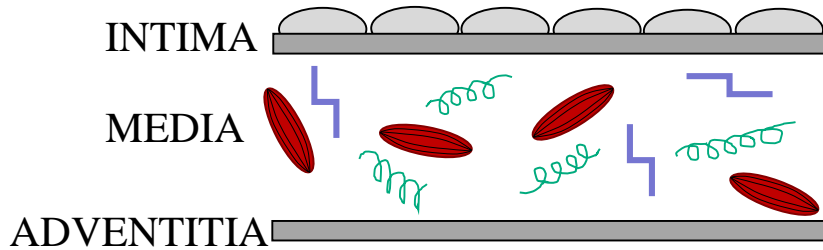




Arterial stiffness



COMPLIANCE

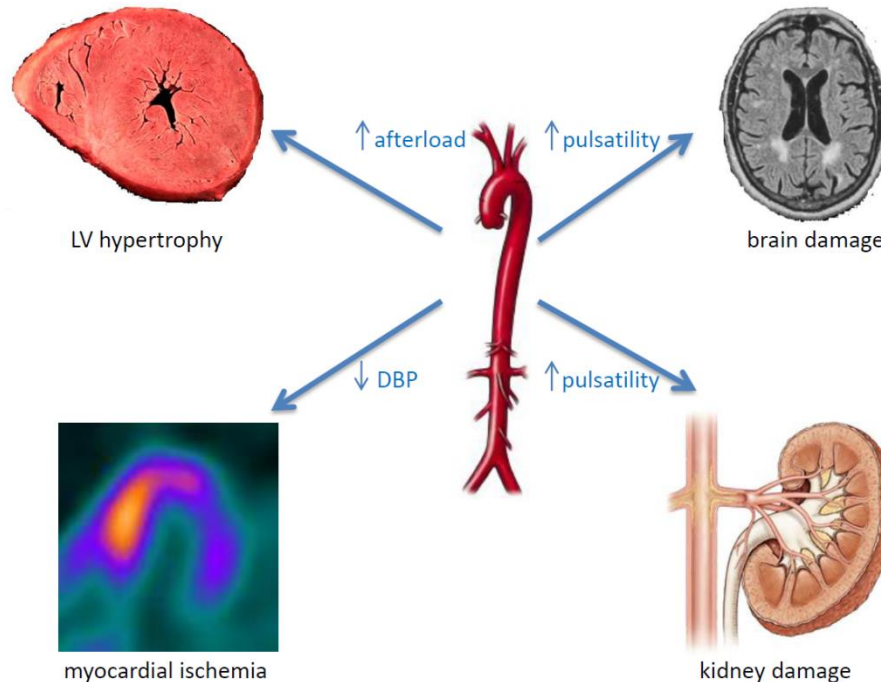


Compliance

$$C = \frac{\Delta V}{\Delta P}$$

MEDIA + ADVENTITIA - responsible for arterial stiffness

Stiffness is ability to resist distension when a force is applied to it.



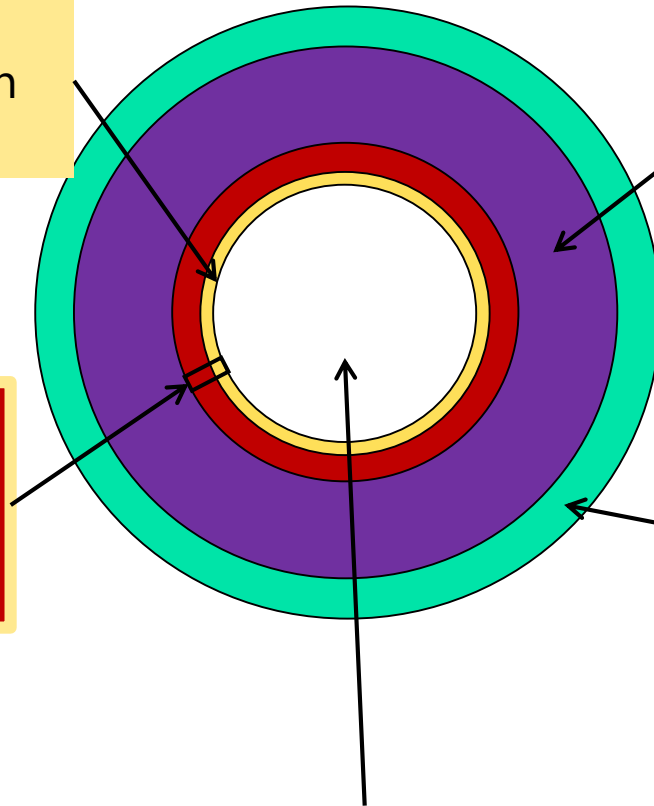
COMPLIANCE

Endothelial cells:

- endothelial dysfunction
- ↑ permeability

Intima:

- ↑ collagen
- ↓ elastin
- ↑ *AGE`s, TGF-β, VSMC*



Media:

- ↑ collagen
- ↓ elastin
- ↑ *AGE`s, MMP, VSMC*

Adventicia:

