Novel flow quantification of the carotid bulb and the common carotid artery with vector flow ultrasound. - DTU Orbit (07/01/2019)

Novel flow quantification of the carotid bulb and the common carotid artery with vector flow ultrasound.

Abnormal blood flow is usually assessed using spectral Doppler estimation of the peak systolic velocity. The technique, however, only estimates the axial velocity component, and therefore the complexity of blood flow remains hidden in conventional ultrasound examinations. With the vector ultrasound technique transverse oscillation the blood velocities of both the axial and the transverse directions are obtained and the complexity of blood flow can be visualized. The aim of the study was to determine the technical performance and interpretation of vector concentration as a tool for estimation of flow complexity. A secondary aim was to establish accuracy parameters to detect flow changes/patterns in the common carotid artery (CCA) and the carotid bulb (CB). The right carotid bifurcation including the CCA and CB of eight healthy volunteers were scanned in a longitudinal plane with vector flow ultrasound (US) using a commercial vector flow ultrasound scanner (ProFocus, BK Medical, Denmark) with a linear 5 MHz transducer transverse oscillation vector flow software. CCA and CB areas were marked in one cardiac cycle from each volunteer. The complex flow was assessed by medical expert evaluation and by vector concentration calculation. A vortex with complex flow was found in all carotid bulbs, whereas the CCA had mainly laminar flow. The medical experts evaluated the flow to be mainly laminar in the CCA (0.82 +/- 0.14) and mainly complex (0.23 +/- 0.22) in the CB. Likewise, the estimated vector concentrations in CCA (0.96 +/- 0.16) indicated mainly laminar flow and in CB (0.83 +/- 0.07) indicated mainly turbulence. Both methods were thus able to clearly distinguish the flow patterns of CCA and CB in systole. Vector concentration from angle-independent vector velocity estimates is a quantitative index, which is simple to calculate and can differentiate between laminar and complex flow. (C) 2014 World Federation for Ultrasound in Medicine & Biology.

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