

**MUNI  
MED**

# **Poddajnost pažní tepny.**

# Otázky z fyziologie – jaro 2021

- Pružnost tepen a její význam
- Arteriální tep, pulzová vlna

# Faktory ovlivňující arteriální tuhost

## A. Vascular Structure

## B. Stiffness Pathology

### Tunica adventitia

- Fibroblasts
- Collagen-containing matrix
- External elastic lamina

### Tunica adventitia

- Collagen deposition
- Increase in fibroblasts

### Tunica media

- Smooth muscle cells
- Elastic fibers

### Tunica media

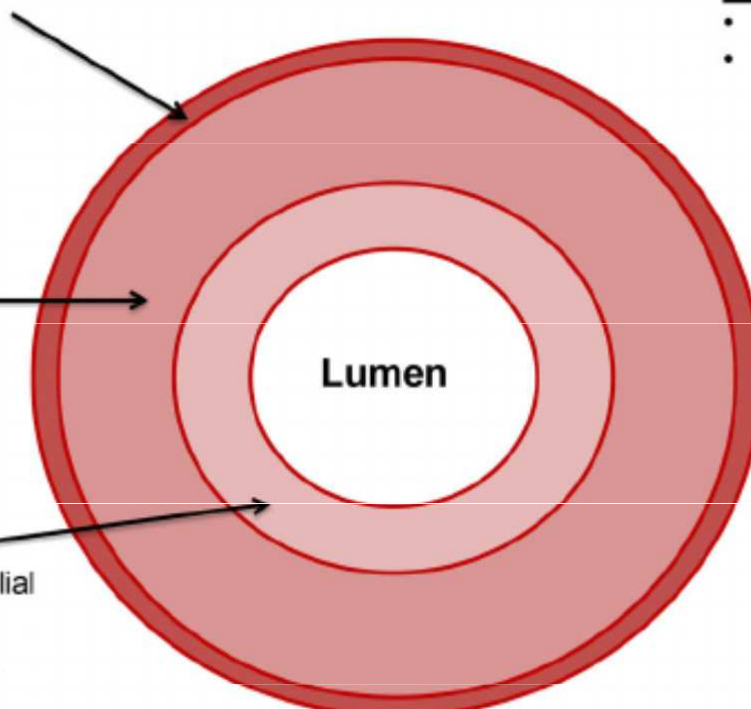
- Collagen deposition
- Elastin degradation
- RAAS Signaling
  - AT1R & MR
- VSMC stiffness
  - Increase in  $\alpha$ -SMA &  $\beta$ 1-integrin

