

**P45****Mitochondrial genotype associated with occurrence of type 1 diabetes mellitus**

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It has been proposed that accumulation of mitochondrial DNA mutations in somatic cells contributes to aging and to degenerative diseases because the DNA genotypes influence oxidative damage of its own. Recently it was reported that Mt5178A (a C-to-A transversion at nucleotide position 5178 within the NADH dehydrogenase subunit 2 gene) is related to longevity, while the individuals with Mt5178C is more susceptible to adult-onset diseases than those with Mt5178A. On the other hand, oxidative stress plays an essential role in the destruction of pancreatic  $\beta$  cells by infiltrating inflammatory cells in type 1 diabetes. To evaluate the effect of the mitochondrial DNA variations on occurrence of type 1 diabetes, we analyzed the frequencies of Mt5178A/Mt5178C by PCR-RFLP with *Alu I* in 385 (156 males, 229 females) Japanese type 1 diabetic patients who were selected randomly among follow-up patients in the Diabetes Center of our University. We also studied DNA of 163 (65 males, 98 females) healthy controls who had no abnormality in glucose and lipid metabolism. The frequency of Mt5178A was significantly lower in type 1 diabetic patients (119/385, 31.0%) than in healthy controls (66/163, 40.5%) ( $p = 0.03$ , odds ratio 1.52 (95%CI 1.04-2.22)). This finding suggests that the individuals with Mt5178A is less susceptible to type 1 diabetes than those with Mt5178C. As Cann et al. mentioned that Mt5178A is relatively rare among the global population, the high frequency of Mt5178A among the Japanese population (40.5%) may be relevant to the fact that the incidence of type 1 diabetes in Japan is relatively low in the world.

**P46****Natural history of hyperglycaemia in children not due to type-1 diabetes**

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We followed 35 children and adolescents over a 2-to-19 yrs period ( $\geq 5$  yrs in 25 cases and 10 yrs in 15 cases) who were referred for evaluation of fasting hyperglycaemia ( $\geq 110$  mg/dl in absence of type-1 diabetes) found on: routine screening (19 cases); screening for family history of hyperglycaemia or diabetes (9 cases); during acute illness (7 cases). Obesity was present only in 5 patients. 15 patients (none with obesity) had at least one first-degree relative with hyperglycaemia or diabetes mellitus, 15 patients (4 with obesity) had second or third-degree relatives with diabetes and finally 5 patients (1 with obesity) had no family history for diabetes.

After 2 years from diagnosis hyperglycaemia was no longer present in 9 cases (1 in the group with first-degree relative; 1 was obese), was confirmed in 15 cases (7 in the group with first-degree relative; 1 was obese) and worsened (fasting blood

glucose and/or OGTT) in 11 cases (7 in the group with first-degree relative; 3 had obesity). All patients of the latter group were given oral hypoglycaemic therapy when glycaemia reached 130 mg/dl and/or HbA1c 6% (normal range 3.8-5.8%) and this happened within 2 yrs from diagnosis in 10 cases and after 3 yrs in 1 case. 2 out of the 11 treated patients required the administration of insulin after 3 and 6 yrs from diagnosis. On the contrary, follow-up at 5 and 10 yrs did not show significant changes in the 24 patients without treatment.

*In conclusion:* 1) the tendency towards a worse glycaemic control with the need of therapy always occurred in our patients within 3 years from diagnosis and no case showed a progression beyond that limit; 2) the group requiring treatment included both about half of the patients with first-degree affected relative and 3 out of the 5 obese patients, but also 1 patient who was thin and with family history negative for diabetes; 3) the patients, usually non obese, with a weaker family history for diabetes or even without affected relatives, are difficult to be classified; most of them show a milder metabolic abnormality.

