Socks off

~~Hands on~~ Training

A step-by-step guide to performing
ABPI & TBPI measurements

Training brought to you by the Huntleigh Academy

HUNTLEIGH

A MEMBER OF THE ARJO FAMILY

Contents

Introduction

ABPI and TBPI assessments have a number of applications, from diagnosing PAD and determining the aetiology of lower limb wounds to forming part of an overall cardiovascular risk assessment.

This document provides a comprehensive, step-by-step guide to performing both ABPI and TBPI assessments, from selecting your equipment to calculating the final result.

Look out for helpful hints and tips from our experienced team and senior practitioners, which we've included to help make performing the assessments easier and more reliable.

This guide doesn't go into the rationale behind the assessments, or how to interpret the results. More information on these topics can be found on the Huntleigh website.

We hope this document will be useful for you and your colleagues as a reference and training aid in the future.

Equipment Selection

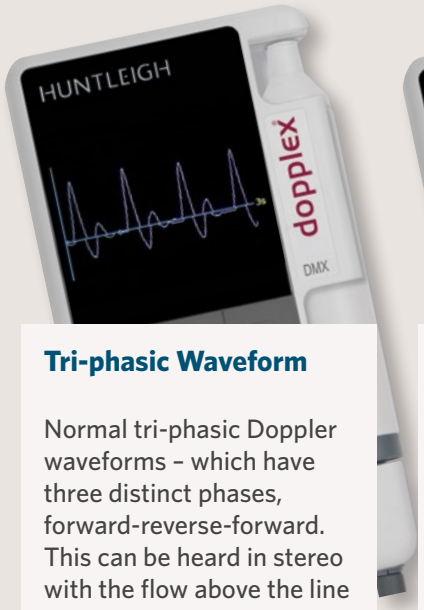
You need a vascular Doppler with the correct probe attached. There are a number of Dopplers available from audio only, flow direction indicator and waveform options.

D900 - Audio Only

SD2 - Flow Indication

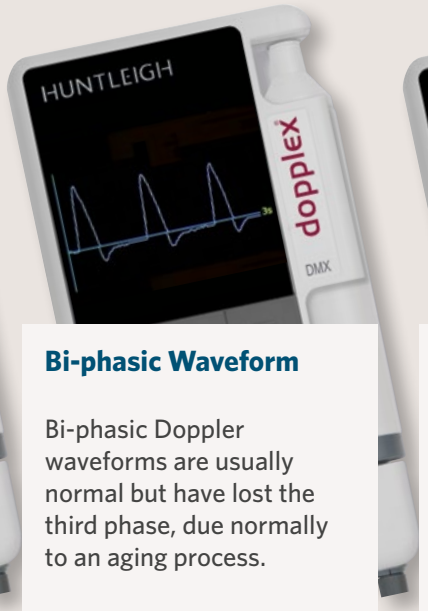
DMX - Waveform Visualisation

Recommended - waveforms provide added diagnostic information.



Tri-phasic Waveform

Normal tri-phasic Doppler waveforms – which have three distinct phases, forward-reverse-forward. This can be heard in stereo with the flow above the line heard in the left channel and flow below the line heard in the right channel.



Bi-phasic Waveform

Bi-phasic Doppler waveforms are usually normal but have lost the third phase, due normally to an aging process.

Monophasic Waveform

Abnormal, monophasic waveforms which are indicative of PAD.

Note the loss of the reverse flow i.e. no waveform below the zero line.

BP Cuff

A blood pressure cuff of the correct size. The bladder of the cuff must be at least 80% of the circumference of the limb being assessed.

Sphygmomanometer

The sphyg you use needs to have an accurately calibrated dial to enable you to read pressures and a trigger to control the release of air pressure.

Ultrasound Gel

Unlike other gels or lubricants, ultrasound gel is designed to enable the transmission of the clear ultrasound signal needed to assess diseased limbs.

Kits

Huntleigh provides kits containing all the equipment required to perform ABPI and TBPI assessments.

Probe Options

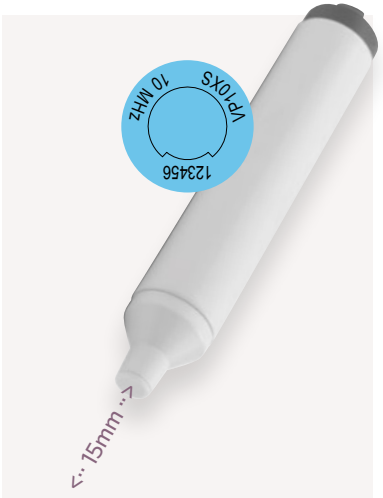
VP4XS
A 4MHz High Sensitivity Doppler probe for detection of deep lying vessels.

VP5XS
A 5MHz High Sensitivity Doppler probe for oedematous limbs and deep lying vessels.

The ideal probe as an adjunct to the Easy 8 for ABPI measurements.

VP8XS
An 8MHz High Sensitivity Doppler probe for easier detection of peripheral vessels and calcified arteries.

EZ8XS
The Easy8 8MHz High Sensitivity Doppler probe incorporates Wide Beam technology to allow easy location of the vessel.



VP10XS
A 10MHz High Sensitivity Doppler probe for detecting smaller vessels in specialist superficial applications.

We offer a range of probe frequencies to suit various clinical applications. 4MHz and 5MHz probes are used for deep vessels and oedematous limbs. 8MHz and 10MHz probes are used for superficial applications.

The EZ8XS and VP5XS are recommended for ABPI measurements.

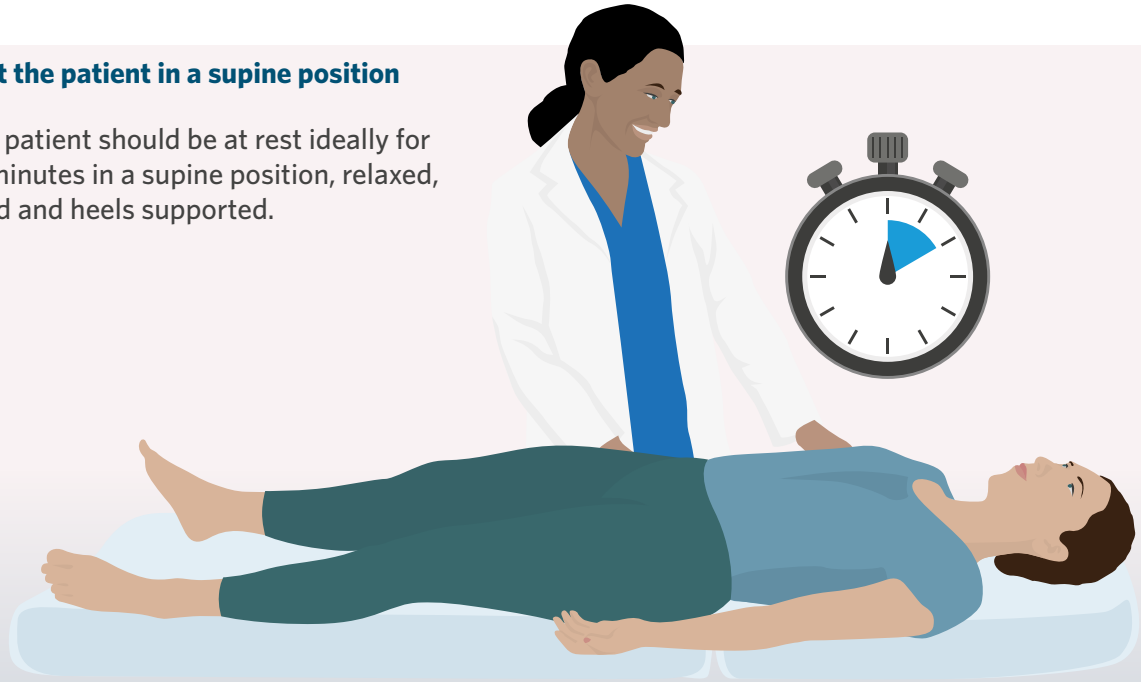
Measuring and Calculating ABPI

ABPI is a ratio composed of the blood pressure of the upper arm (brachial artery) and the blood pressure of the lower limb (dorsalis pedis and the posterior tibial artery). This guide provides a step-by-step approach to performing ABPI measurement.

Prepare the Patient

Rest the patient in a supine position

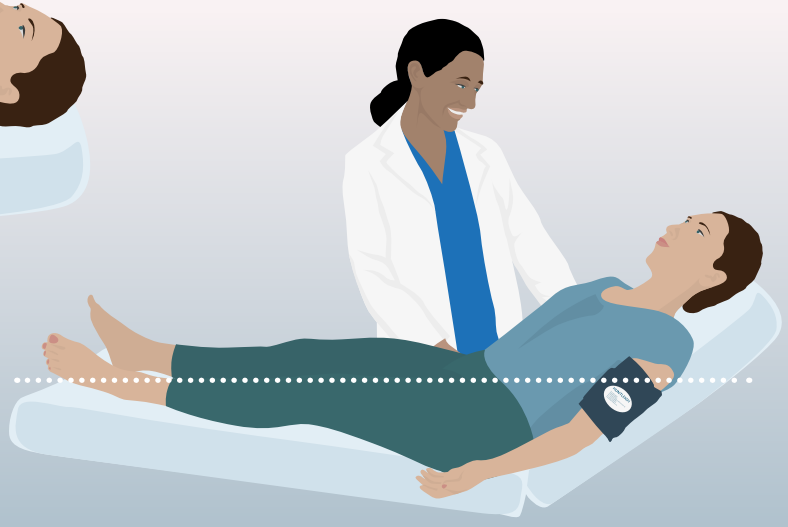
The patient should be at rest ideally for 10 minutes in a supine position, relaxed, head and heels supported.



Tight clothing should be removed from both arms and both legs to allow correct placement of the blood pressure cuff and prevent a tourniquet effect.

