

Radial or Brachial: The tonometry debate continues

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The Reference Values for Arterial Measurements Collaboration, in 2014, has reported different methods used to estimate central pressure in > 80,000 individuals at centres around the world. Around 70,000 subjects had their radial tonometry taken, and the rest had their carotid tonometry or diameter measured.

All methods to estimate central aortic pressure require accurate and reproducible acquisition of peripheral waveform. Currently, the most common method of non-invasive derivation of aortic pressure is using generalised transfer function to correct for distortion of the pressure wave in travel from aortic to radial. Radial pulse has been recorded for centuries. The principles of accurate tonometry can be fulfilled satisfactorily; superficial site with easy access supported against the radius bone behind, thus the anterior wall of radial artery can be flattened by a tonometer and the pressure waves registered accurately. Radial pressure wave is calibrated against systolic and diastolic pressure measured by brachial cuff sphygmomanometry, as required by US FDA approval, based on the findings from invasive studies which confirmed little or no pressure amplification between aorta and brachial or radial.

However, there are conflicting reports of apparent pressure amplification between the brachial, where the cuff pressure are taken, and the radial, where the tonometry is normally performed. This "Popeye phenomenon" of supposedly high amplification of the pulse between brachial and radial sites non-invasively has not been seen with invasive studies. Tonometry is difficult to apply at brachial site and provides "blunted" waveforms compared to radial waves. The physical principle of applanation tonometry cannot be satisfied in this site. Brachial artery is deep, covered by brachial tendon aponeurosis and is not supported by bone behind. Artefactually blunted brachial waveform leads to all pressure amplification in the upper limb appearing to be in the forearm. The method of central pressure derivation from brachial tonometry used by some institutions have reported no value in measuring central pressure clinically, contradictory to other main studies from various laboratories which reported significant relationship between central pressure to cardiovascular events.