Testing Considerations, Patient History, Mechanisms of Disease, and Physical Examination

Chapter 19

Appropriate Indications

- Ordering physician is primarily responsible for determining that a diagnostic study is medically necessary
- Society for Vascular Ultrasound (SVU) has Professional Performance Guidelines on its website to include common indications, contraindications, and limitations [www.svunet.org]

Patient History

- **Very important to obtain a complete history**
- You must obtain appropriate indications for testing prior to performing a study

- What type of questions would be relevant to a carotid exam?

Risk Factors and Contributing Diseases

Diabetes: **Diabetes Mellitus** – *most common*

- A chronic systemic disease
  - Disorders of the metabolism of insulin, carbohydrate, fat and protein
- Atherosclerosis is more common – occurring at a younger age
- Higher incidence of occlusive disease of the distal popliteal and tibial arteries
- Higher incidence of gangrenous changes
  - Leading to amputations
- Diabetes is a **<u>controllable risk factor</u>**

Risk Factors and Contributing Diseases

- **Hypertension**:********
  - Accelerates the process of atherosclerosis
  - Increases the risk of embolization due to
    - Increased flow
    - Turbulence
  - Systemic hypertension is associated with:
    - Greater incidence of coronary atherosclerosis
    - Increase in peripheral and cerebrovascular disease
- Hypertension is a **<u>controllable risk factor</u>**

Risk Factors and Contributing Diseases

- **Hyperlipidemia**:
  - Excessive amount of plasma lipids associated with development of atherosclerosis
  - Frequent cause:
    - Diet high in animal fat
    - Metabolic problems associated with heredity
  - Hyperlipidemia is a **<u>controllable risk factor</u>**

Risk Factors and Contributing Diseases

- **Smoking**:
  - Chemicals in cigarettes irritate the endothelial lining of the arteries
  - Harmful effects include:
    - Vasoconstriction of the arteries
    - Increased blood pressure
    - Increased myocardial oxygen demand
    - Increased cholesterol levels
  - Smoking is a **controllable risk factor**

Risk Factors and Contributing Diseases

- Other Risk Factors:

Controllable:

- Obesity
- Sedentary lifestyle

Uncontrollable:

- Age
- Family History
- Male Gender (higher incidence)

Physical Examination

- Palpation
  - Feel for Heartbeat or Pulse (Diminished or Absent)
    - CCA
    - Superficial Temporal
    - Subclavian
    - Axillary
    - Brachial

Physical Examination

- **Auscultation**
  - Listening through a stethoscope
  - **Bruit** evaluation – noise related to turbulent flow (disappears with very tight stenosis >90%)
    - CCA
    - Subclavian
- **Blood Pressure** – Brachial – Bilateral
  - Pressure different of >20 mmHg suspicious for subclavian or brachiocephalic artery obstruction on side of lower pressure
- **Patient History/Symptoms**
  - Always document

Signs & Symptoms
TIA – Transient Ischemic Attack

- Localized neurologic deficit
- Patient recovers within 24 hours
- Often symptoms are very sudden and brief; lasting 10-15 minutes
- Usually embolic from the heart or carotid artery
- Always effects the side of the body **opposite** its physical location in the brain

RIND

- **R**eversible **I**schemic **N**eurologic **D**efect
- Symptoms last longer than 24 hours
- Neurologic damage with complete recovery after 24 hours
- Usually considered a stroke because some brain tissue damage results even though there is complete resolution

Vertebrobasilar Insufficiency

- Causes bilateral symptoms of:
  - Visual blurring
  - Paresthesia (Numbness/Tingling sensation)
    - Abnormal sensation, heightened sensory response to stimuli
- Patients will complain of:
  - Vertigo
  - Ataxia (gait disturbance)
  - Diplopia (double vision)
  - Drop Attacks

Cerebrovascular Accident

- Referred to as a **CVA** or **Stroke**
- Permanent Neurologic Deficit
- 3rd most common cause of death
  - 795,000 strokes occur annually (130,000 deaths)
- Regional cerebral ischemia secondary to arterial occlusion or stenosis
- Symptoms **DO NOT** resolve

