IS HIGH ANKLE-BRACHIAL INDEX PREDICTOR OF INCREASED CARDIOVASCULAR RISK? THE CZECH POST-MONICA STUDY

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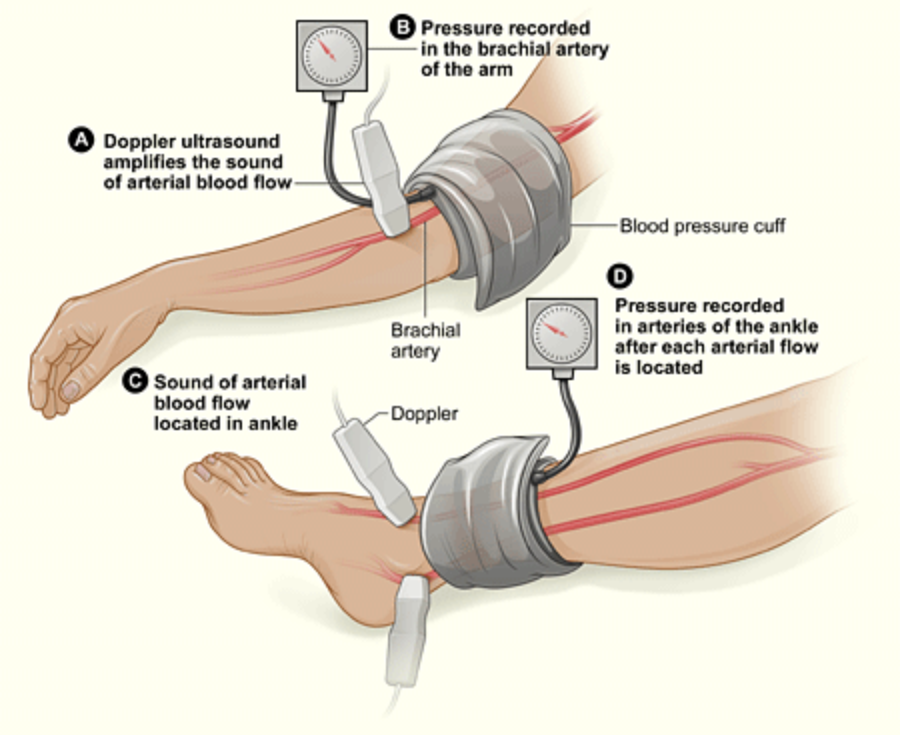
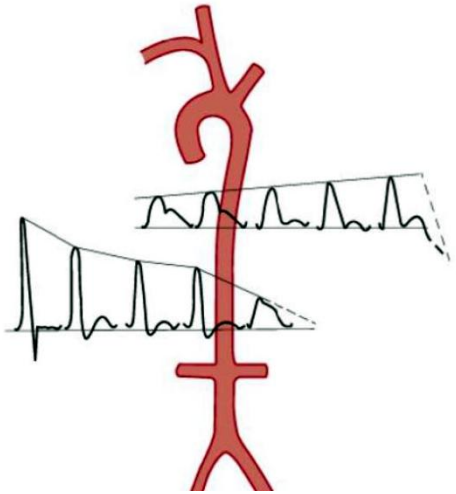
Ankle brachial index

ABI - the ratio of ankle pressure to brachial pressure





≤ 0.9	peripheral arterial disease
0.9-1.3	normal
≥ 1.4	medial arterial calcification

