Subjects

Manuals Covered

2) Fundamentals (anatomy, embryology, developmental anomalies, physiology, biochemistry, epidemiology)
3) Optics, Refraction, contact lenses

1) ANATOMY/ EMBRYOLOGY

Lateral orbital tubercle insertions (Whitnall's tubercle?)
1) check ligaments of LR
2) lateral horn aponeurosis of levator
3) orbital septum
4) lateral canthal tendon
5) Lockwood's ligament
(Whitnall's ligament inserts at trochlea and between lacr. gland lobes)

Lockwood's ligament: connects IO capsule to IR capsule and to lower lid retractors

Whitnall's ligament: where levator aponeurosis originates?

Walls of orbit
Medial (4): ethmoidal, lacrimal, maxilla, sphenoid
Floor (3): maxilla, zygoma, palatine
Lateral (2): zygoma, greater wing of sphenoid,
Roof (2): frontal, lesser wing of sphenoid
- NB: sphenoid everywhere except floor

MOST/LEASTS
Sclera:
- thinnest at EOM insertions
- thickest:posteriorly

Goblet cells:
- most at plica and caruncle
- absent at limbus

Embryonic Derivatives
A) ectoderm
1) lid skin epithelium and appendages
2) conj epithelium
3) lens
4) lacrimal gland
5) lacrimal drainage (puncta, canal., sac, NLD)
6) primary vitreous

B) neuroectoderm
1) neurosensory retina
2) RPE
3) ciliary epith. (both layers)
4) iris sphinter and dilator
5) optic nerve

C) mesoderm
1) endoth. of all blood vessels
2) EOM's
3) temporal sclera

D) neural crest: THE REST
A) *Orbit*
1) orbit c.t.
2) orbital bones
3) trochlea
4) meningeal sheath of O.N.
5) ciliary nerve Schwann cells
6) EOM tendons
B) *Globe*
1) sclera
2) cornea stroma and endoth.
3) choroid
4) c.b. muscle
5) t.m.
6) iris stroma
7) melanocytes
8) 2nd and 3rd vitreous

Development dates:
Lens (Day 25-40 or Week 4-6)
Day:
25: optic vesicle
27: lens plate
29: lens pit (after 4 weeks)
33: lens vesicle
35: primary lens fibers (after 5 weeks)
40: lens is obliterated (after 6 weeks)
40-240: secondary lens fibers
56: Y sutures (2 months)
9 month: pupil mb disappears

Glaucoma
8 month: angle formed

Nerve
at birth: myelination to lamina cribosa (AAO)
7 month to 2 years after birth (Wright) - full myelinization?

Retina
5 weeks: retinal pigment
8 months: nasal retinal vascularization
at birth: temporal retinal vascularization
4 months post-natal: macula

Hyaloid fissure
week 5: hyaloid artery enters fissure –when lens develops
week 6-8: closure (Moore)
month 8: regression

Comparisons

Structure	**New born**	**Adult**
globe length	16	24
cornea diam.	9.5-10	11

Sinus formation
1) maxillary: birth (jaw)
2) ethmoid: birth (nose)
3) frontal: 6 years (forehead)
4) sphenoid: slowly; complete around early puberty (brain)

A) **Ciliary ganglion**
A) *Roots*
1) V1 sensory root is the long ciliary nerve; branch of nasociliary nerve
2) parasympathetic root is from the inferior division of CN 3
3) sympathetic root is from internal carotd
B) *Branches*
1) short ciliary nerves; contain:
a) parasympathetic innervation to iris and c.b.
b) sympathetic innervation to iris and c.b., vessels
c) sensory innervation of globe (iris, cornea)

Numbers
A) *Retina*
1) 1.2 million axons
2) 6 million cones
3) 120 million rods
4) 5 million RPE cells
B) *Arteries and nerves*
1) 6-10 short ciliary nerves
2) 2 long ciliary nerves (sensory from NC n.) - sensory innervation to anterior eye
3) 20 short post. cil. arteries
4) 2 long posterior ciliary arteries
5) 7 anterior ciliary arteries (LR has one)
6) intraorbital optic nerve: 25 mm (1 inch)
7) intracranial optic nerve: 10 mm (1 cm)
C) *Lens*
1) lens: 9.5 mm at equator
2) bag after extraction: 10.5 mm
3) sulcus: 11.5 mm
4) zonules insert 1.5 mm from equ. ant surface
5) zonules insert 1.25 mm from equ. post surface

Attachments of uvea
1) optic nerve
2) scleral spur
3) vortex veins

Attachments of vitreous
1) optic nerve
2) vitreous base
3) macula
4) retinal vessels

Attachments of Tenon's
1) 3 mm posterior to limbus
2) around optic nerve

Vortex veins
1) in eye: ampulla are seen at equator (where they exit the choroid)
2) on sclera: seen near nasal and temporal margins of IR and SR muscles
3) have an oblique course within the sclera