Stroke Classification

Acute	Stroke in Evolution	Complete Stroke
Stroke in Progress	Unstable with uncertain outcome	No progression or resolution
Sudden onset of Symptoms	Symptoms come and go	Stable neurologic deficit
Unstable	Symptoms changing	

Symptoms of Stroke

- **Amaurosis Fugax**:
  - Degree of blindness affecting one eye which is usually described by the patient as "a shade being pulled over one eye"
  - Blindness may affect all or only a portion of the patient's visual field or it may simply be "Blurred Vision"
- **Syncope**:
  - Episodes of "Blacking Out"
- **Dizziness**:
  - May be accompanied by nausea

Symptoms of Stroke

- **Numbness**:
  - Affecting the face, tongue and limbs
  - Hemiparesis – unilateral weakness of a limb or limbs on one side of the body
- **Altered Speech**:
  - Described as "Slurred Speech"
  - Aphasia – Loss of the ability to vocalize
- **Headache**:
- **Confusion**:

} Non-localized, can indicate insufficient cerebral perfusion or impeding stroke

Mechanisms of Disease

- **Ischemia**:
  - Blood deficiency due to stenosis or occlusion
  - Common cause of cerebrovascular insufficiency (tied with hemorrhage)
  - Leading causes: atherothrombotic pathologies, cardiogenic pathologies, lacunar pathologies

Mechanisms of Disease

- Atherothrombotic pathologies:
  - Alters perfusion due to plaque build-up, resulting in stenosis, occlusion, or thromboembolic event
- Cardiogenic pathologies:
  - Altered cardiac function, which can result in embolism
- Lacunar infarctions:
  - Small, circumscribed loss of brain tissue caused by occlusion of a small artery in the brain

Mechanisms of Disease

- **Hemorrhage**:
  - Most common mechanism of cerebrovascular insufficiency (tied with ischemia)
  - Caused by:
    - Hypertension
    - Ruptured aneurysm
    - Trauma

Mechanisms of Disease

- **Stenosis**:
  - Abnormal narrowing of a vessel, caused by atherosclerosis

Mechanisms of Disease

- **Atherosclerosis**:
  - Common condition of older generations in which arteries thicken, harden, and lose their elasticity, creates a stenosis that reduces blood flow - affects brain perfusion
  - Form of arteriosclerosis – includes lipid-containing material, smooth muscle cells, collagen, fibrin, and platelets
  - Forms within/beneath intimal surface and is usually located at the origin of vessels (i.e. proximal ICA)

