

Cardiovascular Markers for Routine Daily Practice Risk Assessment

Andreia Serrano^{1,2}, Filipa Cardoso^{1,2}, Paulo Bonifácio^{1,2} and Valentina Vassilenko^{1,2}

¹LIBPhys – Laboratory of Instrumentation, Biomedical Engineering and Radiation Physics, NOVA School of Science and Technology, Caparica, Portugal

² NMT, S. A., Madan Park Building, Caparica, Portugal

e-mail: a.serrano@campus.fct.unl.pt, feo.cardoso@campus.fct.unl.pt, p.bonifacio@nmt.pt

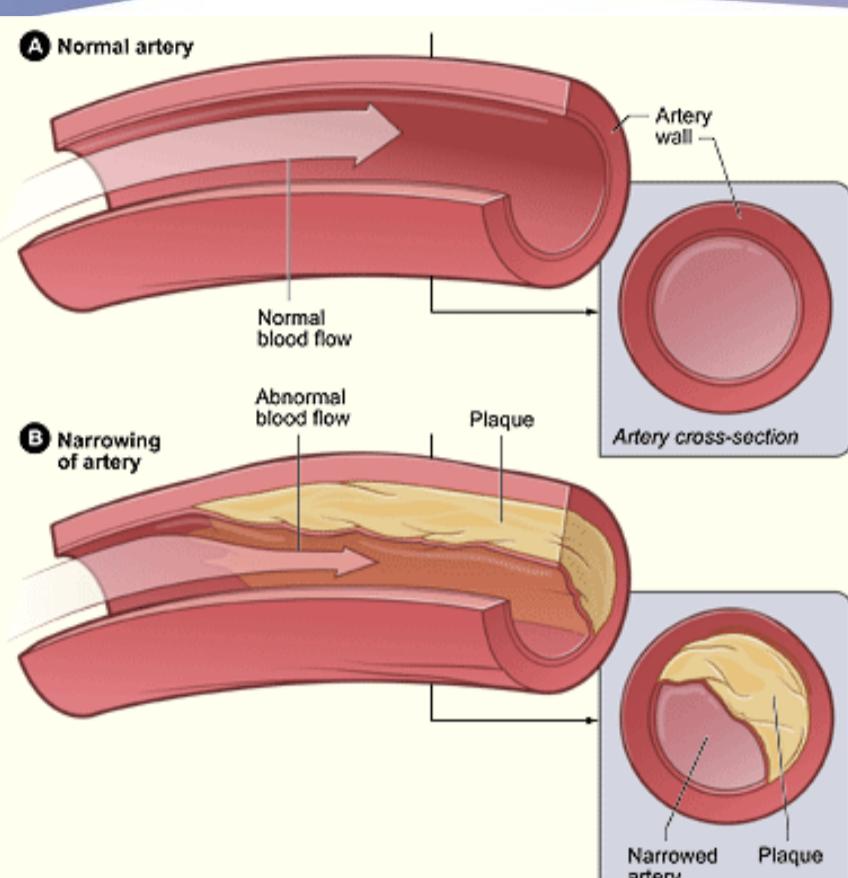


Fig. 1 – Normal (A) and Partially Blocked(B) Blood Vessels.

Cardiovascular Markers

CAVI and PWV – Arterial Stiffness Evaluation

Arterial stiffness can be used as an indicator for the development of cardiovascular disease.

PWV is the **gold standard** marker of arterial stiffness (measured on carotid and femoral arteries); however, this procedure is not always easy to perform, and requires some clinical training.

The cardio-ankle vascular index (CAVI) is another most recent cardiovascular marker that has been proposed for the evaluation of arterial stiffness. Its simplicity of measurement and its tolerance to changing arterial blood pressure makes it a candidate for cardiovascular risk evaluation in routine clinical practice (3).

