Vascular Technology Professional Performance Guidelines

Ankle Brachial Pressure Index Assessment (ABPI): Resting and Post Exercise

This guideline was prepared by the Professional Standards Committee (PSC) of the Society for Vascular Technology (SVT) as a template to aid the clinical vascular scientist / vascular sonographer & other interested parties. This guideline maybe used in part or in its entirety with suitable additions made by local policy implementors. Suggestions for improving this guideline are welcome & should be sent to the Chair of the PSC; see www.svtgbi.org.uk for current Chair details.

Purpose

Ankle Brachial Pressure Index (ABPI) is a reproducible and quantitative assessment of arterial disease above the ankle. The systolic blood pressure is measured in the arm and at the ankle, a comparison of these pressures are used to rapidly assess the blood pressure reaching the lower limb and indicate severity of disease.

ABPI measurements pre and post controlled exercise may be used to quantify the effects of disease in relation to claudication symptoms or may help to confirm normality.

ABPI may also be used to determine if compression bandaging is suitable for patients with leg swelling or ulceration if >1.

Common Indications

Common indications for performing this examination include:

- Intermittent claudication
- Ischemic rest pain
- Gangrene
- Ulceration
- Post-surgical intervention follow-up

Contraindications

Contraindications for ABPI examination include:

- Severe pain in lower limb

- Bypass graft that extends into the lower calf
- DVT confirmed within the last six months or superficial thrombophlebitis

Contraindications for exercise test:

- Chest pain of recent onset
- Evidence of shortness of breath
- Previous myocardial infarction or CABG
- Unsteadiness when walking
- Uncontrolled angina
- Hypertension (>200mmHg)

Limitations

Limitations for ABPI examination and exercise test:

- Calcification of arteries
- Casts, dressings, open wounds/ulcers
- Severe oedema/swelling of the lower limb
- Limited mobility e.g. unable to transfer to a bed, unable to lie flat.
- Patients unable to cooperate due to impaired cognition (e.g. dementia) or from involuntary movements.

Equipment

Compliance with the Medical Devices Directive is necessary. Electrical safety testing is required annually, with regular maintenance & quality assurance testing to a specified level by qualified personnel. Review of in-service equipment should typically be undertaken four to six years after installation[1].

The examination couch should be height adjustable to minimise a compromised position for the Clinical Vascular Scientist (CVS) and must allow the patient to lie supine[2]. For resting ABPI a sphygmomanometer with a dial gauge, a blood pressure cuff (at least 50% wider than the diameter of the limb and a length of at least 80% of the circumference of the limb[3]), and a continuous wave hand held Doppler with a 8MHz probe or 5MHz (if limb is obese/ oedematous) and ultrasound gel is required[4]. For the exercise test, a treadmill can be used if available.

Explanation of Examination & Patient History

The CVS undertaking the examination should confirm the patient's identity (*e.g.* full name & date of birth) and explain why the examination is being performed, the procedure & its duration (consideration should be made to the patient's age & mental status). Relevant medical history should be taken and suitability for exercise test should be considered. Verbal consent for the examination should be obtained.

Examination

Patient Positioning: The patient should be supine and the equipment and limbs at heart level to reduce hydrostatic pressure inaccuracies[5]; the patient should be fully rested for 5 to 10 minutes before the test[6].

Obtaining brachial systolic blood pressure: Perform test bilaterally; if the patient has a haemodialysis fistula use contralateral arm. Place the cuff around the upper arm ensuring that the bladder of the cuff is over the brachial artery. Place the held Doppler probe over the brachial artery at an angle (ideally between 45° and 60°) to detect the signal. Record the phasicity of the waveform then inflate the cuff until the artery is occluded and the signal drops out. Deflate cuff slowly (approx. 4mmHg per second) and record the systolic pressure as the Doppler signal returns.

Obtaining ankle pressures: Perform test bilaterally. Place the cuff around the calf above the medial malleolus. In turn listen to the Doppler signals in the posterior tibial, anterior tibial, dorsalis pedis and peroneal arteries. Record the phasicity of the signal in each vessel[7] and the systolic pressure by repeating the method of inflating the cuff to point of occlusion, and slowly deflating.

