DISEASES OF THE LENS

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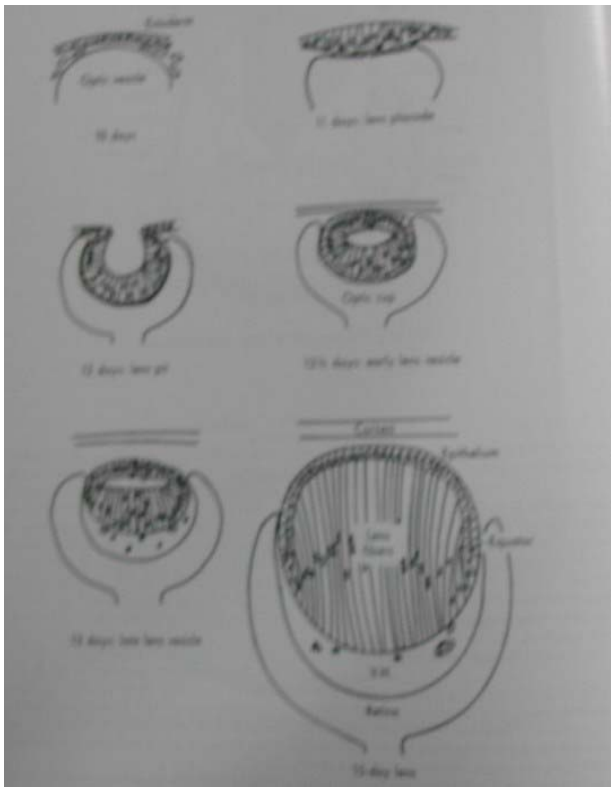
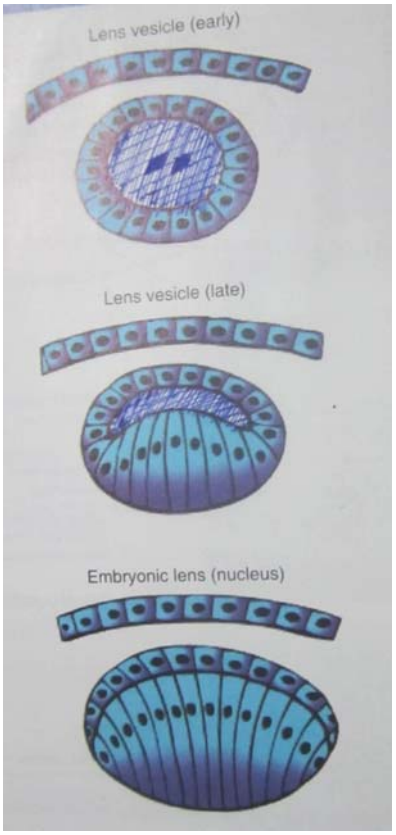
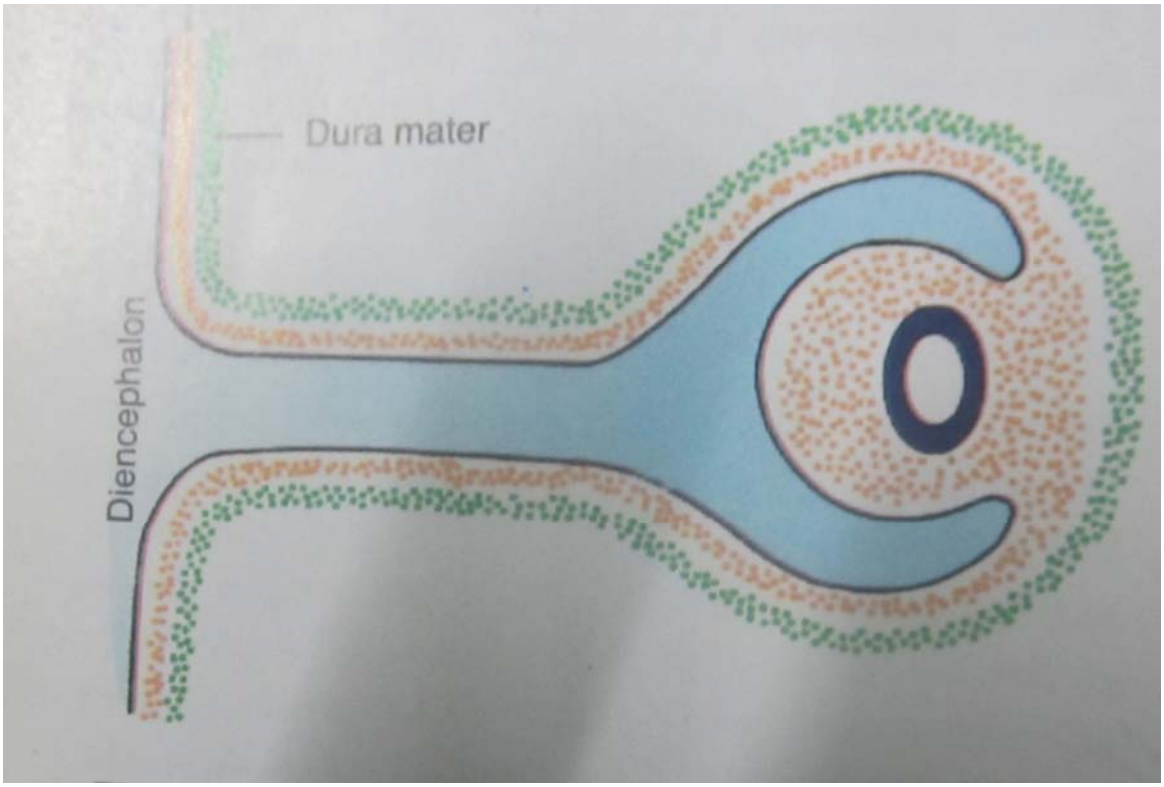
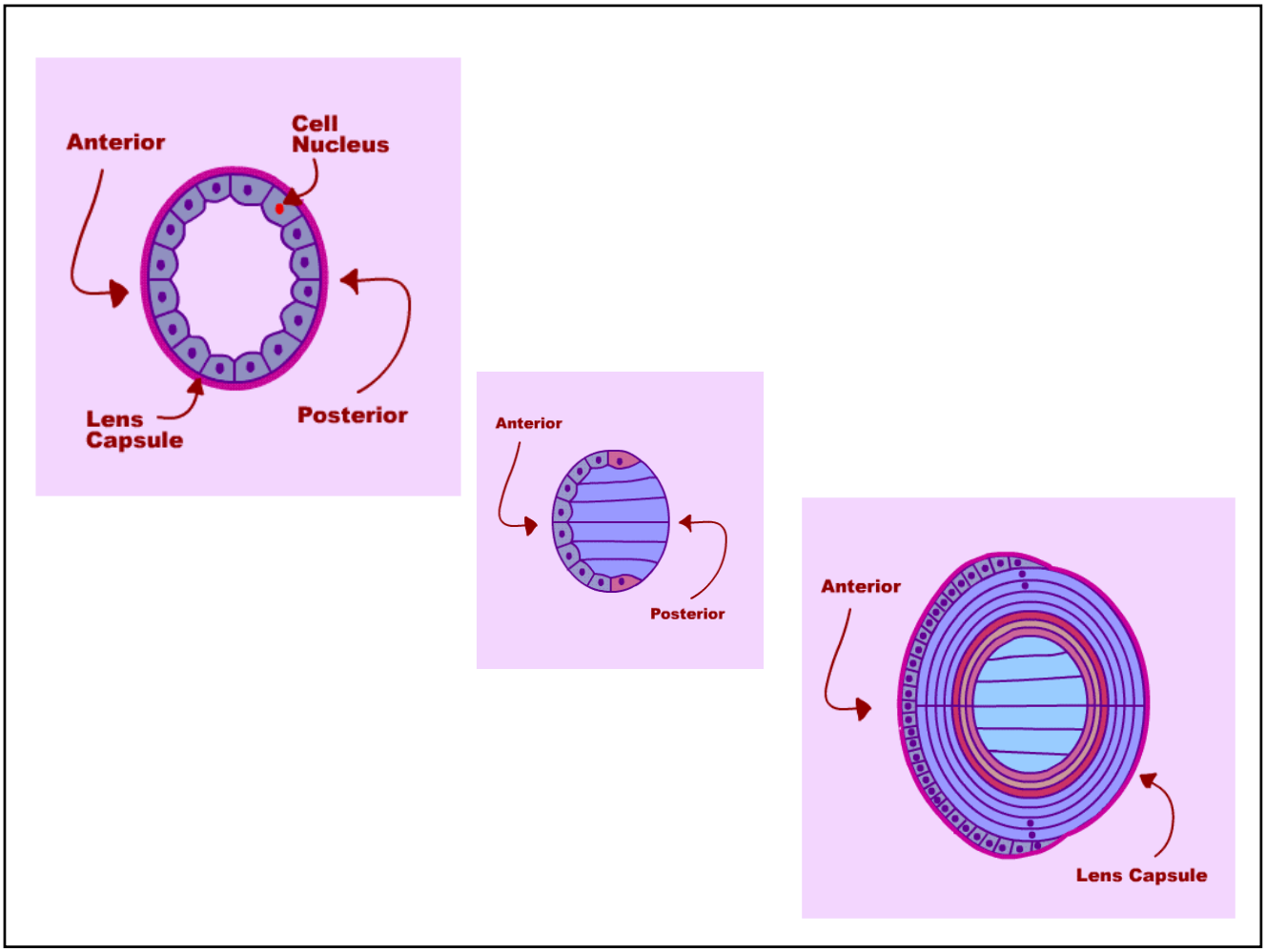
EMBRYOLOGY

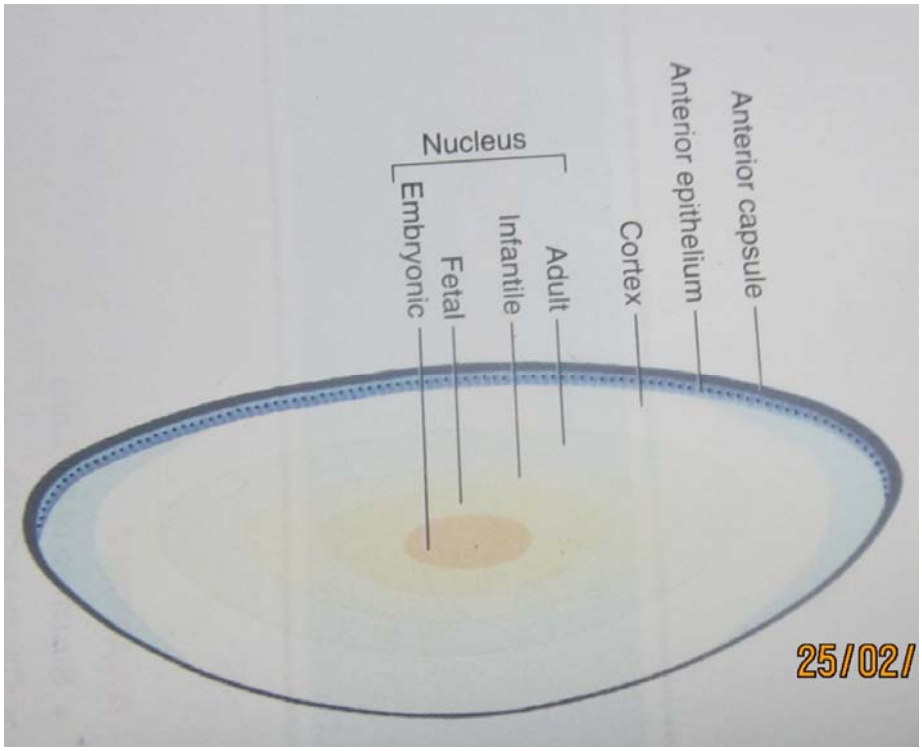



Lens vesicle (early)
Lens vesicle (late)
Embryonic lens (nucleus)