Structures in vertical saccades
A) *Origin*
1) frontal cortex
2) superior colliculus
B) *Secretaries* (Neil Miller) - premotor regions
1) riMLF - rostral internucleus of the MLF(midbrain) - just posterior to the red nucleus
2) interstitial nucleus of Cajal

Structures in horizontal saccades
A) *Origin*
1) frontal cortex: contralateral
2) superior colliculus
B) *Secretaries* (Neil Miller) - premotor regions
1) PPRF: ipsilateral gaze
2) MLF: contralateral gaze

Structures in vertical and horizontal pursuit
A) *Origin*
1) Occipital cortex
B) *Middle men*
2) visual association areas (MT, MST)

3) parietal cortex: ipsilateral
C) *Secretaries*
1) pontine nuclei
2) cerebellum
3) vestibular nuclei

Supranuclear Anatomy (Basic)
A) *Origin*
1) frontal lobe: contralateral saccades
2) parietal lobe: ipsilateral pursuit
B) *Secretaries*
1) PPRF: ipsilateral gaze
2) MLF: contralateral gaze (as soon as it leaves PPRF, it crosses)

Clivus: bone from from foramen magnum until dorsum sella; includes sphenoid and occipital bone

Blood Supply
A) *Globe*
1) optic nerve head: cenral retinal artery
2) prelaminar region: posterior ciliary arteries
3) lamina cribosa: posterior ciliary arteries
4) post-laminar region: pial branches of CRA
B) *Behind globe*
1) orbital optic nerve: ophthalmic artery
2) intracanalicular optic nerve: ophthalmic artery
3) intracranial optic nerve: ICA, ACA, ant. comm. artery
4) chiasm: ICA, anterior comm. art.
5) optic tract: anterior choroidal artery
6) LGN: anterior and posterior choroidal art.
7) optic radiations MCA and PCA
8) occipital cortex: MCA and PCA

ICA/ECA arterial anastomosis
1) the 2 intracavernous ICA's are in communication with the meningeal arterial system arising from the 2 ECA's
i) ascending pharyngeal artery
ii) internal maxillary artery
2) lacrimal artery anastomoses with branches of the external carotid system at 2 or (sometimes) 3 sites
i) middle meningeal artery
ii) anterior deep temporal artery
iii) infraorbital artery (sometimes)

Iris stroma
1) melanocytes
2) clump cells
3) chromatophores

Leforte Fracture which involves floor: 2 and 3

Drusen
<64: small
65-125: medium
>125 large

2) PHYSIOLOGY

Function of RPE (my own)
1) outer blood ocular barrier
2) phagocytosis of rods and cones
3) Vit A metabolism
4) light absorption
5) biochemical in pigment regeneration
6) structural support

Entoptic Phenomena
1) lens: *radiating lines* in star due to suture lines
2) *phosphenes* (flashes): vitreous pulling on retina
3) *Purkinje figures*: images of retinal blood vessels with bright or angled light
4) *floaters:* vitreous collagen, syneresis casting shadow
5) blue field entoptic phenomenon (*flying spots*): represent passing of WBC in blood vessels
- can be used to determine size of FAZ
6) *blue arcs of retina* : NFL - shine rectangle on retina
7) *Haidinger's brushes* radiating from the point of fixation due with plane polarized blue light: due to variations of absortion of light by xanthophyll in Henle's layer - may be affected in macular edema before obvious edema
8) *Styles-Crawford effect:* parallel rays of light are more effective in stimulating cones; rays from edge of pupil which hit retina obliquely are less sensitive than those thru center of pupil

Cataract lens changes
⇑ : Na+, Ca++, insoluble proteins, water (early), reduced hexose, urochrome (pigment)
⇓ : K+, soluble proteins, water (late), glutathione, Vit C,

Cortical: ⇑ Na, Cl, Ca; ⇓ K

Lens sugars which accumulate and cause metabolic cataract
1) diabetes: sorbitol, fructose
2) galactosemia: galactitol ("dulcitol")

Pathways
1) diabetes
a) glucose + NADPH → sorbitol + NADP
(aldose reductase)

b) sorbitol + NAD → fructose + NADH
(polyol dehydrogenase)

B) galactosemia
1) galactose + NADPH → galactitol + NADP;
(aldose reductase)
- galactitol is not a substrate of polyol DH and therefore accumulates

Opsin + 11-cis retinol → Rhodopsin

Krebb's cycle final product: oxalate

Retina metabolism
1) "aerobic" glycolysis (goes faster with O2 around)
2) Krebb's (TCA) cycle: 77% of energy
3) sorbitol pathway?
4) without glucose, can use mannose (not fructose or galactose) ?
5) can use pyruvate, lactate, glutamine, glutamate

Cornea glucose metabolism
1) glycolysis: (2 ATP) 85%
2) Krebs: (36 ATP) 15%
but 70% of energy from Krebs

Lens glucose metabolism
1) glycolysis: (2 ATP) 92%
2) Krebs: (36 ATP) 3%
3) hexose MP shunt (0 ATP) 5%

