Goal

This course will review basic physical diagnosis techniques that can be incorporated into the ocular examination and aid in the diagnosis of underlying systemic disease.

Objectives

- Understand how to perform physical diagnostic techniques including blood pressure, pulse, carotid auscultation, head and neck examination and neurologic screening.
- Understand the indications for performing physical diagnosis techniques.
- Understand the interpretation of physical diagnosis techniques.

Why do we use them?

Blood Pressure

- Diastolic vs. Systolic
  - Contraction vs. Rest
- Controlling Factors
  - Cardiac output
  - Arterial blood volume
  - Blood viscosity
  - Arterial wall elasticity
  - Total peripheral resistance
Blood Pressure

- **Korotkoff Sound**
  - I  sharp thud, regular tapping - **Systolic**
  - II blowing/swishing
  - III softer tapping
  - IV softer blowing
  - V silence - **Diastolic**

- **Recording**

Blood Pressure

- **Auscultatory Gap**
  - Silence between I & II
  - Underestimates systolic
  - Palpate for pulse to avoid

![Auscultatory Gap Diagram]

Blood Pressure

- **Enhancing Techniques**
  - Rapidly inflate cuff
  - Raise arm over head
  - Pump fist

Blood Pressure

- **Normal Variations**
  - Postural
  - Diurnal/Circadian
  - Stress/Anxiety
  - Meals/Fluid Intake
  - Tobacco Use
  - Bladder distention
  - Exercise

Blood Pressure

- **Sources of Error**
  - Cuff size
  - Failure to support arm
  - Arm position
  - Speed of cuff deflation
  - Cuff tightness
  - Clothing

Blood Pressure

- **Indications**
  - Vascular occlusion
  - Retinopathy
  - Macroaneurysm
  - Subconjunctival heme
  - TIA
  - Chronic headaches
### Blood Pressure: Adults

<table>
<thead>
<tr>
<th>Category</th>
<th>Systolic (mmHg)</th>
<th>Diastolic (mmHg)</th>
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</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 120 and/or</td>
<td>&lt; 80</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120-139 and/or</td>
<td>80-89</td>
</tr>
<tr>
<td>Stage 1 Hypertension</td>
<td>140-159 or</td>
<td>90-99</td>
</tr>
<tr>
<td>Stage 2 Hypertension</td>
<td>≥ 160 or</td>
<td>≥ 100</td>
</tr>
</tbody>
</table>

*JNC 7 – December 2003*

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### Hypertensive Retinopathy Pearls

- **Who gets it?**
  - Young patients
  - Protective factor → Arteriosclerosis
- **Importance of “slow” reduction**
- **Incomplete resolution → co-morbidity**
- **Medication holiday**

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### Pulse

- **Heart Rate**
  - 60-90 bpm average for adults
  - 70-80 bpm average for elderly
  - > 100 bpm = tachycardia
  - < 60 bpm = bradycardia
- **Rhythm**
  - Regular
  - Irregular
- **Amplitude**
  - Strong
  - Weak
Pulse

- **Recording**
- **Indications**
  - Beta Blocker
  - Bradycardia
  - Arrhythmia
    - Atrial fibrillation
    - Heart block
    - Vetricular tachycardia
    - Long QT syndrome

68 y.o. AA Male

- OAG OS>OD
- Inadequate IOP on latanoprost
- Began timolol ½% bid
  - Heart rate: 68 bpm, strong, regular

68 y.o. AA Male

- Follow Up visit: IOP improved
  - Heart rate: 64 bpm, irregular, irregular
- Discontinued timolol
- General Medicine Consult
  - Sinus bradycardia
  - Holter monitor:
    - 34-95 bpm, average 61 bpm
  - EKG:
    - Right bundle branch block

Carotid Assessment
Internal Carotid Artery
- Travels w/o branching
  - Petrous portion of temporal bone
  - Cavernous Sinus
- First branch = Ophthalmic Artery
- Divides into:
  - Anterior Cerebral a.
  - Middle Cerebral a.

Ophthalmic Artery
- Enters optic canal with the ONH
- Divides into:
  - Muscular branches
  - Central Retinal Artery
  - Long & Short Posterior Ciliary Arteries
- Branches out of orbit & onto face
  - Supratrochlear a.
  - Supraorbital a.
  - Angular a.