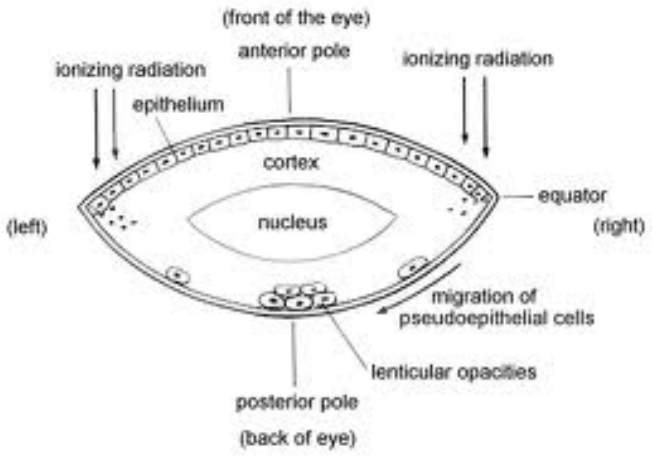

Dura mater
Diencephalon


Anterior
Cell Nucleus
Lens Capsule
Posterior
Anterior
Posterior
Anterior
Lens Capsule

ANATOMY OF LENS

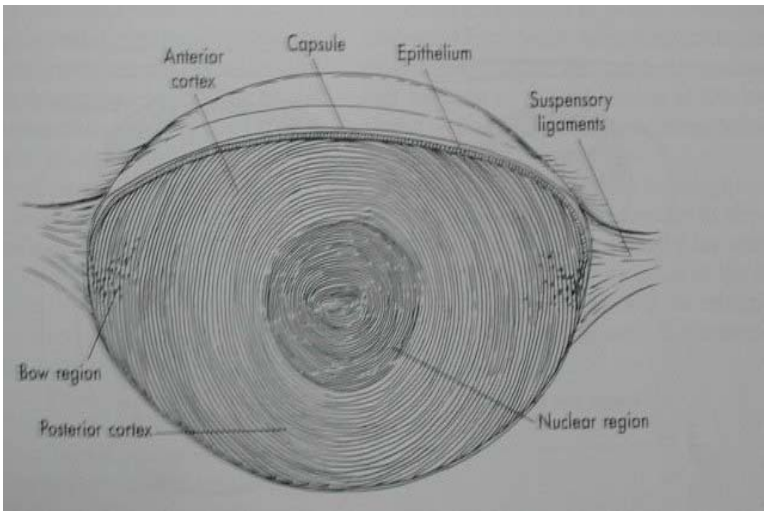


ANATOMY OF LENS



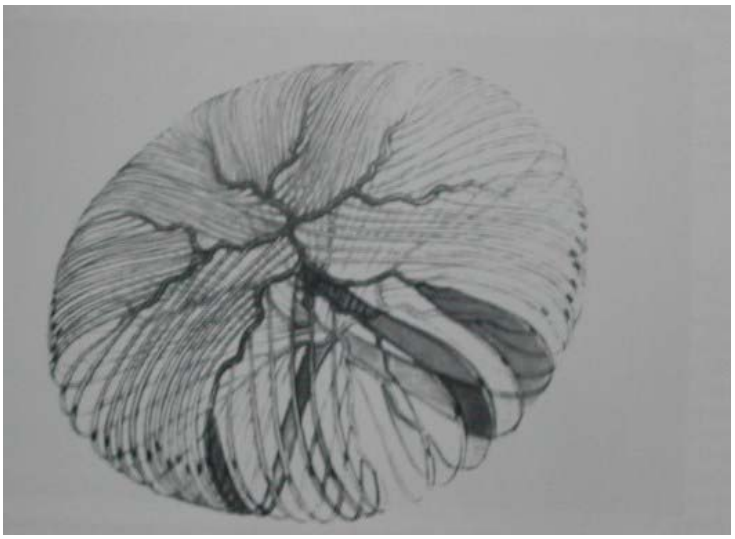
Dia:9-10mm,
Th:3.5-5mm,
Ant R:10mm,
Post R:6mm
Power 14-16D,
RI: 1.39
Ant capsule 14µ
Post capsule 3µ

ANATOMY



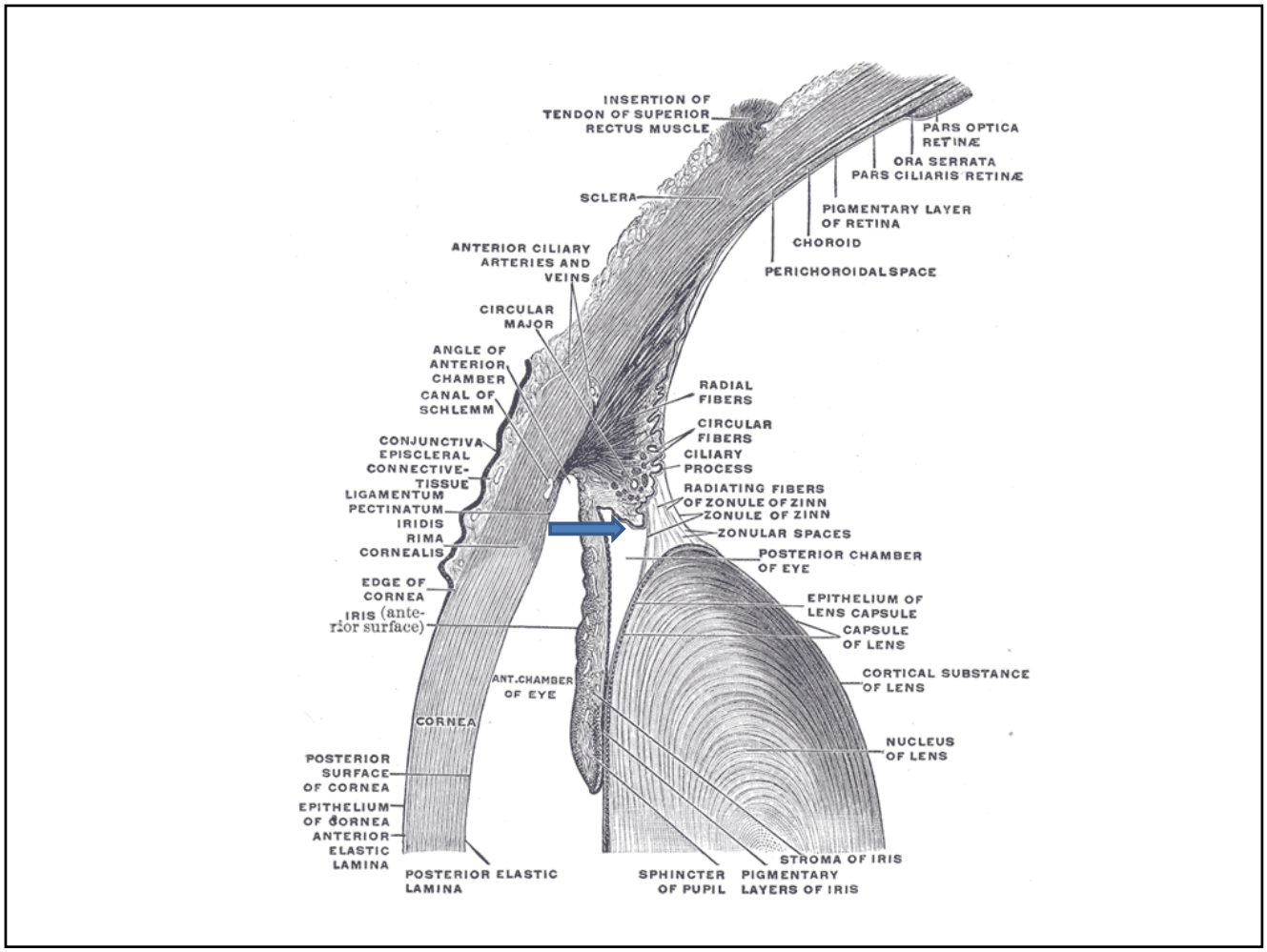
Embryonic:1Mo to 3Mo
Fetal: 3Mo to birth
Infantile: birth to puberty
Adult: adult life

ANATOMY: Y SUTURES

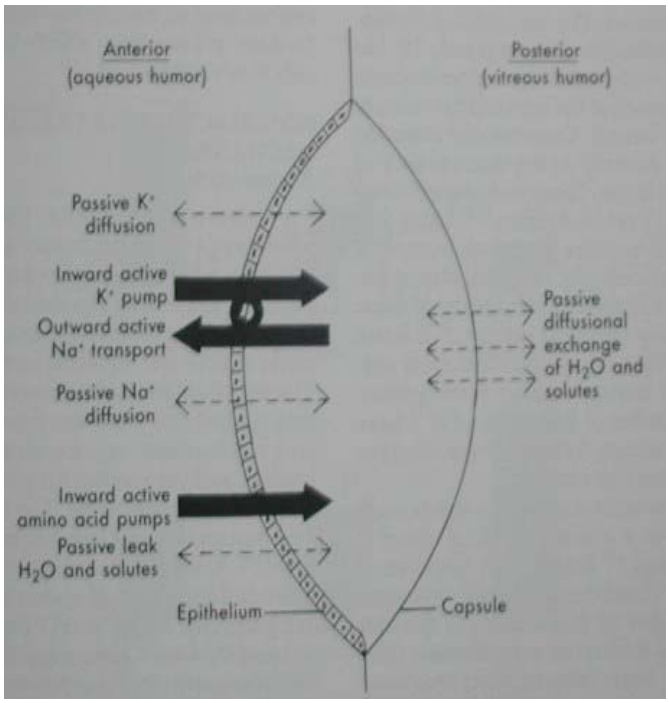


Zonules

- Also called suspensory ligament
- Fibers from ciliary body to lens
- 3 group of fibers; 1st from pars plana to anterior capsule, 2nd from anterior part of CB to posterior capasule and 3rd group from processes to equator
- Role in accommodation


INSERTION OF TENDON OF SUPERIOR RECTUS MUSCLE
PARS OPTICA RETINÆ
ORA SERRATA
PARS CILIARIS RETINÆ
SCLERA
PIGMENTARY LAYER OF RETINA
CHOROID
PERICHOROIDAL SPACE
ANTERIOR CILIARY ARTERIES AND VEINS
CIRCULAR MAJOR
ANGLE OF ANTERIOR CHAMBER
CANAL OF SCHLEMM
RADIAL FIBERS
CIRCULAR FIBERS
CILIARY PROCESS
CONJUNCTIVA
EPISCLERAL CONNECTIVE-TISSUE
LIGAMENTUM PECTINATUM IRIDIS
RIMA CORNEALIS
RADIATING FIBERS OF ZONULE OF ZINN
ZONULE OF ZINN
ZONULAR SPACES
POSTERIOR CHAMBER OF EYE
EDGE OF CORNEA
IRIS (anterior surface)
EPITHELIUM OF LENS CAPSULE
CAPSULE OF LENS
ANT. CHAMBER OF EYE
CORTICAL SUBSTANCE OF LENS
CORNEA
NUCLEUS OF LENS
POSTERIOR SURFACE OF CORNEA
EPITHELIUM OF CORNEA
ANTERIOR ELASTIC LAMINA
STROMA OF IRIS
POSTERIOR ELASTIC LAMINA
SPHINCTER OF PUPIL
PIGMENTARY LAYERS OF IRIS