Tissue immunology
1) Tears
- IgG, IgA, IgE, IgM (not much), complement
- no IgD
2) Cornea
- IgG and IgA; rare IgM
- no IgE or IgD
3) Conjunctiva
- IgG, IgA, and IgM
- no IgD or IgE

Aqueous humor composition (Duane's)
1) ⇑ : a.a., Vit C, citrate, hyaluronate, lactate, pH, glutathione, Cl^-
2) ⇓ : glucose, proteins, urea, oxygen, Ca^{2+}, PO4, K^+, H^+
3) same: Na, Mg, bicarbonate

ERG: ⇑ in dark
EOG: ⇓ in dark

EOG abnormal in:
- lipofuschin seen in these
1) Best's
2) pattern dystrophy
3) chloroquine toxicity
4) Stargart's
5) dominant drusen

Scotopic ERG
1) increased b wave
2) decreased a wave (with dim light)

Color vision fields
central 4 degrees: no blue; red & green only
4 to 20-30 degrees: trichromat
30-70 degrees: dichromat (red-green blind)
> 70 degrees: monochromat

Color vision terminology
R-G-B
protan: red: erythro
deutan: green: chloro
tritan: blue: cyano
anomalous: sees 3 colors but not at same wavelengths as normals
anopia: sees 2 colors (missing pigment)

Optimal Wavelengths
1) blue cone: 450 nm
2) green cone: 550 nm
3) red cone: 580 nm
4) rods: blue-green

Color defects
1) congenital: red-green (large majority)
2) macular disease: blue-yellow
3) optic nerve: red-green (exception: dominant optic atrophy, COAG)

Indications for VEP
1) visual acuity in pre-verbal children
2) confirm increased crossing in albinos
3) predict acuity in media opacity
4) malingering
5) detect subclinical MS

Dark adaptation
1) regeneration of photo pigments
2) increased unbleached rhodopsin levels
3) decreased color vision
4) increased wave amplitude
5) increase in b wave implicit time (rods)
6) optimal wavelength: blue-green

cortical P cells (parvocellular)
1) small cells
2) project to parvocellular layer of LGN
3) make up 80% of ganglion cells
4) small dendritic fields
5) sensitive to:
i) color
ii) form
iii) high spatial frequencies
iv) fine 2-point discrimnation
v) fine stereopsis

cortical M cells (magnocellular)
1) larger cells
2) project to magnocellular layer of LGN
3) 10% of ganglion cells
4) large dendritic fileds
5) senstive to:
i) motion
ii) direction
iii) speed
iv) flicker
v) gross stereopsis

Normal NPC: 6-8 cm

3) EPIDEMIOLOGY

Standard deviation

1 SD: 68%
2 SD: 95% (statistical significance)
3 SD: 99.7%

Type I (alpha) error: missed a difference when there is one

Type II (beta) error: concluded a difference when there was none

Power: chance that study proved what it should: power = 1- beta

Defintions of low vision

1) legal blindness
NA: <=20/200 vision better eye or
VF diameter <= 20 degrees in better eye
worldwide: <20/400 better eye
(a.k.a. profound visual impairment)

2) severe visual impairment
worldwide: <=20/200; >= 20/400

3) moderate visual impairment: <= 20/70

4) visual disorder: *anatomical* changes (cataract, ARMD)

5) visual impairment: *functional* changes in visual organs (VA, VF, color vision)

6) visual disability: loss of *skills and abilities* (reading, mobility)

7) visual handicap: *extra effort* and *loss of independence* in the socio-economic setting (loss of income, job discrimination, depend on equipment)

Causes of worldwide blindness (<20/200)

1) cataract (50%) - 15 million people
2) trachoma (25%) - 8 million
3) onchocerciasis (1%) - 400 000 (was 2 million)
4) xerophthalmia (1%) - 300 000 incidence (many die)

Causes of NA blindness

1) ARMD #1 cause over age 50
2) glaucoma #2 and #1 among blacks
3) DM #1 cause among 20-74

Causes of corneal bindness

A) *NA*
#1: trauma
#2: HSV
B) *World*
1) trachoma
2) onchocerciasis

Interesting numbers

Cornea

1) HSV: 50-90% are carriers of HSV1
2) HZV: 20% will get it in lifetime
3) HZV: 15% of HZV is V1
4) half of HZV V1 will get eye involvement

Glaucoma

1) #1 cause of bleb endophthalmitis: strep pneumo
2) 1% of OHT patients develop glaucoma each year (AAO)
3) prev. of glaucoma: 1% over 50, 15% over 80
4) prevalence of OHT: 5% of pop'n (AAO) (> 21)
5) success of goniotomy: 85%
6) > 60 y.o.: occludable angles prevalence: 5%
7) prevalence of ACG: 0.2% (1 in 20 occludable angles actually occlude (1 per 500)

Lens

1) cong. cataract: 1 per 2000 births
2) cong. cataract: 1/3 disease related, 1/3 inherited, 1/3 spontaneous
3) cataract: 50% by age 70; 70% over age 75

