

# DOPPLER ASSESSMENT: GETTING IT RIGHT

Full leg ulcer assessments are important in order to identify the aetiology of patients' leg ulcer and Doppler ultrasounds form a part of this. Doppler assessment training is an integral part of any leg ulcer management course that all nurses who care for patients with leg ulcers should attend. However, it has been noted that incorrect Doppler readings still occur within practice. This article discusses some of the practices that can affect Doppler readings, thereby helping nurses to improve their Doppler assessments.

*“Determining the aetiology of the ulcer is key to ensuring the correct treatment protocol is followed — inappropriate treatment, at best, would mean ineffective care and, at worst, harm to the patient.”*

Leg ulcers are non-healing wounds on the lower leg that have been present for at least 4–6 weeks (Moffatt et al, 2007). They affect approximately 1% of the UK population (Callam et al, 1985). Leg ulcers are more common among older people (Morris and Sander, 2007) and, with an ageing population, this is going to increase (Douglas, 2001). With 80% of all leg ulcers being treated within the community (Cornwall et al, 1986) and the majority of the assessment and care being delivered by nurses (Moffatt et al, 2007), it is essential that community nurses have the understanding and skills to effectively assess and manage patients with leg ulcers.

### **Full leg ulcer assessments**

Undertaking a full leg ulcer assessment is a necessary skill in that it enables the clinician to gain sufficient knowledge about the patient in order to correctly determine the cause of the ulcer and identify any factors that may delay healing. Nurses need to have knowledge and understanding of the lower limb circulatory system,

theories of how ulcers develop and awareness of unusual causes (Moffatt et al, 2007). Determining the aetiology of the ulcer is key to ensuring the correct treatment protocol is followed. Inappropriate treatment, at best, would mean ineffective care and, at worst, harm to the patient.

### **Doppler assessment**

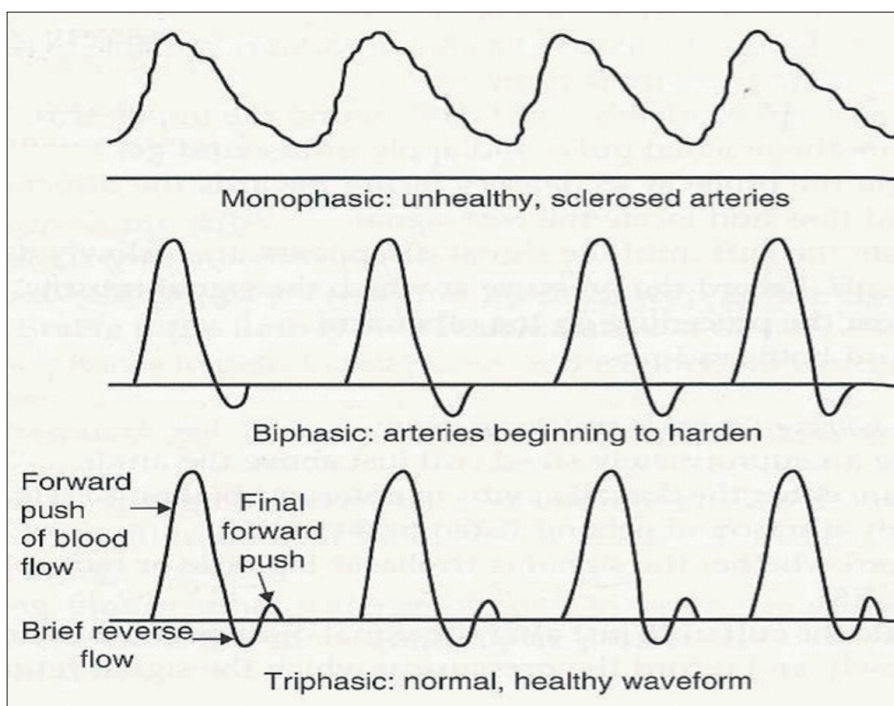
The Doppler ultrasound assessment and ankle brachial pressure index (ABPI) play only part of the assessment process and cannot be relied on alone to provide an accurate diagnosis. The Doppler is a tool for assessing arterial disease in the lower leg and any deviation in the process will produce variables that affect the results obtained (Worboys, 2006).

Nurses need to be educated in both the theory and practice of leg ulcer assessment so that their knowledge, skill and competency allow them to effectively carry them out. However, even with the requisite training and education, inconsistencies are still observed, leading to incorrect Doppler results.

