Bidirectional information transfer between blood pressure and heart rate and its relation to vascular properties in hypertensive patients

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9th meeting of

European Study Group on Cardiovascular Oscillations

Background:

Hypertension:

- around 30–45% of the general population
- a steep increase with ageing

Hypertension:
leading cause of premature death

Background:

Hypertension guidelines

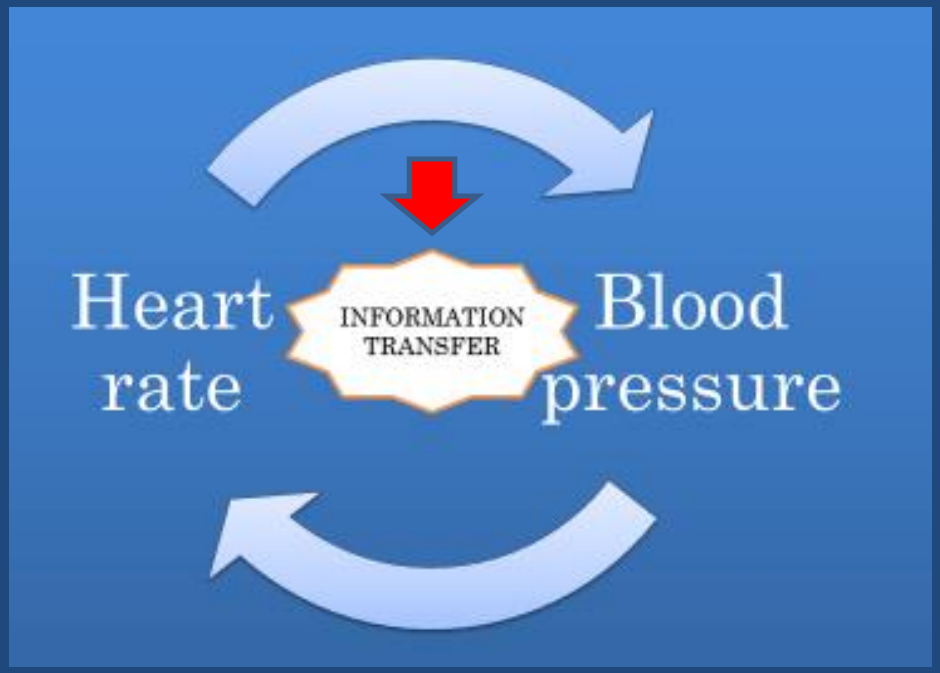
- Blood pressure values
- Complex approach

Patients with cardiovascular diseases:

cardiovascular regulation is often altered which might negatively impact the prognosis.

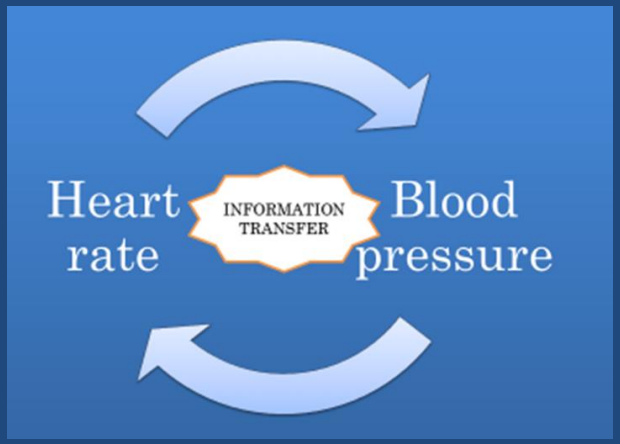
Background:

The impact of heart rate (HR) on blood pressure (BP) and the influence of blood pressure on heart rate are mediated by distinct mechanisms.



The aim of the study

1) to check if hypertension is related to alterations of interactions between HR and BP to check what are most important cardiovascular factors which are related to values of STE
2) to test if blood pressure values and vascular properties are associated with the above relation



