

GENERAL PHYSICAL EXAMINATION

1. Background and Rationale

The physical examination is an important component of translational research. It yields noninvasive, inexpensive and informative data that contributes to clinically relevant diagnoses, prognosis, and assessment of risk. In addition, the physical examination is important to participants and promotes recruitment and retention in the study.

1.1 Objective

The objectives of the physical examination are:

- 1) To document physical findings in the cardiovascular, musculoskeletal and nervous systems that are related to mobility in older adults
- 2) To screen participants for testing exclusion criteria to allow safe and meaningful completion of performance testing

1.1 Recommended Instrument(s)

1.2 Strengths and weaknesses of selected approach

The strengths of the physical examination include ease of performance, non-invasive nature (i.e. low risk), and direct contact with participants.

The weakness of the physical examination, in general, is related to the potential variation in assessment measures and the level of expertise of examiners, the lack of standardized assessment methods for research, and the subjective nature. These effects can be limited by implementing standardized protocols using published techniques when available, utilizing experienced nurse practitioners (NPs) and physicians, training the examiners in standardized fashion, and incorporating ongoing quality control programs that include direct observation and certification.

1.3 Analogous (past) measures used in the BLSA

This is the first version of a fully standardized physical examination protocol that has undergone rigorous training, certification processes, monitoring and quality control checks.

1.4 Reliability/Validity Studies

Limited studies are available on performing the physical examination for

research purposes. Where studies are lacking, we chose to use techniques published in standard textbooks or that were used in other studies (InCHIANTI, OAI, Health ABC).

Some sections include more detailed descriptions in this protocol to reduce inter-examiner variability in the exam, while other sections have reduced or eliminated measures shown to be of limited use for research purposes and/or to the participants. For example, we limited the previously detailed exam for auscultation of heart murmurs since this has no advantage over the echocardiogram, which is now performed on all subjects. However, the cardiac exam is important to participants, and is used to evaluate participants for medical fitness to undergo cardiac testing and therefore remains in the exam.

Jugular venous distension

There are standardized ways to examine and report physical findings of jugular venous distension (JVD), peripheral arterial disease, (presented in the ABI protocol) and venous stasis. In addition to textbooks used to teach proper physical examination techniques, Cook and Simel¹ published a description of a standardized assessment of jugular venous pressure (JVP), and therefore, central venous pressure. We use this technique of assessing jugular venous pressure to record the presence or absence of JVD in the BLSA participants.

The physical exam is known to be inferior to the gold standard of central venous monitoring. For example, in three studies, when the clinical assessment of JVP was reported as low, normal or high, the overall pooled accuracy was 56%.¹ One of these three studies reported correlation coefficients between assessments of CVP by physical examination and by central venous monitoring. The range of the correlation coefficients was 0.65 – 0.74. Another study reported sensitivities of 0.33 – 0.49 and specificities of 0.62 – 0.76. The third study reported that physicians correctly predicted CVP 55% of the time.

Fortunately, some of the suggested problems in assessing JVP are remediable and are related, in part, to variations in positioning of patients, poor lighting, difficulty distinguishing venous from arterial pulsations, biologic variation related to respiration, and the effects of vasoactive medications and diuretics. In addition, some of the studies included mechanically ventilated patients, in which CVP assessment is more difficult, even for very experienced physicians.

Recommendations are available for improving accuracy of JVP assessment in a standardized manner and are incorporated into the protocol outlined in this manual. When the participant is positioned at 45°, JVP that is visible above the clavicle must have a JVP of at least 7 cm, or a CVP of at least 12 cm H₂O. This is considered the high range of normal for JVP. Although there is debate about the absolute cutoff for abnormal JVP, 9 cm is considered the upper limit of normal by leading cardiovascular authorities.¹

Chronic venous stasis

Assessment of chronic venous stasis has always been a subjective measure. The first attempt to standardize the assessment was reported via a consensus statement published in 2000.² A subsequent publication provided suggestions to define clinical manifestations that had remained subjective due to lack of clear definitions, and thus were known to have low interobserver reproducibility (47%).³ Therefore, the protocol in this manual of operations adopts the recommendations for classifying chronic venous insufficiency as proposed in the consensus statement, with definitions adopted from those proposed by Allegra et al³ in 2003. Studies on the reliability/validity of the recommendations *with* the recent definitions in place have not yet been published, but these definitions provide a standardized way to implement the widely accepted classification system published in the consensus statement.

1.5 Key Variables (All missing codes are 555, 666, 777, 888, 999)**Total number of teeth****Non-removable teeth in contact****Oral prosthesis****Mucosal inflammation score****Plaque score for teeth and dentures****Hearing aid****Cranial nerves IX-X, oropharynx asymmetry****Cranial nerves III, IV, VI:
Vertical ocular movement asymmetry****Horizontal ocular movement asymmetry****Wavy ocular tracking asymmetry****Nystagmus****Convergence****Heart murmurs**

Heart rhythm

Carotid bruit

Pacemaker or ICD present

Rales

Wheezing

Prolonged expiratory phase

Dysmetria or “frenage”, right hand

Dysmetria or “frenage”, left hand

Rapidly alternating movements (RAM) rhythmic

Number of hand strikes (RAM) completed in 20 seconds

Muscle tone resistance

Carpal tunnel Tinel’s sign

Hoffman sign

Palmomentary sign

Glabellar sign

Snout sign

Patellar reflex, right

Patellar reflex, left

Quadriceps tendonitis, right knee

Quadriceps tendonitis, left knee

Right hip passive internal ROM

Pain with right hip passive internal ROM

Left hip passive internal ROM

Pain with left hip passive internal ROM

JVD present at 45°

Abdominojugular reflux

Right ankle maximum dorsiflexion

Pain with right ankle maximum dorsiflexion

Right ankle maximum plantarflexion

Pain with right ankle maximum plantarflexion

Left ankle maximum dorsiflexion

Pain with left ankle maximum dorsiflexion

Left ankle maximum plantarflexion

Pain with left ankle maximum plantarflexion

Right knee crepitus

Pain with right knee passive ROM

Right knee maximum flexion ROM

Right knee painful maximum flexion

Right knee maximum extension

Right knee effusion

Right knee tibiofemoral tenderness

Right knee patellar grind sign

Right straight leg ROM

Right straight leg raise painful?

Left knee crepitus

Pain with Left knee passive ROM

Left knee maximum flexion ROM

Left knee painful maximum flexion

Left knee maximum extension

Left knee effusion

Left knee tibiofemoral tenderness

Left knee patellar grind sign

Left straight leg ROM

Left straight leg raise painful?

Unable to place hand beneath arched back

Right biceps reflex

Left biceps reflex

Graphesthesia:

Identifies line drawn on sole

Identifies circle drawn on sole

Identifies '+' sign drawn on sole

Babinski sign

Stereognosis:

Identifies a quarter in hand

Identifies a safety pin in hand

Identifies a dime in hand

Identifies a key in hand

Time (seconds) to complete 10 heel to shin movements were on right

Dysrhythmic heel to shin movements on right

Time (seconds) to complete 10 heel to shin movements were on left

Dysrhythmic heel to shin movements on left

Unable to grasp thumb above head

Unable to grasp thumb at 90°

Unable to grasp thumb next to hips

Absent posterior tibial pulses on right

Absent dorsalis pedis pulses on right

Absent posterior tibial pulses on left

Absent dorsalis pedis pulses on left

Telangiectases/ reticular veins (venules/bluish veins <3 mm dia)

Varicose veins (≥ 3 mm diameter, usually tortuous, visible veins)

Blood pressure cuff size

Pulse obliteration level

Does the participant have any of the following conditions?

