STUDY OF OSTEOPOROTIC FRACTURES

PROTOCOL - ANTHROPOMETRIC MEASURES AND BLOOD PRESSURE

Rounding convention: Round up at .5 of smallest unit recorded on exam form.

Tape measure: Since a steel tape is used for several measurements, it may be convenient to hang the tape on a cord around the examanier's neck, with enough play to allow use without removing the cord.

1) Weight in Kilograms/Pounds

The weight is measured in kilograms, using a standard balance beam scale, without shoes and without outer clothing or heavy sweaters. The participant should stand in the center of the scales with her weight equally distributed on both feet and not touch or support herself on anything. Weight is recorded to the nearest 0.1 kg. Each center should have a 50 kg weight for calibration. (If the scale is calibrated in pounds, measure to the nearest 1/4 pound and covert to kilograms.)

Optional script. "In order to measure your weight, I would like you to remove your shoes (and any heavy outer clothing) and step forward onto the center of the scale."

Some participants will require support while being weighed. A scale with a safety railing would be ideal for this. It may be possible to have the manufacturer of your existing scale install a safety railing at a reasonable cost. Otherwise, weigh yourself with and without the participant's cane, etc., to determine its weight. Subtract the weight of the aid from the participant's weight before recording. In the event that it is necessary for the examiner to support the participant during weighing, provide the minimun support that is safe.

2) Stature (Standing Height) with a wall-mounted Harpendon Portable Stadiometer

The participant stands with her back against the wall-mounted ruler with the heels together and both heels touching the wall ruler. The back (scapulae) and buttocks should also be in contact with the wall ruler. Occasionally, it will be impossible to position the participant's heels, buttocks, scapulae and the back of the head in one vertical plane against the wall-ruler and still have her stand naturally and comfortably. If the back is arched due to large buttocks, move the participant forward and have only one part (usually the buttocks) in contact with the stadiometer. Similarly for participants with severe spinal curvature, if the spine is the part that protrudes the farthest, then that should be the part that is touching the rule.

Be sure that in this position the participant maintains erect posture, i.e., no slouching. Heels should be together with the weight equally distributed and the head in the "Frankfort Horizontal Plane." The line through the lowest point on the inferior orbital margin (orbitale) and the upper margin of the external auditory meatus (tragion) should be horizontal. Note gross, uncorrectable deviations from the Frankfort plane on the scoring form. The horizontal bar is brought down firmly onto the top of the head. It may be necessary, upon occasion, to remove or alter the hairdress of some of the participants. This is necessary for the horizontal bar to make contact with the top of the scalp. Have the participant inhale deeply, again not altering position by, for example, raising the heels off the floor. Stature is measured just before exhaling. The measurement is recorded to the nearest tenth of a centimeter.

Optional script. "Please stand against the ruler which is mounted on this wall. Your heels should be together (as close as possible) and both heels should be touching the ruler. I will position your head so that I can measure your height more accurately." Once in position, say "Take a deep breath." measure height and then say "Exhale."

3) Waist Girth - Steel Tape

Waist girth will be measured in centimeters using a steel tape around the abdomen horizontally at the midpoint between the highest point of the iliac crest and lowest part of the costal margin in the mid axillary line. The participant should stand with her weight equally distributed on both feet. Participants are instructed not to wear any restricting or compressing undergarments which could interfere with the measurement. She should relax and breath normally. **The examiner should be sitting.** Pull the tape halfway around her waist. Palpate the rib cage and the top of the iliac crest on both sides with two or three fingers as you place the tape. Be sure the tape is in the same horizontal plane all around. Measure the waist over light, single thickness clothing, e.g. cotton blouse. Heavy or extra clothing should be pulled up or removed. It may be necessary to lower slacks or skirt a few inches if the waist bans is in the plane of measurement or is producing a bulge in tissue. Do not pull the tape tight enough to compress tissue. Record the measurement to the nearest tenth of a centimeter.