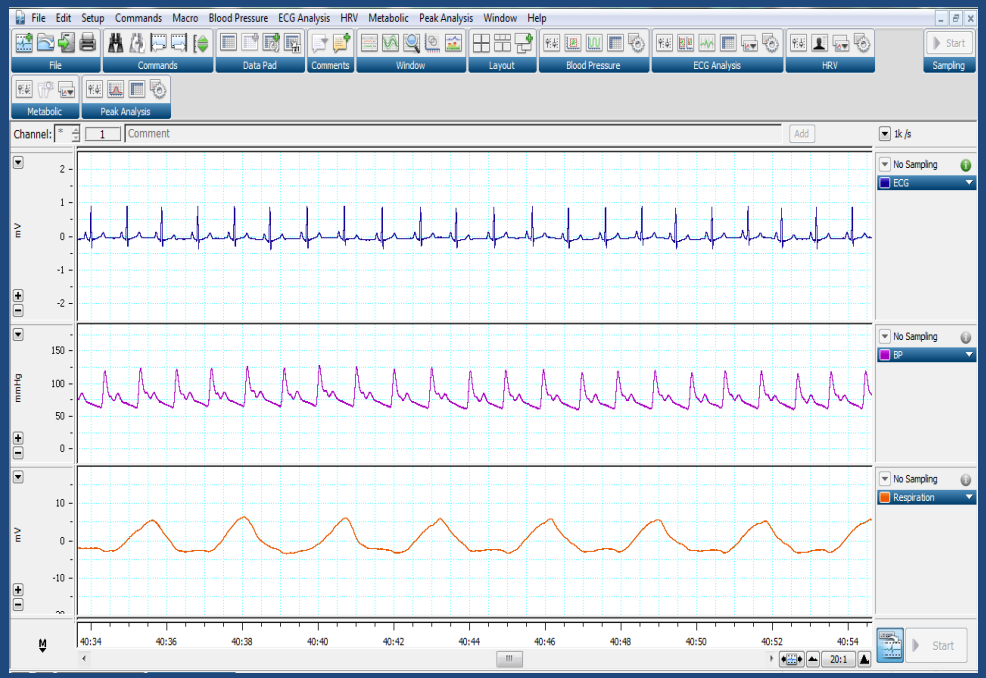
METHODS

- 24 healthy individuals (CON):

  14 men, age 43,4 ± 13,7 years

- 46 patients with hypertension (HTN):

  28 men, age 52,1 ± 13,9 years



20-MIN RECORDINGS
resting – supine position

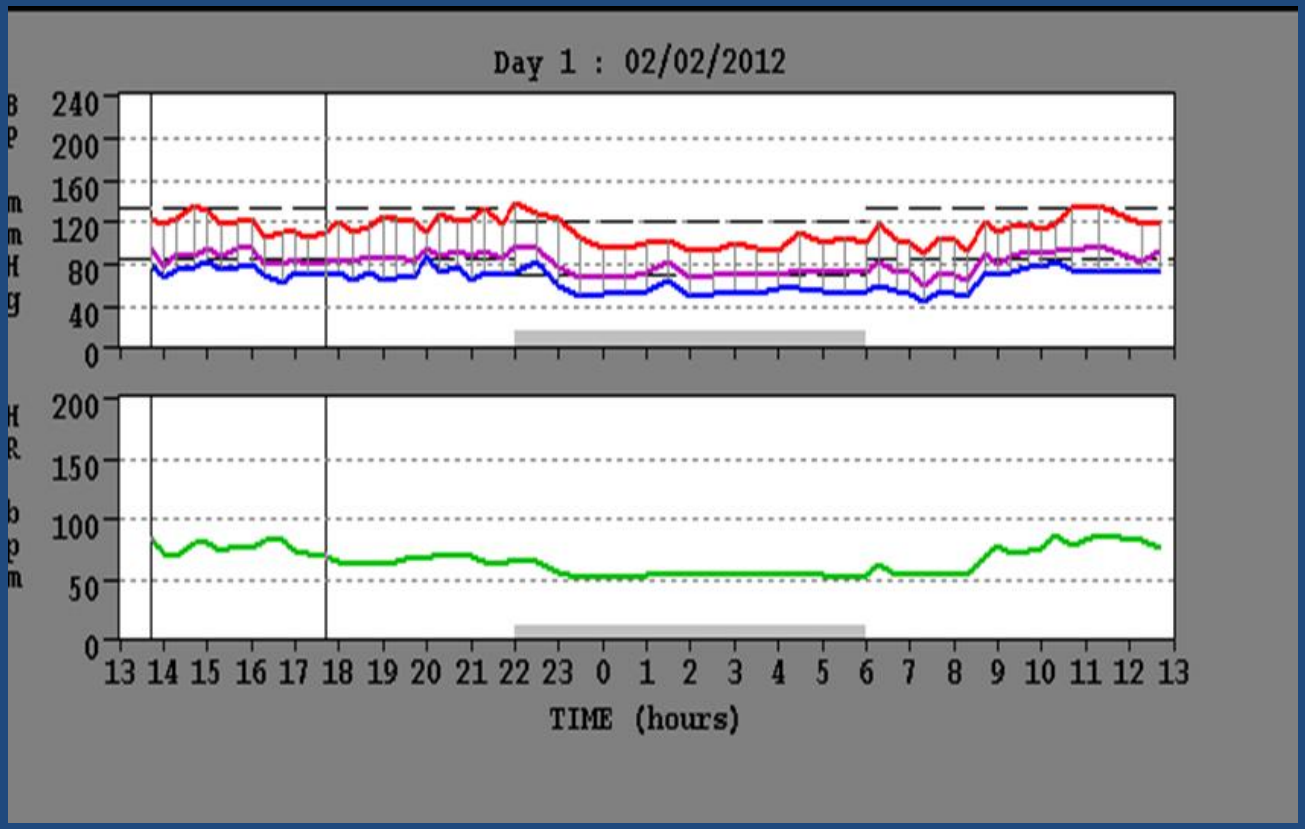
heart rate,
blood pressure

Symbolic Transfer Entropy (STE)

