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NAME: Radhika Gupta STD.: _____ SEC.: _____ ROLL NO.: _____ SUB.: Retina

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Retinopathies in disorders of blood

- In Non Malignant
  - Anaemia
  - Sickle Cell
  - In Hmeg disorders
  - Dysproteinemic
- Malignant disorders
  - Leukemic
  - Lymphoma
  - Multiple Myeloma.

Anaemic Retinopathy

Types

- Micro. (~~Micro~~ Hypo.) → Fe def
- Normo Normo. → Acute Bld loss
- Macro. → Pernicious An. → Production of platelet & granulocytes also affected ∴ > Hmeg

Pathogenesis

Changes < Hb < 50% level
Hb < 5gm %

Innocuous & rarely of Dx imp.

- Duration & type of occurence of R.
  - Period of Hypotension
    - ↓ Anoxia
    - ↓ Venous Stasis
    - ↑ Angiospasm
    - ↑ Capillary permeability
    - Thrombocytopenia.
    - Severity of An
    - ↑ Bld viscosity

→ Factors

classmate
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of

- Fundus
  - Pale.
  - CH spots +/-
- Artery
  - ↓ deeply red.
- Vein
  - dilated
  - tortous

ON

Vascular Dz → ON + Centrocaecal Scotoma
Permanent CA → if Vit B12 supplements not given
Pern A → dementia, Neuropathy & other CNS signs

Retinal things →

- Superficial (Inner)
  - Capillary plexus
    - along NF
      - flame / feather shape
      - fine / Striations
      - Indistinct Margins
      - in 2DD of OD.
- Deep.
  - Vertically along plexiform layers
    - Ends seen as Dot & Blot
- Sub-hyaloid
  - b/t post vitreous & ILM
    - Round
    - Boat shaped
    - Post pole
    - extend in Vit.
    - Passive

Roth Spots — White centered thing are seen
Platelet fibrin constitute the white Centre

classmate
Date
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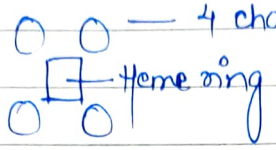
Mx. ℞ by hematologist
Always reversible

(*) Both spot & CM spot >> common ⊆ co-existing thrombocytopenia in Aplastic An.

Sickle cell retinopathy

- Systemic
- Ocular.

Sickling → presence of less than combination of Abn Hb in RBC



Variant

- SS.
- SC. → C disease
- Sβeta (Sthal)
- S. cell trait (AS)

Trait. — disease

Hypoxia → Crescenteic Oval Bld cells (Sickle Cells) → ↑ Hematocrit, ↑ Bld viscosity

↑ chances of V. occlusion → Local ischaemia

C/F

- Ant Seg.
- Post Seg

Ant Segment

a) Cony sickle sign → AIDS
- CML.
- Vaso-Occlusive disease.

linear, comma shaped, truncated segments of Bulbar Cony vessels.

b) Iris atrophy & NV → Extensive Irregular pupil
- NVI ← RD.
- Major Arteriole Obstruction

c) Hyphaema → Permanent Ocular damage ⊆ Minimal trauma & Sx.

Post Segment

a) Vitreous Hmg
b) Salmon patch (Salmon coloured RH) — due to arteriole.
» equatorial retina.
- attributed to colour changes in Hmg
- Initial colour — Bright Red.
- Rupture of Medium sized R. arteriole

↓

Schisis cavity ⊆ iridescent yellow particles in lining of cavity

↓

mφ has engulfed. bld & Hb.

Black Sunburst sign.

↓

Intra arterial thrug

↓

dissect into Sub neural retinal space

↓

disrupts RPE

OD Sign

Sludging red cells in peripapillary R. Capillaries

↓

Dark spots / Vascular lines

OD Neovasc hardly,

Stellate / Spiculated lesions

RPE hyperplasia — Intraretinal Migration

seen in Equatorial region

→ Macular Small Vessel Occlusions (Sickling Maculopathy)

Atrophy & thinning of Macula

↓

Oval depression of Bright Central reflex (Red feed)

↓

M. Ischaemia

- Large Macular infarctions
- CW spots
- RAM
- RA sclerosis
- Venous tortuosity

- Angioid streaks
- CRM
- Macular holes
- Proliferative Sickle Retinopathy (PSR)

classification

- Peripheral Arteriolar Occlusion
- Peripheral Arteriolar Venular Anastomosis
  - ↓
  - NV at Anastomosis
  - No leak on FFA
  - as not true.
- NV proliferation
  - ↓
  - Sea fan. ✓
  - Feeder A. & Draining V
  - NV at fxn of N & Isch Retina
  - White glial cell surround
  - ↓
  - ~~Early detection~~ FFA Leak
- Vitreous Hmg
  - ↓
  - Spont > Trauma.
- RD

Early detection
LNVE → Rx

Treatment Modalities
Diathermy → Cryo → Laser PCA
& Vitreous Hmg & RD.

Ocular Complication
- Ant Seg Isch
- IntraOp Hmg
- 2° glaucoma.
- Maintain ↓ IOP during Sx

Retinal involvement in Hmg disease

- Disorder of platelets
  - ITP
  - TTP
- Disorders of clotting factors
  - Hemophilia
- CT disorders
  - Pseudoxanthoma Elasticum
- Misc disorders
  - Scurvy
  - Steroid
  - Kapasi
  - DIC
  - BM disorders

DIC

activation of Coag cascade, µVasc thrombosis, consumption of Coag factors

↓

Bleeding

Causes — Sepsis, Malig, Toxemia of Preg

Thrombocytopenia + ↑PT + ↑apTT

↓ plasma fibrinogen level

↓ ESR.

↑ fibrin degradation products

+ schistocytes (fragmented RBCs) on peripheral smear also seen.

cf — Bil submacular Choroidal thrombosis

- fibrin deposition underneath R. → SRD
- pin point leakage through RPE on FA

BM disorders

Polycythemia Vera → HyperViscG

Ischaemic Reti = DM = HTN.

Hemat > 50%.

Bilateral

cf

Fundus — dark dilated tortuous veins

Disc — Hyperaemic & Swollen

R. Edema + CRVO.

Loss of vision — R. Edema.

⇒ Dyskeratosis Congenita

⇒ BM failure Syndrome.

Dysproteinemic Retinopathy

Hyperviscosity of Serum.

- ↑ γ glb
- Cryoglobulinemia
- Waldenstrom's Macroglb
- CLL

Presence of Retino ∝. ° of Ass fn.

cf — VH, NVG

CRVO

RV — dark, dilated, tortuous.

Intraretinal Hmg.

CW spots.

Disc Hyperaemia

RH — Sup & deep.

R. edema

RAM.

NVI, NVE

Retinopathy in Malignant Hematological disorders.

Leukaemic Retinopathy

Ocular involvement → > in Acute Leukemia

- 1° → Infiltration of retina by Leukemic cells
- 2° → Ass Anaemia, Thrombocytopenia, Hyperviscosity, Opp inf.

Primary involvement (cf)

- Leukemic Retinal infiltrates → grayish white nodule
- Choroidal Involve^{n} → ↓ perfusion of choio.
  - Capillaries
  - RPE ischaemia.
  - Mottled & Tigroid appearance
- ONH infiltration → - ↑ CNS involve^{n}
  - Intraocular leukemic lesion

Secondary Involvement.

Fundus ↓ Pale & Orange
Retinal Veins — dilated & tortous
R. arterioles — pale & narrow
Roth spots
Subhyaloid Hmrg
Retinal Hmrg & CWS spots
R. Vascular Sheathing — grey white streaks along retinal vessels.
Micro Aneurysm
Hard yellow white exudates
HTLV-1 Leukemia
Retinal NVE

Other Ocular features → Orbital infiltrations
Subconj thmg | Hyphaema
Iris thickening, Iritis

Multiple Myeloma.

Ocular

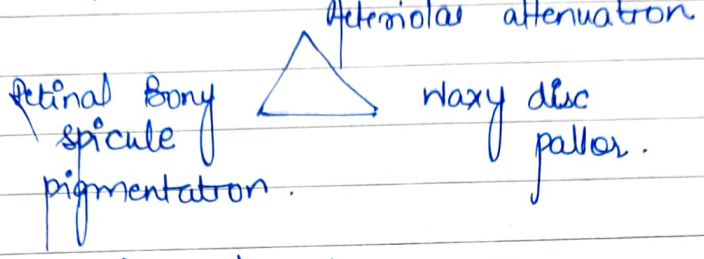
PP Cysts
Cilichoroidal effusions
Uveal plasmocytoma.
RV.
NSD.
RPE detatchments

Hyperviscosity → Causes DR like Spectrum.

Degeneration & Dystrophies of Retina.

Retinitis Pigmentosa

is an inherited retinal dystrophy which leads to loss of photoreceptors characterized by classic triad of



c/f — 1° deg of rods
↓
2° deg of Cones
] explains Nyctalopia.

- Night blindness (Nyctalopia)
- Visual field changes :-
  - Patchy loss of peripheral vision
  - Ring shape Scotoma
  - Tunnel vision

Fundus Exam reveals → Bony spicules
Waxy disc pallor
Arteriolar attenuation
Tessellated fundus due to RPE atrophy
Atrophy of macula ⊆ ERM
CME.

Variants of RP

Pigmental paravenous chorioretinal atrophy

Mutat^{n} of CRB-1 gene
ERG (N)
Eog affected.

Unilateral RP.

- Typical pigmentary deg
- Absence " " in fellow eye
- +nt of symptoms of RP in affected eye
- Exclusion of inflammatory causes in affected eye.

Central RP.

- Pig changes over Macula
- Defective central vision
- Defective colour & Contrast

Sectoral RP

Mad in
1 seg of fundus
VA — retained
Vf → ↓
ERG — subnormal

Infero Nasal Quad

RP sine pigmento

- Absence of pigmentary changes in form of bony spicules
  Pallor + Art Att +
- Extinguished ERG.
- Defective dark adaptation.

Retinitis punctata albescens

Discrete yellow spots upto Eq

Waxy pallor
Peripheral VF +

Goldmann Favre Syndrome

Enhanced S Cone
AR RP featuring large photopic single flash ERG a'wa
↑S, ↓ L,M cones ✗ Rod.
Deep Nummular shaped RPE clumping in Mid periphery

Pseudoretinitis pigmentosa

- Drugs induced pigmentary Retinopathy
  - Thioridogine
  - Chloroquine
- Infective
  - Syphilis
  - Rubella
  - Measles
- Scaring
  - Chronic CSR
  - Trauma.
  - Uveitis (VKH)

Epidemology

- M.C → Autosomal recessive
- L.C → X linked. — Worst prognosis

genetics

Rhodopsin gene — Chr 3a Pro 23

- Max. AD case.
- Non sense Mutation → AR.

PAP-1, PRPF 31 → AD

Red, green pigmentosa on Chr X.

Natural Course of RP

Chronic long lasting disease.

Early
- Night blindness
- Peripheral field defects #
- VF examined under Mesopic & photopic conditions: difficult to pick.
- ERG – b wave suppression

Mild
- obvious symptoms
  - Night driving
  - Manouvering staircase in dark
  - loss of peripheral field.
- ↓ Colour & Contrast
- ERG – Extinguished Cone Response ↓
- OCT – ME, foveal atrophy

Scotopic

End
- Central few ° of VF deviation fixation pt
- ↓ Near vision req use of Magnifying glass

» fundus findings
» Cataract & OAG

RP with rapid progression of visual symptoms & ERG progression

Western blot Analysis for Antiretinal Ab

+ve
- Autoimmune
- CAR. → Evaluate for Occult Malignancy

Ushers

Bardet Biedl

Refsum

Syndromic association of RP.

Focal dysmorphic Syndrome

Cohen

Jeune.

Cockayne.

Metabolic disease

CH3 Malonyl aciduria

Abetalipoten

Cystinosis

MPS I, II, III

Refsum's

Other

Neurological

Joubert.

Hallervorden Spatz

Neuronal Ceroid Lipofuscinosis

Kearns Sayre.

classmate

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Syndromic Association of

Usher
- Most freq.
- Typical RP
- + SNHL
- Vestibular dysfxn ≤ ataxia

Bardet Biedl
- Less common
- RP
- Obesity
- MR
- Post axial polydactyl
- Hypogenitalism
- Nephrogenic DI

Alport
- Ant lenticonus
- SNHL
- Progressive renal failure + Haematuria + Nephritis
- Diffuse leiomyomatosis of Esophagus

Facial dysmorphic

Cohen
- Obesity
- MR.
- Neutropenia
- RP
- facial dysmorphism
  - L Nucleognathia
  - Short philtrum.
  - Prominent Incisors

Jeune.
- Asphyxiating thoracic dystrophy
- Brachydactyl
- Chronic Nephritis
- RP

Cockayne
- Dwarfism
- Progeria
- MR.
- RPC fine granular spots

RP.

Metabolic

- CH_3 Malonyl aciduria
  - Vit B_{12} def Metab
  - Macular atrophy
  - Salt pepper retinopathy
- Abetalipoproteinemia (Bassen Kornzweig Syndrome)
  - Progressive Ataxia
  - Steatorrhoea
  - ↓ plasma lipids
  - RP.
  - Vit A 300 IU/kg/day
  - Vit E — 100 IU/kg/day
- Cystinosis
  - Hypothyroidism
  - DM
  - Renal fail
  - RP
  - Crystalline deposits on Cornea

- MPS I, II, III
  - Facial dysmorphism
  - MR.
  - Skeletal changes
  - RP
- Refsum.
  - Ataxia Cerebellar deg
  - Ichthyosis
  - Hearing loss
  - RP.
  - Cataract.
  - Polyneuropathy
  - Cardiac arrhythmia.
  - ↑ serum phytanic acid
  - x food / fat & butter
- Other rare disorders
  - Zellweger.

Neurological

- Joubert
  - Vermis Hypoplasia
  - Renal cysts.
  - RP.
- Hallervorden Spatz.
  - Iron Pigment deposition
  - Basal ganglia
    - Dementia.
    - Dysarthria
  - Hooked RP.
- Kearns Sayre Synd
  - Cerebral Ataxia
  - Deafness
  - DM.
  - Mitochondrio. myopathy
  - CPEO
  - Endocrinopathies
  - Cardiac Conduction
- Neuronal Ceroid Lipofuscinosis
  - MR
  - Seizure
  - Ataxia
  - RP

III/148 /2023-24/
Email. amritsar.ito.hq2.ccit@incometax.gov.in

Ix, - IOP
- Look for Restricted Extraocular Movem
- Ant Seg - keratoconus & Cataract
- Macula - CME, ERM, Atrophy

↳ Systemic - Hearing
Neurological
PBS, Lipid Profile
RFT
ECG

Examine other family Members

→ ERG. - Rod amplitude → Rod, Cone response extinguished

→ EOG → ↓.

VF - midperipheral ring Scotoma
FA → Chorio capillary loss
CME - petaloid appearance

FAF - Paracentral ring or arc of locally elevated AF

Serum phytanic Acid

Treat & Condition.
- Gyrate Atrophy
- Refsum Syndrome
- Abeta lipoproteinemia

Rx

Slow down deg
- Light dependant forms
  - ∴ Wear dark glasses
- ↑ dose of Vit A. 150000 IU/day
  - do. Serum Retinol & Triglycerides, Liver Enzymes
  - × Vit E

Rx of Complications.
- Cataract – PSC
- Macular Edema
  - Oral Diamox > topical
    - bt leads to metabolic acidosis
- Nifedipine has been tried.

Future treatment
- Gene therapy
- Neuroprotection
  - CNTF
- Retinal prosthesis
  - Microphotodiode arrays
  - Retinal transplantation
  - GC electrode Aqueous retinal prosthesis

- Pharmacol Rx
  - CCB – d-cis-diltiazem
    - ↓ cGMP
- Stem Cell Rx
  - Under Trial
    - follow up by Multifocal ERG.

Cone-Rod ~~Cone~~ Dystrophy

Introduction

All type of inheritance
Progressive Cone dystrophy

Colour defect
* ↓ VA
» AD pattern

Che Gp.

Histo

Complete disappearance of PR in Macular & paramacular region

Cf

Defective Colour Vision
↓ VA
Photophobia
Hemeralopia
Achromatopsia.

PR absent
↑ granularity of RPE at Macula
Beaten Bronze appearance
Choroidal Atrophy
Bull's Eye Maculopathy

Ix

↑ Transmission of choroidal fluorescence
x Leak of dye/staining
- Annular pattern of HF at macula

Central Scotoma, Ring Scotoma

FFA

HVF

Rod Cone Dystrophy / Pericentral RP / Inverse RP

RP in pericentral retina with no involvement of Peripheral retina.