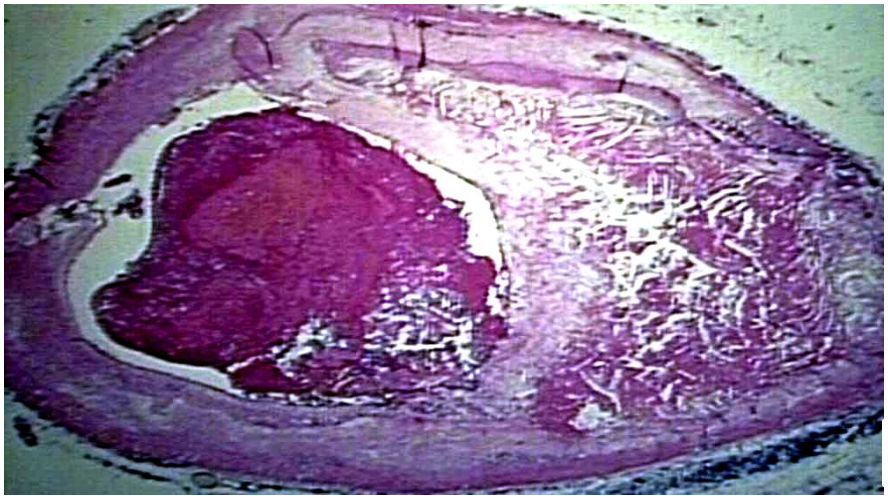
ABI ≤ 0.9

- 79–95% sensitivity and
- 96–100% specificity

in establishing PAD in lower extremities

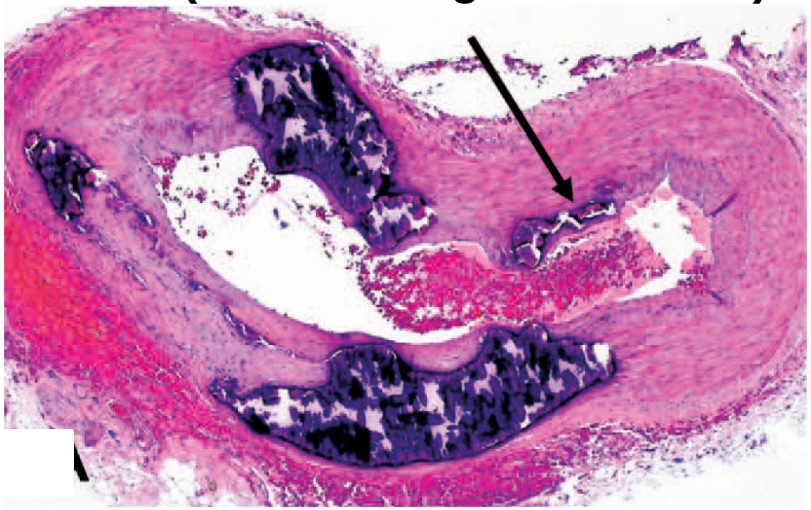
Atherosclerosis vs. Medial arterial calcification (MAC)

