

PERFORMING A DOPPLER ASSESSMENT: THE PROCEDURE

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Leg ulcers can have an extremely deleterious effect on a patient's well being and quality of life. In order to provide a comprehensive assessment of the patient with a leg ulcer, the nurse must perform a Doppler ultrasound and listen to the signals transmitted from the Doppler probe. However, this is a skilled procedure. This article looks at the optimum technique for performing a Doppler assessment.

Christian Doppler, an Austrian physicist, discovered the Doppler effect in 1842. In scientific terms, it relates to the change in frequency of a wave as the source or target moves. When employed as part of a vascular assessment, the technique uses the direction and velocity of blood flow to ascertain whether the patient's arterial blood vessels are healthy or diseased. The brachial and ankle systolic pressures are measured using a hand-held Doppler probe at the brachial pulse, and the dorsalis pedis pulse on the dorsum of the foot. The ankle pressure is divided by the brachial pressure to obtain the ankle brachial pressure index (ABPI).

In the absence of arterial disease, systolic pressure should be equal or exceed that in the arm (producing an ABPI of at least 1), whereas in arterial disease, the index will be below 1. An index of approximately 0.8 (or below) is considered a sign of significant arterial disease (Thomas, 2010). It must be stressed that a Doppler

assessment alone does not constitute an assessment of a patient with a leg ulcer.

The procedure

Before undertaking a Doppler assessment, the patient should

receive a full explanation of the procedure in order that they are aware of what is involved. Patients should be informed that they will need to lie as flat as possible, with one pillow for the head, for 10–20 minutes (this removes the effect



Figure 1. The patient lies supine.



Figure 2. Cuff applied above the elbow.



Figure 3. Cling film is applied to the wound.

of gravity on blood flow). Patients with breathing difficulties may not be able to lie entirely flat, in which case they should be asked to lie as low as is tolerable for them. They should be informed that they may experience some discomfort from the blood pressure cuff on the ankle — patients need to be aware that they may stop the procedure if it is too painful.

Equipment needed

The procedure should be performed by two nurses, one of whom should be a registered nurse trained in Doppler assessment. The following equipment will be required:

- ▶▶ A Doppler ultrasound with an 8Mhz probe
- ▶▶ A sphygmomanometer and the appropriate size blood pressure cuff for the shape and size of the patient's arms and ankles
- ▶▶ Cling film to cover the ulcer bed (this prevents the blood pressure cuff rubbing against the ulcer bed directly, which prevents discomfort and contamination of the cuff)
- ▶▶ Ultrasound gel to use as a contact medium between the patient and the Doppler probe.

Technique

The technique is as follows:

- ▶▶ The patient should lie supine (flat) for about 10–20 minutes to eliminate the influence of gravity (*Figure 1*)
- ▶▶ The blood pressure cuff is applied to the arm above the elbow (*Figure 2*). The brachial artery is located with the fingers and ultrasound gel applied. The Doppler probe is held between 45–70 degrees to the skin and moved over



Figure 4. The pedal (foot) arteries need to be located.

the skin until the clearest signal is heard

- ▶▶ The blood pressure cuff should be inflated until the signal disappears, then the cuff slowly released while the nurse listens carefully for the signal to emerge — this is recorded as the brachial systolic pressure
- ▶▶ This is repeated on the other arm. The highest systolic pressure is used to compare against the ankle pressures
- ▶▶ The patient's ulcer is then exposed and covered in cling film (*Figure 3*)
- ▶▶ The nurse locates the patient's pedal (foot) arteries (*Figure 4*)
- ▶▶ Two of the four pedal pulses are used:
 - Anterior tibial artery
 - Posterior tibial artery
 - Peroneal artery
 - Dorsalis pedis artery
- ▶▶ The two most common arteries used are the dorsalis pedis and posterior tibial arteries, mainly because they are accessible when the blood pressure cuff is applied to the leg
- ▶▶ The blood pressure cuff is then applied just above the patient's malleoli (ankle)
- ▶▶ While the registered nurse applies the Doppler probe over the artery and listens for the signal, the other nurse slowly inflates the blood pressure cuff. The registered nurse listens for the Doppler signal to disappear due to the artery's occlusion by the blood pressure cuff
- ▶▶ The cuff is then slowly deflated and both nurses observe the pressure at which the Doppler signal reappears — this pressure is recorded for that artery
- ▶▶ The registered nurse finds another pedal artery and the process is repeated
- ▶▶ If the artery cannot be compressed by the blood pressure cuff, this indicates severe disease.

Once all the blood pressure readings have been recorded, all of the equipment is removed from the patient's limb and the patient made comfortable in an upright position. This procedure can be stressful for the patient and this should be acknowledged.

Ideally, the patient's ABPI should be 1, in other words, the blood

pressure is the same in the ankle as in the arm. If the artery in the leg has severe disease, the ABPI will be much less than 1, or much greater if the vessel cannot be compressed by the blood pressure cuff. Nurses should be wary of any ABPI that is much greater or lesser than 1.

Calculating the ABPI

In theory, a patient's brachial blood pressure should be the same as the ankle. Therefore, if the brachial pressure equals 124 and the ankle pressure at the posterior tibial artery is 124, then dividing the two figures indicates that the ABPI is 1 (Figure 5 shows an example of a body map used to record the brachial and ankle pressure obtained by sphygmomanometer). In addition to recording the ABPI, the nurse should also be listening to the signals given by the Doppler probe as these can impart useful information and are equally valuable as the ABPI measurement.

Doppler ultrasound signals

Triphasic signal

This is represented by three sounds heard very quickly together (duh...duh...dum), as the blood runs through a healthy un-diseased artery.



Ankle-brachial index interpretation

- Above 0.90: Normal
- 0.71–0.90: Mild obstruction
- 0.41–0.70: Moderate obstruction
- 0.00–0.40: Severe obstruction

Right arm:

Systolic pressure				mmHg
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Left arm:

Systolic pressure				mmHg
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Right ankle: Systolic pressure

Posterior tibial (PT)				mmHg
Dorsalis pedis (DP)				mmHg

Left ankle: Systolic pressure

Posterior tibial (PT)				mmHg
Dorsalis pedis (DP)				mmHg

Figure 5. A body map used to record the ABPI obtained by sphygmomanometer.

Biphasic signal

This can be recognised as two sounds heard together (duh, dum ... duh, dum), this may be because the Doppler probe is not at the optimum angle. Again, it indicates a healthy artery.

Monophasic signal

A single, almost 'banging' sound (...dum! ...) indicates that the Doppler signal is unable to penetrate a diseased artery.

Conclusion

To provide a leg ulcer assessment, the nurse must perform a Doppler ultrasound as well as taking a comprehensive social and medical history. **WE**



Figure 3. The Doppler probe is applied over the artery.

Thomas S (2010) Compression bandaging in the treatment of venous leg ulcers. *World Wide Wounds* Available at: <http://www.worldwidewounds.com/1997/september/Thomas-Bandaging/bandage-paper.html> (accessed 27 May, 2010)