- ↑ collagen
- fibroblasts

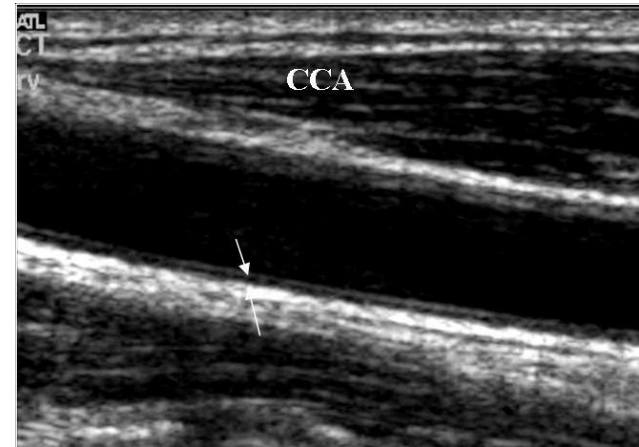
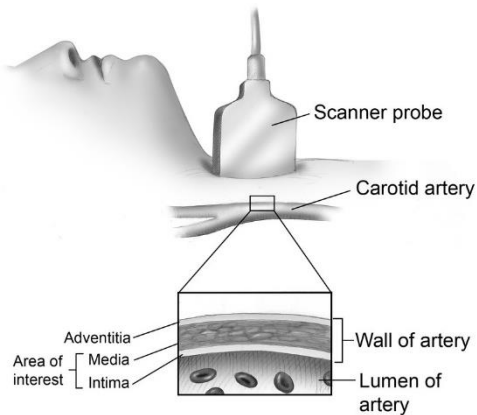
Extrinsic influences

MEASUREMENT OF THE COMPLIANCE

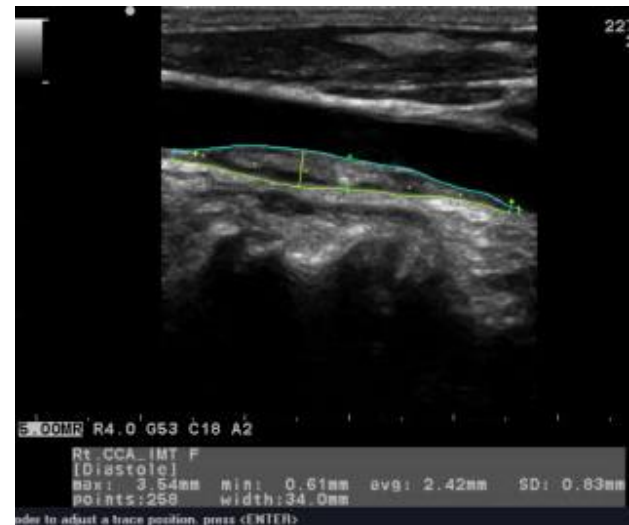
Indirect ways

- Ultrasound
- Sphygmography (PWV a PWA)
- CAVI measurement
- Bioimpedance

Intima Media Thickness (IMT)



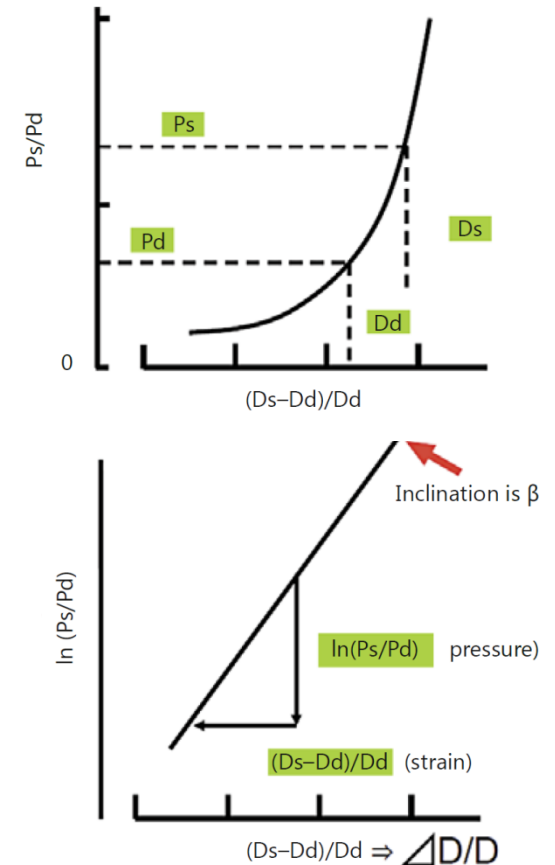
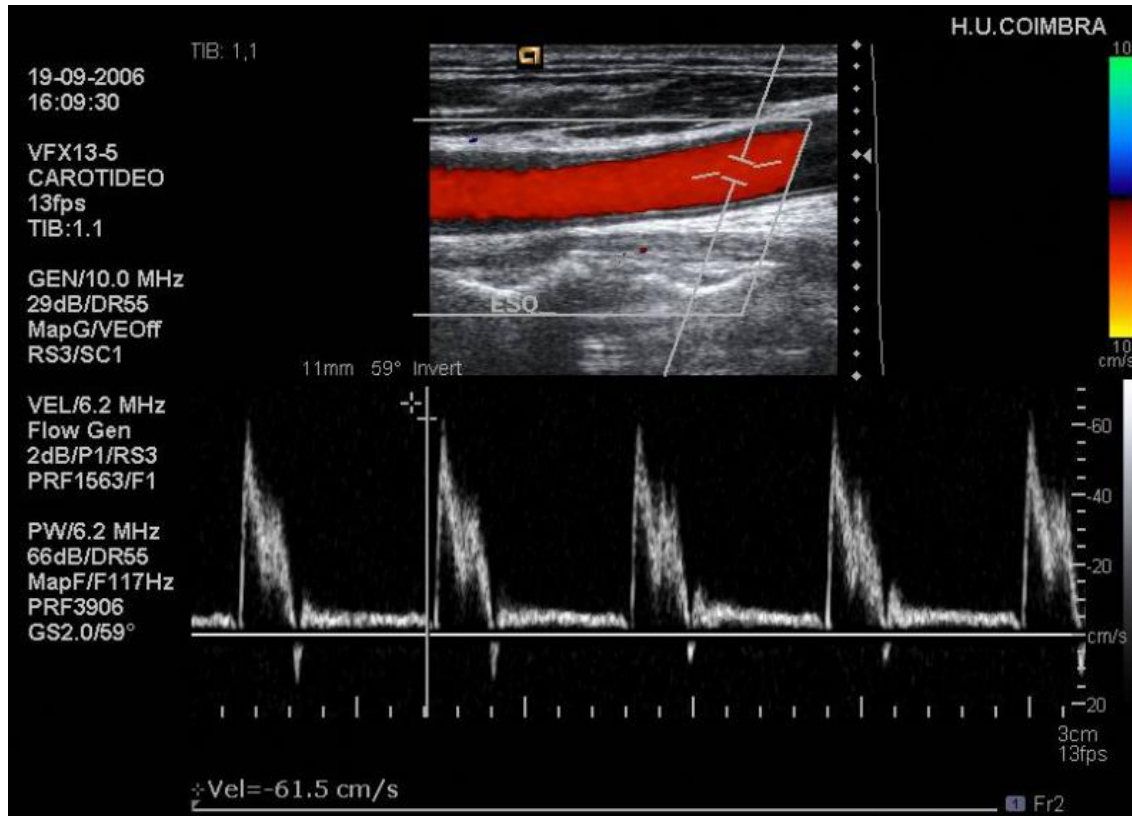
věk.		IMT _R (mm)	IMT _L (mm)
25-35	Mean	0.39±0.07	0.40±0.07
	V%	18.26	17.37
	CI	0.36 <x< 0.42	0.38 <x< 0.42
35-45	Mean	0.43±0.07	0.46±0.09
	V%	15.15	18.59
	CI	0.41 <x< 0.45	0.43 <x< 0.49
45-55	Mean	0.47±0.08	0.50±0.11
	V%	17.49	21.18
	CI	0.44 <x< 0.50	0.47 <x< 0.54
55-65	Mean	0.52±0.11	0.54±0.11
	V%	21.01	20.89
	CI	0.48 <x< 0.56	0.50 <x< 0.58
65-75	Mean	0.55±0.09	0.57±0.09
	V%	16.65	14.60
	CI	0.53 <x< 0.59	0.55 <x< 0.61