### Tunica intima

- Monolayer of endothelial cells
- Internal elastic lamina

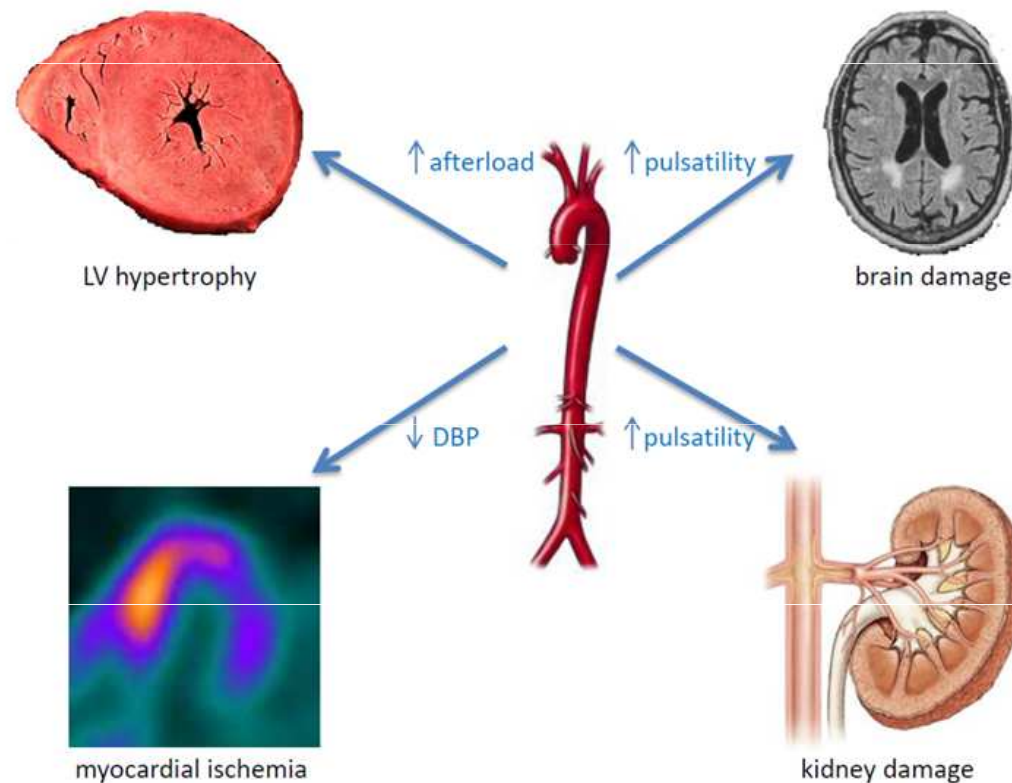
### Tunica intima

- Endothelial dysfunction
- Oxidative stress

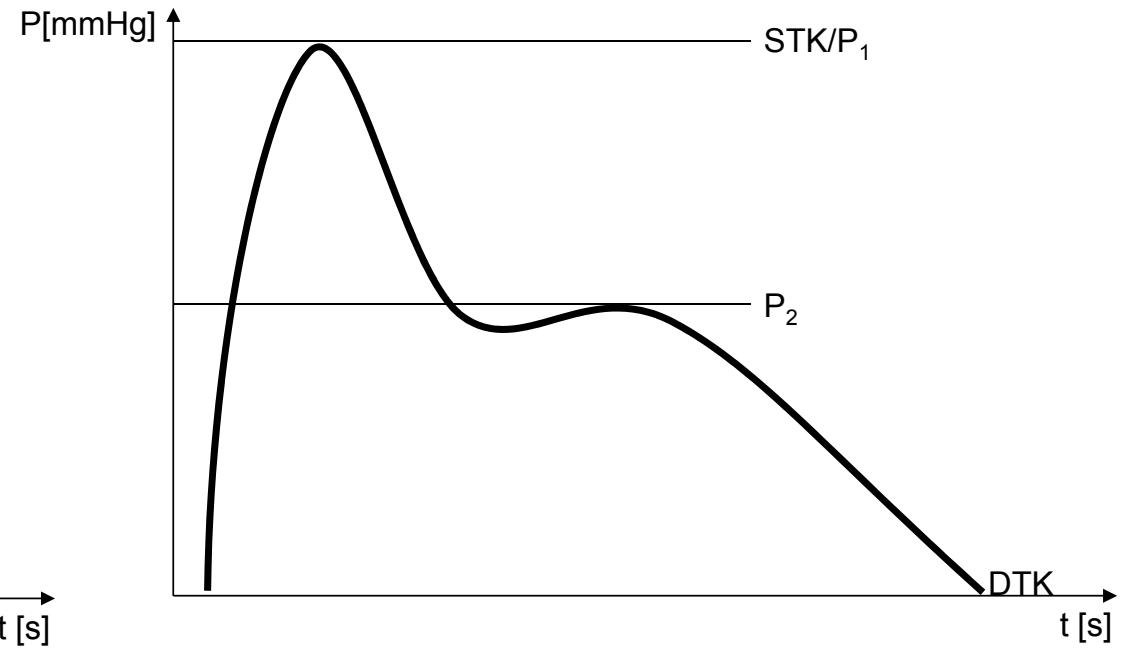
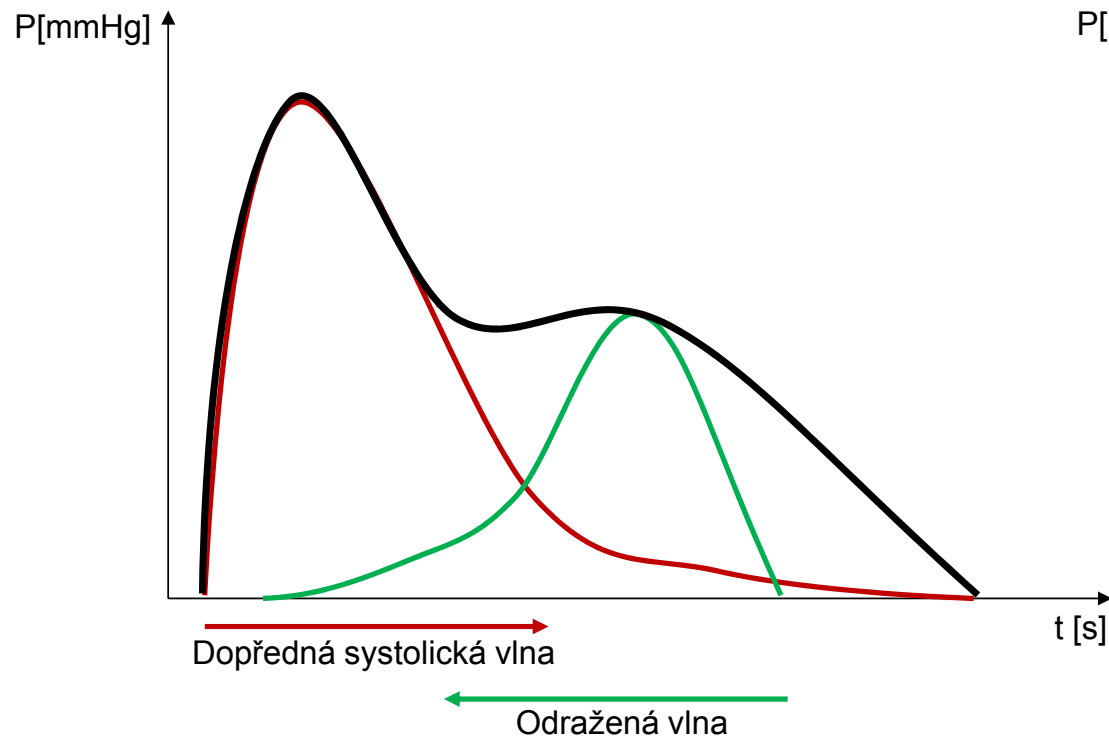


