Safe, time-saving, cost-effective ABPI measurement with automated machines

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The Leg Club Foundation now works in partnership with Professor Whiteley, founder of The College of Phlebology, aiming to provide education, evidence-based treatment and care to improve the quality of life of individuals with chronic lower limb conditions. The Leg Club Foundation embraces endovenous surgery as a cost-effective surgical cure of ulcers, complementing the proven benefits of the Leg Clubs, which tackle social isolation through education and holistic care. https://www.collegeofphlebology.com/www.legclub.org

An abundance of literature has been written about leg ulcer incidence and management costs (Lindsay and Whiteley, 2018). With an ageing population, an increasing incidence of long-term conditions and challenging financial environment, healthcare providers and commissioners face significant challenges (Lindsay and Whiteley, 2018). Clinicians must be aware of advances in medical technology and promote health and education designed to prevent disease. New-generation medical devices used in everyday practice enable clinicians to assess and treat patients more effectively, resulting in better outcomes and increased quality of life (Dowsett and Taylor, 2018).

ASSESSMENT IN PRACTICE

Venous leg ulcers are the most common cause of lower limb ulcer and their incidence increases with age (Wounds UK, 2016). Practitioners undertaking lower limb management need a thorough understanding of the holistic assessment process and the implications of evidence-based wound care for venous leg ulcers. Initial patient assessment should include general, leg and wound/skin assessments to facilitate early intervention and reduce the risk of chronicity (Wounds UK, 2016).

Determination of peripheral perfusion is a fundamental component of assessment; ankle brachial pressure index (ABPI) measurement will exclude the presence of significant arterial disease and confirm that the use of compression is safe (Wounds UK, 2016). Doppler ultrasound is the gold standard non-invasive method of measuring ABPI, though duplex ultrasound and other investigative tools can also be used. Despite its importance, not all patients are referred for ABPI. Guest et al (2015) found that only 16% of leg or foot ulcer cases had a Doppler ABPI documented in their records.

There are two methods commonly used to measure ABPI: automatic devices that simultaneously sense the pressure under inflatable cuffs; and hand-held Dopplers that allow a clinician to listen to blood flow and compare arm and ankle pressures. Many clinicians cite lack of time as a challenge when performing an ABPI, as hand-held Doppler assessment takes over 30 minutes to complete; however, new technology offers faster methods of taking ABPI readings (Wounds UK, 2019). For example, an automated three-cuff device is now available that can determine ABPI index and provide full information in minutes. This non-invasive, simple, and inexpensive test has good diagnostic results when performed by well-trained practitioners (Kaiser et al, 1999; Matzke et al, 2003).

GETTING THE MOST OUT OF ABPI

The benefits of manual and automated ABPI measurement systems are currently being debated. Clarification and advice based on knowledge and experience are invaluable at this time, so the Leg Club Founder sought expert advice from consultant phlebologist Mark Whiteley for his recommendations on ABPI in practice.

Principles of ABPI

ABPI is a standard non-invasive way of assessing arterial pressure in the lower leg and ankle (Wounds UK, 2019). A pneumatic pressure cuff is placed around the lower leg and inflated until blood flow stops below the cuff. Using a Doppler probe to identify pulses, or another measurement of blood flow at the ankle or foot, the cuff is slowly deflated and the pressure noted at the point flow recommences in the arteries. Measurement is repeated on both sides, if both limbs are present, and in more than one artery per limb.

Common wisdom is that arm pressures are taken first. The arm with the highest systolic pressure is used to create the index. You then take the pulses in the lower limbs, identifying the dorsalis pedis, posterior tibial, anterior tibial and peroneal pulses if at all possible. It is recommended that blood flow is measured in a minimum of two of these vessels. The highest brachial pressure is used to calculate the ratio of flow in the left and right lower limbs (Vowden, 2010).

