Association between arterial stiffness and cardiovascular risk factors in a pediatric population

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Background

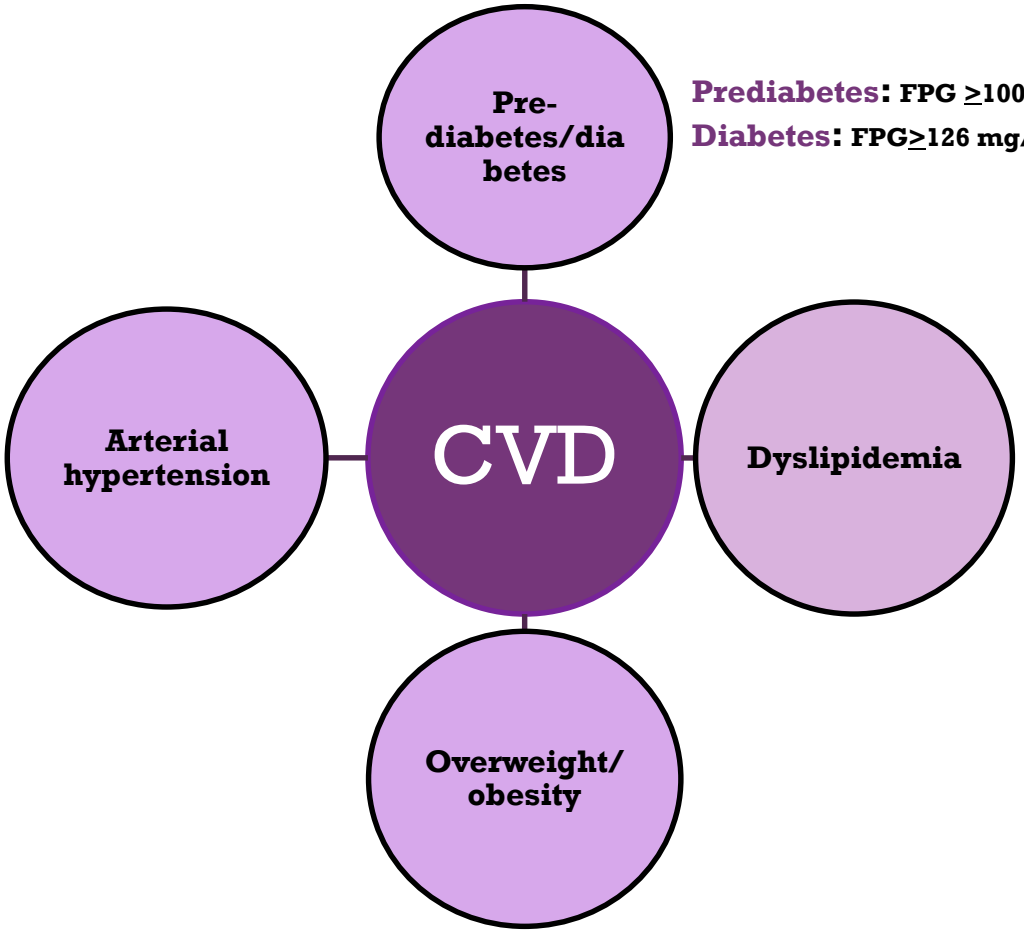
- CVD is a big health problem and one of the leading cause of morbidity and mortality worldwide
- Most of the clinical manifestations of CVD appears in adulthood, even if risk factors for CVD may appear in childhood and adolescence[1]
- CV risk factors (obesity, dyslipidemia, high blood pressure, etc) are significantly correlated with adults levels over long term follow-up[2,3]
- In particular, in the last 30 yrs, the worldwide prevalence of obesity in childhood registered a great increase[4]