PowerLab *(ADInstruments)*, Finometer

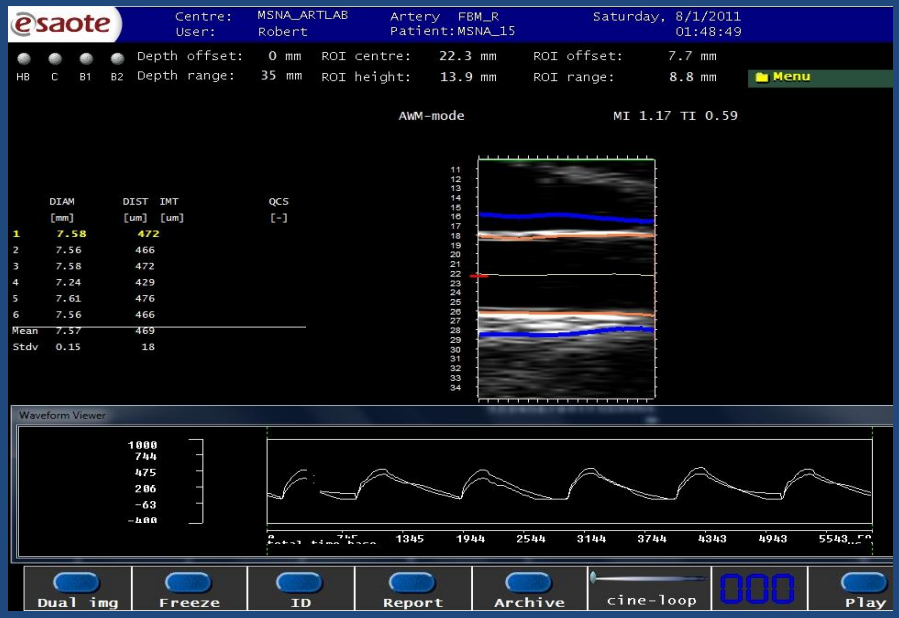
Methods

- blood pressure measurement:
- office blood pressure (OSBP, Omron),
- ambulatory blood pressure measurement (ABPM, Spacelab 90207)



