Oral Presentations and Workshops

O-1

Microalbuminuria is associated with impaired blood pressure regulation and genetic polymorphisms of the renin-angiotensin-aldosterone system

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Background: Microalbuminuria as well as altered blood pressure regulation are early signs of developing angiopathy in diabetic patients. The influence of the same genetic factors might explain the concordance between micro-albuminuria and arterial hypertension.

Methods: In a cohort of 150 patients with type 1 diabetes (77 boys/73 girls, mean age 13.8±2.8 yrs, mean HbA1c 7.5±1.2%, mean diabetes duration 4.9±3.7 yrs), we compared microalbuminuria (albumin excretion > 29 mg albumin/g creatinine in spontaneous morning urine), 24 h blood pressure (BP) profiles and genetic polymorphisms of the renin-angiotensin-aldosterone system (RAAS) previously described as risk factors for cardio-vascular disease in diabetes. Nocturnal blood pressure reduction (dipping) < 10% for systolic BP (SBP) and < 20% for diastolic BP (DBP) was considered pathological.

Results: 12 of the 150 (8%) children had microalbuminuria, whereas 45% showed an abnormal nocturnal pattern as the first sign of blood pressure alteration. Impairment of systolic dipping was significantly more frequent in the patients with microalbuminuria (75% vs. 40.4%, $p<0.02$, χ^2). The extent of dipping was also significantly reduced in the albuminuric children, both for SBP (9.1% vs. 11.6%, $p<0.05$, Mann-Whitney) and DBP (15.5% vs. 20.7%, $p<0.05$). Regarding common genetic polymorphisms of RAAS, a tendency for a higher frequency of the T/T angiotensinogen haplotype could be found in patients with microalbuminuria (704C→T; T/T: 54.6% vs. 27.7%, C/T: 18.2% vs. 56%, C/C: 27.3% vs. 16.3%, $p=0.051$, χ^2).

Conclusion: Associations between microalbuminuria, arterial hypertension and distinct gene polymorphisms of RAAS could be found even in our group of diabetic children with good metabolic control and short diabetes duration. Therefore, after confirmation of these findings in longitudinal studies with a higher number of patients, analysis of genetic variants might become a valuable predictive tool for risk stratification in diabetes management.

O-2

Prevalence of retinopathy and nephropathy in a nationwide cohort of young persons with type 1 diabetes mellitus in Norway

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Background: The aim was to study the prevalence of nephropathy and retinopathy in a cohort of young persons with type 1 diabetes mellitus and compare the results with previous studies.

Methods: A representative subset (n=371) of young people with diabetes onset <15 yr diagnosed 1973-1982 was included. 294 persons were examined, 156 men and 138 women. Mean age was 31.8 yr (range 20-42.3), mean duration of diabetes 22.5 yr (range 18.2-29.3). Fundus photography was performed in mydriasis by a non-mydriatic 45 Canon camera (45NM-CR). Two photographs were taken of each fundus with fovea in center. The mean from both eyes was calculated, but the worse eye decided the state of retinopathy. Non-proliferative retinopathy: presence of one or more red spots; proliferative retinopathy: neovascular changes; diabetic maculopathy: at least one red spot and/or hard exudate within a distance of 1 disc parameter from the fovea. Overnight timed urine samples were collected at home. Persistent microalbuminuria: urinary albumin excretion rate (AER) > 15 _g/min in 2 out of 3 consecutive urine samples. Overt nephropathy: AER > 200 _g/min in at least two out of three consecutive urine samples.

Results: Out of 174 patients: 13 (7.5%) had no retinopathy, 150 (86.2%) had non-proliferative retinopathy, 11 (6.3%) had proliferative retinopathy and one (0.6%) was blind. 116 (66.7%) had diabetic maculopathy. Out of 284 subjects, 58 (20.4%) had nephropathy, either microalbuminuria (n=39, 13.7%) or proteinuria (n=19, 6.7%). One subject was dialysed. 14 subjects with normoalbuminuria received anti-hypertensive treatment.

Conclusions: The high prevalence of retinopathy, consistent with findings from other countries, can be explained by the long duration of diabetes. Quite a few had diabetic maculopathy though its effect on vision was not measured. However, few patients so far have presented proliferative changes as well as blindness. The prevalence of overt nephropathy after diabetes duration of more than 20 years is remarkably low compared to most previous reports.

O-3

Carotid and cardiac function in adolescents and young adults with type 1 diabetes (DM1)

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Background: Cardiovascular complications are a major cause of diabetes-related morbidity and mortality. We previously reported reduced carotid artery distensibility but normal compliance, intimal-medial thickness (IMT) and echocardiographic findings in adolescents with DM1.

Methods: The present study aimed to define changes in both carotid and cardiac function in these adolescents over a 3 yr follow-up. 28 of the 33 (85%) DM1 subjects (17 male; age 18.8±1.3 yr; DM duration 12.6±3.4 yr) returned for follow-up, and were compared with 28 age- and sex-matched nondiabetic controls (17 male; age 18.7±2.0 yr). All subjects were normotensive, and underwent: (i) M-mode carotid ultrasonography to measure distensibility, compliance and IMT; (ii) echocardiography to assess LV structure and function; (iii) lipid profile, HbA1c and urinary albumin excretion rate (AER).

Results: Over 3 yr follow-up, the DM1 group showed no change in HbA1c, lipid profile, AER, but a significant increase in BMI (23.1 to 24.9, $p < 0.002$). Over this time, carotid distensibiltiy increased significantly (38.5±8.2 to 48.6±11.4 x 10^{-3}/kPa, $p < 0.001$), as did compliance (14.0±3.4 to 18.7±4.0 x 10^{-7}/kPa, $p < 0.001$), but there was no change in IMT. At 3 yr follow-up carotid artery measurements in the DM1 and control groups were similar. Only IMT in the DM1 group was slightly, but not significantly greater than in controls (0.061±0.013 vs 0.055±0.132 cm, $p = 0.07$). None of the echocardiographic parameters differed between DM1 and control subjects.

Conclusion: There was an overall improvement in the measures of carotid function and stability in cardiac measures of the diabetic subjects over 3 yr follow-up, such that, in late adolescence/early adulthood cardiac and vascular function of the DM1 subjects was similar to that of healthy controls. The reason for the improvement in carotid distensibility and compliance from mid- to late adolescence/early adulthood is uncertain, but may relate in some way to the changing hormonal milieu following completion of puberty, rather than to changes in metabolic control or lipid profiles.

