Terminal Learning Objective

- **Action**: Communicate knowledge of “Physical Exam of the Cardiovascular and Peripheral Vascular System”
- **Condition**: Given a lecture in a classroom environment
- **Standard**: Received a minimum score of 75% IAW course standards on the formative quizzes and the Physical Exam Practical Test grade sheet

References

- Venes D, Taber CW. *Taber’s Cyclopedic Medical Dictionary*. F A Davis Company; 2013.
Reason

As a SOF Medic/Corpsman, your ability to conduct a thorough "hands-on" physical exam, of the Cardiovascular and Peripheral Vascular Systems, will directly impact your ability to diagnose and treat potentially serious cardiovascular and peripheral vascular conditions.

Agenda

- Identify the keys terms associated with the exam of the cardiovascular and peripheral vascular systems
- Communicate the examination techniques of the cardiovascular and peripheral vascular systems
- Communicate the important topics for health promotion and counseling as it pertains to the cardiovascular and peripheral vascular systems

Agenda

- Communicate how to record cardiovascular exam findings
Key Terms

- Apical Pulse: Point of maximum impulse (PMI)
- Cardiac Output (CO): Volume of blood ejected from the heart in 1 minute (HR x SV)
- Diastole: The period of ventricular relaxation
- S1 – Closure of the AV valves, the first heart sound

Key Terms

- S1 – Closure of the AV valves, the first heart sound
- S2 – Closure of the Semilunar valves, the beginning of diastole
- Systole: The period of ventricular contraction
- LVH: Left ventricular hypertrophy (HTN)
- JVD: Jugular vein distention
Key Terms

- Stroke Volume (SV): Amount of blood ejected from the left ventricle with each heartbeat
- Systole: Contraction of the chambers of the heart

The Examination Techniques for the Cardiovascular and Peripheral Vascular Systems

The Physical Exam

- Blood Pressure and heart rate
  - Let patient rest in quiet area for 5 mins
  - Use correct size cuff
  - Position at heart level
  - Center cuff bladder over the brachial artery
  - Inflate cuff 30mm Hg past the pressure at which the pulse disappears
The Physical Exam

- Heart rate
  - Measure radial, brachial, or carotid pulses with pads of index and middle fingers
  - Measure for a full minute
    - Normal: 60 to 100 bpm
    - Bradycardia: <60 bpm
    - Tachycardia: >100 bpm

The Physical Exam

- Jugular venous pressure (JVP)
  - Gain insight to the patient’s blood volume and cardiac function
  - Directly reflects pressure in the right atrium and/or central venous pressure
  - Best assessed from pulsations in the right internal jugular vein
  - Not used in children 12 and under

The Physical Exam

- Assess JVP by
  - Raise the head of the bed or examining table to about 30°
  - Use tangential lighting to find internal jugular venous pulsations
  - If necessary, raise or lower the head of the bed until you can see the oscillations in the lower half of the neck
The Physical Exam

- Assessing JVP
  - After locating the internal jugular vein, find the highest point of pulsations
  - Measure the vertical distance (cm) from the sternal angle to this point

The Physical Exam

- Venous pressure measured > 3cm above the sternal angle, is considered above normal
  - Increased pressure suggests right-sided congestive heart failure
  - Elevated JVP is 98% specific for ↑ left ventricular diastolic pressure and ↓ left ventricular ejection fraction, which ↑ risk of death from heart failure

The Physical Exam

- Assess carotid pulse
  - Amplitude
  - Contour of the pulse wave
  - Any variations in amplitude
  - Timing of the carotid upstroke in relation to $S_1$ and $S_2$
    - $S_1$ immediately precedes the palpated carotid pulse
The Physical Exam

- Thrills and bruits
  - Caused by stenosis or a narrowing of the arteries
  - Thrills are slight humming vibrations felt during light palpation
  - Bruits are heard using the diaphragm of the stethoscope and have a low murmur sound
  - Patients who are middle-aged or older and/or suspected cerebrovascular disease