NICOLA WHAYMAN  
Independent Leg Ulcer Specialist Nurse,  
National Leg Ulcer Forum  
Committee Member



**Figure 1.** The cuff should be positioned over the ankle area to obtain the ABPI.



**Figure 2.** Pulse sounds.

The procedure for obtaining an ABPI through the Doppler assessment has already been well documented (Worboys, 2006). Therefore, this article focuses on the factors that may affect the readings. It must be noted that the procedure must first be explained to the patient clearly in order for informed consent to be obtained.

### Resting the patient

The patient needs to rest quietly for

10–20 minutes in order to obtain a resting systolic pressure and nursing staff must make sure that they factor in this time within the patient's appointment slot. With frequent time pressures within the workplace, this part is often rushed. Moffatt et al (2007), therefore, offers two time-saving tips:

- ▶ Nurses may either ask the patient to rest for half an hour before the district-nurse visit,

or arrive half an hour earlier to the clinic/practice-nurse appointment so they can rest quietly in the waiting room

- ▶ Or, alternatively, as the patient is lying down resting, nurses can start the assessment.

### Lying flat

The patient needs to lie as flat as possible to reduce hydrostatic pressure inaccuracies (Moffatt et al, 2007). If the patient cannot lie flat, nurses can bring their legs as near to heart level as possible and document this position so that colleagues are aware, allowing consistency for future readings. If patients are not lying flat, readings will be falsely high (Moffatt et al, 2007). Therefore, staff need to be aware of this.

### Cuff size

Nurses must make sure the appropriate sized cuff is used as the wrong size will lead to inaccurate pressures. A cuff that is too short or too narrow results in overestimating pressures and a cuff that is too big will underestimate pressures (Moffatt et al, 2007). When applying the cuff to the leg, nurses should ensure it is positioned over the ankle area (Figure 1) to attain the ABPI; further up the leg will result in a calf brachial pressure index, which is incorrect.

Repeatedly inflating the cuff should also be avoided as reinflating it before it has been fully deflated may alter pressures (Moffatt et al, 2007). The cuff then needs to be slowly deflated until it makes a sound. If the cuff is deflated too quickly, the initial sound may be missed, particularly in patients with irregular heartbeats, and will therefore provide a false reading (Worboys, 2006).

Brachial systolic pressure must be attained from both arms (unless there is a medical reason why

this cannot happen). The highest measurement should be used for the test as having the nearest measurement to the central systolic pressure improves the accuracy (Moffatt et al, 2007).

**Probe**

The probe should be held at a 45° angle to the arm pointing towards the heart and slowly moved around until the nurse can locate the pulse. Pressing too hard can cause the vessel to compress and no sound will be heard. A continuous ‘whoosh’ sound that can be heard is the venous system and not the vessel that is required. It is important to become familiar with the different arterial sounds and to make a note of them; this is often missed out during assessments, but is really important for knowing the state of the vessels you are listening to.

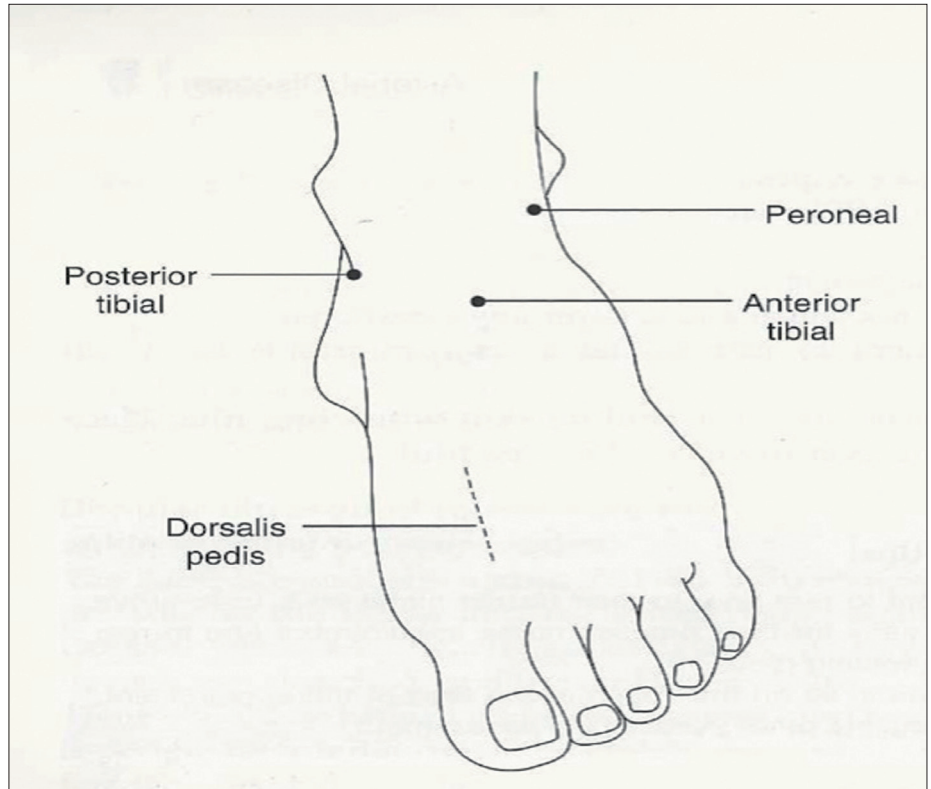
Triphasic is the sound of a healthy artery (three distinct beats are heard), biphasic sounds (two beats) are often heard in the older person as a result of the normal physiological process of ageing, monophasic sounds (single beat, often muffled and dull) indicate that the vessel is diseased (Worboys, 2006; *Figure 2*).

