Education Module

Ankle Brachial Index (ABI) Procedure in Adults for Handheld Doppler & Automatic ABI System
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Ankle Brachial Index (ABI) Procedure in Adults for Handheld Doppler & Automatic ABI System

Framework for Mastering the Competency

Ankle Brachial Index (ABI) is a non-invasive test which uses a hand-held Doppler or an automatic ABI system to measure the arterial blood flow in the lower legs. It is used to screen clients for the presence and severity of arterial compromise. ABI is carried out as part of the full lower leg assessment required to determine which clients need further vascular assessment and treatment.

- Nurses must successfully complete additional education and demonstrate competence before using Ankle Brachial Index testing in their practice.
- The agency / health authority must have a policy and standards in place to support this practice.

Mastering a competency requires that nurses acquire knowledge and integrate this knowledge safely into the practice environment. The activities outlined in # 1 and # 2 are required learning prior to carrying out ABI testing.

1. Acquiring Knowledge includes learning the related theory and developing the skills required to carry out Ankle Brachial Index testing.
   
   Theory:
   - Complete a Health Authority approved ABI Self-learning Education Module as available.
   - or
   - Attend an employer endorsed education session which includes the content of the ABI Procedure and Self Learning Education Module and may contain pre-reading including selected evidence-based articles or documents.

   Skill:
   - Practice the skill according to the:
     - Procedure: Ankle Brachial Index (ABI) in Adults using a Handheld Doppler
     - Procedure: Ankle Brachial Index (ABI) in Adults using an Automatic ABI System

2. Integrating Knowledge into Practice
   - Complete the case studies included in the ABI Education Module or discussed during the education session.
   - Carry out a return demonstration of the skill with a designated clinical lead in the practice setting. The demonstration may be repeated as needed to ensure that both the nurse doing the skill and the practice lead who is observing the skill are confident of the nurse’s mastery of ABI testing.
Introduction

The Ankle Brachial Index (ABI) is a non-invasive test to measure the arterial blood flow in the lower legs. It is used, as part of a comprehensive lower leg assessment to screen clients for the presence and severity of arterial compromise and to identify those clients who require further vascular assessment, as well as being useful in predicting the healability of lower leg wounds.

ABI can be completed using a handheld Doppler probe or an automatic ABI system.

ABI compares the systolic ankle pressure to the systolic brachial pressure using a blood pressure cuff and an 8 megahertz hand held Doppler probe; it is calculated by dividing the higher systolic blood pressure in the ankle by the higher of the two systolic blood pressures in the arms and is expressed as a ratio of these 2 values. In cases of severe edema or lymphedema a 5 meghertz Doppler probe may be needed.

Recently, an automatic ABI system has been developed. This system is comprised of a two chamber cuff for each extremity and automatically calculates, interprets and displays the ABI results in 3 minutes.

The accuracy of an ABI done with a handheld probe can be affected by the length of the rest period prior to the test, blood pressure cuff placement, cuff size and the speed of inflation and deflation. The advantage of the new automatic ABI system is that it can calculate the ABI without the need to rest the client and inflation / deflation is controlled by the machine.

The results of an ABI should be used in conjunction with a review of client history and a complete lower limb assessment when deciding on care. As indicated above, an ABI is done for clients with arterial compromise to predict the healability of lower leg wounds. An ABI is also part of the lower leg assessment required for clients with lower leg edema due to venous insufficiency or lymphedema to determine the presence of arterial compromise prior to initiating compression wraps or stockings.

Various names are used to refer to this assessment. These include:

- $\text{ABI} = \text{Ankle Brachial Index}$
- $\text{ABPI} = \text{Ankle Brachial Pressure Index}$
- $\text{API} = \text{Ankle Pressure Index}$

In this module, the term ABI is used to refer to Ankle Brachial Index.

Purpose

This self-learning module will teach you how measure an ABI, interpret ABI test results and understand the importance of this test for clients with lower leg and/or foot wounds.