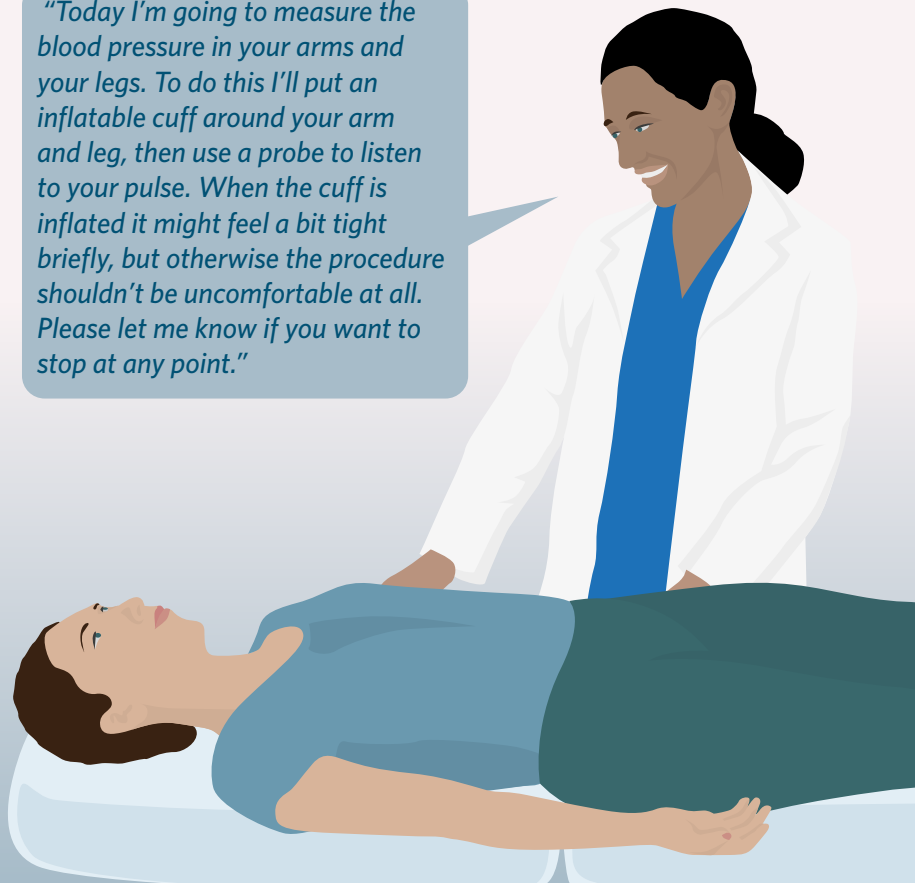
What if the patient can't lay flat?

If patient is unable to lay flat, raise their feet so they are level with the upper arm.



Explain the procedure to the patient

"Today I'm going to measure the blood pressure in your arms and your legs. To do this I'll put an inflatable cuff around your arm and leg, then use a probe to listen to your pulse. When the cuff is inflated it might feel a bit tight briefly, but otherwise the procedure shouldn't be uncomfortable at all. Please let me know if you want to stop at any point."



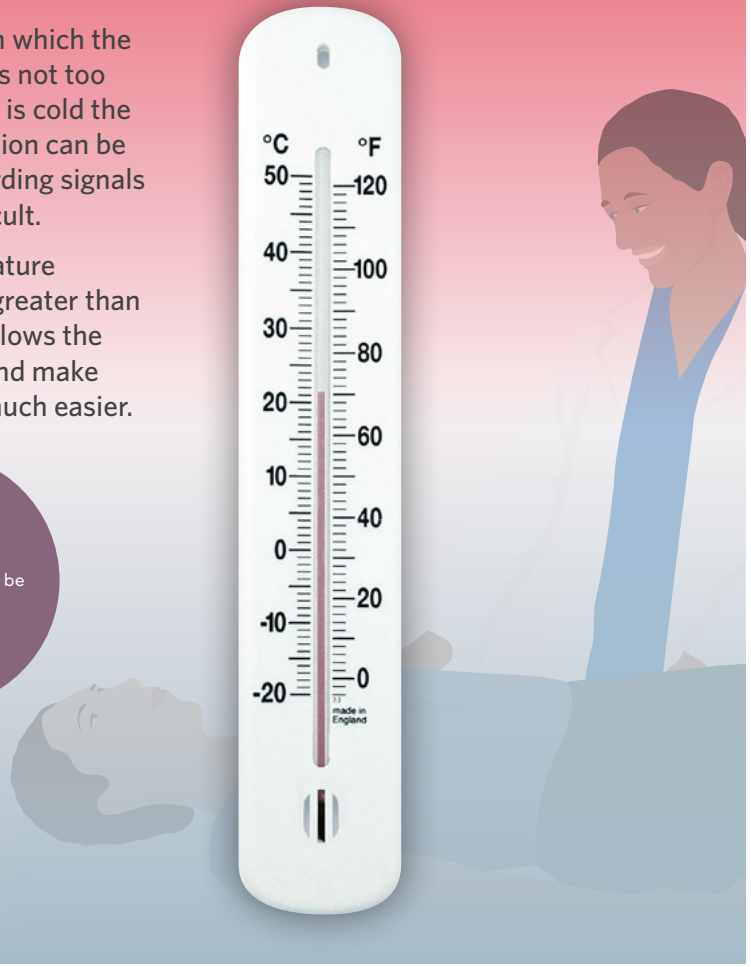
Temperature

Ideally the room in which the examination is in is not too cold. If the patient is cold the peripheral circulation can be affected and recording signals may become difficult.

The room temperature should be ideally greater than 24 degrees, this allows the vessels to dilate and make signal recording much easier.

A comfortable temperature would be

>24°C / >75.2°



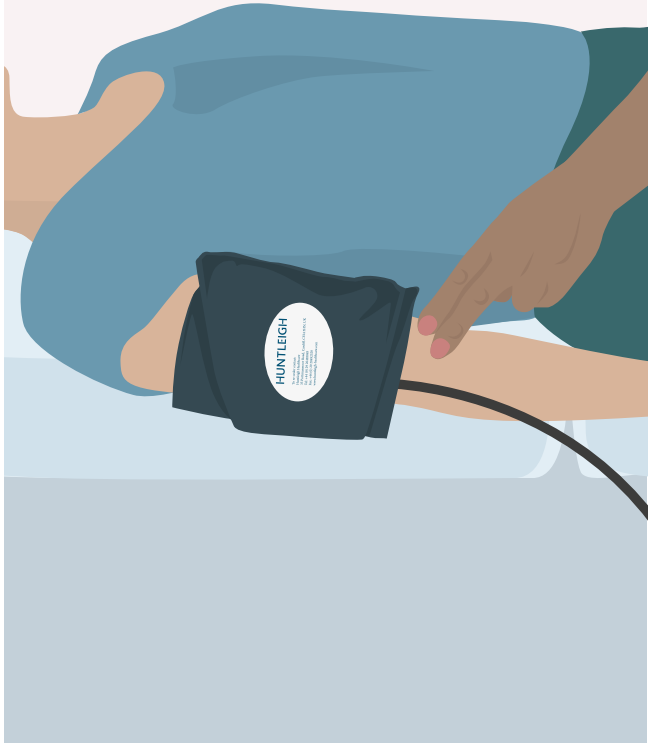
Recording the Brachial Systolic Pressure

Step 1 - Apply the Cuff

Apply the cuff to the upper arm, just above the elbow.

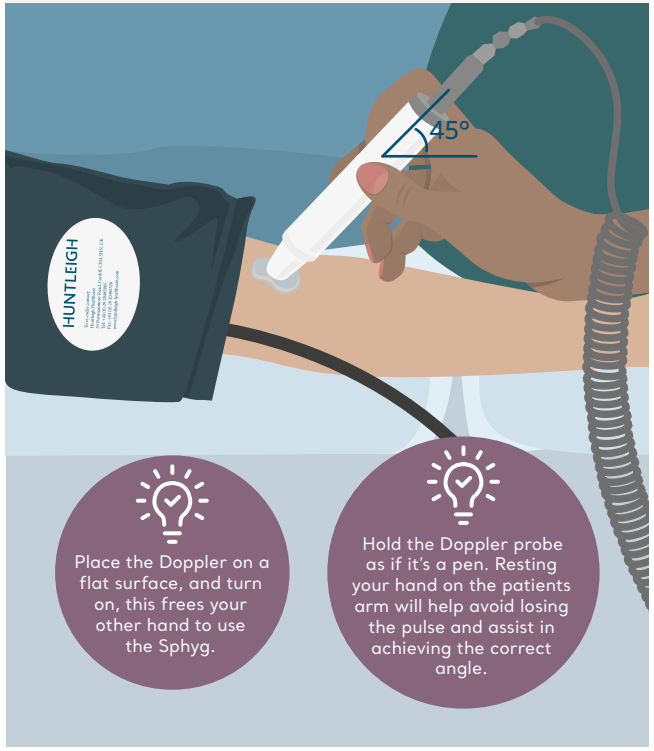
Step 2 - Locate the Pulse

The brachial pulse can normally be found with manual palpation.



Step 3 - Apply Gel and Probe

Apply a suitable amount of gel to the skin over the brachial artery. Apply the Doppler probe to the surface of the skin with the probe at a 45° angle to the artery, with the tip of the probe pointing towards the heart. Adjust the position of the probe to find the best signal.

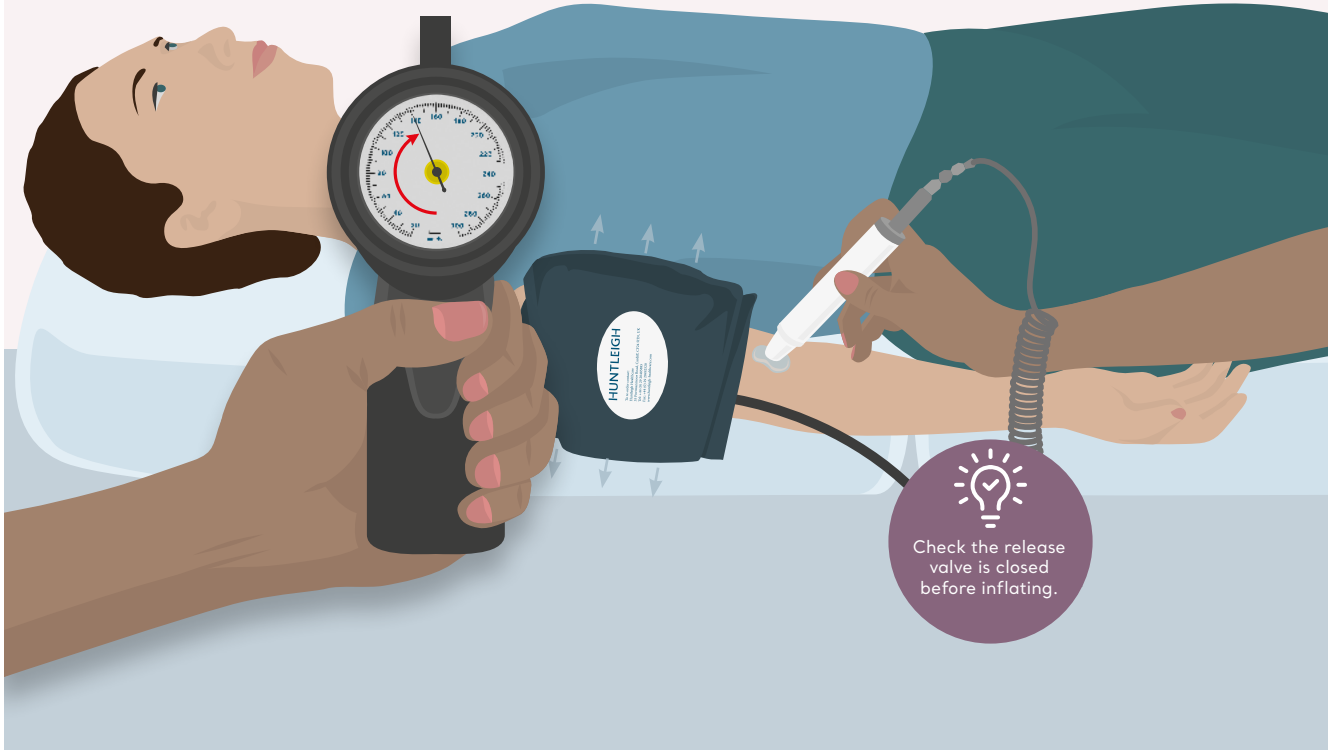


Watch this sequence as a video

Step 4 - Inflate the Cuff & Read the Pressure

Watching the pressure gauge, inflate the cuff until you stop detecting a pulse with the Doppler. Keep inflating to a pressure that is 20 mmHg higher than the pressure was at the time when you heard the last pulse.