There are two sizes of probes:

- ▶▶ 8 MHz is the standard probe for use on normal limbs
- ▶▶ 5 MHz is a probe that can give better results for oedematous ankles and feet where sounds can often be distorted due to tissue fluid.

**Foot pulses**

Having knowledge of the anatomy of the foot will help in locating the four foot pulses (*Figure 3*). Two pulses need to be used for each leg; however, the anterior tibial and the dorsal pedis are part of the same artery and, therefore, should not both be used. One of these pulses



*Figure 3. Four foot pulses.*

**Table 1. Ankle brachial pressure index (ABPI) results (Moffatt, 2007).**

ABPI score	Interpreting ABPI score
ABPI < 0.5:	Excision with adequate margins — followed by direct closure, skin-grafting or reconstructive surgery.
ABPI 0.5–0.9	Moderate-to-severe peripheral arterial disease. Refer to the leg ulcer specialist/tissue viability nurse and/or vascular team. Some may reduce compression, but only under specialist guidance.
ABPI 1.0–1.3	Normal ABPI high compression is probably safe in the absence of other contraindications.
ABPI > 1.3	May indicate false high readings, especially if pulse sounds are monophasic. Ankle vessels may be non-compressible, indicating severe calcification, which is more commonly seen in people with diabetes. Falsely high readings may be a result of poor Doppler procedure and this needs to be reviewed by a specialist nurse. Toe pressure may need to be assessed.



**Figure 4.** Machine for taking TBPI.



**Figure 5.** TBPI taken with hand-held Doppler and appropriate sized cuff.

should be used alongside either the posterior tibial pulse or peroneal pulse. Again, a reading should be taken from both legs in order to attain a picture of the person's whole arterial system, with the highest foot pulse in each leg being used for the measurement.

### Calculating the ABPI

To calculate the ABPI, the highest foot reading on the right foot should be taken and divided by the highest brachial reading. Then, the same should be done for the left foot, taking the highest left-foot reading and dividing it by the highest brachial reading. This will then give you an ABPI for the major vessels for the right and left leg.

Nurses should always refer to their local policy for interpreting

**Table 2.** Toe brachial pressure index (TBPI) results (Moffatt et al, 2007).

TBPI scores	Interpreting TBPI results
TBPI >0.7	Normal/satisfactory peripheral arterial supply.
TBPI <0.65	Indicative of peripheral arterial disease. Refer patient to the vascular team for further investigation.

results as policies may differ on values. However, a general guide to interpreting the ABPI readings can be seen in *Table 1*. ABPI must always be interpreted by a qualified health professional within the context of the local policy and full leg ulcer assessment, using all information gained through assessment and Doppler results (Moffatt et al, 2007). For example, the accuracy of the procedure, the pressures obtained, variations in pressure, and the quality and type of pulse sounds heard must all be considered alongside the rest of the information obtained from the leg ulcer assessment.

As noted, the health professional must not only be a qualified nurse, but must also have further education and training in leg ulcer assessment and management (Royal College of Nursing (RCN), 2006; Scottish Intercollegiate Guidelines Network (SIGN), 2010).

### Documentation

The entire assessment should be documented and held within the patient's records, whether in paper form or uploaded to electronic records. This allows other health professionals to access the assessment. Simply writing the ABPI results in the notes does not constitute good record-keeping practice as this does not consider the whole assessment and the ABPI is meaningless as a stand-alone assessment.