Optional script. "I'm going to measure your waist halfway between the bottom of your rib cage and the top of your hip." Palpate rib cage and top of iliac crest while your saying this and mark your spot and measure.

Note: Purchase a steel tape that is marked in centimaters alone on one side. Confusion may arise if the tape is marked in centimeters and inches on the same side.

4) Hip Girth - Steel Tape

Hip girth will be measured similarly at the **widest** point--usually at level of the greater femoral trochanter. To find the greater trochanter of the hip, pull the tape halfway around the hips and palpate firmly on both sides to find the bony prominence. Mark the spot with your fingers and pull the tape all the way around from that point. (In some people it is not possible to feel that bone and the measurement should simply be taken at what appears to be the widest point around the hips.) **When the tape is in place, look to be sure that it is horizontal around the widest area and has not slipped out of place, especially in back.**

Optional script. "I'm also going to measure your hips. To do so I have to find the bony point called the trochanter." Palpate the greater trochanter as you say this, mark your spot and measure.

5) Measure and mark right arm for blood pressure measurement. (See blood pressure protocol.)

6) Grip Strength (dynamometer)

Grip strength will be measured in both arms. The handle should be adjusted so that the individual holds the dynamometer comfortably. Place the dynamometer in the right hand with the dial facing the palm. The participant's arm should be flexed 90° at the elbow and

the forearm parallel to the floor. As you demonstrate, instruct the individual to squeeze the hand maximally while simultaneously lowering the arm on a three second count. The grip should be released when the subject's arm is completely extended, hanging straight at her side. Allow one practice trial for each arm. On the second trial, record the kilograms pulled from the dial to the nearest 0.5 kg. Reset the dial. Repeat the procedure for the left arm.

Precautions: The arm should not contact the body. The gripping action should be a slow sustained squeeze rather than an explosive jerk.

Optional script. "This device measures your arm and upper body strength. We will measure your grip strength in both arms. I will demonstrate how it is done. Bend your elbow at a 90° angle, with your forearm parallel to the floor. Don't let your arm touch the side of your body. Lower the device slowly as you squeeze as hard as you can. Once your arm is fully extended, you can loosen your grip."

7) Strength Measurements with Hand-held Dynamometer

I. General

These tests are designed to estimate the subject's maximum strength. The examiner must push on the subject with the maximum force needed to overcome the resistance of the subject. The peak force attained will be automatically recorded on the dynamometer.

In order to measure the strength of the muscle, we must know the distance between the joint that is moving and the place where the dynamometer is placed. Therefore, each positon begins by measuring the distance between two landmarks on the arm or leg.

II. To Begin:

Ask the subject: "Have you had a stroke or injury that has made one side of your body weaker than the other?" Record the answer. If "no," test only the right side. If "yes," test both sides.

III. General Instructions to the Patient

Tell the participant: "I am going to use this gauge to measure how strong your muscles are (show it to patient). I will put this cushioned part against your arm or leg. When you are ready, I will count to three. On the count of three, I will start to push against your arm or leg. I want you to hold the position: DON'T LET ME MOVE YOU ARM OR LEG-- PUSH BACK. I will say HOLD, HOLD, PUSH, PUSH, PUSH and then RELAX. I will take one measurement for each muscle." As you give the instruction demonstrate what you will do by pushing the dynamometer with one hand against your opposite arm.

Start with one practice session using the knee extensors.

IV. Specific Tests:

KNEE EXTENSORS
(ONE PRACTICE SESSION; ONE FOR MEASUREMENT)

1. Have the participant sit on the edge of the examination table high enough so that her feet do not touch the ground. Start with the knee joint bent to 90°.

2. Measure the distance between the knee joint line and the lateral maleolus (ankle bone). The knee joint line is a narrow depression in the bones along the lateral part of the knee, just about even with the lower border of the kneecap. If you can't find the exact line, start at a point that is level with the bottom of the kneecap (patella). Record the distance.