Slowly release the pressure from the cuff whilst maintaining the probe position. Record the pressure when the pulse returns, this is the brachial systolic pressure.



Step 5 - Repeat

Repeat these steps to obtain and write down the brachial pressure of the other arm. The highest brachial pressure (from the left or right arm) is the denominator for the ABPI ratio equation.

Recording the Dorsalis Pedis Artery Pressures

Step 1 - Apply the Cuff

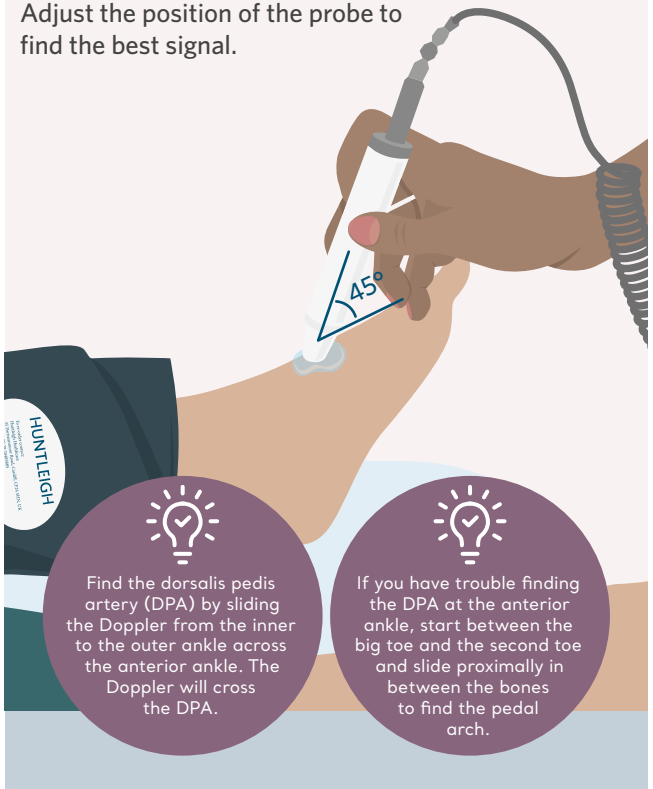
Apply the cuff to the ankle just above the malleolus.

Step 2 - Locate the Pulse

The Pedal pulses can sometimes be found with manual palpation

Step 3 - Apply Gel and Probe

Apply a suitable amount of gel to the skin over the Dorsalis Pedis. Apply the Doppler probe to the surface of the skin with the probe at a 45° angle to the artery, with the tip of the probe pointing towards the heart. Adjust the position of the probe to find the best signal.



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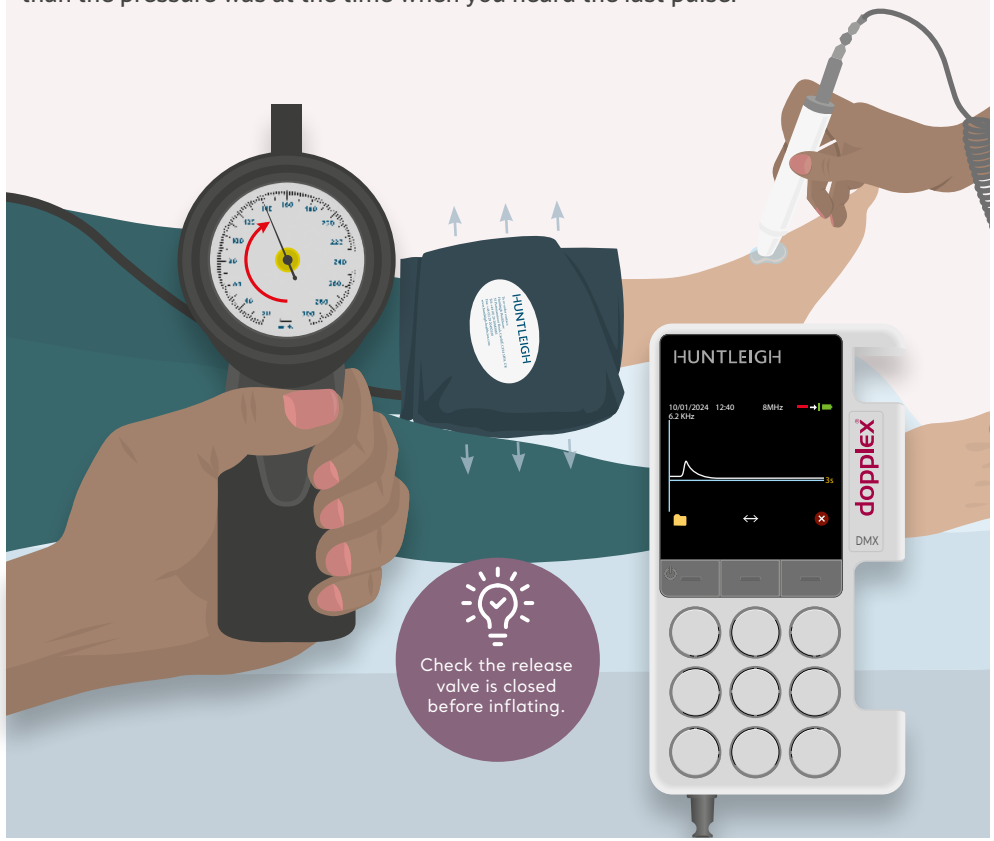
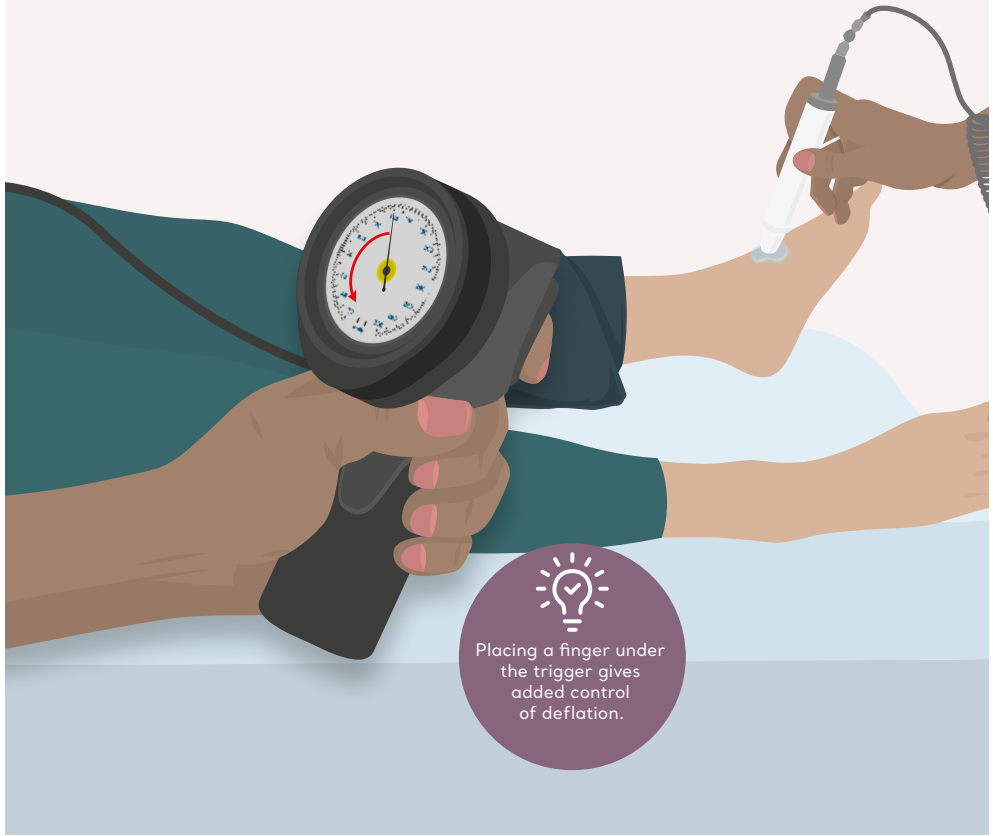
Step 4 - Inflate the Cuff

Inflate the cuff, watch the pressure gauge, and listen for the point at which you stop hearing a pulse from the Doppler. Keep inflating to a pressure that is 20 mmHg higher than the pressure was at the time when you heard the last pulse.



Step 5 - Read the Pressure

Slowly release the pressure from the cuff while maintaining the probe position and record the pressure. When the pulse returns, this is the Dorsalis Pedis systolic pressure.