Atherosclerosis

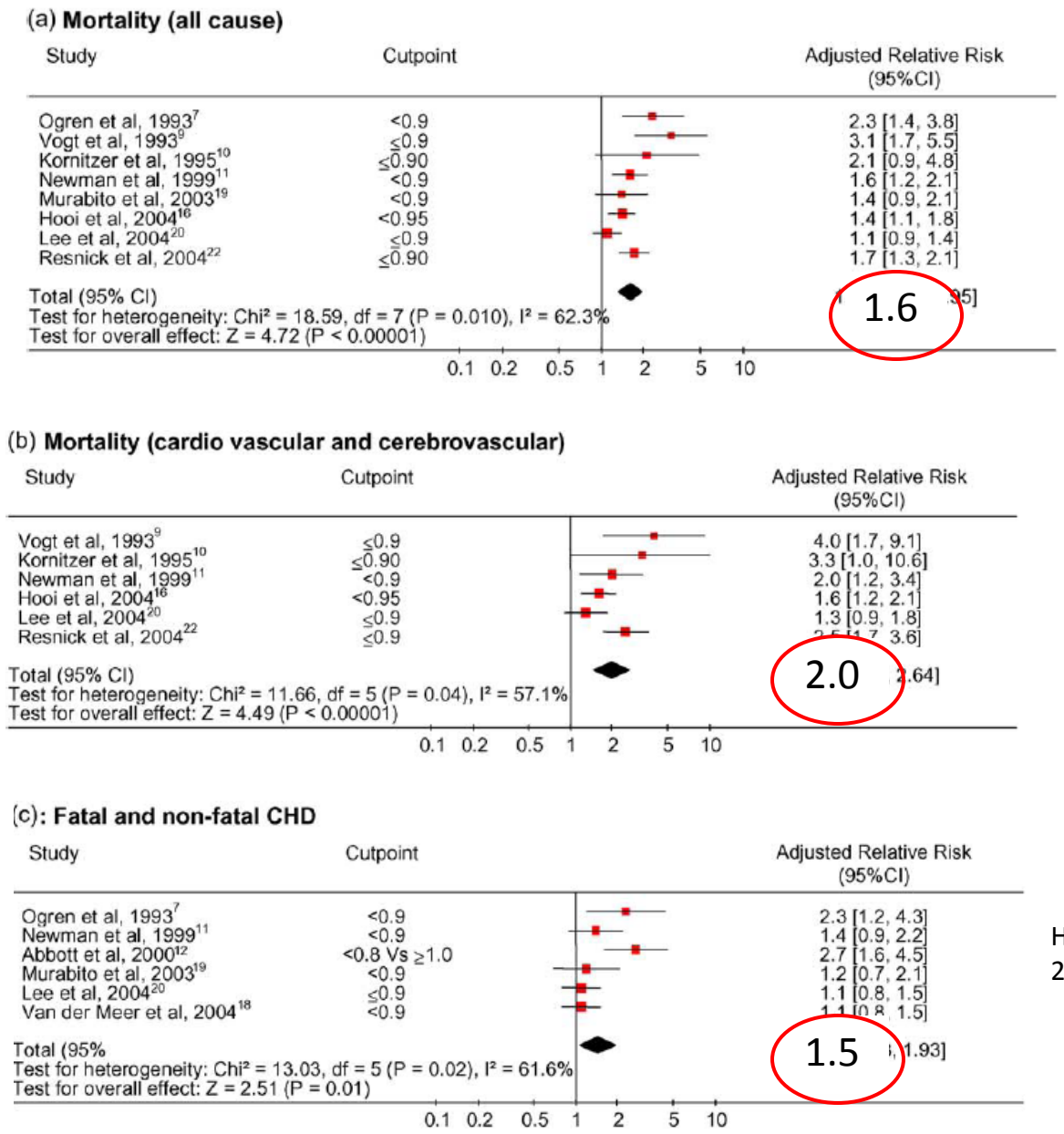


- starts in the intima layer
- lipid accumulation
- inflammation
- arterial occlusion

MAC (Monckeberg's sclerosis)



- localised in arterial media and internal elastic membrane of muscular arteries
- calcium accumulation
- noninflammatory
- increases arterial stiffness of muscular arteries
- does not cause luminal narrowing

