

# Measurement of pulse wave velocity (XII.)

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# Definition of pulse wave

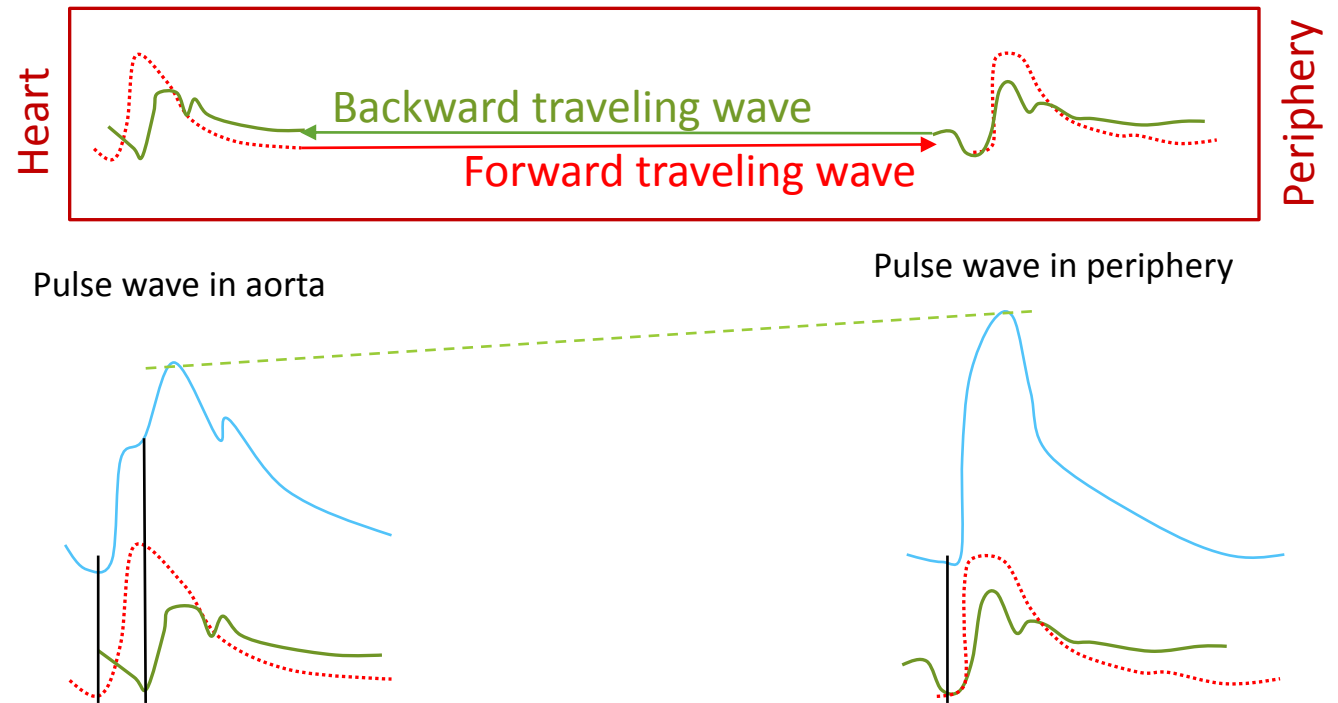
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- Pulse wave arises during heart revolution, when blood is ejected.
- Single pulse is propagated in arterial wall through whole arterial system

# 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 affected the pulse wave velocity

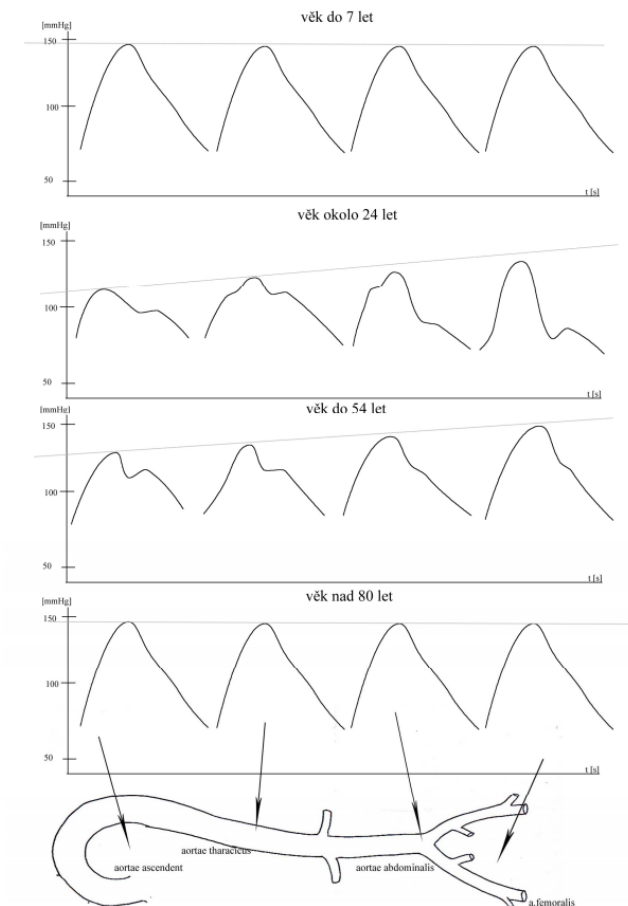
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- Age
- Sex
- Genetic load
  