3. Place the dynamometer on the anterior surface of the lower leg about 3 cm above the level of the lateral maleolus.

4. Ask the participant to hold on to the sides of the exam table with both hands.

5. The examiner should kneel on the floor (you may partly rest on a low stool) in front of the participant. The examiner should hold the dynamometer with her strongest hand with her elbow bent to 90° and that elbow pressed in against the abdomen and upper front part of the pelvis for extra support. The opposite hand should hold onto the wrist of the arm that is holding the dynamometer to give extra strength and stability.

6. When the dynometer is in place say: "When I count three I will begin to push against your leg. I want you to hold your leg here, don't let me push it back, when I say 'push, push, push,' I want you to push against the bar as hard as you can. Don't be afraid to push as hard as you can.

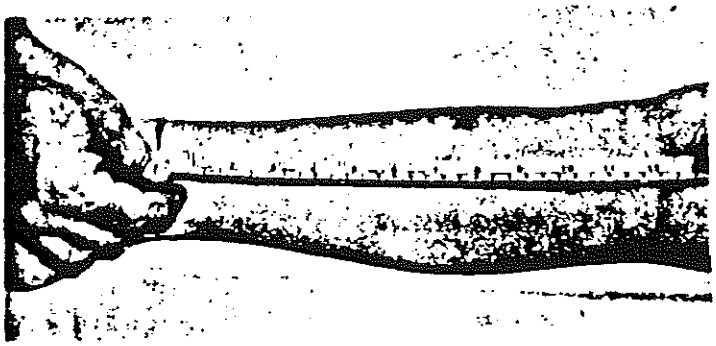
Ready? One, two, three, **HOLD, HOLD, PUSH, PUSH, PUSH...RELAX."**

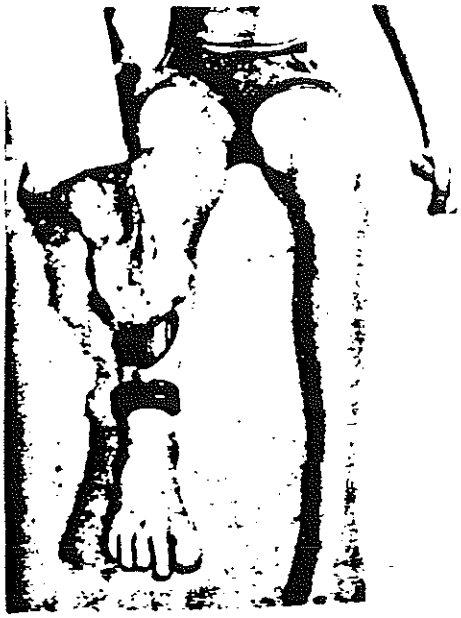
PUSH HARD ENOUGH TO MOVE THE PARTICPANT'S LEG BACKWARD.

7. AFTER THE PRACTICE SESSION, REPEAT FOR ACTUAL MEASUREMENT.

8. RECORD the dynamometer reading to the nearest killogram. RECORD whether you were able to overcome her resistance by moving the leg backward a little. If you could not overcome her strength, we will know that her strength is probably greater than the reading on the dynamometer.

9. Reset the dynamometer to ZERO for the next examination.





TRICEPS (ELBOW EXTENSORS)

Help participant lie face - up on table.

1. Position the arm alongside the body with elbow flexed at 90°.

2. With the elbow at 90°, have the participant turn the palm of her hand toward her feet so that the lateral (exterior) humeral epicondyle (where elbow breadth measure is taken) and the ulnar styloid process (the boney prominence just below the wrist) are on the same side. Measure the distance from the humeral epicondyle to the ulnar styloid. Record the value to the nearest centimeter.

3. Apply the dynamometer to the lateral ulnar side of the distal forearm (the same side as the ulnar styloid), so that the upper edge of the padded bar is just below the prominent ulnar styloid (the bone near the wrist where the measurement is taken).