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$^1$ The term client includes recipients of care in the community (clients), residential care (residents) and acute care (patients).
Learning Objectives

At the end of this module you will be able to:

1. Discuss the anatomy of arterial blood supply in the lower legs and feet.
2. Demonstrate the location of the pulses in the lower legs and feet.
3. Discuss the common etiologies of lower leg and foot wounds.
4. Demonstrate the ABI procedure using the hand held Doppler.
5. Demonstrate the ABI procedure using the automatic ABI system.
6. List hints for using the Doppler and effectively.
7. Describe the appropriate care of the Doppler ABI and the automatic ABI system.
8. Calculate the ABI if using the hand held Doppler.
9. State the significance of the ABI result.

Learning Activities

The learning activities included in this module support knowledge and skill acquisition (Section A) and help the learner to integrate this knowledge and skill into the practice environment (Section B).

Acquiring Knowledge and Skill for doing an ABI Procedure

1. Palpate pedal pulses.
2. Read the linked Decision Support Tool (DST): Guideline Assessment and Treatment of Lower Leg Ulcers.
3. Locate the handheld Doppler or the Automatic ABI System.
4. Read the linked Procedures: Ankle Brachial Index (ABI) in Adults using a Handheld Doppler and if your unit has an Automatic ABI System then the Ankle Brachial Index (ABI) in Adults using an Automatic ABI System.
5. Watch the linked Handheld ABI Procedure demonstration video (11 min).

Integrating knowledge and skill into Clinical Practice

1. Complete the Case Study questions.
2. Demonstrate the two ABI procedures.

Optional additional readings are listed in Appendix D.
SECTION A: THEORY

Anatomy of the Lower Leg Blood Supply

Review the diagrams below to locate the arteries and pulses in the lower leg and foot. All arteries have multiple branches that supply nutrients to all the compartments of the lower leg and foot.

The popliteal artery is a continuation of the femoral artery and divides into the anterior tibial artery and the posterior tibial artery. The anterior tibial artery becomes the dorsalis pedis artery at the ankle joint and is palpated on the dorsum of the foot. Note that a palpable dorsalis pedis pulse is congenitally absent in 12% of population. See the above diagram of the foot to locate the dorsalis pedis pulse.

The posterior tibial artery runs posterior to the medial malleolus and supplies both the lateral and medial plantar arteries. See the above diagram of the foot to locate the posterior tibial pulse.

The peroneal artery (also known as the fibular artery) branches off of the posterior tibial artery and runs anterior to the lateral malleolus. It supplies nutrients to the lateral and medial plantar arteries as well as to the fibula artery. This pulse is more difficult to palpate and auscultate but can be used when the dorsalis pedis or the posterior tibial pulse cannot be palpated or auscultated. See the above diagram of the foot to locate the peroneal (fibular) pulse.
1. Place an X on the pictures below to indicate the correct location of the two main pulses of the foot that are palpated when calculating an ABI.

2. Place an X on the pictures below to indicate the correct location of a pulse that can be used should one or both of the main pulses not be found.

3. Label each artery.

4. Palpate each of three arteries on your own foot or on the foot of a volunteer.

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Acquiring Knowledge and Skill #2

Read the DST
Guideline: Assessment and Treatment of Lower Leg Ulcers
**Lower Leg Ulcers**

Common etiologies of lower leg ulcers include:
- Venous ulcers (most common)
- Arterial ulcers
- Mixed Venous and Arterial ulcers
- Diabetic / Neuropathic ulcers
- Other etiologies, including lymphedema, vasculitis, malignancy, trauma, pyoderma gangrenosum.

Venous insufficiency is the main cause of venous ulcers. Risk factors for venous insufficiency include obesity, multiple pregnancies, major leg trauma, and a history of deep vein thrombosis.

Arterial compromise or atherosclerosis is the main cause of arterial ulcers. Risk factors for developing atherosclerosis include advancing age, elevated blood pressure, elevated cholesterol (LDL), diabetes, and smoking.

The clinical presentation of the lower leg and the ulcer is as important as the ABI in assessing and planning effective treatment. The ability to distinguish among various ulcer types comes with greater clinical experience and knowledge.