METABOLISM



Lens avascular.
Metbolism occurs in cortex.
85% Glucose metabolised by anaerobically by glycolytic pathway.
15% by hexose monophosphate pathway.
Sorbitol pathway used in diabetes and galacosemia

CATARACT CLASSIFICATION

- Cataract: any opacity in lens called cataract

CLASSIFICATION

- Etiological
- Morphological

ETIOLOGICAL CLASSIFICATION

- 1.Congenital and Developmental
- 2. Acquired
  - a. Senile/age related
  - b. Traumatic
  - c. Complicated
  - d. Metabolic
  - e. Radiation
  - f. Toxic: steroid, Cu, iron, miotics
  - g. Systemic diseases: skin, osseous, syndromes

MORPHOLOGICAL CLASSIFICATION

CONGENITAL AND DEVELOPMENTAL CATARACT

- Cong. if insult during pregnancy
- Developmental after birth up to adolescent age
- Particular area of lens affected, other areas remain clear
- Small punctate opacities are common; do not affect vision

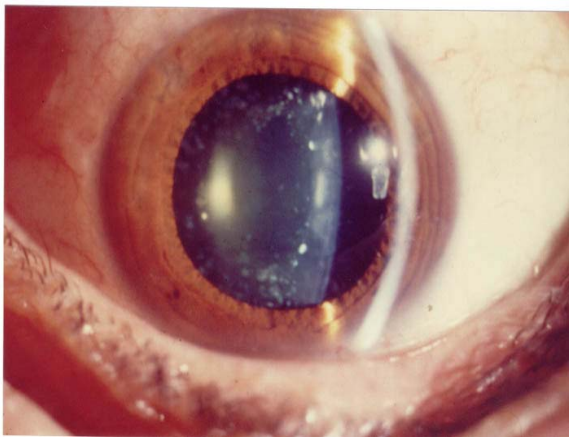
Congenital/Developmental Cataract

- Common cause of childhood blindness
- Responsible for 10% of visual loss in children
- 1:250 births have some cataract
- Isolated anommally
- Associated with other systemic conditions

CONGENITAL/DEVELOPMENTAL CATARACT

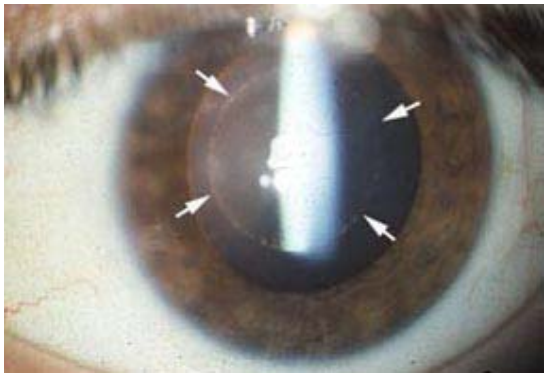
Cataracta centralis pulverulenta

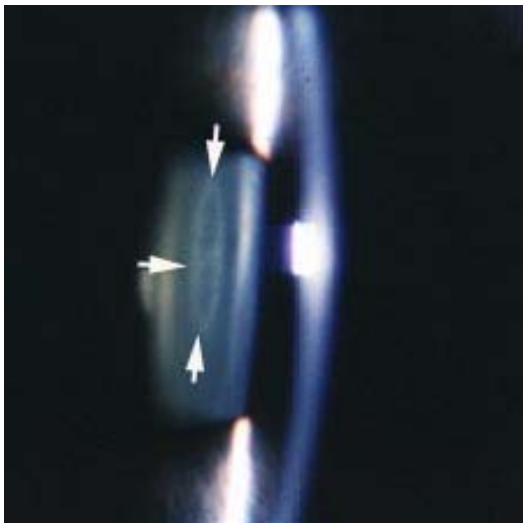
- ✖ Embryonic nuclear cataract
- ✖ Autosomal dominant
- ✖ Bilateral
- ✖ Small round opacities; powdery appearance
- ✖ Does not affect vision

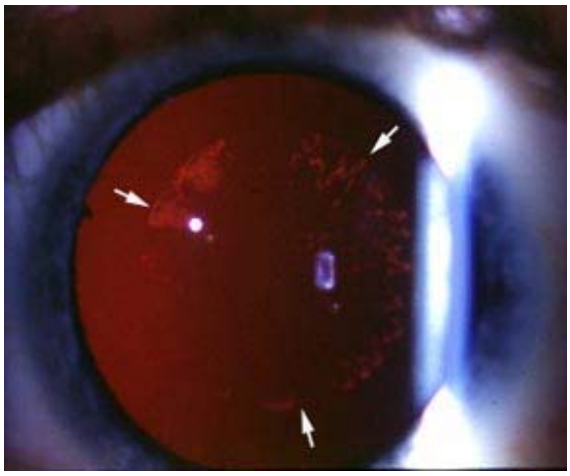


Lamellar/Zonular cataract

- Most common (50%)
- Foetal nucleus involved
- Linear opacities like riders in cortex
- Genetic or environmental
- Bilateral
- Affects vision, need for surgery

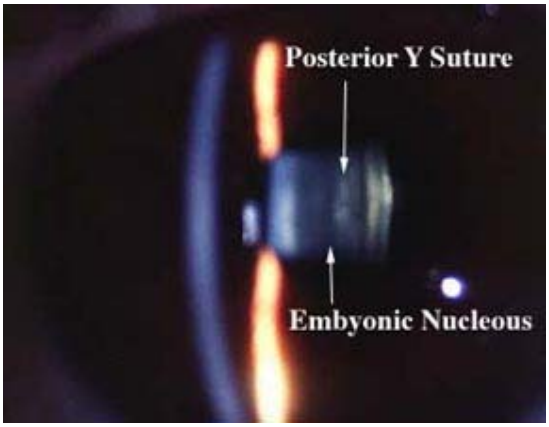






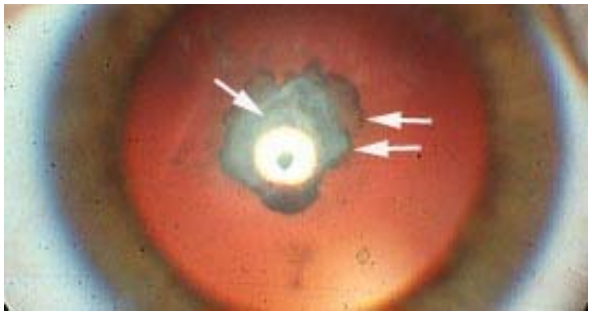
SUTURAL CATARACT

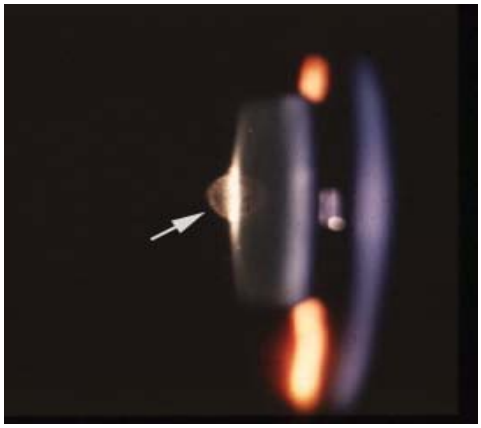
- Punctate opacities along sutures
- Static and bilateral
- Do not affect vision
- Opacities could be floriform, coralliform or spear shaped



POLAR CATARACT

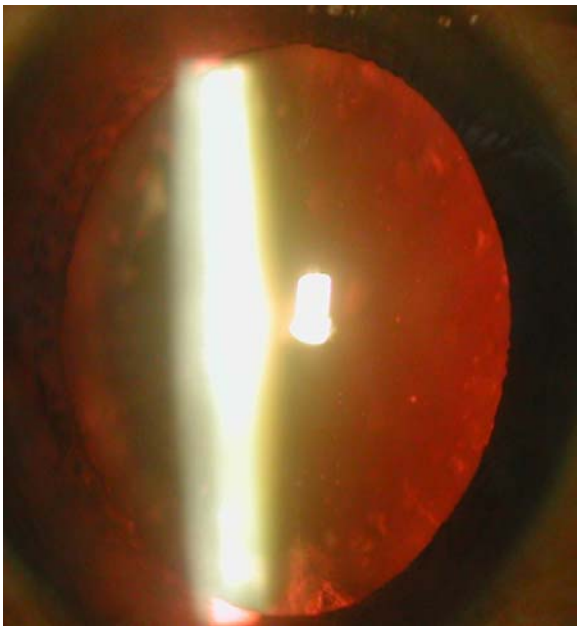
- ✖ Anterior or posterior
- ✖ Anterior due to delayed formation of AC
- ✖ Adjoining cortex involved
- ✖ Pyramidal or reduplicate
- ✖ Congenital or acquired
- ✖ Posterior due to persistent vasculosa lentis





CORONARY CATARACT

- Common variety- occurs during puberty
- Adolescent nucleus and cortex affected
- Club shaped opacities 360 D, radial orientation
- Vision unaffected

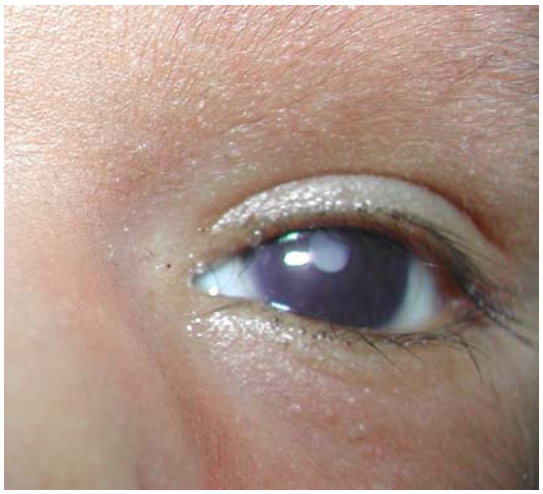


PUNCTATE OR BLUE DOT CATARACT

- Round bluish dots in adolescent nucleus
- Stationary and vision not affected
- Occurs during first two decades

TOTAL CONG. CATARACT

- Common
- Unilateral or bilateral
- May be hereditary
- Rubella can cause such cataract
- Progressive; needs early surgery
- May become membranous



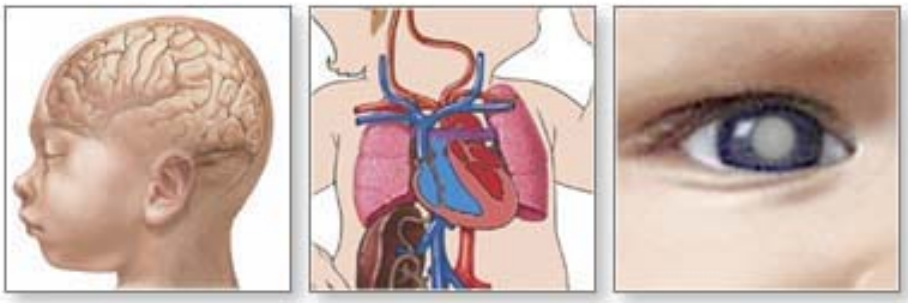
ETIOLOGY OF CATARACT

- Hereditary; autosomal dominent
- Maternal infections; rubella, toxoplasma, CMV
- Drug induced; steroids, thalidomide
- Radiation exposure
- Metabolic disorders; galactosemia
- Birth trauma
- Malnutrition; Vit D
- Idiopathic