O-4

Cardiovaskular risk factors in patients
with type 1 diabetes mellitus during the first two decades of life

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Background: Screening for early microvascular consequences of diabetes is generally accepted in pediatric patients at risk. However, life expectancy and quality of life are primarily dependent on macrovascular complications.

Methods: In Germany and Vienna, Austria, the DPV-Science initiative is based on prospective standardized documentation of patient characteristics, treatment and outcome in pediatric and young adult patients with diabetes. Up to 3/2003, 157 centers participate with a total of 21,335 T1DM patients (age < 20 years, age at manifestation 8.1 ± 4.1 years, 52% male).

Results: During the most recent years, long term metabolic control (HbA1c) was documented in 97%, BMI in 93%, blood pressure (systolic and diastolic) in 92%, cholesterol in 70% and smoking status in 67% of all subjects. Systolic blood pressure was elevated for age in 8.5% of subjects (diastolic pressure: 3.3%), HbA1c fell above the target of 7.5% in 66.5% of patients (HbA1c above 9% in 35.9%). Obesity (BMI >97th perc.) was present in 5.9% of subjects. Hypercholesterolemia (> 6 mmol/L) was found in 10.3%. At least one cardiovascular risk factor was present in 82.7% of patients. Comparing 10,281 girls to 11,054 boys, obesity was more prevalent in girls (7.5 versus 4.3%, p<0.0001). A similar difference was present for hypercholesterolemia (15.6% in girls, 6.4% in boys, p<0.0001). Metabolic control was slightly worse in females (mean HbA1c 8.4% versus 8.2%). In contrast, systolic hypertension and reported smoking were more prevalent in boys (p<0.0001, respectively). Obesity, hypertension and hyperlipidemia increased significantly with age (p<0.0001). Despite the high rate of hypertension and hyperlipidemia, only 1.9% of subjects received antihypertensive and 0.05% lipid lowering medication.

Conclusions: Cardiovascular risk factors are present in a high percentage of pediatric patients with type 1 diabetes. Both screening and intervention in patients at risk are important aspects of long term pediatric diabetes care.

O-5

Cardiovascular disease risk in children and adolescents with type 2 diabetes mellitus

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Background: Type 2 diabetes mellitus (T2DM) has been described as a new epidemic in the American pediatric population, that has been coincident with the overall 33% increase in diabetes incidence and prevalence seen during the past decade. Cardiovascular disease (CVD) accounts for the majority of complications in T2DM. The aim of the present investigation was to study early signs of CVD in children and adolescents with T2DM.

Methods: The baseline examination was conducted between 1989 and 1998. Diagnosis was based on the diagnostic criteria and classification system established by the US National Diabetes Data Group and the World Health Organization. Data on early signs of cardiovascular involvement were collected during the follow-up period through 31 December 2002, with the aid of ambulatory blood pressure measurement, echocardiography and cardiovascular autonomic function tests.

Results: From the original cohort (42 patients) 22 children and adolescents were eligible for re-investigation. Children with T2DM were suffering from nocturnal hypertension: night-time (N) SBP and NDBP were significantly higher in the diabetic group compared to the control group (NSPD/NDBP in diabetic children: 110/58 vs. controls: 96/52, $p<0.05$). Posterior and septal wall thickness obtained by echocardiography exceeded the control values in almost half of the diabetic children. Significant correlation was found between resting heart rate and HbA1c ($p<0.01$), as well as blood glucose ($p<0.05$) and insulin levels ($p<0.05$) during oral glucose tolerance tests. There was a significant correlation ($p<0.05$) between nocturnal SBP and the measure of hyperinsulinemia, while NDBP significantly ($p<0.05$) correlated with left ventricular end systolic diameter.

Conclusion: Sensitive methods can detect early signs of late cardiovascular disease already in children and adolescents with T2DM.

O-6

**Prediction of type 1 diabetes developing at very young age.
Early experience from the DIPP study**
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Background: The aim of the Finnish population-based prospective DIPP study is to screen newborn babies for genetic susceptibility for type 1 diabetes (T1D), and to follow those at risk for T1D-related autoimmunity until diagnosis of the disease or the age of 15 years.

Methods: T1D-associated HLA-*DQB1* alleles were examined in cord blood. The children carrying a genotype conferring high (*02/0302*) or moderate (*0302/x*; *x≠02, 0301* or *0602*) risk for T1D were followed-up for the emergence of ICA. If ICA was detected or T1D diagnosed, all samples from the child were tested for IAA, GADA and IA-2A. The Central Drug Registry of the Finnish Social Insurance Institute was used to identify all patients with T1D who had been born in the study hospitals during the DIPP study.

Results: Annually ~11,000 newborn babies have been screened in the DIPP. During the first 7 yr, 71 screened children developed T1D. 25 (35%) had a high and 30 (42%) a moderate risk genotype. 36 (51% of all children and 68% of the 53 T1D risk identified at birth) participated in the follow-up (dg median age 2.5 yr; range 0.7-7.0). The number of autoabs detected in the pre-diabetic samples increased with increasing age. Multiple (≥2) autoabs were found in 64% of the children diagnosed at <1.5 yr and 96% of those diagnosed at 1.5-7.0 yr of age; all 36 children had multiple autoabs at dg. Of 31 children with multiple autoabs, 14 had 4 autoabs, 8 ICA+IAA+GADA, 1 ICA+IAA+IA-2A, 5 ICA+IAA, 2 IAA+GADA, 1 IAA+ IA-2A. Sensitivities of ICA, IAA, GADA and IA-2A were 78, 94, 67 and 44%, respectively (in those diagnosed at <1.5 yr of age: 45, 91, 45 and 0%). From the whole cohort covered by genetic screening at birth and diagnosed during follow-up, 31 (44%) were identified in advance based on genetic risk and multiple autoabs.

Conclusions: From the whole cohort, 44% of the children developing T1D at young age are identified by risk genotypes and multiple autoabs if samples are drawn at 3-12 month intervals, providing consent rates and adherence to follow-up remain stable. IAA is the most sensitive marker of autoimmunity in the youngest children who often show rapid progression to T1D.

O-7

**Sexual dimorphism in the risk for developing
insulin treated diabetes among relatives of diabetes patients
diagnosed between 15 and 34 years of age**

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Background: In contrast to well established observations of an approximately 10% risk for diabetes among first-degree relatives of diabetic children, the risk for diabetes among first-degree relatives of adult type 1 diabetes patients has not been determined. The DISS (the Diabetes Incidence Study in Sweden) registry registers all patients between 15 and 34 years of age when diagnosed with diabetes in Sweden. In the present study we analysed patients reported to DISS 1982-1993, in total 4,466 patients.