Neuro

1) untreated temp arteritis gets blindness in other eye in 65%; 1/3 1 day, 1/3 1 week, 1/3 1 month
2) MS: >80% of optic neuritis females eventually develop MS
3) non-arteritic AION: affects other eye in 25%
4) optic neuritis patients: in 20 years, 90% of women and 45% of men go on to develop MS; (75% and 35% at 15 years)
5) 25% of MS patients initial presentation is optic neuritis

Peds

1) esodeviations are the most common deviations (>50%)
2) refractive accomodative ET is most common type of ET

Plastics
1) 90% of congenital NLDO will open up in first 9 months spontaneously
2) 5% of newborns have congenital NLDO
3) 90% success with first probing

Refraction
1) the average refractive error in the population is +1.00 D
2) myopia is more common in adults than children

Retina
RD
1) incidence of RD is 1 per 10000-15000
2) prevalence of lattice : 6%
3) prevalence of retinal break: 6%
4) PVD: 10% at 50 y.o.; 60% at 70 y.o.
5) 15% of symptomatic PVD's have a retinal break
6) lattice causes 20-30% of RD's
7) 15% of RD patients get RD in other eye
8) cobblestone more common inferiorly
9) 50% of RD's in myopes, 20% pseudophakes, 10% trauma
11) RD lifetime risk: 1 in 1500

Other
1) S. epi #1 cause of endophthalmitis

POHS
1) disciform in one eye: atrophic lesion in the fellow eye in 25 to 50 percent
2) SRNV in one eye:
a) atrophic lesion in the second eye: 10-25% chance of SRNV in 3 yr
b) no atrophic macular lesion in the second eye: < 5% chance of an SRNV
3) bilateral macular histoplasmosis spots: 5% chance of an SRNV developing within 5 yr.

ARMD
AMD with visual loss
1) 2% 50-65
2) 11.0% 65-74
3) 28% 75-85

Trauma
1) most common rupture sites: under insertion of recti and at superonasal limbus
2) retinal dialysis in youth: m.c.→ inferotemporal
3) retnal dialysis in adults: m.c. → superonasal
4) traumatic retinal dialysis: m.c.→ superonasal
5) all retinal dialysis: m.c. → inferotemporal
6) horseshoe tear: m.c. → superotemporal
7) ROP most common complic → myopia (80%)
8) most common orbital # in kids → orbital roof

Traumatic RD in young person:
1) 10% initially
2) 30% within 1 month
3) 50% < 8 months
4) 80% < 2 years

Uveitis
- 5% of population is HLA-B27 +; 50% of iritis are HLA B27+
- most HLA B27+ people never develop an autoimmune disease

4) OPTICS AND INSTRUMENTS

- **Amsler grid**: each square is 1 degree at 33 cm

- **1 M unit** (1.54mm) is 1 minute of angle at 1 meter

- **1 20/20 Snellen letter** is 5 minutes at 6 meters

- resolution of Snellen letter is 1 minute at 6 meters (i.e. 6M)

- resolution of Snellen letter is 6M

- each 20/20 Snellen letter is 30M

Goldman 3 mirrors: 59-67-73 (gonio is 59)

Fluorescein:
excitation: 490
emission: 520
filter: 500

ICG: 835?

DDx of monocular diplopia
1) astigmatsm
2) keratopathy
3) cataract
4) subluxated lens
5) iris atrophy
6) vitreous disease
7) iridectomy
8) malingering

Steep ("tight") contact lens
1) fluctuating acuity
2) better acuity with blink (moves liquid out)
3) more comfortable
4) poor nutrient exchange
5) persistant astigmatism
6) CL doesn't fall out
7) little mvt with blink
8) central hypoxia (microcystic edema, PEK)
9) lens low
10) symptoms: burning, photophobia, tearing
11) congested vessels
12) corneal vascularization (pannus)

Signs of flat contact lens
1) clear vision
2) worse acuity with blink (moves)
3) discomfort
4) nutrient exchange adequate
5) no astigmatism
6) lose CL easily
7) movement with blink
8) central corneal abrasion (stain)
9) lens high
10) symptoms: f.b. sensation

Change that can be made on a CL
1) flatten peripheral curve
2) PMMA lenses: adjust power by +/- 0.50 D

Treatment of prismatic effect of ADD
A) *Prismatic effect*
1) slab-off more myopic lens (BU effect)
2) reverse slab off hyperopic side (BD effect)
3) Fresnel vertical prisms
4) permanent vertical prisms lens
B) *Types of add*
1) round top for some plus lens (executive)
2) flat top for some plus lens (waiter) - no jump - makes prismatic effect worse
3) flat top for minus
4) dissimilar segments (eg. round and flat)
C) *Centration*
1) different center for each lens (bicentration)
2) decenter both distance lenses downward
3) raise ADD closer to center
D) *Different pairs*
1) contact lenses
2) separate reading glasses

Prentice Rule
- to correct, assume eye looks down 8mm and nasal 2mm

Increased with the rule astigmatism post-op
1) tight sutures
2) many sutures
3) deep bites
4) long bites
5) anterior incision
6) fine sutures (eg. 10-0) - don't loosen
7) non-absorbable sutures