MATERNAL INFECTIONS

- Rubella cataract: 50% transmission during first 8 weeks and later around 33%
- Features: cataract, deafness, heart defects-PDA, microcephaly, MR, Hypotonia, hepatosplenomegaly, thrombocytopenic purpura, pneumonitis
- Ocular: cataract, microcornea, microphthalmia, retinopathy, glaucoma, nystagmus, OA, strabismus

Rubella syndrome



Microcephaly PDA Cataracts

INVESTIGATIONS

- Rubella serology; IgM
- Urine for reducing substances; galactosemia
- Urine for amino acids; Lowe's syn.
- Blood glucose, calcium, phosphorus
- CT, MRI for basal ganglia calcification

TREATMENT OF CONG. CATARACT

- ✖ Observation: stationary opacities, vision not affected
- ✖ Iridectomy: optical; for central nuclear cat.
- ✖ Surgery: Phacoaspiration, ECCE, lensectomy
  - Unilateral
  - Total B/L
  - VA < 6/18

IOL > 2 yrs of age

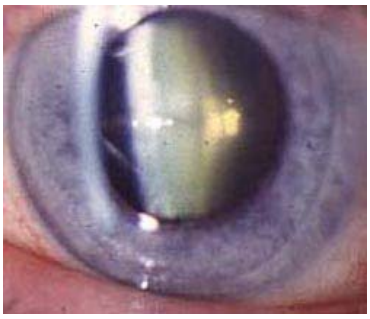
Contact lens

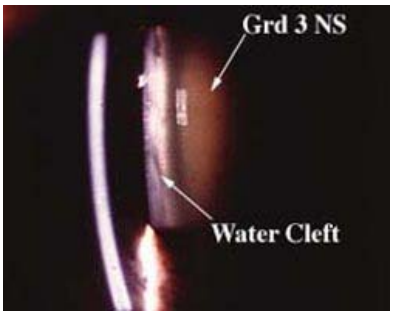
Glasses

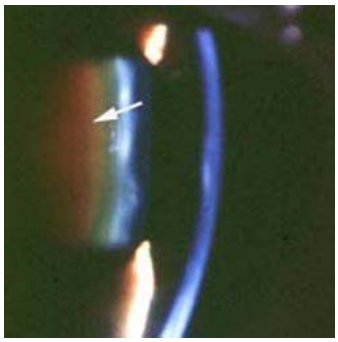
Amblyopia treatment

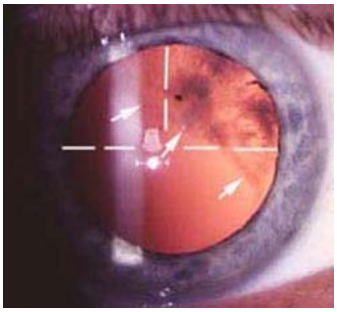
ADULT CATARACTS

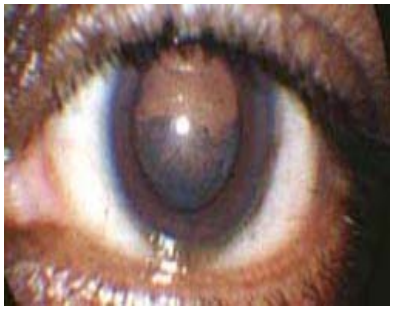
- Age related cataract: most common
- Most common cause of blindness; 50%
- Bilateral; asymmetry common
- Nuclear/ cortical/PSC/Polar
- Factors for early onset; hereditary, U/V radiation, diet




Grd 3 NS
Water Cleft

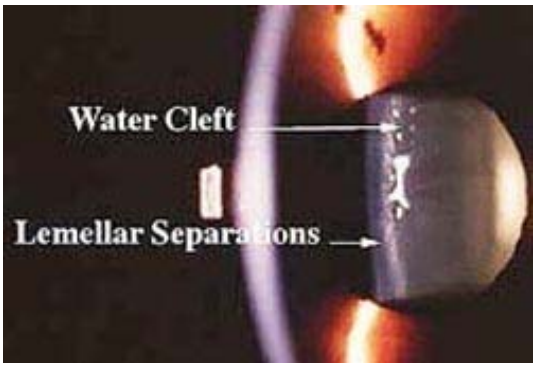


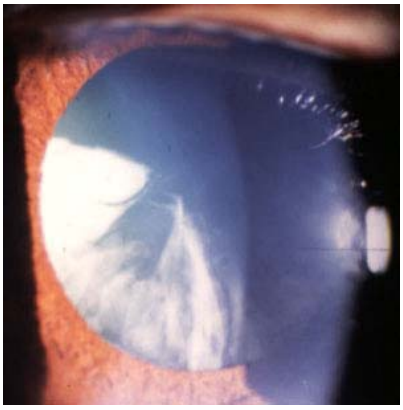


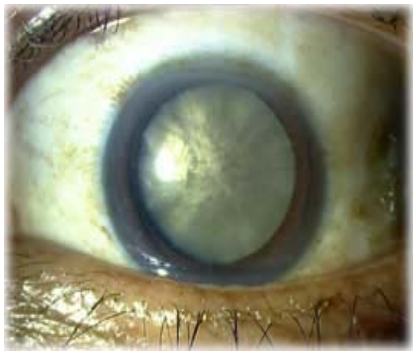


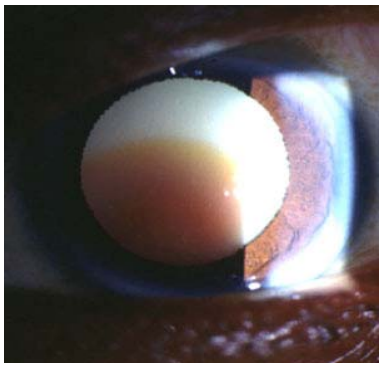
STAGES OF MATURATION

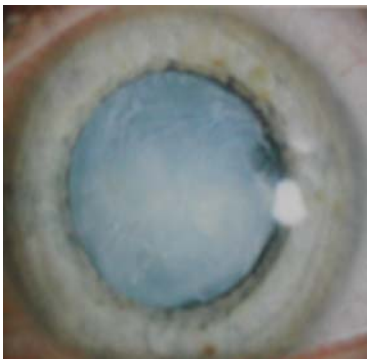
- Lamellar separation
- Incipient cataract
- Immature cataract
- Mature cataract
- Hypermature cataract; morgagnian, sclerotic
- Lens induced glaucoma; phacolytic , phacomorphic, phacoanaphylactic


Water Cleft
Lemellar Separations







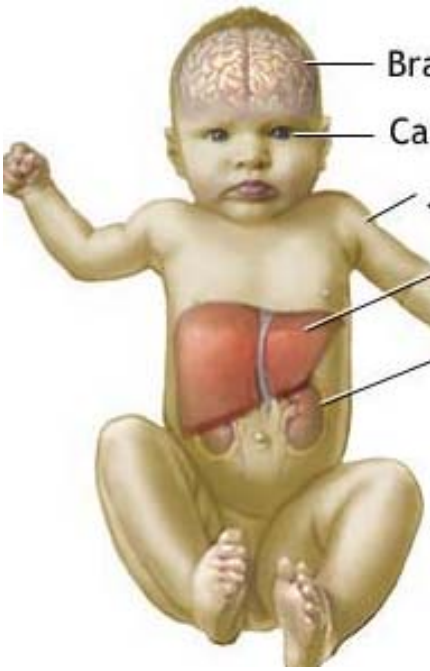


METABOLIC CATARACTS
DIABETIC

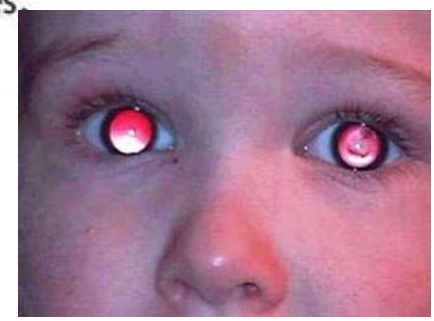
- ✖Senile cataract matures early
- ✖True diabetic; snow flake and PSC type
- ✖Occurs at younger age
- ✖Osmotic hydration of lens, sorbitol pathway

GALACTOSAEMIC CATARACT

- Inborn error of metabolism
- Galactose-1-phosphate uridyl transferase deficiency; classical galactosaemia
- Galatokinase deficiency; classical oil droplet cataract
- Galactose- dulcitol-more osmotic pressure
- Early changes reversible with elimination of milk products in diet



If a galactosemic infant is given milk, unmetabolized milk sugars build up and damage the liver, eyes, kidneys and brain

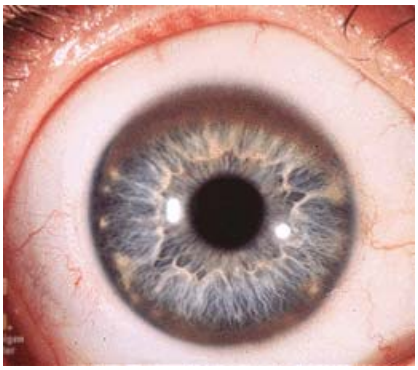


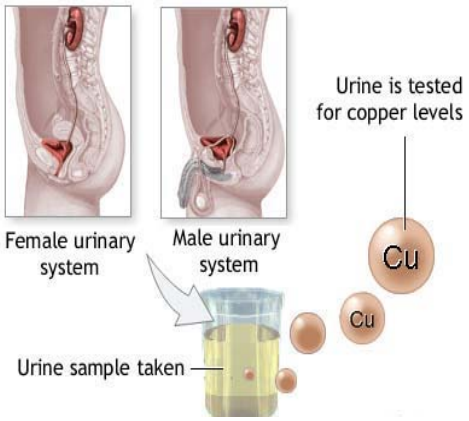
HYPOCALCAEMIC CATARACT

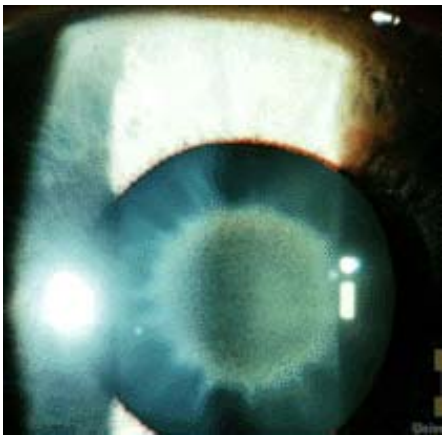
- Parathyroid tetany can lead to cataract
- Could be post surgical;thyroidectomy
- White or multicolored crystals in cortex
- Maturity uncommon

WILSON'S DISEASE

- Inborn error of copper metabolism
- Deficiency of ceruloplasmin
- KF ring
- Green sunflower cataract
- Retinal degeneration
- Jaundice, hepatosplenomegaly and cirrhosis
- Neurological signs; dysarthria,dysphasia
- D-penicillamine drug for treatment