Aortic regurgitation; AV shunt right; AV shunt left; Previous surgery right; Previous surgery left; Hyperthyroidism

Supine measurements:

Measurement 1:	Right	SBP	DBP	Left	SBP	DBP
Measurement 2:	Right	SBP	DBP	Left	SBP	DBP
Measurement 3:	Right	SBP	DBP	Left	SBP	DBP

Heart rate (bpm)

Supine blood pressure completed?

Right femur-to-tibia standing alignment

Left femur-to-tibia standing alignment

Romberg sign

Standing blood pressure: Right SBP Right DBP Heart rate

Dizziness with standing?

Standing blood pressure completed?

Hand exam for joint tenderness, enlargement, deformity

Pronator drift

Natural occiput to wall distance

Total spine flexion ROM

Spinal flexion motion painful?

Right shoulder elevation

Left shoulder elevation

Right shoulder functional external ROM

Left shoulder functional external ROM

Right shoulder motion painful?

Left shoulder motion painful?

Tenderpoints: 1-18

Neck extension ROM

Neck extension painful?

Neck active rotation right

Painful active rotation right

Neck active rotation left

Painful active rotation left

Achilles reflex right

Achilles reflex left

Clinical Classification score:

Clinical score for pain

If pain present, arthritis or joint problem?

If pain present, worse while walking?

If pain present, uses medication for pain?

Clinical score for pain severity (0-10)

Clinical score for edema

Clinical score for pigmentation

Clinical score for lipodermatosclerosis

Lower extremity ulcer

Clinical score for ulcer size

Clinical score for ulcer duration

Clinical score for ulcer recurrence

Extremities inspection

Amputations, if present:

Amputation location RUE

Amputation location LUE

Amputation location RLE

Amputation location LLE

Paralysis, if present:

Paralysis right upper extremity

Paralysis left upper extremity

Paralysis right lower extremity

Paralysis left lower extremity

2. Equipment and Supplies

Stethoscope

Otoscope with light

Reflex hammer

Long cotton swab

Hand-held long-handled plastic goniometer
(JAMAR)

Universal inclinometer

Tuning fork

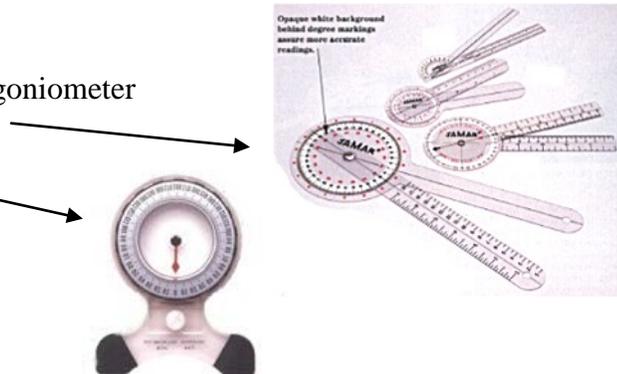
Small metric ruler

Digital timer

Quarter, dime, safety pin, key

Chatillon Dolorimeter

(Bay State Scale and Systems, Inc)



2.1 Maintenance

Scales: The clinical engineering personnel from Harbor Hospital evaluate and calibrate the scales annually.

Sphygmomanometer: The examiners will evaluate the sphygmomanometer daily to ensure the needle lies at zero mm Hg with the bulb valve open and at rest. If not, the zero point will be reset or a replacement will be provided. Monthly, or anytime a leak is suspected, the blood pressure cuffs will be tested by inflating the system to 250 mmHg and observing the pointer. If it slowly drops, there is a leak. Notify an investigator and use another appropriately sized cuff.

Dolorimeter: Examiners should recalibrate pressure daily before performing the

joint examination. Examiner applies pressure to the rubber pad of the dolorimeter with thumb five times and fore/index fingers five times, while watching the dolorimeter markings and observing nail blanching until 1.4 kg of pressure is applied.

3. Safety Issues and Exclusions

- 3.1** There are no exclusions for the physical examination. Reasons for not participating in a specific aspect of the examination must be documented. Participants may experience minor and temporary discomfort during the examination. If the participant reports pain, the examiner will ask if it is OK to continue with the examination and will then continue only with participant's permission.
- 3.2** Clinical judgment is used if a participant has an acute medical issue that would preclude a participant from undergoing the standardized physical examination. In such instances, the participant should have a focused medical examination and history with appropriate follow-up, such as transfer to hospital for further evaluation and treatment.

4. Participant and Exam Room Preparation

A room with the examining table located centrally should be used to allow the examiner free access to the right and left sides. Participants should wear an examining gown and underwear only, with shoes and socks removed. A sheet or blanket will be available for participant comfort. The rooms should be equipped with the necessary equipment and supplies as specified above.

Missing Data: Specific codes are provided in the event a participant is unable or unwilling to do a test. For the physical examination, the codes and descriptions are as follows:

555 = Could not do due to physical problems (e.g. wheelchair bound participant could not perform gait testing)

666 = Could not do due to mental problems (e.g. cognitively impaired participant did not understand directions for rapidly alternating movements)

777 = Could not do due to both physical and mental problems

888 = Refused but theoretically could do (e.g. participant with good mobility and cognitive ability refused to do gait testing)

999 = Did not do due to technical problems (e.g. equipment did not work; tester unavailable; not enough time)

All tests that do not have responses should have the missing code filled in.

5. Detailed Measurement Procedures

The physical examination will be performed on all participants at each visit. The estimated length of time required for the physical examination is two hours, including the medical history questionnaires that are also administered by the examiner. Begin the examination with the participant seated. The foam used for the musculoskeletal exam is placed on the table extension so that the participants' legs rest at the same level as the body.

1. Head and Neck

1.1.Oropharynx/Hearing

If participant is wearing removable oral prostheses, remove them for the exam. Use a penlight and long cotton swab to inspect the oropharynx, including the teeth, gums and mucosal lining. Count the number of teeth, including permanent non-natural teeth. Exclude removable prosthetics. Now count the number of missing teeth. Subtract missing teeth from total number of teeth and record the difference as the number of non-removable teeth that are in contact. Record whether oral prostheses are present; permanent prostheses are considered with natural teeth (e.g. permanent bridge, implants). Only removable devices are coded as prostheses.

Use the Plaque and Mucosa Grading System to record condition of teeth and gums. The description with pictures is kept in the examination rooms. If in doubt between grades 1 and 2, or 2 and 3, choose the lower score. When in doubt between grade 3 and 4, choose 4. This method is recommended by those administering this scale in other institutions and is used to prevent clustering of data in the middle of the scale. (Written communication from Birgitte Moesgaard Henriksen, DDS, PhD of Ullevaal University Hospital, Oslo, Norway through Dalva Padilha, DDS, PhD).

Observe presence or absence of hearing aids and record on the Teleform.

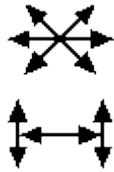
1.2.CN IX & X

Ask the participant to open his/her mouth. Observe the palate, uvula and pharynx for asymmetry or deviations from the midline at rest and while saying "ahhh".

1.3.CN III, IV, VI

Stand in front of the participant. For the eye movement evaluation, ask the participant to move his/her eyes to follow the movements of your finger without moving the head. Move your finger horizontally and vertically, as depicted in either of the diagrams with arrows shown below, in a wavy pattern, and toward the bridge of the nose (convergence). With horizontal movement, observe for

nystagmus in the lateral eye position with your finger 3 feet from the participant. The gaze should not be at the extreme position, as 1 – 2 beats are normal in the extreme lateral position (end-of-gaze nystagmus). If you can still see some white of the sclera laterally, with the eye in the lateral position, you are an appropriate distance from the participant. Lastly, check convergence by moving your finger towards the participant's nose and observing the eye movements.