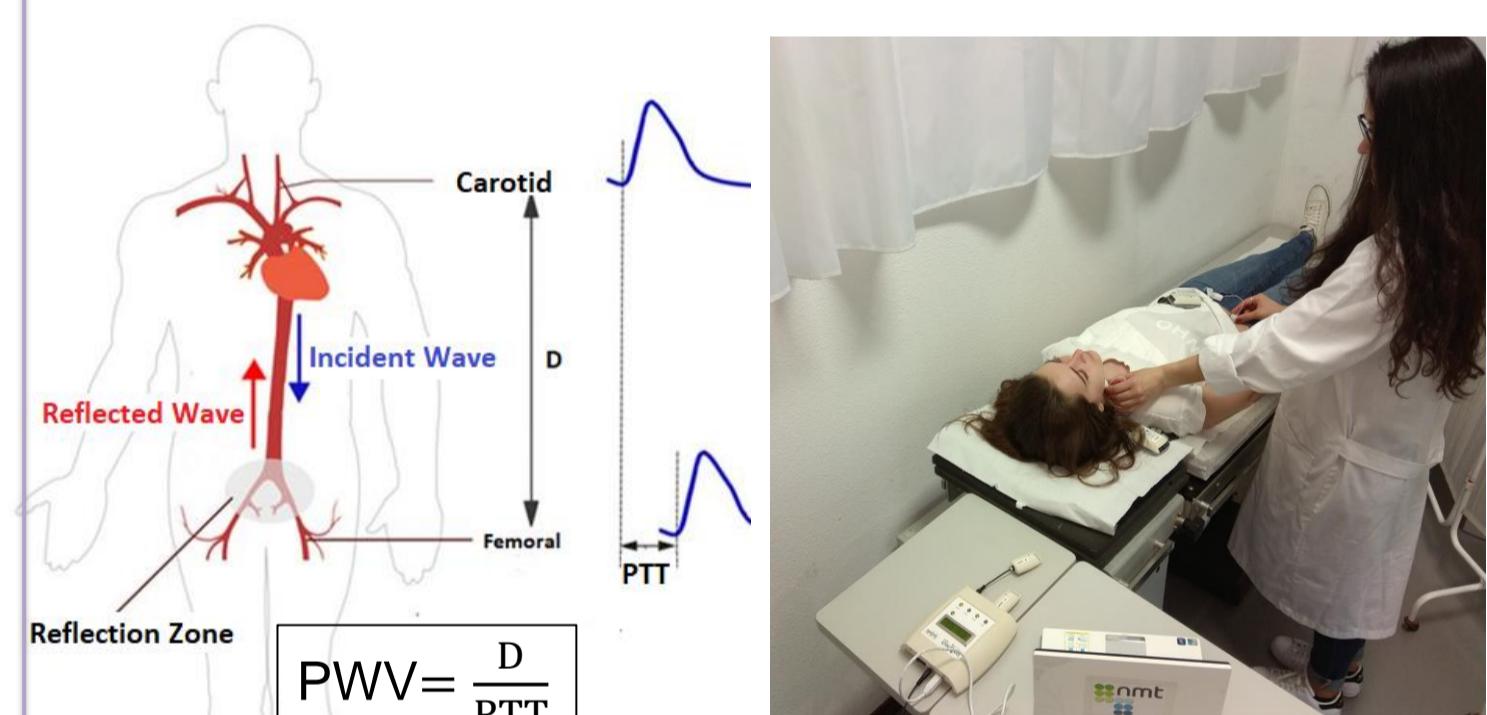


Fig.2 – PWV measurement.



Fig.3 – CAVI measurement.

CAP – Central Aortic Pressure

The effects caused by vasoactive drugs are different in central and peripheral pressures; and the traditional method of CAP assessment consists of an invasive cardiac catheterization procedure. So, the implementation of our novel device for non-invasive measurements of Central Aortic Pressure into clinical routine is very important.



Fig.4 – Validation of non-invasive CAP against invasive measurements by catheters.

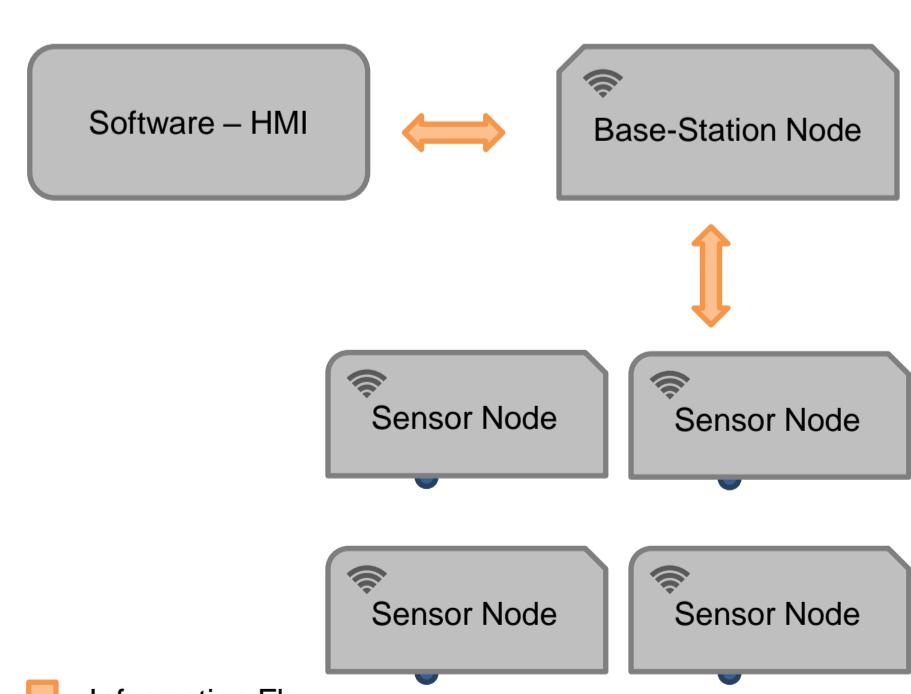
Devices

The VasoCheck® System is a tested device that is being further developed to accommodate several types of pulse signal recordings (4):

- Pulse wave Photoplethysmography (PPG).
- Heart-Sounds (Phonocardiogram).
- Electrocardiogram (ECG).

Fig. 7 – VasoCheck® system diagram and measurement of cfPWV.

Multi-channel Hemodynamic Monitoring System



References

- (1) G. C. S. C. Vlachopoulos, K. Aznaouridis, «Prediction of Cardiovascular Events and All-Cause Mortality With Arterial Stiffness: a systematic review and meta-analysis», JAC, vol. 55, n. 13, pp. 1318–1327, 2010.
- (2) Mancia G. De Backer, «2007 Guidelines for the management of arterial hypertension. The task force for the management of arterial hypertension of the European society of hypertension (ESH) and of the European society of cardiology (ESC)», Eur. Heart J., vol. 28, n. 12, pp. 1462–1536, 2007.
- (3) A. Serrano & V. Vassilenko, Project "Implementation and validation of new markers for diagnosis of arterial related diseases and fast evaluation of cardiovascular risk", PD/BDE/114551/2016
- (4) P. Bonifácio & V. Vassilenko. Project "Instrumentation for Innovative Cardiovascular Markers", PD/BDE/130083/2017
- (5) F. Cardoso , V. Vassilenko & A. Batista Project "Digital signal processing in wearable and portable biomedical devices", PD/BDE/150312/2019

Acknowledgements

This work was funded and supported by the Fundação para a Ciência e Tecnologia (FCT, Portugal) and NMT, S.A. in the scope of the PhD grants: PD/BDE/114551/2016, PD/BDE/150312/2019 and PD/BDE/130083/2017.