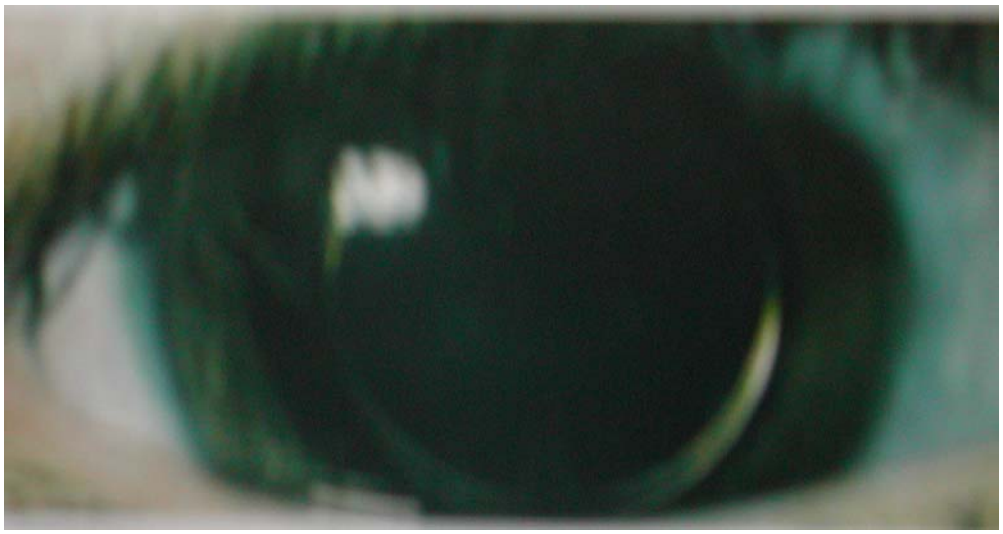



Female urinary system
Male urinary system
Urine is tested for copper levels
Cu
Cu
Urine sample taken



LOWE'S SYNDROME

- Oculo-cerebro-renal disease
- Inborn error of metabolism, boys affected
- Congenital cataract (100%) and glaucoma (50%)
- Microspherophakia
- Mother may show punctate opacities
- Mental retardation, dwarfism, osteomalacia, muscular hypotony, frontal prominence

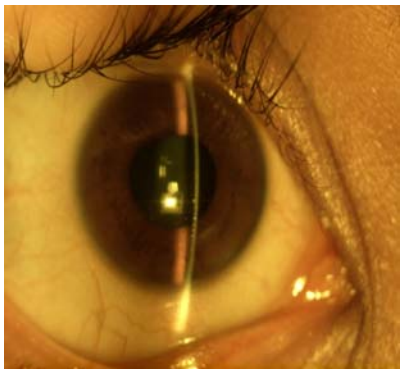


FABRY'S DISEASE

- Alfa-galactosidase A deficiency
- Angiokeratomas- telengiectasia of skin
- Cardiovascular and renal impairment
- Cornea verticillata and spoke like lens opacities
- Vision not affected

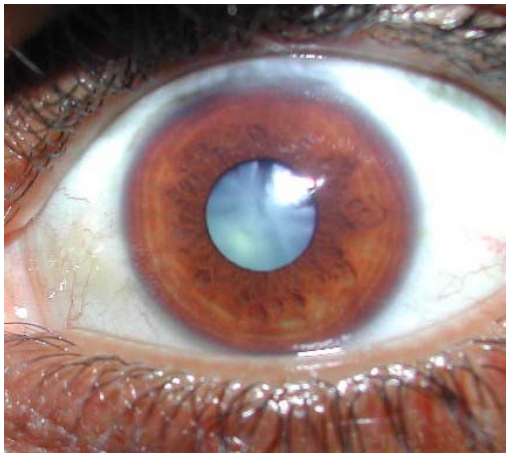
COMPLICATED CATARACT

- Anterior uveitis; posterior sub capsular cataract with polychromatic luster
- Occlusio or seclusio can develop
- Can remain stationary if inflammation controlled
- Occurs due to disturbance of lens metabolism



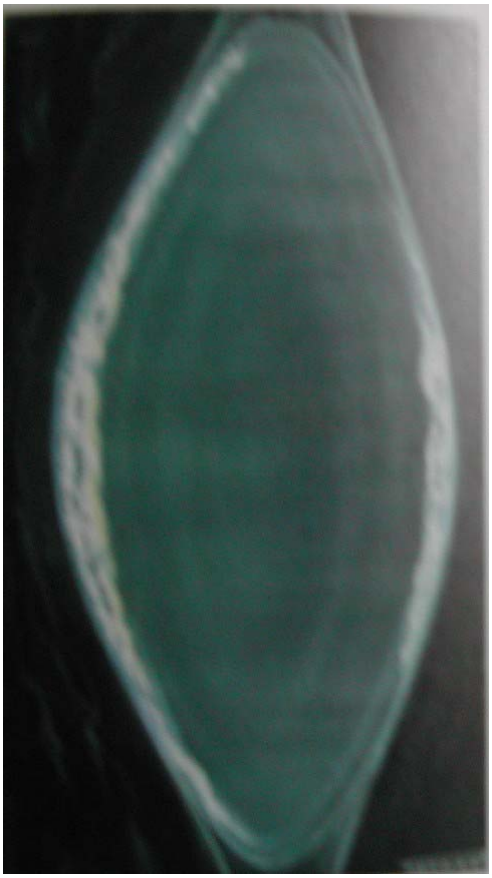
COMPLICATED CATARACT

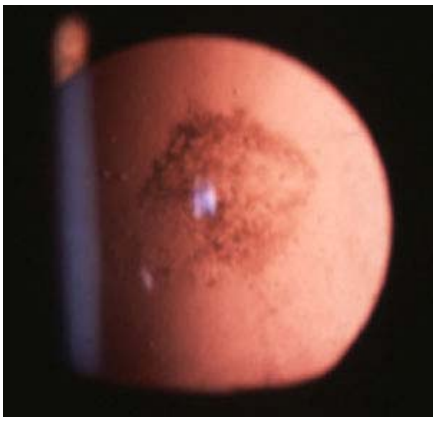
- Retinal detachment and retinitis pigmentosa cause posterior sub capsular cataract
- High myopia; nuclear sclerosis
- Acute glaucoma; glaukomflecken s
- Tumors; retinoblastoma, melanoma



TOXIC CATARACTS

- Steroid induced: Topical and oral steroids can cause posterior sub capsular cataract
- Dose relationship with oral steroids, children more susceptible >10mg for 1yr
- Miotics: Long term use with long acting miotics like ecothiophate.
- Other drugs: Amiodarone, chlorpromazine, busulphan, and gold (ant. Sub capsular)





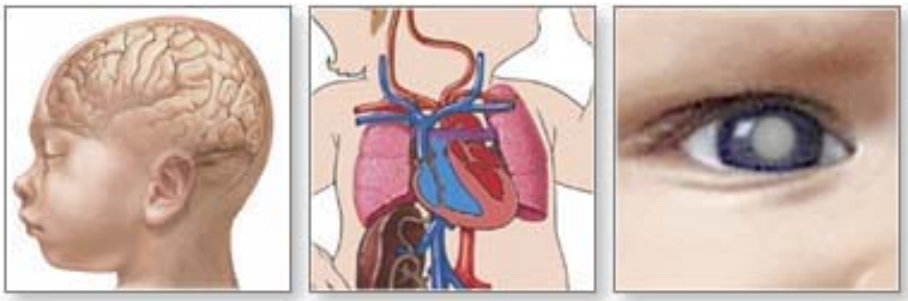
RADIATION CATARACT

- Infrared: Long exposure; posterior sub capsular: glass blower's cataract
- Irradiation cataract: X-rays, gamma rays, neutrons can cause cataract after 6M to 1 year after exposure.
- Ultraviolet rays: Senile cataract
- Electric cataract: After powerful current, punctate sub capsular cataract

MATERNAL INFECTIONS

- Rubella cataract: 50% transmission during first 8 weeks and later around 33%
- Features: cataract, deafness, heart defects-PDA, microcephaly, MR, Hypotonia, hepatosplenomegaly, thrombocytopenic purpura, pneumonitis
- Ocular: cataract, microcornea, microphthalmia, retinopathy, glaucoma, nystagmus, OA, strabismus

Rubella syndrome



Microcephaly PDA Cataracts

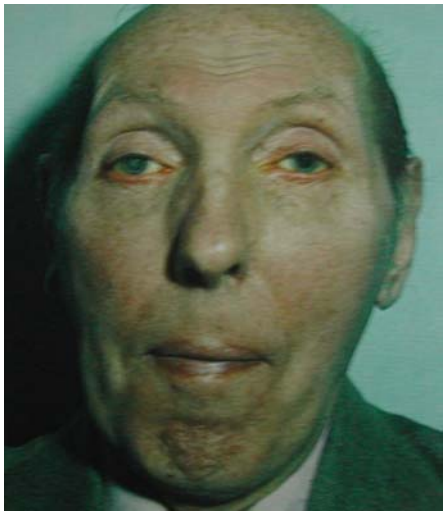
OTHER MATERNAL CAUSES

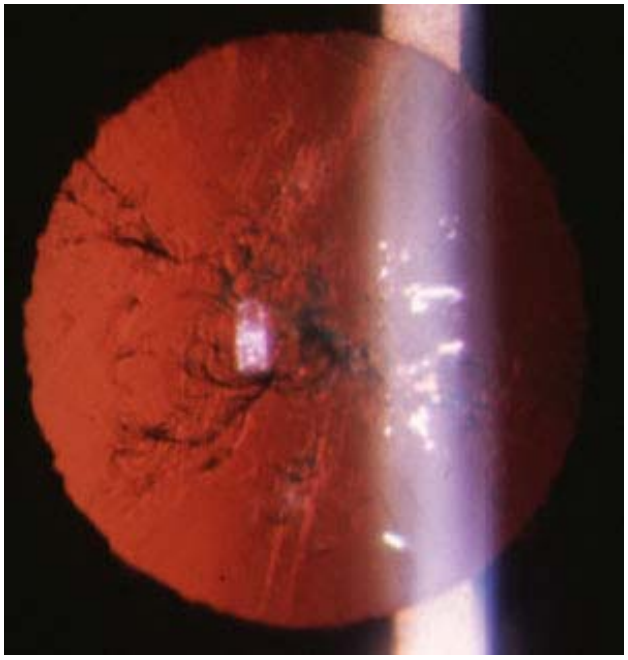
- Toxoplasmosis and CMV also can cause cataract
- Mother drug intake: thalidomide, steroids
- Exposure to radiation
- Malnutrition during pregnancy

SYSTEMIC DISEASES

- Dystrophia Myotonica: Spastic muscle contractions, hypogonadism, frontal baldness, expressionless face, ptosis,and cardiac anomalies.

Ocular: Polychromatic cataract (Christmas tree cataract, light near dissociation, pigmentory macular deg.





SYSTEMIC DISEASES

- Atopic cataract: Atopic dermatitis, bilateral posterior sub capsular cataract, keratoconus, keratoconjunctivitis
- Down syndrome: Trisomy 21, MR, mongoloid face, CHD, Cataract, slanted narrow palpebral fissure, keratoconus, strabismus, nystagmus, blephritis, iris spots, myopia

SYSTEMIC DISEASES

- Werner's syndrome: Premature senility, hypogonadism, diabetes, arrested growth, bilateral cataract.