- Smoking
- Obesity
- Diabetes
- Dyslipidaemia

# Changes of pulse wave in elderly people

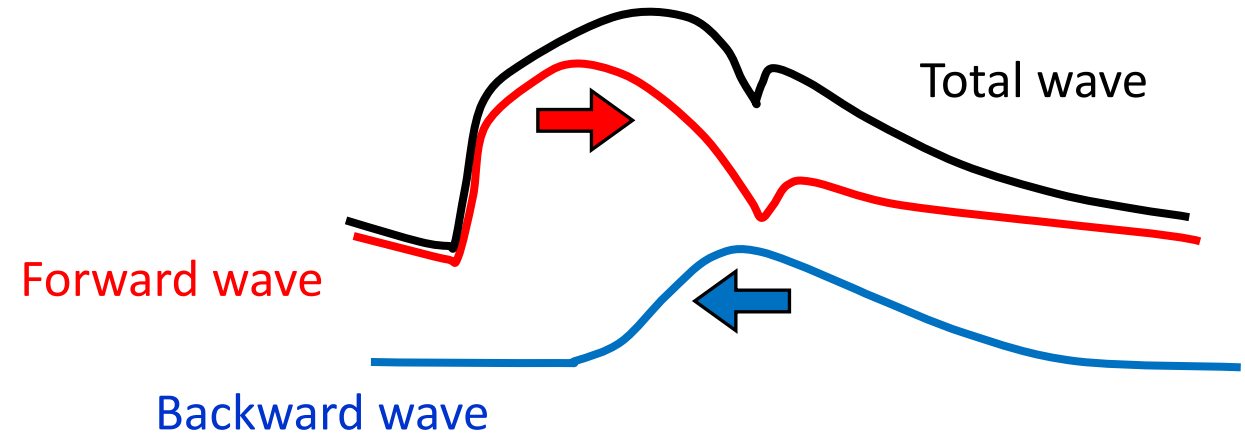
Increased PWV and vanishing of typical characteristics of shape of the pulse wave due to:

1. Increased arterial stiffness
2. Increased blood pressure



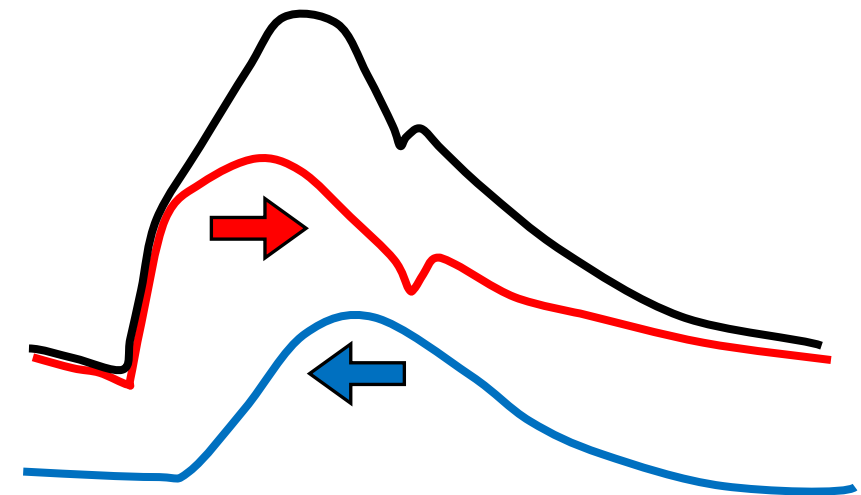
**Young man:**

High arterial compliance → lower pulse wave velocity  
→ backward wave meets forward wave during the beginning of diastole → lower pulse amplitude



