Comparison of arterial stiffness assessed by pOpmètre® with arterial stiffness assessed by applanation tonometry: a clinical study

[1,2]OBEID H,[1,2]KHETTAB H, [3]HALLAB M , [1,2]BOUTOUYRIE P, [1,2]LAURENT S
(1) Inserm U970, Paris, France (2) Paris Descartes University and HEGP, Paris, France
(3) Axelife and Nantes University, Nantes, France

Introduction

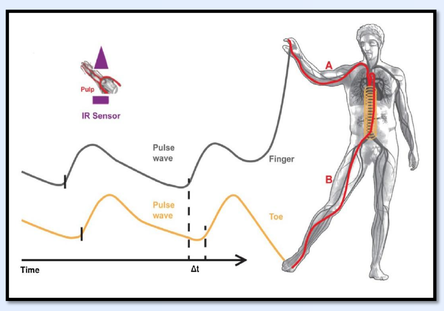
Large artery stiffness is recognized as a strong, independent marker of cardiovascular risk, mainly through aortic pulse wave velocity (PWV). pOpmètre ® is a new non-invasive method, which estimates aortic PWV through finger-toe (ft) wave analysis. In a previous study, Alivon et al. (Archives of Cardiovascular Diseases 2014) have shown an acceptable correlation (r^2 = 0.43 for PWV) between pOpmètre ® and the reference method Sphygmocor ®. However this study led to the necessity to optimize the algorithm and the procedures because of the presence of several outliers involving mainly obese and elderly subjects, and occurrence of suboptimal toe pulses.

Objectives

To analyze the accordance between ft PWV measured by the pOpmètre ® with optimized algorithm and procedures, and carotid-femoral PWV (cf PWV) measured using Sphygmocor ®.

Materials and Methods

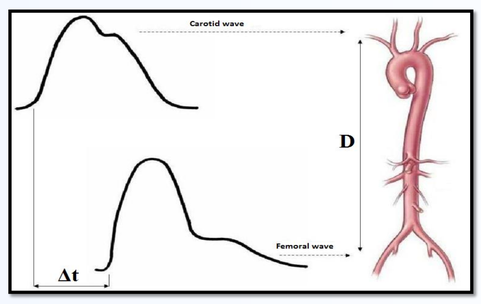
ft PWV - pOpmètre



$$ftPWV = \frac{k.height}{\Delta t}$$

The pOpmètre ® has 2 photodiodes sensors, positioned on the finger and on the toe, next to the pulp artery. A particular attention was drawn on positioning of the toe sensor so that the pulp was in contact with the photodiode. Different signal processing was applied and no cut-off value was used for pulse height.

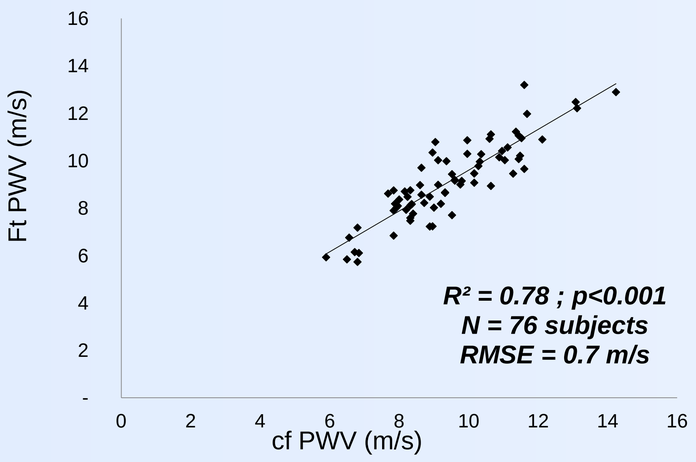
Applanation tonometry

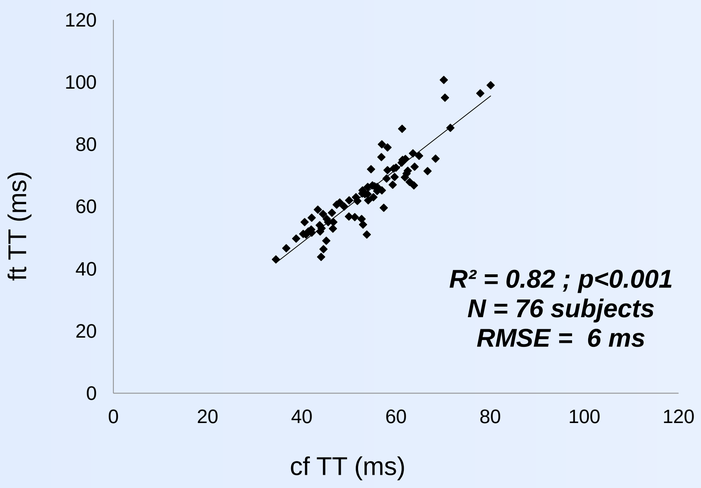


$$cfPWV = \frac{D}{\Delta t}$$

SphygmoCor ® records pulse wave signals using pressure sensors applied successively on carotid and femoral arteries, synchronized with ECG R wave.

Results





	PWV (m/s)	TT (ms)
Sphygmocor	9.4 ± 1.6	54 ± 10
pOpmètre	9.1± 1.6	64 ± 12

	N = 76; 45 men
Age (years)	58 ± 17 [22 - 87]
Height (cm)	169 ± 8 [153 - 191]
Weight (kg)	79 ± 15 [57 - 122]
BMI (kg/m²)	27 ± 6.4 [18 - 37]
SBP (mmHg)	133 ± 16 [98 - 192]
DBP (mmHg)	76 ± 14 [52 – 113]
cf-PWV (m/s)	9.4 ± 1.6 [5.8 - 14.2]
cf-TT (ms)	52 ± 10 [34 - 80]

Data are mean ± standard deviation [range], BMI: body mass index

- 76 subjects were included: 45 men, 23 healthy subjects and 53 patients with essential hypertension aged 58 ± 17 years.
- The correlation between ft PWV and cf PWV was good and significant (r^2 = 0.78; p<0.001) when using optimized algorithms. A better correlation was found in terms of transit time (r^2 = 0.82; p<0.001).
- The Bland and Altman analysis, mean difference was 0.3 m/s versus 9 ms, classifying the device as good agreement with reference (Wilkinson, ARTERY RES 2010).
- A significant bias persisted with underestimation in older subjects.

Discussion and Conclusion

pOpmètre®, newly developed system for measuring aortic pulse wave velocity using the finger-toe approach and calculating the transit time based on height chart, without pulse wave registration on the carotid and femoral artery, is a promising means of assessing aortic stiffness. The greatest advantages of ft-PWV are probably simplicity, rapidity, feasibility, patient acceptability and correct agreement with the reference technique.