- Degradace elastinu
- Depozice kolagenu
- Endoteliální dysfunkce

# Důsledky zvýšené arteriální tuhosti



# Pulzová vlna

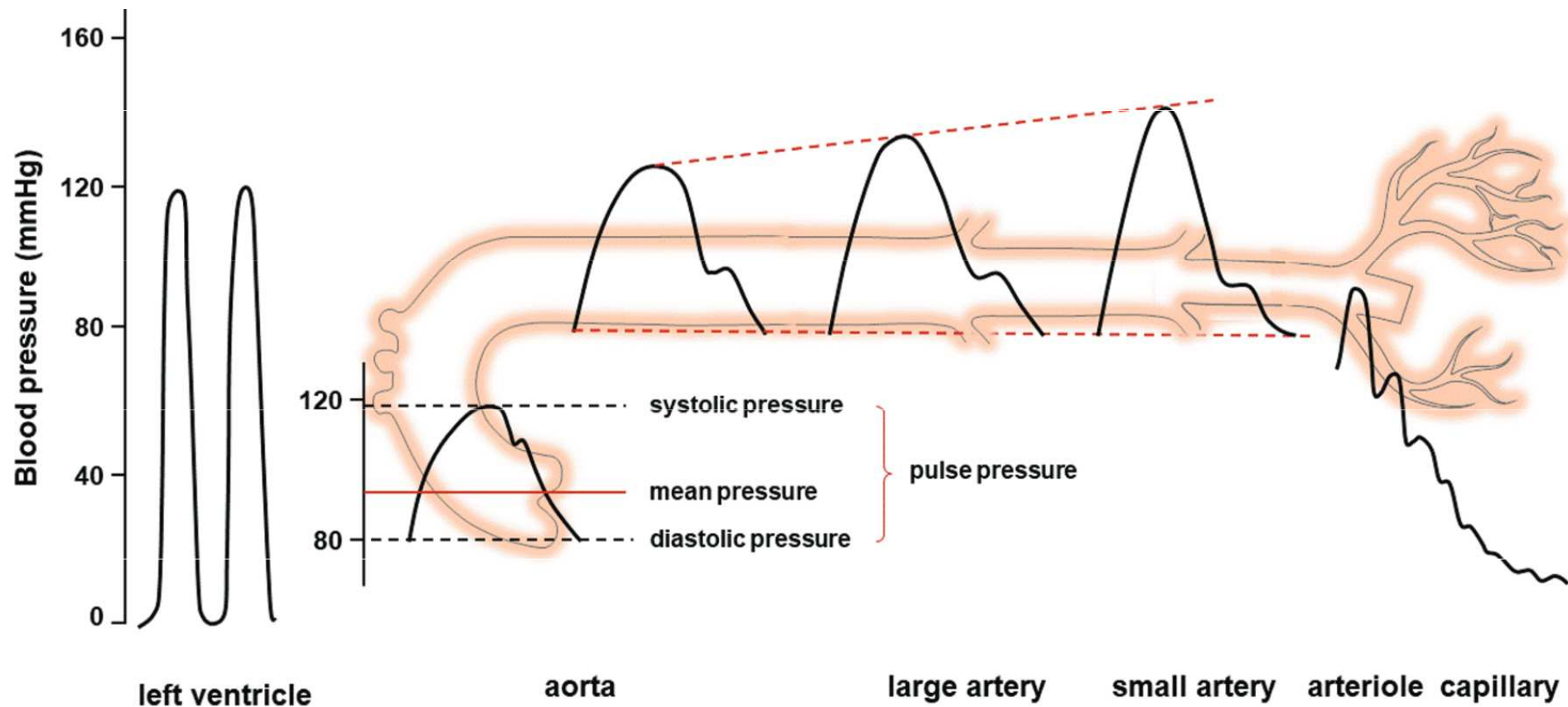


$$PTK = STK - DTK$$

$$\text{stř. TK} = DTK + 1/3PTK$$

$$AP = P_2 - P_1$$

# Pulzová vlna v různých cévních segmentech

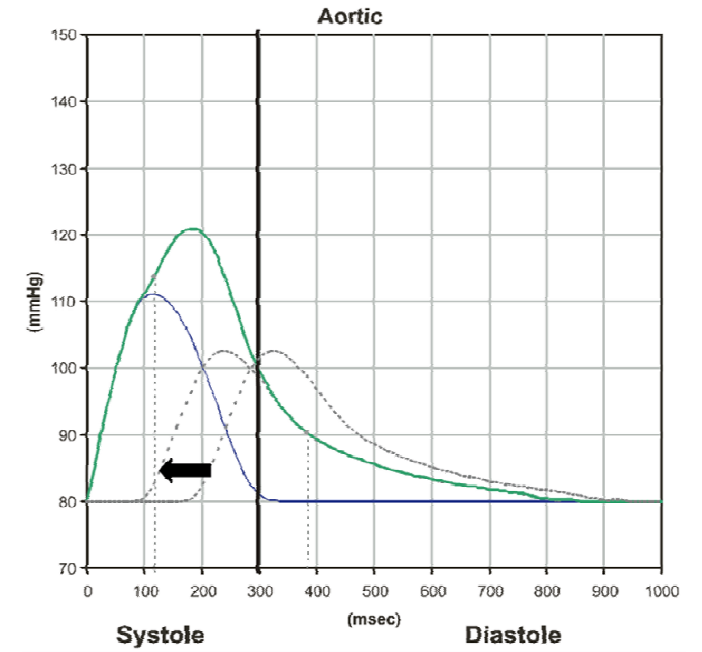
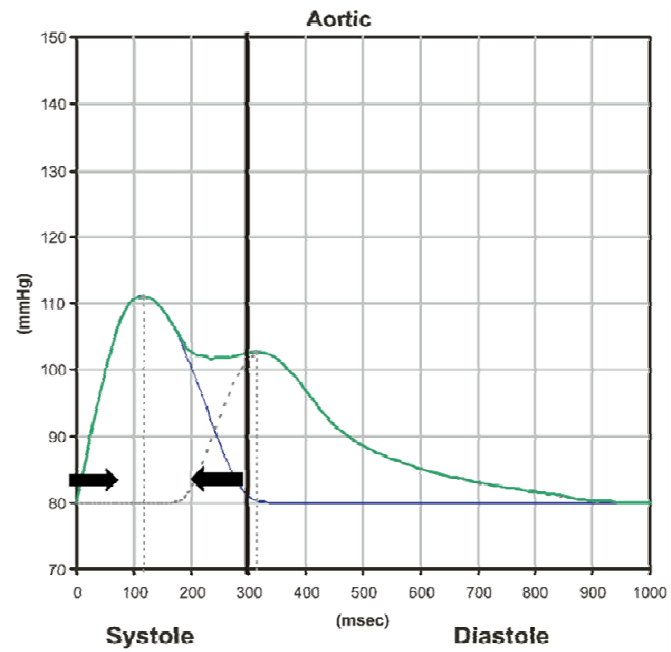
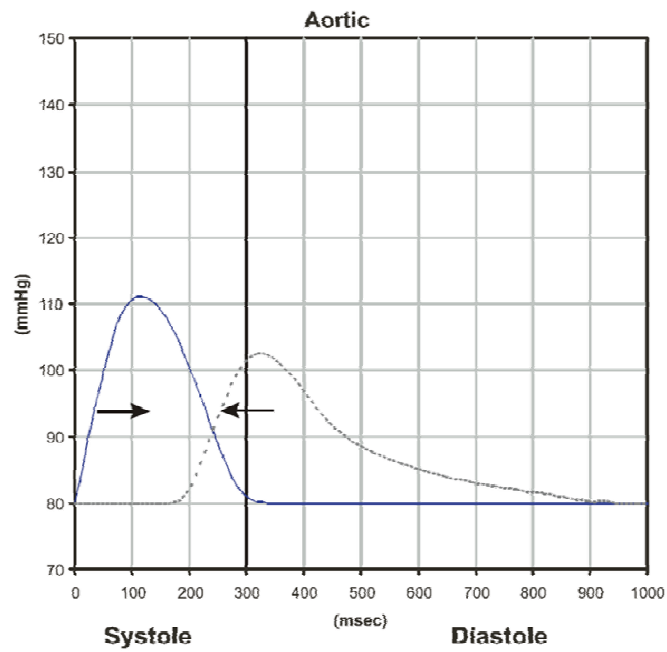


# Pohlavní rozdíly v mechanismech zvýšení arteriální tuhosti

	Males	Females
Mechanism	Relevant pathways	
ECM alterations	↑ Collagen ↓ Elastin	↑ Collagen
VSMC stiffening	↑ β1-integrin ↑ Rho kinase	Unknown
Oxidative stress	↑ Superoxide ↑ Mitochondrial-derived ROS ↑ NADPH-oxidase	↑ Superoxide ↑ eNOS uncoupling via ↑ BH(4) reductions
Inflammation	↑ NF-κB ↑ T-cell activation	↑ NF-κB
RAAS signalling	↑ SMC-MR ↑ AT1R activation	↑ EC-MR ↑ ENaC