**P47****Decreased membrane polarity of polymorpho-nuclear leukocytes from diabetic children**

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Polymorphonuclear leukocytes (PMN) from diabetic children have been shown to be abnormal in chemotaxis, adherence, phagocytosis, killing and respiratory burst. All these activities are the results of complex events mediated by plasma membrane of PMN. Chemical and physical events that take place within the membrane allow the cells to carry out their specific function. The polarity properties of the membrane bilayer are strongly influenced by its composition and dynamics. Different modes of organization of the compositionally and functionally differentiated domains correspond to different functional states of the membrane. Membrane polarity of PMN obtained from 22 children with insulin-dependent diabetes mellitus (IDDM) (age range between 6.6 and 14.4 years; mean  $10.4 \pm 2.2$ ) and healthy controls were studied using fluorescence technique. Membrane polarity was studied by measuring the steady-state fluorescence emission and excitation spectra of 2-dimethylamino(6-lauroyl)naphthalene (Laurdan), which is known to be incorporated at the hydrophobic-hydrophilic interface of the bilayer, displaying spectral sensitivity to the polarity of its surroundings. Laurdan shows a marked steady-state emission blue shift in nonpolar solvents, with respect to polar solvents. PMN were isolated and immediately used for fluorescence measurements. Measurements were performed on an LS 50B spectrofluorometer (Perkin-Elmer Ltd. U.K) as previously described (Photochem Photobiol 1993;57:438-441). Our results show a blue shift of Laurdan emission spectra in PMN from the IDDM group with respect to the control (maximal intensity from 458nm to 454nm). These data indicate a decrease in membrane polarity. The observed changes in plasma membrane could be on the

basis of the alterations in the functional activities of PMN in children with IDDM.

## P48

### Lipid tracking in diabetic patients

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#### Objectives:

1. To perform longitudinal descriptive analysis of lipids, lipoproteins and apolipoproteins in young diabetic over the period 1992–1996.
2. To assess the influence of diabetes and particularly metabolic control on lipid values.
3. To identify early groups with lipidic risk values and/or a family history of the disease.

#### Material and methods:

### I. Diabetic Population

80 patients	41M/39F
Present age	17.54 ± 2.88 years
Age at onset	9.25 ± 3.67 years
Evolution time	7.95 ± 3.99 years
Annual HbA1c	8.23%/7.73%(92 vs 96)

### Complications-risk markers

Microalbuminuria	10intermittent
Retinopathy	10 (8 slight, 2 lasertherapy)
Limited joint mobility (LJM)	16
Family history (dyslipemia, CV disease)	11
Smoking	29

### II. Lipid and lipoprotein measurements in diabetics 1992–1996

#### Results:

Lipid values	1992	1996
Chol (mg/dl)	178 ± 29.73	160.1 ± 27.2
TG (mg/dl)	65.3 ± 25.29	57.4 ± 21.7
HDL-C (mg/dl)	56 ± 12.5	48.3 ± 11.5
LDL-C (mg/dl)	109.5 ± 26.7	96.2 ± 30.2
Apo-A (mg/dl)	150.7 ± 33	138.9 ± 27.4
	1992	1996
Apo-B (mg/dl)	87.4 ± 28.6	77.7 ± 17.1
Apo-A/Apo-B	1.93 ± 0.97	1.88 ± 0.56
LDL/HDL	2 ± 0.6	2.1 ± 0.8
Chol/HDL	3.31 ± 0.7	3.36 ± 0.8
Lp [a] (mg/dl)	20.54 ± 19.3	19.4 ± 24.6

Metabolic control in 1996 improved significantly in girls.

Complications: no significant differences are observed in lipid values of patients with complications and/or risk markers (retinopathy, microalbuminuria, LJM).

Lipidic risk: The most evidence improvement and that which is associated with best metabolic control is observed in the group with cholesterol > 200 mg/dl.

#### Conclusions:

1. Longitudinal follow-up of patients between 1992–1996 shows improvement in some lipid values (chol and TG) associated with better metabolic control; however, worsening of HDL-Chol counteracts this satisfactory evolution with the negative influence of smoking being observed in our patients.
2. HDL-Chol worsened in patients with a family history as in the rest of the patients study, and moreover, presents worse LDL-C and Lp [a] values. These patients form a special group in whom hygienic-dietetic and/or pharmacologic measures should be applied early.

## P49

### Decreased magnesium levels in serum and erythrocytes of young type 1 diabetic subjects. Relationships with glycated haemoglobin levels (HbA1c) and subclinical complications

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Paediatric studies on magnesium depletion in type 1 diabetic patients are scarce, and there are no data on erythrocyte magnesium content (EMC) which is important since 99% of total magnesium (Mg) are intracellular. Moreover, in the paediatric studies there are no data on the relationships between hypomagnesaemia and HbA1c levels or subclinical complications. Therefore the aim of the present study is to communicate our experience in that field.