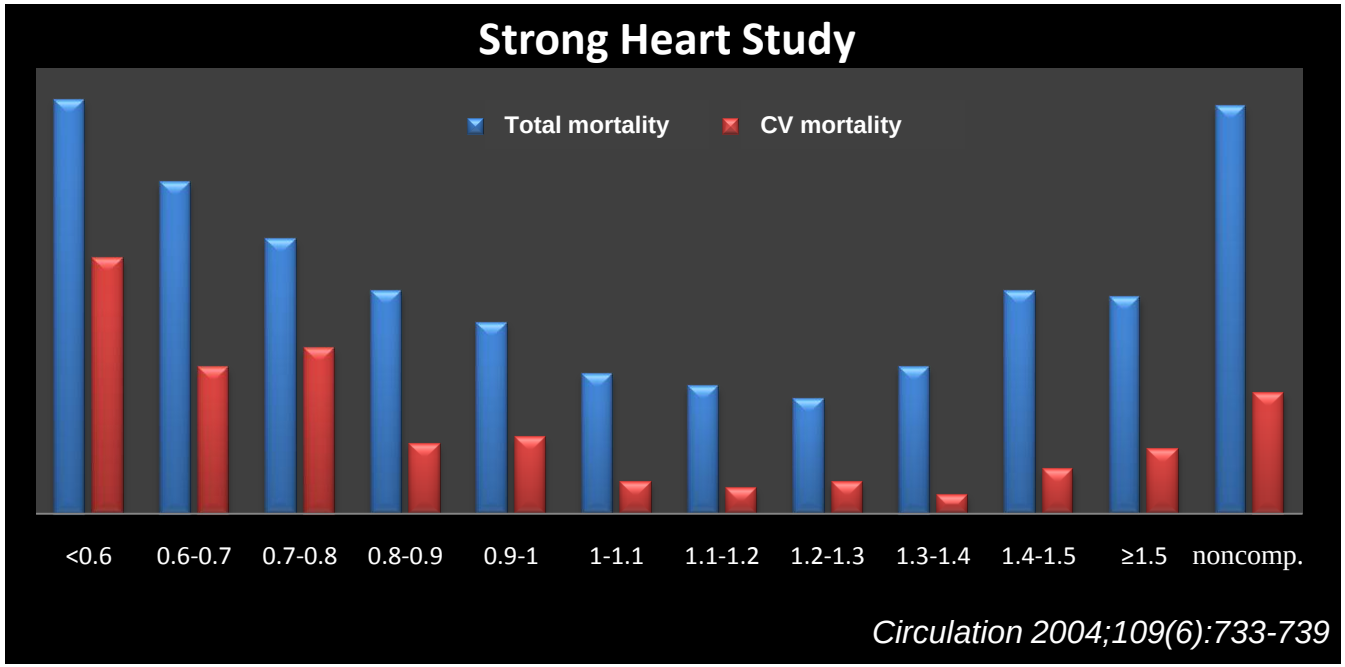


Heald CL , Atherosclerosis 2006; 189, 61–69

Fowkers, JAMA 2008: ABI improves the accuracy of CV risk prediction beyond the FRS

High ABI

- Most epidemiological studies excluded individuals with high ABI



- **Cardiovascular risk study**: high ABI was associated with 27% ⇧ risk of total and 76% ⇧ risk of CV mortality vs normal ABI

- **Atherosclerosis Risk in Community (ARIC)**
  no difference in 12-year CV morbidity rate between high and normal ABI groups

High ABI

- **Atherosclerosis and high ABI**

  PAD is highly prevalent in subjects with high ABI

  Aboyans J Vasc Surg 2008

- Is increased CV risk of high ABI individuals caused by co-existing atherosclerosis?

Hypothesis

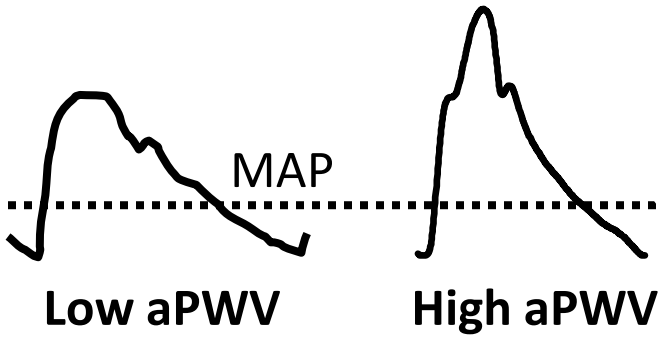
Medial arterial calcifications

In individuals with high ABI not only muscular arterial stiffness is increased, but also aortic stiffness.

Increased aortic stiffness in individuals with high ABI could be responsible for increased LV mass and increased mortality.

aPWV

- Parameter of aortic stiffness
- Independent predictive factor for all-cause and CV morbidity and mortality
- Increased aPWV:
  - ↑ central SBP → ↑ LVH
  - ↓ windkessel function of the aorta
  - ↓ coronary perfusion



Aim

To compare CV risk profile and aortic pulse wave velocity (aPWV) in individuals with

- low (ABI<1.0)
- normal (ABI 1.0-1.4)
- high ABI (ABI>1.4)

