

Education Module

Ankle Brachial Pressure Index (ABPI) & Toe Brachial Pressure Index (TBPI) Procedure in Adults

For Handheld Doppler & Photoplethysmography Probe
(PPG)



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Ankle Brachial Pressure Index (ABPI) & Toe Brachial Pressure Index (TBPI) Procedure in Adults for Handheld Doppler & Photoplethysmography (PPG)

INTRODUCTION

This module will teach you how measure an Ankle Brachial Pressure Index and a Toe Brachial Pressure Index, complete lower leg assessment and interpret the results.

Ankle Brachial Pressure Index (ABPI) is a non-invasive test, which uses a hand-held Doppler or an automatic ABPI system to measure the arterial blood flow in the lower legs. This is used to screen clients for the presence and severity of arterial compromise. An ABPI is carried out as part of the full lower leg assessment required to determine which clients need further vascular assessment and treatment. An ABPI compares the systolic ankle pressure to the systolic brachial pressure using a blood pressure cuff and a handheld 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.

Toe Brachial Pressure Index (TBPI) is non-invasive comparison of small vessel perfusion to the toes using a photoplethysmography (PPG). PPG is a tool, which measures the intensity of light reflected from the skin surface and the red cells below. TBPI is indicative of arterial pulse flow in the arterioles of the area assessed.

The results of an ABPI/TBPI should be used in conjunction with a review of client history and a complete lower limb assessment when deciding on care. An ABPI/TBPI is done for clients with arterial compromise to predict the healability of lower leg wounds. An ABPI/TBPI 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:

- ABPI = Ankle Brachial Pressure Index
- ABI = Ankle Brachial Index
- TBPI = Toe Brachial Pressure Index
- TBI = Toe Brachial Index

In this module, the term ABPI/TBPI is used to refer to Ankle Brachial Pressure Index/Toe Brachial Pressure Index.

COURSE REQUIREMENTS See Appendix A

1. Complete the Pre-Education Quiz (Appendix B)
2. Review the SH-SS ABPI Policy and all the related documents.
3. View the ABPI/TBPI Assessment PowerPoint located under Staff Resources in the HPS.
4. View the 60 Second Foot Screening.
5. Complete the required readings.
6. Do the ABPI/TBPI Learning Module.
7. Complete a preceptorship with a designated clinical lead in a practice environment.
8. Carry out return demonstrations of the skill with the designated preceptor. 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 ABPI/TBPI testing.
9. Attend all employer endorsed education session (as available).
10. Become familiar with the ABPI/TBPI Resource Package.