ULTRASOUND MEASUREMENT

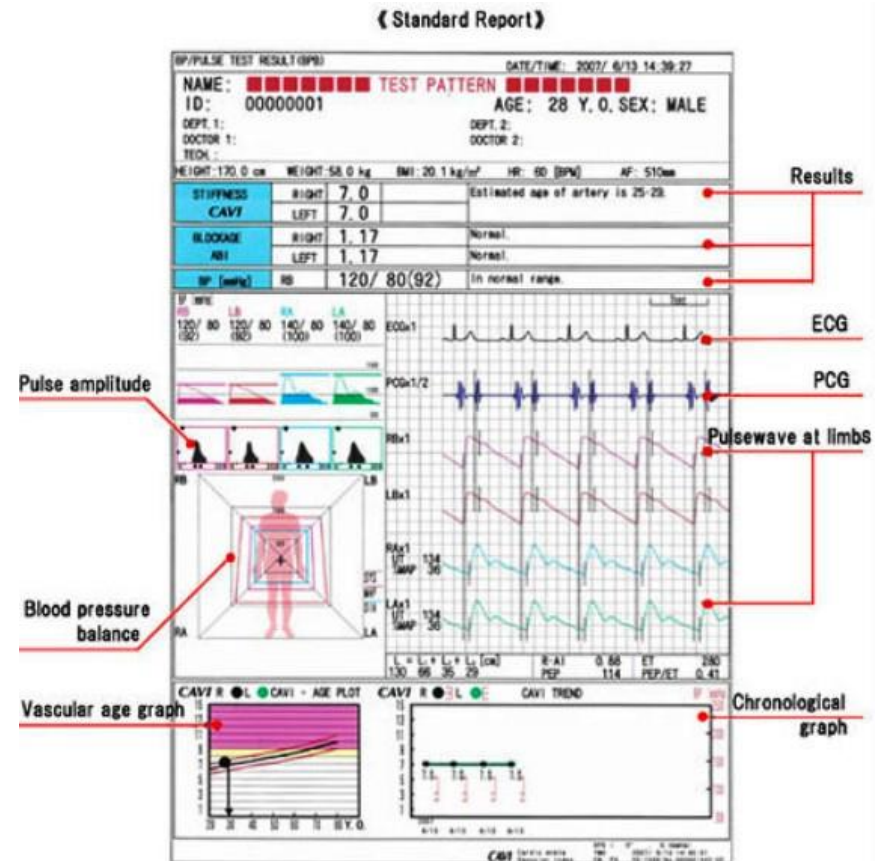
β – index measurement

$$\beta = \left(\ln \frac{P_s}{P_d} \right) \left(\frac{D}{\Delta D} \right)$$





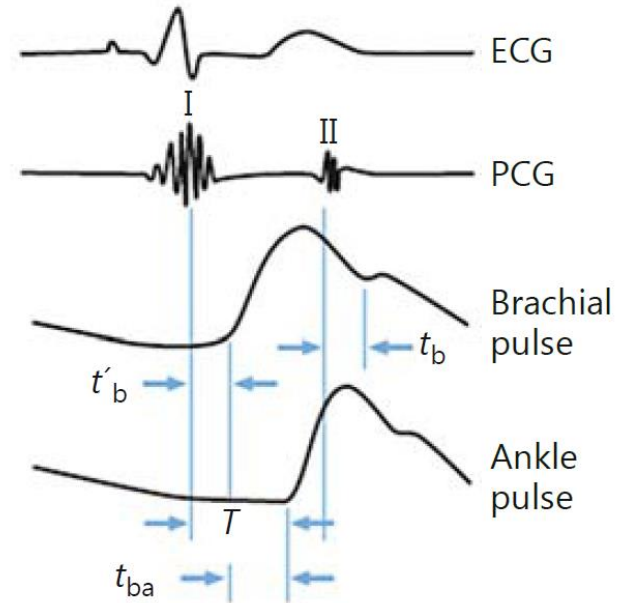
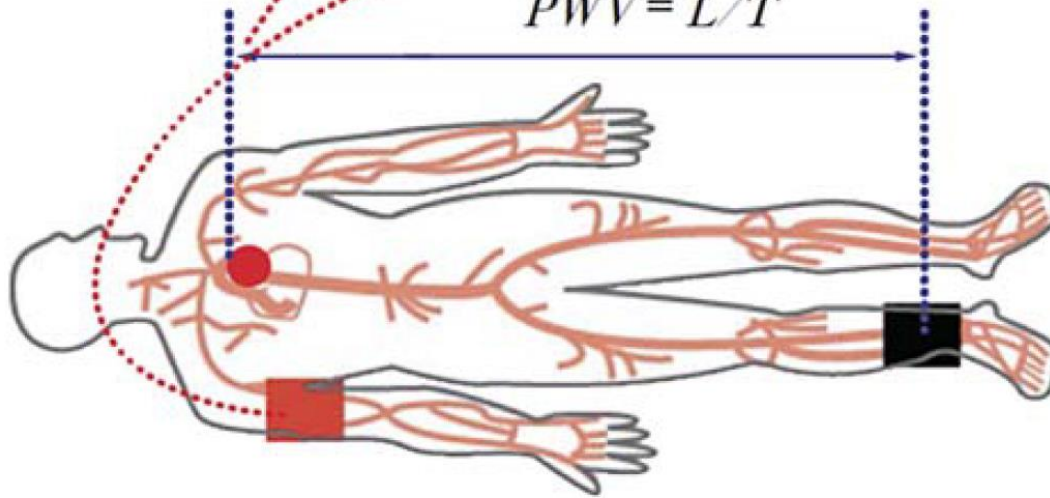
CAVI MEASUREMENT



CAVI MEASUREMENT

$$CAVI = a \left[\frac{2\rho}{\Delta P} \left[\ln \frac{Ps}{Pd} \right] PWV^2 \right] + b$$

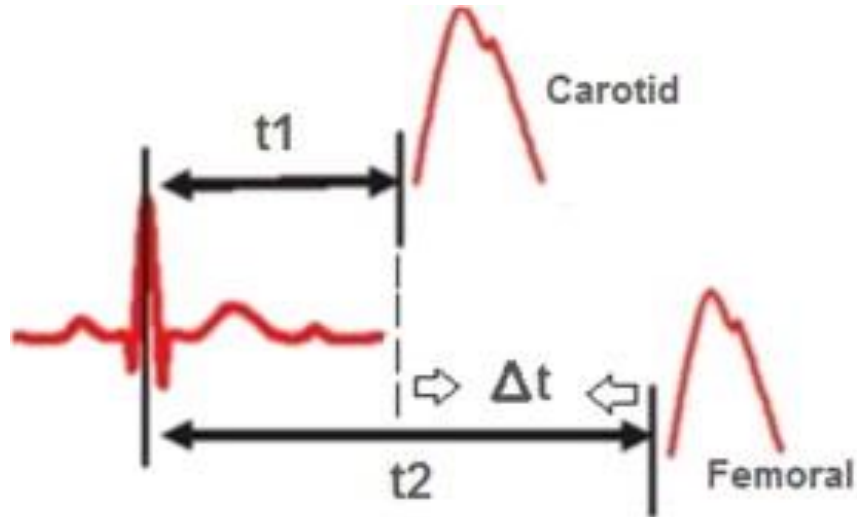
$$PWV = L/T$$



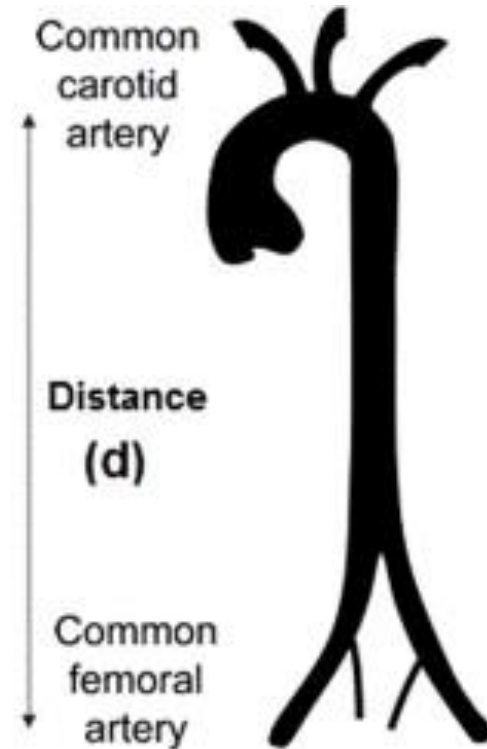
● Reference value of CAVI

CAVI < 8.0	Normal range
8.0 ≤ CAVI < 9.0	Borderline
9.0 ≤ CAVI	Arteriosclerosis suspected