Images referenced from <http://www.medinfo.ufl.edu/year1/bcs/clist/neuro.html>

1.4.CN VII

The examiner observes the participant's face at rest then asks the participant to smile, raise eyebrows, show his/her teeth, and puff out the cheeks, noting ability and symmetry.

2. Cardiovascular

2.1. Murmur

Auscultate heart sounds using the diaphragm of the stethoscope over the left and right 2nd intercostal spaces, along the left sternal border, and at the apex (mitral area) in the 5th intercostal space at the left of the sternum. Listen at the apex using the bell of the stethoscope as well. See Figure below.

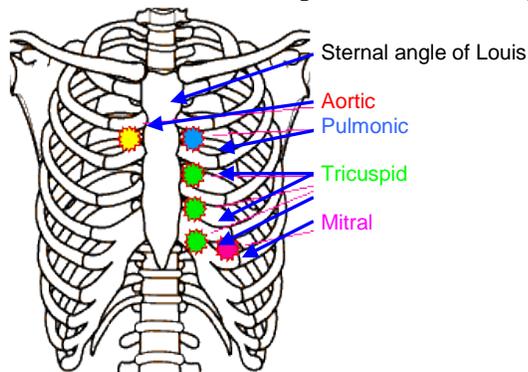


Image referenced from <http://www.medinfo.ufl.edu/year1/bcs/clist/cardio.html>

2.2. Arrhythmia

During heart auscultation, if the rhythm sounds irregular, except for normal variation with respiration or single ectopic beats, arrhythmia is reported.

Observe for the presence of a pacemaker or ICD during the examination of the chest.

2.3. Carotid arteries

With the participant seated in a well-lighted room and the head supported, to relax the neck muscles, palpate the carotid arteries.



Image referenced from www.med.umich.edu/

Ask the participant to take a breath and hold it. Place the bell of your stethoscope over the right carotid artery then the left, allowing the participant to breath between auscultations. Distinguish a possible bruit from a heart murmur by moving the stethoscope down the neck and chest. A bruit is high-pitched and blowing or roaring, best heard over the carotid. Heart murmurs, e.g. aortic stenosis may be heard over the chest and tracked up to the neck.

2.4. Pacemaker/ICD

Inspect chest and abdomen for presence of pacemaker or ICD.

3. Respiratory

3.1. Auscultation

Auscultate the lungs (1) anteriorly below the clavicles and then slightly lower at the 5th to 6th intercostal space on the right side (right middle lobe) and (2) posteriorly in the bases and in the apices (above the scapular ridge and just lateral to the spinous processes). Ask the participant to take deep breaths and to breathe out through his/her mouth. Listen for rales and wheezes.

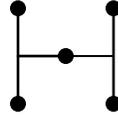
3.2. Forced expiratory movement

Ask the participant to take a deep breath and blow it out as quickly as possible. Listen over the trachea with the bell of the stethoscope while timing the expiration. Note whether the full expiration took longer than six seconds. If so, this suggests obstructive airway disease may be present.

4. Finger to Nose (FTN)

“I am going to hold my finger in front of you. I want you to touch my finger with your right index finger, and then touch your nose with the same finger. Keep your eyes on my finger. I want you to continue going back and forth, touching my finger then your nose. I will move my finger around.” Repeat with left hand.

Stand approximately 2 feet in front of the participant with your finger in front of the participant's face. The distance should be such that the participant must extend his/her arm to touch your finger. When the participant touches your finger, move in the directions depicted below. Note accuracy and slowing (frenage) as participant's finger approaches your finger.



5. Rapidly Alternating Movements

The participant remains seated. Demonstrate this test as you explain it.

“I want you to sit with your (dominant or most functional) hand palm down on your lap. As quickly and as precisely as possible, raise your hand, turn it over and strike your thigh in the same place with the back of your hand, like this. Keep doing this until I say stop.”

Set timer for 20 seconds.

The participant's hand must completely disconnect from the thigh before turning it over and striking the thigh with the back of the hand (palm up). If the participant performs the maneuver incorrectly, stop him/her and restart once. The first strike should be palm up, then palm down. Time the participant for 20 seconds, and record the number of times the *palm* strikes the thigh. One count is palm up (back of hand must strike thigh) then palm down (palm must strike thigh). Observe and record whether the movements were regular (rhythmic) or not.

6. Muscle Tone

Instruct the participant to sit and to relax completely. Take one of the participant's hands in yours and, while supporting the elbow with your other hand, supinate (palm up) and pronate (palm down) the participant's forearm several times. Then flex and extend the patient's arm at the elbow several times. Resistance to your movement that persists throughout the range of motion and in both directions is called lead-pipe **rigidity**. Increased resistance that varies, commonly worse at the extremes of the range, is called **spasticity**. This usually occurs in extension, or when you straighten the person's arm, and can be overcome with continued movement. High resistance, followed by sudden relaxation as the limb is moved, is called clasp-knife spasticity. Spasticity indicates upper motor neuron disease. Repeat on other side.

7. Carpal Tunnel

Palpate the distal ends of the lateral head of the radius and the medial head of the ulnar bones. Find the midpoint between these landmarks at the base of the thenar

and hypothenar muscles. This is the carpal tunnel. Use your middle finger to tap over the carpal tunnel for 30 seconds. Examine both sides.

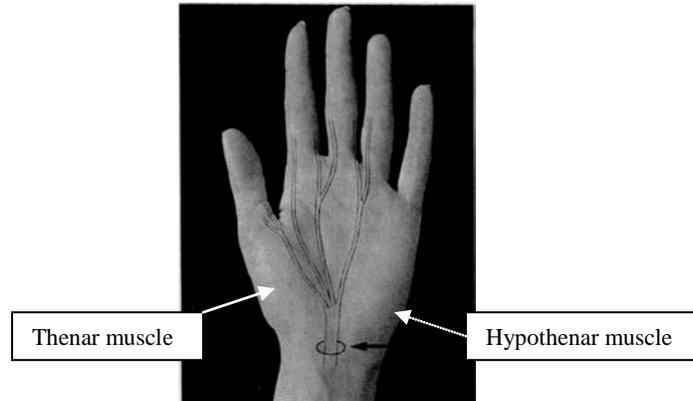


Image referenced from: Barbara Bates "A Guide to Physical Examination and History Taking" 1991: 5th edition, page 489.

"Do you feel any pain, tingling, or electrical sensations?"

If "yes", then the Tinel sign is present.

8. Pathologic Reflexes, Sitting position

8.1. Hoffman

The Hoffman (and other muscle stretch reflexes) and certain primitive reflexes are often detected in seemingly healthy adults. However, the Hoffman technique described here is less likely to elicit a response in normal adults, but it should elicit an exaggerated response in adults with cerebral disease, even those without clinically evident disease. A consensus is emerging that suggests the presence of several of these reflexes indicates central nervous system disease. In addition, this technique is identical to that used in the InCHIANTI Study and therefore allows for comparability across studies.