Serum Mg levels, EMC, magnesuria, and HbA1c were determined in 118 type 1 diabetic subjects (105 boys and 83 girls) aged 19 ± 8 years (mean ± SD) with a diabetes duration of 11 ± 8 years, and in 96 controls. Mg was measured by colorimetric calmagite kits and HbA1c using a HPLC method. We searched for subclinical retinopathy (fluorescein angiography), neuropathy (conduction velocities in the limbs), nephropathy (microalbuminuria and β2-microglobulinuria) in patients aged > 12 years with a diabetes duration > 3 years<sup>1</sup>.

The mean ± SD Mg serum concentration was 1.8 ± 0.2 mg/dl in the diabetic population and 2.0 ± 0.2 mg/dl in the controls (Mann Whitney: p < 0.001). The mean EMC was 5.0 ± 0.5 mg/dl in the patients, vs 5.3 ± 0.2 mg/dl in the controls (p < 0.001). In 14% of the patients serum Mg levels were less than -2 SD below the normal mean, while 6% of the diabetic subjects had EMC less than -2 SD under the normal mean. In the diabetic patients, serum Mg levels were positively correlated with EMC (r = 0.19; p < 0.01) and negatively with age (r = -0.24; p < 0.01), duration of diabetes (r = -0.19; p < 0.05), HbA1c (r = -0.16; p < 0.05). EMC levels were negatively correlated to magnesuria (r = -0.31; p <

0.05), which is related to microalbuminuria ( $r = 0.24$ ;  $p < 0.05$ ) and  $\beta$ -microglobulinuria ( $r = 0.26$ ;  $p < 0.05$ ). In the 74 diabetic patients with one or more subclinical complications, serum Mg levels were significantly lower than in the patients without complications ( $1.8 \pm 0.2$  mg/dl vs  $1.9 \pm 0.2$  mg/dl;  $p < 0.01$ ).

In conclusion, lower serum Mg levels and EMC are found in type 1 young diabetic patients. Hypomagnesaemia is related to age, duration of diabetes, bad glycemic control, and presence of subclinical complications. Mg depletion should be searched for, even in the paediatric population and supplementation in Mg should be considered.

Reference:

<sup>1</sup>Dorchy H. Dépistage des complications subcliniques chez les jeunes diabétiques: l'expérience bruxelloise. *Ann Pediatr (Paris)* 45:585–606, 1998.

## P50

### Relationships between glycated haemoglobin levels (HbA1c) and eradication of *Helicobacter Pylori* (HP) infection in young type 1 diabetic subjects

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In a preliminary study, we have shown that HP-positive diabetic children, adolescents and young adults had higher HbA1c levels than our total diabetic population<sup>1,2</sup>. The aim of the present study was to examine the relationships between HbA1c levels and eradication of HP infection. A total of 47 patients (mean  $\pm$  SEM age of  $18 \pm 1$  years, and diabetes duration of  $9 \pm 1$  years) with HP infection, proven by histology, culture and <sup>13</sup>C-urea breath test (<sup>13</sup>C UBT), were included in the study during a 6 month period after a bitherapy based on a bacterial antibiogram. HP eradication was controlled 2 months later by <sup>13</sup>C UBT. HbA1c levels, measured by an HPLC method at diagnosis, 2 and 6 months after treatment, were expressed as % of normal values, the upper normal limit being 100%.

Eradication of HP infection was obtained in 32/47 patients (68%). Age and diabetes duration were not different in the 2 groups, neither was the the ratio immigrants/non immigrants. HbA1c levels were significantly higher in HP-non eradicated patients than in HP-eradicated subjects at diagnosis ( $147 \pm 10\%$  vs  $136 \pm 5\%$ ;  $p = 0.004$ ), 2 months after treatment ( $147 \pm 8\%$  vs  $136 \pm 4\%$ ;  $p = 0.008$ ), while the difference was less significant 6 months after treatment ( $143 \pm 8\%$  vs  $135 \pm 4\%$ ;  $p = 0.06$ ). In both groups, HbA1c levels were not different at diagnosis and 2 or 6 months after treatment, and were unrelated to age or diabetes duration.

In conclusion, eradication of HP infection is less efficient in type 1 diabetic subjects with the poorest glycemic control whose mean HbA1c level reaches 147% of the upper normal limit.