### Further tools to aid assessment

There are other tools that can be useful in leg ulcer assessments. Trained nurses need to be aware of these and find out if they have access to them.

### Toe pressure

Doppler ultrasound can also be used for measuring toe pressures — useful when there have been false high ABPI readings, owing to calcification, which rarely affects the toe arteries. It is also helpful when there is pain and discomfort preventing ABPI measurements or if there is gross oedema in the lower leg/foot.

The most common way to take a toe brachial pressure index (TBPI) is using a Vascular Assist® (Huntleigh) machine (*Figure 4*). However, TBPI can also be taken with an appropriate sized cuff (*Figure 5*) and a handheld Doppler. The comparison is then made between the brachial and toe pressures, which are measured in the same way — toe pressure divided by the highest brachial pressure.

Toe pressures are normally smaller than brachial pressures. The ratios are lower owing to the size of the arteries. Therefore, it is important to interpret the readings differently (Moffatt, 2007; *Table 2*). Again, this forms only part of a full leg ulcer assessment. All information

must be considered and training must take place before using this procedure.

### **Pulse oximetry**

Another useful tool is pulse oximetry, which can help with the assessment of peripheral arterial perfusion. It is easy to use, as the health professional only has to place it on a finger or toe, rather than locating the arteries, and it is proving to be an accurate, non-invasive tool (Moffatt et al, 2007).

The pulse oximeter measures oxygen levels within the tissue and the signal is diminished when blood flow is occluded. The procedure is similar to that used with the Doppler. The pulse oximeter is placed on the finger or toe and the cuff is placed around the arm or ankle, depending on which reading is being taken. There is, however, a change to how the cuff is inflated and it is necessary to have training on this method if it is favoured. Once again, the calculation used is the toe reading divided by the highest finger reading. Interpretations are similar to those for the ABPI, but appropriate training is required to do this.

### **Tissue viability/leg ulcer specialist**

It is important to know when to seek further help and advice from local tissue viability and/or leg ulcer services. They can offer support to community/practice nurses and review complex patients. Clinicians should be aware of local protocols, and know how and when to refer to these services, as well as when

it is necessary to refer to vascular teams within secondary care. There are national guidelines (RCN, 2006; SIGN, 2010), as well as best-practice documents available (i.e. Compression in Venous Leg Ulcers: A Consensus Document [2008]). The importance of training, keeping skills up to date and knowing when to seek advice cannot be overstated. The national Leg Ulcer Forum, Leg Clubs and Tissue Viability Society are other useful sources of information alongside books and journals.

---

*“The importance of training, keeping skills up to date and knowing when to seek advice cannot be overstated.”*

---

### **Conclusion**

This article has highlighted the importance of full leg ulcer assessments, of which Doppler assessments play only a part, being carried out by trained, competent nurses. Consideration has been given to some areas of the Doppler assessment that can alter ABPI results if not carried out correctly. Other tools that can aid the assessment process have also been examined, as well as the important role of tissue viability and leg ulcer services in supporting nurses out in the community. **WE**

### **References**

Callam MJ, Ruckley CV, Harper DR, Dale JJ (1985) Chronic ulceration of

the leg: extent of the problem and provision of care. *Br Med J (Clin Res Ed)* 290(6485): 1855–6

Cornwall JV, Doré CJ, Lewis JD (1986) Leg ulcers: epidemiology and aetiology. *Br J Surg* 73(9): 693–6

Douglas V (2001) Living with a chronic leg ulcer: an insight into patients' experiences and feelings. *J Wound Care* 10(9): 355–60

Morris P, Sander R (2007) Leg ulcers. *Nurs Older People* 19(5): 33–7

Moffatt C, Martin R, Smithdale R (2007) *Leg Ulcer Management*. Blackwell Publishing, Oxford

Royal College of Nursing (2006) *Clinical Practice Guidelines: The nursing management of patients with venous leg ulcers*. RCN, London

Scottish Intercollegiate Guidelines Network (2010) *Management of chronic venous leg ulcers: A national clinical guideline*. SIGN, Edinburgh

Worboys F (2006) How to obtain the resting ABPI in leg ulcer management. *Wounds Essentials* 1: 55–60

World Union of Wound Healing Societies (2008) *Compression in Venous Leg Ulcers: A Consensus document*. Available at: [http://www.woundsinternational.com/pdf/content\\_25.pdf](http://www.woundsinternational.com/pdf/content_25.pdf) (accessed 29.10.2014)