Diabetic Retinopathy
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Introduction

I. Diabetic Retinopathy (DR) is the leading cause of blindness in the US in working age adults.
II. Prevalence of all types of DR increases with duration of diabetes and patient’s age.
III. DR is rare in children less than 10, regardless of how they have had it.
Wisconsin Epidemiologic Study
- Duration of diabetes was directly associated with an increased prevalence of DR in both type I and II DM.
- After 20 years, 99% of patients with type I and 60% of patients with type II had some degree of retinopathy, regardless of A1C.
Pathology

- Loss of pericytes and basement membrane thickening leads to capillary occlusion and retinal non-perfusion
- Decompensation of the endothelial barrier function that leads to leakage and retinal edema
NPDR and PDR

- **Classification:**
  - Non-proliferative diabetic retinopathy (NPDR)
    - Mild, moderate, severe
  - Proliferative diabetic retinopathy (PDR)
    - Early, high-risk or advanced
NPDR and PDR

Non-proliferative diabetic retinopathy
- Aneurysm
- Hard exudate
- Hemorrhage

Proliferative diabetic retinopathy
- Growth of abnormal blood vessels
- Loss of vision from:
  - Macular edema (NPDR)- MOST COMMON
  - Macular ischemia (NPDR)
  - Ischemia-induced neovascularization (PDR)
  - Non-clearing vitreous hemorrhage (PDR)
  - Tractional retinal detachment (PDR)
NPDR

- NPDR
  - Microaneurysms
  - Capillary non-perfusion
  - Infarcts of the nerve fiber layer
  - Dot and blot hemorrhages
  - Retinal edema
  - Hard exudates (lipid deposits)
  - Dilation and beading of retinal veins
NPDR
Macular Edema

- Diabetic macular edema (DME):
  - Macular thickening from leakage near the foveal center that can lead to visual decline
  - OCT (Optical Coherence Tomography) used to quantify the amount of leakage
  - Fluorescein Angiogram (FA) to pinpoint the area of capillary leakage
DME
DME on OCT
Treatment

- Diabetic macular edema (other than ocular treatment):
  - Optimal systemic control of blood sugar, blood pressure and lipid parameters
  - Treatment of anemia (causing relative tissue hypoxia)
  - Treatment of sleep apnea (causes hypoxemia and blood pressure oscillations)
  - Rosiglitazone may cause or worsen macular edema especially if nephropathy or CHF (reversible)
- Diabetic macular edema treatment:
  - Focal laser photocoagulation (EDTRS study-1985)
    - Laser patches over the leaky vessels
  - Intravitreal injection of Anti-VEGF (initially monthly)
    - VEGF is a cytokine that mediates increased vascular hyperpermeability
    - Increased levels of VEGF exist in DME
    - Avastin $\
    - Lucentis $$$
    - Eyelea- $$$- shown to potentially work the best
  - Intravitreal injection of steroid
    - Anti-inflammatory and also inhibits the expression of VEGF
- Side effects of treatment:
  - Focal Laser
    - Laser scar spread
    - Breaks in the back layer leading to possible neovascularization
  - Anti-VEGF
    - Theoretic systemic thromboembolic events?
    - Recent meta-analysis concluded that it was not associated with significant increases in CV or hemorrhagic events
  - Steroids
    - Cataractogenic
    - Steroid-induced glaucoma

- *Intravitreal injection side effects of endophthalmitis and retinal detachment*
Treatment

- Anti-VEGF vs Steroid?
  - Anti-VEGF
    - Acute DME
      - More VEGF associated hyperpermeability
  - Phakic
    - History of glaucoma
- Steroid:
  - Chronic DME
    - Higher non-VEGF cytokines and more chronic inflammation
  - Pseudophakic
    - No history of glaucoma
- PDR
  - Preceded by retinal ischemia from severe NPDR
  - Patients with PDR are at increased risk of heart attack, stroke, diabetic nephropathy, amputation and death
  - New blood vessels growth that can lead to bleeding or even retinal detachment
Treatment

- Treatment of PDR
  - Medical:
    - Treatment of hypertension
    - Treatment of asymmetric carotid artery disease
      (increased ocular ischemia)
    - Good glycemic control (Diabetes Control and
      Complications Trial (DCCT))
      - Intensive blood sugar control with a HgbA1C of
        7% or below reduced the risk of retinopathy by
        76% and slowed progression by 54%
Treatment

