How to Perform a TBI Toe Brachial Index

A Toe Brachial Index or TBI is performed when the ABI or Ankle Brachial Index is abnormally high due to plaque and calcification of the arteries in the leg; this is caused by atherosclerosis and is most often found in diabetic patients. The abnormally high ABI is >1.3.

Equipment Needed:
The TBI Package which includes the MD6RP Photo plethysmograph and photo transducer and digit cuffs (two UPC 2.5) as well as the Portable ABI Kit which provides the MD6VR Chart Recorder, S300 Aneroid Sphygmomanometer, and two SC12 and 2 SC10 Straight Segmental Cuffs.

Preparation of the Patient:
The patient should be in a warm comfortable room, supine with arms and legs at heart level. Keep feet warm with a blanket or towel if needed.

The Procedure:
Select the appropriate sized cuff for each limb. You will need one cuff for each upper arm and for each large toe. Measure the cuff width to the diameter of the limb; the cuff width should be 20% larger than the limb diameter to compress all of the soft tissue evenly. The cuff should be put on straight and fit snugly but not tight. You must use vascular cuffs which have long bladders to completely encircle the limb and compress all of the soft tissue. The toe cuff should be wide enough to apply pressure over a large enough area so as to not be a tourniquet and long enough to overlap the bladder.

Put the cuffs on the arms and toes once the patient is supine. Have the sphygmomanometer, patient chart, etc. in the room ready to use. A patient can relax best if undisturbed.

The rest period should be at least 10 minutes with 15-20 ideal. The goal is for the patient to relax. This time can be used for interviewing the patient, listening to the heart, palpating the abdomen, checking the neurological reflexes and sensation in the feet.

After the rest period, take the first brachial pressure. Find the brachial pulse with your fingers, and then put some ultra phonic gel on that place. Obtain a good Doppler signal (sound) and waveform, print out to establish a base line. Inflate the cuff until the sound and waveform disappear and then inflate from 20-30 mmHg above that number (super systolic). Slowly deflate the cuff (around 2-3 mmHg at a time) until the sound reappears (Korotkoff sound) the waveform will follow immediately after the sound. The pressure reading when the first sound appears is the correct systolic pressure. Deflate the cuff completely and record the systolic pressure.
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After you have taken the first brachial systolic pressure you can either do the other brachial pressure or the first toe pressure.

Check to see if the cuff is well placed. Put the ppg or photo plethysmograph on the pad of the large toe and not touching the cuffs. Make sure the Velcro will hold the ppg in place but not compress the blood vessels by being too tight. You should see the patient’s pulse as a waveform on the chart recorder. Connect the sphygmomanometer to the toe pressure cuff and inflate slowly until you see the waveform disappear. Note the pressure and continue to inflate until 20-30 mmHg above that pressure (super systolic). Now slowly release the pressure in the cuff at about 2 mmHg per declination until the waveform reappears. This is the systolic pressure. Make a note of it. Deflate the cuff completely. Repeat the toe and brachial pressures on the other side.

How to calculate the TBI

Divide the highest toe pressure by the highest brachial pressure the result is the TBI. 0.65 - 0.7 and above is normal for TBI

\[ \text{TBI} = \frac{\text{Toe Systolic Pressure}}{\text{Brachial Systolic Pressure}} \]

Interpretation

0.64 +/- .20 limbs normal
0.52 +/- .20 claudication in limbs
0.23 +/- .19 limbs with ulcers or ischemic rest pain

A toe systolic pressure greater than 30 mmHg may be an indicator that there is healing potential in a foot with ulcers.

A normal TBI differs from a normal ABI because the normal blood pressure in the big toe (hallux) is expected to be less than at the ankle or the arm. The normal range for a TBI is considered to be an index > 0.65. It the TBI is below 0.65 there is reduced blood flow to the small vessels in the big toe.