in a random population sample

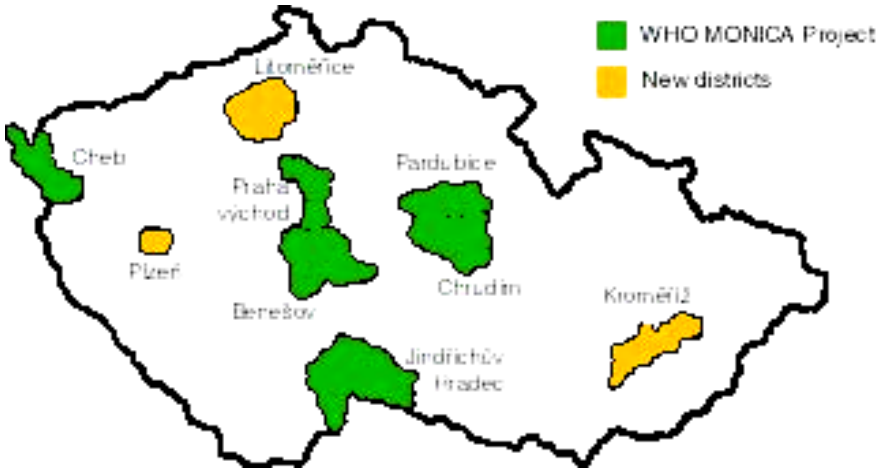
Methods
Population-Czech post-MONICA

MONICA: **MONI**toring of trends and determinants in **CA**rdiovascular disease

- 32 centres, 21 countries

Czech post-MONICA: 2006-2009

- 1% random population sample in 9 districts
- history, BP, echo, ABI, PWV, biochemistry + genetics

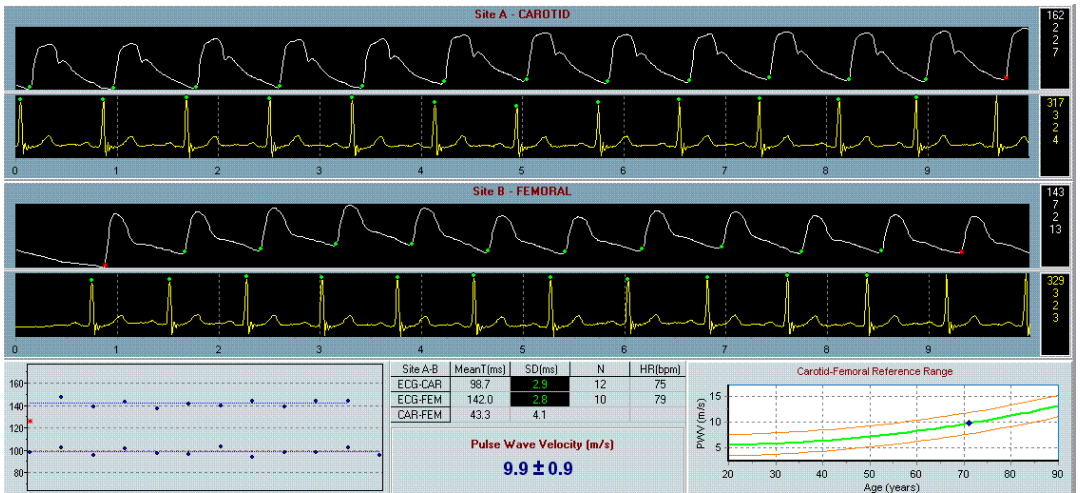


Methods

post-MONICA: 911 individuals from Pilsen district

ABI - Doppler (Dopplex multiTM, Huntleigh) with 8MHz probe and mercury sphygmomanometer (Baumanometer TM, W.A.Baum)

aPWV- Sphygmocor (AtCor Medical Ltd, Australia)