References:

<sup>1</sup>Dorchy H. Dépistage des complications subcliniques chez les jeunes diabétiques: l'expérience bruxelloise. *Ann Pediatr (Paris)* 45:585–606, 1998

<sup>2</sup>Dorchy H. Quel contrôle glycémique peut être obtenu chez des jeunes diabétiques sans sécrétion résiduelle d'insuline

endogène? Quelle est la fréquence des hypoglycémies sévères et des complications subcliniques, *Arch Pediatr (Paris)* 1: 970–981, 1994.

## P51

### Incidence and some risk factors of late complications by diabetic children in Latvia

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The goal of this study was to check the incidence of late complications by diabetic children in Latvia and to evaluate the role of some risk factors in development of them.

Under control of our unit are 280 diabetic children in age interval from 0 to 18 years. At least the last 5 years all diabetic children in Latvia are treated with human insulins and receive 4–6 times daily short acting insulin, 2 times daily — long acting one. Almost all of these patients use insulin injectors. Since 1997 visual strips for blood and urine glucose and urine ketones selfcontrol are available for all diabetic children, but 60% of them have glucometers.

*Results:* 33 patients of 280 or 11.8% have diagnosed one (22 patients) or more (11 patients) late complications of diabetes as follows:

- retinopathy — 16 patients (8 girls, 8 boys) or 5.7% of all patients
- nephropathy — 17 patients (9 girls, 8 boys) or 6.1% of all patients
- cataracta — 8 patients (6 girls, 2 boys) or 2.9% of all patients
- Moriac syndrome — 9 patients (3 girls, 6 boys) or 3.2% of all patients.

Regarding the duration of diabetes — as longer time as more complications. So, during the first 5 years of diabetes neither retinopathy nor nephropathy has revealed; during the next 5 years retinopathy develops to 13.6%, but nephropathy — to 11.1% of patients; after 10 years of diabetes retinopathy develops in 16%, but nephropathy — in 25.8% of cases. Cataracta develops already during the first 5 years of diabetes — in 2.4% of cases, but after 10 years of illness has revealed in 6% of patients. None of diabetic microangiopathies have not revealed before adolescents age; the earliest one — at 11.

Unfortunately, a good metabolic compensation has not reached, but no substantial difference in mean level of HbA1C has revealed between patients with and without late complications — in our study it is 12.1% in group of patients with late complications and 10.1% in group without them.

Just growth retardation (SD below 2.0), without any other development or health problems has revealed in 6% of diabetic children.

## P52

### Tetranectin, soluble P-selectin and VCAM-1 in the plasma of children with IDDM

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It has been suggested that cell adhesion molecules be involved with the early development of vascular endothelium dysfunction in diabetes mellitus. Thus the aim of this study was to investigate the plasma levels of tetranectin (TN), cP-selectin and vascular-cell adhesion molecule-1 (VCAM-1) in IDDM children without vascular complications and to compare their relationship to glycaemic control. TN, cP-selectin and VCAM-1 levels were determined by ELISA in the plasma of 69 IDDM children (mean age 103 yrs, diabetes duration 52 yrs) and compared with those of 35 sex, age and BMI matched healthy controls. Patients were divided into subgroups A and B according to their levels of HbA<sub>1c</sub> (HbA<sub>1c</sub>  $\geq$  6.8% and HbA<sub>1c</sub>  $>$  6.8% respectively). Median plasma levels of TN in children with IDDM (14.9 mg/l, interquartile range: 12.5–18.1) were higher than those of controls (13.4 mg/l, interquartile range: 10.4–16.3,  $p = 0.02$ ). Median plasma levels of cP-selectin and VCAM-1 were also significantly increased in patients [301 ng/ml (218–401),  $p = 0.004$  and 997 ng/ml (814–1222),  $p = 0.0015$  respectively] than in controls [201 ng/ml (135–243) and 724 ng/ml (602–864) respectively]. A trend towards higher cP-selectin levels was observed in subgroup B compared to subgroup A. As regard VCAM-1 no statistically significant difference was found between subgroup A and B. However TN levels were higher in subgroup B than in subgroup A (median value 16.3 mg/l vs 13.6 mg/l,  $p = 0.012$ ), indicating TN elevation with the worsening of glycaemic control. Likewise a longitudinal follow-up of 10 IDDM children revealed a positive correlation between TN and HbA<sub>1c</sub> in each patient. In conclusion, these findings provide evidence for adhesion molecules elevation in IDDM, even in disease stages without apparent vascular damage.