4. Ask the participant to hold on to the edge of examination table with the other hand.

5. The examiner should sit on the table, alongside the participant with one leg on the floor. Face the participant. Hold the dynamometer firmly with your elbow bent at 90° and tucked firmly against your body. Support the hand that is holding the dynamometer with the other hand.

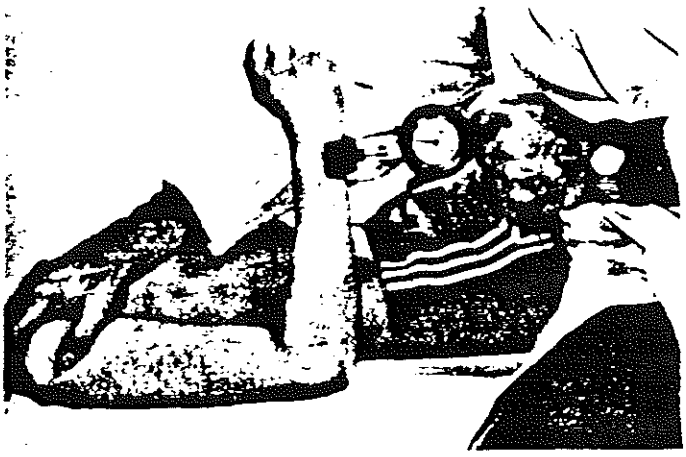
6. When the dynometer is in place say: " When I count three I will begin to push against your arm. I want you to hold your arm here, don't let me push it back, when I say 'push, push, push,' I want you to push against the bar as hard as you can. Don't be afraid to push as hard as you can.

Ready? One, two, three, **HOLD, HOLD, PUSH, PUSH, PUSH...RELAX."**

PUSH HARD ENOUGH TO MOVE HER ARM BACK.

7. **Record** the measurement to the nearest kilogram. **Record** whether you were able to overcome her resistance by moving the arm backward a little.

8. Reset the dynamometer to ZERO for the next examination.



HIP ABDUCTORS

1. The participant should stay in the supine position. The leg to be tested should be flat against the examination table with the patella directed upward. Put a vinyl covered sandbag under the lowest part of the leg so that the heel is resting slightly off the table.

2. The opposite (left) leg should be bent with the sole of the foot flat against the bed and the side of the knee resting against the wall.

3. Measure the distance between the tip of the greater trochanter (hip bone) and the lateral maleolus (ankle bone). Record the distance

4. Tell the participant to hold on to the edges of the examination table.

5. The examiner should sit on a firm high chair or stand with legs apart facing the participant's leg. Hold the dynamometer firmly with your elbow bent at 90° and tucked firmly against your body. Support the hand that is holding the dynamometer with the other hand.

6. Place the dynamometer along the lateral side of the lower leg 3 cm above the lateral maleolus (ankle bone). Tell the participant: "I want you to keep your knee straight. Do not bend your knee."

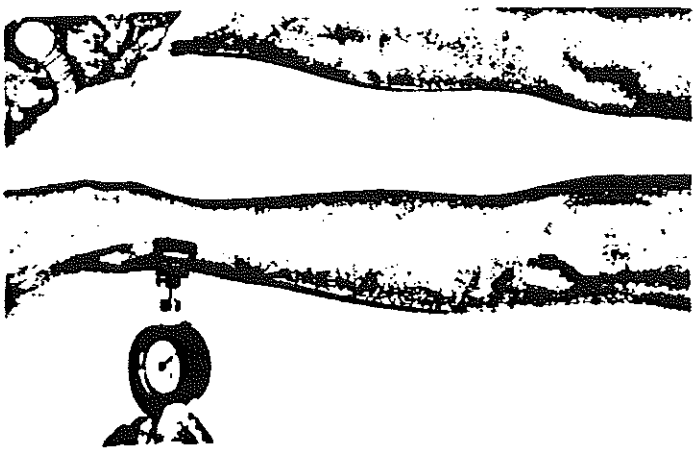
7. When the dynometer is in place say: "When I count three I will begin to push against your leg. I want you to hold your leg there, don't let me push it back, when I say 'push, push, push,' I want you to push against the bar as hard as you can. Don't be afraid to push as hard as you can." Lift the participant's leg and demonstrate how they should push their lower leg outward, away from the wall.