PWV MEASUREMENT

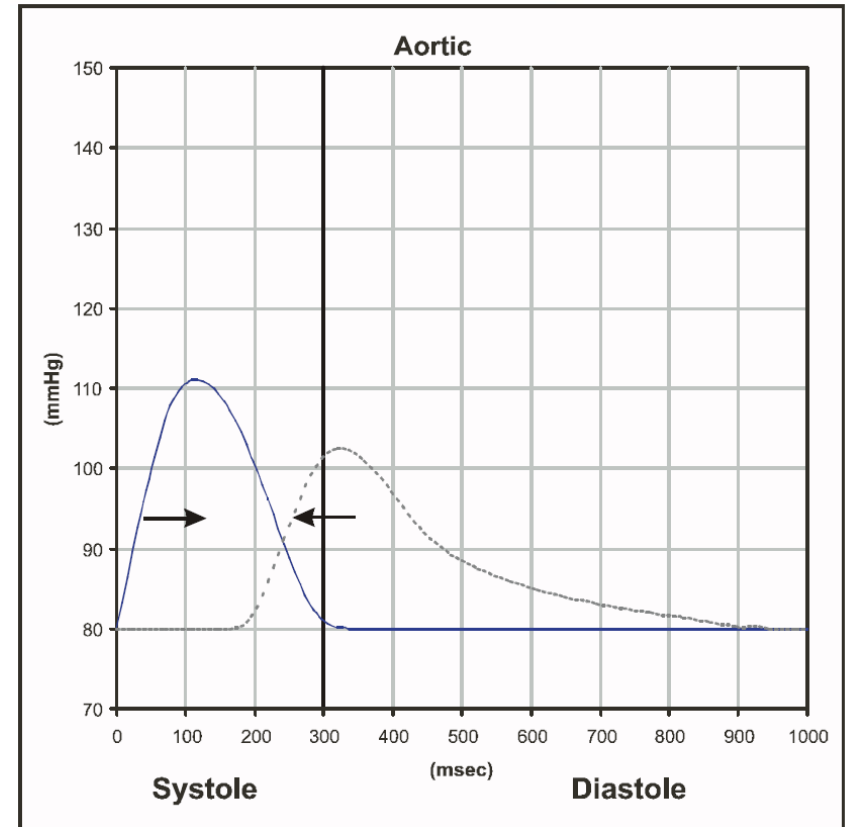
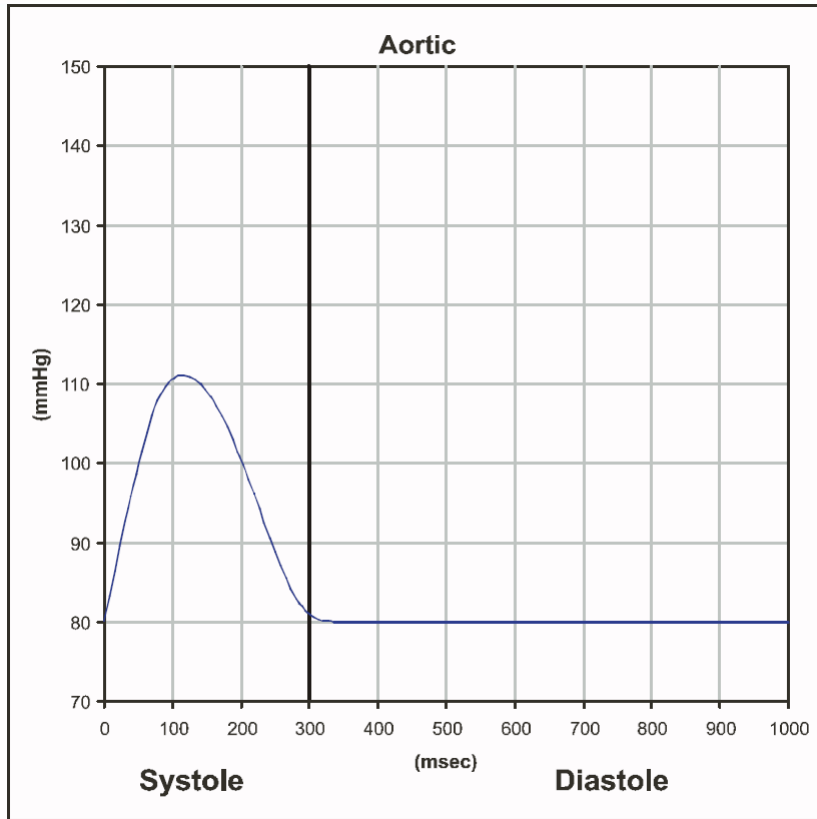


