A new invasive method to assess pulse wave velocity during cardiac catheterization

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Pulse wave velocity (PWV) is an independent cardiovascular risk factor (CVRF), and there are multiple ways to measure it with more or less accuracy.

We sought to easily develop an invasive gold standard axial PWV during cardiac catheterization between ascending aorta (AAo) and tibial artery (TIB) or humeral artery (HUM). Aorto-humeral PWV is not a usual measurement site because of its difficulty to estimate it non-invasively. Axial PWV demonstrates a greater correlation with CVRF, with carotid-femoral PWV the common way to estimate it non-invasively in hypertensive patients and others.

Methods

26 patients were enrolled for AAo-TIB PWV measurements and 50 for AAo-HUM. A cuff connected to the hemodynamic Phillips workstation of the cathlab was placed around the right leg, at mid-calf, and was inflated to superimpose TIB pulsatile blood pressure waves on AAo blood pressure recorded with a fluid filled diagnostic 5 Fr or interventional 6 Fr catheter left at the end of the diagnostic coronary angiography in the ascending aorta. The distance between AAo and TIB was estimated by the distance between axillary and iliac crest, added with the distance between iliac crest and mid-calf. PWV was then calculated from the length estimated between AAo and mid-calf, and the time delay between AAo and TIB pulses (see figure) by gating to the R-wave of the ECG (upper trace) for both measurements, using a dedicated software written in MatLab®. For AAo=HUM PWV, in 50 patients the pressure of the catheter was sequencially recorded in the AoAsc then pulled back in the humeral artery. Both recordings were matched off-line based on the R top of the ECG recorded and the delay between the rise of the 2 pressure curves in the same MatLab® software.

Results

Mean age of our patients is 62,7 ± 9,2 years. 82% had chronic hypertension and 33% had diabetes mellitus. 4 patients (15%) had clinical peripheral artery disease and only one had a stenting on femoral artery. No patients had previous vascular bypass.

Aorto-tibial PWV showed an average PWV at 8.4 ± 1.4 m/s. Aorto-humeral PWV showed an average PWV at 7.2 ± 1.8 m/s. The PWV tended to be 0,6 m/s lower in patients with ≤2 cardiovascular risk factors versus >3.

Conclusion

We describe a simple and accurate PWV gold standard that can be recorded in any patient admitted for a coronary angiography. Aorto-tibial PWV is easier to obtain. Adding this parameter in the global assessment of patients with hypertension or other CVD will refine their CVRF profile.