Ready? One, two, three, **HOLD, HOLD, PUSH, PUSH, PUSH...RELAX."**

PUSH HARD ENOUGH TO MOVE HER LEG BACK TOWARD THE WALL.

8. **Record** the measurement. **Record** whether you were able to overcome her resistance by moving her leg backward a little.

9. Reset the dynamometer to ZERO for the next examination.



ANKLE DORSIFLEXORS (Dropped from Examination 9/12/86)

1. The participant should stay in the supine position. Put a small pillow under the knee. The foot should be held at a 90° angle at the ankle.

2. The opposite (left) leg should remain bent with the side of the knee resting against the wall.

3. Measure the distance between the tip the medial maleolus (ankle bone) and the first metatarsal-phalangeal (MTP) joint (the base of the great toe). Record the distance.

4. Tell the participant to hold on to the edges of the examination table.

5. The examiner should sit on the table alongside the leg facing the participant's foot. Hold the dynamometer firmly with both hands. Place the bar of the dynamometer on the MTP joint at about a 45° angle between the top and lateral aspects of the toe. Check to make sure that the ankle is being held at a 90° angle.

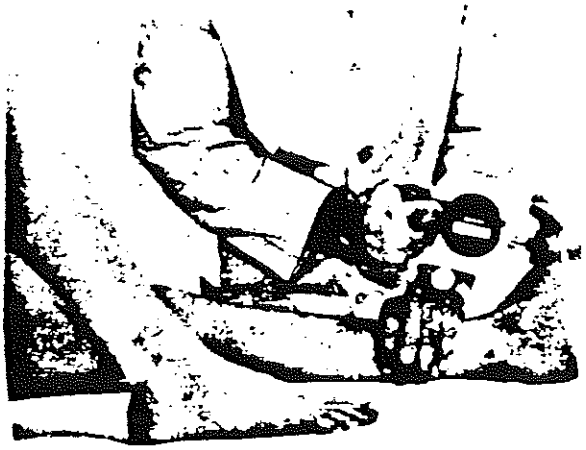
6. When the dynometer is in place say: " When I count three I will begin to push against your foot. I want you to hold your foot here, don't let me push it back. When I say 'push, push, push,' I want you to push up against the bar as hard as you can. Don't be afraid to push as hard as you can.

Ready? One, two, three, **HOLD, HOLD, PUSH, PUSH, PUSH...RELAX."**

PUSH HARD ENOUGH TO MOVE HER FOOT DOWN.

7. **Record** the measurement. **Record** whether you were able to overcome her resistance by moving her foot downward a little.

8. Reset the dynamometer to ZERO for the next examination.



8) Elbow Breadth in Centimeters (spreading caliper)

* Measurement should be taken twice by one observer. If the two measurements do not agree within 2 mm, draw a line through the first two measurements and then take two more.

With the participant lying supine on the examining table, bring the right arm out over the edge of the table so that the right elbow is about 4 to 6 inches past the edge of the table. The elbow is bent to a 90° angle with the forearm held vertically and the palm of the hand directed toward the head. The shirt sleeve should be rolled up past the elbow and the measurement made on bare skin. The examiner should be seated facing the table.

The epicondyles of the humerus are located on the lateral and medial sides of the elbow, and the breadth at this level is measured with the broad blade sliding calipers. The long blades of the caliper are placed over the epicondyles at a 45 degree angle, bisecting the 90 degree angle of the elbow. The blades of the caliper should extend no more than about 1/4 inch past the outer condyle and 1/2 inch past the inner condyle. Firm pressure should be applied, and the two observations should agree within 2 mm (.2 cm). Record the measurement to the nearest millimeter. THE CALIPERS ARE IN CENTIMETERS SO BE SURE TO CONVERT THE READING TO MILLIMETERS.