Recording the Posterior Tibial Artery Pressure

Step 1 - Apply the Cuff

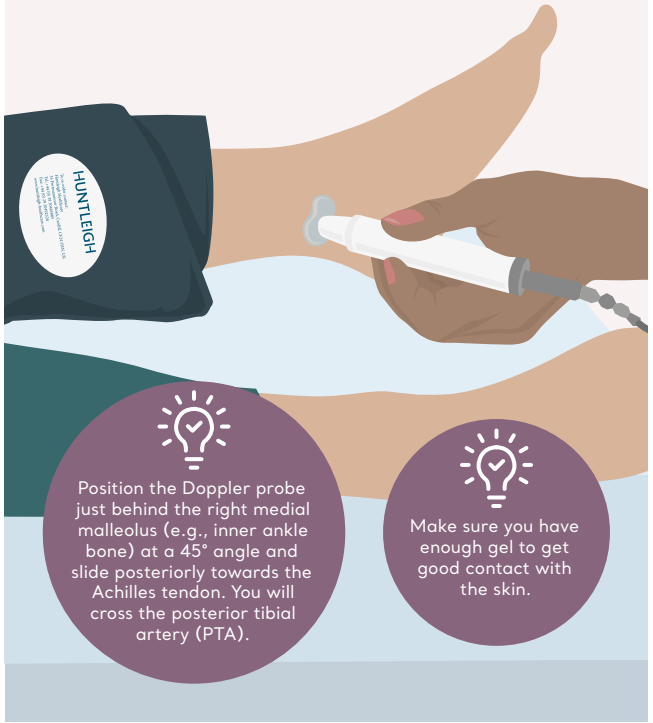
Apply the cuff to the ankle just above the malleolus.

Step 2 - Locate the Pulse

The pedal pulses can sometimes be found with manual palpation.

Step 3 - Apply Gel and Probe

Apply a suitable amount of gel to the skin over the Posterior Tibial Artery. Apply the Doppler probe to the surface of the skin with the probe at a 45° angle to the artery, with the tip of the probe pointing towards the heart. Adjust the position of the probe to find the best signal.



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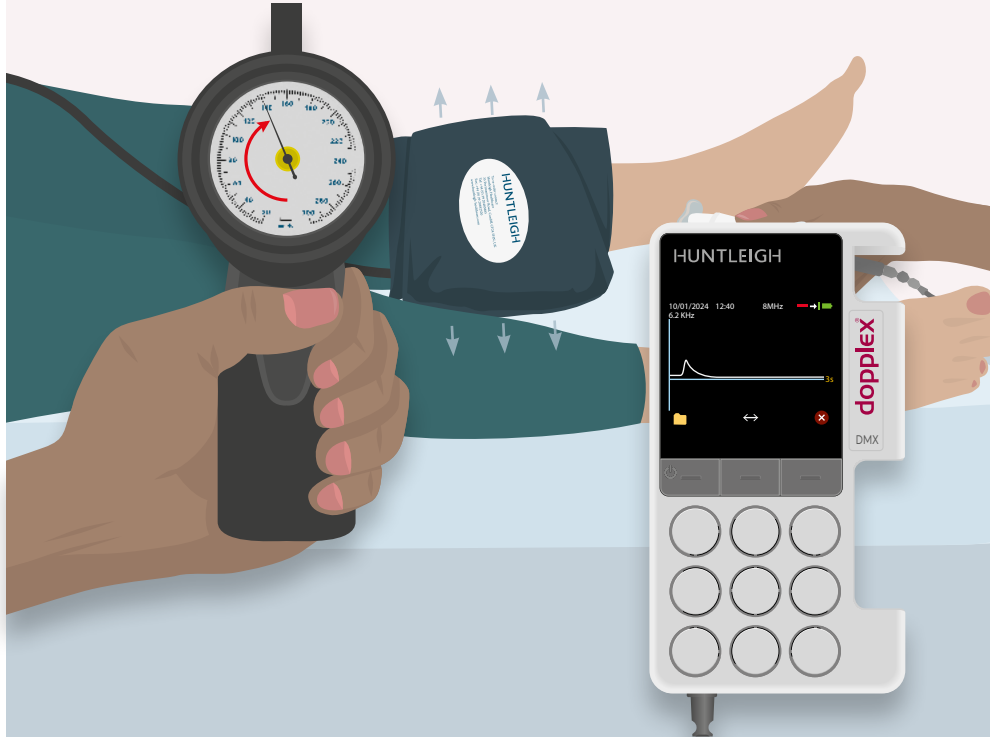
Step 4 - Inflate the Cuff

Inflate the cuff, watch the pressure gauge, and listen for the point at which you stop hearing a pulse from the Doppler. Keep inflating to a pressure that is 20 mmHg higher than the pressure was at the time when you heard the last pulse.



Step 5 - Read the Pressure

Slowly release the pressure from the cuff while maintaining the probe position and record the pressure. When the pulse returns, this is the Posterior Tibial systolic pressure.

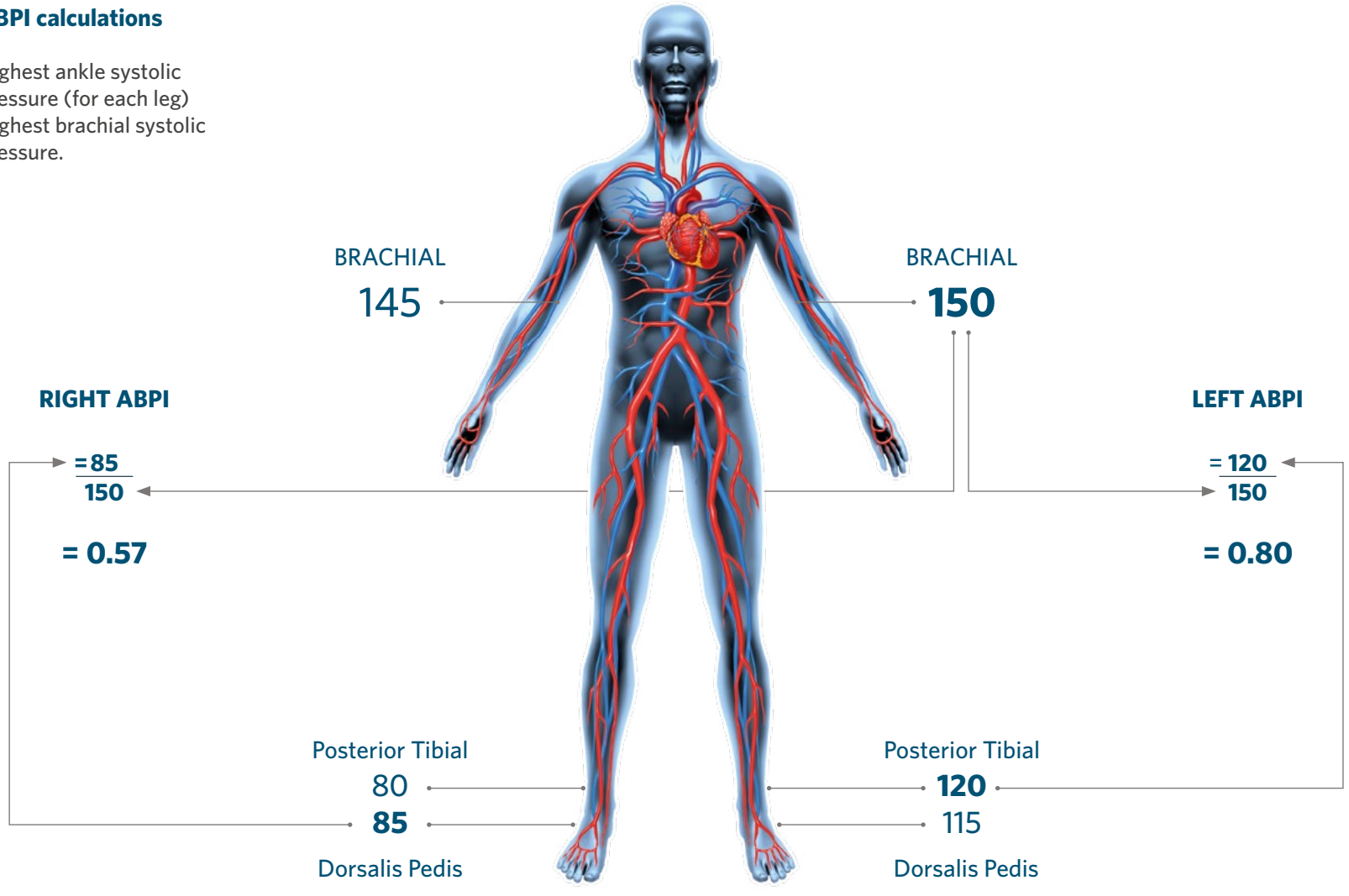
Calculating the Ankle Brachial Pressure Index

The ABPI should be calculated per limb, by dividing the highest systolic pressure at the ankle by the higher of the two brachial systolic pressures, giving an ABPI per lower limb.

Normal ABPI ratio is equal to or greater than 1.00 but not greater than 1.3 (check local policy)

ABPI calculations

Highest ankle systolic pressure (for each leg)
Highest brachial systolic pressure.



Measuring Toe Pressures/ Toe Brachial Pressure Index TBPI

The TBPI measurements in the right/left toes are often taken if the ABPI measurements are high or if the ankle's arteries are determined as incompressible when measuring the ABPI. While the Ankle Brachial Index measurement can become unreliable when arterial stiffness increases, the Toe Brachial Index is less susceptible to vascular stiffness.

ATP Ankle & Toe Pressure Kit

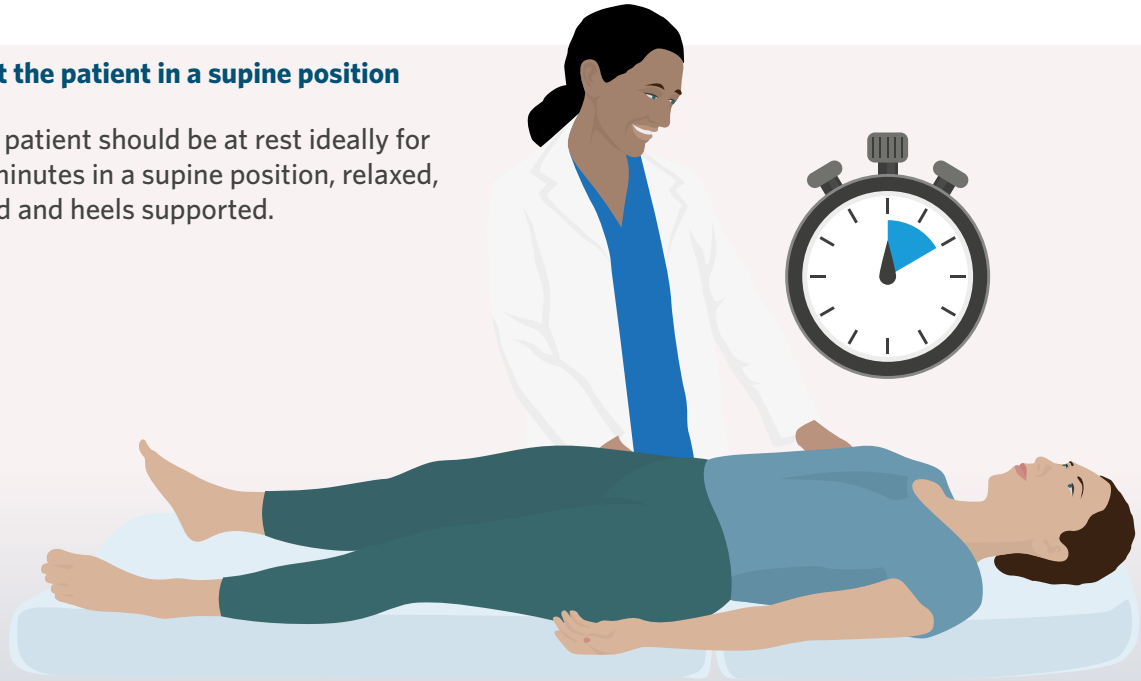
Toe Pressures: (TBPI)
This kit contains all the elements needed to undertake an ABPI and TBPI including:

- DMX Digital Doppler & charger
- 8MHz Widebeam Doppler Probe
- APPG Probe and Adaptor
- Toe Cuffs and Inflator
- Arm/Ankle cuffs
- Trigger Operated Sphyg
- Neuropen

Prepare the Patient

Rest the patient in a supine position

The patient should be at rest ideally for 10 minutes in a supine position, relaxed, head and heels supported.