Special Techniques

- Paradoxical pulse
  - Greater than normal drop in systolic pressure during inspiration
  - Checked by using a blood-pressure cuff
    - Quietly if possible, lower the cuff pressure slowly to the systolic level (note the pressure level at which the first sounds can be heard)
    - Then drop the pressure very slowly until sounds can be heard throughout the respiratory cycle

The Physical Exam

- Things to consider
  - Patient positioning
    - Supine with upper body elevated 30°
    - Patient on left side
    - Sitting and leaning forward
  - Anatomical location
  - Timing of impulses in relation to cardiac cycle
The Physical Exam

- **Inspection**
  - Jugular vein distension
  - Pulmonary edema
  - Contusions
  - Point of maximal impulse (PMI)

- **Auscultation**
  - Know your stethoscope
  - Find a quiet area to do your exam
  - Use location to describe your findings
  - Again use patient positioning to help you

- **Areas to auscultate**
  - 2nd ICS right sternal border
  - 2nd ICS left sternal border
  - 4 or 5th ICS left sternal border
  - 5th ICS mid-clavicular line
What are you listening for

- S1 “lub” caused by the closure of the tricuspid and mitral valves at the beginning of ventricular contraction (systole)
- Usually loudest at the apex of the heart
The Physical Exam

- What are you listening for
  - S2 “dub” caused by the closure of the aortic and pulmonic valves at the beginning of ventricular diastole
  - Usually loudest at the base of the heart

The Physical Exam

- What are you listening for
  - Split S2 “pathological split”
  - Common in our community and other athletic people
  - Normally occurs on inspiration due to decreased intrathoracic pressure
  - Widely split S2 can be associated with several cardiovascular conditions

The Physical Exam

- Splitting of heart sounds
  - Instead of a single heart sound, you may hear two discernible components
  - Normal on inspiration with athletes
The Physical Exam

- Extra sounds
  - S3 “ventricular gallop” sounds like “lub-dub-ta”
  - Occurs at the beginning of diastole after S2
  - Usually benign in youth, athletes, and sometimes in pregnancy
  - Note location, timing, intensity, pitch, and effects of respiration on the sounds

The Physical Exam

- Extra sounds
  - S4 “atrial gallop” sounds like “ta-lub-dub”
  - Occurs just after atrial contraction
  - Pathologic sign, usually a failing left ventricle
  - Note location, timing, intensity, pitch, and effects of respiration on the sounds

The Physical Exam

- Heart murmurs
  - Heart murmurs are distinguishable from heart sounds by their longer duration
  - Attributed to turbulent blood flow
  - Murmurs arising from the pulmonic valve are usually heard best in the 2nd and 3rd left interspaces close to the sternum
  - Murmurs originating in the aortic valve may be heard anywhere from the right 2nd interspace to the apex
The Physical Exam

- Extra sounds
  - Murmurs
  - Timing: systole or diastole
  - Location where the murmur is loudest
  - Grade the intensity 1-6
  - Pitch: high, medium, or low
  - Quality: blowing, harsh, rumbling, or musical

The Physical Exam

- Grade 1
  - Very faint, heard only after listener has “tuned in” (may not be heard in all positions)

- Grade 2
  - Quiet, but heard immediately after placing the stethoscope on the chest

- Grade 3
  - Moderately loud

The Physical Exam

- Grade 4
  - Loud, with palpable thrill

- Grade 5
  - Very loud, with thrill. May be heard when the stethoscope is partly off the chest

- Grade 6
  - Very loud, with thrill. May be heard with stethoscope entirely off the chest
The Physical Exam

• Palpation
  – Pain in the chest wall
  – Heaves or lifts (ventricular contractions)
  – Thrills
  – PMI (usually 5th ICS MCL)
    • Location
    • Amplitude
    • Duration