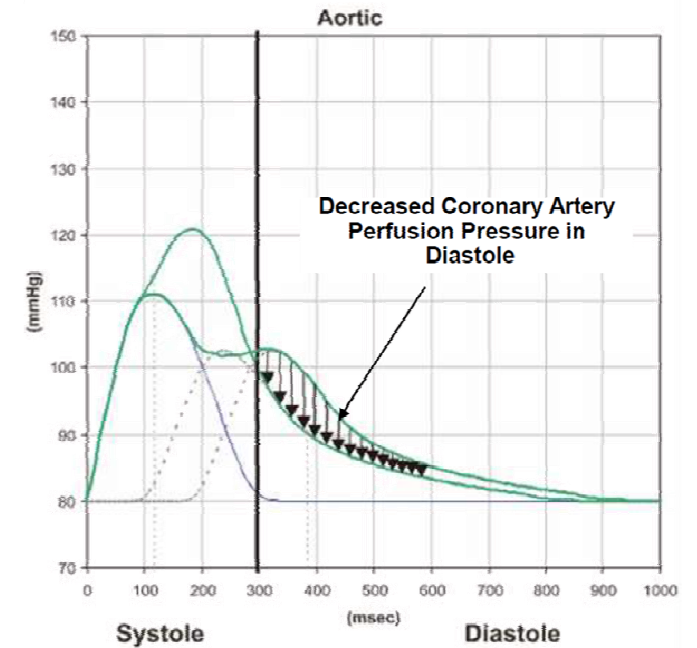
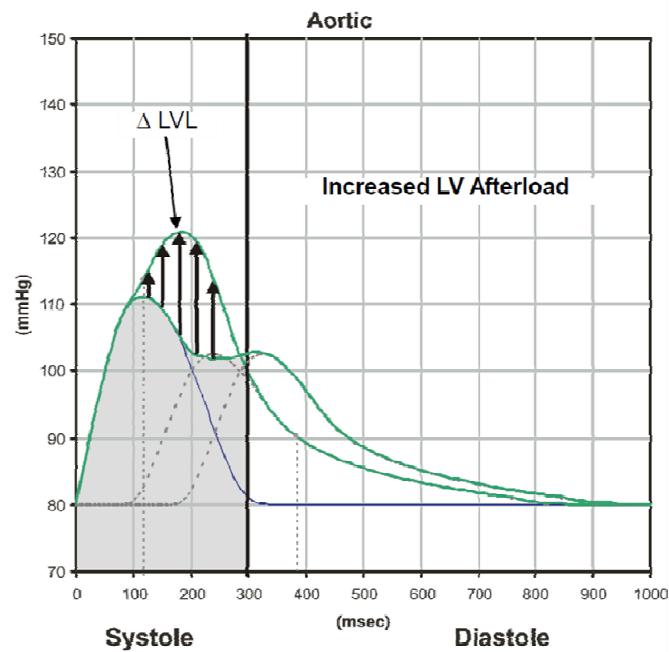
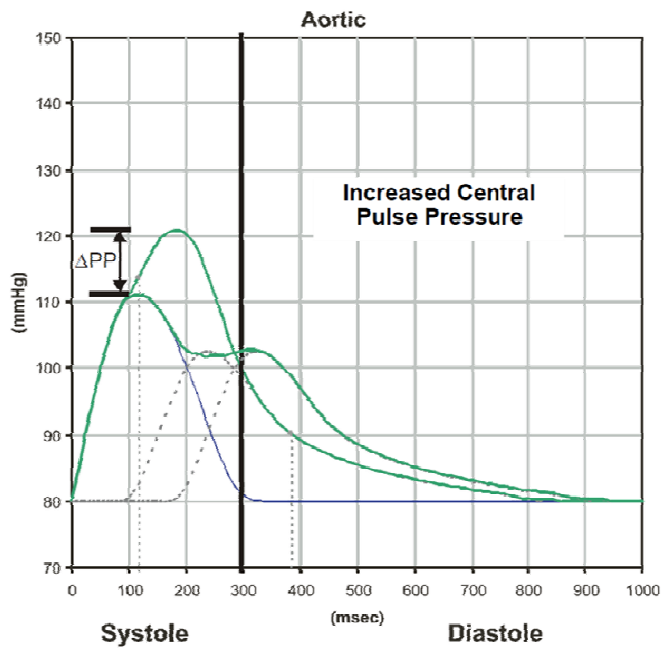
ECM - extracellular matrix; VSMC - vascular smooth muscle cell; eNOS - endothelial NOS; NADPH - NAD phosphate oxidase; BH(4) - tetrahydrobiopterin; SMC-MR - smooth muscle cell mineralocorticoid receptor; AT1R - angiotensin II type 1 receptor; EC-MR - endothelial cell mineralocorticoid receptor; ENaC - epithelial sodium channel.

# Tlak odražené vlny

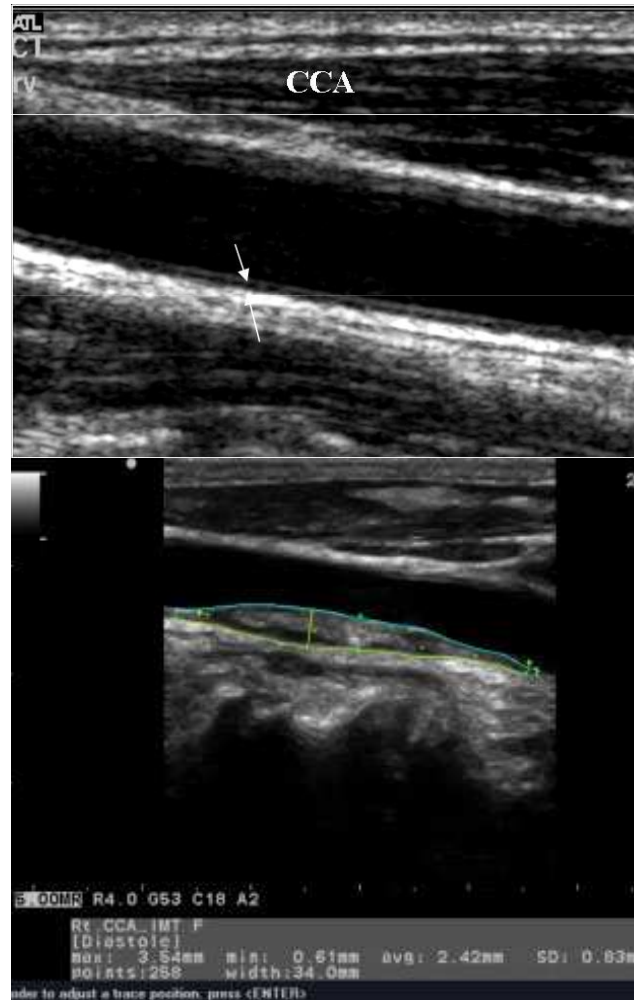
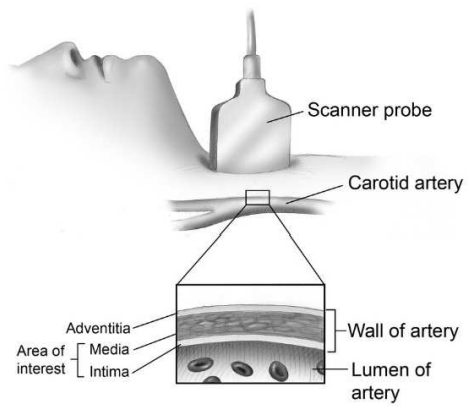




