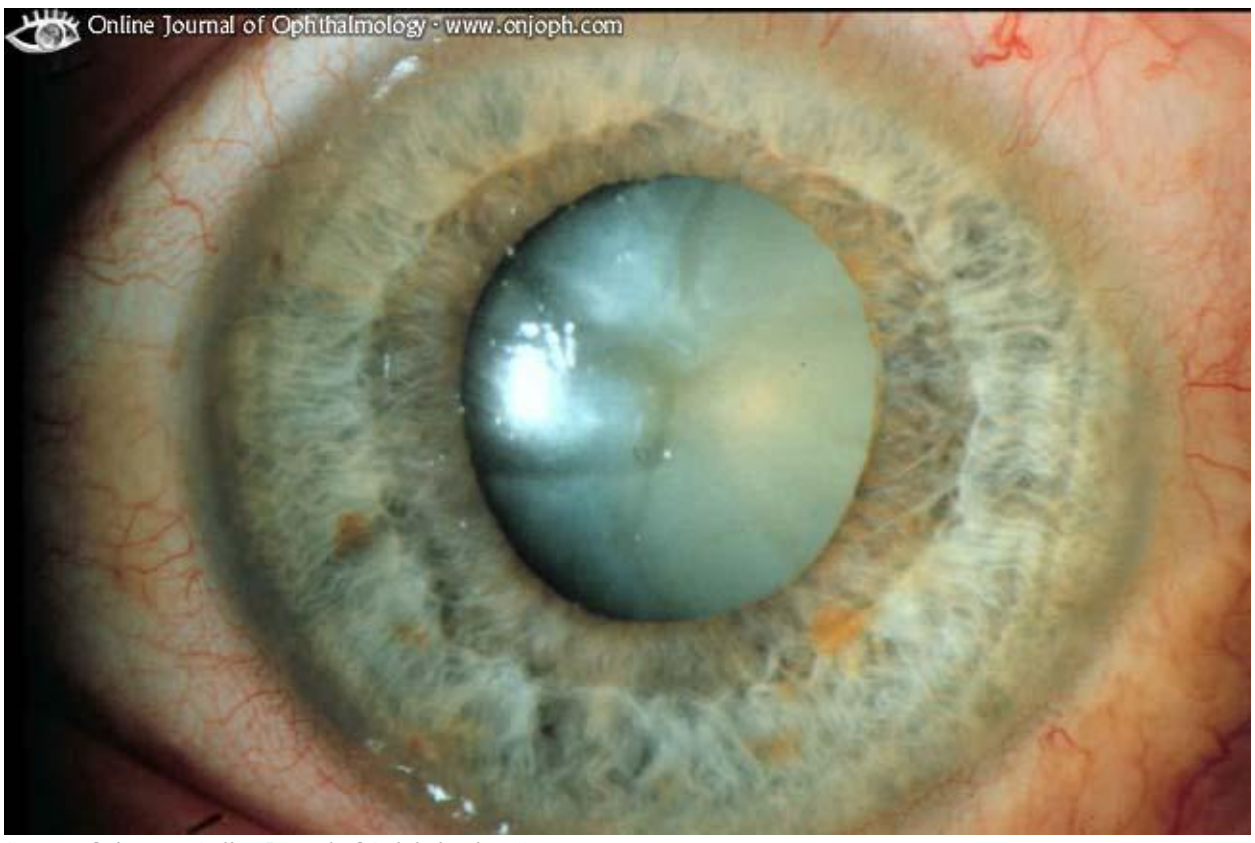
- gray / yellow-brown opacities in lens.
- examination of dilated pupil with ophthalmoscope held 30 cm away discloses subtle opacities - as dark defects in red reflex; large cataract obliterates red reflex.