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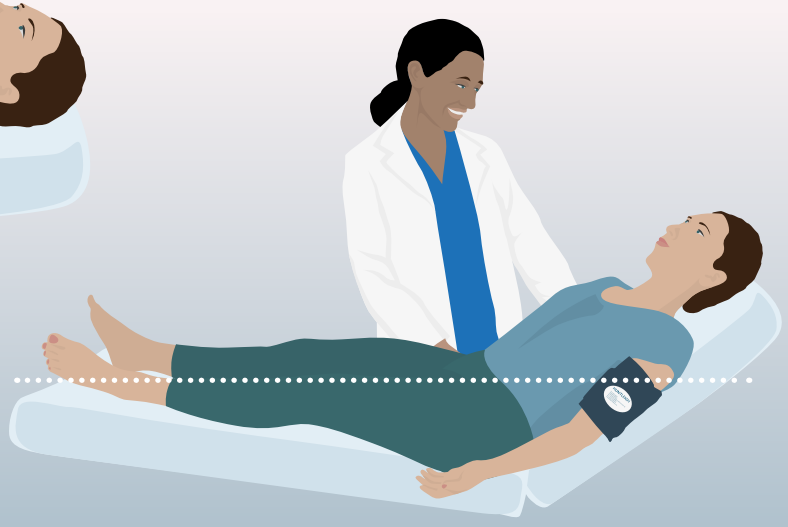

Explain the procedure to the patient

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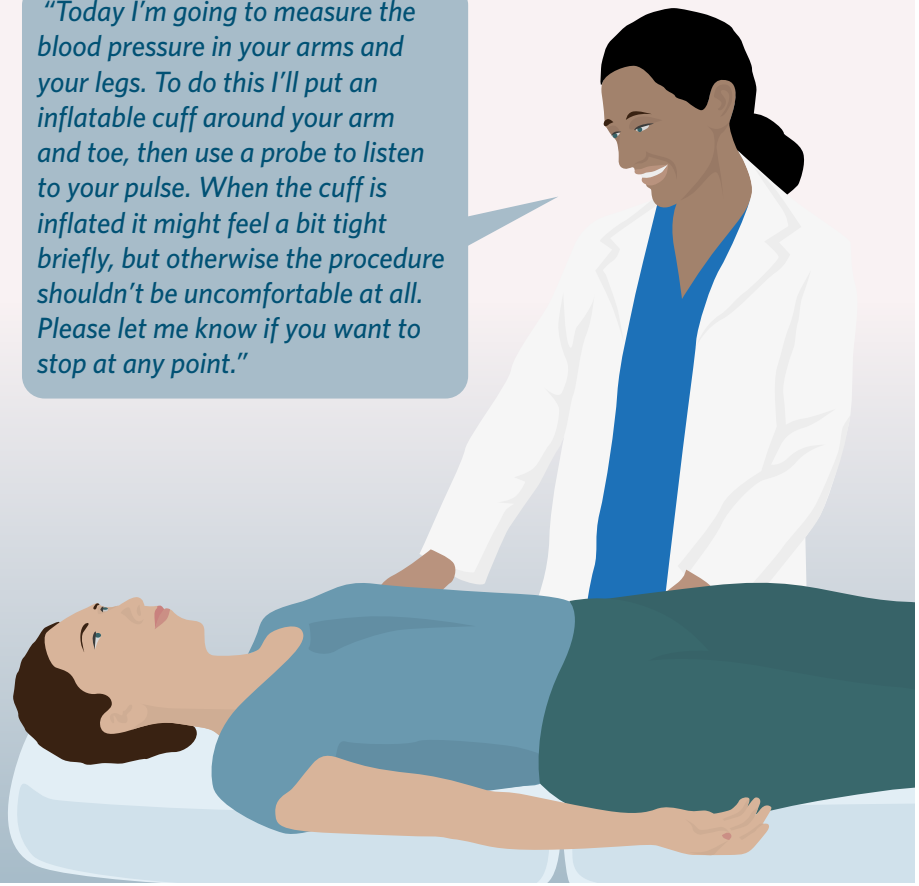

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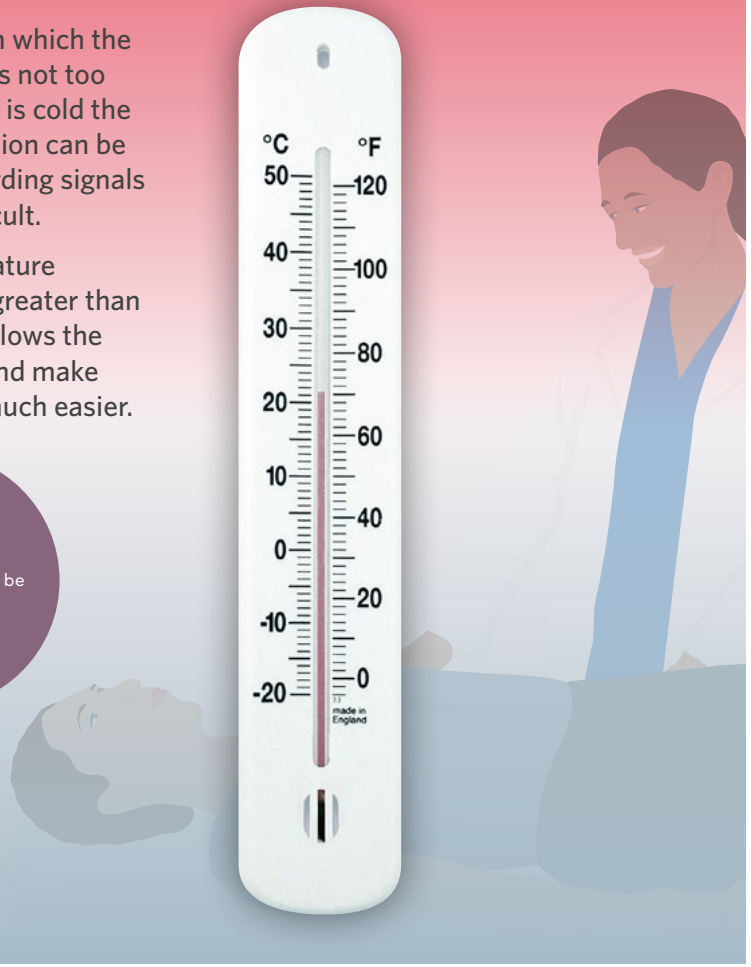


Recording the Brachial Systolic Pressure

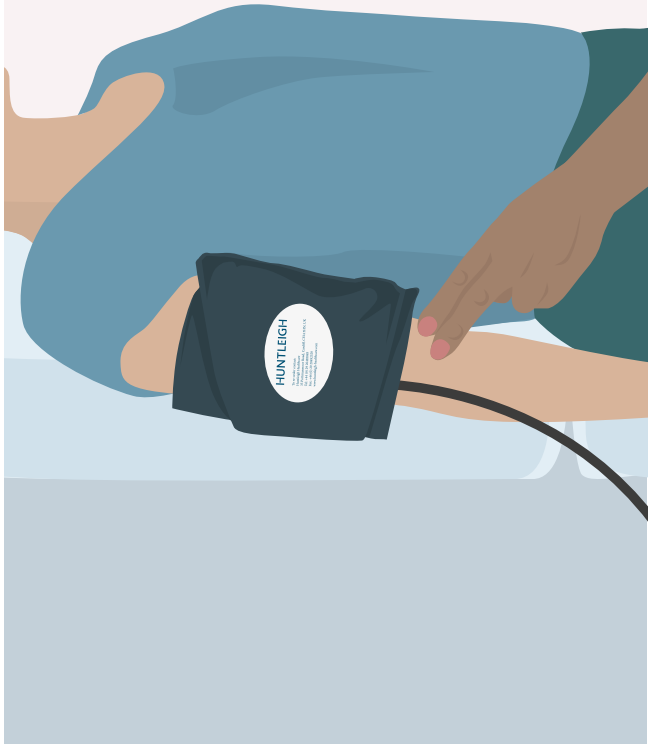
If you have just completed an ABPI, reuse the brachial systolic pressure and go straight to Toe Pressures.

Step 1 - Apply the Cuff

Apply the cuff to the upper arm, just above the elbow.

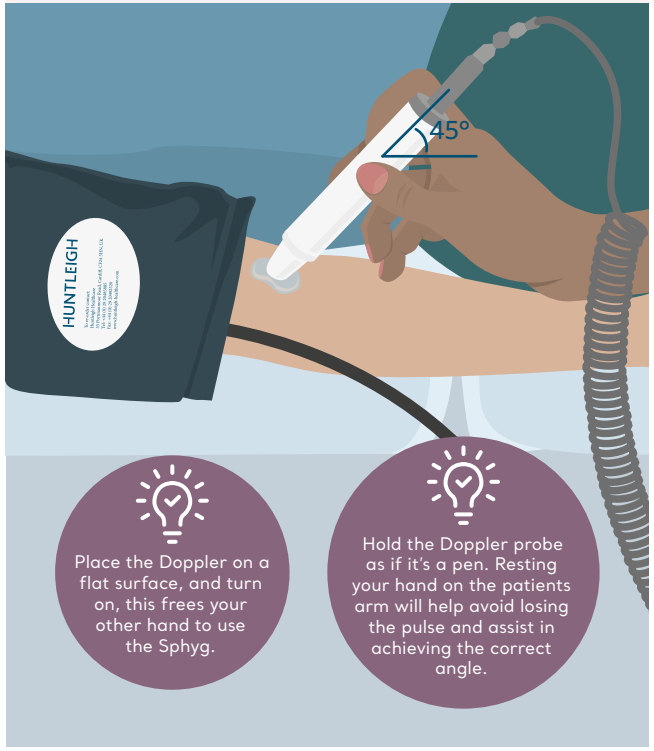
Step 2 - Locate the Pulse

The brachial pulse can normally be found with manual palpation.