Optional script. "This device measures the size of your elbow, which gives us an idea of your frame size. Height and weight usually differs depending on frame size. (Ask the participant to roll up her sleeve, if necessary.) Bend your right arm at a 90° angle, with your palm facing you. The measurement is taken on two bones on either side of your elbow".

9) Knee Height-Sliding Caliper

* Measurement should be taken twice by one observer. If the two measurements do not agree within 0.5 cm, draw a line through the first two measurements and then take two more. Measure the right leg. If there is an obvious difference between the lengths of the two legs, measure the longer one.

The knee height measurement is made with a sliding, broad-blade caliper. This device consists of an adjustable measuring stick with a blade attached to each end at a 90° angle.

While lying supine, the person being measured bends the right knee at a 90° angle. Use the goniometer to measure the angle. Shoes should be removed and slacks rolled up past the knee. Very heavy socks should also be removed. One blade of the sliding, broad-blade caliper is placed under the heel of the right foot. The heel rests on the caliper and just off the surface of the table. The ankle should be held at a 90° angle. Sandbags under the foot and a piece of carpetting on the table should be used to stabilize the foot position.

The other blade is placed over the anterior surface of the right thigh, across the condyles of the femur and just proximal to the patella (kneecap). Pressure is applied to compress tissue. Record to the nearest 0.1 cm.

Optional script. "This device measures the distance from your heel to the top of your knee. Bend your right leg at the knee and pull your foot up to your body. I'm putting a sandbag under your foot for support. I'm going to take two measurements".

10) Take supine blood pressure. (See blood pressure protocol.)

11) Take standing blood pressure. (See blood pressure protocol.)

11) Take standing blood pressure. (See blood pressure protocol.)

STANDARDIZED CLINIC PROCEDURES FOR BLOOD PRESSURE MEASUREMENTS

Correct measurement of indirect blood pressure is of importance and concern both to the fracture study and ancillary studies. It is essential that the standardized format described below for measuring blood pressure be followed exactly.

Major differences in blood pressure measurement methodology among health professionals from several countries have been observed despite the fact that written international recommendations of blood pressure measurement were established in 1939 by a joint committee of the American Heart Association and the Cardiac Society of Great Britian and Ireland. It is also well known that precision is essential for valid comparisons of blood pressure between groups of people and in individuals on different occasions. A number of elements can be identified in measuring blood pressure and each is explained briefly in subsequent subsections of this chapter ending with a subsection on technique that is presented in detail. All of these elements are equally important and close attention should be paid to each in order to insure that the blood pressure measurements have a standard and high level of accuracy and precision.

A. SOUND

For purposes of this study, SBP level is recorded at the level when phase 1 Korotkoff sounds are first heard and DBP is recorded at the beginning of phase 5 with disappearance of sounds. The onset of phase 1 and 5 sounds are the points of clinical importance.

B. EQUIPMENT

The following blood pressure measurement equipment will be used and standardized for the study: stethoscope, standard sphygmomanometers, cuff and bulb.

1. STETHOSCOPE

A standard Littman stethoscope having a bell will be used. Korotkoff sounds are best heard with the bell because of their low pitch. Stethoscope tubing should be about 10-13 inches from the bell piece to "Y" branching. This length provides optimal acoustical properties and allows the observer to read the sphygmomanometer at eye level and in a comfortable position. Earpieces should fit comfortably and snugly in the ears. Four points should be observed in using the stethoscope.

a) The ear pieces should be directed downwards and forwards into the external ear canal.

b) The ear pieces should be tight enough to exclude outside sound but not so tight that they cause discomfort.

c) The bell of stethoscope should be placed lightly on the skin overlying the brachial artery -- immediately below the cuff and medial to the cubital fossa above the medial epicondyle of the radius and posterior to the biceps muscle. Light pressure accentuates low-pitched sound and avoids

compression murmurs. Pressing too heavily with the stethoscope over the brachial artery can also produce sounds that can be heard by the observer by reducing the internal diameter of the brachial artery in the same manner as the cuff. This causes turbulent flow in the artery and a murmur can be heard and may prolong the apparent duration of phase 4.

d) The valve between the bell and diaphragm should be turned in the correct direction.