Contact lens correction

- soft originally for sports, occasional wearers, occasional overnite wearers
- now, for 90% of CL wearers
- RGP better for astigmatism, young progressing myopes
- mulifocals: distance CL for dominant eye; near for non-dominant eye

Types of multifocals contact lenses
1) multifocal aspheric, near in center (soft and hard)
2) bifocal near below
3) multifocal in periphery which moves when eye looks at near to center over pupil (CL moves)
4) diffractive lenses

Types of multififocal IOL's
1) multifocal aspheric, near in center (soft and hard)
2) distance- near - distance (3 rings)
3) diffractive
4) bifocal below?

6 ways to use slit lamp
1) diffuse
2) slit beam
3) indirect - turn knob on arm
4) sclerotic scatter
5) retroillumination
6) specular reflection

Ultrasound wavelengths
1) A scan: 8-15 MHz "reflective"
2) B scan: 8-15 MHz "echogenic"
3) UBM: 50-100 MegaHz

Ultrasound lesion description
1) shape
2) echogenicity
3) homogeneity (regularity)
4) vascularity (dynamic) - seen in melanoma, not angioma or mets
5) dynamic movement: eg RD, PVD

Decrease meridional magnification by
1) decrease cylinder power
2) rotate axis to 90 or 180
3) decrease vertex distance
4) minus cylinder lenses
5) consider CL

Lens Aberrations
1) Spherical aberration
- the most important aberration in the eye
- increases with the 4^{th} power of the pupil
- image is focused anterior to expected location
- ⇑ as object moves away from optical axis
2) Coma
- cause rays from a point to be focused over a small area
- ⇑ as object moves away from optical axis
3) Off-axis astigmatism
- ⇑ as object moves away from optical axis
4) Chromatic aberration
- blue is bent more than red
- yellow sits on retina
- red-blue interval: 1.50 D
- red-green interval: 0.50 D
5) Curvature of Field
- image focused on cuved surface
- advantageous in the eye (only one)
6) Distortion
- different points of the object are magnified dif't amounts
- e.g. pincushion, barrel distortion
7) Astigmatism of oblique incidence
- tilting of lens

Ways eye deals with spherical aberration
1) pupil
2) cornea is aspheric (greater central refraction)
3) nucleus center is more refractive

Accomodation Amplitudes
0 : 18
10: 14
20: 10
30: 8
40: 6
50: 3
60: 1.5
70: 0

Retinoscopy
A) power
- as we approach neutrality, streak is
1) brighter
2) faster
3) fatter

B) axis
- as we approach correct axis, there is
1) less break
2) less skew
3) thinner reflex
4) brighter intensity

Ultraviolet wavelengths
1) UVA: 320-400 - 90% on earth
2) UVB: 280-320 - 10% on earth
3) UVC: <280 - negligeable

Sunglasses: (p. 224 AAO)
1) improve color contrast
2) improve dark adaptation
3) reduction of glare sensitivity (eg. polarized)
4) UV absortion
5) photochromic change with light (silver ions - UV)

UV absorbtion
1) almost all dark sunglasses
2) coated glass (clear glass transmits all above 300nm)
3) plastic made of polycarbonate and CR-39 (transmits above 350; partial absorption)

Regular lenses must
1) be at least 2mm thick
2) withstand 5/8 inch steel ball dropped from 50 inches

Industrial lenses must
1) be at least 3 mm thick
2) withstand 1 1/8 inch steel ball dropped from 50 inches

Lens material
1) glass (high density, high index)
2) high density glass
3) plastic (low density, low index)
4) high density plastic
5) polycarbonate (low density high index)

When to prescribe polycarbonate lenses
(AAO p.229); - "shatter proof"?
- discovered in 1950's
- lighter, stronger lenses
1) sports
2) industrial

Components of Hyperopia
1) Total: Manifest + Latent
2) Manifest: Absolute + Facultative

AC/A ratio
1) normal = 4-6
2) heterophoria method:
IPD (cm) + [ET (dist) - ET (near)]/near (D)
3) clinical distance-near relationship (usual); compare deviation at near and far (> 10 abnormal)
4) lens gradient: compare with no lens and with + 3.00 at near (or other variations of manipulating with lenses)

Prisms for low vision glasses
- 2 PD BI more than prescription
eg. + 10 D glasses: +12 PD BI OU

after + 10 → single vision; available up to + 40

Lensometer: prism moves rings towards base (1 ring per PD)

Advantage of spectacles
1) Both hands free
2) large field
3) Don't have to hold something
4) good for hand tremor
5) binocular

Advantage of hand lens
1) variable magnification
2) compact
3) esthetic

Disadvantage of projector
1) poor contrast
2) fixed distance

Advantage of Keplerian telescope
1) greater magnification
2) greater focusability

