Disclaimer

- I have no financial interests in this lecture or any information discussed therein
Objectives

- Fluorescein Angiogram
  - Dynamic imaging of the retina vs. OCT/Fundus Photo snapshot

- Retinal red flags
  - Warning signs for vision loss and mortality
Retinal Vascular Occlusions
Epidemiology

- ~1 per 10,000 outpatient visits in tertiary eye centers
- Mean age 60yo
- M>F
Pathophysiology

- **Ophthalmic Artery:** 1\textsuperscript{st} branch of Internal Carotid
  - 15-20 Short posterior ciliary arteries from ophthalmic artery supply choroid
    - Cilioretinal artery – derived from short ciliary arteries, found in 15\% of individuals

- **Central Retinal Artery (CRA):** 1\textsuperscript{st} branch of Ophthalmic Artery
- **CRA =** blood supply to inner retina
Pathophysiology

- Arterial Occlusion:
  - Emboli Endogenous
    - Cholesterol (Hollenhorst) – ulcerated atheromatous plaques in the carotid
    - Calcific – derived from cardiac valves
    - Platelet/fibrin
    - Septic
    - Cardiac Tumor
    - Fat
    - Leukoemboli
    - Amniotic fluid
Pathophysiology

 Emboli Exogenous
  • Talc/IVDA
  • Platelet – IV blood transfusion
  • Iatrogenic fragments – catheter tips
  • Nasal/periorbital steroids injections
Thrombosis – Acquired Coagulopathies
Prepapillary arterial loops
Nocturnal hypotension – poor perfusion pressure of CRA
Vasospasm
Direct compression – trauma, retrobulbar
Elevated IOP
Central Retinal Artery Occlusion

- Initial Va is CF to LP
  - NLP is uncommon sugg. Choroidal compromise

**NLP without cherry-red spot, consider ophthalmic artery occlusion**

- Higher incidence of GCA

- Emboli are visible in 25% of cases
  - Presence assoc. with increased CV disease mortality
A/C: Normal except APD

Fundus: Retinal whitening, cherry red spot (no inner retinal neurons, intact blood supply)

2-6 weeks subtle findings

Visual prognosis guarded, unless cilioretinal artery includes fovea = 20/50
Central Retinal Artery Occlusion

- Giant Cell Arteritis: 2-10%
  - Can become bilateral within hours/days
  - Headache, malaise, jaw claudication, nausea, fever, etc
  - CBC, CRP, ESR, Fibrinogen

- Most common cause of death: MI
  - 9 yr mortality rate 56% compared to 17% in age-matched controls

- Higher risk of CVA
CRAO with Cilioretinal Artery Sparing
Cilioretinal Artery Occlusion
BRAO

- Lower survivorship than CRAO
  - 80% maintain 20/40 or better
  - Temporal vessels more often afflicted

- GCA rare because vessels too small
Retinal Artery Occlusion (RAO)

- 15% of CRAO will develop NVI
- NVD only occurs in about 2-3% of cases.
- Only 1% of BRAO will develop NVI

IVFA:
- Delayed arterial filling (most specific finding)
- Delayed A-V transit (most sensitive finding)
Diagnostic Recommendations

- **Echocardiography**
  - High Cardiac embolus risk; All young pts

- **Carotid Ultrasonography**
  - All adult pts regardless of embolus risk

- **Homocysteine Levels**
  - Young pts with no identifiable cause

- **ESR, CRP, Fibrinogen**
  - Over 55 yo with reasonable suspicion

- **Coagulation Studies**
  - Young patients or secondary screen in older patients
Retinal Artery Occlusion (RAO)

- Irreversible damage occurs at 90 minutes

- Possible early treatment
  (Estimated benefit ~1/4 Snellen line…)
  - Ocular massage
  - Breathing 95% O2/ 5% CO2
  - AC paracentesis/IOP lowering
Central Retinal Vein Occlusion

70% non-ischemic (low-risk NV)
- Va >20/200
- 5-20% convert to ischemic
- 83% indeterminate convert over 4 months
- 34% perfused CRVO convert over 3 years