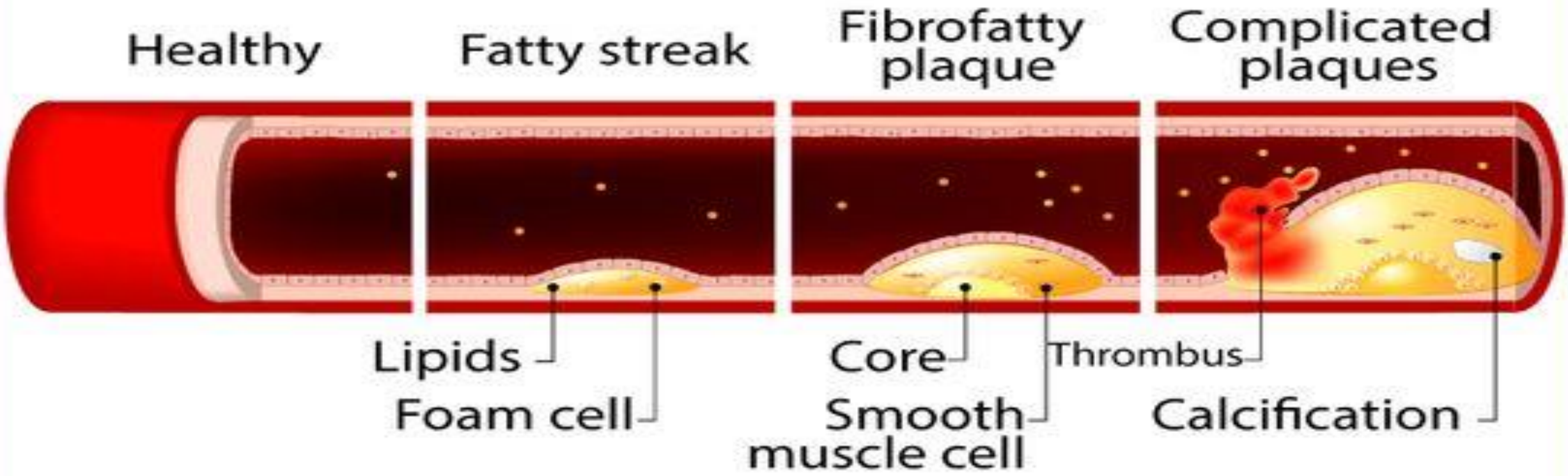
Classification of Plaque

- Fatty streak – thin layer, hypoechoic lipid material laying along the intimal layer
- Fibrous plaque – accumulation of lipids that is encapsulated by lipids, collagen, and elastic fiber deposits
- Complicated lesion – fibrous plaque with more collagen, calcium, and cellular debris

Classification of Plaque

- Ulcerative lesion – deterioration of normally smooth surface of fibrous cap, very important because they shed debris that will cause emboli
- Intraplaque hemorrhage – sonolucent area within the plaque, concerning because it is high risk for rupture, resulting in distal embolization

STAGES OF ATHROSCLEROSIS



Embolism

- Embolus – foreign substance or piece of thrombus that moves through the circulatory system until it lodges in a distal blood vessel, results in partial or complete obstruction
  - May be solid, liquid, or gas
  - Common source of emboli is plaque
  - *Hollenhorst plaque* – bright plaque seen in a vessel of the retina

Thrombosis

- Aggregation of blood factors composed primarily of platelets trapped within fibrin
- Most common cause of stroke
  - Alters cerebral perfusion due to stenosis or embolism

Aneurysm

- Abnormal, localized dilatation of a blood vessel
- May be caused by trauma, infection, atherosclerosis or congenital defects
- Rarely occur in the cervical carotid artery

Nonatherosclerotic Lesions

- Arteritis – Takayasu's arteritis and temporal arteritis
- Carotid Body Tumors (CBT) – vascular lesion that develops between the ICA and ECA
- Collagen vascular connective tissue disorders – immune system disorder that affects collagen and connective tissues
- Dissection – sudden tear of the intimal wall, often caused by trauma

Nonatherosclerotic Lesions

- Fibromuscular dysplasia (FMD) – dysplasia of the media along with overgrowth of collagen, affects mid to distal areas of the ICA (also seen in renal arteries)
- Neointimal hyperplasia – intimal thickening due to hyperplasia of smooth muscle cells, usually in response to vascular injury (i.e. carotid endarterectomy)
- Trauma – may produce a variety of conditions including hemorrhage, occlusion, fistula, dissection, and pseudoaneurysm

Anterior Circulation (Carotid)

- Hemispheric (lateralizing) symptoms
  - Left hemisphere of the brain controls the right side of the body; therefore, a left hemispheric CVA results in neurological deficits on the right side of the body