Methods: The frequency of type 1 diabetes among relatives of type 1 diabetes patients diagnosed between 15 and 34 years of age was determined in DISS registry.

Results: Among 3,087 index patients treated with insulin 17.8% (95% CI 16.5-19.2) had a first-degree relative (excluding offspring) treated with insulin, the frequency being higher among female (19.8%) than male (16.5%, p<0.02) patients. A total of 10.7% had a parent treated with insulin. The prevalence of insulin treated diabetes was higher among parents to female (12.5%) than to male (9.5%) insulin treated index patients (p<0.004). A similar difference was observed using lifetable analysis (p<0.003). The frequency of insulin treated diabetes among fathers was higher if the index case was diagnosed from 25-34 (7.8%) than from 15-24 years of age (4.6%, p<0.003). Among insulin treated index patients 8.4% had a sibling with insulin treated diabetes. The risk for siblings to develop insulin treated diabetes was 2.7% (2.3-3.1%) by 14 years of age.

Conclusions: We suggest that females in the 15-34 years age group need more diabetes susceptibility genes than males and hence might carry more diabetes genes since more of their relatives also develop diabetes.

O-8

Development of type 1 diabetes mellitus in children associated with virus infection of wild bank voles?

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Background: Wild bank voles (*Clethrionomys glareolus*) may develop diabetes in laboratory captivity. It has also been shown that the voles developed diabetes due to specific lysis of pancreatic islet beta cells. Compared to non-diabetic bank voles, diabetic animals had increased levels of Gad65 ($p<0.0001$), IA-2 ($p<0.0001$) and insulin ($p=0.03$) autoantibodies. Affected islets stained positive for Ljungan virus, a novel picorna virus isolated from bank voles. Ljungan virus inoculation of non-diabetic wild bank voles induced beta-cell lysis. It has also been possible to show that virus inoculated guinea-pigs develop diabetes. Moreover, levels of Ljungan virus antibodies were also increased in newly diagnosed type 1 diabetes children from Stockholm ($p<0.01$).

Methods: All children with newly diagnosed type 1 diabetes in Dalarna, a rural county in the middle of Sweden, are tested for the possibility of infection with Ljungan virus. Blood, urine and stools are collected and kept at -70° Celsius for later analyses with PCR techniques. One-year follow-up examinations of the same individuals are also being performed.

Results: The results so far are promising for a statistically positive relationship between an infection with Ljungan virus and the appearance of type 1 diabetes in children. More data, however, are needed for confirmation and the analyses are continuing.

Conclusion: A novel picorna virus has been proved to trigger the outbreak of type 1 diabetes in animal models. There is strong evidence for a relationship with human beta-cell destruction. If this hypothesis could be proved, a new therapeutic model for prevention and/or treatment is possible.

O-9

Thyroid antibodies at onset of type 1 diabetes and future development of hypothyroidism in a biracial cohort

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Background: It is well known that children with diabetes type 1 (T1DM) have a very high risk of developing autoimmune thyroid disease. In our center we routinely measure TSH annually to assess functional hyper- or hypothyroidism and more often in the presence of a changing goiter or unexplained change of insulin sensitivity. However, there is still no consensus in terms of the best method of screening for this condition in these patients.

Methods: We evaluated thyroid peroxidase (TPO) and thyroglobulin (TGA) antibodies in a group of 166 Black (B) and White (W) children age < 19 years, at onset of T1DM (with documented islet cell autoimmunity) from the Children's Hospital of Pittsburgh Registry.

Results: The prevalence of being positive for at least one of the two antibodies, either TPO or TGA, was 14.5% vs 23% ($p<0.18$) in Blacks and Whites, respectively. After a mean follow up of 5 ± 3 years (range: 1-15 years), 30% of children positive for either TPO or TGA developed hypothyroidism (increased TSH with decreased free T_4 who were started on L-thyroxine) compared to 0.9% of negative ones ($p<0.00001$). The rates for different groups were as follows: Whites, 40% vs 0%, $p<0.00001$; Blacks, 10% vs 2%, $p=0.30$; males, 22% vs 0%, $p<0.0005$; females, 33% vs 1.8%, $p<0.0001$; children (< 11 years), 36% vs 1.6%, $p<0.00005$; and adolescents, 26% vs 0%, $p<0.0005$.

Conclusions: These results suggest that thyroid antibodies screened at onset of T1DM in children are useful in predicting the future development of autoimmune thyroid disease even in a relatively short follow-up period and that children and adolescents who are positive for either TPO or TGA should undergo more frequent evaluation of thyroid function (TSH) than those who are negative for these antibodies.

O-10

Natural history of thyroid autoimmunity
in children and adolescents with type 1 diabetes

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Background: Autoimmune thyroiditis (AIT) characterized by the presence of thyroid-specific antibodies is common in children and adolescents with type 1 diabetes (T1D). Up to now, there is controversial discussion concerning the time and frequency of screening for AIT. This study investigated the natural history of thyroid autoimmunity in young patients during the first 5 years of T1D.

Methods: Anti-peroxidase (anti-TPO) and anti-thyroglobulin (anti-TG) antibodies were measured serially in yearly intervals from T1D onset in 126 children and adolescents (80 boys, 46 girls; median age at T1D onset 9.0 years, range 0.1-15.8 years). Anti-TPO > 40 U/mL and anti-TG > 30 U/mL were considered positive, values above 100 U/mL as high. Treatment with L-thyroxin was started, if TSH > 4.5 µU/mL and/or thyroid gland enlargement in sonography were present.

Results: Thirty-one patients (24.6%) had positive anti-TPO (25 patients, 19.8%) and positive anti-TG (27 patients, 21.4%) during the first 5 years of T1D. Girls had more frequently positive anti-TPO (30.4% vs. 13.8%, p=0.03) and anti-TG (30.4% vs. 16.3%, p=0.06) than boys. At T1D onset, positive anti-TPO and anti-TG were present in 21 patients (16.7%) each. After 3 years of diabetes, a further three patients (2.4%) became positive for each of the two antibodies; after 5 years, one patient (0.8%) for anti-TPO and three patients (2.4%) for anti-TG. Except for one patient, all patients with high values of anti-TPO (n=17, 148-5340 U/mL) and anti-TG (n=11, 140-2000 U/mL) at T1D onset remained positive during the first 5 years of diabetes. Of 31 patients with positive antibodies, a total of 18 patients (58%) received therapy with L-thyroxin.

Conclusions: In a high proportion of patients with T1D, thyroid antibodies are positive already at T1D onset, and therapy for AIT has to be started subsequently. Since in some patients positive antibodies appear only later, antibody screening at regular intervals is recommended.