- Treatment of PDR
  - Laser:
    - Scatter laser pan-retinal photocoagulation (PRP)
      - 1200+, 500 micron burns
      - Regression of existing neovascular tissue
  - Anti-VEGF:
    - Regression of neovascularization
    - Usually followed by PRP for long term control
  - Surgical:
    - Vitrectomy for a non-clearing vitreous hemorrhage
    - Repair tractional retinal detachment
Treatment
Follow-Up

- **First Diabetic Exam Based on Age:**
  - **0-30:**
    - Within 5 years of diagnosis, then annually if no retinopathy
  - **31+**
    - Upon diagnosis, then annually if no retinopathy
Follow-Up:

- No retinopathy
  - Annual
- Mild NPDR
  - 9 months
- Moderate NPDR
  - 6 months
- Severe NPDR
  - 2-4 months
- CSME
  - 2-4 months (retinal referral)
- PDR
  - 2-4 months (retinal referral)
DM in Pregnancy

- Diabetes in Pregnancy (NOT gestational diabetes)
  - Worsening of retinopathy
  - Some regression of retinopathy after pregnancy
  - Follow-Up:
    - Before conception or early in first trimester
    - After that, every 1-3 months or at discretion of ophthalmologist depending on degree of retinopathy
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Other complications

- Neovascular glaucoma
  - Patients with PDR may develop new blood vessels in the trabecular meshwork leading to blockage and elevation of IOP. Treated with anti-VEGF and surgery if needed.

- Cataracts
- Poor corneal epithelial healing
- Optic nerve swelling (diabetic papillitis)
- Fluctuations in vision
  - With elevated glucose, the lens swells due to the osmotic gradient causing temporary fluctuations in vision.
Complications
HEDIS

- HEDIS measurements:
- The Healthcare Effectiveness Data and Information Set (HEDIS) is a tool used by more than 90% of America’s health plans to measure performance of the doctors and their health systems they work for.
- HEDIS requires that every diabetic receives a diabetic eye exam every year
- In order to meet these requirements, the primary care physician not only has to send the referral, but also must get proof that the patient is seen
Glaucoma
Glaucoma

- **Definition:**
  - Group of diseases that have in common a characteristic of optic neuropathy with associated visual function loss
  - Intraocular pressure (IOP) is one of the primary risk factors but does not define the disease.
  - Regardless of IOP, the presence is defined by optic neuropathy with excavation of the optic nerve (cupping) and characteristic visual field defects.
- **Types:**
  - Primary open angle (POAG)
    - MOST COMMON
  - Normal tension (NTG)
  - Acute angle closure (ACG)/Narrow Angle Glaucoma
  - Chronic angle closure (CACG)
  - Pseudoexfoliation syndrome (PXF)
  - Pigment Dispersion syndrome (PDS)
  - Steroid-Induced Neovascular
  - Hemolytic or Ghost Cell
  - Angle recession
  - Etc., etc., etc.,
Types

- **POAG:**
  - Chronic, slowly progressive optic neuropathy with characteristic patterns of optic nerve damage and visual field loss.
  - No contributing factors
  - Risk Factors:
    - Family history, advanced age, decreased central corneal thickness (CCT), race
    - Usually bilateral, but can be asymmetric
    - Central visual acuity not detected until late in the disease so can be difficult to diagnose initially.
  - Diagnosed by a combination of tests and findings
  - Exact cause unknown
  - Diseases associated with POAG: myopia, DM, CVD, retinal vein occlusion
Types

Testing:
- Visual Field
- CCT
- OCT of the Nerve Fiber Layer and Ganglion Cell Layer
- Gonioscopy
- +/- Diopsys
- IOP (“normal” 12-21)
Visual Field
Applanation
Gonioscopy
Treatment

- Prostaglandin Analogs (Xalatan/latanoprost, Travatan, Lumigan)
  - First line
  - Low side effects (skin darkening, eyelash growth, iris color change, redness)
  - Once a day
- Beta Blocker (Timolol)
  - Cheap, qday/BID
- Alpha-2 adrenergic agonists (Alphagan P/Brimonidine)
  - BID/TID
  - redness
- Carbonic Anhydrase Inhibitors (oral Diamox, Trusopt)
- Combination (Combigan, Cosopt)
- Hyperosmotic agents (Mannitol)
Treatment:

- Lasers:
  - ALT/SLT- inflammatory changes in the trabecular meshwork that allow better drainage
  - PI (peripheral iridotomy) for angle closure
- Surgical:
  - Trabeculectomy
  - Valves
  - MIGS (minimally invasive glaucoma surgery)
    - Express shunt
    - iStent™
- American Academy of Ophthalmology Basic and Clinical Science Course: Retina and Glaucoma
- http://www.ncqa.org/hedis-quality-measurement/hedis-measures
Thank You!