<table>
<thead>
<tr>
<th>Features</th>
<th>Venous</th>
<th>Arterial</th>
<th>Diabetic/ Neuropathic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td>Distal-medial 1/3 of lower leg (gaiter area), medial malleolus, often multiple ulcers</td>
<td>Pressure points or areas of repetitive trauma (on or between toes, metatarsal heads, lateral malleolus, heels)</td>
<td>Pressure points, areas of repetitive trauma, common to plantar surface of foot</td>
</tr>
<tr>
<td><strong>Wound Bed</strong></td>
<td>Shallow, ruddy, and/or yellow fibrin debris, granulation tissue common, rarely necrotic</td>
<td>Shallow to deep, pale pink or filled with yellow debris, may be necrotic, eschar is common</td>
<td>Shallow or deep, pink or pale or necrotic tissue, may probe to bone</td>
</tr>
<tr>
<td><strong>Exudate</strong></td>
<td>Moderate to heavy serous</td>
<td>Minimal serous or purulent</td>
<td>Small to moderate sero-sanguinous</td>
</tr>
<tr>
<td><strong>Wound Edge</strong></td>
<td>Diffuse, irregular</td>
<td>Well defined, “punched out” appearance</td>
<td>Well defined, “punched out” appearance, undermining or sinus tract</td>
</tr>
<tr>
<td>Peri-wound Skin</td>
<td>Macerated if increased exudate, weeping</td>
<td>Dry</td>
<td>Dry with surrounding callous</td>
</tr>
<tr>
<td><strong>Skin Appearance</strong></td>
<td>Erythema, dermatitis, edema, brown discoloration (hemosiderin staining), scarred areas</td>
<td>Thin, shiny, dry, hairless</td>
<td>Dry skin, heel cracks or fissures</td>
</tr>
<tr>
<td><strong>Pain</strong></td>
<td>Heavy, aching later in day</td>
<td>Severe pain, worse with elevation and activity, intermittent claudication &amp;/or rest pain</td>
<td>Numbness, burning or tingling, loss of protective sensation</td>
</tr>
<tr>
<td><strong>Edema</strong></td>
<td>Generalized dependent</td>
<td>None to minimal localized</td>
<td>None to minimal localized</td>
</tr>
<tr>
<td><strong>Varicosities</strong></td>
<td>Sometimes present</td>
<td>Not present</td>
<td>Not present</td>
</tr>
<tr>
<td><strong>Pedal Pulses</strong></td>
<td>Normal</td>
<td>Absent or faint</td>
<td>Absent, faint or bounding</td>
</tr>
</tbody>
</table>
Using The Handheld Doppler To Measure An ABI

The Doppler is a portable machine that transmits sound waves as blood moves through the blood vessels.

A handheld Doppler machine with an 8 megahertz (MHz) probe is recommended for measuring an ABI as the 8 MHz probe is able to locate peripheral superficial blood vessels. A 5 MHz probe may be needed for clients with severe edema or lymphedema as it has a stronger signal and is better able to penetrate the layers of edema.

Conducting ultrasound gel is used on the skin to help transmit the ultrasound waves. Do not substitute other types of gels.

The Doppler probe should be aimed into the gel and across the artery at a 45-60 degree angle toward the blood flow. Do not hold the probe perpendicular over the blood vessel. Hold the probe like a pencil for the best auditory feedback.

When locating the pulse the quality of the sound is very important:

- Arterial blood flow has a definite “whoosh whoosh” rhythmic sound

  ![Click to listen to a sample of arterial blood flow by Doppler](image)

- Veins lie laterally to arteries and emit a non-pulsatile rushing sound

  ![Click to listen to a sample of venous blood flow by Doppler](image)

Adjust the probe slightly once you hear the sound to determine if the quality of the sound improves or until you feel certain you are hearing arterial flow.

Using the Doppler is a learned technique that requires practice. When used with an appropriately sized blood pressure cuff, the systolic brachial and ankle blood pressures can be measured to calculate the ABI.

Acquiring Knowledge and Skill #3

Locate the Doppler at your site/unit and read the instruction manual if available.
A. Care of the Handheld Doppler and Blood Pressure Equipment

1. Clean and disinfect the Doppler and probe with a disinfectant / cleaning solution after each use according to the manufacturer's instructions and agency policy.

2. If a client has a draining wound, prevent contamination of the blood pressure cuff by protecting the wound with sterile or clean saline moistened gauze and wrap the leg in plastic wrap or cover with a clean plastic bag. If the blood pressure cuff becomes contaminated follow agency policy for cleaning.