LEARNING OBJECTIVES See Appendix C

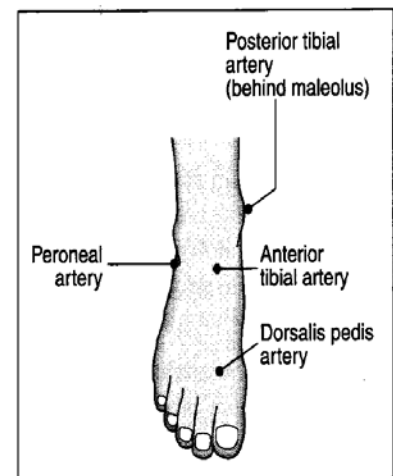
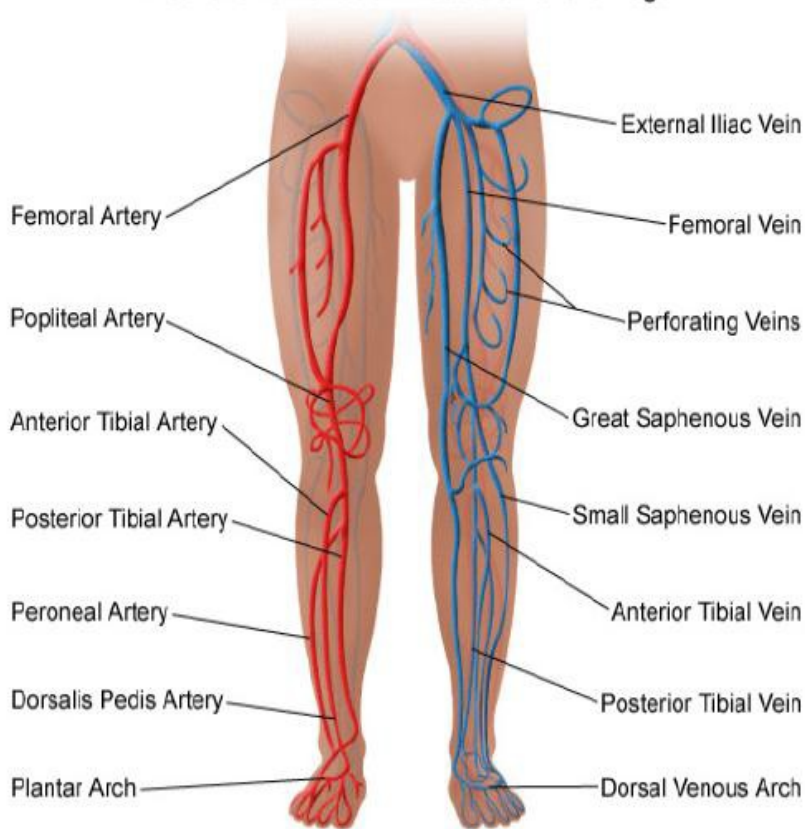
1. At the end of this module you will be able to:
2. Discuss the anatomy of arterial blood supply in the lower legs and feet.
3. Demonstrate the location of the pulses in the lower legs and feet.
4. Discuss the common etiologies of lower leg and foot wounds.
5. Be familiar with ABPI/TBPI equipment.
6. Demonstrate the ABPI procedure using the hand-held Doppler.
7. Demonstrate the TBPI procedure using the PPG.
8. List hints for using the Doppler/PPG and effectively.
9. Describe the appropriate care of the Doppler ABPI and TBPI PPG.
10. Calculate the ABPI using the hand-held Doppler.
11. Calculate the TBPI using the PPG.
12. State the significance of the ABPI/TBPI result.
13. Complete the ABPI/TBPI Assessment Form.

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.

Arterial and Venous Circulation of the Legs



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**.

LOCATING THE PEDAL PULSES

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**.

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 ABPI.

Label each artery.



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

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 ABPI/TBPI in assessing and planning effective treatment. The ability to distinguish among various ulcer types comes with greater clinical experience and knowledge.

Feature:	Venous	Arterial	Diabetic
Temperature	Warm	Cool	Dependent upon co-existence with arterial insufficiency
Skin/Nail	Hemosiderin staining (brown staining) Lipodermatosclerosis Atrophe blanche Ankle flare Stasis dermatitis - Wet - Dry - Infected Hyperkeratosis (nail thickening) Tinea pedis (fungal) Interdigital maceration Callus	Dependent rubor Shiny, taut skin Hairless Buerger's test (leg blanches on elevation) Dry scale Gangrene - Wet - Dry Trophic (fungal) nail bed Interdigital maceration	Dry scale Absence of sweating in feet Tinea pedis (fungal) Interdigital maceration/lesions Heel cracks/fissures
Sensation	Aching, heavy legs later in day, may decrease with elevation	Rest pain (severe pain in leg/foot worse with elevation)	Numbness/loss of protective sensation Tingling - Burning
Capillary Refill	Less than 3 seconds	Greater than 3 seconds	Depends on degree of ischemia
Peripheral Pulses	Palpable - Dorsalis pedis (DP) - Posterior tibialis (PT)	Diminished or absent - DP - PT	Diminished, absent or bounding - DP - PT
Location of Wounds	Gaiter region (distal third to the medial third of lower leg) Medial malleolus Often multiple ulcers	Pressure points or areas of repetitive trauma (on/between toes, metatarsal heads, heels) Dorsum of foot Bony prominences	Beneath calluses Pressure points or areas of repetitive trauma Common to plantar surface of foot
Exudate	Moderate to larger serous exudate	Minimal serous or purulent drainage Dry	Small to moderate sero-sanguinous drainage
Wound Bed	Shallow Presence of granulation tissue Slough may be present Rarely necrotic	Shallow to deep Pale pink Slough common Eschar common May be necrotic	Shallow or deep May be pink or pale May be necrotic May probe to bone
Wound Edge	Irregular shape	Punched out appearance, well defined wound edge	Punched out appearance
Periwound	Macerated if increased exudate	Dry	Dry with surrounding callous
Edema	Pitting Non-pitting Stemmer's sign	Minimal unless leg constantly in dependent position	Minimal unless leg constantly in dependent position
Other characteristics	Varicose veins Fixed ankle joint Fixed hallux joint		Foot deformity - Hammer toes - Prominent metatarsal heads - Charcot foot

ABPI/TBPI EQUIPMENT

Locate the equipment at your work site and read the instruction manual if available.