- Rothmund's syndrome: females affected, skin atrophy, pigmentation and telengiectasia, saddle nose, bony defects, hypogonadism, bilateral cataract

CLINICALFEATURES;

Symptoms

- Visual loss; slow, painless, myopic shift
- Glare and lower contrast sensitivity
- Double or polyopia
- Colored halos
- Blurring of vision, distortion of images
- Pain if glaucoma develops

CLINICAL FEATURES; Examination

- Visual acuity testing
- Refraction
- Distant direct examination
- Iris shadow
- Slit lamp examination and IOP check
- Dilated fundus examination

CLINICAL EXAMINATION

Macular function tests

- Light perception and projection
- Pupillary reaction
- Two point discrimination
- Maddox rod test
- Entoptic images
- Laser interferometry
- Ultrasound, VEP

CATARACT SURGERY

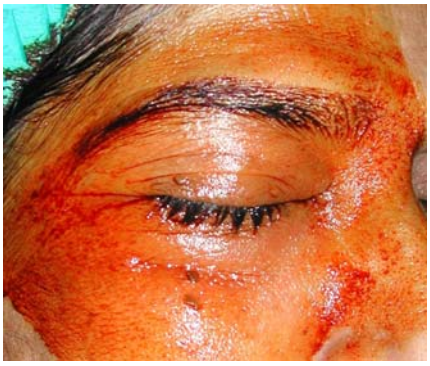
Preop evaluation

- General physical examination and evaluation
- Complete ocular examination; IOP, sac test, conjunctivitis, ocular inflammation.
- IOL power calculation; contact and optical
- IOL calculation formulas
- Plan type of surgery: ICCE, ECCE, Phaco
- Type of anesthesia: topical, local; peri or retrobulbar or general

CATARACT SURGERY

Preop preparation

- Topical antibiotics
- Topical NSAIDS
- Pupil dilatation
- Acetazolamide
- Eye preparation
- Informed consent



CATARACT SURGERY

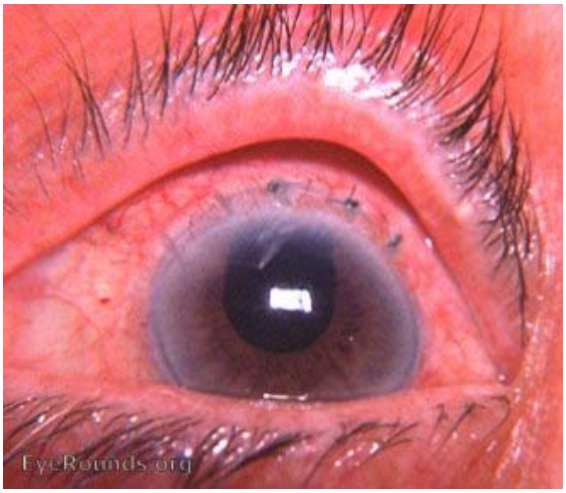
ICCE

- Cheap and simple,
- Less time consuming; mass surgeries possible
- No posterior capsular opacification, as no capsule
- Easy to learn and master
- No sophisticated equipment required
- Can be done when lens displaced

Methods to do icce

- Cryoextraction
- Tumbling
- Erysiphake
- Alfa chymotrypsin
- Capsular forceps


BASAK
Extraction of cataract with its capsule


EyeRounds.org

CATARACT SURGERY

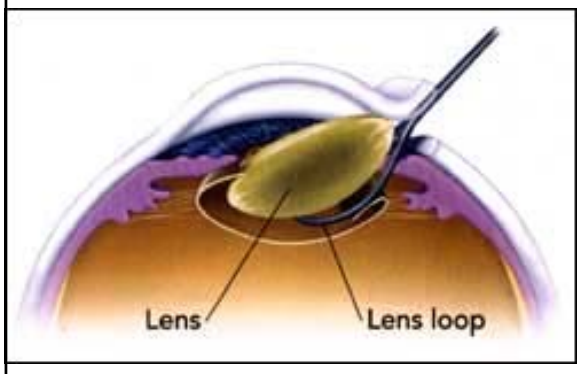
ICCE; disadvantages

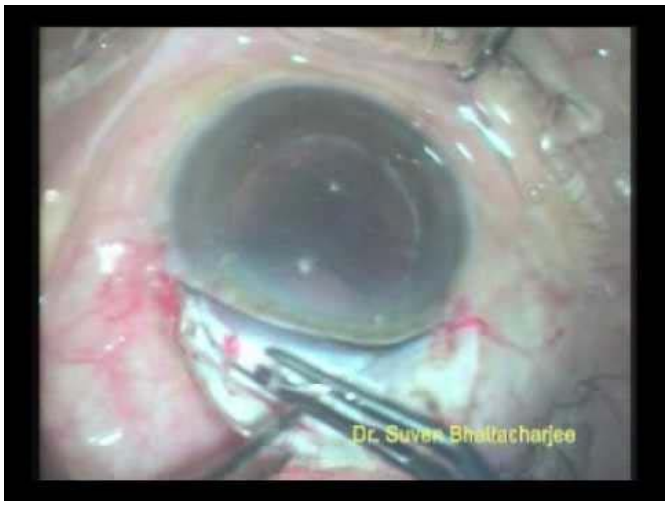
- PC lens not possible, scleral fixation, AC or iris fixation can be done
- Not possible in young people; more vitreous loss
- More complications; vitreous incarceration, vitreous touch, pupillary block glaucoma
- RD, endophthalmitis, CME more chances

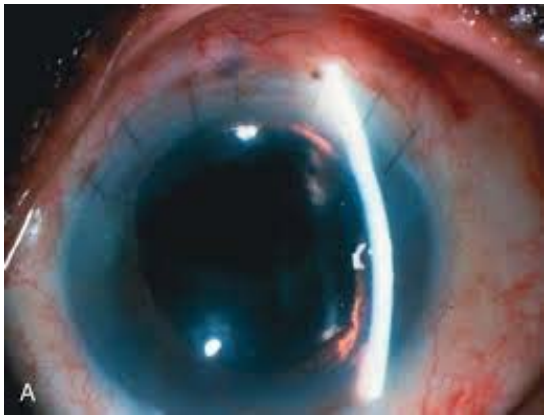
CATARACT SURGERY

ECCE

- ECCE difficult to learn and more complications with beginners
- Posterior capsule opacification
- Can not be done with lens subluxation or dislocations
- IOL implantation possible
- Less posterior segment complications

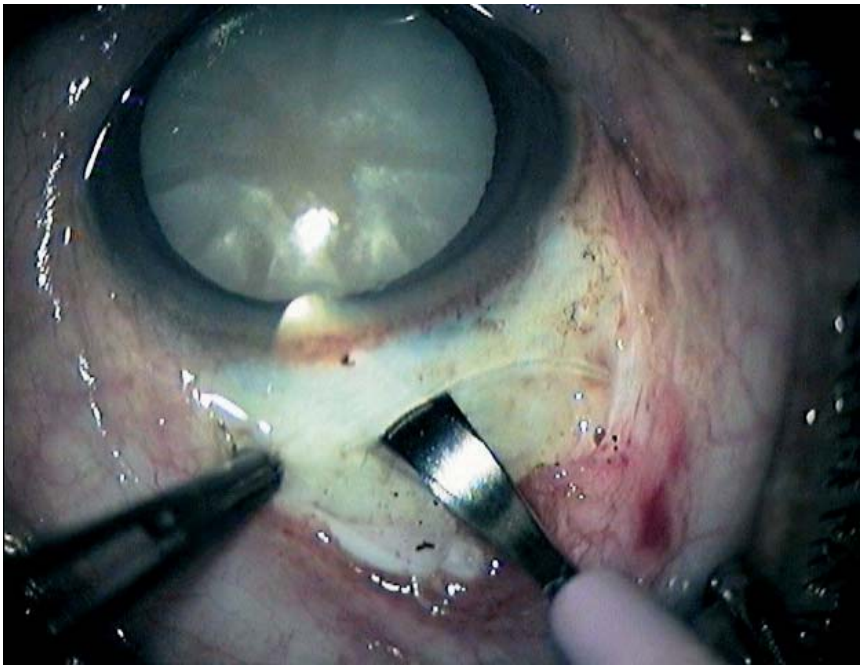

Lens
Lens loop

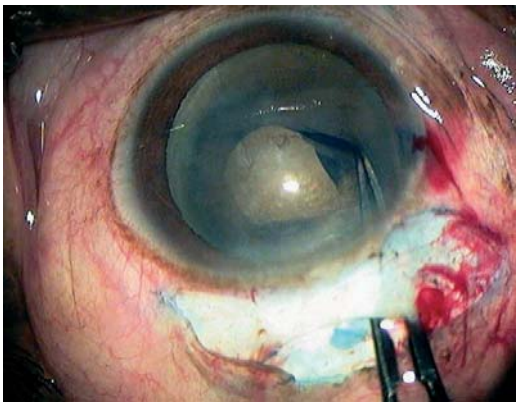

Dr. Suvek Bhattacharjee

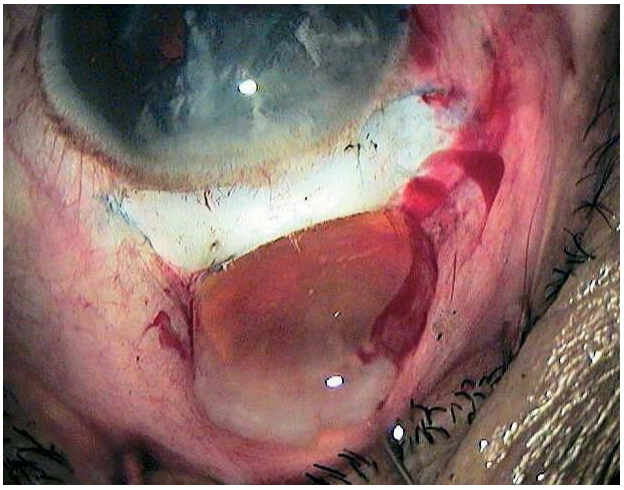

A

SMALL INCISION CATARACT SURGERY

- Type of ECCE
- Incision in the sclera;5-6mm
- Scleral tunnel is made, which is self sealing
- CCC or capsulotomy done
- Nucleus delivered and cortex aspirated
- IOL implanted







CATARACT SURGERY

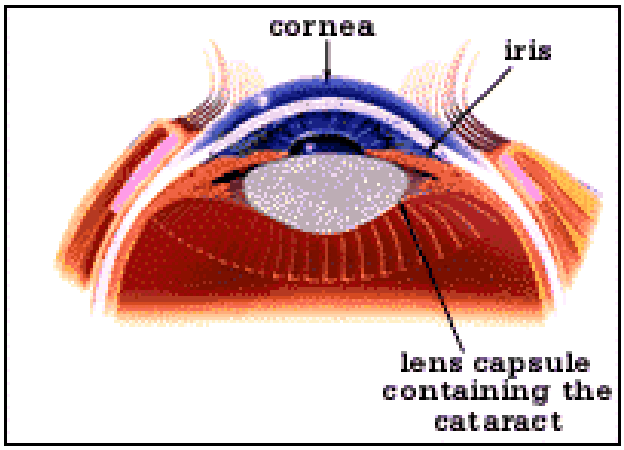
PHACOEMULSIFICATION

- Small incision; 3.2, 2.8, 0.9
- No sutures required
- Less astigmatism
- Early rehabilitation
- Foldable lens material has less PCO
- Complication rate less
- More costly, sophisticated equipment
- Longer learning curve