3. Prevent contamination of the ultrasonic gel by using individual gel packets for each patient.

4. If open areas are present on the foot or ankle, prevent contamination of the Doppler probe by cutting out a finger tip from a protective glove and adding gel into the tip, then inserting the probe into the finger tip. Listen for the Doppler audio sound waves through the gel in the glove tip.

5. Replace batteries in the handheld Doppler if the screen indicates a low battery or if the machine shuts off spontaneously during the procedure. (Note: most units automatically shut off every 10 minutes.)

**Acquiring Knowledge and Skill #4**

Read: *Procedure for Ankle Brachial Index in Adults Using a Handheld Doppler*

**Acquiring Knowledge and Skill #5**

Watch: *ABI Procedure (Handheld) Demonstration Video* (9:33 minutes)
B. Tips for Accurate ABI Measurement with a Handheld Doppler

- Prior to ABI measurement, the patient must rest in a warm quiet room lying in a supine position with one small pillow behind the head for comfort. The patient must rest like this for at least 10 minutes. Document positioning during the procedure if the client is unable to tolerate lying supine.

- Ensure the cuff size is appropriate for the leg and correctly positioned on the arms and ankles.

<table>
<thead>
<tr>
<th>Cuff Size</th>
<th>Upper Arm Circumference at Midpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Centimeters</td>
</tr>
<tr>
<td>Small</td>
<td>22 – 26.9 cm</td>
</tr>
<tr>
<td>Adult</td>
<td>27 – 34.9 cm</td>
</tr>
<tr>
<td>Large Adult</td>
<td>35 – 44.9 cm</td>
</tr>
<tr>
<td>Extra Large (Adult thigh)</td>
<td>45 – 52 cm</td>
</tr>
</tbody>
</table>

- Position the cuff on the arm 2.5 cm above the ante-cubital space (elbow crease) and on the ankle 1 cm above the medial malleolus.

- A blood pressure should not be taken on the affected side of a client post mastectomy or on an arm with a dialysis fistula.

C. Calculating the ABI with a Handheld Doppler

With the recorded ankle and brachial systolic pressures the ABI can be calculated as follows:

\[
\text{ABI} = \frac{\text{The higher of the two ankle pressures for that leg}}{\text{The highest brachial pressure of the two arms}}
\]

ABI can also be determined using an ABI table guide (see Appendix A).

D. Documenting the ABI with a Handheld Doppler

On a paper document (see Appendix B) or in the electronic wound documentation chart record:

- The systolic blood pressures for both arms and both legs
- The calculated ABI for both legs
- Record any deviations from the normal procedure (i.e. unable to lie flat for the entire procedure) or if pulses cannot be measured
Using The Automatic ABI System To Measure An ABI

The automatic ABI system calculates the ABI in 3 minutes without the need for the client to rest prior to the procedure. The results are automatically calculated, interpreted and displayed with Pulse Volume waveforms on the LCD panel at the front of the machine. The test results are printed on either thermal paper or adhesive backed label paper via the integral printer.

The automatic ABI system is comprised of a two chamber cuff for each extremity. One chamber is used to occlude the vessel while the second distal chamber senses the returning signals. This allows the four limbs to be measured simultaneously. Early evidence indicates that the Automatic ABI results are consistent with Doppler results.\(^{10}\)

Cell phones, computers and other electronic equipment must be at least a meter away from the ABI unit and the ABI unit and bed / plinth should not be pushed against the wall. ABI may be difficult to perform in the presence of severe edema, lymphedema, and painful or extensive ulcers.

A. Care of Automatic ABI System

- If storing the unit for a period of time, disconnect the battery and open the printer paper lid slightly. See the Manual for instructions on battery removal.
- Replace the battery every 2 years. To extend battery life, keep the machine plugged in to charge when not in use and store it at room temperature rather than at high ambient temperatures.
- The machine can be cleaned with a disposable cloth dampened with a mild detergent and warm water solution. Do not use disinfectants containing cationic surfactants, ammonia based compounds or antiseptic solutions. Dry well before using. The LCD display panel can be wiped with a soft dry tissue.
• If a client has a draining wound, prevent contamination of the cuffs by protecting the wound with sterile or clean saline moistened gauze and wrap the leg in plastic wrap or cover with a clean plastic bag.