The Physical Exam

• Percussion
  – Palpation has replaced percussion in the cardiovascular exam

Examination of the Upper Extremities
Examination of the Arms

- Inspect – both arms – fingertips to shoulders
  - Size, symmetry, swelling
  - Venous pattern
  - Color of skin/nail beds; texture of skin
- Palpate
  - Radial, brachial, & ulnar pulses

Examination of the Arms

- Auscultate – Doppler – fingers, etc.
- Measure BP in both arms

Recording Your Results

- Grading of pulses:
  - 3+ Bounding
  - 2+ Brisk, expected = Normal
  - 1+ Diminished, weaker that expected
  - 0 Absent, unable to palpate
- Pulses to consider evaluation
  - Radial, Brachial, Femoral, Popliteal, Dorsalis Pedis, Posterior Tibial, Abdominal
- Bruits – femoral, abdominal?
Examination of the Arms

- Brachial artery
  - Carotid artery more accurately reflects aortic pulsations
  - If aortic artery is unsuitable assess the brachial artery
  - Assess using the same techniques as for the carotid artery

Arterial Supply to the Hand

- Indicated for possible arterial insufficiency
- Palpate ulnar, radial & brachial pulses
- Allen test – used to ensure the patency of the ulnar a. & radial a.
  - PT make a tight fist
  - Compress both radial & ulnar arteries

Arterial Supply to the Hand (cont)

- Allen test (cont)
  - Release ulnar pressure; patent, flushes in 3-5 sec.
    - Persisting pallor; occlusion of ulnar a. or distal branches
Arterial Supply to the Hand

- Allen test (cont)
  - PT open slightly flexed hand, should be pale
  - Don’t fully extend hand

Arterial Supply to the Hand

- Allen test (cont)
  - Recompress the ulnar a.; release radial pressure

Arterial Supply to the Hand

- Indicated for pain or diminished pulses
- Looking for postural color changes
  - PT supine
  - Both legs raised to ≈60° (=1min for max pallor)
  - Have PT sit up with legs dangling
    - Return to pinkness to the skin (≈10 sec or less)
      - Rubor? – possible arterial insufficiency
    - Filling of veins in feet & ankles (≈15 sec)
      - Incompetent veins? – test reliable?
Examination of the Lower Extremities

- PT supine, legs fully exposed, genitalia covered
- No stockings or socks
- Inspect
  - Size, symmetry, swelling
    - edema
  - Venous pattern or enlargement

Examination of the Legs

- Inspect (cont)
  - Color of skin/nailbeds
    - Trophic changes
  - Distribution of hair (legs/feet/toes)
    - Trophic changes
  - Pigmentation, rashes, scars, ulcers
    - Brawny changes – chronic venous
    - Skin thickening – chronic venous
    - Reddish-brown pigmentation
    - Gangrene
Examination of the Legs

- Palpate
  - Superficial inguinal nodes
    - Horizontal / vertical groups
    - Note size, consistency, & discreteness and tenderness
  - Temperature
    - Environment
    - Anxiety
    - Unilateral

Examination of the Legs

- Palpate
  - Femoral pulse
    - Between ASIS & pubic symphysis, midway, below inguinal ligament
    - Diminished / absent?
    - Widening?

Examination of the Legs

- Palpate
  - Popliteal pulse – never use your thumbs
    - Knee flexed, relaxed, fingers meet midline
    - Difficult to find
    - Try prone position
    - Widening?
    - Absent?
Examination of the Legs

- **Palpate**
  - Dorsalis pedis pulse
    - Lateral to extensor tendon
    - Congenitally absent
    - Decreased/absent?