METHODS

- Carotid artery wall properties

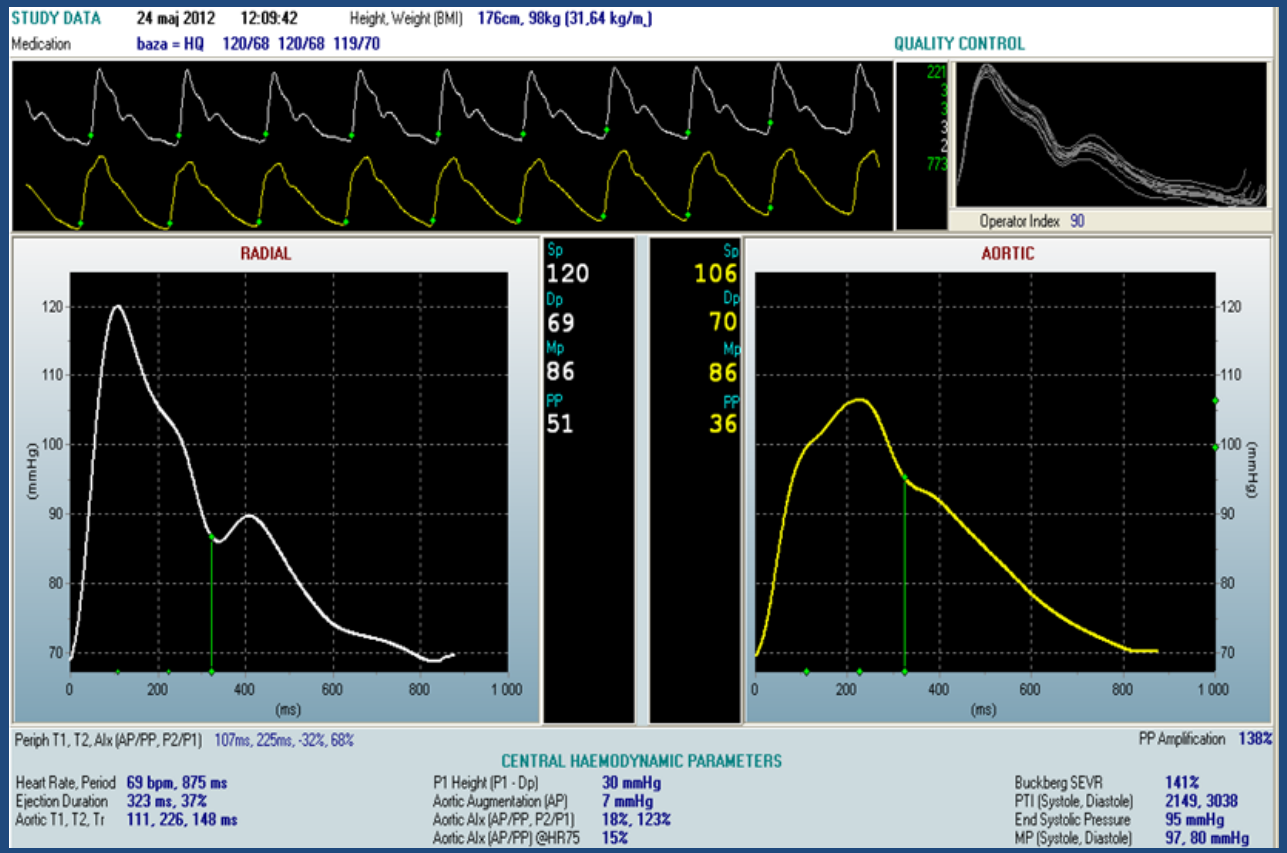


ArtLab System *(Esaote)*

- common carotid artery diameter
- intima-media thickness (IMT)
- wall distensibility (Dist)

METHODS

- carotid-femoral pulse wave velocity



SphygmoCor *(AtCor Medical)*

Results (1):

- In hypertensive subjects (vs healthy):
- lower values of STE in both directions

  RR→BP: 0,06±0,045 vs 0,09±0,041; P=0,0036

  BP→RR: 0,05±0,03 vs 0,07±0,04; P=0,0066

  HOWEVER: age significantly different

- When both groups were selected to match each other according to age
- 14 CON vs 33 HTN, aged 36-65 years
- STE differed only for the interaction directed RR→BP

Results (2): HTN vs CON

- Younger HTN patients (25-44 years)
  - ↓ transfer RR→BP (0,06±0,02 vs 0,1±0,05; P=0,045)

- Middle-aged HTN patients (45-64 years)
  - ↓ transfer BP→RR (0,04±0,02 vs 0,07±0,04; P=0,006)
  - ↓ transfer RR→BP (0,05±0,04 vs 0,09±0,06; P=0,032)

Results (3)

- In hypertensive patients:

STE BP→RR correlated with

- age (R= -0.3; P=0.041)
- arterial distensibility (R= 0.45; P=0.04)
- carotid-femoral pulse wave velocity (R= -0.49; P=0.01)

STE RR→BP

- no correlation with vascular parameters

Results (4)

- In hypertensive patients:

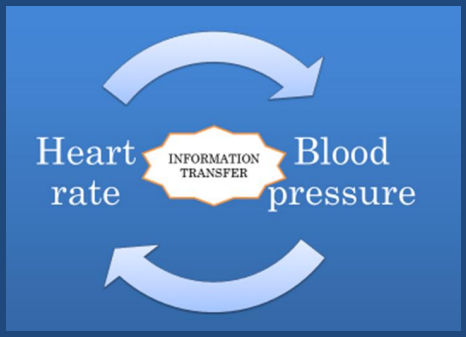
STE for the direction BP→RR correlated with

- SD of day-time systolic BP in ABPM (R= -0.44; P=0,002)
- SD of day-time diastolic BP in ABPM (R= -0.32; P=0.02)

STE in direction RR→BP correlated with

- SD of day-time systolic BP in ABPM (R= -0.33; P=0,027)
- SD of HR (24-hour and night-time) in ABPM (R= 0.37; P=0.01)

Conclusion



- In hypertensive patients bidirectional interaction between heart rate and blood pressure seems to be decreased, especially in middle-aged individuals
- In HTN patients age and vascular properties are related to the information transfer directed BP →HR
- Heart rate – blood pressure interaction is associated with blood pressure variability and heart rate variability and does not correlate with absolute values of blood pressure and heart rate.

Thank you

The study was supported
by the National Science Centre (Poland)
MAESTRO grant
(UMO-2011/02/A/NZ5/00329)
and
HARMONIA grant
(UMO-2012/06/M/ST2/00480)

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