2. SPHYGMOMANOMETERS

Standard Baum Monometers will be used for determining peak inflation level and measuring blood pressure.

3. CUFFS AND BULBS

Clinics will have three standardized cuffs available – regular adult, pediatric, and large adults (by the Baum Company). Proper size of the cuff is essential for accurate blood pressure measurement. The Range Markings which are on the commercial cuffs actually overlap from size to size and are not considered to be optimum correct measurements. The pediatric cuff should be used for an arm circumference (AC) or below 24.5 - 33 cm, large adult cuff for AC of greater than 33 cm. Measuring procedure is described below:

Participants will be given full explanation and instructions about the blood pressure examination as well as an opportunity for discussion. The setting for taking blood pressure must be standardized for all clinic visits. The examination should take place in a quiet room where no other activity is taking place and where temperature fluctuations are minimal.

Once the participant has been given instructions and explanations and the equipment has been checked, blood pressure measurement can begin. The following steps should be followed as precisely as possible.

1) Have the participant stand facing away from the observer with right arm bent 90 degrees at elbow, hand on midsection. Locate the tip of the acromion (shoulder bone) and measure the length of the upper arm from the acromion to tip of elbow using a centimeter tape measure. Mark the midway point of the arm. Have the participant relax the arm at each side. Wrap the tape around the arm over the midpoint mark, being sure the tape is level. Note the circumfrance and choose cuff size accordingly.

2) Have the participant lie down on the examing table. The right arm should be flat on the table at about a 30 degree angle from the body. (If the right arm is missing or injured, reverse chairs and use left arm -- noting this change in the margin of the data form). The legs should be uncrossed.

3) Palpate for the brachial artery (Just medial to and above the cubital fossa). Choose the correct cuff size and wrap the cuff on the arm with the center of the bladder over the brachial artery. If the participant seems particularly apprehensive or nervous, wait until after the five minute wait

to wrap the cuff.

4) There must be a five minute wait before taking the pulse and blood pressure.

NOTE: The participant will be lying on the exam table for more than 5 minutes for the strength and anthropometric examinations.

5) Take the pulse at the radial artery for 30 seconds and record the number of beats in 30 seconds.

6) Connect the cuff to a standard manometer and establish the pulse obilteration level by slowly inflating while palpating radial artery until pulse is no longer felt. Then deflate and disconnect the cuff. Add 30 to the pulse disappearance level. The total is the peak inflation level for the standard manometer.

7) Measurement 1: Connect the cuff to the manometer. Inflate the cuff rapidly to the peak inflation level. Place the bell of the stethoscope on the brachial artery and slowly deflate the cuff (2mm per second) while listening. Record the 1st and 5th phases, reading the pressure in mmHG to the nearest even number and record. The first sound heard in a series of at least two sounds is recorded for SBP (phase 1). The first silence in a series of at least two silences is recorded for DBP (phase 5) not the last sound heard. Disconnect cuff.

8) Measurement 2: Have the participant stand beside the bed, balanced on both feet, not leaning against the bed or table. (You may use an adjustable, high table for holding equipment. The participant may rest her arm on this table during measurement.) The technician should be alert at this point to be certain that the participant does not feel faint or shaky. Be prepared to assist if needed. WAIT ONE MINUTE after bringing participant to a standing position, take one blood pressure reading, as above. Record. Ask The participant if she felt any dizziness, lightheadedness or wooziness. Record dizziness on the scoring form.

9) Take pulse at radial artery for 30 seconds. Record the number of beats in 30 seconds.

10) If a reading is missed, completely deflate the cuff and start over with a replacement reading. Always wait at least 30 seconds between readings.