# Tlak odražené vlny



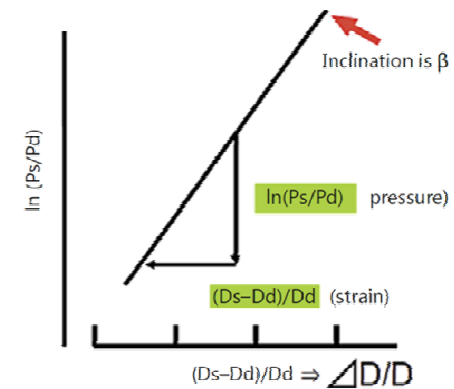
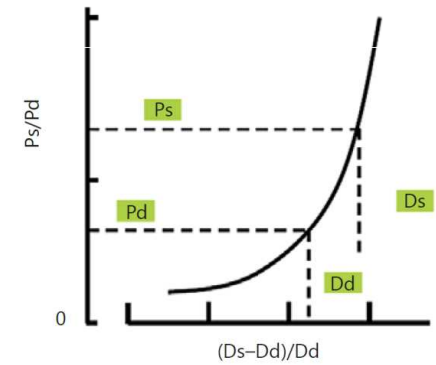
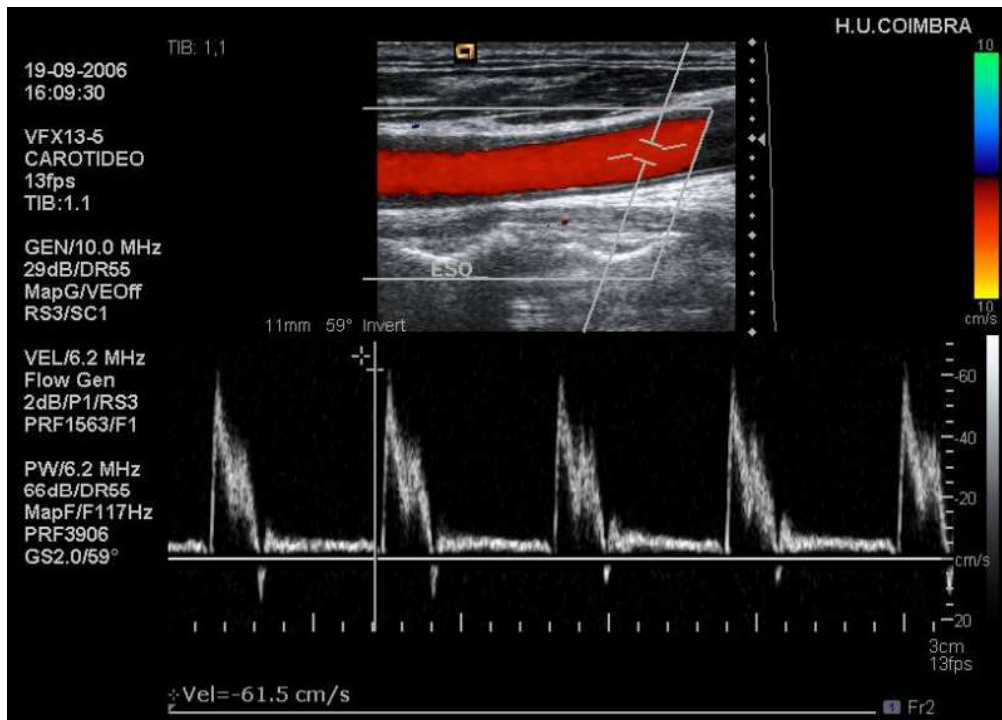
# Sonografie