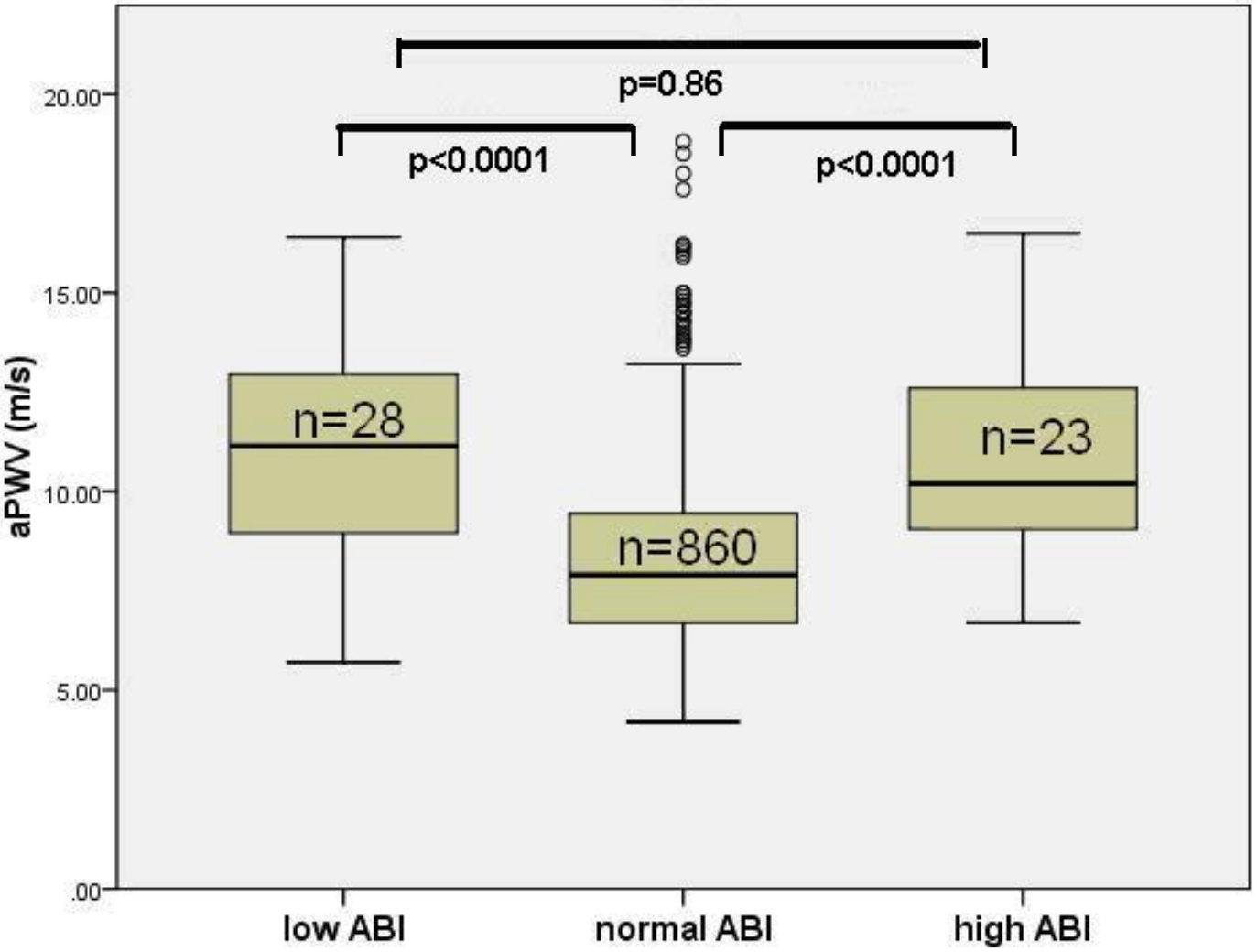
Population characteristics I

	Low ABI	Normal ABI	High ABI
Age (years)	63.29±9.24***	53.45±13.54	62.74±7.82**
Cholesterol (mmol/l)	4.99±1.0	5.17±1.02	5.03±0.99
Triglycerides (mmol/l)	1.64±0.73	1.5±1.05	1.65±0.83
Glycemia (mmol/l)	6.33±1.99**	5.32±1.05	6.74±3.28*
Height (cm)	167.39±8.17	170.63±9.25	174.04±7.55
Weight (kg)	86.57±14.39*	80.15±16.49	90.57±10.69*
Systolic BP (mmHg)	138.85±16.92***	127.08±16.95	138.55±17.56**
Diastolic BP (mmHg)	67.77±11.94	69.48±10.78	71.77±10.87