Step 3 - Apply Gel and Probe

Apply a suitable amount of gel to the skin over the brachial artery. Apply the Doppler probe to the surface of the skin with the probe at a 45° angle to the artery, with the tip of the probe pointing towards the heart. Adjust the position of the probe to find the best signal.

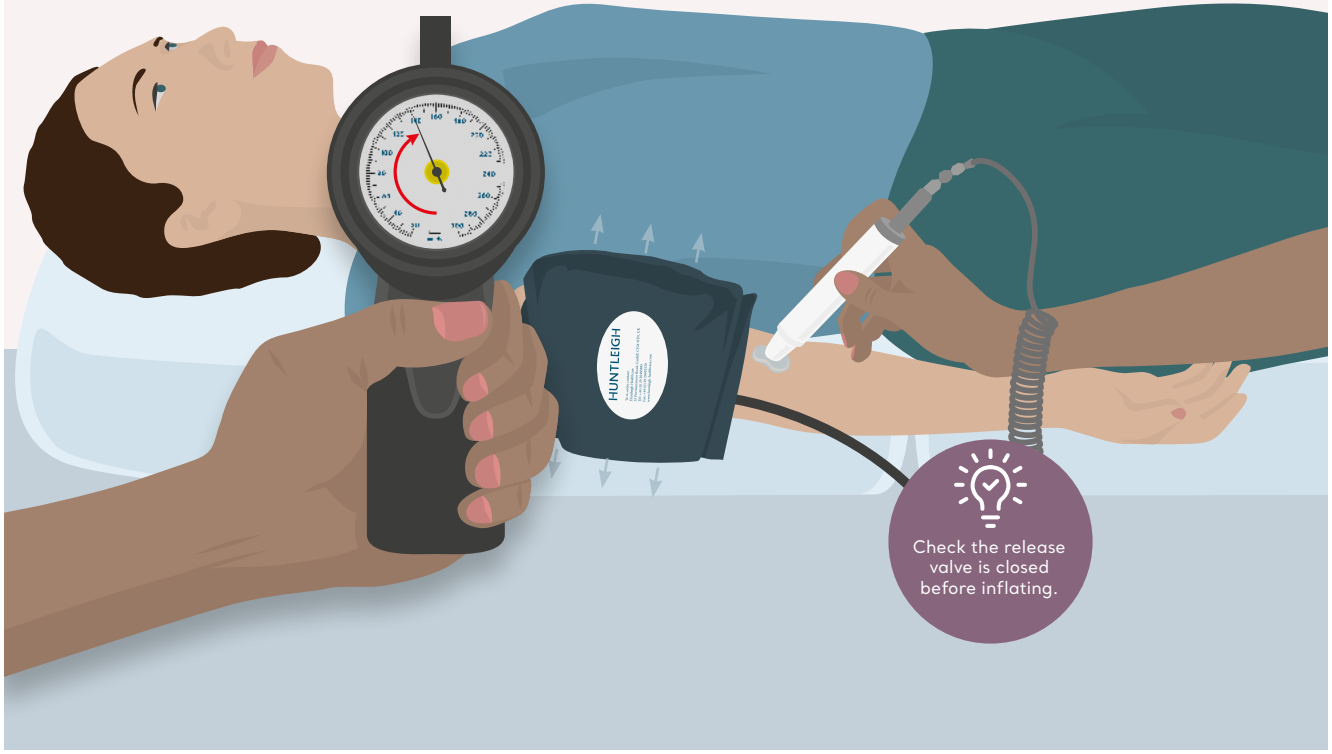


Watch this sequence as a video

Step 4 - Inflate the Cuff & Read the Pressure

Watching the pressure gauge, inflate the cuff until you stop detecting a pulse with the Doppler. Keep inflating to a pressure that is 20 mmHg higher than the pressure was at the time when you heard the last pulse.

Slowly release the pressure from the cuff whilst maintaining the probe position. Record the pressure when the pulse returns, this is the brachial systolic pressure.



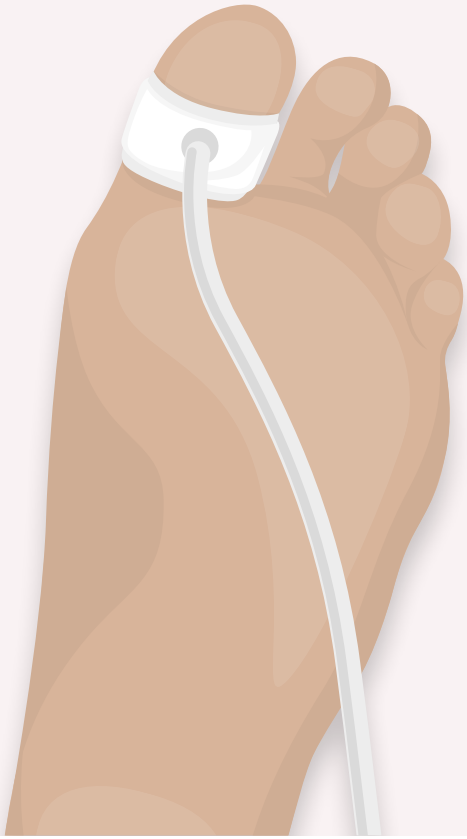
Step 5 - Repeat

Repeat these steps to obtain and write down the brachial pressure of the other arm. The highest brachial pressure (from the left or right arm) is the denominator for the ABPI ratio equation.

Measuring Toe Pressures/Toe Brachial Pressure Index TBPI

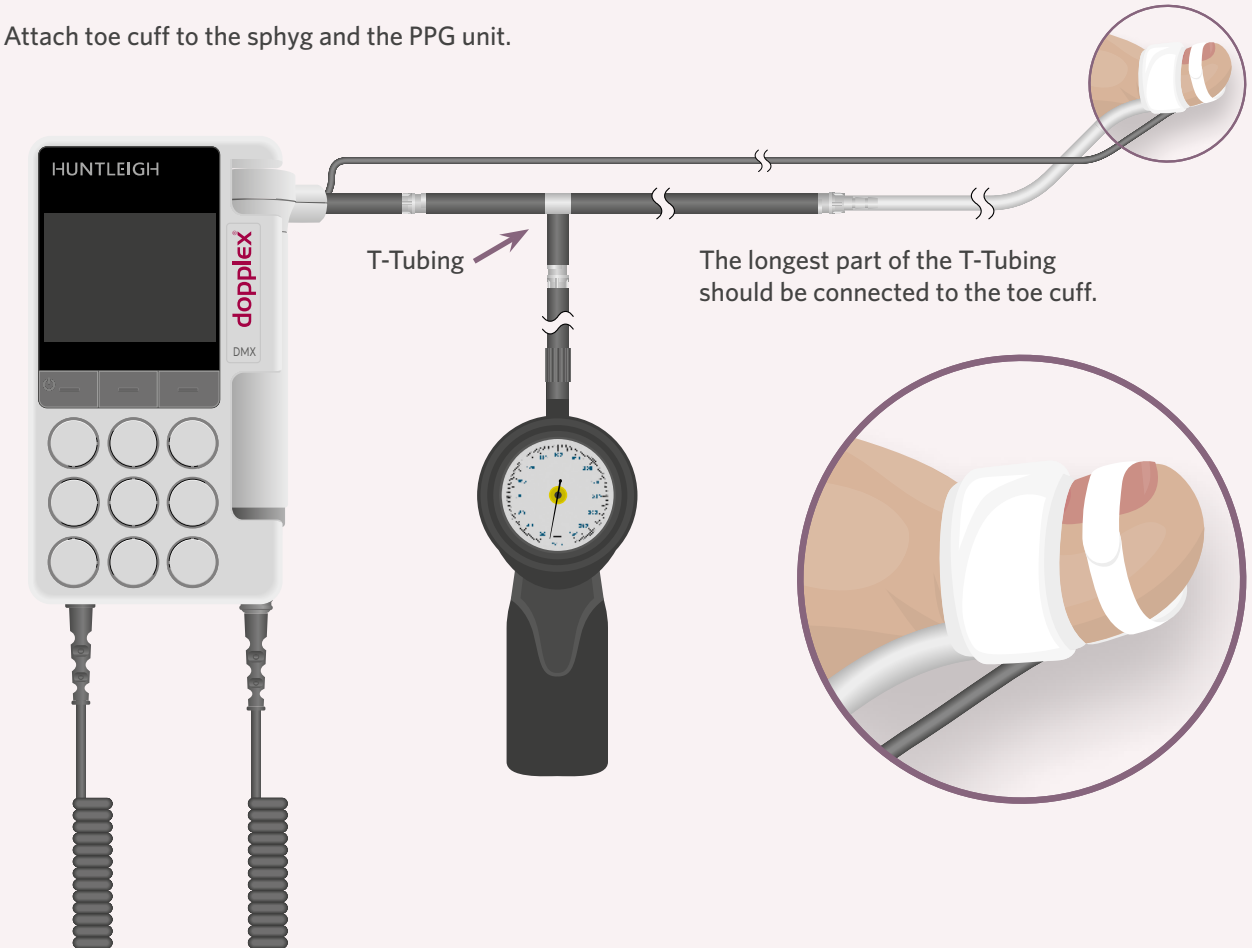
Step 1 - Apply the Cuff

Place appropriately sized toe cuff around the toe.



Step 2 - Connect the Kit

Attach toe cuff to the sphyg and the PPG unit.