O-11

**A longitudinal study of autoimmune thyroid disease
and coeliac disease in children with type 1 diabetes**
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Background: In a previous cross-sectional study of 106 children and adolescents with type 1 diabetes (T1DM) we found a high prevalence of autoimmune thyroid disease (thyroid dysfunction in 8%, thyroid peroxidase antibodies (TPOab) in 13%), and coeliac disease (10.4%). The aim of the present study was to longitudinally evaluate the presence of autoimmune thyroid disease and coeliac disease in children with newly diagnosed diabetes living in the same geographical area.
Methods: All patients with newly diagnosed T1DM, age less than 15 years and living in the county of Funen, Denmark (500,000 inhabitants) were included in the study. From January 1999 to March 2003 a total of 88 children were included (median age 9.6 years, range 1.2-15.2 years). Thyroid function parameters, TPOab and coeliac disease related antibodies (CDab) (endomysium and tissue transglutaminase antibodies) were determined at diabetes onset and annually thereafter. Thyroid ultrasonography was performed in all patients at diabetes onset. Duodenal biopsies were taken in CDab positive patients.
Results: At diabetes onset thyroid dysfunction was revealed in four patients (4.5%) (3F, 1M), aged 1-13 years, TPOab were found in 10.2% and hypo-echogenicity at thyroid ultrasonography was seen in 19.3%. CDab were found in a single patient in whom coeliac disease was confirmed by duodenal biopsy. At follow-up (1-4 years after diabetes onset) a single patient developed TPOab, while no further patients developed thyroid dysfunction. Three patients had developed CDab one year after diabetes onset (one positive biopsy, two not yet biopsied) and a further three patients had developed CDab two years after diabetes onset (one positive biopsy, two normal biopsies). Children with CDab (3F, 4M) were 3-13 years old.
Conclusions: This study supports that children with T1DM regardless of age and sex should be investigated for the presence of autoimmune thyroid disease and coeliac disease already at diabetes onset and regularly thereafter.

O-12

Prevalence of type 2 diabetes among known patients with diabetes aged 0-18 years in Sweden

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Background: The frequent reports of a rising incidence and prevalence of diabetes mellitus type 2 (DMT2) in children and adolescents seen in the world today are worrying. The prevalence of DMT2 in children in Sweden is not known. Body Mass Index (BMI) according to age is rising in Swedish children. To be able to establish an eventual future rise in the incidence of DMT2 in the age group 0-18 years we have made a national retrospective population based case study, detecting all known cases of DMT2 and Maturity Onset Diabetes in the Young (MODY) in Sweden on Dec 31, 2001.

Methods: Sweden has a total population of 8.9 millions. All children 0-18 years of age having diabetes are cared for by 42 diabetes teams in paediatric clinics. All cases (n= ~6,000) were evaluated by their diabetologist regarding age at onset, BMI, autoantibodies and C-peptide at onset, sex, heredity and ethnicity, using a standardised form. The most probable diagnosis, according to the criteria suggested by the American Diabetes Association, was made as type 1, type 2, MODY or "other specified diabetes".

Results: Out of ~6,000 cases of diabetes 0-18 years we found 31 cases of DMT2, 29 cases of MODY and 25 cases of "other specified diabetes". The rest of the ~6,000 cases fulfilled the criteria for DMT1. The sex ratio in DMT2 was two females to one male, and in MODY three females to one male. 50% of the DMT2 cases had an ethnic background known to have high incidence of DMT2. The diagnosis DMT2 was mainly suspected at onset by the diabetologists based on heredity, obesity and age. Lack of autoantibodies confirmed the diagnosis. MODY diagnosis was established on clinical grounds, heredity, lack of autoantibodies and in a few cases by genetic analysis for specific mutations.

Conclusions: Diabetes mellitus type 2 in the age group 0-18 years in Sweden is still very rare (only 0.5% of all cases of diabetes). Whether a rise in the incidence will occur is continuously under debate. The current background study gives a stable benchmark for future epidemiological estimations of prevalence and incidence of DMT2 in children and adolescents in Sweden.

O-13

The epidemiology of type 2 diabetes in NSW and the ACT, Australia 2001-2002

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Background: Childhood obesity is increasing in many Western countries, and obesity is a recognised risk factor for type 2 diabetes. Australia has one of the highest rates of obesity worldwide (15% of children are overweight and 5% are obese), but epidemiological data on type 2 diabetes are lacking.

Aims: To determine the incidence of childhood type 2 diabetes in NSW/ACT and to audit current investigation and management practices.

Methods: Incident cases were ascertained by extending the current NSW/ACT type 1 diabetes register (established in 1990) to include cases of type 2 diabetes. Secondary ascertainment was from the National Diabetes Supply Scheme. Inclusion criteria were: age $\leq$ 16 years, diagnosis $\geq$ 01 Jan 2001, ADA criteria for dg of diabetes. An audit of initial investigations and management was undertaken by medical record review and questionnaire. Completeness of ascertainment was estimated using capture-recapture. Age-standardised incidence was calculated per 100,000 person years and 95% CI assumed a Poisson distribution. Data are mean ($\pm$ SD) or median (range).

Results: Mean annual incidence was 2.5 per 100,000 (95% CI 1.5-4.0) over 2001-2002. Mean age was 14.2$\pm$2.0 yrs (range 9-16, M=F), median BMI SDS was 2.3 (-1.9 to 9.7). Ethnic background: Caucasian (27%), Asian (22%), Aboriginal (19%), Middle Eastern (11%). Urban/rural and socio-economic status were evenly distributed. 75% had a family history of type 2 diabetes (1[st] or 2[nd] degree relative). Investigations performed at diagnosis varied: fasting BGL 13.1$\pm$6.1 mmol/l, HbA1c 9.2$\pm$2.7% (62%), OGTT (19%), C-peptide (51%), autoantibodies (65%, all negative). Most had acute symptoms (polyuria/polydipsia) at diagnosis and urinary ketones in 52%. Initial therapy was metformin (65%), insulin (32%) or both (19%).

Conclusion: Type 2 diabetes represents ~10% of newly diagnosed cases of diabetes in children and adolescents in this population. The diagnosis is often delayed and should be considered in those who are obese or have a family history. The lack of consensus in the investigation and management supports the need for development of evidence-based guidelines.

O-14

Insulin resistance syndrome in Hispanic children
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Background: The incidence of type 2 diabetes (T2DM) has increased dramatically in recent years, particularly among minority children. This study examined risk factors for T2DM in young Hispanic children studied over a two-year period. The objective was to determine the presence and stability of the insulin resistance syndrome (IRS), and the predictive value of BMI for later IRS.