AR mode

(N) Vision
Defective Colour Vision
Nyctalopia +
Bony spicule + (BS) +
No BS in fovea as no vessel
(*) Disc & Vessels (N)

Tritan color defects (↑)

(N) in early course

Cone-Rod.

- Normal photopic & scotopic ERG response
- slight to moderate loss of rod fxn

Rod-Cone

Scotopic — (N)
Photopic — Absent & sub(N)

(N) in Early stage
sub(N) EOG → ERG

Monophasic
↑ rod thresholds

EOG

Dark adaptation Curves

(N)

(N) slightly delayed

Rod Monochromatism.
RP forms
Stargardt's.
Chloroquine

DD

Classic RP
- Late stage of fundus flavimaculatus
- Inflam & Infectious causes of CR.

X linked Juvenile Retinoschisis

Synonym
- Inherited RD.
- Congenital Vasc Veils
- Ant dialysis of young
- Cystic dis of Retina.

Inheo →
X linked c 100% penetrance
Underlying Muller cell defect
Short arm of X chr on p22 region

♂ affected
♀ – Normal vision

Histo
Acq → split b/t NFL & ganglion cell layers
→ OPL & Adj Nuclear layer.

C/F
Classic radial cystic Maculopathy
+ of radiate perifoveal Microcysts located in NFL
c radiate plication of overlying ILM ⇒ seen well c Monochromatic (Red free)

Other features → Peripheral schisis
Vitreous Changes
Perivascular sheathing
Dendritiform pattern.
Retinal dragging
Subretinal Exudates
Pigment lines
Generalized tapetal light reflex

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Vision — Variable vision
20/60 — 20/100

OCT → hyporeflective cystoid spaces

FFA → (N) PP → Diff 4m CME.

Colour test — Tritan defect → Deutan defect

HVF → Absolute VFD. +nt

ERG — abnormal
b wave < P / S → ↓
a → Intact
↓ amplitude — progressive disease
} ∴ Inner retinal localization of disease

Dark Adap → N to sub(N) segments.

DD → Goldmann Favre disease
other forms

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Toxic Maculopathies

- Chloroquine
- Quinine Ocular
- Phenothiazine
- Tamoxifen
- Canthaxanthin
- Talc Maculopathy

Chloroquine Maculopathy

- Chloroquine
  - Niraquine
  - Aralocor
- Hydroxy Chloroquine
  - Plaquenil
    - ↓ Toxic than other

% of Malaria & Rheumatological disorders.

>300g (250 mg/day for 3yr) ↑ risk.

- Accomodation often.
  - M.C.
- Corneal deposition.
- Be & Fene. Retinopathy

all are reversible.

Bull's Eye Maculopathy — Irreversible.

Levels of Chloroquine

- Be Maculopathy
  - Scotoma to red target of 4-9°
- Established 20/30 - 20/40.
  - Faint halo of RPE pallor
- Bull's Eye 20/60 - 20/80
  - dark ring surrounds halo
- Severe 20/120 - 20/200
  - Pseudohole & atrophy
- End stage
  - Legal blind
  - Large RPE atrophy
  - Pigment clumps

Antimalarial accumulate in Melanin containing structure

Bef Baseline retinal evaluation →

VA
Amsler grid
Color Vision
VF (10-2)
dilated retinal Exam
Fundus photo
ERG.

- if no symptoms then anually post Rx
- Provide Amsler grid at home

Phenothiazine

Thioridazine (Melleril)
↓
↓ of schizophrenia
150-600mg/day
>800mg/day *

Chlorpromazine (Largactil)
|
Sedative
75-300mg/day
2400mg/day

Salt & pepper appearance of Macula
↓VA, Poor adaptation
geog. RPE atrophy ± hyperpig clumps

Tamoxifen
(Nolvadex)
Anti estrogen
to ↓ Breast Ca
20-40mg/day

Vortex keratopathy
ON

Multiple superficial yellow crystaline ring like deposits at Macula

Quinine
Antimalarial compound
↓ Nocl Cramps
Cause Cinchonism
(Ocular Complex)

- VA loss
- fixed & dilated pupil
- Retinal edema.
- Attenuated arterioles
- Constricted VF
- OA.

Canthaxanthin
↑ Sun tanning
Prolonged use — Maculopathy

Tiny glistening yellow dots arranged in donut-shaped ring around both macular

Talc Maculopathy — Multiple tiny yellow white glistening particles scattered throughout post poles of both eyes

ME, Venous Engorgement, Punctate & flame hmg, Retinal occlusion, Retinal granuloma, NV
Paramacular scarring

↓

» In cocaine, CH_3 phenidate (Ritalin) abuses
⇔ Doob tub

Microtalc Retinopathy — finer deposits
NFL defects
glaucoma like Visual field loss

Ix → Medicinal & Social drug H/O
Ocular talc — (+) Lung involvement

If glaucoma + → give Ocular Hypotensive drugs.

Photoretinitis

Light induced damage to retina +/- Exogenous photosensitizers

Exog Agent
- + → Verteporfin
- − → Photic Retinopathy

Protective Mech of Eye (400-700 nm) Spectrum

Human Cornea absorbs < 300 nm protecting retina
300 – 400 → Cornea no effect.
Lens protects

Other Mech →
- Shadowing by eyebrows
- Corneal reflection of light rays not ⊥ to its surface (Fresnel's Law)
- Aversion
- Squint
- Blink Response

Human Retina → SOD dismutase, Catalase, Lutein
glutathione, Vit E & C, Zeaxanthin
Macular Xanthophylls

Classification of Photic Retinopathy

Type 1
Ham type.
UV Blue
440 nm
< 12 hrs
RPE

Solar & Operat^n Iscope Inj
← Peaks at
light exp affects

Type 2 — Argon Photo Coag
Noell
Blue green type
>
Neural retina & RPE
Blue Contrast

chief forms

- Acute Solar Exposure
- Welder's Maculopathy
- Operating Microscope

Acute Solar

Retinal Image of Sun — 160μ
⊆ 3mm pupil at noon
temp ↑

- Phototoxicity 4°C → damage. → ∴ pupil dilatation → Solar eclipse damage
- Threshold
- Photocoag 10°C → ↓↓

yellowish foveolar lesion
- fades away
- hole formation

FFA → (N) few transmission defects

Reduction for foveal involve^{n} — due to Henle layer facilitated fibre optic transmission

↑ foveal irradiance by channeling blue light photons 4mm perifoveal — foveal region

½ eclipse dangerous than total

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Precaution during Solar Eclipse

a) Sun gazing - Pinhole — Image on screen ½ m away

b) filters — Gl., Chr., Ag deposit

c) Al. Mylars

- Welder's Maculopathy
  - 400-440 nm acc — sufficient to cause photic damage
  - In young 300-310 nm also penetrate cornea
- Operating Microscope Maculopathy
  - Oval shaped 0.5-2DD
  - >> common in inferior macula
    - Infra red blocking filters → ↓ Thermal enhancement of R.
    - Blue blocking filters → ↓ risk of acute phototoxicity

At level of OPL & INL.

Cystoid Macular Edema

- Intra Ocular Inflammation (Pars planitis)
- Central & BRVO
- DR
- Cataract extraction

Histo Radially oriented cystoid spaces consisting of ophthalmologically clear fluid.

Cysts seems to be area of retina in which cells have been displaced — Henle's Layer

Pathogenesis → Blood Retinal Barrier is damaged

↓

fluid accumulates in retina. both intra & Extracellular

↓

ECF accumulates

↓

disturbs cell fxn & retinal architecture

↓

Muller's cells keep Macula dehydrated

↓

Intracellular fluid accumulation in Muller

↓

↓ Macular Retinal fxn

IO inflammat° → ↑cell Cytokines, IL4, IL2, IL-10, TNFα.

Vitreous Traction also play role ∴ incomplete PVD ⇒ dangerous!

CME

Cataract Sx

Irvine Gass syndrome ✓

» PF
- PCR
- Vitreous loss
- Severe iris trauma
- Vitreous traction at wound

↓

c in 3-12 wk post op.

↓

Resolve spontaneously

» aggressive in diabetics

∴ treat c laser beforehand.

↓

>6mth → chronic

DME

Retinal thickening c in 2DD of fovea

- focal
  - ↓
  - Circinate rings of Hard Exudates
  - ↓
  - resulting 4m leakage 4m aneurysm
- diffuse
  - ↓
  - » extensive BRB break
  - ↓
  - Leakage 4m aneurysm & Retinal capillaries
  - ↓
  - Cystic changes →nt

RVO

↓

May cause permanent damage 2° to disruption

- Trauma
- Ant Uveitis
- PG Analogues ✓
- Silocaine
- ↓ IOP
- ↑ IOP

Post Sx

- RP
- VMT
- CMV
- Tx
- Renal failure

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C/Ix profile

C/F → Slit lamp exam ⊆ C & NC lens — Retinal thickening
Normal slit — Cystoid spaces

Ix

- Analyzing underlying pathology
  - ↓
  - Detect disruption of BRB
  - ↓
  - FFA
  - Petaloid hyperf.
  - ↓
  - OCT.
  - ↓
  - Large cystic spaces
  - ↓
  - shows axial distribution
- Effect of ME on Retina.
  - ↓
  - RTA.
  - ↓
  - Rapid screening instrument that generates detailed map of RT.
- Impact on Visual fxn.
  - ↓
  - affects Macular fxn.
    - VA
    - Contrast S
    - ERG
  - ↓
  - response evoked by foveal cones of retina
  - ↓
  - Multifocal ERG

Rx

Medical | LASER | Vitrectomy | Anti VEGF

Medical — diff in Chronic & persistent cases

↓

Rx for unremitting cases

Steroids → ↓ NSAIDs → ↓ Eng PLA_2 → Any route → IVTA → 4Cs based implants

NSAIDs → Aphakic / Pseudophakic CME → IO inflammation & synthesis of PG → Disruption of tight jxn of perifoveal retinal capillaries → Inhibit COX Eng → acidification of sub retinal space

CA inhibitors → alter polarity of ionic transport in RPE → Inh of CA & γ glutamyl transpeptidase → ∴ ↑ fluid movement RPE → choroid

(b) direct effects on RPE → ↓ standing potential → ↑ Retinal adhesiveness

- Dexamethasone → Biodeg implant → Posurdex
- Helical IVTA 2 → Ivation
- Fluocinolone acetonide → Retisert
- Injectable fluocinolone acetonide → Yeduduo

IVTA → ↓ Inflammation
↓ extravasation of fluid from leaking BV
↓ fibrovasc proliferation
↓ production of VEGF

Routes

- Intravitreal depot Inj
  - ↓ Peaks 1 wk
  - Residual activity for 3-6 mth
- Peri Ocular Inj
- PST
- Intravitreal implant

Complications → ↑ IOP
Cataract formation
Endophthalmitis
RD.

Laser Photo Coagulation

Temp breakdown of BRB.

↓

Subsequent repair as RPE adj to burns

a) proliferate & slide to replace necrotic tissue

b) grid laser → destroys PR → ↓ O_2 consumptn of outer retina → O_2 diffuse 4m choroid to Inner retina → ↑ O_2 tension → ↓ hypoxia

↓

Retinal arteriolar constriction

↑ resistance in arterioles

↓

↓ hydrostatic pressure in capillaries & venules.

Vitrectomy

DME

↓

VMT + nt

» PVD in Non diabetic eyes

Pseudophakic CME

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Anti VEGF &

ERM

Etiopath

Dehiscence in ILM
- Vitreous Seperation from Macula
- retinal glial cells entry onto retinal surface
- Proliferate & Contract

PVD
- Contraction of Vitreous cortical remnants
- Proliferation of hyalocytes on Inner retinal surf
- scaffold for cellular elements.

C/F profile

ERM – Premacular Memb – Epiretinal Macular fibrosis – Surface wrinkling retinopathy – cellophane maculopathy – Macular pucker.

Etio

Ocular inflammatory dis | Retinal Vascular dis | Rhegmatogenous RD

Accidental / Surgical trauma. | After Cryo & PhotoCoag.

C/F

Variable degrees of distortion of vision loss
Metamorphopsia
Micropsia

Dpt & severity of Memb
Memb thickness
" location

- Retinal striae radiating from centre of ERM
- Retinal vessels straightened toward Memb centre
- Tortuosity of RV.
- Dilated Retinal Veins
- Pseudoholes & Lamellar holes

Examine c 90D.

FFA Diff b/t fTMH vs PTMH
transmitted f is not usually ↑nt in Pseudohole

OCT good.

Classification

By gass

Grade 0 → Cellophane Maculopathy

Grade 1 → Crinkled Cellophane Maculopathy

Grade 2 → Macular Pucker

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By FOOS

	Simple	Tissue Repair	Neovascular
Predominant histo features	ILM, Laminocytes	ILM ~~PVD~~, Laminocytes ~~Migration & Activation~~ RPE cells, fibroblasts mϕ	Capillaries & acellular stromal tissue
Etio	PVD, laminocytes migration & activation	Retinal tear, trauma, infection & blunt injury	PDR, RadioRx & Vasoformin Tx
Mech.	Duf tension on retina disruption of ILM	Cytokine driven tissue repair process	Hypoxia & Neovascular Cytokine.
Biological mediators	TNF, TFRα PEDF	NF-κB pathway TGF β, IL6, PDGF	VEGF, HIFα ANG1

Mx PPV + ERM peel

Neg staining of ERM

Double peel → ERM ↘ ILM

Leber Congenital Amaurosis

RP + Nystagmus + poor pupillary rxn, AR.

Normal fundus → Extinguished ERG.
AR. L Absent Scotopic / Photopic / Signals

℞ 'Luxturna' Voretigene Neparvovec
Developed by Spark Therapeutics & Children hospital Philadelphia

In vivo gene ℞ appeoved by FDA.

is an AAV2 vector containing human RPE 65 cDNA ⊆ a modified. Kozak sequence

↓

Virus is grown in HEK 293 cells. & purified for administration

↓

Jack Hogan of New Jersey
OR
Jason Commander.

Location

RD Confirmement

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Retinal Detatchment & PVR

Def → Seperation of Neurosensory retina from RPE.

Embryologically potential space exists b/t the 2 layers.

Factors for Normal Retinal adhesion

Torque generated in Eye

a) Retina →→→ RPE
   a) IOP.
   b) Osmotic pressure of ECF in choroid (< ↓ IOP)

b) Metabolic pump at RPE (Na^+K^+ ATPase) → SRF dry.

c) Formed vitreous — plug the break ∴ Asymphomatic breaks ⊆ no RD.

d) RPE ↔ Retina → Interdigitations of Photoreceptor Outer segment & RPE Microvilli
   → Matrix material serve as glue.

Types of RD

- Rhegmatogenous — 90%
- Tractional — PDR.
- Exudative — Retinal & choroidal conditions → shifting fluid +

Rhegmatogenous RD

Opposing forces

- Liquefied Vitreous gel
- Tractional forces that ppt retinal break
- Break to allow passage

All 3 needs to be + else Asymptomatic breaks.

Pathogenesis →

- Changes in Vitreous
- Peripheral Retinal Deg predisposed to RD
- Developmental Variations predisposed to RD
- ↑ risk factors of RD.

(a) Changes in Vitreous →

formed Vitreous — gel form.

Collagen fibril + Hyaluronic acid molecules

↓

Liquefaction of Vitreous (Synchisis)

↓

Collapse of fibrillar frame work of V gel (Syneresis)

↓

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Small pockets → Larger pockets

↓

defect in Post Cortical vitreous

↓

Vit Subhyaloid space.

↓

Seperation of Post hyaloid from ILM

↓

True PVD (↑ Age)

PVD

Pathological Myopia ← Early → Inflammation

Trauma. Cataract Extraction.

90D slit lamp Exam

Circular Helps Ring → Aff of vitreous of ONH.

If traction in lattice/deg → Tractional horse shoe shaped break formation & convexity towards disc

↓

If vessel is involved → VH

60yrs — floaters + Photopsiae

↓

90D

↓

a) PVD.

b) To rule out break.

Peripheral retinal deg predisposed to RD

Predisposed to RD

\+

Lattice deg
Snail track deg
Retinoschisis
WWOP & WWP
CR scars

\-

Peripheral Cystoid deg
Pavling stone deg
Pigmentary deg of retina

Lattice deg → + RD — 30-40%
\- → 7-8%
Bil — 42-48%

↳ Myopia » freq.

Temp > Sup >.

Inner retinal layers affected

Sharply outlined round or oval mostly circumferentially but may be radially oriented

↓

B/t Equator & post border of Vitreous base

Arborising pattern of white lines ⟺ occluded / sheathed retinal B.V — 17%
– Interlacing pattern of white lines only.