Standing on the right side of the participant and facing the same direction, support the participant's right hand, palm down, by placing the fingers of your left hand beneath the participant's palm. Instruct the participant to relax his/her fingers. Place the fingertips of your right hand under the participant's fingertips at the DIP joint creases. Run your thumbnail down the participant's nail on the middle finger, until it "clicks" over the edge. Your thumb should flex the terminal digit by pressing on the participant's fingernail. Observe and feel for flexion or adduction of the fingers against the fingers of your right hand. Repeat on the left side if no response is observed on the right. Flexion or adduction on either side is considered "present".

8.2. Palmomental

Scratch or stroke firmly the thenar eminence (the mound on the palm at the base of the thumb) and observe for ipsilateral contraction of the chin muscles. Repeat on the opposite side if no response is observed.

8.3. Glabellar

Ask the participant to look forward and instruct him/her to “Try to keep your eyes open.” Lightly tap the participant’s forehead between the eyebrows using your finger pad at a rate of 20 – 30 taps per minute. You should be rhythmic and maintain the same intensity with each tap. Observe the eyes for blinking. The initial forceful blink in response to the visual threat you present should diminish. Count the number of forceful blinks that occur before the blinking diminishes or stops. A normal response is blinking of the eyes that extinguishes with continued tapping (before 3 – 5 taps). Blind persons will not blink at all in relation to the tapping. A response is considered abnormal if persistent blinking occurs after 5 taps, but especially if it persists beyond 15 taps. Stop tapping when the forceful blinking diminishes or on the sixteenth tap, whichever comes first.

8.4. Snout

Gently tap the middle of the upper lip with your finger pads. While a reflexive sucking or puckering response is normal in infants, it disappears by the age of 6 or 7 months and is always abnormal in adults.

9. **KNEE AND HIP EXAMINATION:** The participant should be seated on the examination table with the hips and knees in 90 degrees of flexion. Examine the **RIGHT KNEE**. Then repeat the examination of the **LEFT KNEE**.
 - 9.1. **Patellar Reflex:** The participant remains seated with the testing knee flexed. The participant’s feet should not touch the ground. Tap the patellar tendon just below the patella while your other hand lightly grasps the participant’s anterior distal thigh. You may detect contraction of the quadriceps with your hand even if no visible movement of the knee is noted. If no reaction is detected, ask the participant to lock fingers together in front of his/her chest and pull one hand against the other on the count of three. You should simultaneously strike the tendon as the participant contracts the upper extremities on the third count.
 - 9.2. **Quadriceps tenderness/tendonitis:** The examiner palpates with the thumb for tenderness at (a) the bony attachment of the quadriceps tendon at the patella; (b) the bony attachment of the infrapatellar tendon at the patella; (c) the distal end of the quadriceps muscle as it forms the tendon; (d) below the patella beneath the infrapatellar tendon. While applying 3 lbs of pressure with the thumb directly over each location, the examiner asks the participant “Is

this painful or tender?" Examiner records "Pain in any area" if the participant responds "Yes" as the examiner presses on any of the four locations.

9.3. Passive Hip Internal Rotation – The participant is sitting with the hip and knee in 90 degrees of flexion. The goniometer axis is placed over the center of the patella. The stationary axis remains perpendicular to the floor and the moveable axis remains parallel to the anterior midline of the tibia. The examiner moves the hip to the end range of internal rotation and records the measurement based on the goniometer reading.

9.4. Painful Hip Range of motion. As the participant's ankle is moved, the examiner asks, "Is this painful or tender?" Examiner records the range of motion and the participant's response "No pain" or "Pain present".

10. Jugular venous distension

Seat the participant with the back of the examining table initially at 45° in a well-lighted room with legs extended. Make sure the head is supported, to relax the neck muscles. Stand on the right side of the participant.

Characteristics of venous pulsations:

- Diffuse, usually with two waves; upward deflection is slow
- Level of pulsation changes when the inclination angle is adjusted
- Top of the wave usually descends with inspiration
- Nonpalpable, while the arterial pulse is usually strong
- Gentle pressure above the sternal end of the clavicle obliterates the venous pulse

Identify the highest point of pulsation in the internal jugular vein. Use the criteria above to confirm venous from arterial pulsations. Position the participant at 45°. Observe whether the top of the jugular waveform column approaches the angle of the jaw. If so, the jugular venous pressure is elevated and should be recorded as "Present". Jugular venous distension that is visible just above the clavicle is considered "Absent".

11. Abdominojugular reflux test

With the participant seated at 30 – 45° and head turned slightly to the left, apply pressure over right upper quadrant for ten seconds. Observe the neck veins on the participant's right side. If the top of the venous waveform rises to or near the angle of the jaw and remains, the abdominojugular test is positive. A slight rise, or rise and fall, is not considered abnormal in this study.

12. Ankle: Place the participant in a supine position on the examination table with both knees in full extension. Place foam under both calves. Both heels and

ankles should hang off the edge of the foam to allow complete and accurate ROM. Begin by examining the RIGHT ANKLE. Repeat the exam on the LEFT ANKLE.

- 12.1. Dorsiflexion maximum motion** – Place the goniometer axis approximately .5 inches below (anatomically inferior to) the lateral malleolus. The stationary arm remains parallel to the longitudinal axis of the fibula and the moveable axis remains parallel to the longitudinal axis of the 5th metatarsal. The participant is asked to dorsiflex the ankle so that the toes move in a superior direction. The examiner then presses the ankle to the end range of dorsiflexion and records the measurement from the goniometer reading.
 - 12.2. Painful dorsiflexion maximum motion:** As the participant’s ankle is moved, the examiner asks, “Is this painful or tender?” Examiner records the range of motion and the participant’s response “No pain” or “Pain present”.
 - 12.3. Plantar flexion maximum motion:** Verifying the correct goniometer position with its axis approximately .5 inches below the lateral malleolus, the examiner asks the participant to plantarflex the ankle so that the toes move in a downwards direction. The examiner then moves the ankle to the end range of plantarflexion and records the measurement from the goniometer reading.
 - 12.4. Painful plantar flexion maximum motion:** As the participant’s ankle is moved, the examiner asks, “Is this painful or tender?” Examiner records the range of motion and the participant’s response “No pain” or “Pain present”.
- 13. Knee Examination. With the participant lying in supine position on the examination table with both knees in full extension and resting on the foam, instruct the participant “Please relax your thighs as much as possible”. Begin by examining the RIGHT KNEE. Repeat the exam on the LEFT KNEE**
- 13.1. Knee crepitus:** With the participant lying comfortably supine and the quadriceps muscles relaxed, the examiner places one hand over the patella of the knee and applies light pressure. The other hand is placed to hold and support the ipsilateral heel. Holding the heel just above the table top, the examiner moves the heel upward towards the buttocks until the knee is flexed to 90 degrees, then moves the heel to extension of 0 degrees. The participant is instructed to “Relax your leg while I move it back and forth.” Repeat this 3 or more times per knee. Record “YES” if crepitus is felt during leg motion. “Popping” alone is not considered crepitus.
 - 13.2. Painful knee passive motion:** As the participant’s knee is moved, the examiner asks, “Is this painful or tender?” Examiner records the range of motion and the participant’s response “No pain” or “Pain present”.