Methods: 122 5-9 year-old children were initially recruited from schools for a study of health risks in Hispanic children, including BMI, OGTT, and assessment of blood lipids and blood pressure; HOMA-IR was calculated based on fasting glucose and insulin. 112 children completed study procedures, and of these, 47 (42%) were followed up two years later at a mean age of 9.9 years. At follow-up, fasting blood samples were obtained for determination of glucose, insulin and lipids, and blood pressure and BMI were also measured. IRS was defined as high HOMA-IR scores (>50th %ile for study sample) plus dyslipidemia and/or high SBP. The analyses are based on the 47 children measured at both times.

Results: At time 1, 61.7% of children had BMI >85th %ile; 45.7% had triglycerides >90th %ile; 15.2% had HDL-C <10th %ile; 10.9% had dyslipidemia; 27.7% had SBP >90th %ile; and 21.7% had IRS. Two years later, 72.3% were overweight; 36.2% had high triglycerides, 17% low HDL-C, 8.5% dyslipidemia, 34% high SBP, and 27.7% IRS. Controlling for age and gender, partial correlations from time 1 to 2 were significant ($p<0.02$) for BMI ($r=0.90$), HOMA-IR ($r=0.36$), triglycerides ($r=0.50$), and HDL-C ($r=0.68$); high SBP was also stable over time (as indicated by a non-significant chi-squared test). Logistic regressions revealed that overweight status from time 1 to time 2 predicted elevated HOMA-IR scores at time 2 ($p<0.05$), and that BMI at time 1 predicted the presence of IRS at time 2 ($p<0.01$)

Conclusion: Risk factors for type 2 diabetes are present in young Hispanic children and stable over time. Being overweight in childhood predicts the presence of IRS two years later.

O-15

Successful strategy to improve glucose tolerance in obese youngsters

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Background: Childhood obesity is considered to be an emerging national health problem in Thailand. Our previous study found that one third of 77 obese children and adolescents had impaired glucose tolerance (IGT) and 2.6 percent had already developed type 2 diabetes. An immediate strategy needs to be established in order to improve these metabolic problems.

Objective: To determine whether diet and exercise education for lifestyle modification with or without metformin therapy in our diabetes clinic is able to improve these metabolic problems.

Methods: Twenty-six obese children and adolescents with IGT at pediatric endocrine clinic, Siriraj Hospital, were enrolled into this study. At least 6 months after initiation of treatment consisting of lifestyle modification alone or lifestyle modification and metformin (combined treatment), each patient underwent the second 2-hour oral glucose tolerance test (OGTT). In addition, insulin levels, HbA_{1c} and lipid profiles were measured.

Results: Approximately 1 year after intervention, 19 out of 26 patients with IGT completed the second 2-hour OGTT. Sixteen patients (84.2%) successfully reversed to a normal glucose tolerance test whereas 3 patients (15.8%) remained with impaired OGTT. The body mass index (BMI), BMI SDS, 2-hour blood glucose, basal insulin level, 2-hour insulin level and HOMA score were significantly decreased after treatment in the normal OGTT group (p<0.05). Treatment with lifestyle modification alone and combined treatment improved the abnormal glucose tolerance test in our patients to a similar extent (83.3% vs 84.6%).

Conclusion: We demonstrate that IGT in obese youngsters is an abnormality reversible by lifestyle modification with or without metformin.

O-16

Thinness at birth rather than birthweight influences insulin-resistance (IR) in subjects born small for gestational age (SGA)

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Background: IR is observed in approximately 30% of young adults born SGA. Whether the risk for IR is already determined at birth or influenced by post-natal growth is not clarified.

Methods: To address this question, we studied 734 subjects born SGA (birth weight $<10^{th}$ perc) aged 22 years, selected from a population based registry, in whom insulin-sensitivity was assessed by the fasting insulin-to-glucose ratio (I/G). The effect of characteristics at birth and catch-up growth on I/G were analysed after adjustment for BMI, age, gender, smoking, family history of IR and oral contraception at the time of the study.

Results:	Tertile of BMI at birth			**p**
	-5 to -1.7 SD	**-1.6 to -1 SD**	**-0.9 to 1.5 SD**	
Birth weight (SDS)	-2.1 (0.3)	-1.6 (0.1)	-1.5 (0.3)	<0.0001
Birth length (SDS)	-1.3 (1.4)	-1.4 (0.9)	-1.6 (1.3)	0.07
Catch-up height (SDS)	0.7 (1.6)	0.7 (1.2)	0.8 (1.6)	ns
Catch-up BMI (SDS)	2.0 (1.2)	1.3 (1.1)	0.3 (1.3)	0.0001
Adult BMI (SDS)	-0.11 (1.2)	-0.05 (1.2)	-0.05 (1.3)	ns
Adult I/G.10^{-9}	6.7 (5.4)	6.8 (5.0)	5.7 (3.0)	0.005

Neither gestational age (32-42 wks) nor birth weight (1130-3080 g) influence the I/G, but BMI at birth was inversely related to the adult I/G (p=0.005). BMI at birth was also inversely correlated with catch-up in BMI from birth to adulthood but with no overcompensation. Catch-up in BMI significantly increased the I/G, irresespective of the adult BMI (p=0.02). In contrast with catch-up in BMI, catch-up height had no effect on the adult I/G (p=0.35).

Conclusion: Thinness at birth but not low birth weight increases the risk of IR in adulthood. Additionally, thinness at birth was also related to a greater catch-up in BMI, which in turn related to major IR in adulthood. Taken together these results suggest that body composition rather than birth weight itself influences long-term metabolic outcome. A better knowledge of foetal growth patterns leading to SGA therefore appears critical to move forward understanding of the mechanisms responsible for post-natal outcome.

O-17

Cerebral edema (CE) complicating diabetic ketoacidosis (DKA) in children: Canadian Paediatric Surveillance Program

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Background: 25-40% of patients with new onset diabetes and about 5%/year of those with established diabetes present with DKA. CE has been reported in 1-3% of cases of DKA with 21-35% morbidity and 20-25% mortality.

Methods: Surveillance of CE-DKA in patients <16 yr (Pop. 6.4 million) was carried out (07/1999-06/2001) through the Canadian Paediatric Surveillance Program. We aimed to determine incidence, outcomes and risk factors for CE-DKA, defined as sudden or unexpected deterioration in level of consciousness associated with pH<7.35 and/or low bicarbonate with diabetes/ketonuria. After CT scan confirmed reports of CE prior to initiation of DKA treatment, we included patients with CE suspected at DKA presentation. DKA cases (<16 yr) were identified from the Canadian Institute for Health Information Discharge Database. All CE-DKA cases and two randomly selected non-CE-DKA controls per case from the same institution were reviewed by a single individual to confirm the diagnosis and abstract clinical data. To increase the number for risk factor analysis, cases of CE-DKA occurring from 1995-1999 were identified by medical record searches.

