I. Glaucomatous and compressive optic neuropathy: Why we can be fooled

A. Enlargement of the optic cup is nonspecific and found in more optic neuropathies than just glaucoma, specifically compressive optic neuropathy
B. Loss of nerve fiber layer, as seen clinically or by OCT imaging, also is nonspecific
C. Visual fields, used heavily in glaucoma diagnosis, are prone to fluctuation and unreliability
D. There is overlapping patient demographics for glaucoma and chiasmal compressive optic neuropathy
E. Glaucoma is diagnosed more commonly than compressive optic neuropathy
F. Non-secreting pituitary adenomas often have no overt systemic signs/symptoms
G. The cost and logistics of getting brain imaging leads to resistance in ordering

II. Brief anatomical review of the optic nerve and anterior visual pathway

A. The retinal ganglion cell axons and the optic nerve
   1. The primary neural tissue of the optic nerve is composed of the retinal ganglion cell axons
   2. The ganglion cell axons originating nasal to the optic nerve within the retina take a direct course to the optic nerve
   3. The ganglion cell axons originating temporal to the optic nerve within the retina do not all course directly to the optic nerve
   4. The ganglion cell axons originating in the central macula course directly to the temporal optic nerve (papillomacular bundle)
   5. Ganglion cell axons from other portions of the temporal retina must take an arcuate course around the papillomacular bundle and therefore enter the optic nerve at the superior and inferior poles
B. The optic nerve and the visual field
   1. The fovea sits in the center of the vertical meridian that separates the visual field into nasal and temporal hemifields
   2. The ganglion cell axons corresponding to the temporal field project to the ipsilateral optic tract
   3. The ganglion cell axons corresponding to the nasal retina cross over to the contralateral optic tract at the chiasm
   4. The retinotopic organization of the ganglion cell axons is generally preserved within the optic nerve, but as the nerve approaches the chiasm, the axons from the nasal retina begin to occupy more nasal portions of the optic nerve in preceding their chiasmal crossing
   5. After the chiasm, some of the crossed nasal fibers briefly loop into the opposite nerve before coursing back in the tract (Wilbrand’s knee)

III. Demographic overlap between glaucoma and pituitary adenoma

A. Demographics of glaucoma
   1. Primary open angle glaucoma is more common in African American and Latino populations compared to Caucasians
   2. Low tension glaucoma more common in Asian (specifically Japanese) populations compared to Caucasians
   3. In all ethnic groups, glaucoma becomes more common with increasing age
A. Demographics of pituitary adenoma
   1. Incidence of adenomas is more common in women than men until age 30 then reverses into older age groups
   2. Adenomas have been found in as high as 16-20% of autopsy studies
   3. Adenomas have been found in up to 6-8% of patients diagnosed with low tension glaucoma
   4. Pituitary adenomas are more common in African American compared to Asian and Caucasian populations
   5. Pituitary adenomas become more common with increasing age with peak incidence when glaucoma is also most common
IV. Clinical feature overlap between glaucoma and compressive optic neuropathy from pituitary adenoma
   A. Seen in patients with with normal ranges of intraocular pressure
   B. Increased optic nerve cupping
   C. More pallor of the optic disc relative compared to a normal population
   D. Loss of retinal nerve fiber layer seen clinically or measured by ocular coherence tomography
   E. Visual field loss

V. How we can better differentiate between glaucoma and compressive optic neuropathy and determine who should be scanned
   A. More likely to be glaucoma
      1. Retention of good central vision until late in the disease
      2. Vertical enlargement of optic nerve cupping
      3. Sectoral loss of the neuroretinal rim
      4. Presence of progressive laminar remodeling
      5. Presence of disc hemorrhage
      6. Visual fields relatively respecting of horizontal midline
   B. More likely to be chiasmal compressive optic neuropathy
      1. Occurring in young age groups (less than 40)
      2. Reduction in central visual acuity relatively early in the disease
      3. Optic nerve pallor clinically obvious and greater than the extent of cupping
      4. Visual fields relatively respecting of vertical midline
      5. Presence of systemic signs consistent with pituitary dysfunction

VI. Systemic symptoms/signs of pituitary dysfunction
   A. Non-secreting adenomas usually only produce signs/symptoms associated with mass effect
      1. Headache
      2. Visual dysfunction
      3. Seizures
   B. Secreting adenomas can produce symptoms specific to overproduced hormone
      1. Prolactinoma (Prolactin)
         a) Men: erectile dysfunction, infertility, galactorrhea
         b) Women: galactorrhea, amenorrhea, infertility
      2. Somatotrophic adenoma (Growth hormone)
         a) Gigantism in children
         b) Acromegaly in adults
      3. Corticotrophic adenoma (ACTH)
         a) Cushing’s disease
      4. Gonadotrophic adenoma(Follicle-stimulating hormone)
         a) Men: decreased libido, erectile dysfunction

VII. Citations