L = 1DD – 12DD M = 1/4DD - 2/3DD

⊕ Retinal pigmentation
Yellow / white surf flecks
Retinal pavings ⊂m lesion
] 80% +

Ass ⊆ - liquefaction of overlying vitreous gel
- firm vitreoretinal adhesions along edges of lesion

found ateophic holes ⊆ in lattice.
Multiple hole may be +

Snake track deg → Variation of lattice
sharply demarcated shiny band
↓
Multiple tiny, yellowish white flecks that appear as inner retina
↓
white frost like appearance ✓

Longer than lattice
- ⊆ as ⊆ out overlying V. liquefaction/traction
- Ateophic holes may be + nt.

degenerative Retinoschisis →

Typical → At level of OPL ✓
- Extension of peripheral cystoid deg toward PP.
>40yrs → 4-22%
♀ = 0 →
IT → ST → Nasal
smooth retinal elevations

Reticular → NFL.

may ↑ → dome shaped, smooth surf

↓

Multiple round spots = frog eggs ✓

↓

If break in both layers → RD occurs

	RD.	Retinoschisis
Clinically	Undulating fold.	dome shaped elevated, smooth
Mobility	Mobile	fixed.
Transparency	Translucent	Transparent
Extent	from Ora to disc	from Ora to Equator
Break	Just	+/-
Rxn to PC (Photocoag.)	Absent	Whitening (+)
Field defect	Sloping border	Sharp border
USG & Ideal depression	Become shallow.	No change.

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HHOP

geographic area of rel whiteness of peripheral retina

≤ scleral interdat^ ≤ out

HHP — HHOP.

HHOP are circumferentially oriented.

- Post boundaries — scalloped., sharply defined, beyond eq
- Ant — less precise

» Temp & IT Quad

(N) Eye - 30%. Bil — 20%.

Pt <40yrs, Myopic eyes.

If ROP +nt. then. fellow eye 40% has HHOP.

→ Recommend 360° barrage laser.

Development variations predisposing to RD.

Enclosed Oral Bays → Coalescence of adj dental processes to form a ring

» Nasal wheel dentate processes » prominent

↓

Mimic Retinal hole

Ass ⊆ development of R. breaks

Bays		RHole
Beaver	–	Red
Granular	–	Smooth

Break ⇔ Bay = 17%.

Break is post to oral bay

associated ⊆ PVD.

focal traction +

Cystic Retinal tufts — Nodular projection of retinal tissue surrounded by cystic retinal deg

↓

discrete, sharply circumscribed opaque white lesions ⊆ pigment alteration at their bases & vitreous att to their surf

Break in 6.5% eyes

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Meridional folds & Complexes

Common developmental variation at the Ora
20-12% of eyes

Oblong radially oriented areas of thickened retinal tissue
80% from dentate process
located in Superio Nasal Quad

MF align ≤ ciliary process ⇒ M. Complex

If RD +nt look for break post to fold

Zonular traction tufts. — Ant projection of retina. att to I> thickened zonular fibers

↓

Single & Unil located at vitreous base in Nasal Quad

↓

large size, ant angulation & closed proximity to Ora.

↓

Imp cause of small flap tears

↓

× significant RD. as they are in vitreous base

↓

✓ >> imp in Aphakic RD production

High risk factors of RD.

Myopia — Axial Myopia

35%.

Incidence ∝ degree of Myopia

Myopic — 0.7-6%

Emetropic — 0.06%.

RD

Early liquefact^ of vitreous → PVD

» axs of lattice & Snail track deg

Cataract exte — >40%. RD in Aphakic & Pseudophakic

ICCE. → 2-5%.

ECCE. → 0-3.6%.

Phaco → 0.8-2%.

20%. ↑ ⊆ vitreous loss & PCR.

due to vitreous disturbances

(Leakage of Hyaluronic Acid)

ppt of synchisis

Syneresis of vitreous

↓

PVD

foamation of Break] → RD.

Traumatic Necrosis → RD → 5-6 mths.

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Trauma — Retinal dialysis 75% pt
» ↓N Quad & counter coup coming from.
IT Quad

↓

RD → Transvitreal fibroproliferative membranes

Family H/O — Axial Myopia, Lattice.
» Imp in young age.
↓
RD in Myopia.

familial VR condition → Stickler's VR. dysteophy
Marfan's, Homocysteinuria

RD in other eye

Peripheral RDeg not predisposed to RD.

Peripheral Cystoid deg → Occurs at OPL → fxn of Dual blood supply

↓

deg retinoschisis is preceded by peripheral Cystoid deg

Typical ⟶ Reticular

Typical →

Begins at Ora. extends posteriorly

↓

Symmetrical in two eyes

↓

μcyst ⟶ Macrocysts (0.15mm dia)

Cystoid deg → band like distribution around eyes
» extensive temporally > N
Superi > I.

has characteristic stippled pattern & honeycomb appearance

1/2 – 3 * thicker retina

Reticular — Small spaces microscopically at level of NFL c/ loss of GC & bounded by ILM & IPL.

fine stippled border c/ retinal BV posteriorly
Gray appearance deep to retinal vessels c/ obscures RPE.

Pigmentary deg of Retina.

Variations in amt of pigmentation in middle & far periphery of retina

Bil c/ = Sex affected

Reaction of choriocapillaries & RPE to elongation of globe & aging.

Paving Stone degeneration

at level of RPE

k/c/o cobble stone deg

If bil then symmetrical also

» long axial length

believed to be due to choroidal vascular insufficiency

No changes in overlying vitreous

seperated from Ora by band of intact RPE.

- Small lesion
  - ↓ Circular
- Large
  - ↓ Scalloped margins

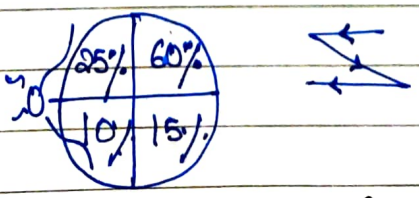
40% ⟶ 80%.

Retinal Breaks

is full thickness defect in neurosensory retina

- **Tear** → Caused by vitreoretinal traction
- **Hole** → atrophy & deg → VR traction has no role to play → Round / Oval → Ass c → Lattice / Snail track deg
- **Dialysis** → full thickness disinsertion of retina at Ora → Vitreous gel att to post margin ∴ prevent tears. rolling

Tear →
- **Horseshoe Tear** → Behind the vitreous base → In process of PVD → Convexity always towards disc → Head towards disc → VR adhesion - Localized
- **Operculated tears** → flap torn from retina → Operculum remain att to detached vitreous gel
- **Giant retinal tear** → Circumferential RT of 90° or > → A / Edge / P
  - A → att to vitreous gel
  - Edge
  - P → free from vitreous → Inverted → Widespread



) Pathogenesis of Rhegmatogenous RD.

C/F

Symptoms → 4 f

- flashes
- floaters
- field defects
- failing vision

flashes → Precede RD.

Symptoms of Acute PVD

flashes

Irritation of retina because of Vitreoretinal traction at site of adhesion which pt may experience in process of seperation of post hyaloid from ILM.

↓

Better in dim light

Induced by movements

floaters — Black spot seen in field of vision

↓

Entoptic phenomenon

- Cobwebs
  - ↓
  - Syneresis
  - ↓
  - Condensation of collagen fibrillar network of vitreous due to its collapse
- Weiss Ring
  - ↓
  - Detached attatchment of cortical vitreous on ONH.
  - ↓
  - Surest sign of PVD
- Sudden shower
  - ↓
  - Tear involves retinal vessels
  - ↓
  - Sparse & small VH.

Only PVD — 10%.
PVD + VH — 75%.] Breaks Chances

Field defect — fall of veil.

Failing vision → Rapid loss of vision involving Macula.

Signs

Anterior

Leucocoria
RAPD → if extensive RD
↓ IOP → Aq → Vitreous → Break.
Subretinal Space
Tobacco dust / shaffer sign
Iritis — Old RD. due to irritation of uvea.

Posterior

- **Fresh**
  - grey white.
  - Cobweb Config
  - Corrugated fold
  - Choroidal pattern lost
  - vessels & reflexes & darker
  - Diff to diff A & V
  - Mobility good.
  - On depression no. apposition
  - Break +/- Flat
- **Old**
  - 2 H_2O shed line (6m)
  - > Fixed
  - ↓ Mobile
  - RPE changes
  - Break - Elevated
  - Starfold Inf → Sup
  - Intraretinal cyst (6m)
  - Transparent loss
  - 1yr of atrophic changes
  - Demarcation line
  - Subretinal band
- **Inferior**
  - Demarcation line / H_2O marks
  - ↓
  - proliferat" of RPE at jxn of flat & detached
  - Thinning retina
  - 3m th shallow RD.
  - x bullous.
  - repair once Macula involved
- **Aphakic / Pseudophakic**
  - Small Break
  - In periphery
  - post to base
  - » Extensive detachment than phakic
  - PVR » common
- **Traumatic**

Exam of RD case

- VA
- BCVA
- Retinoscopy
- RAPD — if ✓ — Macula on is an Emergency
- Examine Sclera — guarded prognosis to detect estasia & staphyloma

PR. ✓

Slit lamp Exam

Cornea clarity
AC - Cells/flare — Chronic RD
ACD. — Buckle — ACG
NVI — TRD.

IOP → ↓
↑ ⇒ Schwartz Sign

Lens — Separatory Cataract

In Aphakic eyes — Examine Ant hyaloid face
↓
✓ Ruptured — then × paracentesis else comes into the site

- Vitreous pigments — PVD
  - × Uveitis
  - × Trauma.
  - ↓
  - Rule out RD.
  - Larger ↓ PVR
- Its movement ↓ in RD.

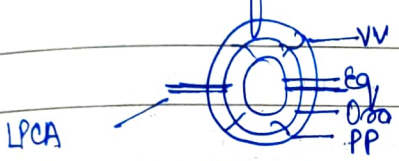
AOD — 3 *
37-40°

Localization of R. Break.

Lincoff's Rule

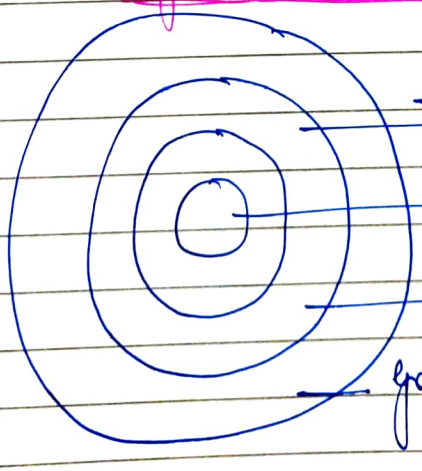
- Sup RD → 12 O clock
- Inf RD → 6 O clock
- Bullous RD → 12 O clock
- If higher on 1 side then toward that clock he.
- Subtotal RD → Break toward higher edge.

Smoke fundus drawing



- Lattice → Atrophic hole
- Operculum in Hemorrhage
- Spots & Pigments
- Sup edge of RD → @ 1½ clock he

Goldmann 3 Mirror



- Equatorial
  - 30- Eq — 73° Largest Obl
- Central 30° — Central
- Peripheral
  - Eq - Ora — Medium Eq, 67°
  - Gonioscopy mirror
- Smallest Dome. 59°

USG

RD

↑ spike on A Scan
funnel shaped att to ON

\+ ↓ gain −

- Characteristic undulating motion after abrupt eye move^n

VH

PVD

No att to ONH

- Beak motion but ⊆ » restricted excursion.

Exudative — VKH — Choroidal thickening
Sclerits — Scleral "

Exudative RD

lesion causing RPE pump failure.

Causes

- **Idiopathic**
  - Coat's
  - CSCR Idiopathic
  - Uveal effusion Syrd
- **Congenital**
  - FEVR
- **Post Sx**
  - PRP
- **Inflammatory**
  - Post Scleritis
  - Orbital cellulitis
- **AI.**
  - VKH
  - SO.
- **Vascular**
  - PIH.
  - HTN retinopathy
- **Neoplastic**
  - RB.
  - MM.
  - Ch. Metastasis
  - C. Hemangioma

Cf

- x break
- x fold. ∴ Smooth
- Bullous RD.
- shifting SRF

USG
CT Scan

Rx acc to Condition

	Rhegmatogenous	Tractional	Exudative
a) Symptoms	flashes & floaters	×	×
b) VF defect	develops fast.	slowly & static for months	develops fast
c) Laterality	U/L	U/L & Bil	Bil, simultaneous
d) PVD	Complete PVD → RD.	× ass ⊆ PVD. Incomplete PVD	× ass ⊆ PVD
e) Break	Always +	−	−
f) RPE pump	+	×	due to RPE pump fail
g) Configuratn	Convex, bullous corrugated folds ✓	Concave ×	Convex, smooth No folds ✓
h) Mobility of Retina	to Ora	Seldom	to Ora
i) Extent	+ In due Course	×	×
j) PVR	×	Shallow & × shift	✓
k) RF shift	Sx	Sx	
l) Rx			

TRD

bcos of Vitreoretinal bands developing as a result of disease

Causes
- PDR
- ROP
- Penetrating post segment trauma
- CRVO / BRVO.

Types of reactions

Tangential
↓
Contraction of epiretinal fibrovasc membs.
↓
Puckering of retina distortion of vessels

AP.
↓
from Post retina
↓
Vitreous base Ant

Bridging (Table top)
↓
Spanning across Vascular arcades.

CF

- Bil no Acute PVD
  ↓
  ↓ VF defects
- Bil
  Concave
  Absent beaks
  Restricted mobility
  x extends to Ora
  Shallow
  x Shifting fluid
  Highest elevatn at site of traction
  ∑x Cutting, peel, seg.

	Rhegmatogenous RD.	Choroidal Detachment
Symptoms	flashes & floater +	-
VFD.	Develop fast	Absent unless very extensive
AC & IOP	Normal ↓	Shallow ↓↓
Break	+	-
Configuration	Concave route Corrugated folds. mobile	Convex. Smooth, × mobile
Extent	Disc to Ora.	Anterior to Equator beyond Ora
Rx	Surgery	Spontaneous.

Prophylaxis of RD

R/F for RD

Path Myopia
Aphakia/Pseudo
Family H/O
RD in 1 eye
YAG Cap.
Post Ocular Trauma.
Marfan, Stickler, Ehler D.
CMV Retinitis & ARN.

Precursors of RD

Lattice.
Small tears.
WWOP.
Retinoschisis
Cystic Retinal tufts

Characteristics of Breaks

Horse shoe tear
tiny flap tears
Operculated breaks
Larger Breaks
Sup >.
Equator >
Symptomatic break

guidelines for Px

- Symptomatic Break.
- Horse shoe tears > Sup > Larger > Ass ⊆ SRF
- Operculated Symptomatic tears
- Atrophic Round holes ⊆ ± of PVD.
- Asymptomatic break ⊆ precursors of RD. near base.
- Break in fellow eye ⊆ RD.

Treatment of RD

α

Number, Location
Size

Lens status
+nce of Vitreous Opacities
Surgeon preference

a) Scleral Buckling
b) PPV
c) Pneumatic Retinopexy

Pathogenesis of Rhegmatogenous RD

✗ RD

✓ RD

IOP → » hydrostatic pressure in vitreous

> Oncotic pressure of choroid

RPE active pump 4m SR space to choroid

Vitreous traction

gravity

Eye Movⁿ

(a) Scleral Buckling

Indirectly relieves radial vitreous traction

displaces SRF away from Break.

1st → displace vitreous away from break → tamponade it by. Cortical vitreous

2nd → offset the deleterious action of IO fluid currents caused by eye move^{n}.

? → SPCE procedure.

Extent of Buckling

Cerclage → 360° Buckling
- → support
- support unidentified breaks

Segmental Buckle → Single / Multiple, closely spaced Breaks → Complicat^{n}

SRF drain +/-

Complication +
- Vision threatening
- Vitreous incarcerat^{n}
- Retinal "
- Suprachoroidal Hmg
- Potential Endoph

+ / −

× SRF drain

Q. Drainage
A Air
C Cryopexy
E Encircling

Implant

Explant

& surrounding choroid & RPE → Cryo / LASER] To form permanent CRA.

Ix

Inferior.

C/I

PVR. Advanced Very Post Breaks

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Surgical tech

a) Clean → 10% Povidone
5% Inotill
↓
Lid speculum

b) Conj Peritomy → 360° → Undermine Conj & tenon's
↓
Hook 4 recti ⊆ 3-0 silk
↓
Examine sclera using depressor to look for
- Abnormal Vortex Vein
- Scleral thinning
- Staphyloma

c) Localization of rx Breaks → Wepers
Lattice Mark

d) Cryo

e) Choice of explant

2° tear = W

Encirclage	Radial	Circumferential
- A & Pseudop RD	Single, Large,	- Small Break
- Multiple	- Post horse shoe tear	- Extend / Check
- No Break found.	- awards final mouthing	he beyond
- Star fold.	- Ant breaks	
- ↑ Myopia.		
- Extensive drainage SRF.	Silicon Solid	Soft Sponge
- ↓ lattice deg	↓	↓
- Create permanent buckling effect	Broader buckle	↑ Indentation
Support V. base		↓
		∴ x SRF drainage req

- Nylon 5-0 or Ethibond ✓
  Spatula type

Bites 1-2mm than explant

- Drainage of SRF

favour drainage → Long standing RD
↑ RRD
Inf retinal breaks
+nce of PVR.
× break recog.
Elderly pt (RPE × fxn)
Eyes that cannot control ↑IOP.