- 13.3. Maximal knee flexion range of motion:** With the participant lying comfortably supine, the examiner first tests active ROM and instructs the participant “To see how much motion you have in your knee, bend your knee and move your heel as close to your buttocks as you can, keeping your foot flat on the table.” The examiner then coaxes the knee into additional flexion by gently pushing the ankle towards the buttock until no additional flexion is achieved. Maximal knee flexion will be measured with the axis of the goniometer over the lateral femoral condyle, the fixed arm aligned along the axis to the greater trochanter, and the moveable arm aligned with the lateral malleolus of the ankle.
- 13.4. Knee painful maximum flexion:** As the examiner moves the knee into maximum flexion, the examiner asks the participant “Is this movement painful or tender to your knee?” Examiner records the range of motion and the participant’s response “No pain” or “Pain present”.
- 13.5. Knee maximal extension:** Position the foam cushion inferiorly to the popliteal fossa so that no foam is beneath the popliteal fossa. The axis of the goniometer is placed over the lateral femoral condyle. One arm of the goniometer is aligned along the femoral axis. The other arm is oriented along the tibia aligned with the lateral malleolus of the ankle. In full extension if the goniometer reads “0” the examiner records this. Flexion contracture is defined as the angle formed by the upward pointing goniometer arm. Hyperextension is the degree recorded with the goniometer arm pointing down. The examiner records the angle of flexion contracture OR hyperextension as the deviation from “0”.
- 13.6. Knee effusion:** The examiner explains, “I’m going to feel your knee joints for swelling.” The examiner inspects the knees for visual signs of swelling and asymmetry. The examiner then tries to elicit signs of an effusion. Bulge sign – The examiner uses the flat of the hand and sweeps the hand upwards from the lower medial side of the knee then applying moderate pressure laterally to displace fluid medially. The motion is reversed to push fluid from the lateral to the medial side. Patellar Tap – is performed by the examiner cupping one hand around the superior aspect of the patella, and applying downward pressure onto the patella. A positive sign is when the patella moves downwards and abruptly stops as it hits the underlying femoral condyles. If an effusion is detected on either the Bulge or Tap maneuvers the examiner records “Effusion present.” If neither Bulge nor Tap maneuvers elicit effusion the examiner records, “No effusion detected.”
- 13.7. Knee Tibiofemoral Tenderness:** The examiner removes the foam block and places the participant’s knees in 60-90 degrees of flexion. The examiner identifies the inferior pole of the patellar tendon, moves fingers medially to feel the “notch” of the medial joint line. While applying 3 lbs of pressure, the examiner asks, “Is this painful or tender?” to determine medial tenderness. The examiner then again

identifies the inferior pole of the patellar tendon and then moves fingers laterally to the “notch” of the lateral joint line. While applying 3 lbs of pressure, the examiner asks, “Is this painful or tender?” to determine lateral tenderness. The examiner records the participant’s response. Tenderness is recorded if present in either location.

13.8. Knee Patellar grind sign: The participant lies in the supine position with the quadriceps muscles relaxed. The examiner instructs, “I’m going to feel around your knee cap for tenderness,” and applies downward pressure onto the patella toward the femur and towards the feet, until the patella rests in the trochlear groove. The examiner then instructs the participant, “While I am pressing down on your kneecap, slowly tighten your thigh muscles by pushing the back of your knee down onto the table,” and asks, “Do you have pain under your knee cap?” The examiner records the participant’s response.

13.9. Straight leg raise: The straight leg raise test is performed with attention to the amount of motion available. The patient is supine with the hips and knees extended. The inclinometer is positioned on the tibial crest just below the tibial tubercle. The inclinometer is zeroed. The examiner instructs the participant, “Relax your leg as I lift it from the table” then passively lifts the straight leg to the maximum tolerated straight leg raise (not the onset of pain), without lifting the opposite leg from the table. Perform two trials, and record results from the second. The examiner records the degree of motion.

13.10. Straight leg raise painful: While performing the straight leg test the examiner asks, “Is this painful or tender?” The examiner records the participant’s response. Stretching or tightening of the hamstrings is not considered a painful or tender response.

14. Bridging: Participant should lie supine with knees and hips flexed and feet flat on table, comfortably close to buttocks. Ask the participant to arch his or her back so that the lower back is raised off the table. The hips and shoulders remain in contact with the table. The examiner then attempts to slide his/her hand under the participant’s lower back. Touching the back is normal, but you should not force your hand under the participant’s back. Note the presence or absence of this ‘bridge’ by whether you can slide your hand under the arch of the back or not, without force.

15. Biceps reflex: The participant lies supine with his/her arms resting on the abdomen and flexed at the elbow. Press the forefinger gently on the biceps tendon in the antecubital fossa and strike the finger with the reflex hammer. This should cause flexion of the forearm and visible contraction of the biceps muscle. You may only feel the contraction, which is also considered normal.

16. Graphesthesia

“I am going to draw three symbols on the sole of your [dominant] foot using the blunt end of this reflex hammer. I want you to tell me what symbol I drew.”

While the participant is supine with eyes closed, draw three symbols (a line (-), a circle (O), and plus sign (+)) on the sole of the dominant foot. After each symbol, ask the participant to name the symbol. For the +, acceptable responses include ‘x’, ‘cross’, ‘t’, ‘+’ or ‘plus’, but not ‘T’. If the participant doesn’t respond, ask him/her, ***“Please make a guess. For research purposes, I need to write something down, so make your best guess.”*** If the dominant foot has scar tissue or other physical problem that would affect sensation, use the non-dominant side.

17. Babinski

Hold the participant’s ankle in one hand. Using the blunt end of the reflex hammer or a wooden applicator, stroke the sole of the foot, beginning at the heel and moving along the lateral side to the ball of the foot then medially towards the big toe. Use the lightest stimulus that will elicit a response. You may use increasingly firm pressure if needed.



Images referenced from <http://www.medinfo.ufl.edu/year1/bcs/clist/neuro.html>

Normally, the toes will flex to withdraw from the stimulus. If the big toe extends, the toes fan, or if both occur, this is abnormal and should be coded as “Present”.

18. Stereognosis

“Now I am going to place some objects in your hands while your eyes are closed. I want you to identify each object. Close your eyes.”

While the participant is lying down with eyes closed, place one object at a time (a quarter, a safety pin, a dime, and a key) in the dominant hand and ask the participant to name the object. If he/she cannot, instruct them,

“Please make a guess. For research purposes, I need to write something down, so make your best guess.”

19. Heel to Shin

With the participant lying supine on the exam table, place the cushion provided on the end of the table under the lower leg and heels. Give the instructions below and allow the participant to practice once with eyes open to be sure he/she understands the instructions. Instruct him/her to do the following:

“Close your eyes. As quickly and accurately as possible, move your right heel back and forth from your left knee to the table until I say stop.” Record the time using the digital timer provided to complete ten times. The starting position is with both legs extended straight. Each count occurs when the heel returns to the table. Observe rhythmicity. The participant is dysrhythmic if the heel oscillates back and forth or grossly misses the knee.

“Now do it with your left heel on your right leg.” Record the time it takes to do ten times on the other side, again observing for rhythmicity.

20. Hand to Finger

The participant should remain supine with arms by sides.

“I’m going to position your (dominant) arm in three different positions with your hand in a ‘thumbs up’ position, like this. With your eyes closed, reach across with your other hand and grab your thumb. We’ll do it once with your eyes open then all three positions with your eyes closed.”

Position the participant’s dominant arm at his/her side close to the hips but not touching the body, and with the fist closed and the thumb pointing up.

“With your eyes open, reach across with your (non-dominant) hand and grab your thumb. Now close your eyes. Each time I move your (dominant) arm into a new position, reach with your other hand and grab your thumb. Keep your eyes closed.”

Abduct the arm away from the body and above the head for first position, then to 90° from the shoulder with elbow bent, then at hip level with arm extended at elbow. The test is abnormal if the participant first touches any part of the hand other than the thumb. It is acceptable if the participant touches the thumb and slides the hand to grasp the thumb. Record only the results when the participant’s eyes were closed. After positioning the participant’s arm, the tester may continue to touch the participant’s arm to maintain position.