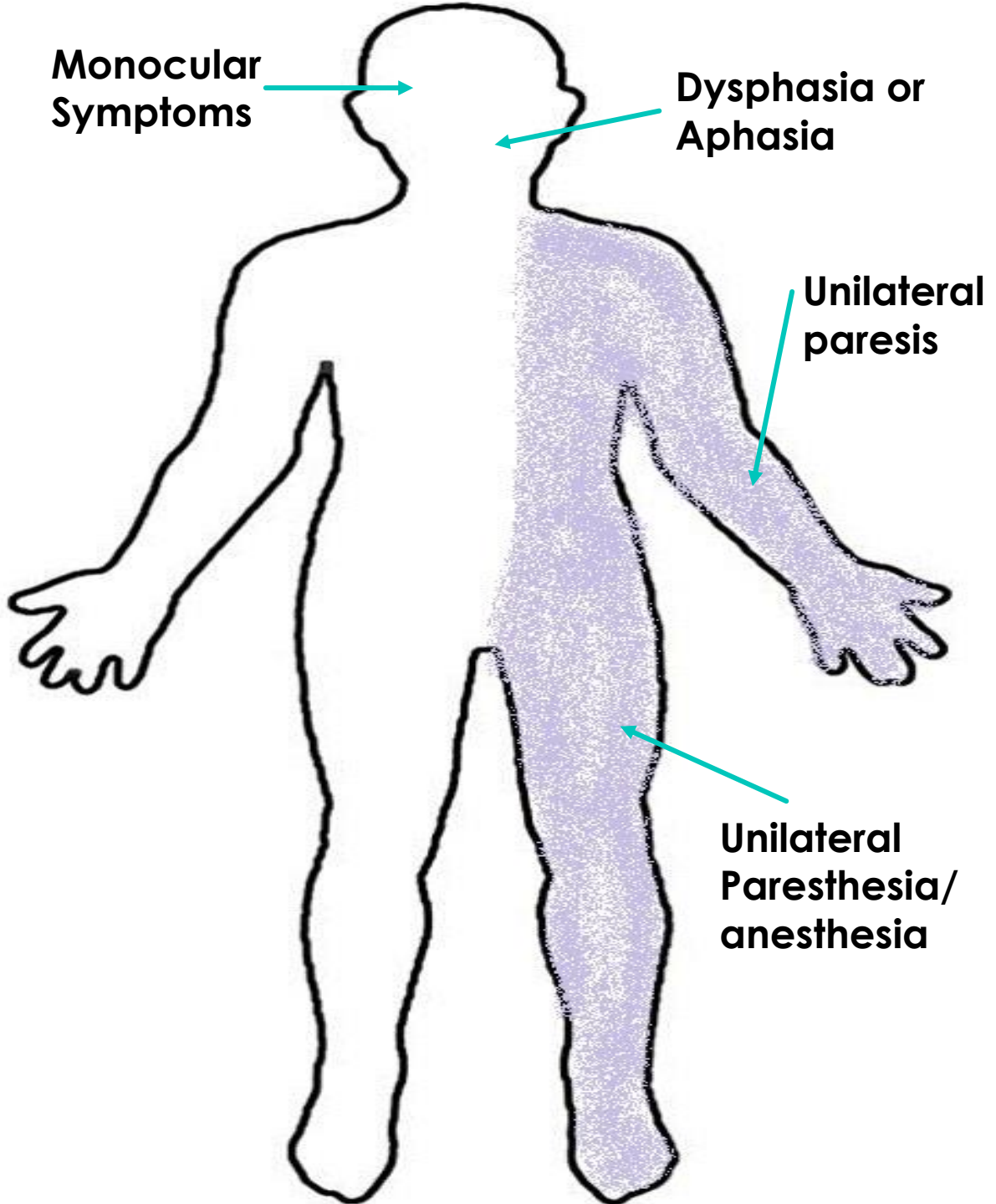
** Specific eye symptoms, e.g., amaurosis fugax, are suggestive of ipsilateral ICA disease **

Anterior Circulation – Sx of ICA Lesions

- **Unilateral paresis**: weakness or slight paralysis on one side of the body
- **Unilateral paresthesia**: prickling or tingling of the skin
- **Aphasia**: Inability to speak
- **Amaurosis fugax**: temporary, partial or total blindness, usually of one eye

Hemispheric Signs of Cerebrovascular Disease

- *Lateralizing symptoms* can be used to indicate which side or hemisphere of the brain has been affected
- For example: left-arm numbness is consistent with decreased perfusion of the right hemisphere by the anterior circulation