? to be done → Beneath MR
× Vortex veins
Ant drainage sites

Radially oriented cuts in Sclera, gravity dependent
↓
Endpoint — herniation of small knuckle of choroid
Stoppage of fluid, Pigment appearance

No. of bands

Types
Use
Multiple Break

Silicon Circling Bands

40 — 240

2mm — 2.5mm

Sleeves
↓
To secure the band

275 AS
276 AS] — 7mm
277 S]
278 AS
280 AS] 9mm
279 S]
21 - 12.5 mm

Complications

Intra-Op

- Corneal Clouding
  - Epi debelde
- Miosis
  - Cryo
  - → SRF drainage
  - hypotony
- Scleral perforation
- Drainage related
  - Dry tap
  - Choroidal thrug
  - L. incarceration

Post Op

- Glaucoma
- Ant Segment ischaemia
- Inf & Extension
- Choroidal detachment
  - W obstruction
  - SRF drainage
- PVR

PPV

Advantages over Conventional Scleral Buckling

1) Removes vitreous traction by lysing the strands directly
   - S. buckling. indirectly.
   - Pneumatic ✗ remove.

2) Removes vitreous fluid & pigments clearing the visual axis
   ∴ PVR + Combined RD — possible.
   Vitreous Opacity — Better Visualization.

3) Achieves intraop reattachment complete. » fRT repair.
   Pseudophake + PVR.

   - SB + SRF drainage → Only ½
   - SB + SRF - Pneumatic → Never achieve complete. re-att.

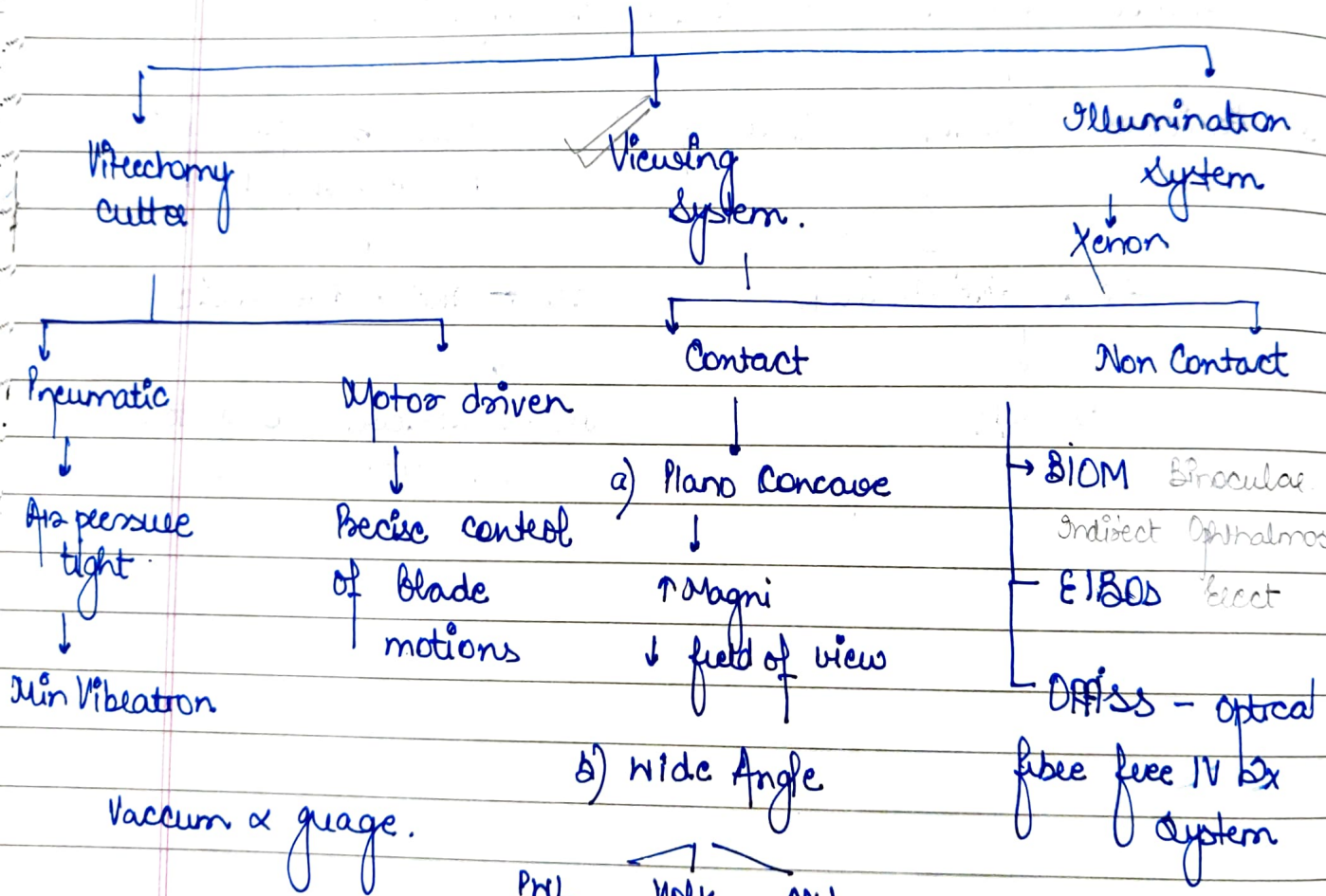
Basic Machine

a) VGFI (Vented gas fluid infusion system)

b) ↑ speed cutting

c) Built in IOP sensors

d) Trochars of 23/25g used.



Dx

M.C

- Rhegmatogenous RD
- Severe Non clearing VH
- TRD
- Combined
- Progressive fibroVasc Proliferation
- Macular Hole & ERM
- Endophthalmitis
- Post dislocated IOL / Nucleus frag
- RIOFB.

L.C

- Peripheral Hmrg
- Ghost cell glaucoma
- Macular edema ⊆ pseudophakic reaction
- Ant hyaloidal fibroVasc proliferation
- fibrinoid syndrome ⊆ RD
- Severe Vitreous floaters.

Complications

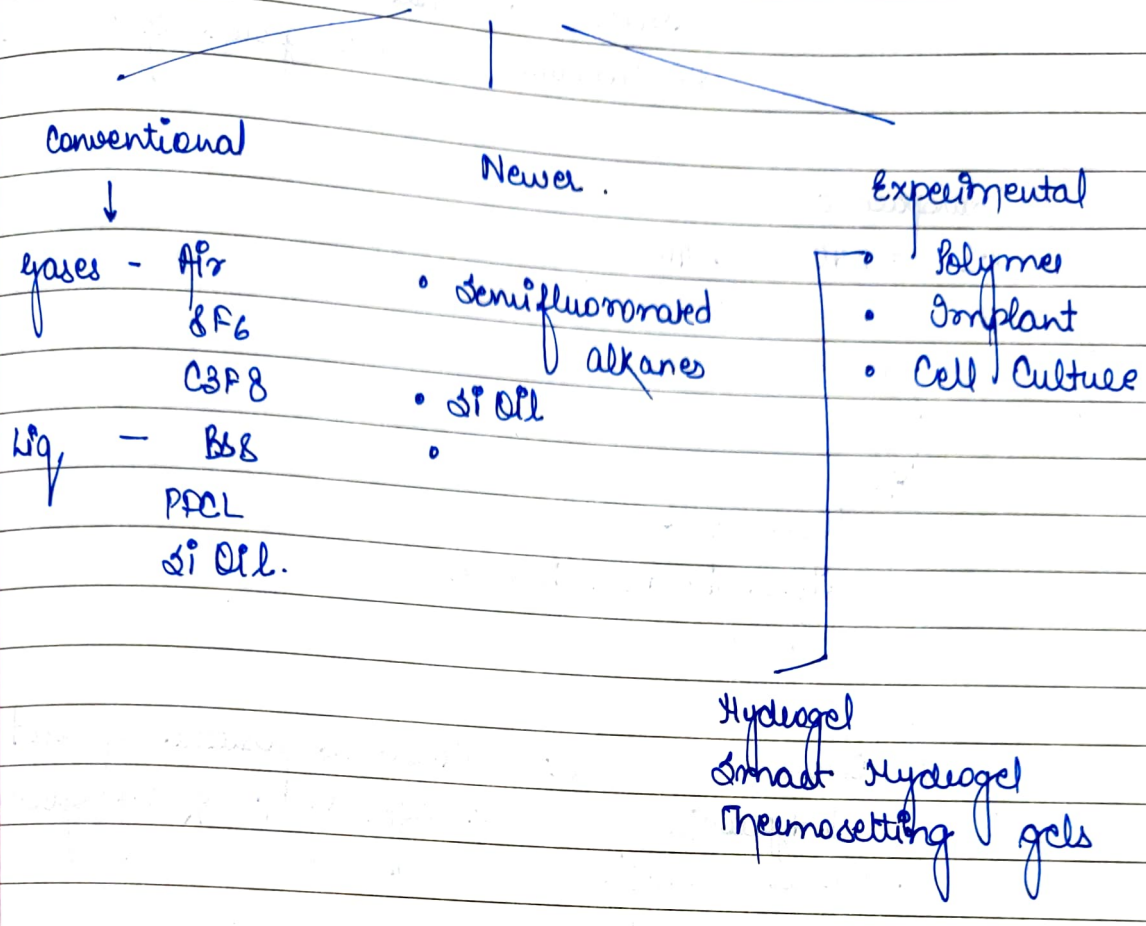
Trauma to lens, retina, ON
IO gas / oil → Cataract formation
Unfix break — PPV fail
Select Post op positioning Req.

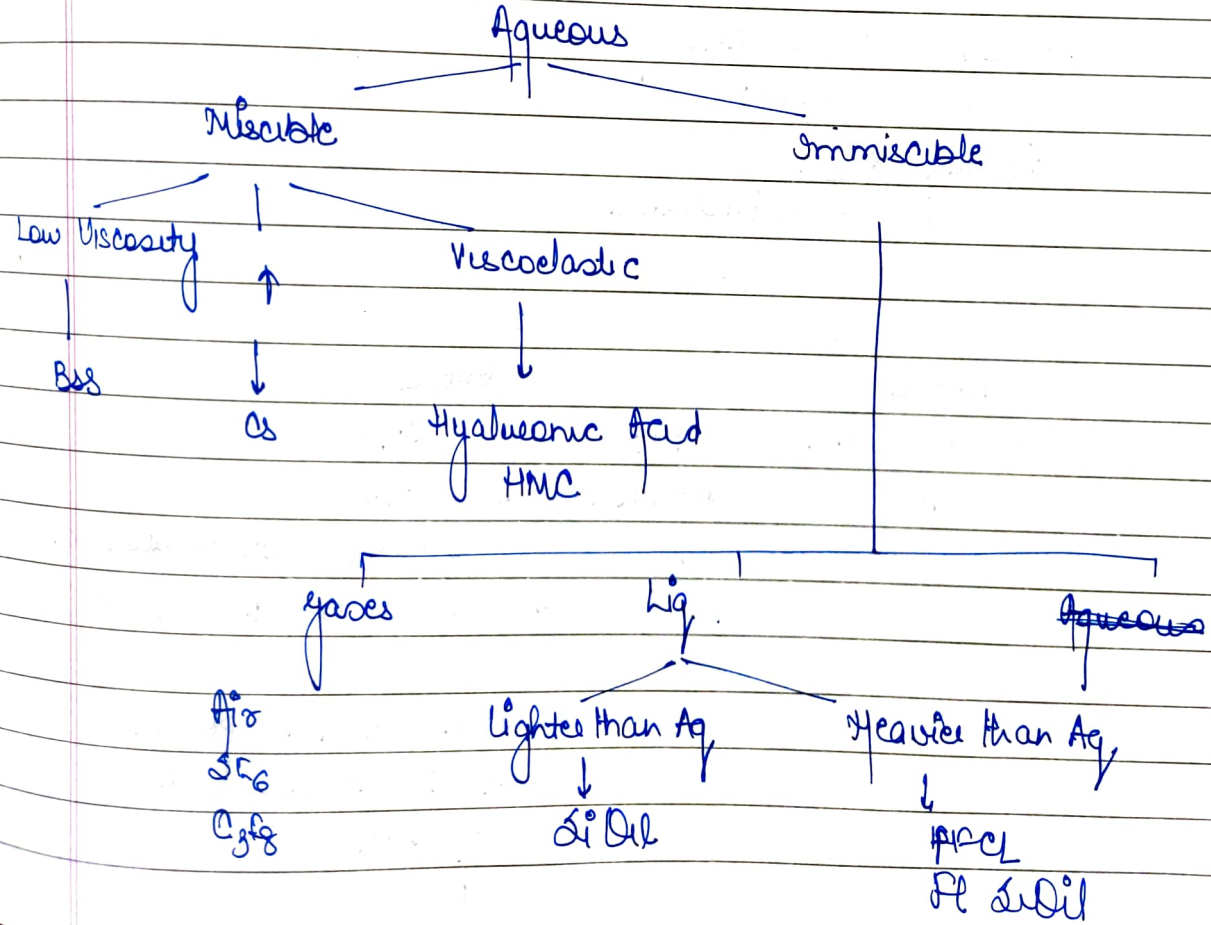
RD

- ⊆ PVR C2, C3 & D grade
- GRT
- Multiple Breaks
- Posterior Breaks
- failed scleral Buckle
- Combined
- Non clearing VH.

Trans Conjunctival Sutureless Vitrectomy (TSV) Systems

Vitreous Substitutes





(a) Silicon Oil.

Properties → Length ∝ Viscosity
HC radicals ∝ Side groups of Polymer.

Transparent
R.I = 1.40 (> Vitreous)



→ Concave (−lens)
Hyperopia +6D induce

(Convex ∴ ↓ Hyperopia
Duo lens ∴ Myopic

∴ altered by position of head
∴ difficult to Rx by spectacles

⇒ ↓ Hyperopia eventually

Viscosity — Centistokes
M.wt

Viscosity ∝ 1 / Emulsification

1000 cs
30,000 dalton
403

Mwt
Repeating Units

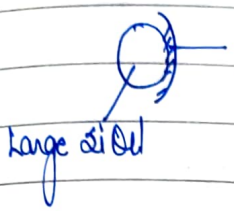
5000 cs
50,000
673

↓ chances of Emulsificat"
» difficult to remove

better retinal tamponade
esp in severe cases
of PVR.

Purpose → Long term tamponade.
Surf tension < gas H_2O interface
Sp gravity = 0.971 → Buoyant force ⊆ in eye (BF)

BF = 1/3 of gas → redtt of retina (× for radial foldⁿ)



∴ × vitreous traction.

Interfacial tension of Si Oil ⊆ H_2O forms bubble ∴ × migrate through open hole

Propensity of re-proliferation in Oil filled eyes treated with RD
↓
Small remaining fluid cavity
↓
Concentrate proteins

SOI
Explain procedure
↓
Aphake – Ardo PI at 6 O'clock
↓ × in high buckles (Si Oil)
Leave eye soft

SOR
3-6 mth till Bush.
If Aphake – Make paracentesis to drain Oil.

Look for →
- Recurrent paracentral fibrosis
- Shallow RD missed (Periphery)
- Open Breaks

Ix

a) PVR. → One eyed
× position maintain
IOP k 5 & recurrent RD
Superior Break (RD)
↓ for inf Break ∴ + Buckling

b) PDR → due to extensive retinal ischemics

c) GRT

d) Trauma → Avoid Wound extension
Massive hypotony

e) RD in AIDS

f) RD due to Coloboma Choroids
diff to close directly as × RPE & choroid
Retinopexy – × effective.
Buckling – difficult

Complication → a) Emulsification — shearing effect – proteins in vitreous

b) Keratopathy – EDTA

c) Cataract

d) Pupillary block

e) Glaucoma

f) Persistent Oil proliferation & Macular pucker

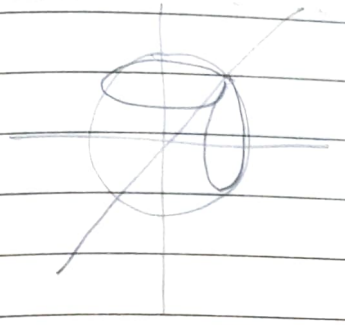
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fluorinated si oil

Densuon 68

Oxane HD

HWS 46-3000



Area of contact & Size of gas bubble

Vol 14 No. 6 Dec 2008. Lokesh Jain.