• If the cuffs become soiled or contaminated, clean as follows.
  o Wipe the cuffs with a mild detergent and warm water solution.
  o Then wipe the cuffs with a 70% isopropyl alcohol wipe.
  o Wipe with clean water to remove any residue. Do not allow fluid to enter the cuff tubing.

• Inspect the cuffs and cuff tubing before each use for material damage, splitting, fraying etc. and ensure that labeling is clearly legible. Cuffs should be replaced every 2 years.

• Preventive maintenance checks should be carried out annually by qualified personnel.

B. Calculating the ABI with an Automatic ABI System

As noted earlier, ABI results are automatically calculated and the system will provide an interpretation of the results.

C. Documenting the ABI with an Automatic ABI System

• The results are automatically printed, this print-out should be put in the client’s paper chart. If the client has an electronic wound documentation chart, chart the results in the appropriate section of the chart.

• Record any deviations from the normal procedure (i.e. unable to lie flat for the entire procedure) or if pulses cannot be measured.

Interpreting the ABI Results (both Handheld and Automatic)

The ABI measurement does not diagnose the etiology of lower leg wounds; rather it helps predict healability of lower leg wounds, determine appropriate treatment and identify the need for further vascular assessment.

An ABI below 0.91 indicates arterial compromise; the lower this number, the greater the arterial compromise. Arterial compromise in the lower leg is also called Peripheral Arterial Disease (P.A.D.).

1. An ABI between 0.91 and 1.30 indicates the absence of significant arterial disease.

2. An ABI between 0.41 and 0.90 indicates mild to severe arterial compromise and requires referral to a wound clinician or physician / NP for further assessment.

3. An ABI of less than / equal to 0.40 indicates critical leg ischemia and requires immediate physician / NP notification.

4. An ABI greater than 1.30 indicates arterial calcification and requires referral to a wound clinician or physician / NP for further vascular assessment e.g Toe Pressures. Calcified arteries cannot be compressed and are present in approximately 50% of those with diabetes mellitus and / or end stage renal disease. Toe Pressures / Toe Brachial Index (TBI) should be considered for clients with an ABI greater than 1.30 as this test is more reliable in that the arteries of the toes are not as likely to become calcified as those of the foot. TBI is not covered in this learning module.

Compression therapy is the gold standard for venous leg ulcer care in the absence of arterial compromise. An ABI between 0.41 and 0.90 indicates some degree of arterial compromise and requires referral to a physician / NP or wound clinician to determine if compression therapy is appropriate. An ABI between 0.91 and 1.31 indicates an absence of arterial compromise and a wound clinician can recommend compression therapy.
Frequency of ABI Reassessment

As part of a comprehensive Lower Leg assessment; an ABI is reassessed:
   a) Every 6 months for clients with a lower leg /foot wound which has a goal of care “To Heal”
   b) Every 6 months for clients receiving compression therapy
   c) When either of the following occurs:
      • Increasing lower leg and / or foot pain unrelated to infection.
      • Increasing signs of arterial insufficiency, e.g. delayed capillary refill, cold skin temperature, absent or diminishing peripheral pulses.

Congratulations you have completed the following learning objectives:
   1. Identify the anatomy and blood supply of the main arteries in the lower leg.
   2. Locate the pulses of the lower leg.
   3. Learn the handheld and automatic ABI procedures.
   4. Calculate and document the ABI.
   5. Understand the significance of the ABI measurement.
   6. Review tips for effective handheld Doppler use.
   7. Describe the appropriate care for handheld and automatic ABI machines.

SECTION B: Practice

Integrating Knowledge and Skill into Practice #1

Complete the Case Studies
(Case Study answers are in Appendix C)

Case Study #1

Mr. J. has had an ulcer above his left lateral ankle for 9 months. He reports that the ulcer started after he banged his leg on the side of a book shelf and he cannot understand why the wound is not healing. He has had several wounds on his leg in the past which have always healed within 6 months.