Below, draw an arrow connecting the name of the equipment to the corresponding picture.




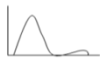

- Doppler probe
- Ultrasound gel
- Hand Held Doppler
- 10 cm BP cuff
- PPG sensor
- Sphygmomanometer
- PPG probe
- 12 cm BP cuff

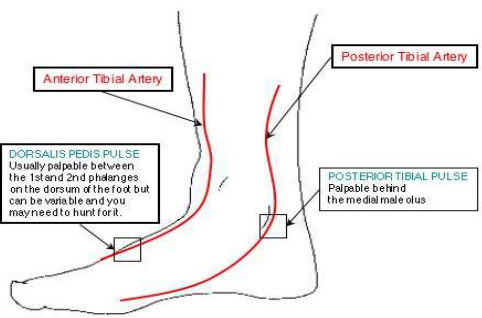
CARE OF THE HANDHELD DOPPLER AND BLOOD PRESSURE EQUIPMENT

1. Clean and disinfect the Doppler and probe with a disinfectant/cleaning solution after each use according to the manufacturer's instructions and Southern Health Santé Sud 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 Southern Health Santé Sud policy for cleaning.
3. 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.)
4. Inspect the cuffs and cuff tubing before each use for material damage, splitting, fraying etc.
5. Preventive maintenance checks should be carried out annually by Prairie Mountain Health Biomedical Regional Service Program.
6. All equipment should be asset tagged with number identifying Property of Southern Health Santé-Sud.

ABPI/TBPI PROCEDURE

ABPI Procedure Steps	Key Points										
<p>1. Have client to go to washroom prior to testing. Remove the client's shoes, socks or compression stockings. Roll up sleeves and pant legs. Have client lie down on a flat, comfortable surface, with a maximum of one flat pillow under their head.</p> <p>Client should be on his/her back with ankles at same level as heart. As the client is lying down, apply all cuffs and the toe probes. Cover the trunk and lower extremities to prevent cooling.</p>	<p>Having the client in a supine position reduces any hydrostatic pressure inaccuracies.</p> <p>The accuracy of an ABPI 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</p>										
<p>2a. Have client rest in supine position in a quiet warm room for at least 15 - 30 minutes prior to beginning the test. Complete the Ankle Brachial Pressure Index & Toe Brachial Pressure Assessment CLI.4110.PL.022.FORM.03 form at this time.</p> <p>2b. While client is lying flat, teach client/caregiver:</p> <ul style="list-style-type: none"> • The ABPI/TBPI procedure that will be performed • Arterial and venous systems 											
<p>3. Collect equipment & perform hand hygiene. Wear clean gloves, if indicated. Clean gloves should be worn if there is an open area, discharge, fungal toenails or a rash on the foot/ankle area</p>	<p>Infection control and prevention measures.</p>										
<p>4. Place an appropriate size BP cuff, that comes with the sphygmomanometer, around the client's arms, legs and toes snugly, straight and not spiral. Apply blood pressure cuff snugly 1 – 2cm above the malleolus, permitting one finger to fit between client's leg and cuff.</p> <table border="1" data-bbox="147 1318 854 1539"> <thead> <tr> <th>Limb or Digit</th> <th>Cuff width</th> </tr> </thead> <tbody> <tr> <td>Small arm</td> <td>10 cm</td> </tr> <tr> <td>Large arm</td> <td>12 cm</td> </tr> <tr> <td>Ankle</td> <td>10 cm</td> </tr> <tr> <td>Great toe</td> <td>1.9cm (small toe) 2.5 cm (large toe)</td> </tr> </tbody> </table>	Limb or Digit	Cuff width	Small arm	10 cm	Large arm	12 cm	Ankle	10 cm	Great toe	1.9cm (small toe) 2.5 cm (large toe)	<p>Cuff selection should be based upon the size of the upper limb and the leg just above the malleolus. If the cuff is too narrow, the reading may be a falsely high; if the cuff is too wide, the reading may be a falsely low.</p> <p>A cuff placed too high above the malleolus may result in higher ankle pressures.</p> <p>Repeatedly inflating the cuff or inflating it for long periods may cause the pressure to fall.</p>
Limb or Digit	Cuff width										
Small arm	10 cm										
Large arm	12 cm										
Ankle	10 cm										
Great toe	1.9cm (small toe) 2.5 cm (large toe)										
<p>5. Connect ultrasound probe to unit. Turn on ultrasound unit and adjust sound.</p>	<p>Replace batteries in the handheld Doppler if the screen indicates a low battery or if the machine shuts off spontaneously during the procedure.</p>										
<p>6. Palpate brachial pulse and apply ultrasound gel (quarter sized) over the pulse</p>	<p>DO NOT use KY jelly as it destroys probe crystals.</p>										