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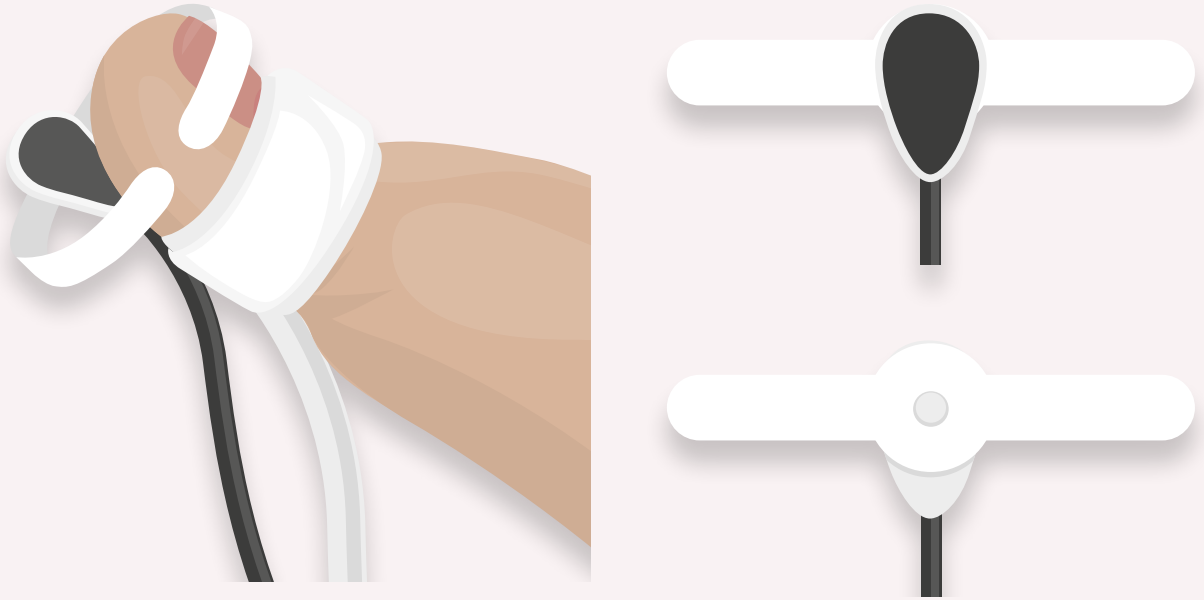
Step 3 - Apply Toe Sensor

Attach PPG sensor to apex of toe with surgical tape or similar, turn on the unit and check that a pulse waveform has been located on the screen.



Place the sensor on the centre of the back of the toe. Make sure that the entire sensor is flat against the skin and it is secure. Since the sensor is sensitive and can pick up the smallest movement, the readings will be inaccurate if not correctly placed.

Measuring Toe Pressures/Toe Brachial Pressure Index TBPI

Step 4 - Switch on the Doppler

Press and hold the left, grey button for 1 second to turn on the Doppler.

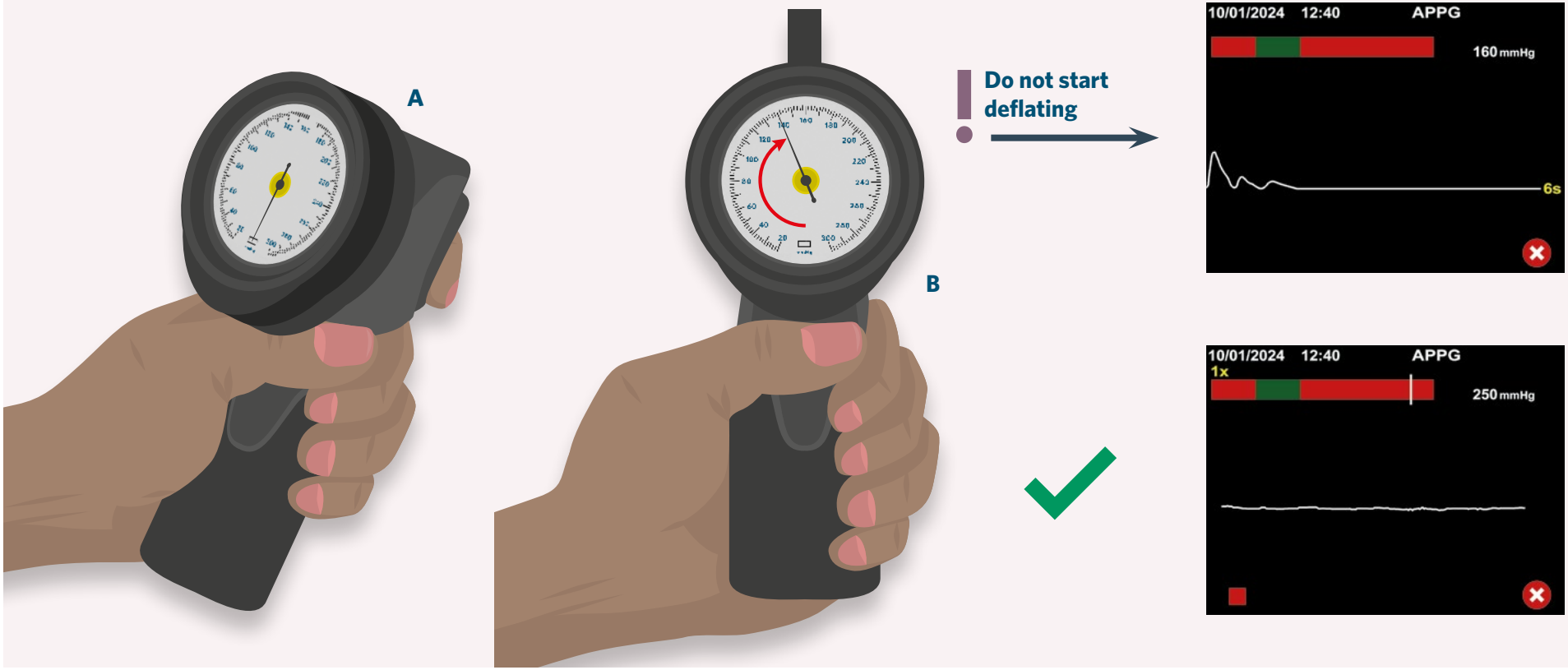
Step 5 - Locate the Pulse

Before inflating, make sure that a consistent waveform is being displayed on the screen (allow at least 6 seconds).

Note that waveforms may look different than the image below and may differ from patient to patient.

Step 6 - Inflate the Toe Cuff

Press the top of the trigger of the sphyg until it clicks (A), then squeeze the bulb (B) to inflate the cuff until the waveform is flat on the entire screen (at least 10s)



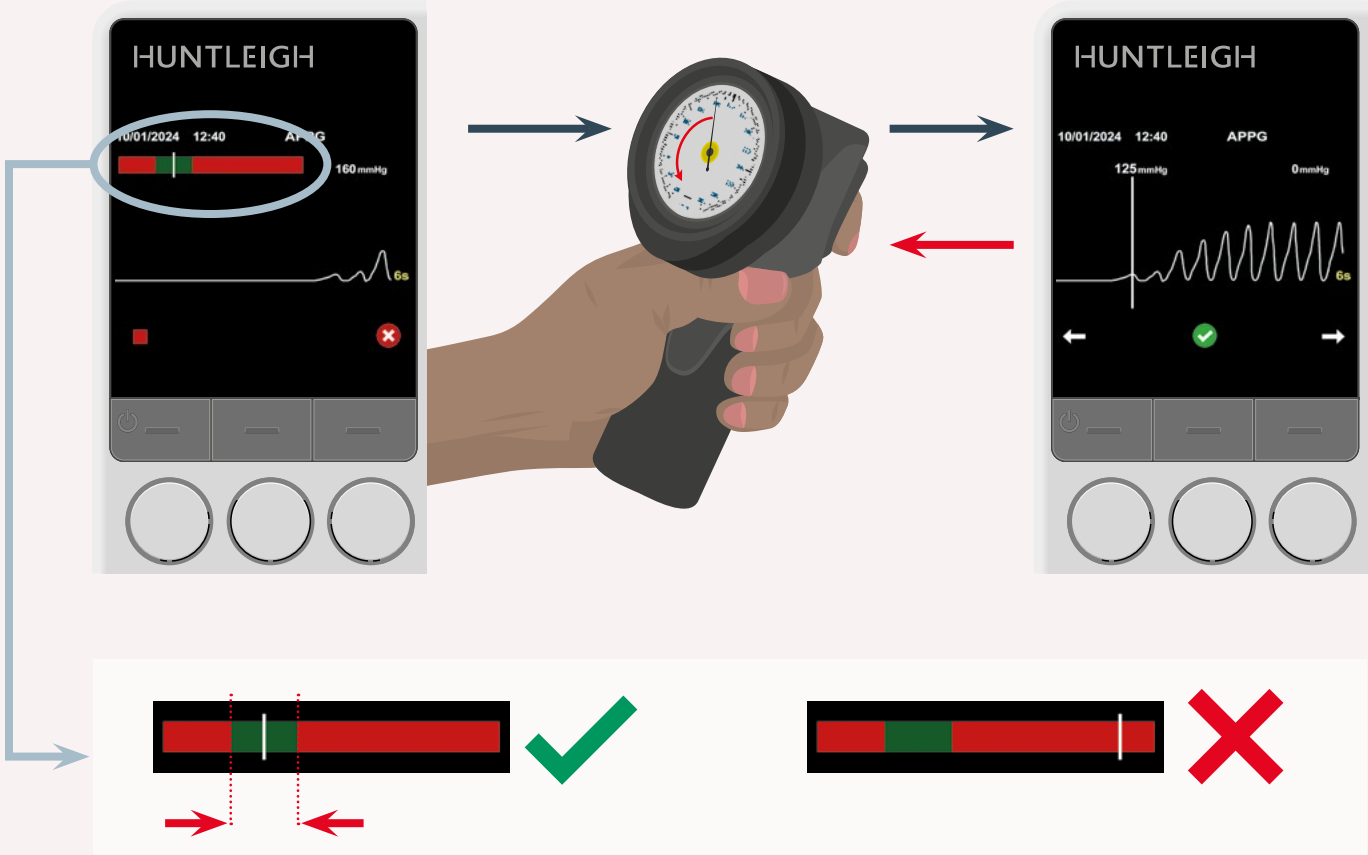
Measuring Toe Pressures/Toe Brachial Pressure Index TBPI

Step 7 - Deflate the Cuff

Once the waveform is flat for an entire screen, (at least 10s), begin slowly deflating the cuff by placing a finger gently on the trigger release of the sphyg.

Place enough pressure on the trigger so that the white line remains in the green area during the entire time of deflation. This helps to deflate at a consistent rate of 3 mmHg. If the cuff is not deflated at a slow, consistent rate (about 3 mmhg), the white line will fluctuate from left to right in the red area and provide inaccurate readings. Once the sensor detects the pulse, the screen will automatically stop and display a waveform and the pressure reading. Remember to deflate the cuff completely after the toe pressure is obtained.