Exercise test: Perform resting ABPI. The exercise test is designed to bring about the patients symptoms. This part of the protocol is open to variation and local departmental policies may differ depending on the facilities available and the ability of the patient.

If a treadmill is available the following can be used: Set treadmill at 10% incline and set the pace according to the needs of each individual patient. Exercise the patient for 3 to 5 minutes until claudication symptoms prevents them from going any further. After exercise return the patient to the couch in a supine position and repeat the ABPI measurement as quickly as possible (within 45 seconds) and again at 2 minutes. If the patient is unable to use the treadmill or a treadmill is not available then a 'corridor walk', step test or rapid calf raises ('tip-toe test') can be used until the desired symptoms are bought on[4]. If the patient exercises for more than 5 minutes without symptoms then the test should be stopped.

Reporting

Interpretation: The greater the difference between the systolic pressures at the brachial and ankle the lower the index and the more significant the disease. In a patient with peripheral arterial disease the pressure at the ankle will be lower and the phasicity will reduce[3].

$$\text{ABPI} = \frac{\text{Highest ankle systolic pressure (mmHg)}}{\text{Highest brachial systolic pressure (mmHg)}}$$

Table1: Interpretation of resting ABPI readings

Resting ABPI	Severity of disease (suitability for compression treatment)
>1.4	Incompressible indicating calcified vessels
>1.0	Normal (apply compression)
1.0 – 0.81	Mild peripheral arterial disease (apply compression with caution/ reduced compression)
0.8 – 0.5	Intermittent claudicant indicating moderate/ severe arterial disease (compression contra-indicated)
<0.5	Severe disease (compression contra-indicated)

<0.3	Critical ischemia (compression contra-indicated)

False high systolic pressure readings may be obtained in diabetics, this occurs when the cuff is unable to compress calcified distal vessels[8]. If desired toe pressures may be used for these patients[4].

Post exercise in the absence of disease the ABPI will remain the same as at rest, the more severe the disease the greater the reduction in the ABPI reading.

Writing the report: The report is a recording and interpretation of observations made during the ABPI examination; it should be written by the CVS undertaking the examination and viewed as an integral part of the whole examination[9].

The report should include correct patient name, demographics; date of examination; and examination type. Include the absolute pressures the ABPI, the pressure index and phasicity of the Doppler signal waveform.

If an exercise test has been performed record the type of exercise used and post exercise indices. When using a treadmill report the walking distance, incline and speed. For all types of exercise test it is important to make a note of what stopped the patient from any further exercise e.g. calf claudication, chest pain.

Referral of critical ultrasound results should be made to the referring consultant or appropriate medical/surgical team (as per local protocol) prior to the patient being discharged so that treatment plans can be developed, enforced or expedited accordingly.

REFERENCES:

[1] Standards for Ultrasound Equipment; Royal College of Radiologists, February 2005 www.rcr.ac.uk

[2] Guidelines for Professional Working Standards Ultrasound Practice; United Kingdom Association of Sonographers (UKAS) October 2008 www.sor.org/learning/document-library

[3] Zweibel W J, Pellerito J S 2005 Introduction to vascular ultrasonography 5th edition. Esevier Saunders, Philadelphia.

[4] Vascular Laboratory Practice Part III, IPEM 1st Ed 2001.

[5] Vowden K, Vowden P. (2001) Doppler and the ABPI: how good is our understanding? *J Wound Care*, 10(6):197–202.

[6] Yao ST. Haemodynamic studies in peripheral arterial disease. Br J Surg. 1970;57(10):761–766.

[7] AbuRahma A F 2000 Segmental Doppler pressures and Doppler waveform analysis in peripheral vascular disease of the lower extremities. In: AduRahma A F, Bergan J J

[8] Al-Qaisi M., Nott D.M., King D.H., Kaddoura, S. (2009) Ankle Brachial Pressure Index (ABPI): An update for practitioners. *Vascular Health Risk Management*, 5: 833–841.

[9] Society for Vascular Technology Professional Standards Committee Image Storage Guideline April 2012 www.svtgbi.org.uk