

Feasibility and precision of transcutaneous very-high resolution ultrasound for the quantification of arterial structures in neonates

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Background: Non-invasive transcutaneous very-high resolution vascular ultrasound (VHRU, 25-55 MHz) has recently been developed to quantify vascular structures in adults and children. The performance of the method has yet not been evaluated in neonates. The aim of the study was to assess the feasibility and precision of VHRU in the analysis of superficial arteries in neonates.

Methods: 120 images from central elastic (common carotid, CCA) and peripheral muscular (brachial, BA; femoral, FA) arteries were obtained in 20 neonates of different ages (range 33+0 to 41+5 gestational weeks) and weights (range 1825 to 4950g). Manual electronical calipers were used to measure lumen dimension (LD) and intima-media thickness (IMT) for all arteries, and intima-media-adventitia thickness (IMAT) for muscular arteries. The intra- and inter-tester variabilities were assessed.

Results: Adequate images were obtained from all CAAs with 35 and all FAs/BAs using 35 and 55 MHz frequencies. IMTs of the smallest BAs and FAs were beyond the axial resolution (<0,05 mm) and, thus, unmeasurable. The intra- and inter-coefficients of variation (CV) were inversely related to the size of the measured dimensions for LDs (range 1.44-2.62 mm, CVs between 1.6 - 3,2%), IMATs (range 0.141-0.161 mm, CVs between 8.8-19.9%), and IMTs (range 0.062-0.165 mm, CVs between 12.8-24.8%) of the different arteries. No bias between readers was found.

Conclusion: VHRU is feasible and precise in the assessment of superficial arteries in the neonatal population. Neonatal arterial wall layers thicker than axial resolution may be quantified with VHRU.