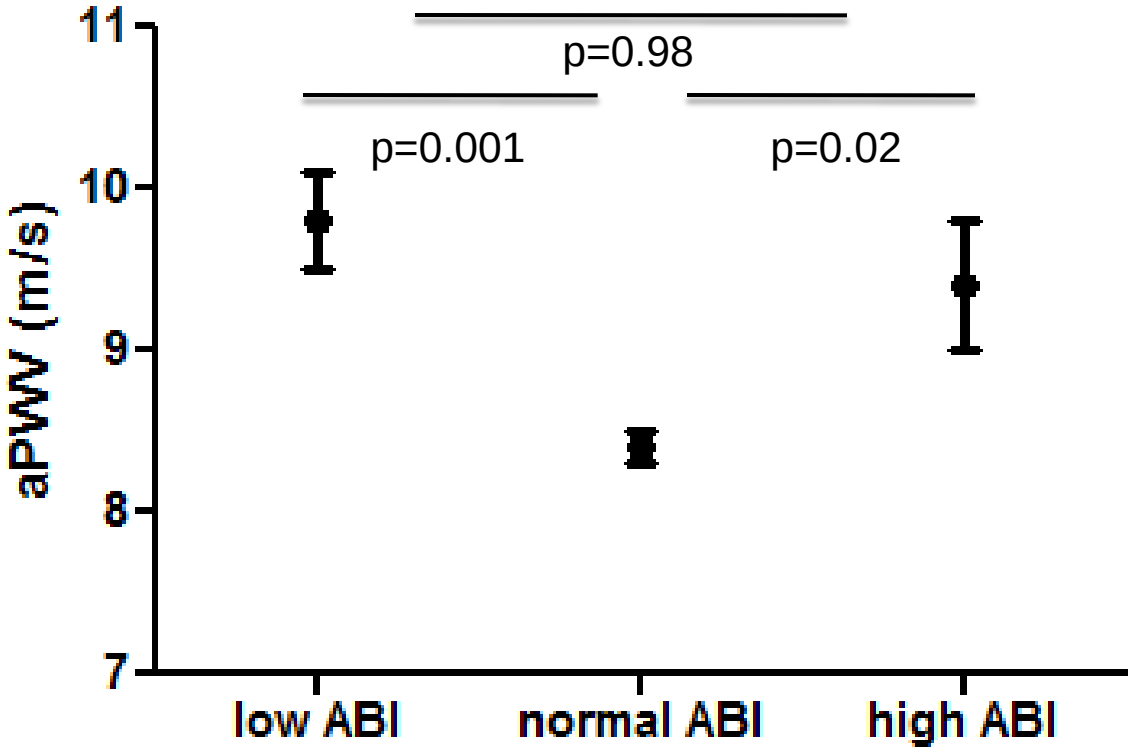
Population characteristics II

	Low ABI	Normal ABI	High ABI
CHD	7 (25%)**	38 (4.4%)	1 (4.3%)
Stroke or TIA	1 (3.6%)	18 (2.1%)	1 (4.3%)
DVT	2 (7.1%)	38 (4.4%)	5 (21.7%)*
HT	22 (78.6%)**	380 (44.5%)	16 (69.6%)*
DM	11 (39.3%)***	53 (6.2%)	6 (26.1%)**
HLP	26 (92.6%)	598 (70%)	16 (69.6%)
Sex (male)	16 (57.1%)	393 (45.8%)	20 (87%)**

Aortic PWV by ABI groups



Adj. aortic PWV by ABI groups



adjusted for age, sex, systolic, diastolic, mean blood pressure and examiner

Parameters independently associated with high ABI in logistic regression analysis

	B	OR (95%CI)	S.E.	Wald	p
Glucose level	0.33	1.39 (1.05-1.86)	0.14	5.45	0.02
aPWV (m/s)	0.31	1.36 (1.16-1.64)	0.09	12.29	0.001
Sex (male)	-2.02	7.52 (1.76-36.9)	0.77	6.87	0.009
DVT	1.61	0.20 (0.05-0.77)	0.70	5.25	0.022
Age (years)	0.55	1.73 (0.78-3.82)	0.41	1.82	0.18
Weight (cm)	0.32	1.38 (0.48-3.98)	0.54	0.35	0.55
Waist (cm)	-0.07	0.94 (0.29-3.02)	0.6	0.01	0.91
Systolic BP (mmHg)	0.04	1.18 (0.79-1.76)	0.2	0.68	0.41

r^2= 0.2, $p<0.001$, DVT - history of deep venous thrombosis, S.E.- standard error

Conclusion I

- In a random population sample, the prevalence of high ABI (2.8%) was similar to the prevalence of low ABI (3.1%)
- Individuals with high ABI had a higher prevalence of hypertension, diabetes and obesity compared with normal ABI individuals
- 26% of patients with high ABI had diabetes