Results: The incidence of CE in DKA was lower than expected at 0.5%: 57% (13/23) were identified prospectively. Mortality rate was 22% (5/23); 9% (2/23) had mild to moderate neurologic sequelae and 70% (16/23) were reported as normal. Low initial bicarbonate (p<0.001) and high initial BUN (p=0.01) concentrations were associated with increased risk of CE-DKA. In logistic regression analysis of demographic and treatment factors, only new onset diabetes was associated with CE-DKA (OR 6.9, 95% CI: 1.4, 33.0, p=0.02). We did not find an association with previously reported risk factors: young age, duration of symptoms, low initial Pco_2 or treatment factors. Compared to previous reports, we found similar mortality, but a considerably better outcome in survivors. Risk factor analysis revealed associations only with factors denoting severity at presentation (low bicarb and high BUN).

Conclusion: These data indicate that primary prevention of DKA is the critical step in avoiding CE-DKA and its sequelae.

O-18

Adolescents with type 1 diabetes exhibit cognitive adaptation during prolonged mild hypoglycemia

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Background: To examine the effects of prolonged mild hypoglycemia on cognitive functioning, we evaluated 34 adolescents during two hypoglycemic clamps 2 months apart, in random order.

Methods: Subjects were 12-18 years old (mean 14.5), had mean diabetes duration of 6.6 yrs, and a mean HbA_{1c} of 8.3% (range 6.5-10.5). In Clamp H, subjects were evaluated during euglycemia (100 mg/dl; session 1), 30 min after beginning of hypoglycemia (60 mg/dl; session 2) and 75 min after the beginning of hypoglycemia (60 mg/dl; session 3). In Clamp E, both sessions 1 and 2 were at euglycemia. The repeatable cognitive test battery required 15 min and included Trail Making, Choice Reaction Time, and Digit Vigilance.

Results: During Clamp E, performance either improved significantly from session 1 to 2, indicative of practice effects, or did not change. During Clamp H, performance at session 2 was significantly impaired relative to clamp E. Continuation of mild hypoglycemia for an additional 45 min (session 3) was associated with improved performance. In fact, at session 3, test scores obtained during Clamp H were no different from scores obtained during session 2 of Clamp E. Cognitive adaptation was unrelated to age, diabetes duration, HbA_{1c} or IQ. Epinephrine levels, currently available showed no decline between sessions 2 and 3.

Conclusion: These data provide the first evidence of cognitive adaptation in adolescents during prolonged mild hypoglycemia and are consistent with an earlier study of well-controlled diabetic adults (Kerr, 1991). Other researchers have failed to find evidence of adaptation but studied non-diabetic adults during more severe hypoglycemia. Further evaluations are needed at lower blood glucose levels.

O-19

Influence of physical activity and food intake on weight gain in adolescent girls with type 1 diabetes

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Background: Adolescent girls with type 1 diabetes often gain excessive weight during late puberty. The cause of this weight gain is unclear. The aim of this prospective case-control study was to examine the relation between food intake, physical activity and development of overweight.

Methods: 26 girls with type 1 diabetes and 49 healthy controls, 12-19 yr of age, were included in the study. There was a tendency for higher BMI SDS (0.92 ± 0.86 vs 0.48 ± 1.0; $P = 0.07$) in girls with diabetes at baseline. Mean HbA_{1c} was $7.6\pm1.4\%$ and daily insulin dosage was 1.1 ± 0.3 U/kg. At baseline, physical activity was measured during 7 days with a uniaxial accelerometer and energy intake with a 7-day food diary. Body composition was assessed by DXA at baseline and after 1 year in 23 girls with diabetes and 19 controls.

Results: We found no significant difference between the groups regarding physical activity or total energy intake. The level of physical activity ($P<0.01$) and total energy intake adjusted for body weight ($P<0.001$) decreased significantly with increasing age. Total physical activity was inversely associated with BMI SDS ($P<0.05$). Percentage body fat increased significantly in both girls with diabetes (2.4 units; $P = 0.001$) and controls (1.7 units; $P<0.05$). Variability in energy intake (CV%) ($r = 0.59$; $P<0.01$) and energy-adjusted fat intake ($r = 0.64$; $P<0.001$) were positively related to the increase in body fat, whereas energy-adjusted carbohydrate intake ($r = -0.63$; $P = 0.001$) was inversely related to the increase in body fat in diabetic girls. No relation was found in the control group. Physical activity was not related to changes in body composition.

Conclusions: This prospective study has shown that variability in energy intake, energy-adjusted fat and carbohydrate intake are of importance regarding accumulation of body fat in adolescent girls with type 1 diabetes in contrast to healthy controls. Physical activity was not related to changes in body composition.

O-20

Psychosocial factors and metabolic control in children with insulin-dependent diabetes mellitus (IDDM)

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Background: To study the relationship between patient's age, sex and psychopathology, familial psychopathology, socioeconomic status, and HbA1c, in insulin-dependent diabetic (IDDM) children and adolescents.

Methods: We prospectively followed, for 5 years, all IDDM children and adolescents (114 girls and 120 boys) of a Unit of Pediatric Diabetology. They were assessed by structured diagnostic interviews (DISC-R) and by questionnaires filled in by the patients (STAIC and CESD), their parents (CBCL and CPRS) and teachers (CTRS). Parents' psychiatric problems were assessed by GHQ-28. Path analysis was used to study the relationship between psychosocial variables and HbA1c (CALIS procedure - SAS System).

Results: 104 patients had at least one DSM-III-R disorder before inclusion in the longitudinal study. The children and adolescents with mental disorders had significantly poorer metabolic control than the other patients (mean HbA1c: 9.6% vs 9.1%). The STAIC and CESD scores, CPRS-I and VI, CBCL-internalizing and externalizing, CBCL-anxiety-depression factor were positively correlated with HbA1c. The socioeconomic status, patients' age and IDDM duration were correlated with HbA1c. Forty-two patients had at least one diagnosis of mental disorder during follow-up, associated with higher longitudinal mean HbA1c. Patients with microangiopathy had a higher rate of clinical mental disorders. We computed a structural model with path-analysis which showed that a psychosocial latent variable (constructed with socioeconomic status, age and sex of the patients, parents' psycho-pathology, child psychopathology) was responsible for higher HbA1c levels (RMSEA estimate = 0.0572; RMSEA 90% lower confidence limit = 0.0336; RMSEA 90% upper confidence limit = 0.0785; Bentler & Bonett's (1980) NFI = 0.92).