Ophthalmic Artery Collaterals
- External Carotid Artery
  - via smaller facial branches
- Anterior Cerebral Artery/Anterior Communicating Artery
- Middle Cerebral Artery
  - via pial connections

Pathophysiology of Carotid Occlusive Disease
- Atherosclerosis
  - LDL laden macrophages in intima
  - fatty plaques → collagen accumulation → narrowed lumen/stenosis
  - endothelial compromise → platelet aggregation
  - ulceration
  - hemorrhage
  - emboli

Pathophysiology of Carotid Occlusive Disease
- Uncommon Causes:
  - Arterial dissection
  - Fibromuscular dysplasia
  - Moya Moya syndrome
  - Takayasu’s arteritis
  - Head or neck radiation
Carotid Pulse/Palpation
- Compare:
  - sides
  - along length of vessel
- can dislodge embolus

Carotid Auscultation
- Bell end of stethoscope over vessel
- Patient holds breath
- Listen over CCA and at bifurcation
- Bruit
  - Heard between 50-80% stenosis
  - Neither specific nor sensitive
- Can dislodge embolus

Carotid Pulse/Palpation
- Compare:
  - sides
  - along length of vessel
- can dislodge embolus

Carotid Pulse/Palpation
- Compare:
  - sides
  - along length of vessel
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Blood Flow
- Laminar pattern
  - faster in center
  - slower at walls
  - SILENT
- Occlusion disrupts flow → turbulence → vibrations → bruit
  - intensity directly proportional to velocity
    - faster = louder

Duplex Scan
- Non-Invasive
- Combines:
  - B-Mode Ultrasound
    - image of vessel
    - amount of stenosis
    - morphology of plaque
  - Doppler Ultrasound
    - flow/wave form
      - peak = max flow/systolic
      - run off = diastolic

Duplex Scan
- 92-97% accurate in detecting stenosis >10%
- Most economical
- Does not distinguish between 99% & complete occlusion
- Intracranial & aortic arch lesions cannot be imaged.
- Accuracy depends on:
  - skill of technician/technique
  - anatomy
  - equipment
Carotid Assessment

- MRA Head & Neck
- CT Angiography
- Angiography

Systemic Signs & Symptoms of Carotid Disease

- Transient Ischemic Attack (TIA)
- Stroke (CVA)
- Episodic limb shaking
- Dysphasia

Ocular Manifestations of Carotid Disease

- Transient Monocular Blindness/Amaurosis Fugax
- Ocular Ischemic Syndrome
- Venous Occlusive Disease
- Asymmetric HTN or DM Retinopathy

Acute Partial CRAO

Hollenhorst Plaques

Horner’s Syndrome
Non-Arteritic AION

Carotid vs. Vertebral Basilar

<table>
<thead>
<tr>
<th></th>
<th>Carotid</th>
<th>Vertebral-Basilar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision Loss</td>
<td>Monocular TMB, rare hemianopia</td>
<td>Bilateral TLOV, hemianopia</td>
</tr>
<tr>
<td>Motor</td>
<td>Contralateral hemiparesis</td>
<td>Bilateral or unilateral paresis</td>
</tr>
<tr>
<td>Sensory</td>
<td>Contralateral dysethesias</td>
<td>Bilateral or unilateral dysethesias</td>
</tr>
<tr>
<td>Speech</td>
<td>Dyphasia, dysartrha</td>
<td>Dysarthria</td>
</tr>
<tr>
<td>Other symptoms</td>
<td></td>
<td>Vertigo, ataxia, dysphagia, memory loss, nausea, vomiting, tinnitus</td>
</tr>
<tr>
<td>Other ocular findings</td>
<td>Ocular ischemia, CRAO, etc.</td>
<td>Diplopia, nystagmus, ptosis</td>
</tr>
</tbody>
</table>

Stroke Risk Factors

- Age > 55 years
- Male gender
- Smoking/EtOH abuse
- Hypertension
- Diabetes
- Coronary artery disease
- Arrhythmia, esp. atrial fibrillation

Stroke Statistics

- 4th leading cause of death in U.S.
- Leading cause of long-term disability
- ~795,000 strokes per year
  - Every 4 min someone dies of a stroke
  - On average, someone in the U.S. has a stroke every 40 seconds
  - More women die than men regardless of age
- Increased risk w/ increased age
- Greater risk & mortality in African Americans, Hispanics & diabetics

Transient Ischemic Attack (TIA)

- New Definition:
  A transient episode of neurological dysfunction caused by focal brain, spinal cord or retinal ischemia without infarction. Typical duration of < 1 or 2 hours but occasionally prolonged episodes occur.