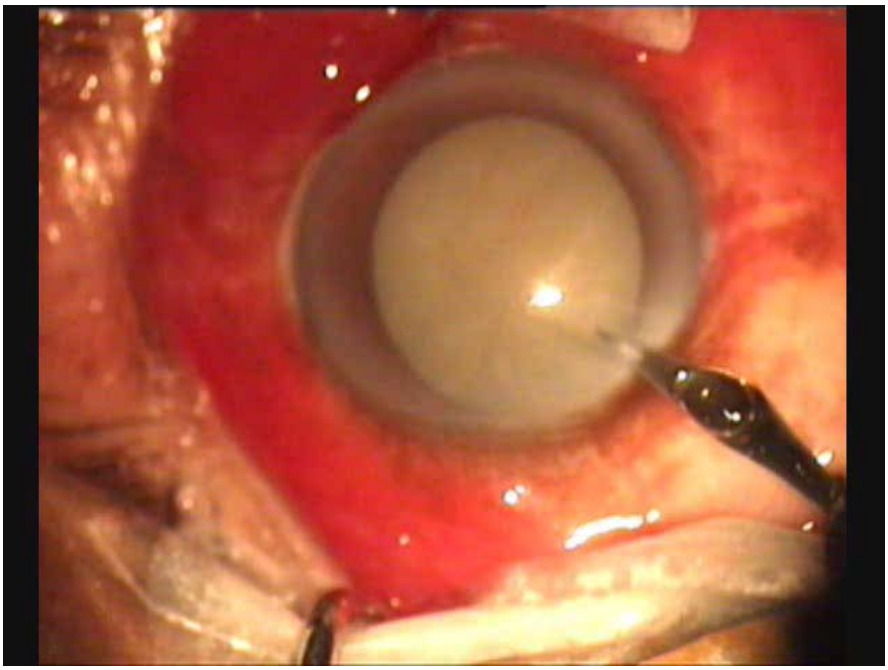
CATARACT SURGERY

Surgical steps

- Conjunctival incision and cautery; ICCE, ECCE, SICS
- Wound construction; scleral, corneoscleral, corneal. Superior or temporal
- Capsulotomy: CCC, can opener, Envelope
- Hydro dissection and hydrodilination
- Removal of nucleus or emulsification
- Cortical cleanup
- IOL implantation; PMMA, Acrylic, silicone
- Wound closure


cornea
iris
lens capsule
containing the
cataract

Video

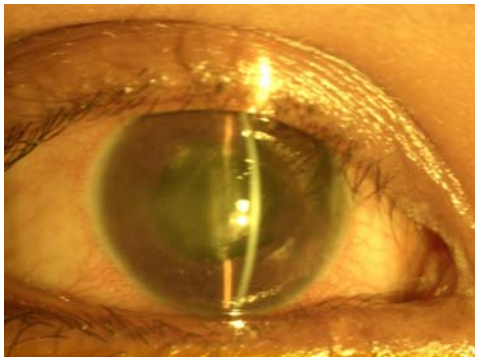


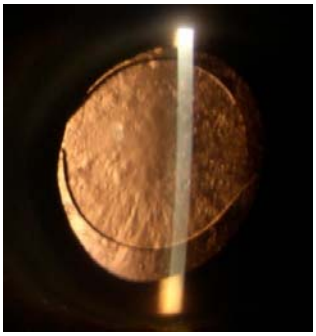
ACRILISA MULTIFOCAL

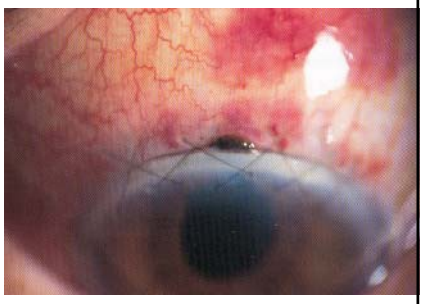
CATARACT SURGERY

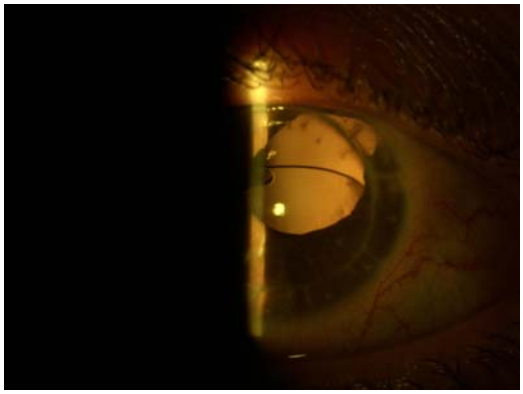
Complications

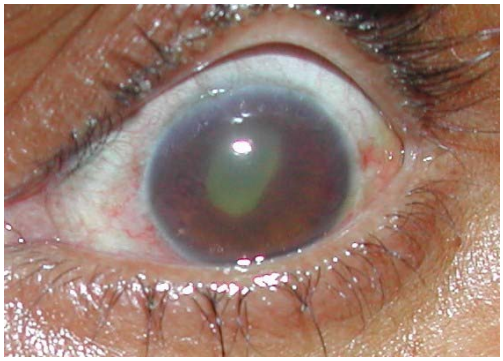
- Early: Iris prolapse, hyphema, wound leak, pupil block, IOP raised, endophthalmitis, ciliochoroidal detachment
- Late: CME, PCO, RD, Corneal decompensation, epithelial/ fibrous in growth
- Lens malpositions
- Glaucoma

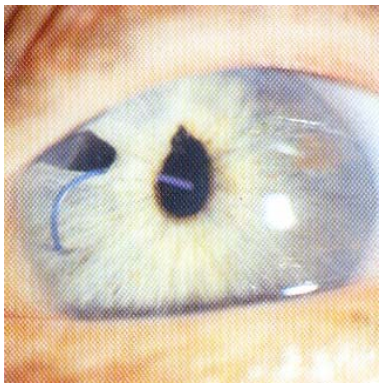




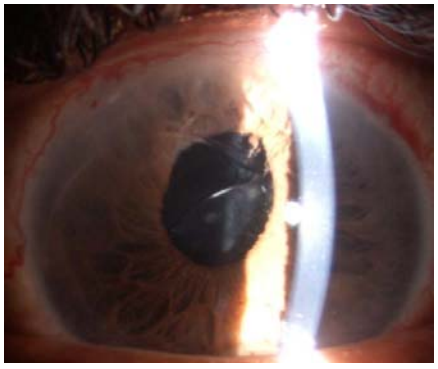


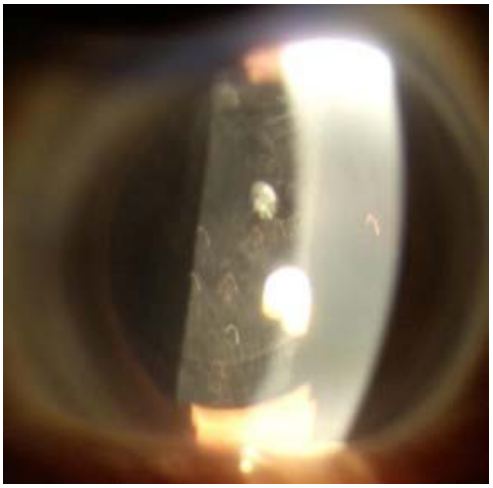


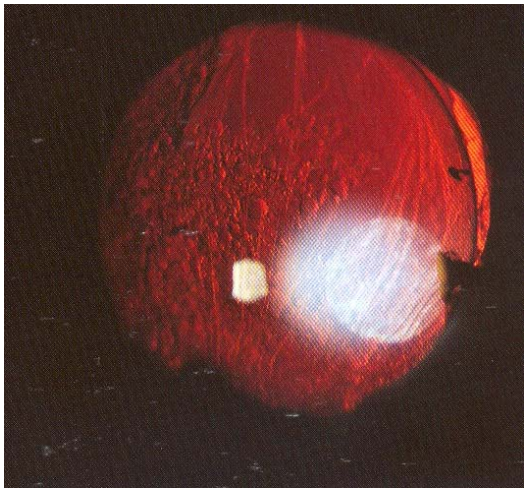


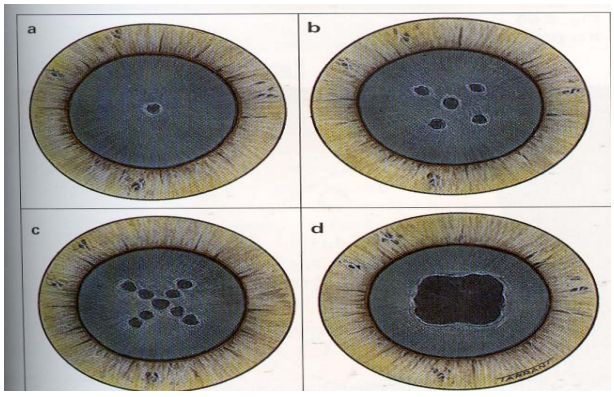


IOL subluxation








a
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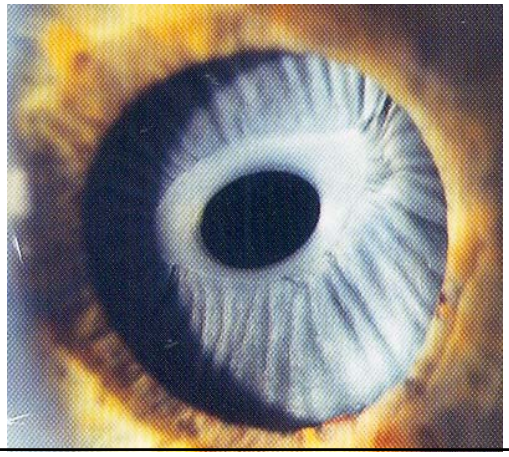
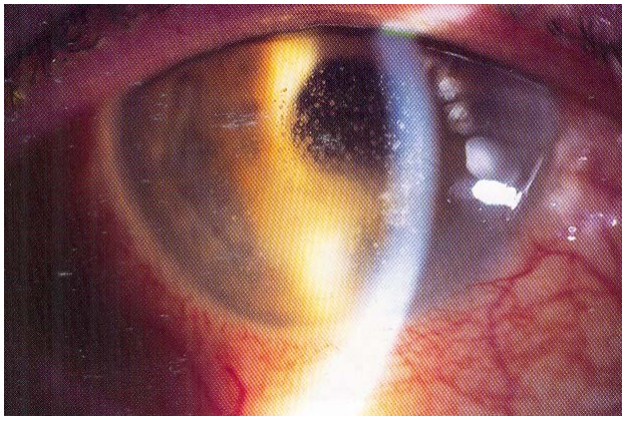
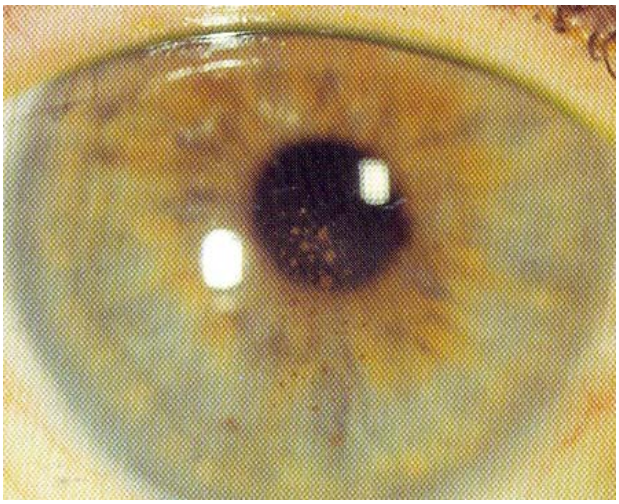
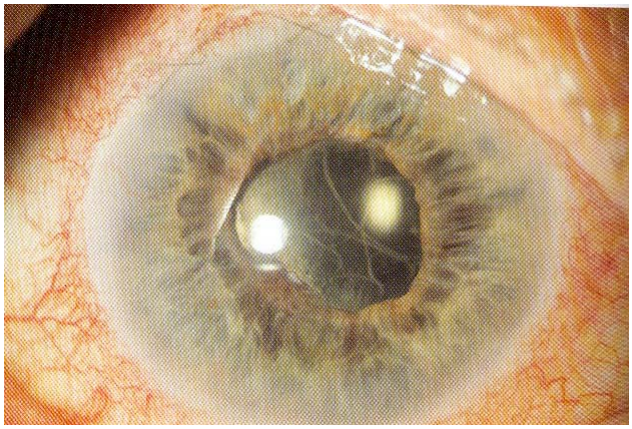