Ischemic
- Va ~CF, +RAPD
- >10CWS, >10 DD Non-perfusion
- High-risk NVA/NVI
- Low-risk NVE/NVD
Systemic Considerations

- HTN, DM, Homocysteinuria
- Hyperviscosity syndromes (hypergammaglobulinemia, etc)
- Hyperviscosity states (Malignancy, Nephrotic syndrome, Chronic lung dz, Syphilis, OCP)
CRVO Management

- Follow closely for NVI/NVA/NVG
  - Gonioscopy monthly in early

- PRP once neovascularization develops

- CME
  - Anti-VEGF
  - Corticosteroids
BRVO

- Arteriole compression leads to thrombus formation and leakage from capillary beds
  1. HRVO (Before 1\textsuperscript{st} bifurcation)
  2. Intermediate (MC) (After 1\textsuperscript{st} bifurcation)
  3. Twig (Macular area only)
BRVO

- Non-Ischemic (70-80%):
  - Treat macular edema with Va <20/40

- Ischemic: <20/200; 5DD nonperfusion
  - NVI/NVA rare | NVD/NVE common

- HRVO – behaves like BRVO
BRVO Management

- Follow monthly until heme resolves
- Monitor q4-6 mos for next 3 years
- 50% Va >20/40
- CME
  - Anti-VEGF
  - Laser
  - Steroid
Non-perfusion

Dye Leakage
Combined Artery/Vein Occlusion
- Retinal whitening
- Cherry Red Spot
- Dilated/Tortuous Vessels
- Scattered IRH
- Optic Disc edema
- Marked capillary non-perfusion
- Nvi/nvg in 81% of eyes
Pulsations in CRA corresponding to systole and diastole

Small study showed 5 of 10 patients with combined CRVO/CRA Occlusion showed pulsations with FA

Ocular Ischemic Syndrome

- **Symptoms**
  - Diminished vision in bright lights
  - Chronic Eye Pain
  - Progressive vision loss

- **Findings**
  - Dilated NON-tortuous veins
  - Mid-peripheral dot-blot heme
  - CME, CWS, +/- Cherry red spot
  - 33% NVD/NVE
  - 90% NVI and CF vision within 1 year
Ocular Ischemic Syndrome

- Other ocular findings
  - Corneal edema
  - Unilateral red eye
  - Hypotony

- Rule out GCA
OIS vs CRVO or DR

Vs. CRVO
- CRVO has tortuousity
- Patchy non-confluent heme in OIS

Vs. DR
- DR is symmetric
- Exudates rare in OIS
Diabetic Retinopathy
Diabetic Retinopathy

- Importance of IVFA
  - Macular perfusion
    - Guides therapy (Laser vs. No Laser)
    - Guides prognosis
  - Peripheral non-perfusion
    - Chronic macular edema
    - Retinal neovascularization
    - NVI/NVA/NVG
Severe capillary nonperfusion

“Macular Ischemia”
Hypertensive Retinopathy
Hypertensive Retinopathy

- Retinal arteriole damage
  - Diffuse or focal vasospasm
  - Arteriosclerosis (thickening of the vessel wall)

- Fibrinoid necrosis of the choroid
Retinal Macroaneurysm (RMA)
RMA

- 75% associated with HTN
- Arise within 1st three bifurcations
- Spontaneous thrombosis of aneurysm can occur
- Typically female >60yo
- Bleeding can occur at all 3 levels
RMA Management

- Observe

- Chronic exudation
  - Laser

- Hemorrhage
  - YAG/hyaloidotomy
  - Surgical evacuation
Clinical Findings

- Nonproliferative retinal changes
  - Venous tortuosity
  - Salmon-Patch hemorrhage
  - Black Sunburst

- Proliferative retinal changes (SC dz)
  - S1: Peripheral arteriolar occlusion
  - S2: A-V anastomosis
  - S3: NV proliferation
  - S4: Vitreous hemorrhage
  - S5: Retinal Detachment
Sickle Cell Retinopathy
Sickle Cell Retinopathy
Management

- Observation
- Cryotherapy
- Photocoagulation (Feeder vessel, Scatter)
- Avoid Scleral Buckle – 71% ant segment ischemia
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