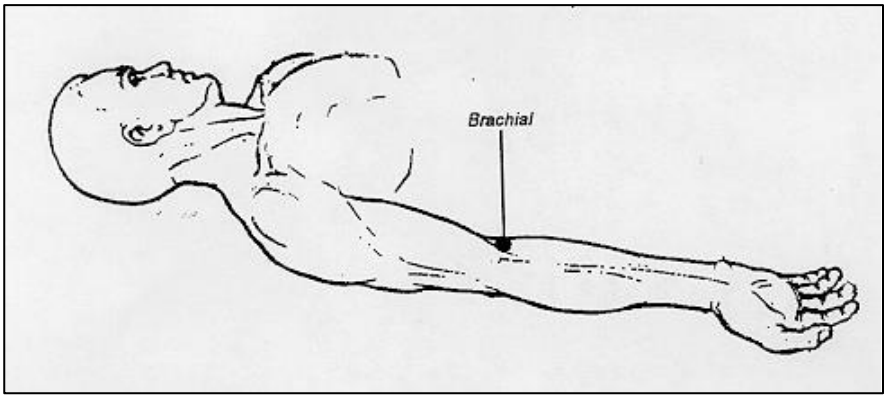
Title	**Procedure: Ankle Brachial Pressure Index (ABPI) Testing Using a Handheld Doppler**
Background	Learning resources and background available at www.swrwoundcareprogram.ca • Resource Hub (log in required – free of charge) → Wound Skills Videos: Instructional → **Ankle Brachial Pressure Index Test** • Resource Hub (log in required – free of charge) → Wound Skills Videos: Instructional → **Lower leg wounds and the ABPI Test**
Indications	This procedure is intended to be used by health care providers to assist with their assessment and management of individuals presenting with a leg or foot ulcer, lower limb edema, and/or signs of PAD. This procedure should be performed with caution: • In a patient with diabetes due to the high likelihood of arterial calcification • The patient cannot remain still or lie flat • The patient has untreated cellulitis or suspected deep vein thrombosis • The patient has severe edema or lymphedema • In the presence of extensive wounds and/or pain This procedure should **NOT** be conducted: • Immediately post-superficial bypass graft without first consulting with the surgeon • If the patient has significant lower leg/wound pain, making them intolerant of the procedure • On the arm of a patient with a dialysis fistula or who has had a mastectomy • Patients with severe dermatitis, pulmonary hypertension, a missing arm, severe hypertension, Parkinson's disease, and/or very edematous limbs • Patients with severe heart failure (not medically controlled), gangrene, or recent skin graft on their upper or lower extremities • By a health care provider who has not received training in ABPI testing
Procedure	**NOTE: ABPI results are one part of the holistic assessment. The holistic patient assessment and clinical judgement should be incorporated into the interpretation of the ABPI results.** **Assessment** 1. Determine whether the performance of this procedure is appropriate for the patient 2. This procedure should be used in conjunction with a comprehensive lower leg/foot assessment. For further guidance refer to the "Guideline: The Assessment of People with Diabetic/Neuropathic Foot Ulcers" or "Guideline: The Assessment of People with Leg Ulcers". 3. Review the patients chart or medical record for any documented ABPI results. 4. If you have any concerns about the safety of performing this test contact the patient's primary health care provider or most responsible physician for further direction

Planning

1. Expected outcomes:
    a. Information from your ABPI assessment will help identify if peripheral arterial disease is an underlying cause of the foot/leg wound(s) or lower leg edema
    b. Health care providers will be able to use the ABPI and comprehensive assessment information to implement an appropriate, interdisciplinary, patient-centered plan of care which contains clear directions for staff and others who are providing the patient with direct care