[12]Freedman DS, et al. Pediatrics 1999;103:1175-1182

[3]Juhola J, et al. J Pediatr 2011;159:584-590

[4]Ebbeling CB, et al. Lancet 2000;360:473-482

Definitions and measurement of CV risk factors in children



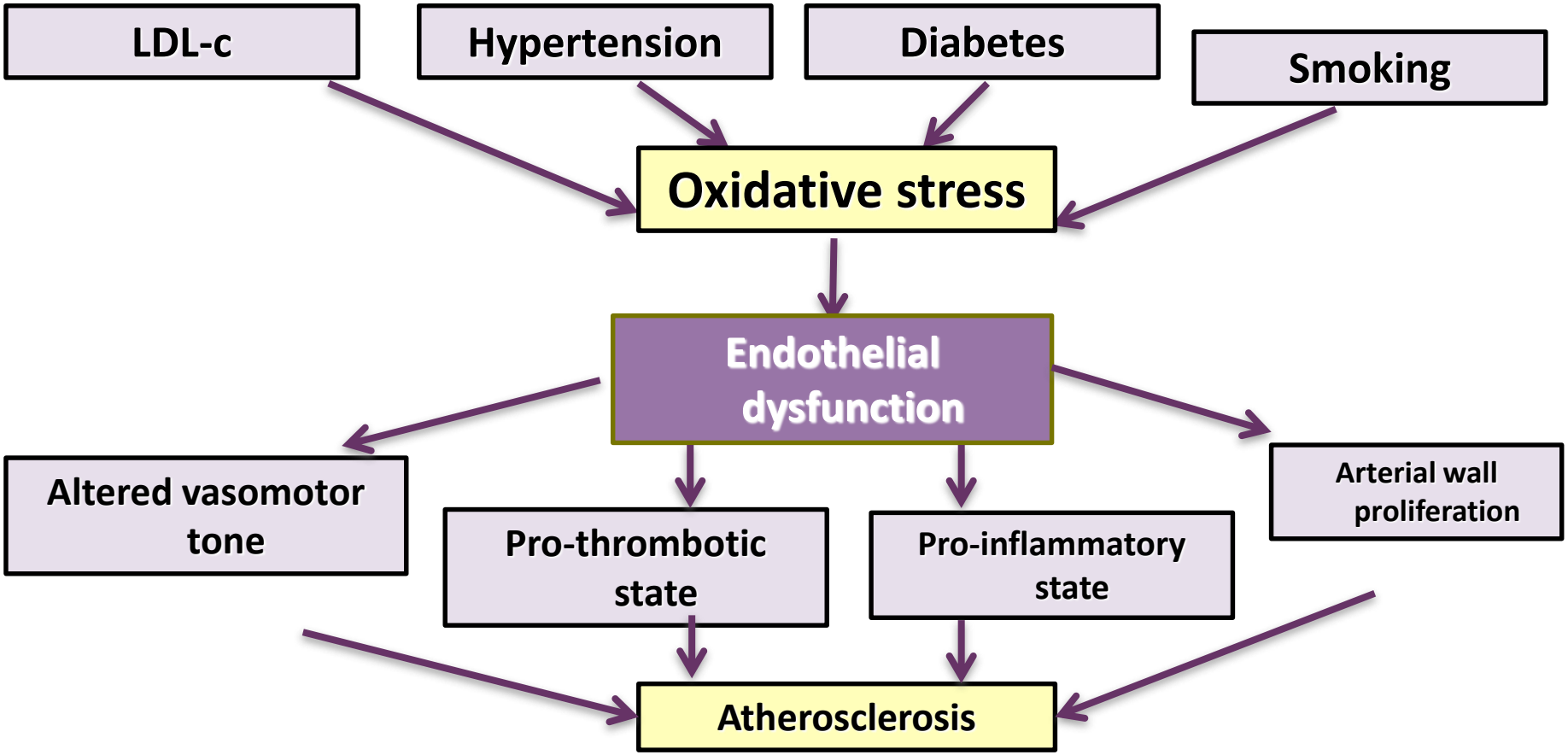
Prediabetes: FPG ≥100 mg/dL and <126 mg/dL
Diabetes: FPG≥126 mg/dL

Pre-hypertension:
BP ≥ 90° and < 95°
Hypertension:
BP ≥ 95 °

Hypercholesterolemia:
LDL≥160 mg/dL and/or HDL<40 mg/dL
Hypertriglyceridemia
Triglycerides≥200 mg/dL

Overweight: body weigth ≥ 85° and < 95°
Obesity: body weigth ≥ 95°

The endothelium



Arterial stiffness

- Arterial stiffness reflects the structural arterial wall modifications, characterizing vascular aging
- Abnormal arterial stiffness is an independent predictor for various adverse outcomes, including CVD, stroke, and renal disease.
- Arterial stiffness is associated with traditional CV risk factors and metabolic alterations including obesity, impaired glucose tolerance, and dyslipidemia
- It can be easily evaluated through pulse wave velocity (PWV) measurement

Aim of the study

To evaluate the possible relationship between PWV and different CV risk factors (obesity, arterial hypertension, dyslipidemia, diabetes, hyperuricemia) in a group of pediatric subjects