### P53

#### Renal sodium and dopamine handling in diabetic children with family history of essential hypertension

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Diabetic nephropathy (DN) develops only in a subset of patients with type I diabetes mellitus (DM). It has been suggested, that diabetic patients with a genetic trait for essential hypertension (EH) are susceptible for DN. Since sodium handling is altered both in DM and EH, and dopamine (DA) is the main natriuretic hormone, the aim of our study to assess the difference in sodium and DA excretion after sodium challenge in diabetic patients with and without a genetic trait for essential hypertension. Eight diabetic children with (FH+) and eight patients without (FH-) a family history of hypertension have been studied. Age, duration of diabetes, metabolic control (HbA<sub>1c</sub>) and body mass index were comparable in the two groups. All patients underwent a 3 day sodium challenge by ingesting 8 g NaCl per day beside a sodium and carbohydrate fixed diet. Blood pressure was recorded by ambulatory blood pressure monitoring, and urinary DA excretion was measured by HPLC before and after the sodium load. Systolic and diastolic blood pressure were unaltered and comparable in the two groups before and after sodium challenge. After

sodium load urinary sodium excretion was significantly higher ( $p < 0.03$ ) in FH- group ( $212 \pm 47$  mmol/day) compared to FH+ group ( $146 \pm 51$  mmol/day). Natriuresis was accompanied by significantly ( $p < 0.005$ ) higher urinary DA excretion in the FH- group ( $2.48 \pm 0.7$   $\mu$ mol/die) compared to the FH+ children ( $1.48 \pm 0.3$   $\mu$ mol/die).

*Conclusion:* Diabetic children with a family history of EH fail to increase urinary sodium and DA excretion following high salt diet. The importance of his phenomenon in the development of DN is unknown.

### P54

#### Analysis of association of insertion/deletion (I/D) polymorphism of angiotensin I-converting enzyme (ACE) with diabetic nephropathy and retinopathy in the group of Moscow children

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The association of insertion/deletion (I/D) polymorphism of angiotensin I-converting enzyme (ACE) with diabetic microangiopathy remains controversial. To assess the association of the ACE genotypes with the development of diabetic nephropathy (DN) or retinopathy (DR) we studied I/D polymorphism in a group of children and adolescents with IDDM ( $n = 72$ ). In comparison with 168 healthy adults from Moscow the I allele was more frequent (49.3% vs. 36%,  $p = 0.005$ ). Patients were divided into 3 groups: patients with early (less than 10 yr after the diagnosis) onset of DR-A ( $n = 46$ ), patients with early onset of DN-B ( $n = 36$ ), patients without these complications (the duration of diabetes more than 10 yr)-C ( $n = 22$ ). There was no difference in frequency of I and D alleles in these groups. Genotype ID was less frequent in the C group ( $p < 0.005$ ). Early onset of microangiopathy was associated with the higher frequency of other complications: cataract, delayed puberty and short stature, necrobiosis lipoidica, limited joint mobility (LJM). HbA<sub>1c</sub> (%) was higher, too ( $p < 0.001$ ). The results are shown in table 1.

	A	B	C
Duration of diabetes	8,3–0,038	8,69–0,037	11,85–0,05
I/D	47,8/52,2%	48,6/51,4%	52,3/47,7%
II/ID/DD	19,5/56,5/ 23,9%	16,7/63,9/ 19,4%	40,9/22,7/ 36,3%
HbA <sub>1c</sub>	13,5–0,037	14,1–0,046	12,2–0,078
DN	67,4%	100%	0
DR	100%	83%	0
LJM	43%	50%	22,7%
Delayed puberty and short stature	21,7%	19,4%	9%
Cataract	21,7%	27,7%	0%
Necrobiosis lipoidica	10,8%	13,8%	0%

**P55****Hyperglycaemia in necrotizing enterocolitis**

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Seventeen cases of hyperglycaemia were diagnosed in a group of 144 newborns and infants with necrotizing enterocolitis (NEC) treated between 1986–1997 at the National Research Institute of Mother and Child in Warsaw, Poland.

Hyperglycaemia was defined as blood glucose level more than 8,3mmol/l (> 150mg/dl) in at least two examinations per day, during two or three consecutive days.

131 children were born prematurely, between 27–34 weeks of pregnancy (av. 29) with birth weight between 830–2650g (av. 1300g).

Hyperglycaemia in the acute phase of NEC was observed in 9 infants with birth weight > 1000g, in 6 infants with birth weight between 1001–1500g and in 2 with birth weight > 1501g. Accompanied hyperosmia was not found. Hyperglycaemia was not seen in fullterm newborns with NEC.