PWV = distance (m) / transit time (s)
transit time = t2 – t1

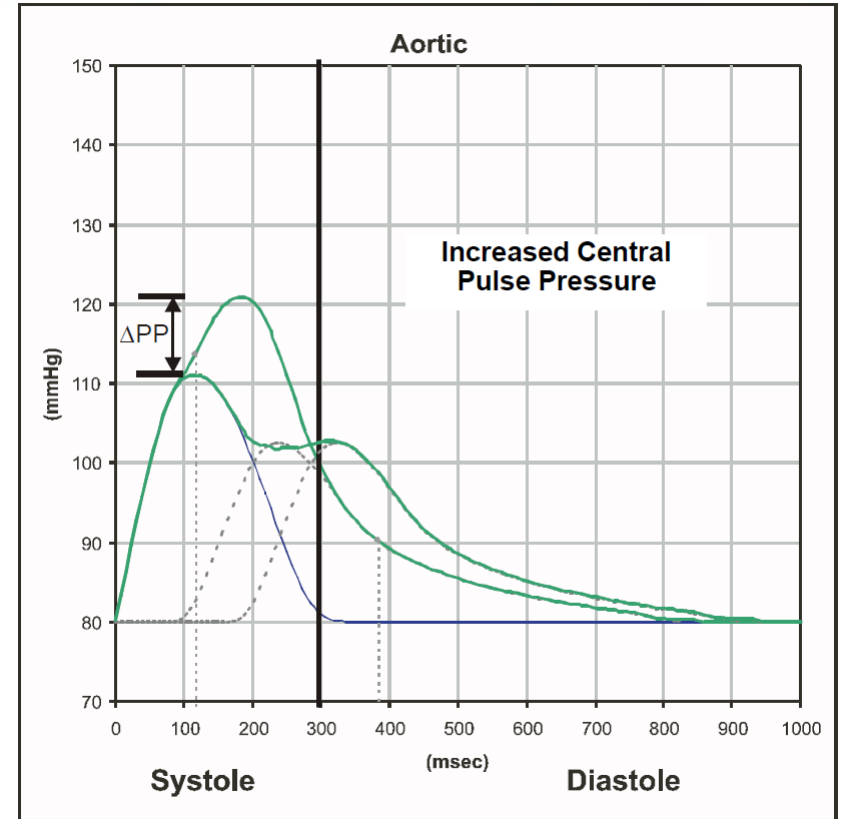
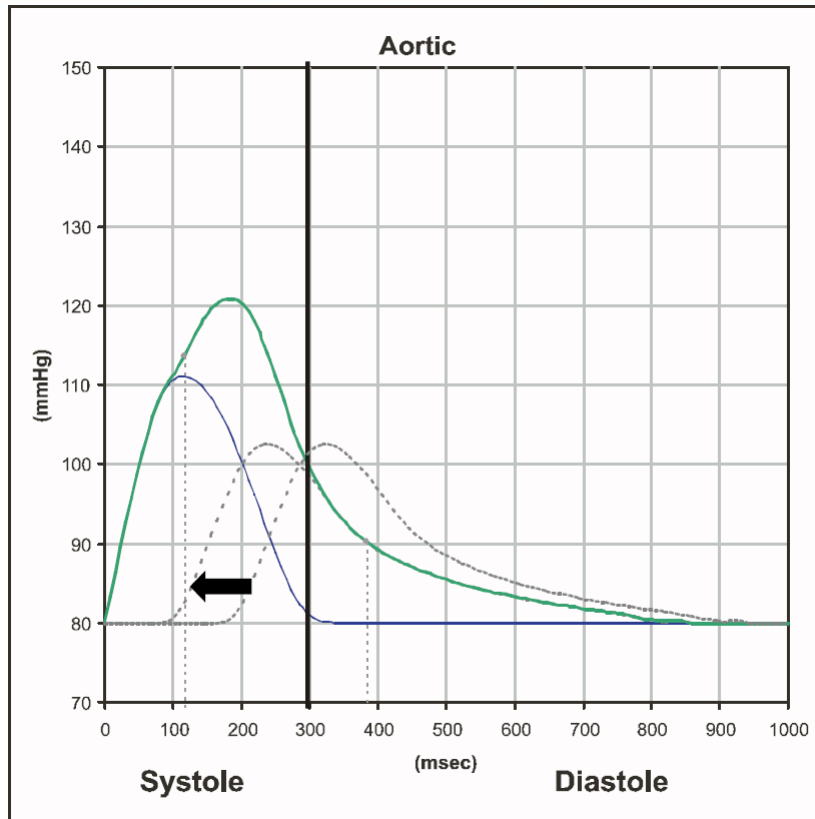