<p>7. Hold the Doppler probe like a pen, at a 45 - 60-degree angle towards the blood flow; move slowly through the gel in circular motion until a clear arterial pulse sound is heard and a steady wave form is produced on the LCD screen. Steady your hand and probe.</p>	<p>Whooshing sounds are usually venous; if in doubt, apply pressure below the probe with your hand and release. This will cause sound changes.</p>
<p>8. Note waveform and take a recording if applicable for Doppler unit. Otherwise, identify the waveform pattern as triphasic, biphasic or monophasic. This can be done auditorily and/or visually.</p> <ul style="list-style-type: none"> • Triphasic:  Doppler signal is pulsatile, with three signals or more each beat, and higher pitched • Biphasic:  Doppler signal is lower pitched and it is difficult to hear more than two phases • Monophasic:  Difficult to hear signal, very low pitched sound 	
<p>9. Inflate the cuff, proceeding 20 mmHg over last sound heard; do not inflate cuff past 200 mmHg.</p>	<p>Inflating the cuff past 200 mmHg may dislodge plaques in the blood vessels.</p>
<p>10. Gradually deflate the cuff (2 mm/sec) until the arterial sound returns. When the sound is heard completely deflate the cuff. Record the pressure at which the sound returns. Remove the ultrasound gel from the client's arm.</p>	<p>If unsure of when the arterial sound started, re-inflate the cuff at any time NOTE: Cuff does not need to be completely deflated.</p>
<p>11. Repeat steps 6-10 on the other arm. Reassess brachial systolic pressure if there is a considerable difference in both arms for accuracy and reproducibility.</p>	<p>In individuals free of arterial disease there should be less than or equal to 20mmHg systolic pressure difference between the two arms. Blood pressure difference between the arms of greater than 20 mmHg is an indication of upper extremity arterial disease (subclavian steal syndrome).</p>
<p>12. If a wound is present on the lower leg, find the pressure of the non-wounded leg first. Cover any leg wounds that are in close proximity to the cuff with a non-adherent low-profile dressing. If inflation causes pain, do not inflate cuff on the affected limb. If unable to inflate the cuff, clinicians should still assess pulsatility of dorsalis pedis (DP) /posterior tibialis (PT).</p>	

<p>13. Locate the DP/PT pulses in the foot.</p> 	
<p>14. Using the same method outlined in steps 7 - 10, palpate the DP pulse; apply the gel. Using the doppler, note the pulsatility. Determine the DP systolic pressure; do not inflate cuff past 200 mmHg. Deflate the cuff. Record the systolic pressure reading. Using a tissue, move the gel from the foot.</p>	<p>If DP pulse is not palpable, use the doppler probe in the general area to locate the pulse sound. If the DP pulse cannot be located, use the PT pulse to calculate the ABPI. If the pulse sound does not disappear at 200 mmHg the blood vessel is calcified causing it to be non-compressible.</p>
<p>15. With the cuff in the same position on the same leg, palpate the PT pulse, apply the gel and using the doppler, note the pulsatility, and determine the PT systolic pressure; do not inflate cuff past 200 mmHg. Deflate the cuff. Record the systolic pressure reading. Using a tissue, remove the gel from the foot.</p>	<p>If PT pulse is not palpable, use the doppler probe in the general area to locate the pulse sound. If the PT pulse cannot be located, use the DP pulse to calculate the ABPI. If the pulse sound does not disappear at 200 mmHg the blood vessel is calcified causing it to be non-compressible.</p>
<p>16. Repeat steps 13 - 15 on the other leg.</p>	
<p>TBPI Procedure Steps</p>	<p>Key Points</p>
<p>17. Disconnect the Doppler probe and connect the PPG probe to unit and turn on. Turn down volume when using PPG.</p>	
<p>18. Attach PPG sensor to plantar surface or pad of great toe (avoid callous) using tape or a Velcro strap. If great toe is missing, 2nd toe may be used but is less successful to test due to size and shape. The PPG probe should be positioned with the cords resting on the bed, not hanging down or moving, and the receiver should be positioned close to the sphygmomanometer so that both can be viewed easily during cuff inflation and deflation. Ensure tape is not around entire toe causing a tourniquet effect.</p>	