In your assessment, you note he has brown staining on both his lower legs and pitting edema to mid calf. The ulcer is 6 cm long and 3 cm wide, shallow, irregularly shaped and draining large amounts of serous fluid. Mr. J. states that he experiences pain in the evening after he has been out for his walk after supper.

1. What would your best plan of action be?
   a. Leave the wound open to air.
   b. Apply high compression wraps.
   c. Advise him to raise his legs above the level of his heart as much as possible.
   d. Perform an ABI measurement.
2. You perform an ABI with a hand-held Doppler and find his brachial systolic pressure is 145 on his left arm and 136 on his right arm. The dorsalis pedis systolic pressure on his left foot is 130; the posterior tibialis systolic pressure is 145. Calculate the ABI of his left lower leg. The correct answer is:
   a. 0.92
   b. 0.84
   c. 1.00
   d. 1.10

3. Your plan of care includes which of the following interventions?
   1) To continue with the care plan of daily dressings.
   2) To obtain a recommendation for high compression therapy from the Wound Clinician.
   3) To request that the physician refer the client for vascular consultation.
   4) To explain the theory behind compression therapy to the client and the importance of compression therapy 'for life'.
   5) To tell the client to stop taking walks after supper.
   Is the answer?  a) 1, 2 and 4
                   b) 1 and 5
                   c) 2, 4 and 5
                   d) 3 and 5

Case Study #2
Mrs. M has had two ulcers on the inside ankle region for five years. She has managed these ulcers by wrapping her leg with old tensor bandages.

1. Which of the following would you consider as part of her care planning?
   a. Tell her to buy new tensor bandages.
   b. Consider doing a referral to OT/PT for exercises.
   c. Assess her lower leg, wound, history, and complete an ABI measurement.
   d. Tell her to put Band-Aids on the ulcers and you'll reassess in a week.

2. Her ABI is 0.4; what would you do?
   a. Consult with your Wound Clinician regarding wound care.
   b. Discuss with the physician/NP the need for a referral for a vascular consultation.
   c. Go ahead and apply compression.
   d. a & b.
1. Practice the Handheld ABI procedure.
2. Practice the Automatic ABI System procedure (if one is available).
3. Demonstrate the Handheld ABI procedure to your Educator, Wound Clinician or designate and complete the Skills Checklist (Appendix E).
4. If available, demonstrate the Automatic ABI System procedure to your Educator, Wound Clinician or designate and complete the Skills Checklist (Appendix F).

You have completed the required additional education needed to perform an ABI procedure.

Congratulations!
References


Document Creation/Review

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<tr>
<th>Created By</th>
<th>British Columbia Provincial Nursing Skin and Wound Committee in collaboration with the Wound Care Clinicians from across all Health Authorities. Special thanks to Northern Health Wound Clinicians for taking the lead on this work.</th>
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<td>Publication Date</td>
<td>June 2013</td>
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<tr>
<td>Revision Date(s)</td>
<td></td>
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<td>Review Date(s)</td>
<td>May 2014 (in conjunction with the Handheld and Automatic ABI Procedures)</td>
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June 2013
## Appendix A: Ankle Pressure Index Guide

### Dopplex Ankle Pressure Index (API) Guide

<table>
<thead>
<tr>
<th>Ankle Pressure (mmHg)</th>
<th>Brachial Pressure (mmHg)</th>
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<tbody>
<tr>
<td>40</td>
<td>230</td>
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<tr>
<td>45</td>
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<td>45</td>
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<tr>
<td>200</td>
<td>40</td>
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</tbody>
</table>