**Elder man:**

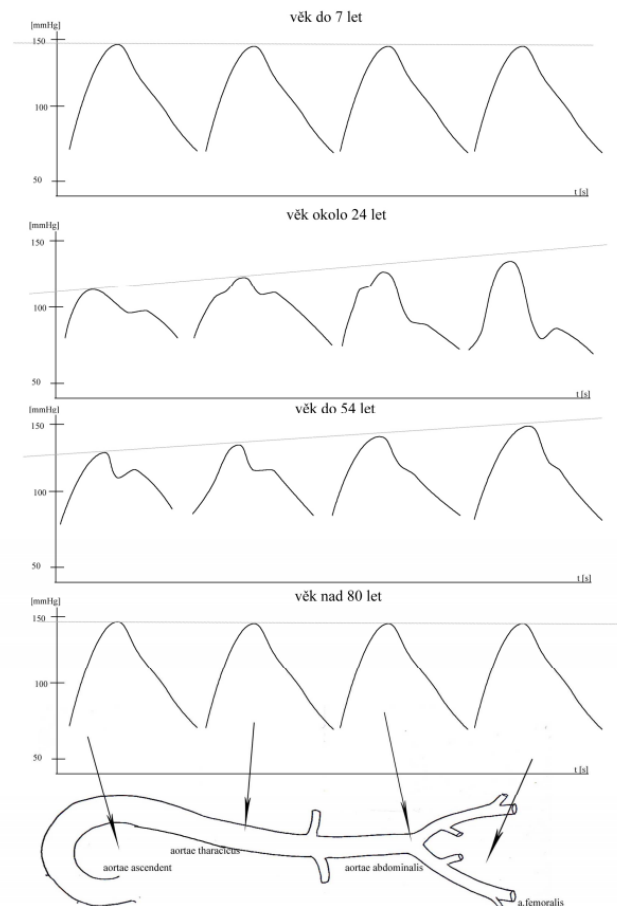
decreased arterial compliance → increased pulse wave velocity  
→ backward wave meets forward wave during the end of systole → increased pulse amplitude



# Changes of pulse wave in children

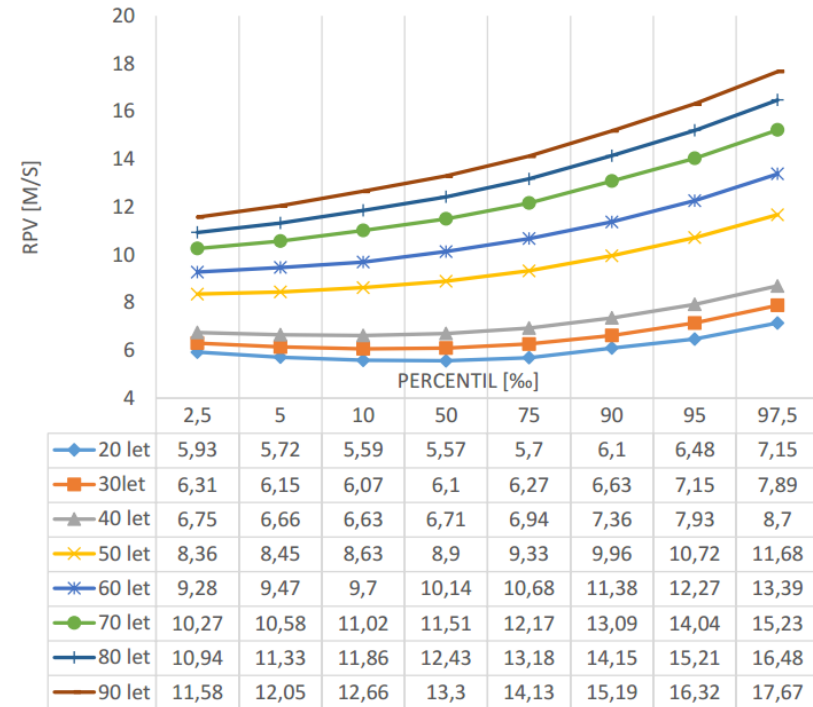
Increased PVW and vanishing of typical characteristics of shape of the pulse wave due to:

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 ( see textbook Physiology and neuroscience practicals, 2013, pg. 48-50)

- Carotid-femoral PWV („gold standard“) measured from pulse on a. carotis, a. femoralis and ECG.
- Well reproducible method (differences between two measurement are < 5 %),
- Arterial segment is analysed as complexly
- In clinical practise, it is important to take in consideration the actual blood pressure. Arterial compliance is a function of blood pressure and arterial hypertension increases rigidity of the arterial wall.
- Aortal PWV is the most important parameter, because it reflects dampening function of the central arterial system.