TIA Statistics

- > 10% risk of CVA
  - highest risk in 1st 30 days
- Up to 25% of patients will die w/in 1 year
- 1/3 will have major CVA w/in 5yrs.
- 1/3 no additional symptoms
- 1/3 recurrent TIA's
- 2.5% risk of CVA in patients with asymptomatic bruit & hemodynamically significant stenosis
Cardiac Disease
- Coexistent in ~ 45% of patients with carotid disease
- As many patients have a cardiac event as have a stroke.
- Carotid duplex recommended prior to CABG

Carotid Evaluation Pearls
- Occlusion may be intracranial
  - MRA, CTA
- 100% Occlusion = not a surgical candidate
- Carotid endarterectomy vs. stent

Head & Neck Evaluation

Sinus Transillumination
- Location
  - Frontal
  - Ethmoid
  - Maxillary
  - Sphenoid

Transillumination of the Sinuses
- Palpation & Percussion
  - Tenderness
- Transillumination Technique
  - Dark room
  - Frontal & maxillary only
  - Look for symmetry
- Indications
  - Periorbital pain/Headaches
  - Sinusitis
**Frontal Sinus**

**Maxillary Sinus**

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**Palpation of the Lymph Nodes**

- **Location**

**Lymph Node Palpation**

- **Description**
  - Size, shape
  - Surface characteristics (smooth, nodular)
  - Consistency (firm, soft, spongy)
  - Mobile vs. Non-Mobile
  - Tenderness

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**Lymphadenopathy**

- **Indications for lymph node palpation**
  - All Red eyes
  - Viral (EKC, Herpes)
  - Hyperacute bacterial (Neisseria gonorrhoea)
  - Inclusion (chlamydia)
  - Suspected metastasis

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**58 y.o. White Male**

- Red OD with facial swelling and pain
  - 1 month duration
  - No improvement with Vigamox
58 y.o. White Male

- Enlarged Right Parotid Gland
- Large, tender overlying pre-auricular lymph node
- Right Submandibular & Supraclavicular Nodes
- Afebrile
- Leukocytosis 12.5 (ref range: 4.0-11.0)

ENT Consult
- CT neck: enhancing parotid lesion 1.3cm
- Treated for sialoadenitis
  - Augmentin x 7d
- Biopsy: granulomatous inflammation
- Heerfort’s Syndrome?

Thyroid Gland Palpation

- Identify landmarks
  - Thyroid cartilage
  - Cricoid cartilage
- Palpate the isthmus
  - Patient swallows
- Displace the gland to the opposite side
- Palpate lobe
  - Feel surface
  - Note asymmetry, texture, nodules
- Repeat on other side

Thyroid Gland

- Indications
  - Diplopia
  - Exophthalmos
  - Optic neuropathy
Neurologic Examination

2 Basic Components

- History
- Physical Examination
  - mental status
  - sensory system
  - motor system
  - reflexes
  - cerebellar function/tests of coordination
  - cranial nerve testing

The Neurologic History

- Episodic Disturbances of Consciousness
  - syncope
  - seizures
  - convulsions

The Neurologic History

- Disorders of Memory & Thought
  - personality change
  - loss of memory
  - decreased concentration

The Neurologic History

- Headaches
  - new type HA
  - unusually severe HA
  - recurrent severe HA
  - HA associated with other symptoms
Intracranial Mass
- Provocative
  - Change in body position
  - Valsalva maneuver
- Quality
  - Deep, steady aching pain
- Region
  - 90% unilateral, well localized
- Severity
  - Progressive
- Timing
  - Progressive in frequency & duration
- Unrelated
  - Nausea, projectile vomiting, photophobia, nuchal rigidity, mental status changes, CN VI palsy, papilledema, visual field loss, aura

Neurologic History
- Sensory Disturbances
  - pain sensitivity
    - analgesia, hypealgesia, hyperalgesia
  - tactile sensitivity
    - anesthesia, hyperesthesia, hypesthesia
    - perverso of sensation
    - paresthesia

Neurologic History
- Motor disturbances
  - flaccidity
  - ataxia
  - fasciculations
  - tremor