A highly compliant aorta has a relatively low PWV (< 6 m/s)

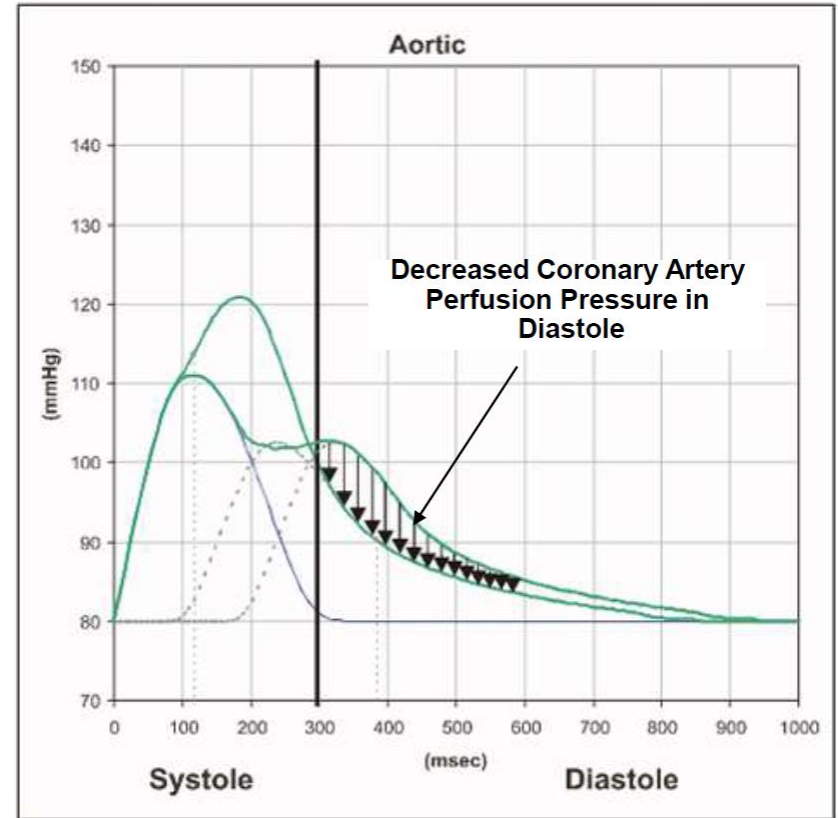
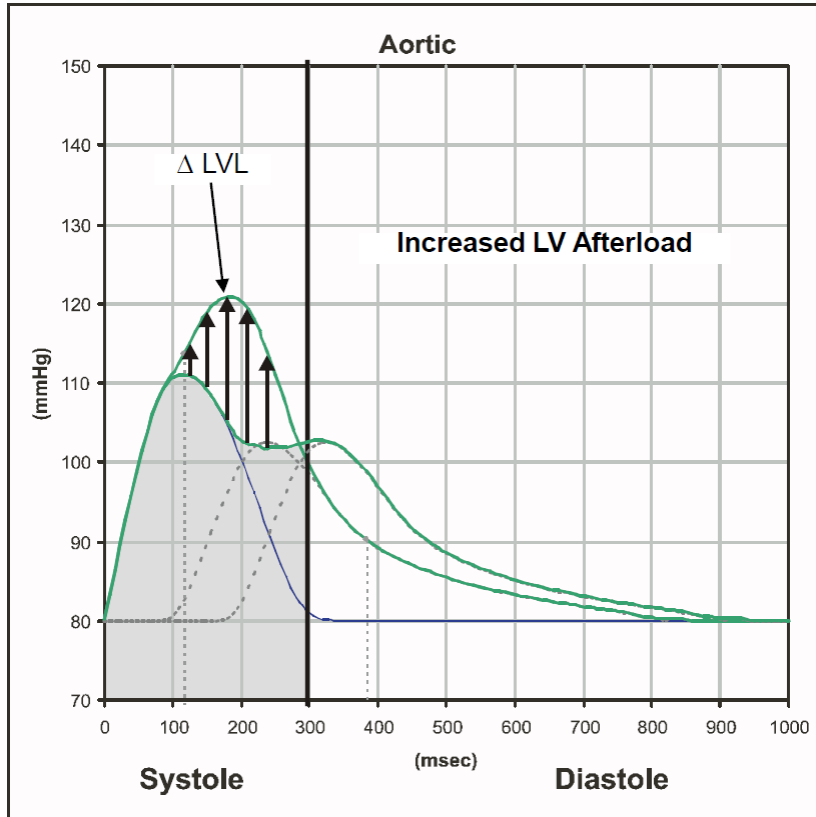
PULSE WAVE