Examination of the Legs

- **Palpate**
  - Posterior tibial pulse
    - Below the medial malleolus
    - Pain
    - Numbness
    - Absent

Examination of the Legs

- **Palpate**
  - Edema – compare each foot & leg
    - Note relative size & prominence of veins, tendons & bones.
    - Pitting edema?
      - Press firmly for 5 sec.
    - Present? Causes?
    - Color of skin
      - Local area of redness
      - Brownish areas near ankles
      - Ulcers & where
    - Thickness of skin
The Important Topics for Health Promotion and Counseling for the Cardiovascular and Peripheral Vascular Systems

Cardiovascular Common Symptoms/Signs

- Chest pain
  - Classic exertional pain, pressure, or discomfort in the chest, shoulder, back, neck, or arm
  - Unstable angina, non-ST elevation myocardial infarction, and ST elevation infarction
  - Anterior chest pain, often tearing or ripping, often radiating into the back or neck, in acute aortic dissection

- Palpitations
  - Atrial fibrillation, which is “irregularly irregular,” can be reliably identified at the bedside

- Shortness of breath
  - Dyspnea
  - Orthopnea
  - Paroxysmal nocturnal dyspnea
Common Symptoms/Signs

- Swelling with redness or tenderness
- Arterial ischemia indicates the site
- Poor healing/nonhealing wounds
- Abdominal pain
  - After meals
  - Associated “food fear”
  - Weight loss
- 1st degree relatives with an AAA

Common Symptoms/Signs

- Swelling (calves, legs, feet)
  - DVT
  - Pitting edema
  - Chronic venous insufficiency
  - Lymphedema
- Color changes (fingertips/toes)
  - Pallor (paleness)
  - Petechiae (red spots)
  - Cyanosis

Common Symptoms/Signs

- Pain (arms or legs)
  - Relieved by rest?
  - Rest leg pain?
- Intermittent claudication - ischemia
  - Pain/cramping in the legs (limping)
- Cold, numbness, pallor in the legs; hair loss
  - Decreased arterial perfusion
  - Skin ulcerations?
Health Promotion and Counseling

- Risk factors for lower-extremity PAD
  - <50 y/o: diabetic, smoker, dyslipidemia or hypertension
  - 50 – 69 y/o: smoker or diabetic
  - >70 y/o
  - Leg symptoms with exertion or rest
  - Abnormal lower extremity pulses
  - Hx (history) of atherosclerotic (lipid/hardening) coronary, carotid, or renal artery disease

Health Promotion and Counseling

- Screening for PAD: Ankle-Brachial Index
  - Used to assess for PAD; detects stenosis of >50% in major vessels in the legs
  - Ankle-Brachial Index (ABI)
    - Measure L/R BP of brachial, dorsalis pedis & posterior tibial
    - Doppler ultrasound & BP cuff
      - >0.90 (0.90-1.30): Normal
      - 0.89 to 0.60: Mild PAD
      - 0.59 to 0.40: Mod PAD
      - <0.39: Severe PAD

Health Promotion and Counseling

- Screening for PAD: Ankle-Brachial Index
  - Interventions that reduce onset & progression of PAD
    - Meticulous foot care and well-fitted shoes
    - Tobacco cessation
    - TX of:
      - Hyperlipidemia
      - Diabetes
      - Hypertension
    - Exercise
    - Surgery
Health Promotion and Counseling

- Screening for renal artery disease
  - Screening should begin with ultrasound with:
    - < 30 y/o with hypertension
    - >55 y/o with severe hypertension
    - Accelerated, resistant or malignant hypertension
    - Decreased renal function or worsening after use of ACE or angiotensin-receptor blocking agent
    - Small kidney - unexplained
    - Pulmonary edema – sudden & unexplained

Health Promotion and Counseling

- Screening for Abdominal Aortic Aneurysm (AAA)
  - Risk factors:
    - Infrarenal aortic diameter > 3.0cm
    - Smoking – strongest risk factor
    - >65 y/o, FH, CAD, PAD, HT, elevated cholesterol level
  - Screening
    - Physical exam
    - Ultrasound – 65 to 75 y/o
    - Other imagining