Neurologic History
- Disorders of Speech/Swallowing
  - dysarthria
  - dysphonia
  - dysphasia, aphasia
  - dysphagia

Neurologic History
- Visual changes
  - blur
  - diplopia
  - VF changes
  - transient loss of vision
  - visual hallucinations, aura

Neurologic History
- Auditory Disturbances
  - deafness
  - tinnitus
  - vertigo
- Disturbances of Gait/Balance
- Visceral Symptoms
  - bowel/bladder incontinence
  - change in libido
Neurologic Evaluation: Physical Examination

Mental Status

Mental Status Examination

Mental Status Examination Major Components

- state of consciousness
- orientation
- ability to cooperate
- mood
- appropriateness
- thought processes

- memory
- ability to handle concepts & proverbs
- practical skills
  - reading, writing, calculations
- speech & language

Methods of examination

- informal
  - history
  - conversation
  - family members
  - observation
- formal
  - orientation memory
  - concentration
  - mental status questionnaire
  - mini-mental state

Mental Status Examination

Mini-Mental State Examination

Assessment Scale:

- 25-30: borderline dementia
- 20-25: mild dementia
- 10-20: moderate dementia
- 0-10: severe dementia

Adjust for education

Use clinical judgment
Potential Signs of Altered Mental Status

- poor historian
- confusion/inability to cooperate with exam
- inappropriate responses
- "non-compliance"
- suspect neurologic diagnosis

Sensory System

Sensory: Methods of Examination

Detection of Sensation
- superficial touch
- superficial pain
- position sense
- vibration sense
- temperature sensation

Discriminative Sensations
- Stereognosis (astereognosis)
- Graphesthesia
- Two-Point Discrimination
- Point Localization
- Extinction
Sensory: Methods of Examination

- Localization: Dermatomes

Motor System

Methods of Examination
- strength/active movement
- tone/passive movement
- inspection
- fasciculations, tremors

Reflexes

Types of Reflexes (non-infants)
- Normal
  - deep tendon
  - superficial
  - brainstem
- Abnormal
  - pyramidal tract disease (Babinski)
  - hyperactive DTRs
  - primitive reflexes (snout/suck, grasp)
Deep Tendon Reflexes

Reflex Arc
- intact sensory/afferent fibers
- functional synapses in spinal cord
- intact motor/efferent fibers
- functional neuromuscular junctions
- competent muscle fibers

Deep Tendon Reflexes

Grading
- 0 no reflex with facilitation
- Trace reflex only with facilitation
- 1+ - 3+ physiologic if symmetric
- 4+ pathologically hyperactive

Recording

Facilitation Maneuvers
- Jendrassik’s maneuver
- clench jaws together
- tighten/contract quadraceps, pushing right side against left

DTR Interpretation

Intact Reflex Arc at specific levels
- brachioradialis (C5/C6)
- biceps (C5/C6)
- triceps (C6/C7/C8)
- patellar (L2/L3/L4)
- achilles (S1/S2)

Influence From Higher Cortical Levels
- hyperreflexia
- hyporeflexia
CASE EXAMPLE: ADIE’S TONIC PUPIL

Babinski Response

- Plantar reflex
- Lesion of upper motor neuron in pyramidal tract
- Technique
  - Blunt object
  - Move lateral & inferior towards toes medially

Babinski Response

- Results
  - Normal: all toes curl down
  - Intact plantar reflex
  - (-) Babinski
  - Abnormal: dorsiflexion of great toe & fanning of others
  - (+) positive Babinski

Cerebellar Function

- Dysnergia
- Dysmetria
  - Finger to nose
  - Finger to finger
  - Heel to shin

Cerebellar System

http://www.prohealthsys.com/physical/coordination.php
Cerebellar System

- Dysdiadochokinesia
  - rapid alternating movement
  - rhythmic hand clapping or heel tapping

Cerebeller Function

- Scanning Speech
  - Methodist Episcopal

- Gait
  - walking
  - normal
  - tandem
  - heel to toe
  - on heels or toes
  - Romberg’s Sign

Cerebellar Function

- Ocular Signs
  - nystagmus
  - skew deviation
  - ocular dysmetria

Cranial Nerve Evaluation

*isolated vs. multiple cranial nerve involvement

Cranial Nerve I

- Olfactory
- Anosmia
- Do not use alcohol wipe
- Complete loss is significant

Cranial Nerve Testing

- One involved → Must test ALL
- II, III, IV & VI tested in routine eye exam
- IX & X tested together
- SYMMETRY!
Cranial Nerve II
Optic

- Visual Acuity.....But what others?
  - Visual fields
  - Color vision
  - Red Desaturation/Brightness Comparison
  - Contrast Sensitivity
  - Pulfrich Phenomenon

Cranial Nerves
III Oculomotor
IV Trochlear
VI Abducens

EOMs!

