

Background: The prevalence of macrovascular complications is probably underestimated in children with type 1 diabetes (T1D). Arterial stiffness (AS) represents a subclinical marker of cardiovascular (CV) risk. The most validated non-invasive method for AS measurement is pulse wave velocity (PWV). There are limited numbers of studies with PWV on children with T1D.

Aim: To assess the relationship between arterial stiffness and parameters associated with metabolic control in children with T1D.

Patients: From 2014 to 2015 study on children with type 1 diabetes was carried out at Pediatric department, Faculty Hospital in Prague. The patients were recruited from children admitted to our department for unsatisfactory metabolic compensation.

All participants or their parents signed an informed consent.

The patients had to be less than 19 yr of age and have type 1 diabetes as defined by the American Diabetes Association 1998.

Exclusion criteria were presence of diabetic complications, any medical treatment (except insulin) and acute infections.

A cross-sectional study on children with type 1 diabetes (n=77)

- Median age 16 years (14 - 17), 38 males (49.4%)
- Median of diabetes duration was 9 years (6-11)
- Therapy mode: CSII n = 35 (45.5%), MDI n = 42 (54.5%)

Complete characteristics are summarized in Table 1.

Table 1. Characteristics of the study population (n = 77)

Age (yr)*	16 (14 - 17)
Diabetes duration (yr)*	9 (6 - 11)
Males, N (%)	38 (49.4)
CSII treatment, N (%)	35 (45.5)
BMI (SDS)*	0.97 (0.24 - 1.50)
HbA1c - baseline (mmol/mol)*	71 (62 - 84)
HbA1c - three years (mmol/mol)*	71 (61.5 - 81)
Triglycerides (mmol/L)*	1.00 (0.73 - 1.28)
Cholesterol (mmol/L)*	4.40 (4.00 - 4.75)
LDL-Cholesterol (mmol/L)*	2.36 (1.96 - 2.76)
HDL-Cholesterol (mmol/L)*	1.39 (1.23 - 1.69)
ACR (mg/mmol)*	0.60 (0.48 - 0.98)

* median (IQR)

Methods: PWV was evaluated in all participants (n=73) and measured as the carotid-femoral pulse transmission time. The resulting velocity was compared to published normative percentiles adjusted for gender, age and height and converted to standard deviation scores (SDS) [Reusz GS et al. Hypertension 2010;56:217-224].

Sixty four (83%) of all patients have performed ABPM using standard procedures and adjusted for gender and height using published methods. All of them have evaluated blood pressure (BP) status using published assessments [Urbina E et al. Hypertension 2008;52:433-451] and were divided into three categories: normotension (NT), white coat hypertension (WCH) and hypertension (HTN).

Statistical analyses: Non-parametric test and a multiple regression analysis were used to compare the PWV percentiles and parameters associated with metabolic control.

Results 1: Results of PWV and ABPM measurements are summarized in Table 2.

Median of PWV measurements was 5.10 m/s (-0.01 SDS of age specific norm).

Increased AS (PWV >1.28 SDS) was found in eight (11%) of all patients.

Hypertension was found in eighteen (28%) patients examined by ABPM. Thirty three (52%) have WCH and remaining thirteen (20%) have normotension.

Table 2. Results of PWV and ABPM measurements

PWV (m/s)*	5.10 (4.45 - 5.73)
PWV (SDS)*	-0.01 (-0.97 - 0.54)
ABPM SBP-24 hours (SDS)*	0.01 (-0.63 - 0.90)
ABPM DBP-24 hours (SDS)*	0.09 (-0.60 - 0.96)

* median (IQR)

Results 2:

Significant positive association between PWV and HbA1c levels (median from last three years of follow up) was found (p=0.001; Figure 1). Cholesterol and LDL-cholesterol levels were also associated with PWV (both p=0.003), remaining biochemical parameters are not associated.

Duration of diabetes, age, sex, BMI SDS and mode of treatment were not associated with PWV.

Significantly increased PWV was found in individuals with hypertension (p=0.01; Figure 2).

In multivariable analysis the most significant variable associated with increased PWV was HbA1c (p=0.0087; Table 3).