PFCL — Perfluoro N Octane

Optically clear × optical abberations
Sp gr > Saline = 2 * H_2O ∴ » tamponade
Interface visible as they are immiscible
Visc = 0.8 – 8 csi ∴ easy inj & removal
Boiling pt > Saline ∴ safe & ↓ Vapourizat^n

Perfluoro-Octane

Inert liq
Intraop Use.

Ix for use →

a) PVR — Open peripheral folds
— Better visualizat^n of Memb
— Post retinotomy not necessary ∴ ↓ injury to retina & ↓ risk of reproliferation.
— does not cause Miosis intra-Op.

3rd Hand

b) PDR — flatten the retina

c) GRT →

- 90-180° × PVR → gas tamponade C_3F_8
- Si Oil
- ×PVR → Scleral buckle.

d) Trauma — IOFB can be floated on PFCL surf

e) IOL drop

f) Surgical excision of Subretinal Membr →

g) Retinal incarceration →

h) Endophthalmitis

i) RD secondary to Macular hole — Schisis → SRF drain.
sm. peripheral hole.

j) Massive SR Hmrg

k) ROP

l) RD ass ⊆ Choroidal Coloboma.

m) RD ⊆ post retinal breaks

n) Suprachoroidal Hmrg

o) Complications
- Retinal break
- Subretinal migration of PFCL
- Dispersion of PFCL
- Residual PFCL

Combination of Oil & PFCL

2 Si Oil — support Superior Retina
1 PFCL — Inferior Retina

delay emulsification

Heavier than H_2O Si Oil

F_6H_8 → for Recurrent Macular Hole.

H_8O — Persistent Macular Hole

Visco-Elastic fluids

a) Visco-dissection
b) PDR
c) RRT repair
d) Stage V ROP
e) If Cornea hazy or dry — Visco injected to coat it

Gases

Air, SF_6, C_3F_8

↓

∴ maintain position till hole closes.

Air injected → gas liq surface tension → of thin fluid → melting detached retina.

Better for dye breaks if maintain position

Complication

- Post op Cataract formation
- RD of Retina 4mm PVR.
- Transient Ocular HTN
- Need for extensive face down position.

1½ - 2 Hr ↓ arc of

	Air	C_3F_8 (0·3ml)	SF_6 (0·6ml)
Expand	0	3	2
Resp	5-7.	30-35 days 14%	10-14 days 20%

C_3F_8		Oil
<4wk	Tamponade Post op Inflamm Rehab Re-Operat" Post op Vision	>4wk ↓ Quicker. fewer Poor

3 phases

Expansion — Equilibrium — Dissolution

C_3F_8 (gas)

✓

- Absorbs spontaneously
- Duration of tamponade controlled using diff conc.

- » quick visual rehab
- ↓ long term complicat^n ass $\underline{c}$ use.

×

× long last $\underline{c}$ ER

prohibited air travel

Cataract formation i
prone position × mau

↑ IOP.
Hypotony

Si Oil

✓

Provides tamponade
» for . R. tears &
large retinotomies

- » in eyes achieving
  1/2. result.
- No air travel restrict^n
- Better tamponade in eyes
  $\underline{c}$ hypotony

×

× prevent repoliferat^n in
Adv retina

VA slow to improve &
causes subs changes in
refract^n

Corneal toxicity
Cataract
Si Oil emulsificat^n
↑ IOP.
SOR to be done

Mx of RRDs

Def full thickness retinal break that extends circumferentially around the retina for 3 or > clock hrs
90 degrees or >

+ PVD
+ Viteous gel to Ant flap
+ Independent mobility of Post flap.

RRD

Dialypes
Retinal disinsertion from Ora ≤ 90° or > circumferential extent

✗ to Ant flap only
∴ inversion occurs

Viteous bridges gap.
Att to Post flap ∴ ✗ PVD
∴ no inversion

Sp techniques i.e. unfolding.

Buckling

Types

- Idiopathic 70%
- Traumatic 20%.
- Post edge of CR deg ↓ 10%.

Associations

- ♂
- Myopia (>8D)
- Marfan's, Stickler's

↑ risk in fellow eye.

Pathogenesis →

Liquefying process of central gel
↓
forming Cavity
↓
Progressive shrinkage of gel exerting traction on the base
↓
Peripheral retina → RRT

RRT in trauma = + Avulsion of V. base
+ CR scarring in eyes c/ ARN
Ass c/ Stickler, Ehlers, Marfan's
during PPV Sx — Blunt instrument
Open sky Deep Vitrectomy

Pre-Op Evaluation

Pre-Op → Size of tear
Mobility of post flap
Radial extension
Amt of Vitreous liquefaction
Abn areas of V. Condensation
Extent of PVR.

Why it is complex

Large area of base choroid → release of pigments → ↑ inflammat° & PVR.

Aff Aq drainage pathways
↓
Severe hypotony
↓
Choroidal detachment

flap unfolding difficult → PVR / Vitreous att.
↓
↑ risk of retinal damage

↑ risk of placement of SR infusion Canula.

damage to crystalline lens

Surgical Management:

PPV
↓
PFCL used
- Earlier → Retinal sutures / Tacks / Prone fluid air Exchange
- L ↑ sp gravity, ↓ viscosity, assume liq form at room temp. flattening forces » air / Si Oil

↓
Sealing the tear ± CR adhesion
↓
Providing long term. ↓ tamponade.

Sx Manouvre

a) **Vitrectomy** — PPV thorough
↓
Meticulous removal of V. gel
↓
Optimal Visualization of Vitreous base.

Wide ∠ viewing is the best

b) **Mx of Lens** — Ix → Cataract
Lens subluxatn
PVR +

✓ → Visualization of edge of tear during FAC.
Improved access to region of V. Base
↓
✗ Compromise in PPV to salvage the lens

c) Complete Traction Removal — ERM.
removal of proliferative tissue

d) Role of PFCL → Tip inside bubble
gradual unfolding #

e) Role of EndophotoCoag → 8-10 rows
200 - 500μ
] Post Edge

5 rows in fundus periphery
↓
FA ✗ → Maintain proper pressure → PFCL Oil Exchange
↓
↑ chances of slippage

Complication a) Posterior slippage of a giant tear
b) Retention of PFCL bubble in Vitreous Cavity
└ Macular damage ≤ in 1-3d

× Prone
↓
Corneal damage

× Supine
↓
Macular damage

c) Recurrent detatchment → due to PVR.
d) Post op Epimacular Memb →

Role of Scleral Buckling → >> in GRT + PVR.
↳ ↓ early & late reaction
↓
GRT remained closed
↓
Will not extend
↓
Counteract late reactn on Peripheral retina in GRD

(X) → . gaping of RT.
. Redundant retinal folds
. fish moulting
. ↑ tedency of slippage of retina.

Tech — 35mm encircling band ⊆ tie diagonally opp to GRT.

Px buckle in fellow eye & its Mx.

Management of Retained IO foreign Body

Post trauma — IOFB

3 port PPV

Wide ∠ Viewing system

Xenon illumination — IOFB forceps

Magnets

+ AoB

- Limbal Ring as a reference plane
- Radiogram taken in AP & Lat position
- Scout films of Orbit

CT Scan — USG

- Etiology of Injury
- Type of material
- Time of Injury

Complete Exam

- Initial VA
- RAPD
- dilated fundus exam
  - IOFB
  - RD
- slit lamp Exam (Endoph)

IOP
USG B scan
] x. tt repair done

↓

Moxifloxacin 400 mg i.v / oral PO.
Levofloxacin 500 mg i.v OD
] All but < Pseudomonas A. / Bacillus Cereus.

↓

CT Helical scan of Orbit & Brain —1mm as 0.625mm

↓

- Intracranial f.b or roof #

ENT Eval ±

USG → Site of Impaction of f.b.
Status of PVD.
Associated RD.
+ VH.
Endoph.

1° repair → IOFB removal.

1° repair + IOFB removal

Corneal clarity → so may wait for C. haze to go.

2) Decide mode of delivery ie instruments req.
   a) Limbal incision → Post → PPV → thr same port < 0.5 mm big
   b) Intralenticular by Lens aspiration. → larger. → different 20/23g ports.

Conventional 20g vs. Small port vitrectomy

PPV

- 20g PPV
- ✓

Trocar insertion → TON, Corneal edema, Wound leak

- Suprachoroidal bleeg
- Take vitreous Sample

Aphakic → 2° IOL.

If < 5x5x5mm f.b → do Phaco.

- Achieve complete Post hyaloid separation before f.b removal

Forceps

- 10FB Endo Magnet (grasphable) → 1x1x1mm → prevent 10FB from catching edge & falling back into the eye
- 1x3mm → g. Pannanale Basket forceps
- g. Machemer diamond coated f.b. forceps → 3x5mm → diamond coating → x slippage.

- Sclerotomy Incision >5mm
  - x thru 20G.
  - thru Scleral/Limbal tunnel.
- Corneal Clarity
- Illumination of retina during PPV
  - Xenon light source
  - Chandelier light.
  - Preservative free Intra-Op. Triamcinolone.
- Without signs of Retinal Injury, globe can be left c BSS
- RD may occur

IOFB related aspects

a) Visual Outcomes → BeOp — ↓ in Traumatic Cataract VH.
- & long term factors.
  - TON
  - Corneal scarring
  - Post traumatic Endoph.
  - Supra Choroidal thing
  - PVR. → RD.

b) M.C type of IOFB Injury → Small Corneal laceration. + Traumatic Cataract + VH.

c) Corneal Scarring & Astigmatism →
As reconstruction using double armed Mc Connell Suture to repair Iris defect

Guidelines for LASER to Breaks

Acute, Symptomatic

- Horseshoe tear → Urgent
- Operculated holes → ✗ necessary
- Symptomatic dialysis → Urgent
- Traumatic R. break → ✓ Treat

Asymptomatic

- Horseshoe tear ± ✗ subclinical RD → ✗
- Operculated
- Atrophic round holes → ✗ treat unless PVD.
- Lattice deg ± cystic hole → ✗
- Asymptomatic dialysis → ✗ conservative

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Date 5/6
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Approach for localization of IOFB

H/O injury to Eye ⊆ Suspicion of f.b.

Eye Ix → detailed H/O
Diffuse torchlight Exam.
Slit lamp Exam
Ophthal Exam
Gonioscopy.
Transilluminination

Media

Clear
↓
RIOFB

Visible
↓
Further Ix, Sx Tech

FB removal after PPV & forceps
↓
No Ix

IOFB removal ⊆ hand Magnet
↓
Rope Hall locator

Metallic FB

Magnetic
↓
Removal ⊆ Magnet

Non Magnetic

Non Metallic FB

Not visible

Hazy
↓
Other Method
- USG
- MRI
- Bone free method

Xray Orbit
↓
FB

+
↓
Limbal ring localization

−

Very strong suspicious
↓
CT Scan

Doubtful H/O
↓
No Further Ix

PPV must ⊆ FB forcep removal

Traumatic Aniridia & Symptomatic photophobia
↓
Mc Cannell Suture.

31% has PEOP RD.
↓
Nidus for PVR formation
↓
Endophthalmitis.

Late Rhegmatogenous RD.
↓
PVR, VH ⟶ Non separable RD ⟶ Phthisis
↓
Enucleation

Post traumatic Endoph.
Bact — B. cereus.
Staph aureus
Strep Pn.
Pseudomonas Aeruginosa

Risk — Delay in 1° closure
" " IOFB removal
Disrupt^{n} of Crystalline lens
Sustaining O. trauma in rural setting

fav OutCome – Better VA.
Culture of Non Virulent Org
Lack of RD.
Absence of Endoph
↓ Wound length.

Insert – Rubber & graphite ⟶ Monitor by ERG/VEP.

Open globe injury ⊆ possible f.b

→ Start B.S
A.B

↓

H/O, Exam.
x IOP, USG

↓

CT Orbit ⊆ Out Contrast

↓

IOFB

+ → ↓

Pt stable for Sx
x Active inf.
VR facility

+ → ↓

1° closure
⊆ IOFB removal

↓

− → 1° globe repair

↓

1° closure
⊆ delayed IOFB removal

↓

Perform Complete Vitrectomy

↓

Stain sent

↓

IOFB removal Dt

(a) Size

<1.0 mm Magnetic → ↓ Magnetic

1-3mm stone → ↓ Basket

3-5mm glass → ↓ IOFB diamond coated

(b) Removal Site

↓

IOFB > 4×4×4

+ ↓ Scleral tunnel

− ↓ Sclerotomy

(c) IOL

Capsule

+ ↓ IOL

− ↓ Leave aphakic

(d) Tamponade

Is there | RD, tear.

+ ↓ Laser, Air

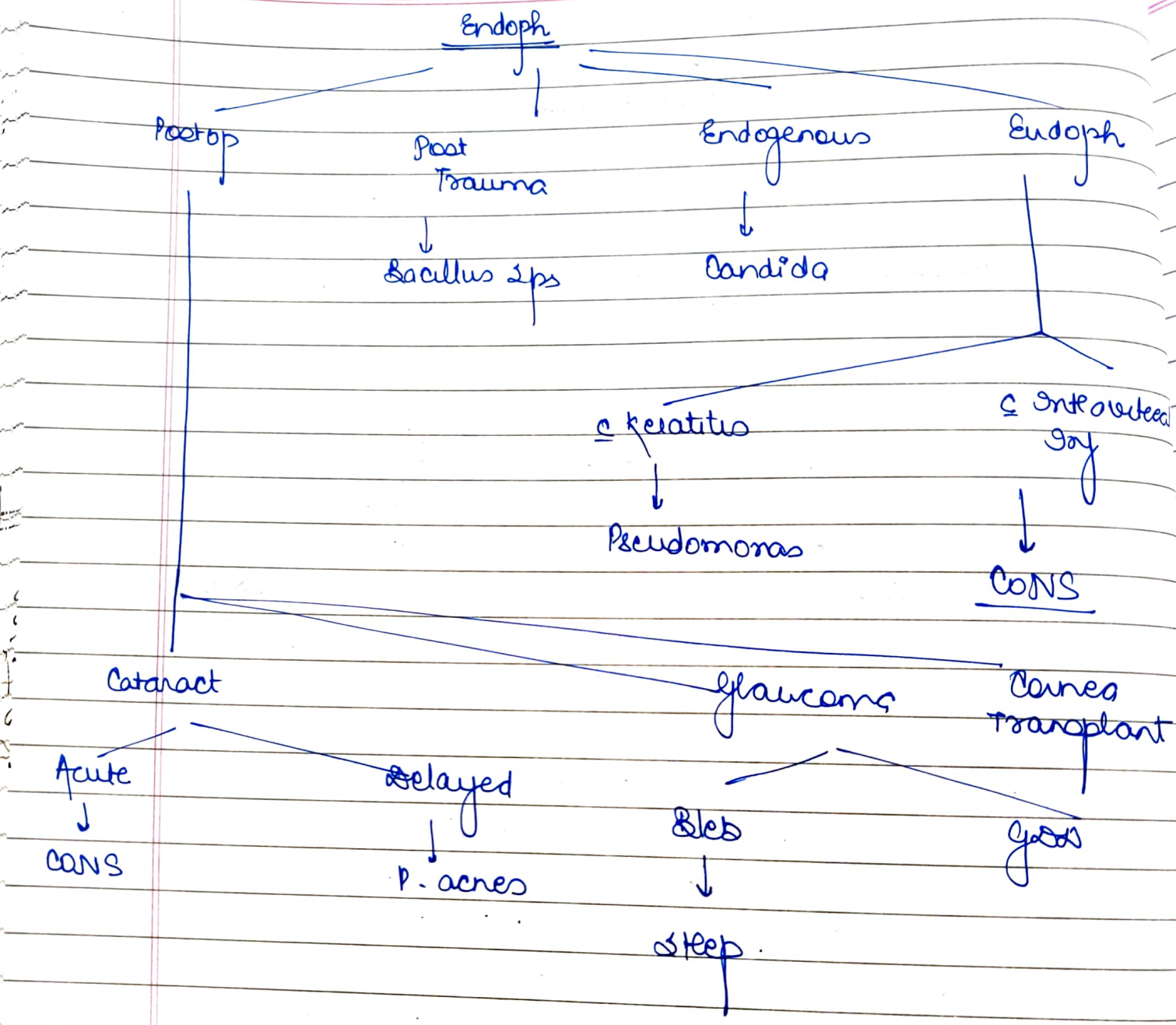
− ↓ BSS.

Retinal tear | RD.

↓ RD repair + gas

RD | Choroidal

↓ RD repair + SF Oil.