Advantage of Galillean
1) easier to use
2) smaller
3) field expander

Correction of aphakic anisoconia
1) CL
2) decrease vertex of spectacles
3) IOL insertion
4) overcorrected plus CL with minus spectacle lens
5) minus cylinder spectacle lenses
6) decrease lens convexity?? (notes)

Fresnel lens uses
A) *prism*
1) adaptation test (pre-op surgery in adult)
2) correction of temporary deviation
3) exercises for X(T)
4) stable incomitant deviations
5) nystagmus (null point)
6) VF defects

B) *plus lens*
1) penalization
2) accomodative ET's
3) temporary aphakia
4) occupational bifocal adds
5) low vision high power segments

C) *minus lens*
1) X(T) treatment

Multifocal lenses
1) unwanted astigmatism in area lateral to progressive corridor

Aphakic lens problems
1) ring scottooma
2) jack in the box
3) pincushion distortions

Types of plastic frames
1) CR-39
2) MMA (Plexiglass)
3) Celluloid (cellulose)
4) Nylon
5) carbon-nylon
6) carbon graphite

Types of Metal frames
1) gold
2) aluminum
3) titanium
4) stainless steel
5) "nickel/silver" (German silver - nickel + copper + zinc)

Ways to hold CL in place
1) prism ballast
2) truncation
3) myoflange (plus lenses)
4) lenticular bevel (minus lens)

Automated Refractors Metjhods
1) optometer
2) Scheiner principle (2 holes)
3) laser speckle pattern movement
4) photo of retina (screening)
5) VEP
6) automated phoropter
7) automated refracting lane

Low Vision Aids
A) *Near*
1) high plus glasses with BI prism
2) hand-held magnifying lens
3) stand magnifier
B) *Far*
1) Galilean telescope
2) astronomical telescope
C) *Increase field*
1) reverse Galilean telescope
D) *Non-optical*
1) monitor
2) large print books
3) good lighting
4) tinted glasses (improves contrast
5) computers which scan text
6) audiible books

5) BLOOD AND CLINICAL TESTS

A) Inflammatory diseases
sarcoid: ACE, serum lysozyme, SPEP (alpha globulin)
Wegener's: C-ANCA
PAN: D-ANCA
(ANCA = Anti Neutrophil Cytoplasmic Antibody)
Behcet's: skin puncture
GCA: C reactive protein, ESR
Lyme, Toxoplasma, Toxocara: ELISA
Lyme: IFA
TORCHS: IgG and IGM titres
JRA: ANA

B) Tumors
CEA: malig. of breast, lung, GI, prostate
VanillynMandelic Acid (catecholamine): neuroblastoma
cystathianone: neuroblastoma

C) Metabolic
ceruloplasmin: Wilson's (decreased)
serum ornithine: gyrate atrophy
urine sodium nitroprusside: homocysteine
urine reducing substances: galactosemia
urine amino acids: Lowe's, homocystinuria
urine proteins: Alport's
serum lysine: hyperlysinemia

Titmus Stereo Acuity

circles		secs	VA
1	800	20/200	
2	400	20/100	
3	200	20/80	
4	140	20/70	
5	100	20/60	
6	80	20/50	
7	60	20/40	
8	50	20/30	
9	40	20/25	

Animals:
1 400 secs
2 200
3 100

Fly : 3000 secs

Dry eye Tests
5 x 30 mm Whatman filter paper #41

1) *Basic Secretion Test (AAO manual)*
- tests basic secretion only
- with anesthetic
- strip for 5 minutes
normal: > 10 mm
equivocal: 5-10 mm
abnormal: < 5 mm

2) *Shirmer I Test*
- tests basic and reflex secretion
- no anesthetic
- strip for 5 minutes
normal: > 10 mm (cornea manual)
> 15 mm (plastics manual)
abnormal: < 10mm

3) *Shirmer II Test*
- tests reflex secretion only
- with anesthetic
- strip for 5 minutes
- tickle nose
normal: > 15 mm
abnormal: < 15 mm

Conclusion: 5/10/15

Tear outflow tests
1) *Dye disappearance test (DDT) (AAO Manual)*
- fluorescein placed in conj cul de sac
- tear film is observed over 5 minutes
- persistence of fluor. shows poor outflow (lid, puncta, NLD causes)

2) *Jones I test*
- basically DDT with looking in nose added
- fluor. is placed in conj cul de sac (from DDT)
- inspection to see if fluor. enters nose (or Q tip)
- rarely done: abnormal result in 1/3 of patients

3) *Jones II test*
- detects functional obstruction of NLD
- after fluor. was placed in cul de sac, NLD is irrigated with NS
Result of Jones II:
i) flour. in nose → functional obstruction of NLD (fluor. got into lacr. sac)
ii) no fluor. in nose → obstruction of lacrimal pump, puncta or canaliculus (fluor. not in sac)

tear BUT: (TBUT)

> 15 sec → normal
10-15 → equivocal
< 10 secs → abnormal

Dry Eye
1) lysozyme decreased
2) lactoferrin decreased
3) osmolarity increased

Westergren (more accurate than Wintrobe)
male normals: age / 2
female normals age / 2 + 5