Health Promotion and Counseling

- Important topics
  - Screening for hypertension
  - Screening for coronary heart disease and stroke
  - Screening for dyslipidemias
  - Promoting lifestyle modification and risk-factor reduction
### Health Promotion and Counseling

#### Blood Pressure Classification

<table>
<thead>
<tr>
<th>Blood Pressure Classification</th>
<th>Systolic BP mm Hg</th>
<th>Diastolic BP mm Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;120</td>
<td>&lt;80</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120-139</td>
<td>80-89</td>
</tr>
<tr>
<td>Stage 1 Hypertension</td>
<td>140-159</td>
<td>90-99</td>
</tr>
<tr>
<td>Stage 2 Hypertension</td>
<td>≥160</td>
<td>≥100</td>
</tr>
</tbody>
</table>

#### Health Promotion and Counseling

- **Common screenings**
  - Coronary heart disease and stroke
    - Establish multiple risk score for CHD based on:
      - Age, gender
      - Height, weight, and waist circumference, or BMI
      - Smoking status
      - History of cardiovascular disease or diabetes
      - Systolic and diastolic blood pressure
      - Total cholesterol, LDL and HDL cholesterol
      - Triglycerides
      - Family history of early heart disease

- **Screening for dyslipidemias**
  - Risk factors include cigarette smoking
  - BP greater than 140/90 mm Hg or use of antihypertensive medication
  - HDL less than 40 mg/dL
  - Family history of CHD in male first-degree relative before 55 years or female first-degree relative before 65 years, and age 45 years or older for men or 55 years or older for women
Health Promotion and Counseling

- Promoting health and risk-factor reduction
  - Complete cessation of smoking
  - Optimal blood pressure control
  - Healthy eating and lipid management
  - Regular aerobic exercise
  - Optimal weight
  - Diabetes management
    - FBS is below 110 mg/dL and HgA1C is less than 7%
    - Conversion of atrial fibrillation to normal sinus rhythm or, if chronic, anticoagulation

Recording Cardiovascular Exam Findings

Record Your Findings

- Initially use sentences to describe your findings (example)
  - “The jugular venous pulse (JVP) is 3 cm above the sternal angle with the head of bed elevated to 30°. Carotid upstrokes are brisk, without bruits. The point of maximal impulse (PMI) is tapping, 7 cm lateral to the midsternal line in the 5th intercostal space. Crisp S1 and S2. At the base S2 is greater than S1 and physiologically split, with A2 > P2. At the apex S1 is greater than S2 and constant. No murmurs or extra sounds.”
### Record Your Findings

- Later you will use phrases (example)
  - "The JVP is 5 cm above the sternal angle with the head of bed elevated to 50°. Carotid upstrokes are brisk; a bruit is heard over the left carotid artery. The PMI is diffuse, 3 cm in diameter, palpated at the anterior axillary line in the 5th and 6th intercostal spaces. S₁ and S₂ are soft. S₃ present at the apex. High-pitched harsh 2/6 holosystolic murmur best heard at the apex, radiating to the axilla."

### Recording Your Results

#### Extremities
- Temperature: warm, cool, normal
- Edema: absent, slight, non-pitting, pitting
- Skin changes: hairloss, trophic changes, thickening of skin, narrowing of leg
- Ulcerations: present/absent, location, involvement
- Color: normal, cyanotic, pale, petechiae, brown pigmentation, rubor
- Pain: intermittent claudication, painful, numbness, tingling, OPQRST

#### Lymph nodes – cervical, axillary, epitrochlear, inguinal
- Adenopathy, size, rubbery, mobile
Questions?

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- Communicate how to record cardiovascular exam findings
Reason

As a SOF Medic/Corpsman, your ability to conduct a correct physical exam, of the Cardiovascular and Peripheral Vascular Systems, will directly impact your ability to diagnose and treat cardiovascular and peripheral vascular conditions.

Break

THE VASCULAR SYSTEM AND VISCERA