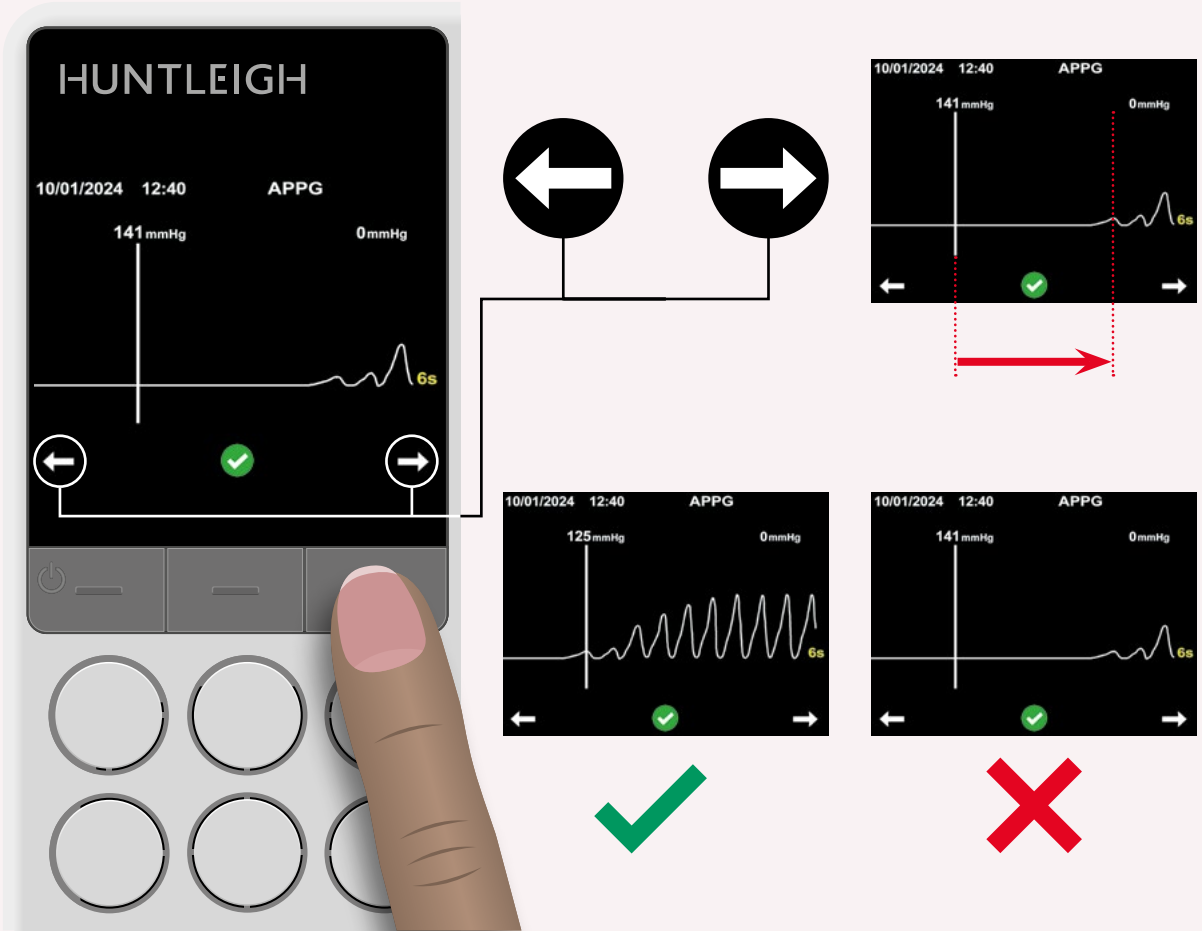
Placing a finger under the trigger gives added control of deflation.



Step 8 - Read the Pressure

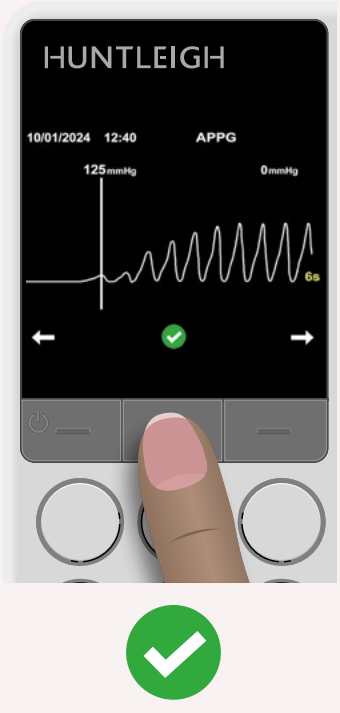
The pressure reading can be moved from left to right.

Make sure that the vertical line of the pressure reading is on the part of the waveform indicating a pulse. Using clinical judgment, the vertical line can be moved further right for a more accurate reading.



Step 9 - Confirm Reading

Press the middle grey button under green check mark to confirm reading of the waveform.

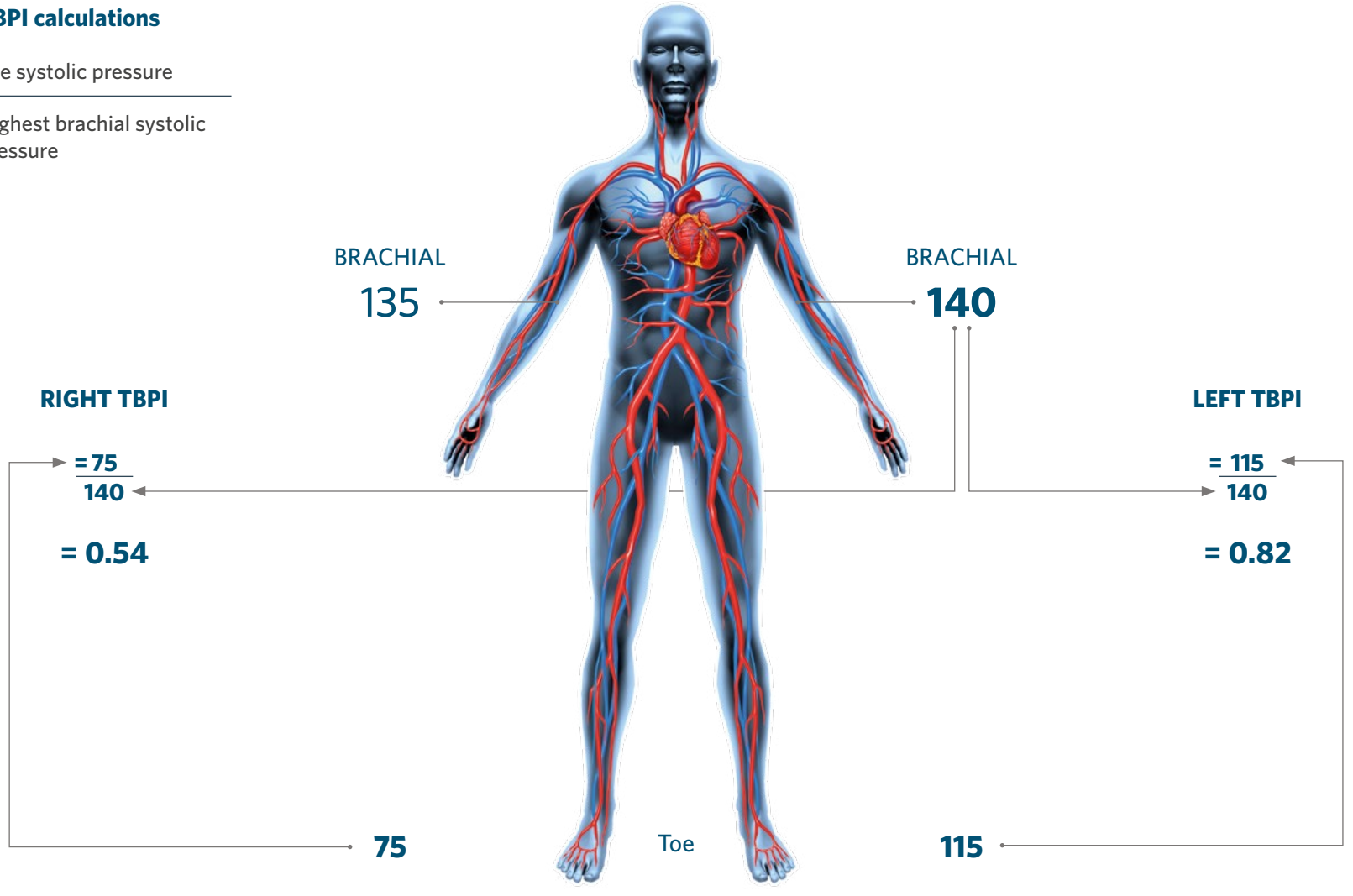


Calculating the Toe Brachial Pressure Index

The TBPI should be calculated per limb, by dividing the toe systolic pressure on each foot by the higher of the two brachial systolic pressures.

TBPI calculations

$$\frac{\text{Toe systolic pressure}}{\text{Highest brachial systolic pressure}}$$



FAQ's

How many pedal pulses do you measure?

A minimum of two arteries on each foot e.g.

Dorsalis Pedis or Anterior Tibial and Posterior Tibial or Peroneal (NB. Always include peroneal for persons with diabetes / suspected diabetes)

When should toe pressures be measured?

- When ABPI > 1.3
- When arterial calcification is suspected or known to be present e.g. persons with diabetes
- When Doppler waveforms and ABPI do not concur

Which probes should you use to take ABI measurements?

We recommend an EZ8XS probe for general use and a VP5XS for obese patients and oedematous limbs

Why measure pressure in both arms and take the highest reading

This ensures that the systolic pressure is closest to the systemic pressure, especially if arterial disease is present

Why do you use the higher of the two measurements in the foot?

This will determine whether there is adequate blood flow to the foot from one of the arteries

In which direction should the Doppler probe be held when detecting reflux?

Towards the heart. This ensures that the waveforms are recorded correctly

Which ABPI values allow you to apply compression therapy?

Values between 0.8 & 1.3 providing the holistic patient assessment has also ruled out arterial insufficiency

I can't get a stable flat line when I'm inflating the toe cuff, what am I doing wrong?

If the Doppler sometimes shows a signal once you've inflated the cuff, this may not be due to anything happening in the vessel. One reason could be any movement of the patient. Another factor may be electrical interference causing artefacts on the Doppler. Try and remove any devices that may be causing interference, including mobile phones, from the area to ensure a stable flat line before deflating.

Notes

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