### Ankle Pressure (mmHg) vs Brachial Pressure (mmHg)

- **40 mmHg**: 230 mmHg
- **45 mmHg**: 220 mmHg
- **50 mmHg**: 210 mmHg
- **55 mmHg**: 200 mmHg
- **60 mmHg**: 190 mmHg
- **65 mmHg**: 180 mmHg
- **70 mmHg**: 170 mmHg
- **75 mmHg**: 165 mmHg
- **80 mmHg**: 160 mmHg
- **85 mmHg**: 155 mmHg
- **90 mmHg**: 150 mmHg
- **95 mmHg**: 145 mmHg
- **100 mmHg**: 140 mmHg
- **105 mmHg**: 135 mmHg
- **110 mmHg**: 130 mmHg
- **115 mmHg**: 125 mmHg
- **120 mmHg**: 120 mmHg
- **125 mmHg**: 115 mmHg
- **130 mmHg**: 110 mmHg
- **135 mmHg**: 105 mmHg
- **140 mmHg**: 100 mmHg
- **145 mmHg**: 95 mmHg
- **150 mmHg**: 90 mmHg
- **155 mmHg**: 85 mmHg
- **160 mmHg**: 80 mmHg
- **165 mmHg**: 75 mmHg
- **170 mmHg**: 70 mmHg
- **175 mmHg**: 65 mmHg
- **180 mmHg**: 60 mmHg
- **185 mmHg**: 55 mmHg
- **190 mmHg**: 50 mmHg
- **195 mmHg**: 45 mmHg
- **200 mmHg**: 40 mmHg

---

June 2013 18
Appendix B: ABI Measurement Worksheet

Date: _________________    Wound Location (if applicable) _________________________

<table>
<thead>
<tr>
<th>Brachial Systolic Readings</th>
<th>Right Arm</th>
<th>Left Arm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest reading of the two arms is used to calculate ABI</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dorsalis Pedis* Systolic Readings</th>
<th>Right Ankle</th>
<th>Left Ankle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest reading for each leg is used to calculate ABI</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Posterior Tibialis* Systolic Readings</th>
<th>Right Ankle</th>
<th>Left Ankle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest reading for each leg is used to calculate ABI</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Use the peroneal/fibular artery if you are unable to determine the other two ankle systolic readings.

Calculation of ABI:

Right leg: \[
\text{Highest Right Ankle reading} \div \text{Highest Brachial reading} = \text{Rt Leg ABI}
\]

Left leg: \[
\text{Highest Left Ankle reading} \div \text{Highest Brachial reading} = \text{Lt Leg ABI}
\]

Signature: ________________________      ABI Next Due ___________________

June 2013
Appendix C: Answers to Case Study Questions

Case Study #1
1. d) Perform an ABI measurement
2. c) 1.0
3. a) 1, 2 & 4. You continue to visit weekly and ask the client to continue changing his dressing daily. You obtain an recommendation for high compression therapy from the wound clinician and explain the theory behind compression therapy to the client including the importance of compression therapy ‘for life’

Case Study #2
1. c) Assess her lower leg, wound, history, and complete an ABI measurement.
2. d) a & b

Appendix D: Additional Optional Readings

Please note that the second article listed here is an update to the first article. It is recommended that article #1 be read first.


## Skills Checklist for Ankle Brachial Index (ABI) Using a Handheld Doppler

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Comments</th>
<th>Meets Criteria</th>
<th>Needs Mentoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Adequately prepares the client and the environment for an ABI.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. If a wound or an infection is present, uses appropriate infection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>control measures when carrying out an ABI.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Correctly places an appropriately sized blood pressure cuff over the</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>upper and lower limbs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Is able to palpate the brachial, dorsalis pedis, posterior tibial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pulses and perineal pulses.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Correctly inflates and deflates the blood pressure cuff.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Uses the Doppler machine and probe correctly.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Differentiates an audible signal from arterial blood flow.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Once all the values are obtained, correctly calculates the client's</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABI.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Correctly cleans and stores the Doppler probe.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Correctly documents the ABI results and the next reassessment date.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Ensures that the client is comfortable before leaving.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Competency achieved:**

- **YES** □
- **NO** □
- **NEEDS REVIEW** □

---

June 2013
## Skills Checklist for Ankle Brachial Index (ABI) Using an Automatic System

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Comments</th>
<th>Meets Criteria</th>
<th>Needs Mentoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Adequately prepares the client and the environment for an ABI.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. If a wound or an infection is present, uses appropriate infection control measures when carrying out an ABI.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Sets up the automatic ABI machine and colour coordinated wires correctly.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Correctly places the four blood pressure cuffs over the upper and lower limbs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Correctly cleans and stores the automatic ABI machine.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Correctly documents the ABI results and the next reassessment date.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Ensures that the client is comfortable before leaving.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Competency achieved:**
- YES □
- NO □
- NEEDS REVIEW