Conclusion: This study shows that psychosocial variables have a causal effect on poor metabolic control in young IDDM patients.

O-21

Demographic and clinical predictors of quality-of-life in children and adolescents with type 1 diabetes

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Background: This study examined demographic (age, gender, marital status, parental education, ethnicity) and clinical (diabetes duration, type of regimen, HbA1c) predictors of general and diabetes-specific QOL in children and adolescents.

Methods: The study sample consisted of 152 youths with type 1 diabetes (54% female; mean age=11.0 years; mean duration=4.5 years; mean HbA1c =8.8%). The sample was ethnically diverse (47% white, non-Hispanic, 41% Hispanic, and 12% Black), and 35% lived in single-parent families. 72% of the study sample had conventional insulin regimens while 28% were on the insulin pump. General and diabetes-specific QOL were measured with the PedsQL (both child and parent forms).

Results: Compared with norms for healthy children, diabetic children and parents reported less favorable QOL ($p < 0.001$). Parent and child-rated QOL scores were generally similar, however children reported less favorable DQOL ($p < 0.05$). Children on the insulin pump had lower HbA1c ($p < 0.05$). Multiple regression analyses with demographic and clinical predictors indicated better child-reported QOL was related to older age ($p < 0.05$); the model for child-reported DQOL was not significant. Parent-rated QOL was predicted by gender ($p < 0.04$) and diabetes duration ($p < 0.03$); parent-rated DQOL was predicted by gender ($p < 0.04$) and age ($p < 0.01$). Parents rated boys as having better QOL than girls, and rated older youths with greater diabetes duration as having better DQOL than younger children. QOL and DQOL were unrelated to marital status, parental education, ethnicity, type of regimen, and HbA1c.

Conclusions: These findings indicate that QOL of children with diabetes is less favorable than healthy children. QOL and DQOL are associated with gender and age, but unrelated to clinical factors such as use of the insulin pump and level of glycemic control. Use of the insulin pump was associated with better glycemic control with no adverse effects on QOL.

O-22

The management of diabetes in Norwegian children and adolescents. A prospective national quality study

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Background: Long-term blood glucose control is important to prevent severe late complications. This is difficult to obtain in children and adolescents. The present status of care is not known on a national level.

Aim: To compare the management of children and adolescents with diabetes at the different hospitals in Norway.

Methods: All Norwegian children are treated at the paediatric clinics of the government hospitals. 943 patients from 20 clinics (of total 25) throughout Norway, aged 0-15 yr (0-18/20 yr at some clinics) were included. Data were collected during 12 months according to the WHO Basic Information Sheet. HbA1c was analysed by a central DCCT standardized HPLC assay (CV<3%, normal range = 4.1-6.4).

Results: Mean age of the patients was 12.2 yr (1-21 yr) and mean diabetes duration 5.2 yr (0.1-17.2 yr). Mean HbA1c was 8.3% (hospital range 7.5-9.1%), increasing with age, 8.1% in children <12 yr, 8.4% in 12-15 yr and 8.8% in >15 yr. Target is HbA1c <8%. 44% of the patients had HbA1c <8%. Severe hypoglycemia with unconsciousness was reported in 12% of the patients; hospitalized ketoacidosis in 4% and this increased by age, from 3% in children <12 yr to 8% in children >15 yr. 40% of the patients had not been screened for retinopathy according to the ISPAD Consensus Guidelines but only 7% had not been screened for microalbuminuria. 15% of the patients use insulin pumps. The proportion of patients using ≥ 4 daily injections were 47% (age <12 yr), 73% (age 12-15 yr) and 81% (age >15 yr).

Conclusion: 44% of all patients reach the target level for HbA1c (<8%). The majority of the patients use multiple daily injections. The frequency of severe hypoglycaemia and ketoacidosis is within international levels.

O-23

Factors associated with glycaemic outcome
of childhood diabetes care in Denmark

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Background: Intensive diabetes management may delay the onset and slow the progression of complications. However previous studies demonstrate unsatisfactory HbA_{1c} levels in children and adolescents with diabetes. In a quality improvement study we analyse how selected structure and process indicators affect HbA_{1c}.

Methods: Data from the Danish Registry for Childhood Diabetes. One questionnaire sent to all children (response rate 78%, n=1,335), one to the 19 centres treating them (response rate 100%). Blood sample for central HbA_{1c}. Linear mixed models for analysis, HbA_{1c} as response variable, structure and process indicators and confounders: age, diabetes duration, sex, ethnic background as explanatory variables; centre as random effect.

Results: An increased number of home blood glucose measurements was associated with lower HbA_{1c} (p=0.02). Multiple daily injections were not associated with better glycaemic control, as children on 2 daily injections had a lower mean HbA_{1c}-value than children on 3 or more injections. An increase in insulin dosage (units/kg/day) was not associated with a decrease in HbA_{1c}. Diabetes team, hot-line service, and clinical guidelines were not associated with HbA_{1c}, but access to hot-line service was associated with an increased number of blood glucose measurements (p=0.01).

Conclusions: More frequent blood glucose measurements were associated with improved glycaemic control, and hot-line service seemed to reinforce a higher frequency of blood glucose measurements. We did not demonstrate any effect of the indicators on HbA_{1c}. Further studies on factors affecting blood glucose control are needed to learn how the management of childhood diabetes can be improved.

O-24

**Insulin regimen and metabolic control in Japanese children
with type 1 diabetes mellitus.
Lesson from a multicenter collaborative study in Japan**
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Background: The optimal insulin regimen for pediatric patients with type 1 diabetes remains controversial. The JSGIT was established in 1994 for the first time in Japan. A total of 736 pediatric patients aged 6 to 18 yr were registered and their insulin regimen and metabolic control over 4 yr were reported (Pediatr Diabetes 2: 160, 2001). A total of 774 patients aged 0-18 yr were registered for the second time in 2000 and their insulin regimen and HbA1c levels compared over 2 yr.

Methods: Blood was collected for every 4 months to determine HbA1c. The measurement of HbA1c was standardized.