<p>19. Watch monitor screen for a cyclical waveform. Reposition PPG sensor or ensure good contact with skin if a poor waveform is noted.</p>	<p>The PPG probe does not require ultrasound gel like the ultrasound probe. The PPG is sensitive to ambient light, so the output reading maybe poor in a brightly lit room. Cover foot with a cloth to reduce light.</p> <p>The PPG probe is dependent on capillary flow of the skin, therefore if the patient is cold this will result in vasoconstriction; there may be a poor reading. Ensure client is kept warm. If there is poor peripheral arterial flow, the reading would be poor, due to the lack of red blood cells available at the point of measurement.</p>
<p>20. Inflate the cuff until the wave form flattens and continue to inflate 20mmHg more. Initially start no higher than 100 mmHg to see if waveform flattens.</p>	<p>Toe cuffs are small and prone to breaking if over inflated.</p>
<p>21. Deflate cuff 2-3 mmHg per second, pausing after each deflation for PPG to register, until waveform returns. Record the systolic pressure reading of the toe.</p>	<p>Ensure the waveform that returns, is pulsatile and not a 'blip' on the screen since this could be caused by movement or artifact. Your reading will NOT be accurate if you let air out of the cuff at a steady rate because of the automatic adjustments the equipment has to make to "find" and display the arterial waveform. "Three screens" is appropriate time to determine if flow has returned.</p>
<p>22. Repeat and record steps 18 – 21 on the toe of the other foot.</p>	
<p>23. Remove cuffs and probe. Assist client to reposition and redress if required.</p>	
<p>24. Perform hand hygiene once the procedure is completed. Clean and disinfect all equipment.</p> <ul style="list-style-type: none"> • Sensors are cleaned with alcohol swabs • - Remaining equipment is cleansed with approved disinfectant wipes. 	
<p>25. Calculate the ABPI for both the right and left legs by dividing the higher ankle pressure from each leg by the higher systolic brachial pressure from the arms.</p> <p style="text-align: center;">The higher of the two ankle pressures for that leg</p> <p>ABPI = -----</p> <p style="text-align: center;">The higher brachial pressure of the two arms</p>	<p>The higher of the two brachial readings is the true reading.</p>

<p>26. Calculate the TBPI for both the right and left toes by dividing the toe pressure by the higher systolic brachial pressure from the arms.</p> <p style="text-align: center;">Toe Pressure</p> <p>TBPI = ----- The higher brachial pressure of the two arms</p>	<p>The higher of the two brachial readings is the true reading.</p>
<p>27. Send results to the Primary Care Provider who requested the ABPI/TBPI, using the Ankle Brachial Pressure Index & Toe Brachial Pressure Index Assessment form CLI.4110.PL.022.FORM.03</p>	<p>The results of an ABPI/TBPI should be used in conjunction with a review of client history, a complete lower limb assessment, and interpretation of ABPI/TBPI Chart when deciding on care. The results of the ABPI and TBPI are considered as part of a comprehensive lower leg assessment, which includes a review of client history and a physical exam.</p>