Materials and methods

- We enrolled 69 subjects (31 M and 38 F; mean age 10±4 yrs) with at least 1 CV risk factor referred to our Department for the study of vascular function
- The study was approved by the Local Ethic Committee and written informed consent was obtained from parents/legal tutors of the subjects
- All subjects underwent collection of their medical history, physical examination, routine blood tests, insulinemia and HOMA index to evaluate insulin resistance

Vascular assessment

- Intima-media thickness was evaluated in all subjects through an ultrasound technique using 17MHz probe
- Pulse wave velocity was evaluated by a validated system employing high-fidelity applanation tonometry

Results – Anthropometric and biochemical characteristics of the study population

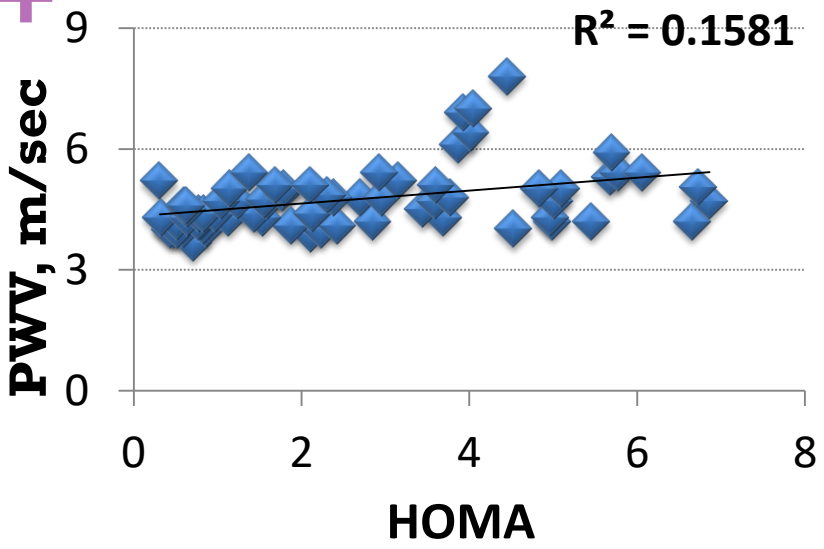
Variable	Study population (n=69)
Sex (*M/F*)	31/38
Age (*yrs*)	10.0±4.0
BMI (kg/m^2)	26.4±2.7
Total cholesterol (*mg/dL*)	170.4±39.0
HDL-cholesterol (*mg/dl*)	53.5±12.0
LDL-cholesterol (*mg/dl*)	98.7±31.1
Triglyceride	91.0±72.5
FPG (*mg/dl*)	84.9±8.8
Insulin (*mU/L*)	12.2±8.4
HOMA	2.62±1.89
hs-CRP (*mg/L*)	0.42±0.21
Uric acid (*mg/dl*)	4.2±1.2

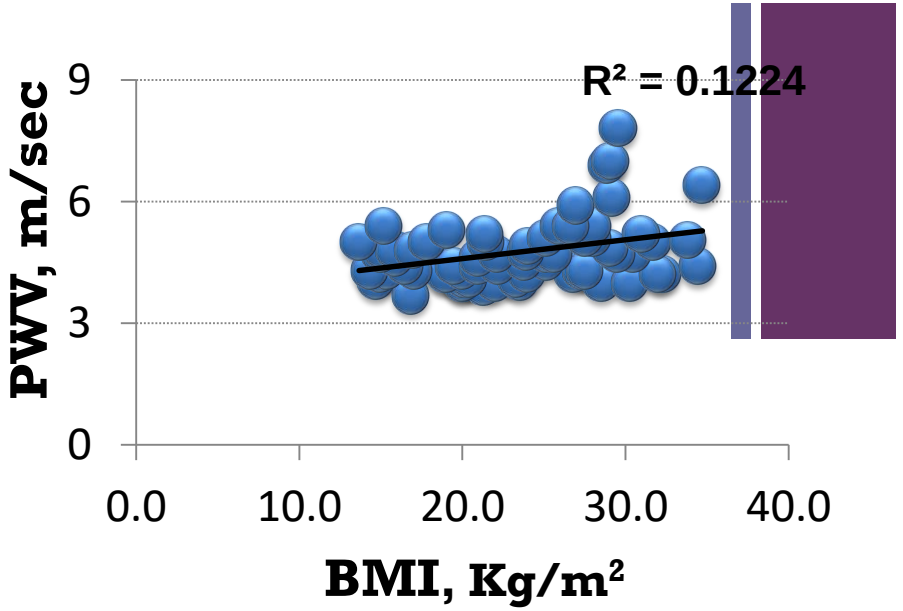
Results – Hemodynamic characteristics of the study population