Implementation

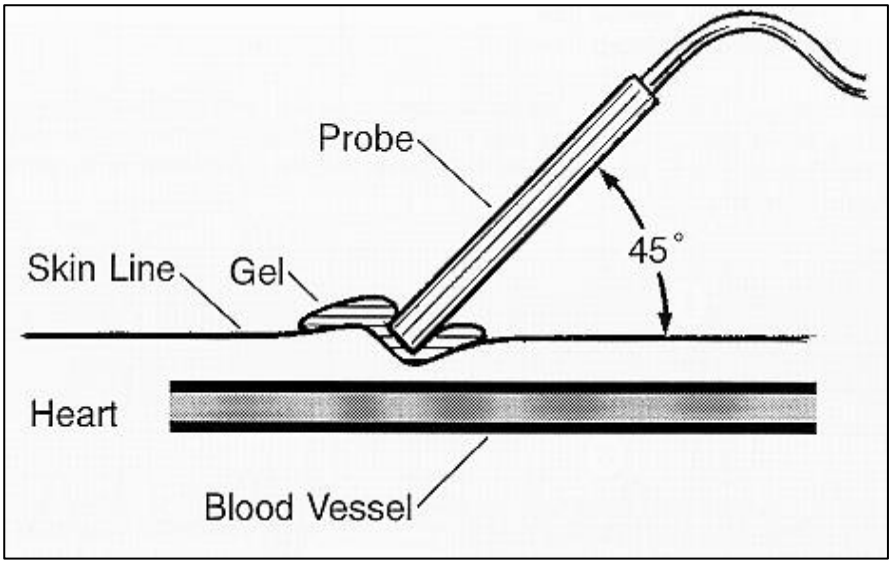
1. Explain the procedure to the patient and obtain informed consent per your employer's policies and procedures
    a. The patient must lie flat for 15 minutes prior to the start of the test
    b. Blood pressure measurements will be taken from both arms and legs
    c. The patient may experience some discomfort from the blood pressure cuff and to inform the health care provider if they need the test to stop
2. Provide for privacy
3. Have the patient remove any clothing that may restrict accurate assessment of their arm/leg pressures, i.e. shoes, socks, tight pants/shirts, sweaters, etc. Assist them as needed
4. Have the patient lie supine in a relaxed, comfortable position to facilitate the assessment – have them lie as flat as possible. Position the patient so that their arms are at their side, palms up (see the diagram below).
   NOTE: the patient must remain in a supine position for at least 15 minutes prior to and during ABPI testing to minimize any hydrostatic pressure inaccuracies



5. Ensure adequate lighting
6. Wash your hands
7. Don clean disposable gloves and expose the patients antecubital spaces
8. Apply an appropriately sized blood pressure cuff on the patient's **RIGHT** upper arm, approximately 1-2cm above the antecubital fossa.
   NOTE: Cuff width must equal 20% more than the upper arm diameter or 40% of circumference around upper arm and two thirds of upper arm length (see chart below). If the cuff is too narrow, the reading may be falsely high and vice versa

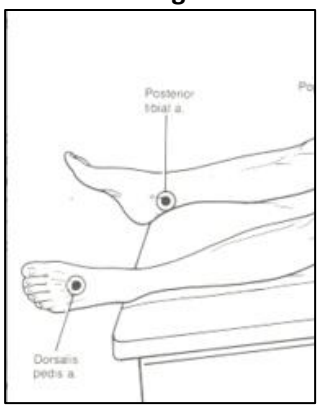
Cuff Size	Upper Arm Circumference at Midpoint (cm)
Small	22-26.9
Adult	27-34.9
Large Adult	35-44.9
Extra Large (Adult Thigh)	45-52

9. Palpate for the brachial pulse and place ultrasound gel (1/4" thick) over that area. **NOTE: ensure there are no large air bubbles in the applied ultrasound gel, as the Doppler requires a continuous conducting medium**
10. Turn the Doppler on and hold the 8MHz Doppler probe at a 45-60 degree angle to the artery (the probe itself should be pointing in the direction of the patient's head – see the diagram below)



11. Gently move the probe through the gel in a circular motion until you find the best quality pulse sound
12. Stabilize your hand/arm before inflating the blood pressure cuff to ensure that you are able to hold the probe in position as the cuff inflates/deflates
13. Inflate the blood pressure cuff quickly to approximately 70-90mmHg, and then further inflate in 20-30mmHg increments until the pulse sound is completely lost. Do NOT inflate the cuff past 200 mmHg as this may dislodge any plaques that may be present in the blood vessels
14. Gradually deflate the cuff (2mm/sec) until the pulse sound returns, and record the pressure at which the pulse sound returns.
    NOTE: if it is necessary to re-inflate the cuff due to loss of sound, be sure to completely deflate the cuff before re-inflating. If the cuff is repeatedly inflated or left inflated for long periods, the systolic pressure reading may be falsely low. If the cuff is deflated too rapidly, the true systolic pressure may be missed

15. Repeat steps 7-13 on the LEFT arm
16. Next, move to the lower legs. If an ulcer is present on one of the lower legs, test the unwounded leg first
17. If a wound is present in the location where you will be placing the blood pressure cuff, ensure the wound is covered with a low profile dressing
18. Apply an appropriately sized blood pressure cuff on the patient's lower leg, approximately 1-2cm above the medial malleolus.
    NOTE: If the cuff is too narrow, the reading may be falsely high and vice versa
19. Palpate for the posterior tibial artery (see the diagram below re location of the pulse), and place ultrasound gel (1/4" thick) over that area.
    NOTE: ensure there are no large air bubbles in the applied ultrasound gel, as the Doppler requires a continuous conducting medium