21. Peripheral Pulses

The participant’s feet should be relaxed and still, with the participant in the supine position. See the diagram below for location of the posterior tibial pulse (left) and

the dorsalis pedis pulse (right).



Posterior tibial pulse



Dorsalis pedis pulse

Images referenced from: Barbara Bates "A Guide to Physical Examination and History Taking" 1991: 5th edition, page 489.

Vary the pressure of your fingertips in order to feel the pulse, and be careful not to confuse the participant's pulse with your own pulsating fingertips. In general, normal pulses are easily felt with moderate to firm pressure. Locate the dorsalis pedis (DP) pulse by placing the first and second fingers anterior to the ankle and midway between the medial and lateral malleoli, just lateral to the extensor tendon of the great toe. Begin just below the level of the ankle, palpating laterally or more distally along the dorsum of the foot until the pulse is located. For the posterior tibial (PT) pulse, the examiner stands to the side of the participant and places the fingers around the ankle, slightly below and posterior to the medial malleolus to palpate the pulse. Since awkward positions decrease tactile sensitivity, you should be able to comfortably place 2 –3 fingers over each pulse. Absent pulses are those that are not felt after several trials of 30-60 seconds with varying degrees of pressure.

22. Venous Insufficiency I

- 22.1. Telangiectasis/Reticular veins** - Telangiectasis are venules <1 mm diameter. Reticular veins are bluish veins that are 1.0 to <3.0 mm in diameter. They are usually tortuous. Do not include "normal" visible veins in people with transparent skin.
- 22.2. Varicose veins** – These are veins that are ≥ 3 mm diameter in upright position. They are almost always tortuous.

23. Supine Blood pressure: Select two appropriate adult size blood pressure cuffs. The bladder inside the cuff should encircle 80% of the arm circumference and two-thirds of the length of the arm. Place the bladder directly over the brachial artery.

- 23.1. Blood pressure measurement should begin after at least 5 minutes of rest (time elapsed while performing ECG serves as rest period if the ECG is performed in the examining room).
- 23.2. Make sure there are no kinks or twists in the hose that extends from the cuff.
- 23.3. Use a high quality stethoscope to auscultate blood pressure readings.
- 23.4. Place one blood pressure cuff on each arm. Rest the participant's arm at the same level as the heart.
- 23.5. Palpate the brachial arteries and place the cuff so that the midline of the bladder is over the arterial pulsation. The lower edge of the cuff should be 1 inch (~2.5 cm) above the bend of the elbow.
- 23.6. Wrap the cuff snugly around each bare upper arm. Leave enough room between the cuff and the arms for two fingers. Avoid rolling up sleeve so that it does not cause tourniquet-like pressure around the upper arm.
- 23.7. Make certain the needle on the sphygmomanometer is at zero before beginning. If it is not, calibrate the sphygmomanometer by turning the dial at the bottom until the needle rests on zero.
- 23.8. Palpate the radial or brachial pulse while inflating the blood pressure cuff on each arm. Note when the pulse disappears. This approximates the systolic blood pressure and should be recorded on the Teleform as the Pulse Obliteration Level.
- 23.9. When the pulse disappears, inflate the cuff 20mm Hg above this level.
- 23.10. Place the diaphragm of your stethoscope over the brachial artery. Deflate the cuff slowly, at a rate of 2mm Hg per second.
- 23.11. Record the Korotkoff phase I (appearance) for systolic blood pressure and phase V (disappearance) for diastolic blood pressure. If Korotkoff sounds are weak, have the participant raise the arm and open and close the hand 5 – 10 times; then inflate the cuff as instructed above. Record the new reading.
- 23.12. Record the pulse by timing the radial pulse for 15 seconds and multiply by 4, or 20 seconds and multiply by 3 (right arm only).
- 23.13. Take three (3) blood pressure measurements from each arm, alternating right then left, and allowing one minute between each measurement on the same arm.
- 23.14. If measurements between the two arms differ by more than 20 mm HG systolic and 10 mm Hg diastolic on repeated measurements, alert a staff physician for assessment (rule out coarctation, aortic dissection, etc.).

24. Orthostatic Blood Pressure Measurement (NOTE: Knee alignment [femur to tibia alignment], hand exam, and Romberg are performed immediately after the participant stands, during the 3-minute wait period before taking the Standing Blood Pressure measurement. If three minutes pass before all three of these are assessed, perform the blood pressure measurements whenever the alarm sounds.)

- 24.1. After the supine blood pressure and pulse are recorded, **press the Holter event** button on the Holter monitor while the participant is still supine and resting. Record the time from the Holter recorder clock and the date in the Holter Diary. Remove the left cuff.

- 24.2. Help the participant stand in front of the table or a chair, in case the participant feels faint. **Press the Holter event button** again, after the participant stands, and record the time in the diary. Set the timer for 3 minutes.
- 24.3. The participant should stand for 3 minutes before taking the standing pulse and blood pressure, using the protocol described above. During the three-minute wait, perform the knee alignment, hand examination, and Romberg if time permits.
- 24.4. While standing, ask the participant if he/she feels dizzy, light-headed, or faint. Record in PE Teleform. If he/she becomes symptomatic, seat the participant and retake the blood pressure and pulse right away. Record results in the Teleform as well as in the progress notes section of the medical record. Also record presence of orthostatic symptoms in the appropriate question of the Teleform.
- 24.5. After standing for 3 minutes, take the blood pressure and pulse again, recording the results on the Physical Examination Teleform. Record presence/absence of symptoms.
- 25. Knee Alignment:** The participant faces the examiner with bare feet positioned at shoulder-width apart, weight equally distributed. Toes point straight ahead. Examine the **RIGHT KNEE** then repeat for the **LEFT KNEE**. Examiner places the axis of the goniometer at the center of the patella. The stationary arm of the goniometer is aligned mid thigh and the moveable arm of the goniometer is aligned along the center of the ankle. If the goniometer reads 0° then record this. If not, record the degree of varus (knees pointing outwards) or valgus (knees pointing inwards) on the Teleform.
- 26. Romberg:** Stand next to participant and be prepared to catch him/her if unstable. *“Stand with your feet together and almost touching and without holding anything for support. Now close your eyes.”* Time the participant in this position for 20 seconds. If the participant loses balance, the Romberg is present. Slight swaying is normal.
- 27. Hand exam:** Participant is instructed to place hands with palms downward. The examiner feels each joints of the RIGHT hand noting any abnormality. Examiner records (T) tenderness, (E) enlargement, and/or (D) deformity for each joint indicated on the examination form. Heberden’s nodes are coded as “E”, for enlargement. Misalignments, swan neck deformity, and boutonnière deformities are examples of deformities, coded as “D”. Absence of a mark indicates that the abnormality is not present. Examiner fills in “All normal” if none of the joints have tenderness, enlargement or deformity. Repeat the examination of the LEFT hand.
- 28. Pronator Drift:** *“Stand and hold your arms stretched out straight in front of you with your palms up until I tell you to stop.”* The feet should be parallel (ankles are not touching) and beneath the center of the anterior superior iliac crest. Time the participant standing in this position for 30 seconds. A pronator drift is reported if either arm drifts

downward or into a pronated position. If the participant cannot stand for this assessment, perform it while seated.

29. Occiput to Wall Distance: Ask the participant to stand against the wall. “With your lower back flat against the wall, touch the back of your head to the wall.” If the occiput touches the wall, the examiner records “Yes (0 cm)”. If the occiput does not touch the wall, record the distance (centimeters) between the occiput and the wall. Flexion at the hips and knees and taking a single step away from the wall are permitted to attain the appropriate position of lower back to wall.

