

# Measurement of pulse wave velocity (XII.)

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DEP. OF PHYSIOLOGY, FAC. OF MEDICINE, MU, 2015 © JANA HRUŠKOVÁ

# Definition of pulse wave

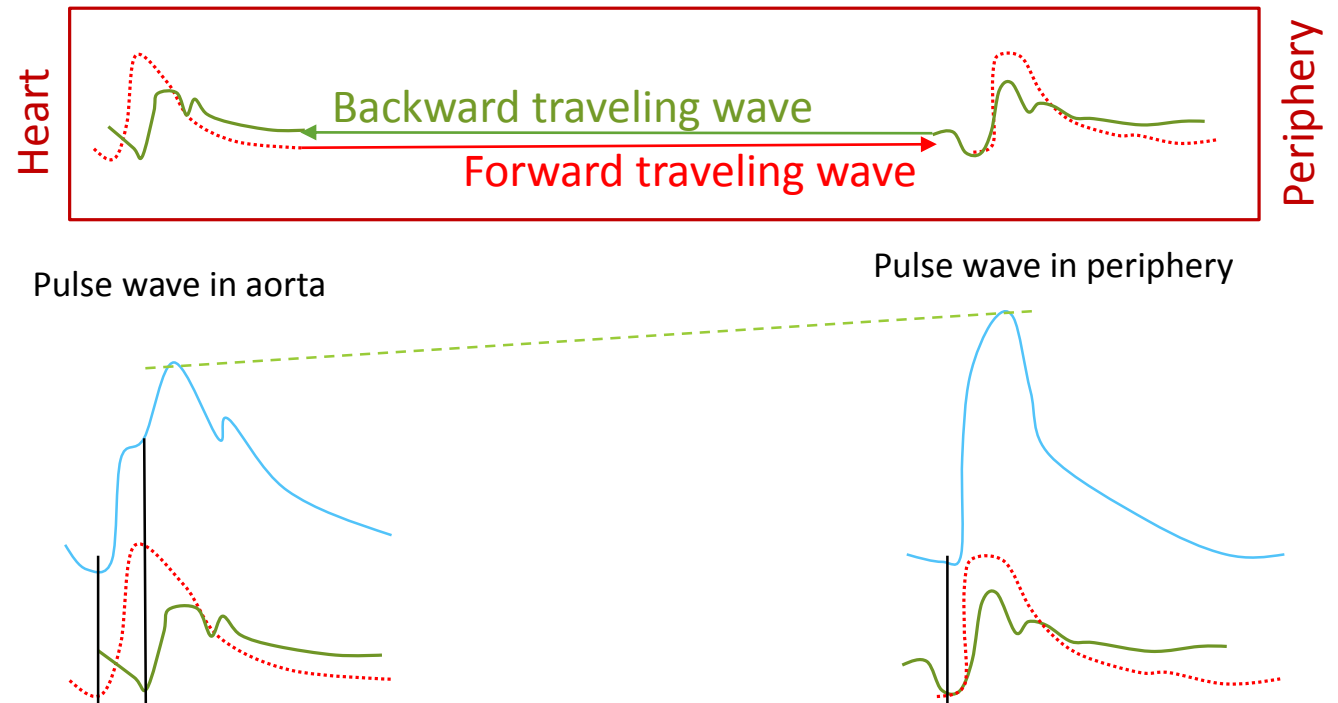
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- Pulse wave arises during heart revolution, when blood is ejected.
- Single pulse is propagated in arterial wall through the whole arterial system

# Pulse wave curve

Pulse wave is composed of two waves: forward traveling wave and backward traveling wave. Forward wave travels from the heart to periphery. Backward wave is rebounded from bifurcations of arteries in periphery. It travels to the heart, interferes with forward wave and both together form shape of the pulse wave curve.

Amplitude of pulse wave increases in periphery due to increased pulse wave velocity. The shape of the curve is depend on the place where it is measured. The smallest amplitude is common in radial artery, greatest one in dorsal pedis artery.