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:



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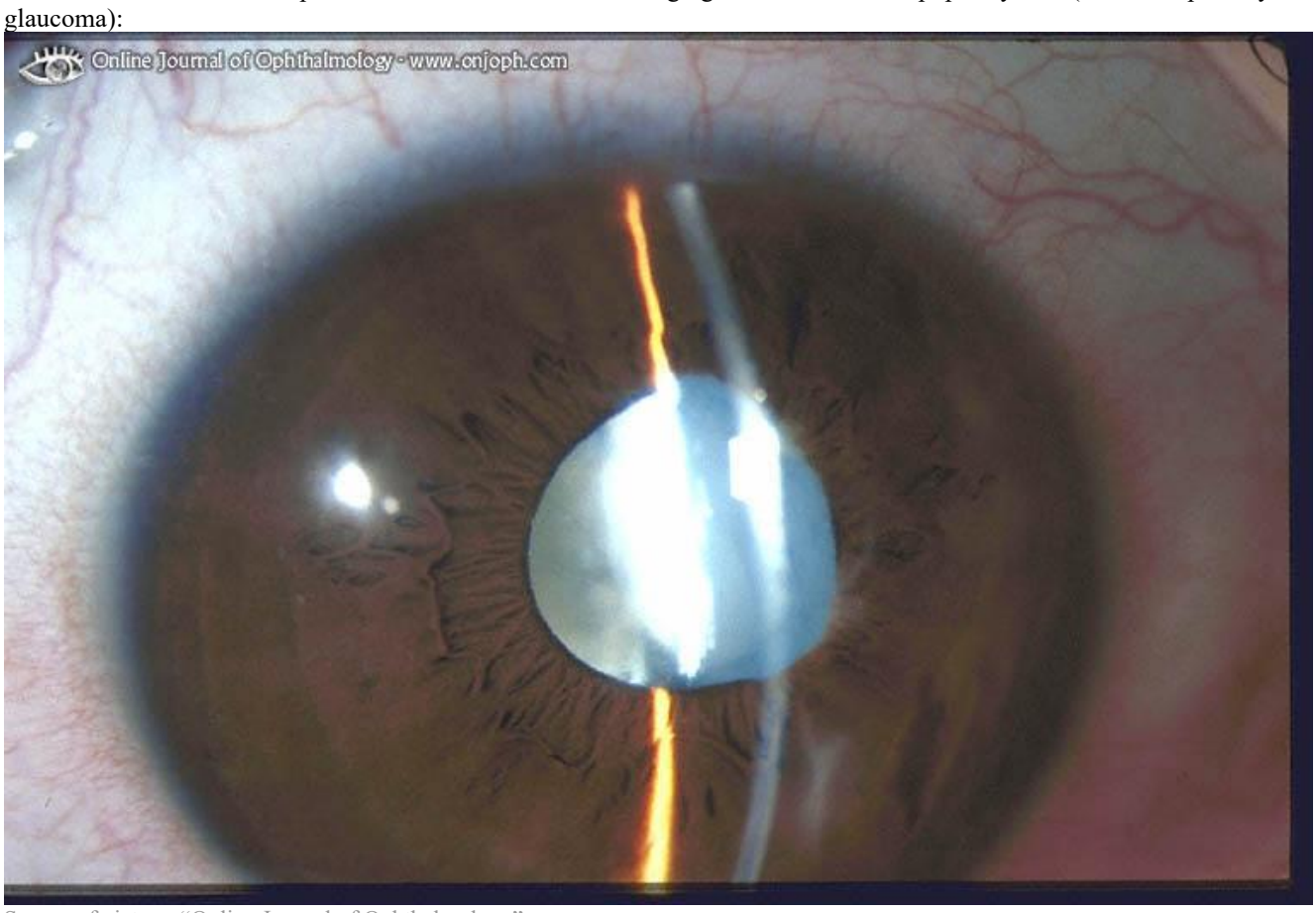
Mature cataract: whitish opacification of whole lens with bulging of lens material in pupillary area (imminent phacolytic glaucoma):



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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 ≤ 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 (≈ 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 6-8th postoperative week - corrective lenses can be prescribed.
- 95% eyes achieve vision ≥ 20/40 (6/12).

Complications of cataract surgery: retinal detachment, cystoid macular degeneration, bullous keratopathy, choroidal hemorrhage (causing intraocular contents to be expulsed 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 >>