30. Spine Exam

30.1. Total Spine Flexion Range of Motion - Active range of motion of the lumbosacral spine is tested with the participant standing facing away from the examiner. Examiner instructs the participant, “Stand with your feet shoulder-width apart, toes pointed straight ahead. Stand with your weight equally distributed.” To identify T₁₂, place hands on bilateral iliac crests and identify the spinous process that is in line with the top of the iliac crests—this should be at the level of the 4th lumbar vertebrae (L₄). Then, count up until the spinous process of T₁₂ is reached (L₄>>L₃>>L₂>>L₁>> T₁₂). The inclinometer, which is oriented in the sagittal plane, is placed just above this mark with the base centered over T₁₂. Then, the inclinometer must be set to zero. The inclinometer is centered over the mark at T₁₂, but the base is placed flush against the spine so that the inclinometer is oriented in the sagittal plane. The examiner must stand to the side of the participant in order to read the face of the instrument. The inclinometer is zeroed. The participant is instructed to bend forwards as far as possible without bending the knees. The range of motion value on the inclinometer is recorded for total flexion.

30.2. Spine flexion motion painful: Examiner asks the participant, “Is this movement painful or uncomfortable?” and records the response.

30.3. Total Spine Extension - The inclinometer is centered over the mark at T₁₂. The inclinometer is zeroed. The participant is instructed to bend backwards as far as possible without bending his knees. The range of motion value is recorded for total extension.

30.4. Spine extension motion painful: Examiner asks the participant, “Is this movement painful or uncomfortable?” and records the response.

31. Active Shoulder Elevation - The participant is instructed, “Please lift your hands directly in front of you as high as you can with your thumbs pointing up. Do not allow the participant to extend his trunk or abduct the shoulder as a substitution movement. Record the extent to which the participant is able to do this movement, “Fully” “Partially” or “Unable.”

- 32. Functional Shoulder External Rotation** – Shoulder external rotation will be measured with a functional test for each side. Full active external rotation is required to place the hand behind the neck. Therefore, the examiner will ask the participant to place both hands behind the neck at the level of the ears, with the arms parallel to the floor and elbow pointed out to the sides at 180 degrees from the body. Record the extent to which the participant is able to do this movement, “Fully” “Partially” or “Unable” for each side.
- 33. Shoulder External Motion Painful** - As the participant is taken through external rotation, the examiner asks, “Is this movement painful or uncomfortable?” and records the participant’s response for each side.
- 34. Tender points** With the participant comfortably seated in a chair or standing, instruct the participant “Using this instrument I will apply pressure to several point on your body. Please tell me when you first experience any pain or discomfort.” Ask the participant to stand comfortably to complete the gluteal and greater trochanter assessments. The following pressure points are examined on each side of the body: Occiput, trapezius, supraspinatus, gluteal, greater trochanter, low cervical, second rib, lateral epicondyle, and anserine bursa. Examiner applies up to 3 pounds of pressure to each of the pressure points and records the pounds of pressure applied if pain is reported at less than 3 pounds. If the participant does not report pain or discomfort by 3 lbs, stop and leave that field blank. If all locations are not painful or tender, record “All normal.”
- 35. Neck:**
- 35.1. Neck extension range of motion:** The examiner stands at the side of the participant and places the inclinometer in the sagittal plane on the participant’s head in front of the participant’s ears. Next the examiner zeroes the inclinometer and instructs the participant “Keeping your back against the chair, raise your head up and back as far as you can without moving your shoulders.” The examiner records the degree of motion. The participant extends the neck to the limit of motion. The degree of motion on the inclinometer is recorded for extension.
- 35.2. Neck extension painful motion:** Examiner asks, “Is this movement painful or uncomfortable?” The examiner records the participant’s response.
- 35.3. Neck Rotation** – The participant is seated in a chair facing away from the examiner. The examiner stands behind the participant at a vantage point to look down at the participant’s head (e.g. the hideaway step at the end of the examination table). While standing over the participant, the examiner centers the goniometer on top of the participant’s head, aligning the two arms of the goniometer with the tip of the participant’s nose. Examiner holds the stationary arm in place and instructs the participant, “Move your head and look as far right as you possibly can without moving your shoulders.” The participant rotates the neck to the limit of motion. As the participant rotates, the examiner moves the moveable (top) arm of the

goniometer with the nose while maintaining the stationary arm in its initial position. Examiner records the rotational range of motion to the RIGHT. Repeat for the LEFT.

35.4. Active rotation painful. As the participant rotates his/her head in each direction, the examiner asks, “Is this movement painful or uncomfortable?” and records the response. Repeat for the LEFT.

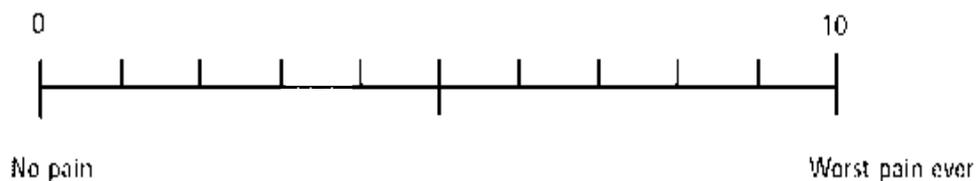
36. Achilles Reflex: Ask the participant to kneel in the chair, facing and holding onto the back of the chair. The participant’s feet should hang off the edge of the front of the seat. Gently strike the Achilles tendon with the reflex hammer while resting your hand on the gastrocnemius (calf) muscle. You should feel and/or see plantar flexion of the foot and contraction of the gastrocnemius. If there is no contraction or plantar flexion, gently press the ball of the foot so that the foot is slightly dorsiflexed. Strike the Achilles tendon with the reflex hammer.

37. Venous Insufficiency II - Clinical Classification:^{3,4} Venous insufficiency is assessed using the clinical assessment criteria in the CEAP Classification System described by Nicolaides.² Visually inspect the entire legs to assign the clinical classifications below. Palpate the lower legs to assess edema and presence of lipodermatosclerosis.

37.1. “Do you have pain in your lower legs that is worse when standing for long periods of time and is relieved by sitting and elevating legs?”

If “Yes”, ask the participant, “*Is it due to joint pain or arthritis?*” “*Does it worsen with walking?*” If “No” to both questions, ask, “*Do you need over-the-counter or prescription medication to relieve the pain?*” Then ask,

“*On a scale of zero to ten, with zero being no pain, and 10 being the worst pain ever, how would you rate your pain?*”



- 37.2.** Edema: Assess extremities for peripheral edema by applying pressure to the pretibial and ankle regions on both legs. No indentation should be score as “No pitting edema”. Edema that is very easily detected, e.g. leaving moderate or deep indentations, should be coded as “Very obvious pitting edema”. Otherwise, code pitting edema as “Trace pitting edema”, including edema that pits with shallow indentations even if it involves most of the pretibial leg region. If there is uncertainty whether edema should be coded as “none” vs. “trace”, choose “none”; if uncertainty lies between “trace” and “obvious”, choose “obvious”.



- 37.3.** Pigmentation – Pigmentation may be observed as a brownish discoloration in lower extremities due to hemosiderin deposition in the skin, also called stasis dermatitis.

Image referenced from: <http://www.nlm.nih.gov/medlineplus/ency/article/000834.htm>

- 37.4.** Lipodermatosclerosis (LDS) – This is chronic induration of the skin that may be associated with loss of subcutaneous tissue and a decrease in lower leg circumference.