Endoph
Postop
Post Trauma
Endogenous
Endoph
Bacillus spp
Candida
c keratitis
c Intravitreal Inj
Pseudomonas
CoNS
Cataract
Glaucoma
Cornea transplant
Acute
Delayed
Bleb
Graft
CoNS
P. acnes
Steep

Endophthalmitis

Def → Involvement of Ant or Post segment or both with involvement of adjacent ocular wall

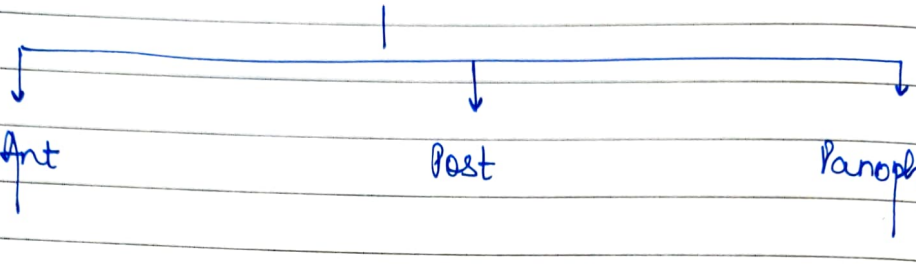
Classification

- Infectious (sterile)
  - Endogenous
    - Metastatic
      - ↓
      - Hematogenous spread
  - Exogenous.
    - → Post op Endoph 0.28%
    - → Post traumatic 2.4 - 18.4%.
    - → Bleb related Endophthalmitis 0.2 - 1.3%.
- Non Infectious
  - ↓
  - TASS

Endogenous Endophthalmitis

Blinding complication

2-17 %



Microbial Spectrum >40% has evident systemic source.

Pedis – DM, Organ transplant
IC pt Neuteopenia
Malignancy i.v Hyperalimentation.
i.v catheter Hemodialysis
Contaminated i.v infusion.

Common Extra-Ocular sites

- Liver Abscess
- Pn.
- Endocarditis
- Meningitis
- Soft tissue Inf
- Renal abscess
- Pyonephrosis
- Brain Abscess



- Klebsiella > in DM
- Aspergillus after single i.v fluid injection.

Clinical features

Binocular in 15% cases

♀ >

Peak age

- Bact → 3rd decade < 1yr.
- Fungal → Middle age

L > L focus of infection due to comparative blood flow to RCA.

Symptoms

Pain
Blurred Vision
Lid Swelling
Discharge

Signs

Chemosed Conj
↑ IOP.
Corneal edema.
AC rxn.
Viteous rxn.
Hypopyon
↓ / Red reflex.
Retinal CW spots.
Roth spot.
Hmrg
Chorioidal Abs / Viteous Abs

∝ type of Bact

B. Cereus M.C cause of Metastatic endoph in drug abusers
ring shaped Corneal ulcer & Descemet AC exudates

Listeria Monocytogenes
If Descemet hypopyon + but no Corneal involver think of Listeria Monocytogenes.

Mis dx as → granulomatous Uveitis
fungal Endoph
Angle closure glaucoma
Mucor Mycosis
CST.
Orbital Cellulitis

Dx →

USG → Vitritis, Retinal detatchment
Vitreous Exudates → ↓ to moderate intensity
point like echoes in vitreous cavity

Bld Culture – 94% +ve.

Vitreous +ve – 44-70%.

Incubate for 1wk before giving neg report

PCR – diff fungal vs Bact.

℞ → look for primary focus

» Bacterial Inf

Empirical — Vanco + cephalosp or Aminoglycoside

» fungal — Candida i.v Amphotericin. 5-10μ. + Systemic triazoles.

Systemic Voriconazole & Caspofungin are new. options.

PPV eyes — 3* to retain vision.

3* (↓ Enucleation & Evisceration)

Ix for PPV → • Worsening of Signs & Symptoms
• Rapid progression
• Retinal Necrosis
• Extensive Subretinal Abscess
• Retinal detachment

Poor Prognosis — Delayed dx & Rx (>4D)
Poor initial VA
+nce of hypopyon
+nce of virulent Organisms
Kleb species.
Candida worse than Aspergillus.

Evisceration — 29% cases.

VA gain

20/20 → 5%.

CF CF → 64%.

Exogenous Endophthalmitis

- Post op.
- Post Traumatic
- Bleb related.

Post op Endophthalmitis — 0.13 - 0.7%

» after Cataract Sx
» PK.

- Cluster cases
- Isolated cases

Cluster Cases → Occurence of 2 > infection.

Pt factors — IC pt
Uncontrolled DM
Poor lid hygiene
Chronic dacryocystitis
Inadequate Pre-Op Medicat°.
Prolonged use of A.B.

Surgeon factors »
Poor sterilization of OR.
Contaminated sol.
Visco. elastic
Contaminated IOL.
Irrigating sol.
Visco - elastics
Ventilation system.

- Acute — 1-2 wk.
- Chronic. — > 6wk.

Microbial Spectrum & Risk factors →

- CNS 33-77%
- Staph aureus 9-19%
- β. hemolytic steep
- Gram neg Bact.
  - P. aeruginosa
- Fungi 8-18%

Delayed Post op Capsular Bag Endoph → Propionibact Acnes
C. macginleyi

Post op Endoph — CNS (67%)
(glaucoma Sx)

POE

Pt related
- ↑ DR.
- Cataract Sx + IOL Sx

Surgeon related.
- ↓ Sx vol
- limited experience
- ↑ Operating time

Clinical features →

- Incubation
  - 16-18hr duration
- Acceleration.
- Destructive phase.

Pseudomonas — 10min.
Propionibact — >5hr.
Staph epidermidis, aureus — 3rd.

1st post op day. — 2wk after operation

POE

Acute.

Pain
↓ vision

Lid edema
Congestion
Hypopyon
↓ Media clarity
Loss of red reflex — Vitreous clouding

Poor → ↓ VA
RAPD, Corneal involve".
Rubeosis Iridis

Chronic late.

after 2wk of Cataract operation

P. acnes, S. Epidermidis
Diphtheroids, fungi

Whitish plaque. seen in Capsular bag in 40-90%.
Cases — P. endoph.

- C. Edema → 48%.
- Keratitis → 26%.

has to be differentiated from TASS.

Symptoms – Pain, Headache
Blepharitis, Conjunctivitis

Fungal – ↑ Incubat^{n} period.

Dx → USG ≤ RD / CD / Vitreous Memb +

Rx Peri-Op antisepsis – 5% Povidone Iodine 3min prior the Sx

↓ Post op Endoph 0.24 ↘ 0.06%

Levoflox in AC.
Post-Op Moxiflox.

Excess → Intracameral cefuroxime inj ↓ Endoph

× Ix for intravenous drug usage.

Rx EVS Study
- Only Post op Endoph —» S. Epidermidis
- I.V Amikacin & Ceftazidime used
- Diff b/t Diabetic & Non diabetic

Do PPV → if × possible
- Do. Vitreous Biopsy
- Inject.

Viteous Biopsy

↓ Plating

→ take. needle/syringe to Micro

Vancomycin — 1mg in 0.1ml
Cefta — 2.25mg in 0.1ml

(or)

Amikacin — 400µg in 0.1ml
Vancomycin — 2mg in 0.1ml

Dexa: 400µg/0.1ml ↓ as Inflammatn is main culprit

Away from Macula in mid viteous.

PPV recommended for Chronic/fungal Endoph.

Clarithro 250mg BD.

Special considerations in PPV

- 6mm Infusion Canula — Thickened retinochoroid in inflamed eye.
- ACM applied to clear AC exudates
- Collect undiluted Vitreous sample.
- Clear only Core Vitreous
- A post Capsulotomy made to make A & P Vitreous, a common chamber
- IOL explantation done → gross Inf plaque in Capsule Recurrent Endoph.

P. acnes → Vancomycin 1mg/0.1ml in capsular bag

↓

Total Capsulectomy + IOL explantat^n done.

(fungal) Amphotericin 5-7.5μg

↓

Pseudallescheria boydii — Resistant to it
L Sensitive to Miconazole (fungistatic)

Bacillus

Post Traumatic Endophthalmitis

Date 66

Incidence 100 * > 25-30%

Open globe injury

IOFB

\+ → 3.1 - 11.9%

\+ → 3.8 - 48.1%

\+ → Rural → 30%

\+ → Non Rural → 11%

Microbial Spectrum & R.F →

Culture

\+ → Culture +ve

\- → clinically dx

Bacillus → Polymicrobial infection.

R/F –

- Rural setting trauma
- Veg matter ass c inj
- Delayed repair after 24 hr
- Dirty Wound
- Age > 50 yrs.

↓

- Large Wound size
- Location of Wound.

- Ocular tissue prolapse
- IOL placement
- Extent of injury
- Lens disruption

c/f Extreme pain ⊆ hypopyon
Vitelus

Interval 3-6 d.

fungal Endop. — steing of pearl appearance / fluffy ball
Symptoms
Signs.

Reactive. Endoph → Metallic Non Magnetic IOFB.
↓
Non Pufectous Puflammation

100% Cu → Rapid, sterile endoph like rxn ⊆ hypopyon.

↓ Cu → Chalcosis — Chronic Uveitis related
complication — hypotony
• Phthisis
• Green colour of Iris.
• Greenish brown colour of peripheral cornea.
• KF rings (due to Cu deposition) in DM
• Sunflower C.
>85% Cu — severe loss

CT scan ⊆ 2mm slices
USG B scan — glass/plastic

Diagnosis → USG B Scan / CT Scan] IOFB.

Rx → Proper Wound Irrigation.

↓

Staining.

If high suspicion of PTE while repair — IVAB use
Subcony steroid used ✓

Rx → PPV

↓

Vitreous tap done

↓

IVAB (Cefta + Vanco)

Soil → Clostridium

Vegetative → fungal

Bacillus sp → I.vit clindamycin (0.5mg/0.1ml) .

Sympathetic Ophthalmia.

Bleb related Endophthalmitis

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Post op Endoph.
- 1st Cause → Post Cataract Sx
- 2nd " → Bleb related.

» Antifibrinolytic agents
» Inferior Blebs.

Bleb related Complication → Bleb leak
Blebitis
Endophthalmitis

Microbial Spectrum → Bleb leakage
↓
Bact from tear film & periocular structure access into the eye

Early
↓
≤ 3mth
↓
Wound dehiscence
Incomplete conj closure

Late
>3mth
↓
Use of adjunctive metabolites
↓
↓ population of goblet cell
↓
Mucin
↓
Protective barrier against leakage & Bact
- Conj thinning
- ↓ Cellularity
- Avascular Bleb

Blebitis → Isolated bleb infection ± signs of anterior segment inflammation ± Vitreous involvⁿ

↓ Untx

Endoph.

Blebitis + Vitreous involvⁿ ⟹ BRE.

Early BRE
↓
67% case
↓
CNS

Delayed BRE
Streptococci.
Gram neg.
H. influenza 93%.

C/F Prodromal signs — Bcaw ache, Headache,
Ext eye inflammation, Blepharitis, Conjunctivitis
↓
Post trab ↑ Index of suspicion
↓
Differentiate BRE

↓ VA.,
Redness, pain, swelling, Conj congestion
Opalescent blebs
Intense fibrin, hypopyon in AC, fluid vitritis

Fungal Endophthalmitis

» Exogenous Cause — 2° to trauma or Sx.

Microbial Spectrum Endo – Candida

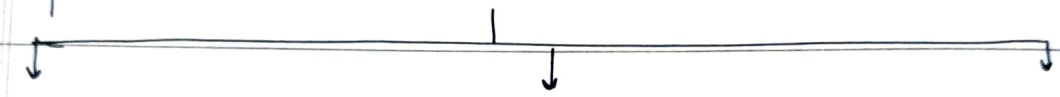
Breach in immunity → Inf spread.

R/f → Indwelling catheters, IV drugs, Hyperalimentation

H/o recent Sx

Exogenous → filamentous fungi — Aspergillus

C/f



Endogenous	Post op.	Post traumatic
↓VA.	focal choroiditis	Veg matter
Vitreous Inflam	Ring of pearls infiltrates	
Whitish puff balls		
CNV – C. albicans		
Macular CRAO.		
Subretinal hypopyon		

Dx. Of Endog finding of fungus + IO fungus

Vitrectomy samples » Conc by Centrifugation

Multiple format

C. Neoformans – stain ⊆ Mucicarmine & Gms

filtrate Cytology to be done

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℞ → Intravitreal Amphotericin 5-10 µg — retinal toxicity
dexa — 400 mg — to combat toxic
macular effects

↓

Voriconazole → ↓ R. toxicity

Endo

Broad Spectrum A·B to ℞ primary source of infection

↓

PPV

↓

I.V Ampho 5-10 µg

↓

Systemic triazoles

Exo

× Amphotericin in gas filled eye.

factors with Poor Visual Outcome

Corneal involve
Hypopyon >1.5 mm
Detection of Bact spp other than CNSP
Absence of fundus visibility.
NVI.
RAPD.
Virulence of Causative Org.
Endoph → due to gram neg Org
fungal infection.
Post traumatic Endoph
geriatric/ Pediatric

Late Sequelae → Macular Edema
Disc Edema.
Optic Atrophy
ERM
Macular Infarction.
Scarring.

TASS (Toxic Anterior Segment Syndrome)

Acute inflammation of anterior chamber of the eye
↓
Acute sterile AC inflammatory rxn that develops 12-48hrs after OS Sx
↓
sterile, non infectious Endoph ± pain.

Patho Multi factorial
Abn PH, Osmolarity, OVD, IO medication, Topical oint
inadequate sterilization

gram stain neg
Culture neg.

Cf ↓ VA 12-24hrs after Sx
diffuse corneal edema limbus to limbus ✓
Endothelial Cell damage
severe AC rxn ⊆ hypopyon
3 oz > pt

Rx → 1° prevention
Proper protocol during Sx
BSS ⊆ Correct pH, Osmolarity & ionic Composition
Use of preservative free IO sol, IC medicat^n
Adequate sterilizat^n of instruments

give I fnly steroids

In severe cases — permanent damage ✓

TUMORS OF RETINA

- Retinocytes
  - Retinoblastoma
  - Retinomas
- Retinal Vasculature
  - R. hemangioblastoma
  - R. AV Communicat^{n}
- Glial cells
  - Astrocytic hamartomas & Astrocytomas
- Lymphoid tx & leukemias
  - 1° Retinal lymphoma
- Metastasis via Bld sply
- RPE Tx
  - Congenital Anomalies
    - Simple / Combined hamartomas CHRPE
  - True Neoplasia
    - Adenoma
    - AdenoCa
- Phakomatosis Neurocutaneous Syndrome

(a) Retinal Vascular Tx

- True Neoplastic entities
  - Hemangioblastomas
    - Solitary
    - VHL
  - Cavernous hemangioma.
- Congenital AV Communications

VPRT (Hemangioma + glial Tx)

- Sporadic
- 2° to Ocular pathology
  - Uveitis
  - Retinitis Pigmentosa

Retinal hemangioblastoma. → Benign, Vascular RT.

- Capillary Retinal Angioma
- Capillary Retinal hemangioma
- Retinal Angiomatosis
  - Sporadic
  - VHL ass.

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AD

VHL → Renal Carcinoma
VHL → CNS hemangioblastoma
VHL → Pancreatic/Renal Cyst
VHL → Phaeochromocytoma

VHL gene — Ts gene → involved in cellular responses to change of intracellular O_2

Genetics → Retinal Angioma phenotype + localization of missense mutat^n VHL gene

- α domain → Juxtapapillary Angioma
- β domain → Peripheral Angioma

→ Molecular testing

Screening Protocol

Annually from age 1
11-19 — every 6mth
>20 yrs — Annually

USG/yr CT/MRI for abd lesion/2yr.

CF

VHL — Retinal Angioma — Multifocal & bilateral

Occurs in Mid periphery as Orange Spherical Tx by enlarged, feeder vessels

∝ Tumour Size
Leakage of fluid & lipids frm hemangioblastoma
↓
2° Maculopathy
Exudative RD.
⇓
Vision impairment.

TRD, VH

Juxtapapillary — Peripheral

↓ typical
irregular border
↓ well demarcated
growth pattern is variable

DD — Choroidal hemangioma
Amelanotic C. Melanoma.
CNV.

↓

Severe ↓ VA.

Painless loss of VA → pain + → Painful 2° glaucoma

Histo — Large capillaries displaying normal endothelium BM & pericytes & Astrocytes containing large lipid filled vacuole seperating the vascular channel

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MX

FFA

Small peripheral R. hemangio.
↓
Laser photoCoag
Large lesion by
- Cryo
- Radio Rx
  - Ruthenium 106 plaques
  - Proton beam irradiation

Juxtapapillary R. Hemangio.
↓
d° VF scotoma
↓
Asymptomatic
↓
observe
- Laser Coag → Ext beard proliferation
- Vitrectomy
- Std PDT.