# Pulse wave velocity (PWV)

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- Velocity of pulse wave propagation varies from 6 m/s (in aorta) to 20 m/s (in periphery)
- It is much greater than velocity of blood flow (0.8 – 1.0 m/s)

# Factors affecting the pulse wave velocity

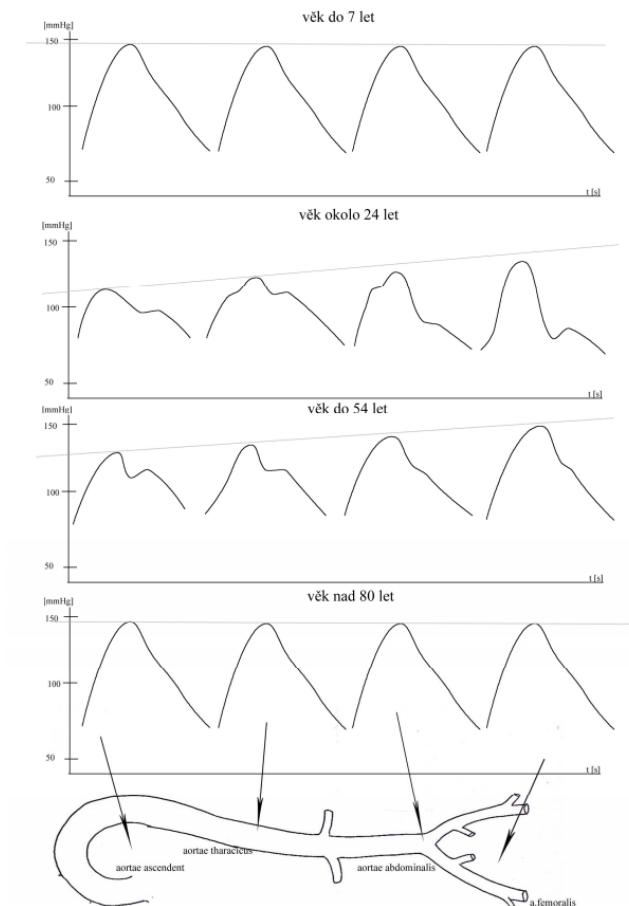
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- Age
- Sex
- Genetic load
  
- Blood pressure
- Smoking
- Obesity
- Diabetes
- Dyslipidaemia

# Changes of pulse wave in elderly people

Increased PWV and vanishing of typical characteristics of shape of the pulse wave due to:

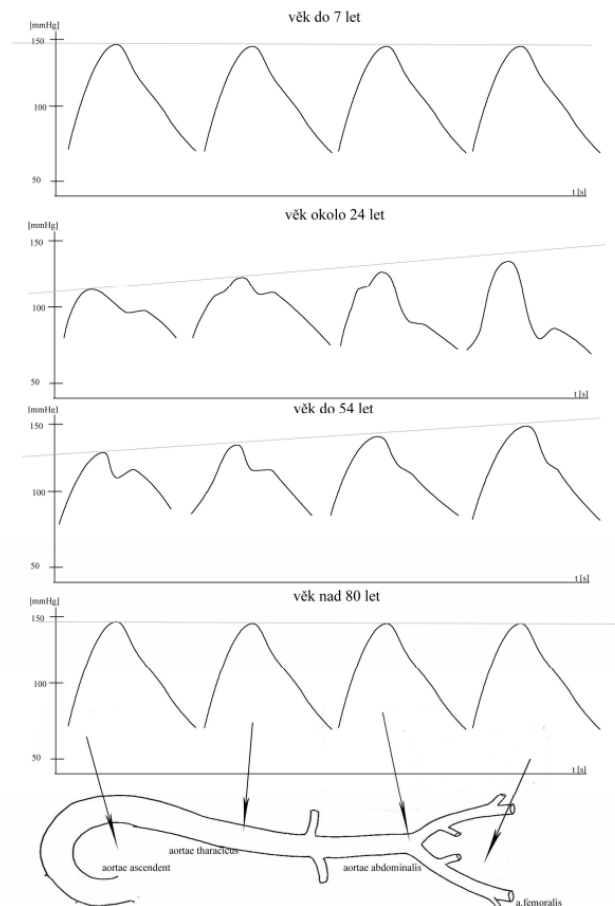
1. Increased arterial stiffness
2. Increased blood pressure