20. Turn the Doppler on and hold the 8MHz Doppler probe at a 45-60 degree angle to the artery (the probe itself should be pointing in the direction of the patient's head).
21. Gently move the probe through the gel in a circular motion until you find the best quality pulse sound
22. Stabilize your hand/arm before inflating the blood pressure cuff to ensure that you are able to hold the probe in position as the cuff inflates/deflates
23. Inflate the blood pressure cuff quickly to approximately 70-90mmHg, and then further inflate in 20-30mmHg increments until the pulse sound is completely lost. Do NOT inflate the cuff past 200 mmHg as this may dislodge any plaques that may be present in the blood vessels
24. Gradually deflate the cuff (2mm/sec) until the pulse sound returns, and record the pressure at which the pulse sound returns
25. On the same leg, now palpate for the dorsalis pedis artery (see the diagram above for general location of the pulse), and place ultrasound gel (1/4" thick) over that area, and repeat steps 19-23
26. Repeat steps 19-24 on the opposite leg
27. Remove remnants of the ultrasound gel from the patient's skin
28. Assist the patient to a comfortable position as needed and assist them with the reapplication of any clothing items removed for testing purposes, as needed.
    NOTE: the patient may feel dizzy/lightheaded when they first sit up, so encourage them to remain seated for a few minutes before attempting to ambulate
29. If the patient is to remain in bed, ensure the bed is returned to a safe height (if applicable), and ensure the patient's safety per their care plan

30. Clean reusable equipment/surfaces touched during the procedure with warm soapy water or detergent wipes and dry thoroughly to prevent cross contamination
31. Remove and dispose of your gloves in the appropriate receptacle and wash your hands
32. Calculate the patient's left and right leg ABIs, and compare with any available previous results:

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

33. Discuss the findings of the assessment with the patient and/or their support person(s

34. Update the patient's primary care provider, wound care specialist, and other members of the patient's interdisciplinary team

Grade	ABPI Result
Non-compressible	>1.40 Be cautious of falsely elevated measures
Normal Range	1.0-1.40
Borderline	0.91 – 0.99
Abnormal	<0.9
• Mild	0.7 – 0.9
• Moderate	0.41 – 0.69
• Severe	<0.4 critical limb ischemia

Evaluation

1. Unexpected outcomes:
    a. Doppler testing is not done according to this Procedure, and appropriate interventions are not initiated based on your holistic foot/lower leg assessment
    b. You are unable to compress the patients arteries or they present with an abnormally high test result, necessitating further referrals
    c. You are unable to complete the testing as the patient is unable to lie flat for a period of 15 minutes pre-procedure and during the procedure, you are unable to detect pulses with the Doppler, or the application of an inflated blood pressure cuff is too painful for the patient to tolerate
2. Reassess ABIs:
    a. Every six months for people with wounds on a healing trajectory
    b. Every six months for people undergoing compression therapy
    c. If the patient develop signs of PAD
    d. If the patient develops lower leg/foot pain unrelated to infection/injury
    e. If the wound deteriorates

References	1. Evans, R., et al. 2019. Best practice recommendations for the prevention and management of venous leg ulcers. *Wounds Canada.* Available at: https://www.woundscanada.ca/docman/public/health-care-professional/bpr-workshop/1521-wc-bpr-prevention-and-management-of-venous-leg-ulcers-1874e-final/file [Accessed June 4, 2020]. 2. Beaumier, M., et al. 2020. Best practice recommendations for the prevention and management of arterial ulcers. *Wounds Canada.* Available at: https://www.woundscanada.ca/docman/public/health-care-professional/bpr-workshop/1690-wc-bpr-prevention-and-management-of-peripheral-arterial-ulcers-1921e-final/file 3. Alavi, A., et al. 2015. Audible handheld Doppler ultrasound determines reliable and inexpensive exclusion of significant peripheral arterial disease. *Vascular, 23*(6), pp. 622-629. 4. Beldon, P. 2011. How to… Ten top tips for Doppler ABPI. *Wounds International, 2*(4), pp. 18-21. 5. Saskatoon Health Region. 2017. Doppler assessment (ABPI/TBPI) for compression therapy (initiating a plan of care). Available at: https://www.saskatoonhealthregion.ca/about/NursingManual/1018.pdf 6. British Columbia Provincial Nursing Skin and Wound Care Committee. 2013. Education Module: ankle brachial index (ABI) procedure in adults for handheld doppler & automatic ABI system. Available at: https://www.clwk.ca/wp-content/uploads/2014/10/ABI-Procedures-Education-Module.pdf 7. British Columbia Provincial Nursing Skin and Wound Care Committee. 2013. Procedure: Ankle Brachial Index (ABI) in adults using an automatic ABI system (Dopplex ability). Available at: https://www.clwk.ca/buddydrive/file/procedure-abi-automatic-abi-system/