Note loss of tissue and decreased lower leg circumference. Tissue would be thickened and firm on palpation.

Venous stasis ulcer on medial aspect of lower leg

Image referenced from <http://www.emedicine.com/med/topic2760.htm#target1>

- 37.5.** Ulcer: “Traumatic” ulcers are those that resulted from direct injury, e.g. from pets jumping on participant or from participant bumping into furniture, and should not contribute to the CEAP score. Notice areas that appear to be healed wounds/ulcers. If these are present, ask the participant if he/she has had any ulcers of the lower extremities in the past. Clarify if the wound was from

trauma vs. vascular disease. If an ulcer is present on the exam, measure the largest diameter to determine if it is $<$ or ≥ 2 cm. Determine from the participant whether it is a first ulcer or a recurring ulcer and how long it has been present ($<$ or ≥ 3 months). Record on Teleform.

38. Inspection

During the examination, note whether any amputation or paralysis/paresis is present. If digits are amputated, only code amputations if more than one phalanx is missing.

39. Finger Tapping Program (on computer):

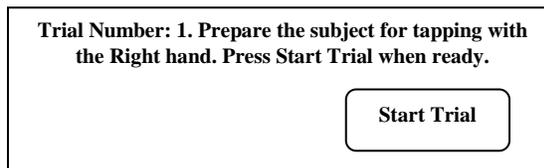
Seat the participant at the table in front of the computer. You may need to move the keyboard near the center of the table to provide adequate room. Ask the participant to remove watches or jewelry on the wrists. Demonstrate the test as you explain it.

“Next we will measure your motor coordination. Are you right-handed or left handed? Place your (dominant) hand on the table so that your wrist touches the table and your index finger rests on the spacebar of the keyboard, like this.”

(Show hand position if necessary.) *“When I say ‘Go’, I want you to tap with your index finger on the space bar as quickly as you can. Try to make sure the spacebar goes all the way up before tapping it again. The screen will show the word ‘TAP!’, when you should begin tapping. I will tell you when to stop.”*

Allow the participant to tap on the spacebar before beginning the test to make sure he/she understands the instructions. Double click on the Motor(2) icon on the desktop of the computer in the exam room. Use the cursor to select ‘Operations’ on the toolbar. Select ‘Simple Tapping’. Move the cursor to ‘Start Test’ and click.

Type ‘1’ if right handed and ‘2’ if left-handed. Press **ENTER** or click ‘OK’. If you type ‘1’, the following message will appear:



(Note: If the person is left handed, the message will say “.....with the Left hand.”) The program assumes the participant always uses the **dominant hand for the first trial, the non-dominant hand for the second trial, and so on** so make sure the participant performs the tests in this order.

Just before beginning fingertapping, press the Holter event button and record the time from the Holter clock on the Holter diary. When the participant is in position

and ready to begin, select **'Start Trial'** and give the command to begin. Do not say 'Go' before clicking "Start Trial". If the participant begins before you press "Start Trial" the program will restart and all trials must be repeated. The program begins immediately after selecting 'Start Trial' with the word **"TAP!"** appearing on a white screen. The program automatically stops after ten seconds. You do not need to time it. The message below will appear on the screen telling you the trial is complete.

TRIAL COMPLETE
Click here to present
the next trial

Click on this **'TRIAL COMPLETE'** box (shown above). The message below will then appear:

Trial Number: 2. Prepare the subject for tapping with
the Left hand. Press Start Trial when ready.

Start Trial

Make certain the participant uses the dominant hand on the first test and the non-dominant hand for trial number 2, and alternates throughout the trial for Simple Tapping. When the participant is ready with the left hand for trial two, give the command to begin and click on the **'Start Trial'** box (shown above). The white **'TAP!'** screen will appear again while the participant taps for ten seconds. At the end of the ten seconds, you will see the **'TRIAL COMPLETE'** box again (shown below).

TRIAL COMPLETE
Click here to present
the next trial

Prepare the participant to tap again with the right hand. Repeat this sequence of events until the participant has performed three measurements on each hand

The message will read "Trial Number: 7." When this appears in the box, use the cursor to select **'Operations'**.

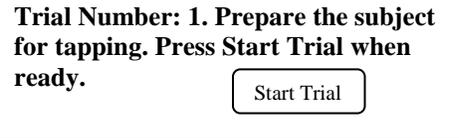
Select **'Complex Tapping 1'**. The data from Simple Tapping will not be lost.

"Now I would like you to alternate tapping the "S" key using your left index finger and the "L" key using your right index finger. Remember to keep your wrists resting on the table. When I tell you to start, begin tapping as quickly and accurately as possible. It doesn't matter which hand you begin with but do not tap both keys at the same time." The participant may start with either hand. If the

participant cannot reach the middle row of keys easily, use the “C” for the left hand and the “M” for the right hand.

When the participant is ready with both wrists on the table and the index fingers on the ‘S’ and ‘L’ keys, (or, alternatively, the ‘C’ and ‘M’ keys),

Select ‘Start Test’

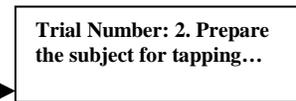


When the participant is Ready, select

‘Start Trial’



TAP!



Continue until the fourth trial appears, select ‘Operations’. Then select ‘Scores’. Press the Holter event button when fingertapping is completed and record the time from the Holter clock on the Holter diary.

Type the participant’s name in the box next to Subject, replacing “John Doe”. The date will be filled in automatically.

Click on “Compute simple”. Data should appear in the empty boxes for Simple Tapping.

Click on “Compute Complex1”. Data should appear in the empty boxes for Complex1. If not, repeat the missing tests (without the practice trials). When the data appears, select ‘Save Data’.

In the Name box, type **B:\####v##.txt**, where ####v## represents the participant’s BLSA ID number and visit number. Include leading zeros in the ID number. For example, if the participant’s ID number is 99 and visit 6, you would type **B:\0099v6.txt**.⁵

Select ‘OK’.

Exit out of the program by selecting the ‘X’ in the upper right corner. A message will appear; ignore it and select ‘OK’.

6. Procedures for Performing the Measurement at Home

The physical exam should be performed at home as described in the protocol for the clinic assessment.

7. Alert Values/Follow-up/Reporting to Participants

Abnormal physical exam findings from this protocol do not generally warrant an alert if the participant is asymptomatic. Clinical judgment should be used. Findings that would likely affect a participant's medical treatment are reported to the participant. With the participant's permission, these findings are also reported to the participant's physician or other health care provider. Specific examples include blood pressure $\geq 140/90$, orthostatic findings, new heart murmurs, altered characteristics of a heart murmur, the presence of vascular bruits. If the clinician has questions or concerns, particularly if a patient is symptomatic, one of the staff physicians should be consulted to aid in assessing the participant and to make decisions regarding the need for further evaluation in an outpatient or inpatient setting. Letters are mailed within two weeks of the participant's visit.

8. Quality Assurance

All examiners will undergo training, certification, and regular re-certification.

8.1. Training Requirements

All examiners must be trained to perform the standardized physical examination by a staff physician. Written documentation of completed training should be maintained. (See 8.2)

8.2. Certification Requirements

A staff physician must certify all examiners to perform the physical examination. Reassessment and re-certification should be conducted semi-annually. To be certified, the staff physician(s) must observe each examiner performing the complete physical examination.

8.3. Quality Assurance/Certification Checklist

Examiners must be observed and re-certified semi-annually by staff physician.

9. References

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