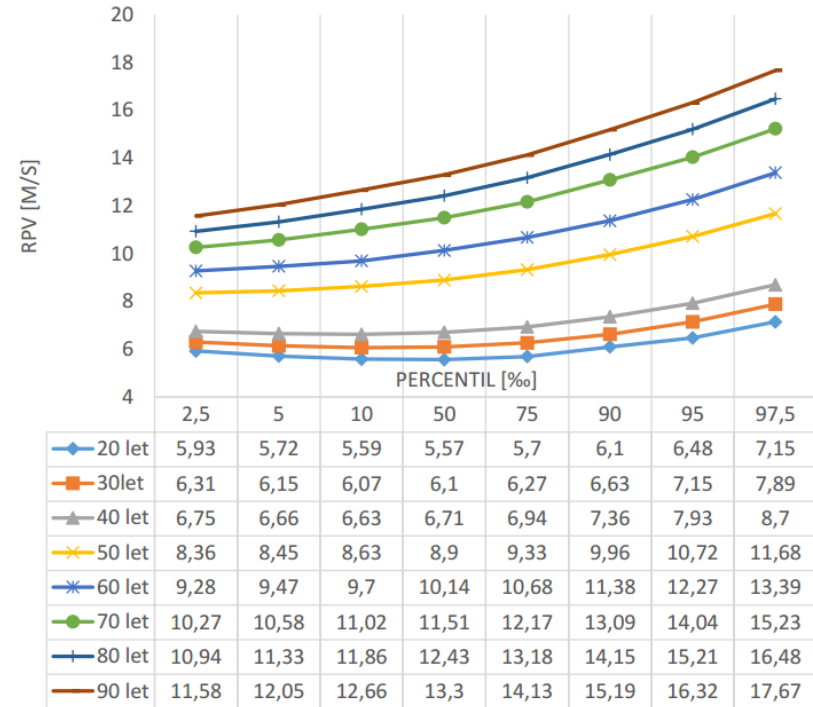
# Changes of pulse wave in children

Increased PVW and vanishing of typical characteristics of shape of the pulse wave due to:

1. Smaller length of arterial system
2. Longer ejection time
  - Relatively long ejection time to small body and higher heart rate leads to changes of summation of consecutive pulse waves



# Normal values of PWV



Reference intervals for carotid-femoral index (PWV)

If the measured value is higher than 90. percentile for the age, it is the sign of cardiovascular pathology (such as atherosclerosis) and such person has significant higher risk for cardiovascular diseases.



# Measurement of PWV

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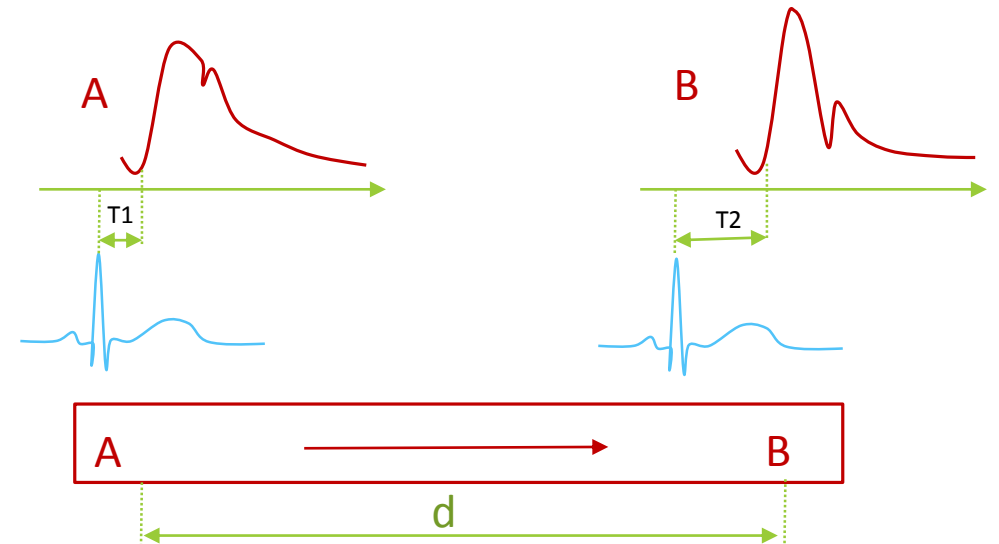
1. Direct method
  - Catheterisation
2. Indirect methods
  - Ultrasonography
  - Sphygmography
  - Bioimpedance analysis

# Sphygmography

For estimation of PWV, it is necessary to record pulse wave in two different places (on two arteries) and ECG simultaneously.

The carotid-femoral index – the PWV estimated between carotid and femoral artery – is a marker of aortic stiffness.

It is important to take in consideration values of blood pressure. Higher blood pressure increased arterial stiffness and therefore PWV is also increased.



$$PWV = d / (T2 - T1)$$

T (T1, T2) – transition time – time from peak of R on ECG and beginning of pulse wave

d – distance between registration points