ABPI & TBPI INTERPRETATION CHART

ABPI	Toe Pressure	TBPI	Ankle Doppler Wave Form	Possible Diagnosis	Potential for Wound Healing	Amount of Compression	Type of Compression
Greater than 1.2				Calcified – refer to Toe Pressure results			
0.8 - 1.2	Greater than 55 mmHg	Greater than 0.6	Triphasic (Normal)	No significant arterial disease	Good	High (30-40 mmHg)	Coban 2; Class 2 Graduated compression stockings; Comprilan; Elastigrip
0.5 – 0.79	Greater than 40 mmHg	Greater than 0.4	Biphasic / Monophasic	Arterial disease; compression may be used with CAUTION	Adequate	Moderate (20-30 mmHg)	Coban 2 Lite; Class 1 Graduated compression stockings; Elastigrip
0.35 – 0.49	Less than 30 mmHg	Greater than 0.2	Biphasic / Monophasic	Arterial disease	Poor	Refer to Vascular Specialist. Normally NO compression BUT can be used with GREAT CAUTION ONLY if mixed venous/arterial ulcer and edema is an issue and ONLY if directed to do so by a Vascular Physician.	As per Vascular Physician's orders.
Less than 0.35	Less than 20 mmHg	Less than 0.2	Monophasic	High risk for critical limb ischemia		NONE. Refer to a Vascular Specialist.	

INTERPRETING THE ABPI/TBPI RESULTS

The ABPI/TBPI measurement assesses arterial flow. It 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 ABPI below 0.8 or a TBPI below 0.4 or 40 mmHg indicates arterial compromise; the lower this number, the greater the arterial compromise. Arterial compromise in the lower leg is also called Peripheral Arterial Disease (PAD).

- An ABPI between 0.8 and 1.20 indicates the absence of significant arterial disease.
- An ABPI less than 0.35 indicates high risk critical limb ischemia and requires a referral to a vascular specialist.
- An ABPI greater than 1.20 indicates arterial calcification. Calcified arteries cannot be compressed and are present in approximately 50% of those with diabetes mellitus and/or end stage renal disease. A TBPI is more reliable in that the arteries of the toes are not as likely to become calcified as those of the foot.

Compression therapy is the gold standard for venous leg ulcer care in the absence of arterial compromise.

Inaccurate readings may result from:

- using both brachial readings instead of higher of the two
- client anxiety
- open wounds, pain
- client movement
- poor positioning of client
- poor positioning of cuff
- cuff too tight
- wrong cuff size
- lack of audible output
- repeated or prolonged cuff inflation
- excessive pressure from probe or moving the probe from the artery
- inexperienced practitioner performing the test
- inaccurate calculations

FREQUENCY OF ABPI/TBPI REASSESSMENT

As part of a comprehensive lower leg assessment, an ABPI/TBPI is reassessed:

- a) Every 6 months for clients with a lower leg /foot wound which has a goal of care "To Heal"
- b) Yearly 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.

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 ABPI/TBPI measurement.

2. You perform an ABPI/TBPI 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 ABPI of his left lower leg. The correct answer is:
 - a) 0.9
 - b) 0.8
 - c) 1.0
 - d) 1.1

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.
 - 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 ABPI/TBPI measurement.
 - d. Tell her to put Band-Aids on the ulcers and you'll reassess in a week.

2. Her ABPI is 0.4; what would you do?
 - a. Consult 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.

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- Adapted from 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. May 2014

APPENDIX A

Course Requirements	Date Completed
1. Completion of the Pre-Education Quiz (Appendix B)	
2. Review the Southern Health-Santé Sud ABPI/TBPI Policy and all the related documents - Printed Copy included in Package <ul style="list-style-type: none"> ▪ Policy - CLI.4110.PL.022 ▪ Request Form - CLI.4110.PL.022.FORM.01 ▪ ABPI/TBPI Client Appointment Instructions and Information - CLI.4110.PL.022.FORM.02 ▪ ABPI/TBPI Assessment Form - CLI.4110.PL.022.FORM.03 	
3. ABPI/TBPI and Lower Leg Assessment Power Point	
4. 60 Second Foot Screen – Go to WoundPedia <ul style="list-style-type: none"> ▪ http://woundpedia.com/evidence-informed-topics/60-second-foot-screening-tool/ 	
5. Required Reading – Printed Copy included in Package <ul style="list-style-type: none"> ▪ The Science Behind ABPI by Pamela Houghton. Wound Care Canada Volume 17, Number 1 – Spring 2019 ▪ Ankle Brachial Index Quick Reference Guide for Clinicians. WOCNS March/April 2012 	
6. Complete Mentorship with an Advanced Wound Care Clinician. Appendix C)	
7. Attend an SH-SS endorsed ABPI/TBPI education session as available.	
8. Optional Additional Reading/Resources <ul style="list-style-type: none"> ▪ RNAO – Assessment and Management of Venous Leg Ulcers https://rnao.ca/sites/rnao-ca/files/Assessment and Mangement of Venous Leg Ulcers.pdf ▪ Wounds Canada – Best Practice Recommendations for the Prevention and Management of Diabetic Foot Ulcers https://www.woundscanada.ca/docman/public/health-care-professional/bpr-workshop/895-wc-bpr-prevention-and-management-of-diabetic-foot-ulcers-1573r1e-final/file ▪ WRHA – Venous, Arterial and Mixed Lower Leg Ulcers http://www.wrha.mb.ca/extranet/eipt/files/EIPT-013-0005.pdf ▪ CLWK https://www.clwk.ca/buddydrive/file/guideline-summary-lower-limb-arterial-ulcers/ https://www.clwk.ca/buddydrive/file/guideline-summary-lower-limb-venous-ulcers/ 	

