Response to Pulsatile Flow Analysis of the Femoral Artery

We thank Mc Loughlin and Mc Loughlin for their interest in our recent article and their important suggestions for investigating the potential association between the Pulsatility Index (PI) of the femoral flow waveform and pressure pulse parameters. We reanalyzed our data obtaining the PI by dividing the forward-to-reverse peak velocity amplitude by the mean velocity. As a result, the mean femoral PI was 8.6±3.7 for the 138 subjects. The PI was significantly correlated with age (r=0.28; P=0.001) and femoral vascular resistance (r=0.72; P<0.001). However, it had no significant correlation with the aortic pulse wave velocity, aortic augmentation index, or aorta-to-femoral pulse pressure amplification (r<0.06; P>0.54 for all). Surprisingly, the femoral PI was related to the mean flow velocity (r=−0.71; P<0.001) rather than to the peak-to-peak velocity amplitude (r=−0.02; P=0.84). Only a poor correlation was observed between the PI and the reverse-/forward-flow index (r=0.26), indicating that the reverse-flow index behaves differently from the PI.

The femoral PI has long been validated for the diagnosis and management of peripheral artery disease, whereas its clinical implication is less evident in the absence of peripheral artery disease. The femoral PI was devised originally to quantify the damping of flow pulsation attributable to the upstream (ie, aorto–iliac) artery stenosis in peripheral artery disease patients. However, Evans et al pointed out that the femoral PI depends on both arterial inflow and peripheral (distal) resistance and that the dependence becomes much more dominant on peripheral resistance over arterial inflow as the upstream stenosis becomes milder. In fact, we confirmed this in our patients without peripheral artery disease, for whom the femoral PI was closely correlated with the peripheral resistance. Moreover, the PI was dependent mainly on the denominator (the mean flow velocity) rather than the numerator (the flow pulse amplitude). Our findings agree with a previous report in normal volunteers, showing that peripheral resistance is a stronger determinant of the femoral PI than arterial stiffness.

Blood flow has 2 components: steady and pulsatile. A previous investigation related the steady flow component to peripheral resistance and the pulsatile flow component to arterial compliance. The theoretical basis for our study to calculate the femoral reverse-/forward-flow index as the ratio corrected for the end-diastolic flow was to extract only the pulsatile component (including the reverse and forward peak flows) and eliminate any confounding effects of the steady component (ie, the end-diastolic flow) affected by peripheral resistance change. As demonstrated, the reverse-flow index was related to arterial stiffness and pulse pressure amplification, both of which are major determinants of the pulsatile flow component. In contrast to its designation of “pulsatility,” the femoral PI could relate mainly to the peripheral resistance determining the steady flow component, at least for non–peripheral artery disease patients. In conclusion, the femoral reverse-flow index is a unique parameter that differs from the conventional PI, and it can provide novel information on the important pulsatile pressure–flow relationship.

Disclosures

None.

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