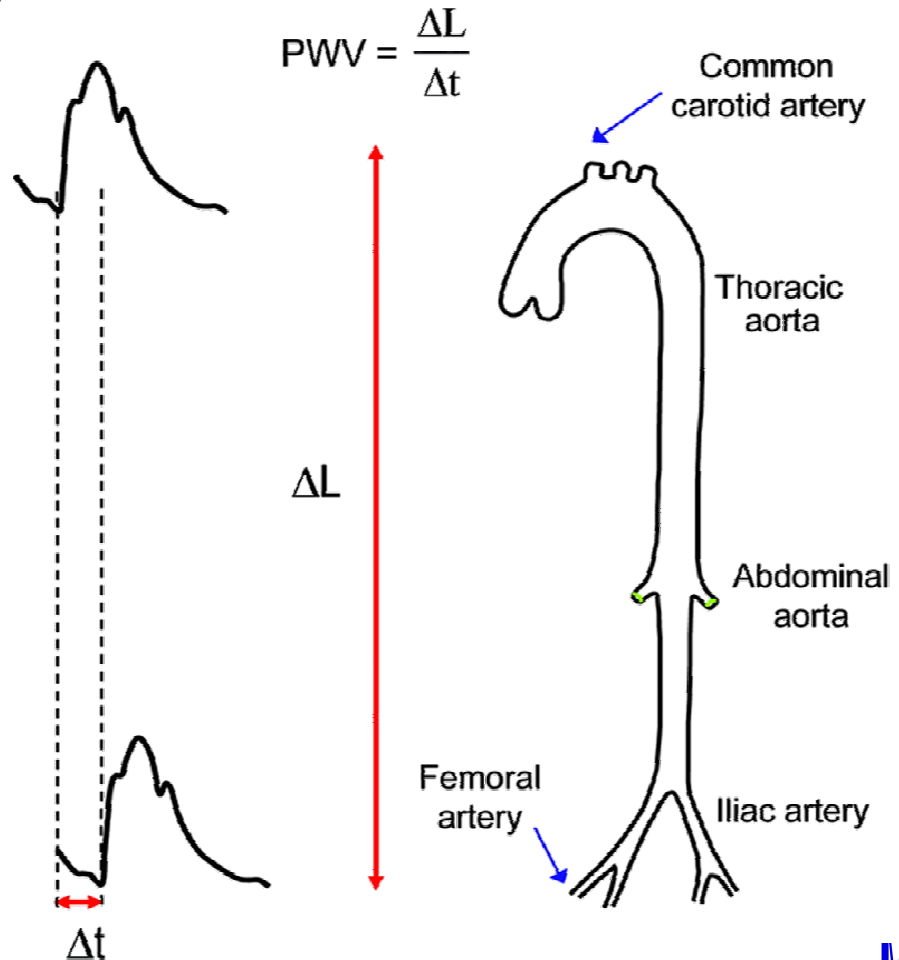
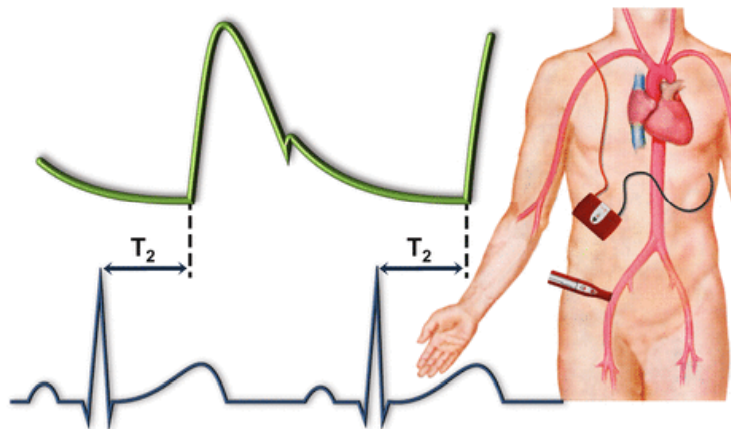
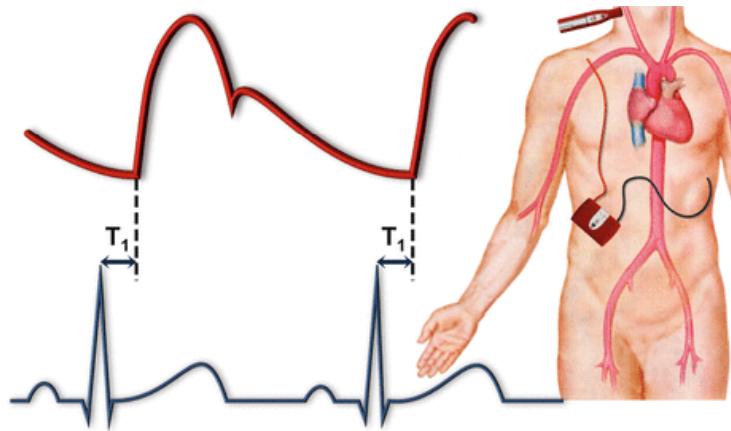
age		IMT <sub>R</sub> (mm)	IMT <sub>L</sub> (mm)
25-35	Mean	0.39±0.07	0.40±0.07
	V%	18.26	17.37
	CI	0.36<x<0.42	0.38<x<0.42
35-45	Mean	0.43±0.07	0.46±0.09
	V%	15.15	18.59
	CI	0.41<x<0.45	0.43<x<0.49
45-55	Mean	0.47±0.08	0.50±0.11
	V%	17.49	21.18
	CI	0.44<x<0.50	0.47<x<0.54
55-65	Mean	0.52±0.11	0.54±0.11
	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