Automated machines to measure ABPI

With automated machines, pneumatic cuffs are positioned on the lower legs and on one or both

upper arms. The cuffs automatically inflate and deflate. Restoration of flow is usually sensed by the pulsatile waveform in these machines. The machine can automatically display an ABPI for each side.

Should I use one arm cuff or two?

To answer this, consider the anatomy of the arteries (*Figure 1).* The aorta emerges from the heart, arches from the front to the back of the chest and descends down the spine into the abdomen. The first branch, the 'innominate' artery, splits into two in the lower neck, with the right subclavian artery going to the right arm and the right common carotid artery going to the face and brain. The second branch, the left carotid artery, goes straight to the face and brain on the left-hand side. The third branch, the left subclavian artery, goes to the left arm. The pattern is asymmetric because in the womb the aorta develops from tissues (arches) that split into several parts and are broken down or remodelled to form arteries, leaving a single arch (the aorta) that projects from the left-hand side of the heart. In patients with arterial disease, it is relatively common to have some atheroma at the origin of the left subclavian artery, though it can occur at the right subclavian artery (*Figure 2).* Atheroma often collects around junctions. If it gets big enough to narrow the artery, atheroma can reduce blood flow and increase pressure. In patients with arterial disease, blood pressure may differ in each arm, as was the case in 13.6% of patients in one study (Guest et al, 2015). You can safely use manual or automated machines to measure ABPI in patients provided that, if you use a single-arm cuff machine, you check which arm has the higher pressure first and use that arm.

One-arm cuff machines

To implement the most appropriate treatment based on ABPI, take a reading from both arms in turn and use the arm with the highest systolic pressure in the calculation. You may wish to repeat the measurement a couple of times to ensure there is no difference due to 'white coat hypertension'. If systolic pressures are the same in both arms, it does not matter which arm you use. Once you have chosen the optimal arm, use that arm and both legs for automated ABPI machine readings.

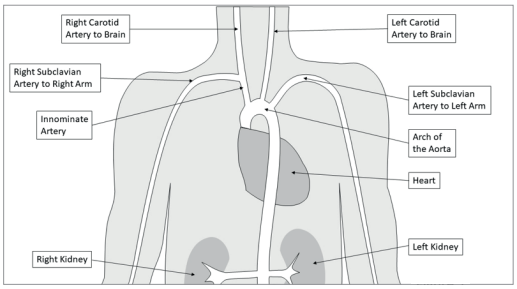

Figure 1. Anatomy of the arteries

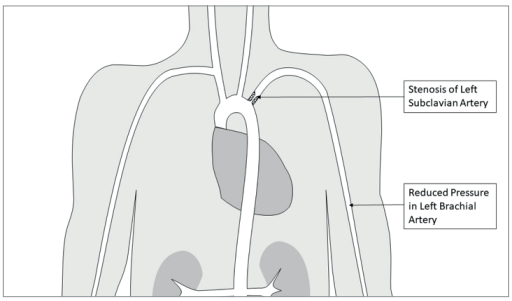

Figure 2. Atheroma forms at the origin of the arteries

Two-arm cuff machines

If you use an automated machine with two arm cuffs and two leg cuffs, the machine should automatically choose the best arm to generate ABPI for both sides. It is important to know your machine. You need to make sure that the machine is not just using the right arm for the right ABPI and the left arm for the left ABPI. If this is the case, one of the ABPIs could be incorrect.

Choose what is right for you

Choose equipment based on what you want it to do, cost-effectiveness and the advantages it offers:

- Simultaneous measurement of arm(s) and both legs that excludes error due to blood pressure drift (white-coat effect)
- Identifying severe peripheral arterial disease
- Analysis of pulse waveform
- Detecting external influences that can harm the reliability of the result
- Easy and effective operation.
- Portability, if used in a community setting.

CONCLUSION

One- and two-cuff machines can be used to measure ABPI. Ensure the best arm is used in calculations. Automated machines save time and can offer additional benefits, making their use cost-effective in practice. WUK

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