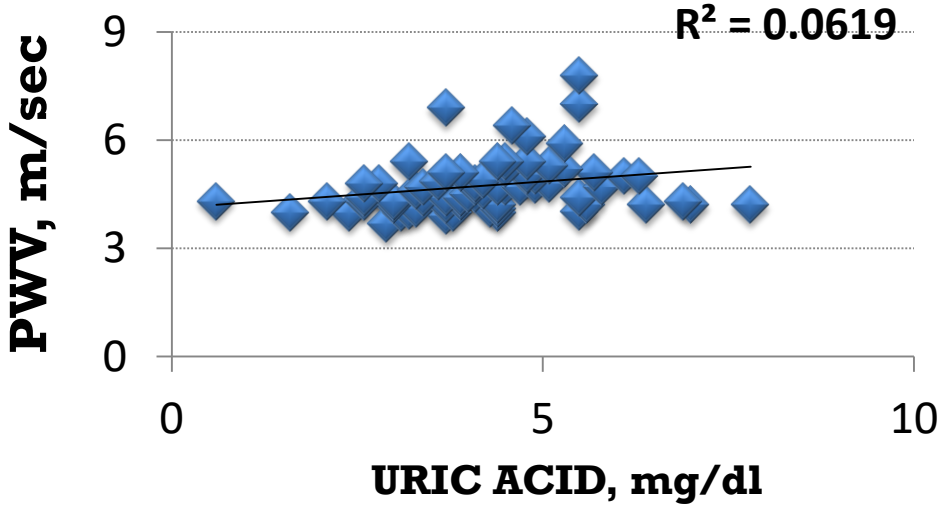
Variable	Study population (n=69)
SBP (*mmHg*)	112.4±12.8
DBP (*mmHg*)	68.1±9.5
PP(*mmHg*)	43.6±9.2
c-SBP (*mmHg*)	101.1±13.5
c-DBP (*mmHg*)	70.6±9.6
c-PP (*mmHg*)	30.5±11.4
PWV (*m/s*)	4.8±0.8
AIx (%)	5.76±7.54

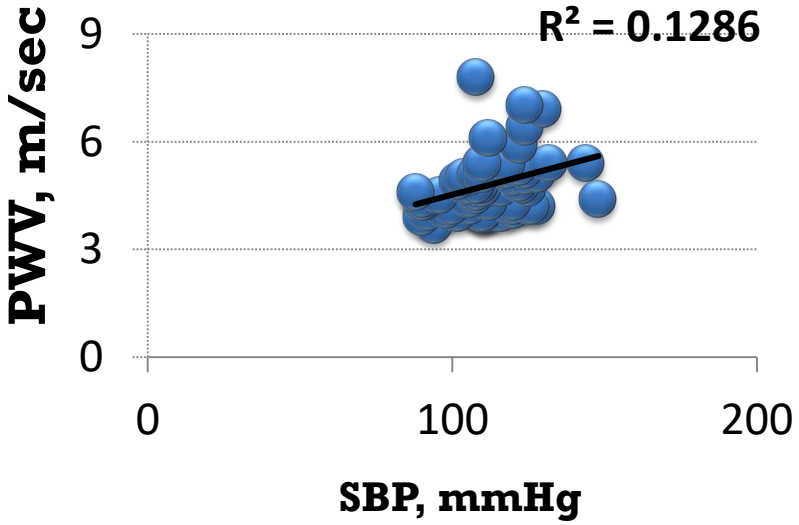
Results – Linear regression analysis between PWV and different covariates

	r	P
HOMA	0.385	0.001
BMI (*kg/m²*)	0.338	0.002
SBP (*mmHg*)	0.338	0.002
Uric acid (*mg/dL*)	0.241	0.023


R² = 0.1581
PWV, m/sec
HOMA
0
2
4
6
8
0
3
6
9


R² = 0.1224
PWV, m/sec
BMI, Kg/m²
0.0
10.0
20.0
30.0
40.0
0
3
6
9


R² = 0.0619
PWV, m/sec
URIC ACID, mg/dl
0
5
10
0
3
6
9


R² = 0.1286
PWV, m/sec
SBP, mmHg
0
100
200
0
3
6
9

Conclusions

- In our population PWV, a surrogate marker of arterial stiffness, resulted linearly related to all classical CV risk factors, similarly to what observed in adults
- In particular, we found a significant relationship between PWV and HOMA, BMI, SBP, and uric acid
- IR resulted the strongest independent predictor of PWV
- The early detection of CV risk factors in childhood is mandatory in order to promote corrective strategies