Modified PDT.
↓
Paint brush fashion
83-125s

Plaque Rx
⊗ of Exu RD
VBx ↓

Complicatn – Angioma Rec
2° gl
RD

Retinal Cavernous hemangioma

Benign Vascular Tx

Clusters of Aneurysmatic dilated RV

+

gliosis fibrosis

+ CNS Vascular Anomalies
  Cutaneous Vasc Malformations

× Exudation
× Progressive
× Require any Rx.

Racemose Hemangioma
(Hyburn Mason Syndrome)

Occurence of retinal AV communications without interposed capillaries.

+ CNS Malformat^{n} = Hyburn Mason also Bonnet Dechaume Blanc Syndrome

Cf — Single, multiple direct AV communication from OD to post pole & mid periphery

resembles feeder vessels

Unlike True Hemangioblastoma — fluid leakage from affected vessel is often absent

Deshe et al

Grade I	II	III
Retinal AV Comm ⊆ interposition of an abn capillary plexuses b/t major vessels	Single or multiple AV comm ⊆ out capillary bed	Extensive & complete AV comm ⊆ out capillary bed ⊆ VL & CNS lesions

FFA — helps.

Cause Spontaneous Intracranial hmrg, leading to Neuro. complication

★ Examine pt for CNS.

Retinal Vasoproliferative Tx

5-6 decade. Retinal periphery.
Unil / solitary

Pts c IO, Inflamm, Ischaemic, VP pathology

Inf & temp Quad of retinal periphery

As yellow, orange, red coloured, well vasculorized non pigmented retinal lesions having yellow halo composed of subretinal deposition of lipid exudates

Amt of exudate α activity of VP lesion

④ No prominent feeding vessels

Histo Proliferating glial cells, telengiectatic capillary network.

Dd R. Hemangioblastoma., Coat's disease
Amelanotic Tx, PEHR.
genetic testing to rule out VHL.

Tx Symptomatic — 2° CME or Epiretinal gliosis
└ CME, Intraretinal lipid deposit

Smaller → PC, TTT

Larger → PDT, Cryo., Brachy

Epi. gliosis 2° Macular pucker → Additional vitrectomy

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Retinal Astrocytoma

Benign, Acq, Retinal papillary Neoplasias ass c Tuberous sclerosis complex.
Bourneville - Pringle disease

ass c NF1 as independent
rarely progressive lesions

T&C - Multifocal lesions +
⇒ located in Inner layers of retina as OD, obscuring retinal vessels
milky gray appearance & Amt of calcification

FFA - Early blockage. Tx Vasc highlighted in middle & late phase of Angio.

Rx PDT

↳ Intraocular lymphoma

Isolated intraretinal lesions — infiltrating various parts of Bruch's membrane — RPE — Neuroretinal complex.

Gray yellow colouration → under RPE they often acquire leopard fur. appearance due to RPE clumping & atrophy

As masquerade

Dx ↳ AIVR, White dot Syndrome, VC. mets >60 yrs of age.

VR & choroidal Bx

60-90%. — Bil cases

clinically aggressive — Ass ⊆ CNS lymphoma

VR, Metastasis

Major common IO Tx.
located in Post choroid
1° — Breast Ca → lung Ca
Metastatic Cutaneous ~~lymphoma~~ Melanoma

Clin — Blurred vision, floaters
yellow white intraretinal patches ± cout perivascular infiltration
Vitreous cellular infiltrat° +

Cut. Melanoma → Vitreous infiltrate are large, globular pigmented vitreous opacities

Met Ca → Unpigmented.

2° glaucoma — Obstr of AC ∠ by clumps of cells

Dd

Retinal infil
- Choroidal Met
- Infectious retinitis
- Vaso Occlusive retinal disorder ± exudation

Vitreous floaters
- Uveitis
- Amyloidosis
- IOL.

Ix
- Systemic Work Up
- FFA — diff Mets from Vaso Occlusive disease
- Vitreous Bx.

Rx
Choroid Met — EBRT.

× Systemic chemo role.

Tx of RPE

Simple Hamartoma of RPE

Intraretinal heavy pigm.
1/2 DD size. Macular/ parafoveal location. Small extension into IR interface
- Non progressive
- Ass ⊆ ERM traction

OCT – Exact localization
Ass ⊆ FAP or Gardner syndrome

RPE - Neoplasia

Deeply depigmented
↓
Amelanotic Variants described
↓
Typical amelanotic
Dx by Biopsy
fast growing – Eye salvaging local excision
Radiotx.

Combined Hamartoma of RPE & Retina

Congenital lesion
⊆ NF2.
Unil, Non progressive, close to disc

Intermingled components
Prolifeat^n of R. glial cells & RPE cells
Straightening of larger vessel.
Tortuous – small vessel
If Involve macula – distortion foveal ectopia, ER gliosis

PPV + NP
If enlarging parafoveal hamartoma threatening fovea
└ PDT proposed.

CHRPE.

Cong. Dx at 5th decade
– Nud to outer fundus periphery
flat lesions – Hypertrophy heavily pig RPE monolayer
x detected by USG

Double halo pattern
grouped, multiple CHRPE – Bear Tracks

Phakomatoses

Neuroocular Cutaneous Syndromes ≤ multiple Tx.

- True
  - NF
  - TS
  - VHLS
- Not true
  - Sturge Weber (SWS)
  - Wyburn Mason Syndrome

Neurofibromatosis

	NF-1	NF2
Introduction	Classical / Von Recklinghausen 1 in 3500 person ♀ = ♂ AD. NF-1 gene mutat^n 17q 11 — tx suppressor gene Neural crest- + hamartomas	Central Acoustic NF <25yrs. AD. mutation in Merlin 22q 12. P
D/F	Ophthalmic Manif Pulsatile Exo. Eyelid NF Conj/Sclera NF Prominent Corneal Nerves C. glaucoma Lisch Nodules — Melanocytic hamartoma of iris Retinal Capillary Hemangioma R. Astrocytoma CHRP hamartoma ON glioma Choroidal hamartoma	Bilateral Vestibular Schwannomas PSC ERM Uveal Melanoma ON glioma Combined Hamartoma Systemic MNHL Seizure Neurofibromas Vertigo. Spinal Schwannomas UC Meningioma

NF1	NF2

Systemic Manifestation

- Cafe-au-lait spots
- Axillary freckles
- Inguinal freckles
- CNS Neurofibroma
- Cutaneous "
- GIT "
- scoliosis
- Learning disability
- HTN.

Dx Criteria

2 or >
- 6 or > 5mm Cafe-au-lait in prepubertal
- >15mm post "

- 2 or > NF of any type / 1 plexiform NF.
- Freckling of Axillary / Inguinal region (Crowe's sign)
- ON glioma
- 2 or > Lisch Nodules
- Distinctive Osseous lesion
- 1° rel NF1 — by abv criteria

Bil masses of 8 CN seen on CT/MRI or 1° degree rel NF2 & either
a) Unil 8 CN mass
b) 2 of foll:
- NF.
- Meningioma
- glioma
- Schwanoma
- Juvenile PSC.

Ix

CT/MRI

Rx

- Eyelid → Sx debulking
- ON glioma → Observation
- Bil Acoustic N → Stereotactic Radiotherapy

Sturge Weber Syndrome

Dermato-Oculo-neural Syndrome

facial hemangioma
Ipsilateral ophthalmos
Contralateral seizures

Leptomeningeal hemangioma (LMH)
→ hemiplegia

LMH
Choroidal hemangioma
Cutaneous Hemangioma

If no CNS
Then Port Wine stain

Only phaco → ✕ inherited
♀ = 0→

Cf

- Glaucoma
- Diffuse Choroidal Hemangioma
  L Ipsi to Nevus.
  flammeus — Tomato Ketchup fundus
- Exudative RD
- Telengiectasia of Conj & Episclera.

SM LMH.
Cutaneous H/N. flammeus/PWS 10% SWS.
V1,V2 doski
Bil N has » likelihood

Wyburn Mason Syndrome

Bonnet Dechaume Blanc Syndr
Non hereditary
R. Brain, facial Angiomas

Disturbances in embryologic develop of Vasc. Mesoderm
♀ = 0→

Cf

Racemose Hemangioma

I — Arteriovenous plexuses of Ret. Vessels
II — direct AV comm without interposition of Capillary & Reticular elements
III — Complete AV communicat"
- Associated ⊆ VL (Visual loss)

No Exudation, RD, vessels do not leak on Angio.

Systemic Ipsi Midbrain Hemangio
Spont IC bleed.
- Skin Manif

Ix FFA + Rapid transit of dye
MRI & MRA of Ipsi Orbit

Rx

Stable → No Rx
Persistent VH → Vitrectomy of choice

Ix

MRI (CE) – cerebral atrophy
LM malformation

CT Scan – Intracranial calcifications.

Rx

- Small, circumscribed Choroid Hemangioma
  - ↓ TTT
  - Argon LPC.
  - Plaque Brachy T.
  - ↓ dose Proton beam
- Diffuse Choroidal H.
  - ↓ EBRT.
  - PDT.
- Glaucoma
  - ↓ Medical Rx
- Seizure
- Nevus
  - ↓ Demo LASER
- follow up.
  Early death due to seizure

Bournville disease.

Tuberous Sclerosis

Multiple potato like (Tubers) in Brain — Intra

Multi Organ disease

2 Tx suppressor gene

TSC 1	TSC 2
↓	↓
Chr 9q 34	16p13
Hamartin	Tuberin

Angiofibroma

Epilepsy — MR

Infantile Spasm
Salaam "

Facial Angiofibroma — in malar region like butterfly involving chin — Adenoma sebaceum

→ Ash leaf spots — earliest finding

→ Shagreen patches — fibromatous Infiltrat^{n} of Eyelid & lumbar region

VHL

predilection for CNS & Retina
CNS Hemangioblastomas
Retinal Capillary Hemangioma

AD — VHL gene — Chr 3p25-26

↓

codes a.a protein that targets Hypoxia Inducible factors for degradation

↓

If pVHL absent — VEGF ↑

♀ = 0 →

20-25yrs Median Age

Retinal Angioma
Vail's classification

↳ Stage I → early & dilation of feeding artery & draining vein & Angioma formation

↳ Stage II — Develop^{n} of Hmrg & exudation

↳ Stage III — Massive Exu. + RD.

↳ Stage IV — Uveitis, absolute glaucoma, loss of eye

T8

c/f

Ophthalmic

Angiofibromas of eyelids
Retinal hamartoma / Astrocytoma

1	2	3
flat	Elevated	- Transitional lesion b/t Type 1/2.
Smooth	Multinodular	
Non Calcified.	Calcified.	
Grey	Opaque-like mulberry	
Semi Transparent		

- SRF
- Lipid exudates
- Strabismus
- SRD.
- V+H.
- Papilledema
- Punched out CR hypopig
- Colobama of Iris/Retd
- Sector iris depig

Systemic

Infantile Spasm
Adenoma Sebaceum ✓
Ash leaf spots ✓
Shagreen patches ✓
Sublingual fibroma
Benign Cardiac Rhabdomyoma
- Angiolipoma of Kidn
- Renal Cyst
- Pulmonary fibrosis
- Subpleural Cysts

Major	Minor		
Angiofibroma.	- pits in dental Enamel	Definite	2/1+2
Periungual F.	- H. Rectal polyps	Probable	1+1
Hypomelanotic M.	- Bone Cysts		
Shagreen patch.	- Cerebral white matter Migration lines	Possible	1/2
Multiple R. Nod. H			
Cortical tuber	- Gingival fibroma		
Subependymal Nodule	- Non Renal H.		
2. giant Cell A.	- Confetti Skin lesion		

VHL

classmate
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Classify RCH

- Retinal distribution
  - Peripheral
  - Juxta papillary
- Morphology
  - Exophytic
  - Endo
  - Sessile
- Effects on retina
  - Exudative
  - VR.
- Systemic features.

\+ VHL −

VHL types

I

Type I

- Retinal Hemangioblastomas
- CNS "
- RCC
- Pancreatic Neoplasm

2a
- Pheochromocytoma
- R. Hemo.
- CNS H.

Type II

2b
- PC.
- RH.
- RCC
- P. Neop.

2c
- PC only

Dx criteria of VHL

\+
- RCH
- CNS H
- Visceral lesion
  - Renal cyst
  - PCheomo.
  - Pancreatic C

−
- 2 or > CH.
- 2 or > CNS hemang.

D.D

RB.
Choroiditis — 2° to toxocara
OD Dawson
Coat's disease
Myelinated NF.

Coat's dis
Racemose H.
PAM.
VPRT
RPE Adenoma
Uveal Melanoma

Ix

Wood's UV light
EEG. — Abn Hypsarrhythmic pattern
Xray | CT | MRI — Calcification
Involv periventri Basal ganglia
USG
FFA — Type 2, 3 — AF

Arterial early filling

Venous dilated Capillary loop & MA. | Rx

screening protocol

Urinary Catecholamine		1yr
Fundus		1yr
FFA		x Doubtful
Enh MRI B/S	11-60	2yrs
	>60	3-5yrs
Abd USG		1yr.
CT		4-2yrs

- Genetic Counselling
- Laser PC
- PDT
- Vitrectomy

Observe — Angioma < 500μ
LPC → >0.5mm.
TTT
PDT — Juxta, peripheral
Photopsychin derivative Rx.
Cryo — Tx > 3mm.
Plaque Radio — Tx > 4-5mm
EBRT.
Proton beam RT
PPV
Enucleation.

classmate
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Dd of Retinal Macrocysts

fluid filled

Classificat" by Kischel

- Small: upto 1mm
- Medium & Isolated: 4-8DD
- Giant: 8-10DD
- Large: Retinoschisis

D.D

- Post Uveitis.
- Subretinal abscess
- Retinoschisis
- Malignant Melanoma
- Circumscribed Choroidal Hemangioma

Macrocyst	vs	Retinoschisis
		IT Quad +
	Hypermetropia	+
	B/L	+
-	Vasc sheathing	
	White spots	
+ glistening	Retinal hole	+

Malig Melanoma - dome shaped mass c collar stud appearance
2° RD away from summit of Tx mass
High surface reflectivity
↓ to moderate Internal reflectivity
Acoustic Hollowing with ↓ Kappa
Choroidal Excavatn

Circumscribed Choroidal hemangioma →
- Non homogenous choroidal mass lesion
- ↑ surface reflectivity
- Moderate to high internal reflectivity
- 2° RD

Subretinal Abscess → Well defined.
Dome shaped
elevated mass lesion
↑ surface reflectivity
Mod - ↑ internal "
localized hypoechoic area of subtenon space
widening noticed

Post Scleritis → - lesion ⊆ ↑ surface reflectivity
- Regular ↑ internal reflective site at scleral level
→ localized ↑ in Subtenon space

Amino Acid Metab.

- Albinism
- Cystinosis
- Homocystinuria
- Hyperornithinemia

Lysosomal storage disease

- Mucopolysaccharidosis

Lysosomal Enzyme Phosphorylation

Mucolipidosis I-IV

Glycoprotein degradat^n & str.

Fucosidosis
Sialidosis I, II

Inborn Metabolic disorders

Abn in Vit Metab

Congenital CH_3 malonic aciduria & homocystinuria

Lipid Metab

Niemann Pick dis
Fabry
Gaucher
Metachromatic Leuko dystrophy
Krabbe's
Wolman
Farber lipogranulomatosis

Gangliosidosis

Gen. gangliosidosis
Galactosialidosis
GM_2 gangliosidoses

Mucolipidosis

- Menke's
- Neuronal Ceroid Lipofuscinoses

Carbohydrate Metab

- Von Gierke's disease

Lipoprotein & Lipid disorder

- Bassen Kornzweig Syndrome
- Refsum Disease

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Syndromes Involving Retina

Chondrodysplasia ass ⊆ VR deg

- Stickler
- Marshall
- Kneist
- Knobloch
- WZ

Ciliopathies – Novel Systemic Retinal dystrophy

- Bardet Biedl
- Alstrom
- MORM.
- Senior Loken.
- Joubert.
- Jeune.

Syndrome ⊆ RP.

- Usher
- Bardet Biedl
- Joubert
- Jeune
- Alport
- Kearns Sayre.
- Cohen
- Cockayne.
- Methylmalonic
- ABeta
- Cystinosis
- Mps
- Refsum

Retinal deg + Ectodermal Spectrum

- Hypotrichosis ⊆ juvenile Macular
- Jalili Syn.
- Oliver MC Farlane Syndrome

Gyrate atrophy of Choroid & Retina.