APPENDIX B: PRE-EDUCATION QUIZ

- 1) How would you best describe intermittent claudication?
 - a. Numbness to the feet when sitting
 - b. Cramping leg pain occurring with exercise
 - c. Muscle cramps during the night
 - d. Periodic leg weakness

- 2) What is the significance of intermittent claudication?
 - a. It is a symptom of peripheral arterial disease
 - b. Requires follow up to assess vascular status
 - c. The client is out of shape
 - d. a and b

- 3) What is another word for the hallux?
 - a. Forefoot area
 - b. Great toe
 - c. Plantar region
 - d. Heel

- 4) Check all that are true about hemosiderin staining.
 Occurs with chronic venous disease
 Is a failure of the vein valves
 Is a symptom of arterial disease
 Presents as dark purple or rusty colored discoloration to the lower legs
 Is a dangerous condition
 May be misdiagnosed as cellulitis
 Caused by leakage of hemoglobin from engorged capillaries into the skin
 Occurs after surgery

- 5) Where is the posterior tibial pulse located?
 - a. Top of the foot
 - b. Medial ankle area
 - c. Lateral ankle area

- 6) What percentage of people do not have a dorsalis pedis pulse?
 - a. 15%
 - b. 20%
 - c. 8%
 - d. 0%

- 7) The gaiter region can be described as the area extending above the ankle to below the knee.
 - a. True
 - b. False

8) Place the number of the condition beside the correct definition

1. Hyperkeratosis	_____ Changes to the skin of the lower legs defined as an inflammation of the layer of fat under the epidermis. Progresses to fibrosis.
2. Lipodermatosclerosis	_____ Ivory coloured stellate scars on the leg.
3. Atrophy blanche	_____ Fiery to dusky red coloration visible when the leg is in a supported position
4. Ankle flare	_____ Contagious fungal infection
5. Tineas pedis	_____ Thickening of the outer layer of skin
6. Dependent rubor	_____ Tiny varicose veins on the inner aspect of the ankle

9) Foot deformities in a patient with diabetes can result from neuropathic changes.

- a. True
- b. False

10) Charcot foot (circle all that are true):

- a. Increased warmth is the first indicator of inflammation and may be the first sign of acute Charcot foot
- b. Is one of the major complications of diabetes
- c. Characterized by pathological fractures that occur with activities of daily living
- d. Is preceded by a traumatic injury

11) Monofilament test (circle all that are true):

- a. Is part of a 60 second foot screen
- b. 4 or more negative reactions with the monofilament skin touch, is indicative of neuropathy
- c. Test over calluses is included
- d. If positive for neuropathy, places a client at a greater risk for foot ulcer/injury

12) The normal range of ABPI is 0.91 – 1.2

- a. True
- b. False

13) To ensure accuracy of data while obtaining ABPI's, how long should the client rest flat on stretcher or bed before beginning procedure?

- a. 5 to 10 minutes
- b. 15 to 30 minutes
- c. Does not need to rest

14) Pallor with limb elevation would indicate _____ disease.

- a. Venous
- b. Arterial

15) A Stemmer's sign is:

- a. Leakage of red blood cells in surrounding tissues of the lower leg
- b. A sunburst pattern of visible capillaries distal to medial malleolus
- c. A test that results in either a positive or negative sign for Lymphedema
- d. Used in the assessment of arterial insufficiency

16) Compression can be used in the following situations:

- 1. Lower leg edema in clients with uncontrolled CHF
- 2. Lymphedema or lipedema where lower limb perfusion has been verified with an ABPI/TBPI
- 3. Clients with a normal ABPI/TBPI with a venous leg ulcer who do not have edema
- 4. A client with an ABPI of less than 0.5

17) Describe 5 differentiating characteristics of the following lower leg ulcers:

Venous	Arterial	Diabetic Neuropathy
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.
5.	5.	5.