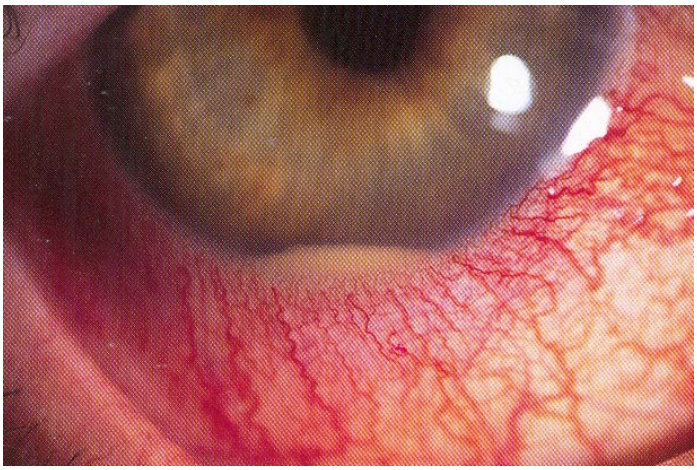


Endophthalmitis

- Devastating complication of cataract surgery
- Incidence: 1:10000
- Organisms
  - Staph. epidermis, Staph aureus, pseudomonas, fungal
- Clinical features
  - Pain, visual loss, corneal edema, hypopyon severe reaction
- Rx:
  - Intravitreal injection of Vancomycin 1mg & Ceftazidine 2.25mg
  - PPV

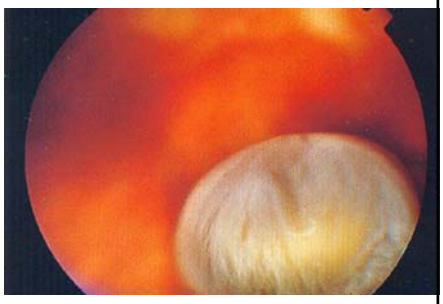


Endophthalmitis



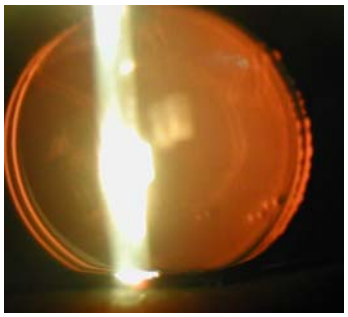
Aphakia

- ✖ Refractive state
- ✖ Condition with absent lens in pupillary area
- ✖ Could be dislocated posteriorly
- ✖ Capsule could be present if ECCE and no IOL
- ✖ Iridodonesis, AC deep, jet black pupil or white capsule
- ✖ No 3rd purkinje image
- ✖ Require high power glasses



Pseudophakia

- Condition with IOL in the eye
- Normal physiological lens absent
- AC/PCIOL/Iris fixated
- AC deep, iridodonesis, Purkinje images from IOL



ECTOPIA LENTIS

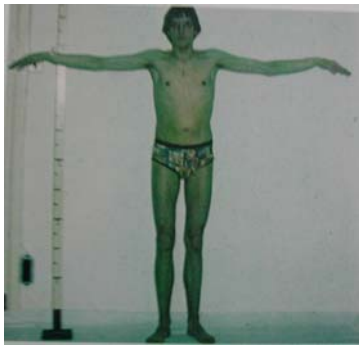
- Lens not fully in its place; partially displaced from ptellar fossa, some zonular attachment present.
- Dislocation: lens totally displaced from its place.
- Could be anterior or posterior dislocation
- Can cause glaucoma, astigmatism, uniocular diplopia
- Isolated anomaly or associated with systemic disease

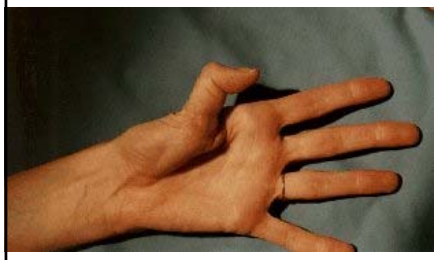
ETIOLOGY

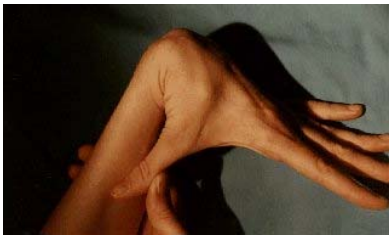
- Isolated anomaly
- Part of syndrome
- Trauma
- Pseudoexfoliation syndrome

MARFAN'S SYNDROME

- Autosomal dominant
- Cardiac anomalies; aneurysm of aorta and regurgitation
- Skeletal anomalies; Upper limbs long, arachnodactyly, pectus deformity, joint laxity, high arched palate
- Ocular: Lens subluxation upwards, symmetrical, angle anomaly and glaucoma, axial myopia, flat cornea, RD

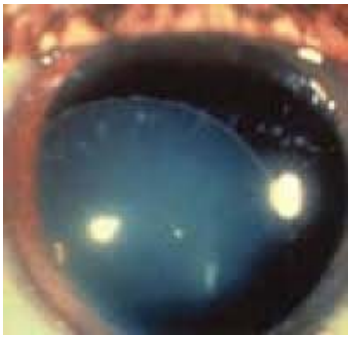






ECTOPIA LENTIS

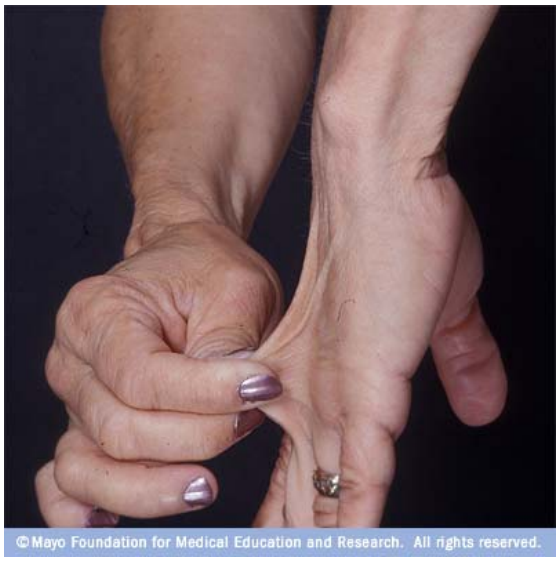
- Weill Marchesani syndrome: Autosomal recessive.
- Short stature, short stubby fingers, mental retardation
- Ocular: Microspherophakia, inferior dislocation, angle anomalies, glaucoma
- Ehler Danlos syndrome: Joints lax, skin loose and thin, subluxation



- Ehler Danlos syndrome:
- Joints lax,
- skin loose and thin,
- subluxation

Joint and Skin Findings IN EHLER DANLOS

-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ECTOPIA LENTIS

- Homocystinuria: Autosomal recessive, deficiency of enzyme-cystathione synthatase

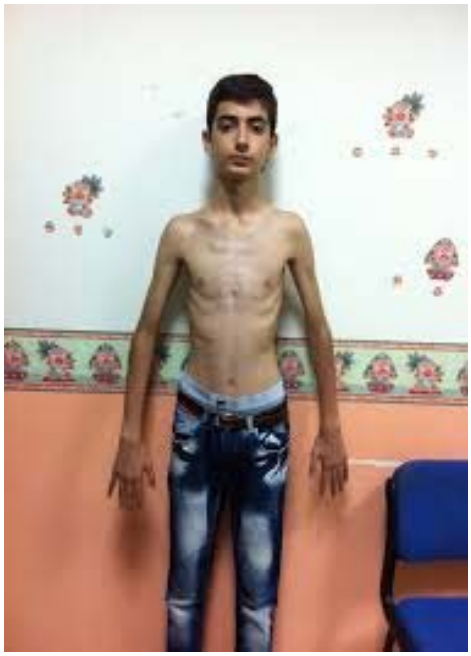
  Features like Marfan's

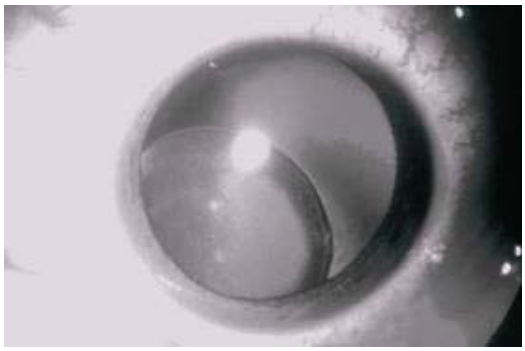
  MR, osteoporosis

  Thromboembolism after GA

  Hair fine and fair

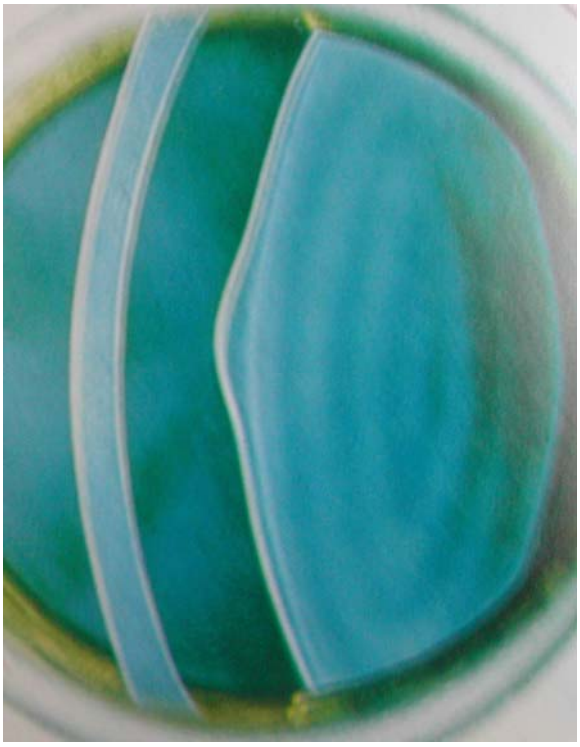
  Lens subluxation downwards, glaucoma



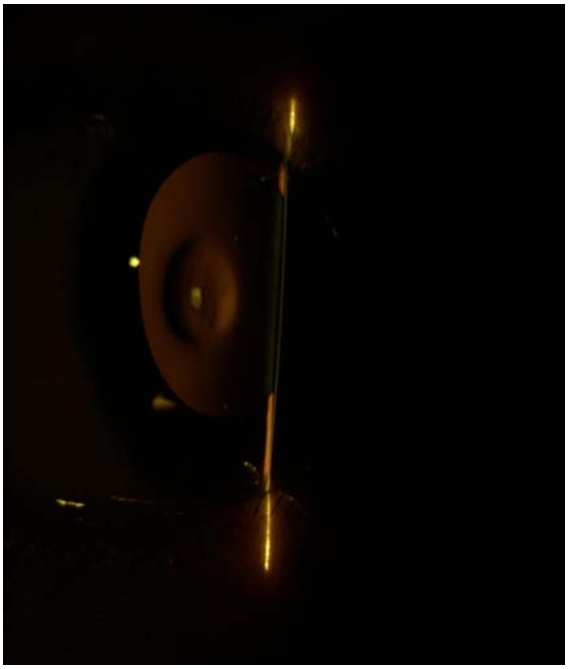


OTHER LENS ANOMALIES

- Lens coloboma
- Anterior lenticonus- Alport's syndrome
- Posterior lenticonus-sporadic unilateral
- Microspherophakia- Lowe's syndrome, Weill Marchesani syn., Marfan's syn. Hyperlysinemia



Anterior lenticonus



Posterior lenticonus