Hyperornithinemia

Rare AR

Metabolic, retinal & choroidal deg → caused by defi of enz pyridoxal PO_4 dependent — mitochondrial Ornithine - δ- Aminotransferase — 10q26

All body fluids — 10-20 * levels of Ornithine

Excessive ornithine → Retinal thinning

Systemic features → Mild mal Weakness — tubular aggregate in type 2 mal fibres

Fine straight hairs ⊆ patches of Alopecia

EEG → slow wave background changes

Peripheral neuropathy ✓

Hearing loss +

Ocular features → Night blindness, Myopia, multiple round Islands of peripheral chorioretinal deg

Night blindness → Late childhood

Atrophic area — progress to PP → eventually affect central vision.

Symmetrical affection

Pt has myopia (may be upto 20D)

Zone of pigmentary changes b/t Normal & atrophic areas

ERG → ↓ rod & Cones responses (Rods » affected in early phase)

Dark adapted ERG → ↑ rod thresholds

Swollen Mitochondria in PR.

Corneal epi

Non pig/ Ciliary epi

Macular Edema

PSC

Rx by A·A tablets.

↓ protein diet ⊆ limited fruit & Veg

Albinism

Heterogenous group of hypomelanotic disorders based on melanin pigment.

Inheritable metabolic disorders of

- Ocular.
- Oculocutaneous
  - Tyrosine +ve
  - Tyrosinase -ve

Ocular

- (N) Hair skin
- Hypopig macule + XL & AR
- ↓ caudice - 1/2 iris translucency
- Macular stippling mid peripheral depig & granularity

Tyrosine -ve. (complete)

- White hair
- Pale skin
- AR
- < 6/60 – foveal Hypoplasia
- Nystagmus - Pendular & horizontal
- ↑ Bright light
- Iris – diaphanous & translucent
- Pink eyed.

Tyrosin +ve (Incomplete)

- Variable amt of melanin
- Hair & skin darken ≤ Age
- AR inheritance

fundus – ↓ pig, large choroidal vessels. foveal hypoplasia + absence of foveal pit

OChiasm → ↓ Uncrossed fibres

VA + Angle Kappa. Squint, No stereopsis

Ass dis

- Chediak Higashi
- Hermansky Pudlak
- Waardenburg Syndrome

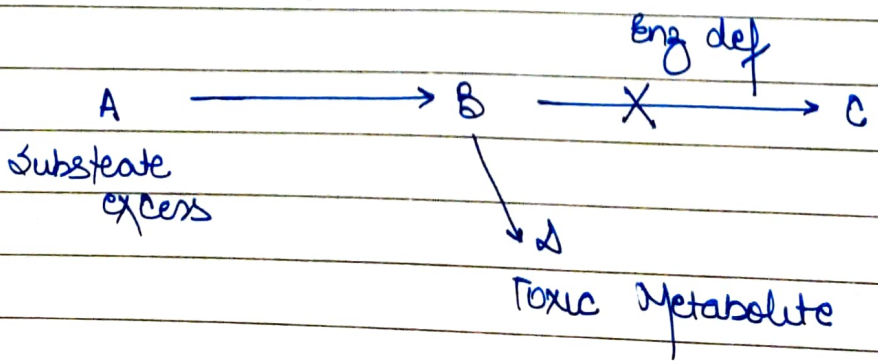
Dx — Hair bulb assay — status of T. activity
Genetic Sequence Analysis
Amniocentesis 16-18wk
HPS is suspected — BT, Platelet test
CHS — PMN fxn evaluate

Rx
Low Vision Aids — Need glasses
Biopts
Tinted glasses
Wearing Cap & Visor.

Strabismus — start patching at 6mth

Nitisinone — Hereditary Tyrosinemia type I
↓
↑ plasma tyrosine levels
↓
↑ eye & hair pigmentation

Garrod's hypothesis



Anti VEGF

VEGF → 7 families VEGF A-F, PlGF.

VEGF A — Dalal Angiogenesis

6 minor

6 May

121, 145, 165, 183, 189, 206

VEGF 165 —MMP / plasmin→ VEGF 110

VEGF

B

Coronary B.V growth

C, D

Lymphangiogenesis

VEGFR-3.

VEGFA → VEGFR2 ⇒ DR.

PlGF

VEGFR

1 — more affinity — A, B — PlGF — VEGFR1

Embryo → Angiogenesis

Adulthood → dampen VEGF activity

2 — A, C — via MAPK → endothelial cell activation

3 — C, D, E, F

HIF (Hypoxia inducible factor)

↓ stimulate

VEGFR 1,2

VEGF

↑

Starvation

Several metabolic factors

RAS

VEGF A → Neutrophils 1,2 (presents VEGF 165, VEGFR2.)

VEGF degraded Blood Retinal Barrier in Venules not Capillaries.

VEGF A → monocyte chemotaxis

ICAM 1 → allow NT cell

→ Vasc Endothelial cell.

	~~Pegatinib~~ Aflibercept	Bevacizumab	~~Ranizumab~~ Pegatanib	~~Aflibercept~~ Ranizumab
Description	fusion protein & recep seg bound to fc frag of IgG1	Recombinant humanized murine Ab to VEGF-A	Pegylated aptamer (modified RNA frag)	Recombinant, humanized, murine Ab fragment to VEGF-A
Molec Wt	115	149	50	48
Isoforms	VEGF A, B, PGF	VEGF A	165	A
Binding affinity for VEGF165	0.5	58 - 1000	46 - 192	50
Intravitreal ½ life	9	9.8	7	7.1
Serum ½ life	6	21	0.2	2-4

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Aflibercept

VEGF Trap eye
Recombinant, high affinity, soluble, decoy recep molecule
2nd & 3rd Ig binding domain frm VEGFR1 & 2nd binding domain frm VEGFR2 fused to constant region Fc of human IgG1 molec
- All forms of VEGF A, B, PlGF
- Composed entirely of human a.a sequence
- ↑ affinity for VEGF 165 PlGF2 — 2 fused dimer of VEGF dimer

block VEGFA induced activat^n of VEGFR 1,2 in human endothelial cells & greater potency than Bevaci/R
block VEGFA & PlGF

Bevacizumab

humanized recombinant murine derived monoclonal Ab that binds all forms of VEGFA.

for systemic solid Tx
Othr side effects >

BOLT study
PACORES
SRCR net. Phase II trials

↓ OD NeoVasc
Adjuvants to improve Sx outcomes → ↓ Intraop. hmrg, ↓ Post op VH.
facilitate fibrovasc Membr dissection
◎ migration, tube formatn

Issues VEGFR2 phosp
- Unfav safety profile
- Limited efficacy
- Unable to cross Inner R.
- ↑ acute IO Inflammatn
- ↑ Systemic side effects

Pegatinib

Modified RNA fragment of Aptamer that attaches to heparin binding domain of VEGF 165.

Pegylatn → ↑ drug binding affinity & stability by protecting it against endonucleases

No Pan VEGF suppression
Only attaches on diffusible VEGF 165 not on 121 as fibrin split 110.
) ↓ VEGF binding to neuropilin-1
) Retains VEGF receptor binding site
↓ endothelial cell prolif
↓ VEGF mediated Vasc permeability

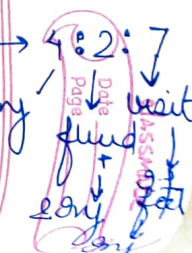
Ranibizumab.

Binds all isoform of VEGF-A.
affinity for VEGF165 - 5-20 *

Affinity enhanced humanized single bindn site Ab fragment-mab created

↓ VEGF mediated proliferation of human vascular endothelial cells (HUVAC)
- ↓ Endothelial cell ◎ apoptosis
- ↓ prolif, migrat^n & assembly in Vasc Str

Read,
Rise, Rule.
Protocol I → 4:2:7
Resolve
Restore
Retain
in PDR



Excute study
Ladder trial -
for port delivery system.

ROP

Phase I

↓

Hyperoxia

↓

delayed Retinal Vascular growth

↓

Apoptosis
Capillary Regression

Both - 30-31wk of gestation

II

↓

Hypoxic

↓

VEGF over stimulation

↓

Abn. vessel formation
fibrovasc proliferation

31-32wk, arrived

VISION LEVEL trial

Laser in ROP ⇒ Myopia

↓

Incomplete become vitreous mφ are second source of VEGF.

BEAT - ROP.

SANA
BOLT

Induced migration of endothelial cells

DA VINCI
UVID - USTA

Broculizumab

single chain Ab fragment VEGF A

6mg/0.05ml

» Dosing than other

Small size penetrate choroid easily

Trials

Phase I

Phase II

↓

OSPREY

Phase III

|

Hawk & Harrier

Macular fxn tests

Physiological | Electrophysiological

Physiological

- Visual acuity
- Papillary fxn
- Photostress test
- Amsler grid
- 2 pt discrimination test
- Entoptic phenomenon
- Test dependent on Macular pigment.
- Maddox rod test
- Colour Vision
- Foveal flicker sensitivity
- Grating psychophysics
- Dark adaptations
- Nicoperimetry

Electrophysiologic tests → ERG, EOG, VER.

clear Media

Test

Opaque Medium

- Maddox Rod
- VEP
- ERG
- Entoptic ph
- Laser interferometry
- Potential acuity meter

PIH & Eye

- Mild PIH
  - 140/90
  - returns to normal by 12 wks post partum
- Pre eclampsia
  - HTN on 2 occasion L 4 hrs apart
  - Proteinuria = 300mg/24hrs
  - Edema
- Eclampsia
  - Convulsions

Fundus changes

- Spastic stage
  - spasm of R. arterioles
  - A. spasm superimposed on A. sclerosis
  - AV crossing changes — Gunn sign, Bonnet Salu sign
  - generalized straightenn & attenuation of R. arterioles
  - Tearducency of vessel wall
  - Vascular reflex — Ag, Cu
  - sheathn of vessel
  - Aneurysm
  - Edema
  - RH
  - Exudate
  - Papilloedema
  - RD
- Stage of Sclerosis
  - Choroidal changes
- Stage of Retinopathy

Eyelid – Blepharophosis
Ptosis

Conj – Subconj Hmg

Cornea – Curvature ↑
↓ Sensations

Aq Humour dynamics – ↓ IOP

Pupil – Mydriasis, Nystagmus
Lens
Amaurosis

Angoid Streaks

Crack like dehiscences in brittle thickened & calcified Bruch Memb

↓

Atrophy of overlying RPE

Systemic Association

- Pseudoxanthoma elasticum (PXE)
  - Gronblad Strandberg Syndrome
  - Plucked chicken appearance of skin
- Ehlers Danlos Syndrome
  - Type 6 Collagen
- Paget disease
- Hemoglobinopathies
  - ↓
  - Due to Iron deposition
- Mucal other ass

Signs

Grey / dark red lesion ⊆ irregular edges radiating peripapillary.

↑ in size ⊆ Age

Peau d orange — Leopard skin
yellow speckles

DD drusen

Scleral depression — c/I.

Complication

Asymptomatic | CNV | Choroidal rupture | Foveal involvement

- Red free photo

- FA

window defect | FA ↑↑ CNV +nt

- FAF — Autofluorescence

℞

Observation | Anti VEGF

Aniridia

Rare, bilateral absence of iris

Epid

3 phenotypes

- AD → M.C
- Congenital sporadic → Wilm's Tx (Nephroblastoma)
- AR → Gillespie Syndrome (Cerebellar ataxia + MR)

If MR → Miller syndrome

WAGR syndrome (deletion of short arm of chr 11)

Hereditary Aniridia
└ ass ⊆ PAX6 gene

Pathogenesis

- Type of Coloboma
- Development theories

Strands of iris → Contracture → ACG.
↘ Gonidysgenesis

50% Aniridia — Glaucoma.

Ocular Manifestation

Photophobia & extent of iris involved
Pendular Nystagmus
↓ Vision
Amblyopia.
Strabismus
Bil ptosis
Rudimentary iris leaflet

foveal, ONH hypoplasia
Chorioidal coloboma.

Lenticular changes
↓
Cataract.
Ectopia lentis
Nuclophakia.
PPM

Corneal changes
↓
Microcornea.
Corneal opacification

Systemic Manifestation

WAGR.

Miller Syndrome

Gillespie Syndrome

Pathology → Arrestment of Neuroectodermal tissue

Rx → Prophylactic modified gonioatomy
Rx of glaucoma

Artery Occlusions

CRAO

- CRAO 57%
- BRAO 38%
- Ciliioretinal artery 5%

CRAO ⇓ Worst prognosis

BRAO & Ciliioretinal artery → better

Epid

1/10,000

Any age » 7decade

♂ > ♀

Rt = Lt

Bil = 1-2%

Systemic factors → HTN, DM, GCA, Lipid disorders, Cardiac Valvular dis

Etio

- Embolic → >50
- Thrombotic → young
- Vasculitic
- Vasospastic

SNHL

Susac Syn.

RAO . Encephalopathy

Embolism	Thrombosis	Vasculitic
Elderly	Virchow Triad	GCA
a) Atherosclerosis 80% CEI	Cigarette Beg, OCP Trauma, Malig	SLE, RA, Behcet
b) Heart & Major BV → Valvular abn	+ve family H/O of Thr. in young	
	Other Condition Leiden factor etc	

Types

- Cholesterol → Common
- Ca^{2+}
- fibrin

Site

- Level of lamina.
- Bifurcation of artery

CRAO

Cf

Sudden painless profound loss of vision

<3/60

Amaurosis fugax

RAPD +

Retinal edema.

Cherry red spot

Attenuated arteries with Box Caring

25% patent cilioretinal artery

OA Bloc

of no PL

ON dam

Cholesterol > Smaller

Ca^{2+} > Common size

yellow glistening ↓ Hollenhorst plaque

Carotid artery, Aortic arch, OA

Arise — Cardiac Valves

Over time

opacification resolves ↓

Pale disc
Narrow Retinal vessels
Atrophic retina
x Pigmentary changes

NVG — Most devastating

CRAO: 8-9 wk, 2-16%

CRVO: 5 mth

Ix

Fundus findings

FFA — Delay filling of retinal circulation ⟹ OA obstruction
If Choroidal also

Systemic Exam — Pulse, CVS

BRAO

6/6 – 3/60
∝ Nasal, temp
∝ foveal involvement

RAPD ∝ retina extent

Localized retinal edema +

Nasal → asymptomatic
May not be detected

FFA – delayed transit of dye through affected vessels & retrograde filling of vessels

80% → better 6/12
VF loss persist
fundus – near Normal

Clio Retinal artery Occlusion → 3PCA 30% eyes

Isolated 40% | + NI CRVO 40% | AION 15%

Isolated + NI CRVO → good Prog

AION → Poor

Subtle pericentral scotoma
x RAPD
Retinal edema over CRA distribution

(*) diff CRAO & OA occlusion.

℞

Systemic Work up.

Acute episode ℞

Sequelae ℞

a) Work up for associated systemic. Condition. to establis

etiology.

HTN
DM

Colour Doppler — Caeotid status
TT | TE || Echo — Cardiac status

ESR, CRP — GCA
CBC, platelet Count

Other HyperCoagulable states work up.

- AntiCoagulation
- Anti platelet
- Caeotid endarterec

Acute episode

↓ IOP — Apra
Timol 0.5
Aceta i.v 500m

Digital Ocular Massage —
Adoption of supine posture
AC paracentesis

Medical Vasodilatn
- Carbogen
- Rebreathing bag
- Sublingual NTG
- CCBs

Fibrinolytic ℞

Only 16% fibrin emboli

℞

└ Vitrectomy ± Cannulatn of CRA
└ Laser photodisruption of embolus (Nd YAG)

GCA

↑ dose steroid

classmate
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Page

% of NVG

Laser
Cryo
Gas

Trials in CRAO.

Eagle study

Intra-arterial fibrinolysis ≤ IPA.
Vs Obs in pt ≤ NA. CRAO

⇓

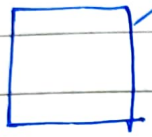
No use.

Amsler grid

20° of visual field

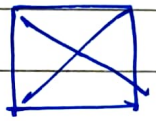
→ Screening Macular Disease
→ Central Scotoma
→ CNV pt at home.

7 Charts

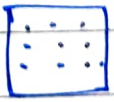


400 smaller
5 mm
1/3 m ⟶ Angle 1°

Chart 1 — White on black

2 —  Diagonal line
aids fixation for central scotoma

3 — Red on Black
Long λ stimulate
∴ subtle colour scotomas
L ↓ON, ON, chiasmal lesions

4 — Only dots 
diff scotoma 4m Metamorphopsia

5 — horizontal lines
- Metamorphopsia along specific meridian.
Diff in Reading

6 White background



Closer lines

7 Central grid — ½° L.

→ No dilation
Presbyopic Correction worn if req.