Date: _____

Score: _____

APPENDIX C

Skills Checklist for Ankle Brachial Index and Toe Brachial Index using handheld Doppler

Name:	Date:	Date:	Date:	Date:	Date:
Criteria	Assessor:	Assessor:	Assessor:	Assessor:	Assessor:
1. Adequately prepares the client and the environment for ABPI/TBPI.					
2. Performs hand hygiene. If a wound or infection is present, uses appropriate infection control measures when carrying out ABPI/TBPI.					
3. Correctly places an appropriately sized blood pressure cuff over the upper and lower extremities including great toes.					
4. Is able to palpate the brachial, dorsalis pedis and posterior tibial pulses.					
5. Correctly inflates and deflates the blood pressure cuff.					
6. Uses the Doppler machine and probe/sensors appropriately.					
7. Differentiates an audible signal from arterial blood flow.					
8. Once all the values are obtained, correctly calculates the client's ABPI/TBPI.					
9. Performs hand hygiene. Correctly cleans and stores the Doppler probe.					
10. Correctly documents the ABPI/TBPI results and next reassessment date.					
11. Ensures that the client is comfortable before leaving.					

Competency achieved: (circle one)	Yes	No	Needs review
Manager or Supervisor (print name): _____			
Signature/Designation: _____			

APPENDIX D

ANSWERS TO PRE-EDUCATION QUIZ

1. B
2. D
3. B
4. Occurs with chronic venous disease
 - Is a failure of the vein valves
 - Presents as dark purple or rusty colored discoloration to the lower legs
 - May be misdiagnosed as cellulitis
 - Caused by leakage of hemoglobin from engorged capillaries into the skin
5. C
6. C
7. True
- 8.

1. Hyperkeratosis	<u>2</u> Changes to the skin of the lower legs defined as an inflammation of the layer of fat under the epidermis. Progresses to fibrosis.
2. Lipodermatosclerosis	<u>3</u> Ivory coloured stellate scars on the leg.
3. Atrophy blanche	<u>6</u> Fiery to dusky red coloration visible when the leg is in a supported position
4. Ankle flare	<u>5</u> Contagious fungal infection
5. Tineas pedis	<u>1</u> Thickening of the outer layer of skin
6. Dependent rubor	<u>4</u> Tiny varicose veins on the inner aspect of the ankle

9. True
10. A, B, C
11. A, B, D
12. True
13. B
14. B
15. C
16. B, C

17. Venous:

- location of wounds are usually in the gaiter area
- wounds are shallow with a moderate – heavy amount of drainage
- wound edges are irregular
- periwound area is often macerated due to increased exudate
- there can be hemosiderin staining and areas of scarring
- legs ache and are described as being heavy
- edema presents when legs are dependent
- varicosities may be present
- pedal pulses are normal

Arterial:

- wounds are located at the metatarsal heads, lateral malleolus, heels
- wounds have a minimal amount of drainage
- wound edges have a “punched out’ appearance
- periwound area is dry
- lower leg skin is thin, shiny, dry and hairless
- no lower leg edema
- can have severe pain which is worse with activity
- pedal pulses are absent

Neuropathic:

- wounds are common at pressure points, areas of repetitive trauma or plantar surface of the foot
- wounds present at shallow or deep, pink or pale or necrotic tissue, may probe to bone
- wound exudate is small to moderate sero-sanguineous
- wound edges are well defined with a “punched-out” appearance and may include undermining or sinus
- heel cracks or fissures may be present
- client may describe numbness, burning or tingling lower extremities
- minimal to no lower leg edema
- pedal pulses can be absent, faint or bounding

ANSWERS TO CASE STUDY QUESTIONS

Case study #1

1. d) Perform an ABPI/TBPI measurement
2. c) 1.0
3. a) 1, 2 & 4. You continue to visit weekly and ask the client to continue changing his/her dressing daily. You obtain a recommendation for high compression therapy from the health care provider and explain the theory behind compression therapy to the client including the importance of “Compression for Life”.

Case Study #2

1. c) Assess her lower leg, wound, history and complete ABPI/TBPI measurement.
2. d) a & b