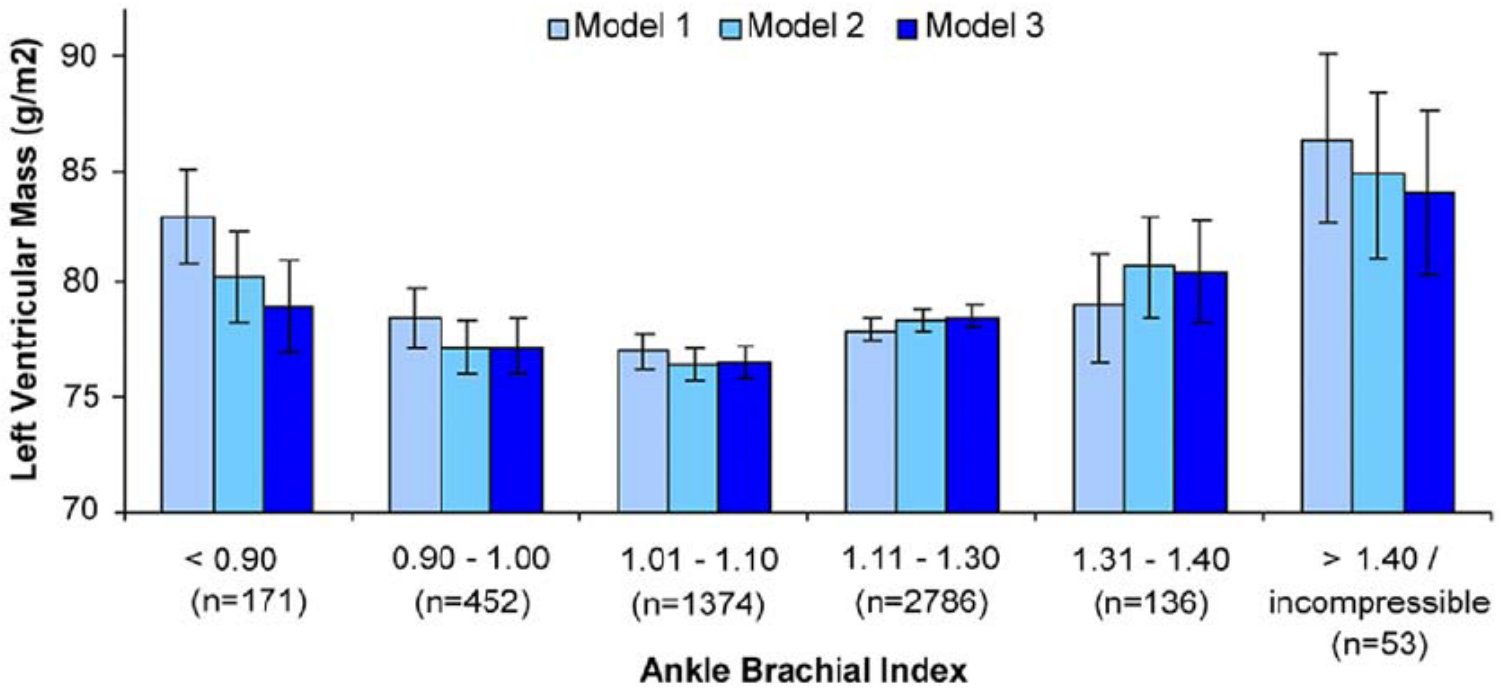
Conclusion II

- We have shown, for the first time, increased aPWV in individuals with high ABI that was similar to individuals with low ABI
- Worst CV risk profile and increased aPWV point to increased CV risk of individuals with high ABI

- Prof. Renata Cífková – *mentor*
- members of the Czech post-MONICA study team
- Internal Grant Agency of the Ministry of Health

Thank you for your attention

High ABI and LVH



Model 2: adjusted for HT, DM, smoking, SBP, cholesterol, CRP
Model 3: adjusted for 2, cIMT, coronary artery calcium

Increased LVM in individuals with high ABI is not caused by atherosclerosis

Ix JH, J Am Coll Cardiol 2010;55:342–9

Intra-observer variability aPWV