Pupil tests
A) *Horner's*
1) Cocaine 4% (or 10%); - prevents reupake of NE
2) Hydroxyamphetamine 1% (Paredrine) - causes release of NE (done next day)
3) hypersensitivity to 1% phenylephrine in 71%
B) *Adie's*
1) Pilo 1/8% - constricts

When to follow CBC weekly (with internist)
1) pyrimethamine Tx
2) Dapsone Tx.
3) Gancyclovir
4) immunosuppresants
5) sulfadiazine ? AAO uveitis p.167

Ultrasound findings
A) *Globe*
1) melanoma: low-medium reflectivity
2) disciform: medium to high reflectivity
3) cavernous hemangioma: high reflectivity
4) nevus: high
5) mets: medium to high
6) choroidal heme: variable
B) *Orbit*
1) orbital lymphangioma: low
2) orbital hemangioma - high
3) TRO EOM's: high? (GAG's)
4) myositis EOM's: low?

Internal Reflectivity on U/S
1) melanoma - low
2) angioma - high
3) mets - medium to high
4) disciform: medium

Strabismus/Diplopia Tests
1) **Lancaster red/green test**
- red/green goggles
- examiner shines red slit and patient points with green slit; dissociates the 2 eyes
- test distance: 2 meters
- each square represents 2 degrees
- Kanski: **Lancaster** used in USA and Hess in England (basically the same test)
2) **Hess screen** (Ste. Justine)
- red-green goggles
- special screen has red dots
- match your green slit projector with red dot
- test distance: 50 cm
3) **Lees screen**: (MCH)
- similar to Hess/Lancaster (same paper used for results) but uses mirror to dissociate the 2 eyes
NB: field show muscles from patients perspective (right temporal mvts furthest right)
- like VF (from pt's perspective) and unlike EOM drawings (from examiners perspective)

Tests for color blindness:
1) Farnsworth Munsell (FM-100): 84 color points to line up
2) Farnsworth Panel D-15: mainly red-green defects
3) CIE (Commision Internationle de l'Eclairage) charts
4) HRR (Hardy-Ritcher-Rand) color plates (for all color)
5) Ishihara color plates (for red-green mainly)
6) Nagel anomalsocope (computer)

Test for Color Vision
A) *Red-green only*
1) Ishihara
2) Dvorine
3) American Optical Corporation (AOC)
B) *All types of color defects*
1) AO Hardy-Rand-Rittler test (HRR)
2) Tokyo Medical College Plates (TMC)
3) Farnsworth panel D-15

Anomaloscope
- the reference color-vision test against which newly devised tests are compared
- tests for color confusion

- subject adjusts a mixture of red and green light until it matches a standard yellow light

Background Illuminations (Duanes')
1) Goldman: low photopic (31.5)
2) Humphrey: low photopic (31.5 asb)
3) Octopus: mesopic (4 asb)

Advantage of lower illumination (Octopus)
- dimmer backgrounds allow a machine to present "brighter" stimuli to the visual system with respect to background light
- this is helpful for evaluating patients with markedly reduced sensitivities
- this is Weber's law

Disadvantage of lower illumination
- the risk of shifting retinal sensitivity from the photopic range, with a subsequent alteration in retinal sensitivities
- effect of media opacities is more pronounced
- longer time for dark adaptation
- test situation is more sensitive to aberrant light

Pre-op tests for macular function
1) PAM
2) laser interferometry
3) macular photo stress test (shine penlight - 2-3 cm in front of eye; normal < 60 sec)
4) blue field entoptic phenomenon
5) Haidinger brushes
6) Maddox rod (see if scotoma)
7) VEP
8) pattern ERG

Evaluation of cataract
1) VA (dark and light)
2) glare testing
3) contrast sensitivity
4) near acuity

Tests for malingering
A) *unilateral decreased acuity*
1) stereoscopic vision (Titmus, Randot)
2) red-green duochrome visual acuity with red/green glasses
3) polarized Snellen chart with polarized glasses
4) visual acuity with "encouragement"
5) progressive fogging of "good" eye
6) Risley Prism
7) rotating 2 opposite cylinders over good eye (McKinnis)
8) acuity at 20 and 10 feet

B) *bilateral decreased acuity*
1) visual acuity with "encouragement"
2) pinhole with encouragement?
3) near and far acuity comparison
4) bring closer to chart (doubles angle)

C) *unilateral complete "blindness"*
1) OKN
2) large mirror tilted
3) prism in front of "bad" eye while reading
4) pattern ERG, VER
5) RAPD

D) *bilateral complete "blindness"*
1) OKN
2) large mirror test
3) menace reflex
4) signature (should be easy)
5) finger to nose (should be easy)
6) pattern ERG, VER
7) "shock patient"

E) *Other signs*
1) VF: tunnel or other non-physiologic field
2) bumping into furniture
3) IFA: normal