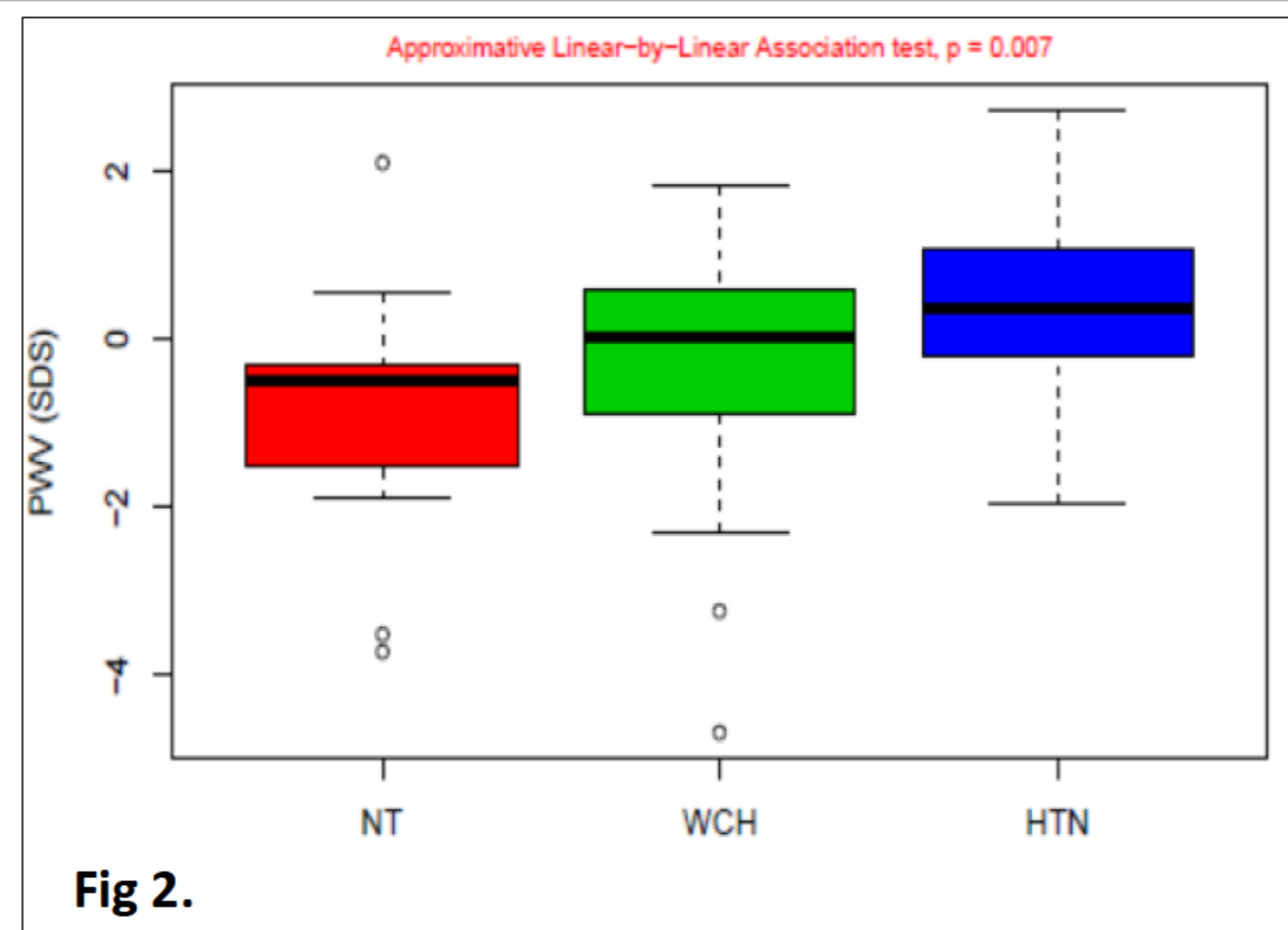
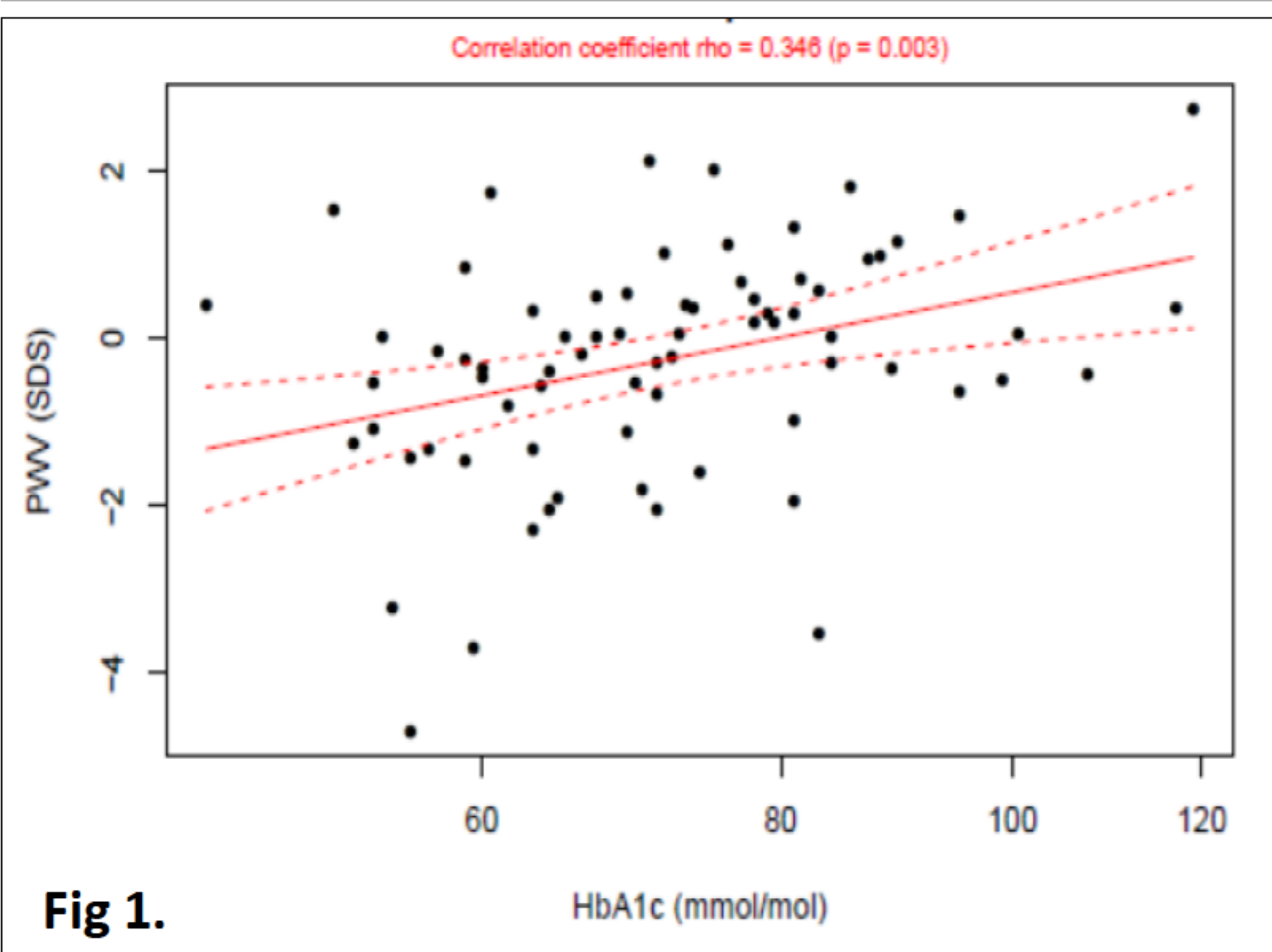


Table 3. Multivariable analysis

Variables	p-value
HbA1c	0.003
Lipids profile	NS
Mode of treatment	NS
Diabetes duration	NS
Age	NS
Sex	NS
BMI SDS	NS
SBP-24 hours SDS	NS
DBP-24 hours SDS	NS

Conclusion: The finding of increased PWV in poorly controlled T1D children is in accordance with the hypothesis of increased AS as an early predictor of CV risk.

The study was supported by IGA grant 5300