# Sonografie ( $\beta$ – index).

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



# Rychlost Pulzové Vlny



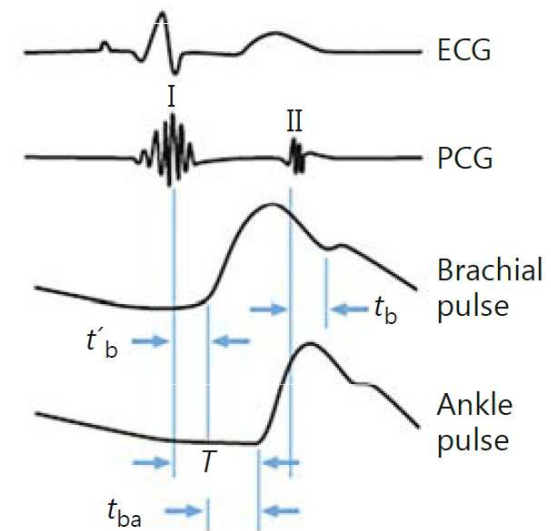
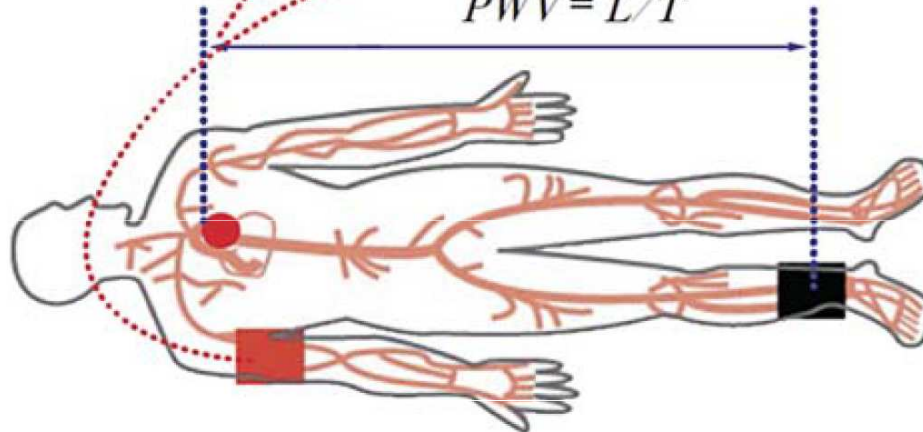
$$PWV = \frac{\Delta L}{\Delta t}$$

Vysoce poddajná aorta má relativně nízkou RPV (<6 m/s)

# CAVI měření

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

$PWV = L/T$



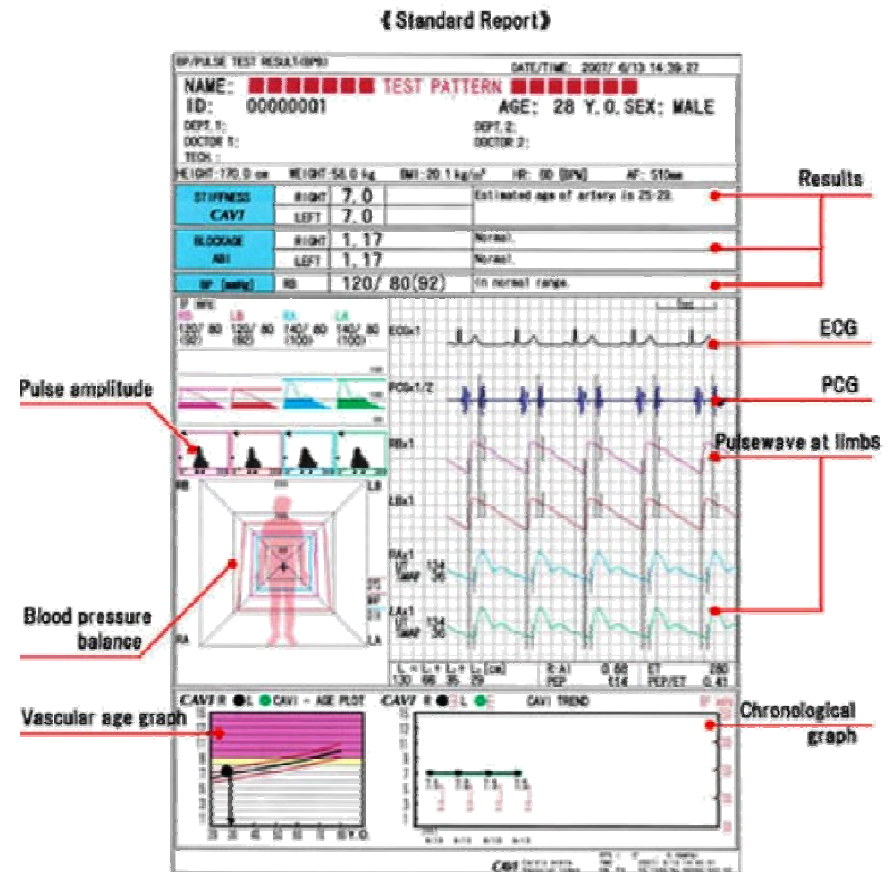
## ● Reference value of CAVI

CAVI < 8.0	Normal range
$8.0 \leq CAVI < 9.0$	Borderline
$9.0 \leq CAVI$	Arteriosclerosis suspected

# CAVI měření



14 Physiology department



# Děkuji za pozornost