Insulin use was necessary in two cases only. In 15 cases reduction of i.v. glucose concentration to 4mg/kg/min. was sufficient to obtain normalisation of glycaemia.

Among 17 NEC cases complicated by hyperglycaemia 9 babies died (53%). Total mortality in the whole group was 34%.

Hyperglycaemia in necrotizing enterocolitis can be regarded as a bad prognostic sign.

**P56****Retinopathy, albuminuria and autonomic neuropathy in patients with type I diabetes mellitus — A population based study**

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The study-population included all newly diagnosed IDDM-patients between 1.1.1979 and 31.12.1984 in Vienna, and age < 15 years at manifestation, drawn from the Austrian IDDM incidence register. The achieved ascertainment of the diabetes incidence register was 94%. The aim of the study was to determine the prevalence of diabetic retinopathy, albuminuria and neuropathy.

*Patients and methods:* 105 patients (m = 59, f = 46) were eligible, mean age at manifestation was 9.1 yr ± 3.8, mean duration of the disease at the time of the investigation was 15.4 yr ± 1.9. All eligible patients were invited to participate. 14 could not be traced, 1 patient has already died, 57 (m = 36, f = 21) took part, 16 by answering the questionnaire and 41 by answering the questionnaire and an additional clinical investigation. Retinopathy was assessed by grading retinal photography diagnosing at least one microaneurysm, according to the EDTRS-score. Albuminuria was defined as albuminexcretion rate above 20 µg/min and less than 200 µg/min, calculated from a 12-h nightly urine collection, using an immunologic assay. For evaluation of peripheral neuropathy we used the

Neurothesiometer, for cardiac autonomic neuropathy the ProSciCard 2.1-programm.

*Results:* at the time of investigation the mean HbA<sub>1c</sub> was 8.8 ± 1.6 rel%. The prevalence of diabetic retinopathy (more than 1 microaneurysm) was 58% (95%CI = 44–71), of microalbuminuria (> 20 µg/min): 21% (95%CI = 9 – 37), 1 overt nephropathy. Cardiac autonomic neuropathy was found in 13% (95%CI = 4–28). Peripheral neuropathy was not detected in this study-cohort.

*Conclusion:* the observed prevalence of diabetic late complications in this cohort of young patients is comparable to results of the EURODIAB IDDM complications study in adults. The prevalence of retinopathy and microalbuminuria was less compared to american studies, but higher compared to scandinavian publications in children and adolescents.

**P57****Bone density in type 1 diabetes**

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Measurements of quantitative ultrasonic velocity (SoS) in patients with type 1 diabetes were carried out to evaluate the bone status. 85 children and adolescents (44 b., 41 g.) with type 1 diabetes of duration from 5 month to 13 yrs. aged 6–15 yrs. and the mean HbA<sub>1c</sub> 9,4 ± 1,6% (ref. < 6,8%) were enrolled in this study. SoS was measured at the right mid tibia using a Myriad ultrasound system (SoundScan 2000TM). The results compared with our age- and sex- matched reference values, expressed as Z-score and made correction for the bone age (that was assessed according to the method of Greulich and Pyle).

We found a reduced bone density (SDs between –1,5 and –2,1) was correlated with diabetes duration (p < 0,03), age (p < 0,03), delayed puberty (p < 0,05), glyated haemoglobin level (p < 0,05), but not sex, limited joint mobility and microalbuminuria. None of the patients with diabetes duration less than 5 yrs. (n = 22) had decreased bone density at the investigated site. But decreased bone density was established in 15,9% (n = 10) of the patients after as long as 5 yrs. of disease. While making correction for the bone age we obtained these results. It is to be pointed out that measurement of SoS without the correction shown a reduction of bone density in 22,2% of the patients (n = 14). In regard to correlation between glyated haemoglobin level and low bone density we suppose that it may well as being due to deteriorated glycaemic control in teenage years when decreased bone density is seen frequently.

*In conclusion:* This study indicates that osteopenia can developed in children and adolescents with long- standing diabetes. Furthermore, it seems to reflect one of the initial metabolic changes of bones in diabetes patients that might account in part for the increased prevalence of food problems in the future. Thus, regular monitoring of bone density can be recommended for long-term diabetes children, adolescents and young adults.