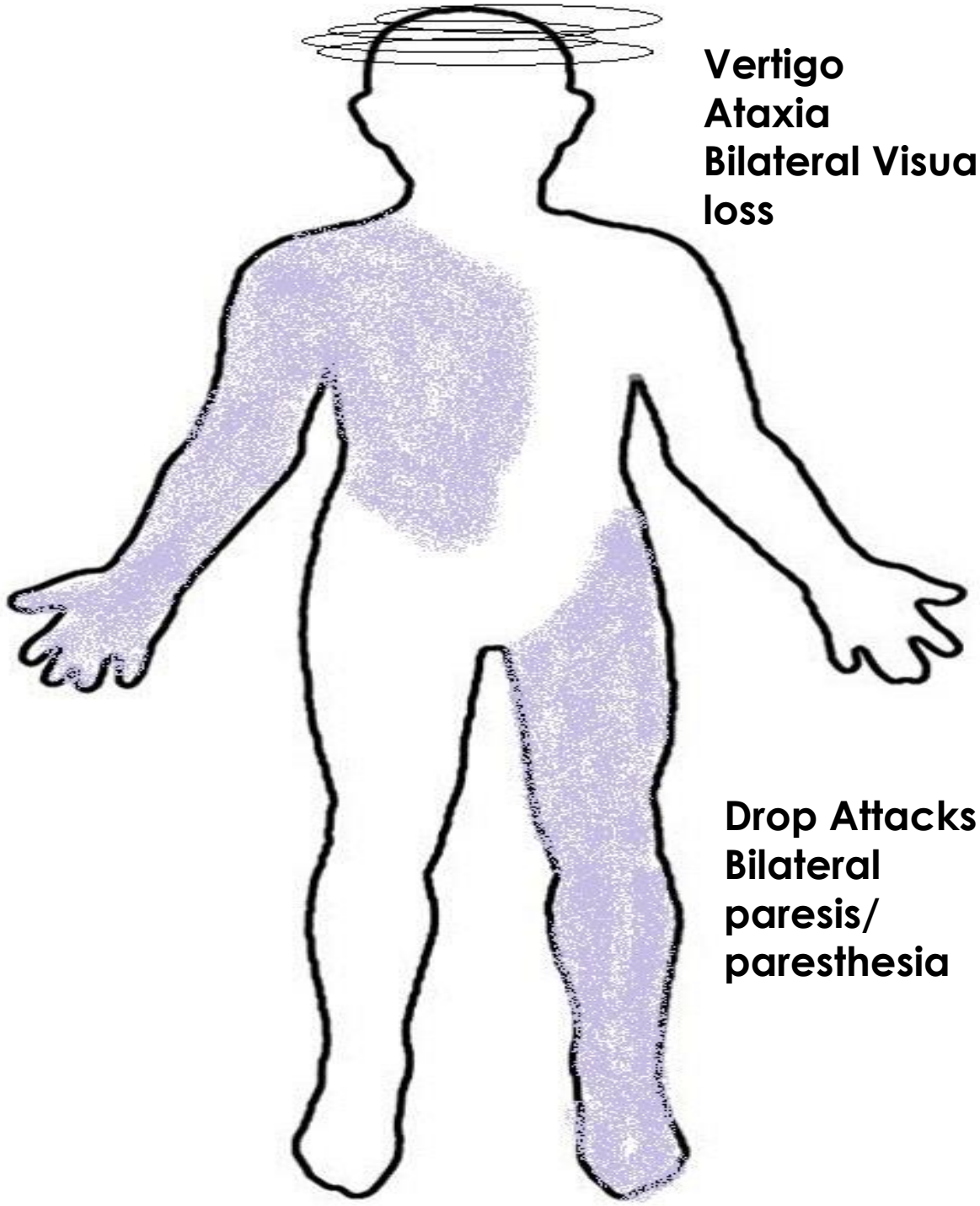


Posterior Circulation (Vertebrobasilar)

- **Vertigo**: difficulty in maintaining equilibrium
- **Ataxia**: muscular incoordination
- Bilateral visual blurring or double vision **(diplopia)**
- Bilateral paresthesia or anesthesia
- **Drop attack**: falling to the ground without a loss of consciousness

Non-Lateralizing Sx of Cerebrovascular Disease

- Usually associated with problems of the brain stem or posterior circulation



Non-Localizing Symptoms

- **Dizziness** – sensation of whirling within one's head, lightheadedness, and a tendency to fall
- **Syncope** – transient loss of consciousness
- Difficulty with speech
- Headache
- Confusion

COMPLETE Pt. History is Critical!

- ??? Type of neurologic symptom(s)
  - When they occurred and the duration
- Myocardial infarction (MI)
- Hypertension (HTN) – huge contributor to strokes
- Diabetes (DM)
- Smoking - # ppd
- Surgical procedures