CN 3 Palsy

How do you test for CN IV in the presence of a CN III palsy?????

CN IV in Presence of CNIII Palsy

- Choose an anatomic landmark
  - Vessel
  - Pigment
- Patient looks inferior nasally
- Watch for intorsion
Cranial Nerve V  
Trigeminal
- Sensory to the Face
  - 3 dermatomes
  - Is sensation present?
  - Is it symmetrical?
- Motor to Muscles of Mastication
  - Clench teeth
    - Palpate muscles on either side including temporal
  - Open or close jaw against resistance
  - Deviate jaw against resistance

Cranial Nerve VII  
Facial
- Motor to Muscles of Facial Expression
  - Observation
  - Make faces
    - Wrinkle brow
    - Raise brows
    - Show teeth
    - Smile
    - Pout
    - Frown
    - Puff cheeks
  - Try to keep eyes closed while you try to pry open

CASE EXAMPLE

Facial Nerve Palsy
Pearls
- Bell's Palsy? → Diagnosis of exclusion
- Upper vs. Lower Motor Neuron
  - Forehead sparing
  - Affected side often looks better
- Check for Bell's reflex
- Treatment
  - Lubrication
  - Tape?
  - Active use

Cranial Nerve VIII  
Vestibular-Auditory
- Vestibular
  - Caloric testing
  - Barany chair
- Auditory
  - Whisper 2 syllable words from behind
  - Rub fingers together moving inward
  - Rinne & Weber tests

Cranial Nerves  
IX  Glossopharyngeal
X  Vagus
- Tested together
- Uvula deviation
  - Deviates away from the affected side
- Soft palate elevation
  - Fails to elevate on affected side
- Gag reflex
- Listen to voice quality
Cranial Nerve XI
Spinal Accessory

- Trapezius
  - Shrug shoulders

- Stenocleidomastoid
  - Turn head against resistance

Cranial Nerve XII
Hypoglossal

- Motor to the tongue
  - Stick out tongue
  - Deviates toward the affected side
  - Press tongue against cheek

Multiple Cranial Nerve Palsies

Foster Kennedy Syndrome

- Frontal lobe tumor
- Olfactory groove meningioma
- Ipsilateral anosmia (CN I)
- Ipsilateral optic atrophy (CN II)
- Contralateral papilledema (CN II)

Intracranial Hypertension

- "Pseudotumor cerebri"
- Papilledema (CN II)
- Horizontal diplopia (CN VI)
- Headaches
Ramsey Hunt Syndrome
- H. Zoster Oticus
- Decreased hearing (CN VIII)
- Ipsilateral facial palsy (CN VII)
- Other CN palsies possible

Orbital Apex Syndrome
- Diplopia (CN III, IV, VI)
- Ptosis (CN III)
- Pain (V1)
- Proptosis
- Chemosis
- Decreased VA, VF, & color (CN II)

MRI

Weber’s Syndrome
- Midbrain infarction
- Contralateral hemiplegia
- Diplopia (Ipsilateral CN 3)
- Contralateral facial palsy (CN 7)
- Difficulty speaking, eating & swallowing (Contralateral CN 12)

Cerebellopontine Angle Tumor
- Decreased K sensation (CN V)
- Diplopia (CN VI)
- Hearing (CN VIII)
- Facial weakness (CN VII)
- Ataxia (cerebellar)
- Nystagmus (cerebellar)

Cavernous Sinus Syndrome
- Trauma, vascular, tumor, inflammation
- Ptosis (CN III)
- Pupils (CN III)
- Diplopia (CN III, IV, VI)
- Pain (CN V1)
Indications for Neurologic Testing

- pupil defects
- VF defects
- disc swelling
- other CN palsies
- HA’s potentially c/w mass
- optic atrophy
- diplopia
- other neurologic symptoms
- trauma

"Mr. Osborn, may I be excused? My trash is full!"