Caldwell view
- chin down; front abutted
See well:
1) posterior orbital floor (best)
2) posterior segment of the lateral wall
3) direct visualization of the greater sphenoid wing contribution to the lateral wall (meningioma)

Waters view (best for floor fractures)
- chin up
1) floor of orbit
2) maxillary sinus

Normal Hertel Exophtalmometry
1) 15 mm in white women (max: 20)
2) 16 mm in white men (max: 21)
3) 18 mm in black women (max: 23)
4) 19 mm in black men (max: 24)

Tests for malignant hyperthermia
1) muscle biopsy with in vitro Halothane
2) Caffeine contaction testing - more specific; useful to confirm diagnosis
3) CPK: elevated in 2/3 of MH patients (so normal test does not rule out MH)

EOM velocities
1) saccade
- latency: 200 msec
- velocity: 700 degree/sec
2) pursuit
- latency: 125 msec
- velocity: 30 degree/sec
3) vergence
- latency: 160 msec

Test for rhinorrhea: CSF vs. mucous
- CSF has high glucose

VER changes
A) *prolonged latency*
1) B12 deficiency
2) Parkinson's
3) spinocerebellar degeneration
B) *decreased amplitude*
1) compressive
2) ischemic
3) toxic optic neuropathies
4) central serous retinopathy

6) Varia

Ocular Disoders associated with Myopia

A) *Retinal diseases*
1) ROP
2) RP
3) CSNB
4) cone dystrophy
5) choroideremia
6) gyrate atrophy (90%)

B) *Other*
1) glaucoma
2) keratoconus
3) ectopia lentis
4) myelinated nerve fibers
5) spherophakia

Systemic Associations with myopia

A) *CT disorders*
1) Stickler
2) Marfan's
3) Ehlers Danlos
4) Weil Marchesani
5) Homocysteinuria
B) *Other*
1) gyrate atrophy
2) Down syndrome
3) Cohen syndrome
4) fetal alcohol syndrome

Ocular disorders associated with hyperopia

1) Leber's amaurosis
2) microcornea

Things which cause myopia

1) hyperglycemia
2) uremia
3) sulfa drugs (c.b. swelling)
4) lens dislocation
5) spherophakia
6) scleral buckle
7) nuclear sclerosis
8) miotics
9) ROP, prematurity

Things which cause hyperopia

1) silicone oil?
2) macular edema
3) orbital tumor
4) CL flattening of cornea
5) posterior subluxation of lens
6) cataract
7) hypoglycemia

Things which cause accomodative insufficiency

1) illness
2) diphtheria
3) botulinism
5) mercury poisoning
5) head injuries
6) third nerve palsy
7) Adie's
8) Meds - antipsychotics

Findings in axial myopia

A) *Anterior Segment*
1) subluxated lenses
2) COAG
3) thin sclera
B) *Posterior Segment*
1) staphyloma
2) lattice
3) peripheral retinal thinning, holes
4) RD
5) isolated subretinal hemorrhage
6) SRNV
7) RPE atrophy (pale fundus)
8) Fuch's spot (focal RPE hyperplasia)
9) lacquer cracks

Things which worsen during pregnancy

A) *Retina*
1) CSR
2) HTN
3) RD
4) DM
5) melanoma
6) choroidal hemangioma
B) *Orbit*
1) CC fistula
2) cavernous hemangioma
3) Graves'
4) meningioma
C) *CNS*
1) pit adenoma
2) IIH

Meds contraindicated in pregnancy

1) pyrimethamine (folate metabolism)

2) Sulfas (folate metabolism) - Dapsone, sulfadiazine
3) immunosuppresants
4) Diamox

Risk factors for Stevens Johnson
A) *Infections*
1) HSV
2) adeno
3) strep
4) mycoplasma
B) *Drugs*
1) sulfas
2) ASA
3) Penicillin
4) Ampicillin
5) isoniazid
6) anticonvulsants

Causes of platelet dysfunction
1) ASA
2) DM
3) liver disease
4) renal disease
5) macroglobulinemia

Inert metals / objects in the eye
1) gold
2) silver
3) platinum
4) glass
5) plastic
6) cilia
7) porcelain

Findings in chalcosis (copper)
- deposits in b.m.
1) Kaiser Fleisher ring
2) sunflower cataract
3) greenish aqueous particles
4) green iris
5) brownish vitreous opacities
6) metallic flecks on retinal vessels

Findings in siderosis (iron)
- deposits in epithelium
1) rust colored corneal staining
2) brown lens deposits
3) iris heterochromia
4) pupil mydriasis
5) retinal pigmentation
6) optic disc discoloration
7) POAG
8) ERG: initial increased a wave, then decreased ERG

Findings in argyrosis (silver)
- chronic use of silver-containing medications
- silver is deposited in the reticulin (i.e., loose collagenous) fibrils of the subepithelial tissue and in the basement membranes of the epithelium, the endothelium and blood vessels
- Grayish discoloration of:
1) nasolacrimal apparatus
2) lids
3) conjunctiva
4) corneal peripheral deep stroma
5) Descemet's membrane