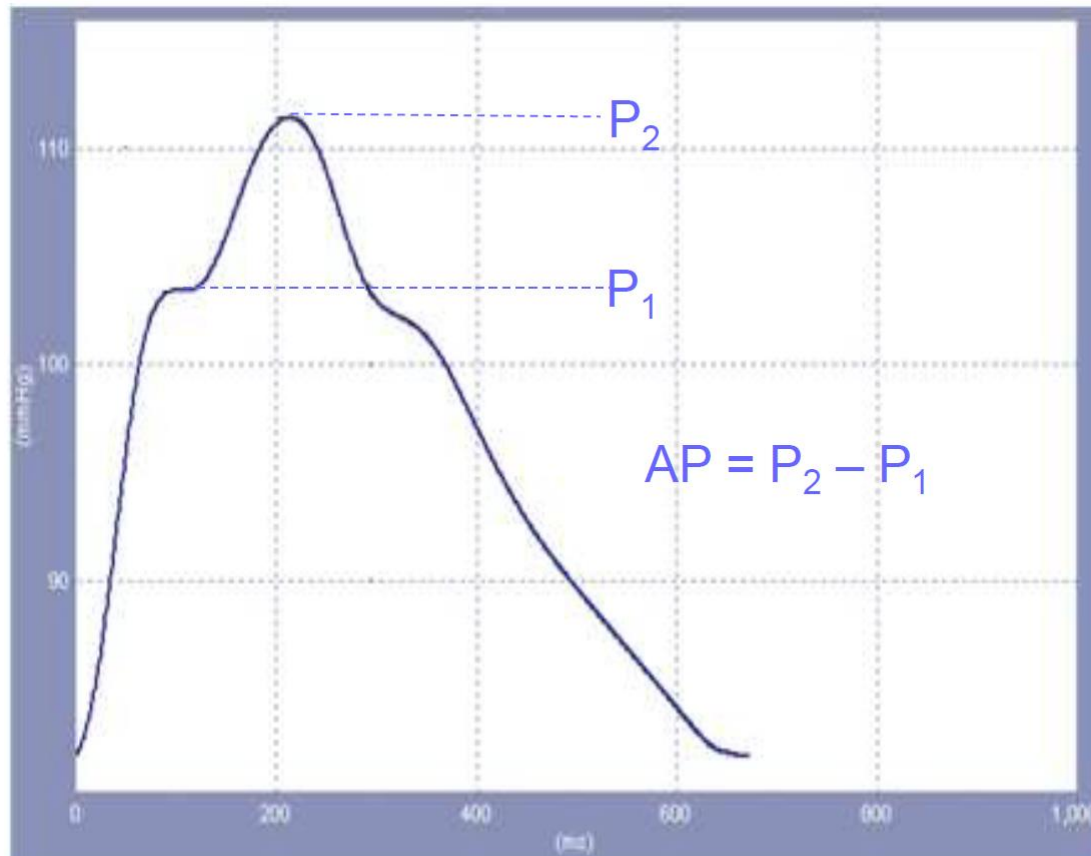
PULSE WAVE



PULSE WAVE



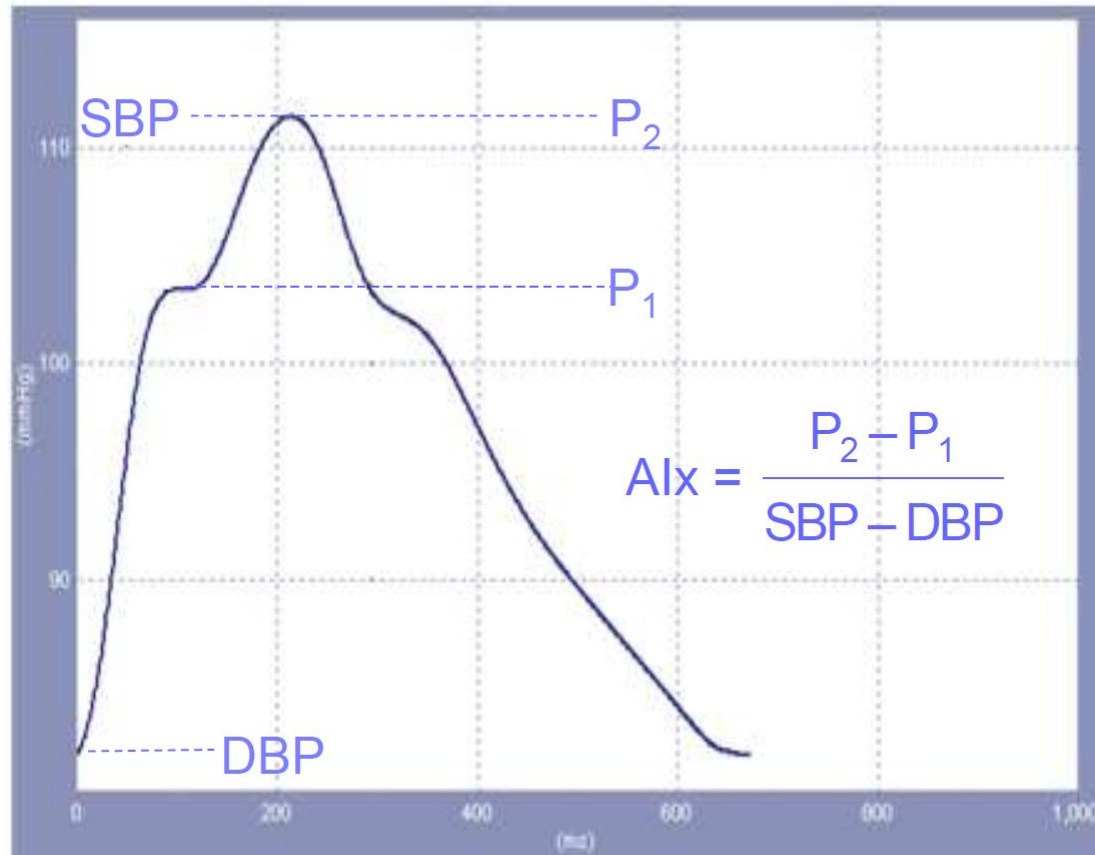
PULSE WAVE ANALYSIS



P₁ corresponds to the pressure at peak systolic flow and is usually identified by the first shoulder of the pressure wave.

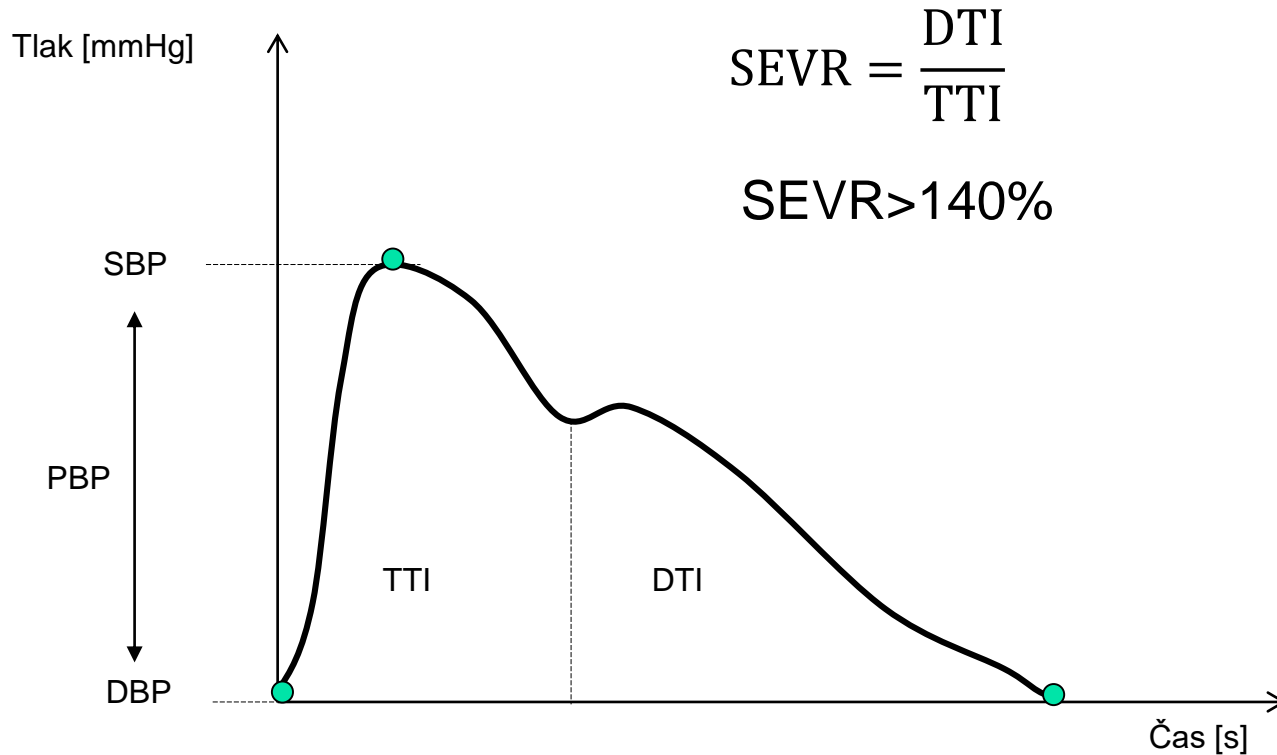
P₂ corresponds to the peak of the reflected wave and is usually identified by the peak of the pressure wave after the first shoulder.

PULSE WAVE ANALYSIS



Higher values of AP and Alx indicate increased wave reflection from the periphery and/or early return of the reflected wave as a result of **increased pulse wave velocity** (due to increased arterial stiffness)

PULSE WAVE ANALYSIS



TTI - Tension Time Index (area under systolic part of the pulse curve)

DTI - Diastolic Time Index (area under diastolic part of the pulse curve)

SEVR - Buckberg Sub-Endocardial Viability Ratio – subendocardial blood supplying



PULSE WAVE ANALYSIS