Results: 1) Insulin injection regimens and HbA1c: 2-, 3-, 4-injection insulin regimens were 26.6%, 18.2%, 55.2%, respectively in 2000, and 14.2%, 16.8%, 68.9%, respectively in 2002. Over 2 yr, metabolic control did not improve despite the increased use of 4-injection insulin regimen (mean HbA1c 2000: $8.1\pm1.6\%$; 2002: $8.1\pm1.5\%$). However, it had improved from that of 1994 ($8.4\pm1.9\%$). No significant difference between insulin injection and HbA1c. 2) Insulin injection regimens, age, gender and HbA1c level: 4-injection insulin regimen increased with age and in females. However, mean HbA1c and incidence of poor control (HbA1c >10%) was significantly higher in females than in males at age groups >15 and 10-15 yr.

Conclusions: Metabolic control improved in the past 8 years. However, it was unsatisfactory in adolescent females. A psychosocial approach, including educated nurses and psychologists, will be necessary for further improvement of metabolic control.

O-25

IDF WPR childhood and adolescence
Diabcare survey 2001 in Shanghai

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Aim: To describe diabetes control, management and complication status in childhood and adolescence in Shanghai, and to investigate the relationships among diabetes control, management and complications status.

Methods: Eighty-three diabetic children and adolescents who were aged at diagnosis less than 18 yr and with diabetes diagnosed for at least 12 mo participated in this study. Clinical data were obtained by patient interview, reviewing medical records and physical examination. Capillary blood sample was taken for HbA1c (Bio-Rad).

Results: 97.6% (81/83) of the children and adolescents had type 1 diabetes mellitus, only 2.4% (2/83) type 2 diabetes mellitus. Mean age of the patients was 13.2 ± 3.9 yr with mean duration of 5.4 ± 3.1 yr and mean BMI 18.69 ± 2.56. All of the patients presented normal blood pressure. The mean HbA1c of patients was $8.9\pm2.0\%$ (5.8-13.8%). 12% (10/83) of the patients were found with HbA1c level less than 7.0%, 30.1% (25/83) between 7.0 and 8.0%, and 57.8% (48/83) greater than 8.0%. All the type 1 diabetic patients were treated with insulin. Diabetic chronic complications were not common in the patients: 2 patients (2.4%) suffered retinopathy, and 5 patients (6.0%) microalbuminuria. All the patients performed glucose self-monitoring either on blood or urine. Occurrence of ketoacidosis in type 1 diabetes was associated with longer duration of diabetes and poor glycemic control.

Conclusions: Diabetes mellitus is difficult to manage at any age. Although diabetic chronic complications were rare in the present study, more than half the patients were found with poor glycemic control. Strengthening of diabetes education in the future may be beneficial in improving the present state.

O-26

Which children and adolescents with type 1 diabetes profit from insulin pump therapy?

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Background: Continuous subcutaneous insulin infusion (CSII) is increasingly used in pediatrics. We analysed factors associated with improvement of glycemic control in pediatric patients before and during CSII.

Methods: A cohort of 53 consecutive children and adolescents (30 males, 23 females; age: 13.5 ± 3.5 years, diabetes duration: 6.4 ± 3.8 years; BMI-SDS: 0.8 ± 0.8; HbA1c: 8.7 ± 1.7%, DCA 2000) who changed from intensified conventional therapy (basal and prandial insulin: [mean ± SD] 0.32 ± 0.11 and 0.56 ± 0.15 IE/kg/d, respectively) to CSII were analysed in 3 monthly intervals for HBA1c, body weight and parameters of insulin therapy.

Results: 55% of the patients improved their HbA1c during CSII after 6 months. In the entire group the HbA1c did not change significantly after a short decrease within the first 3 months (8.0 ± 1.1%; p=0.03); 6 months (n=31): 8.1 ± 1.4%; 12 months: (n=17): 8.1 ± 1.4%. No significant increase of BMI was detected. Apart from 3 patients, all continued CSII. Using multiple regression analysis to analyse the association of various clinical parameters before pump therapy with the HbA1c difference after 6 months as dependent variable a significant influence of the level of HbA1c before CSII (r^2: 0.37) and age was noted. In particular, those patients with higher HbA1c before CSII improved glycemic control. At all time-points a negative correlation between the average number of daily boluses (6 months: 5.9 ± 2.2 boluses/d) and the respective HbA1c (r= -0.62, p<0.001) was found.

Conclusion: Adolescents with poor glycemic control frequently profit from CSII. Infrequent administration of boluses correlates closely with a higher HbA1c. On the other hand, a slight rise of HbA1c in previously very well controlled patients may be due to a declining incidence of unrecognized hypoglycemia during CSII. Therefore the recommendation for CSII in childhood and adolescence should always be considered individually.

O-27

Basal and bolus doses in children and adolescents when starting with insulin pump and after at least one year of treatment

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Background: When starting with an insulin pump the basal rate and bolus doses are calculated from the current dose on injection therapy. The aim of this study was to investigate the basal rate and bolus doses in different age groups when starting with insulin pump and after one year of use.

Methods: Case records from 29 children and adolescents who had started their pumps during the years 1997-2001 were examined. All pumps were started with rapid-acting insulin (Humalog).

Results: The patients were aged 13.1 ± 3.9 yrs (range 3-21), with a diabetes duration of 5.4 ± 4.1 yrs (0.8-15) at pump start. Their insulin requirements were 1.1 ± 0.3 U/kg/day (0.6-1.7). 16 pumps were started because of high HbA1c (age 13.9 ± 2.6 yrs, duration 6.3 ± 4.2 yrs) and 13 for other reasons (age 12.2 ± 2.6 yrs, duration 4.2 ± 3.7 yrs): 6 for life quality reasons, 4 for painful injections, 2 due to fluctuating glucose and 1 for dawn phenomenon. Age and diabetes duration was not significantly different between the 2 groups. At pump start 56% of the total daily dose was given as basal rate in the 3-9 yr-olds, 54% in the 10-15, and 57% in the 15-21 yr-olds. The total insulin dose/24 hour after 3 days was 78% of the pre-pump dose in the age group 3-9 yrs, 78% in the age group 10-15, and 76% in the age group 16-21. HbA1c after 1 yr with the pump was significantly lower than before starting with the pump (8.0 vs. 9.2%, $p<0.001$, t-test). After 1 yr there was a significant difference between the age groups in the percentage of basal rate in the late evening and during the night ($p=0.05$, ANOVA). The younger 3-9 age group had higher basal rates during the late evening and early night (0-3 am) while the oldest age group had higher basal rate in the late night (3-7 am).

Conclusions: We found that the basal insulin dose when starting with an insulin pump in children and adolescents can be reduced by approximately 20%. The bolus doses were reduced by 25-30% when the indication was high HbA1c and by ~15% in the other cases. The younger children needed higher basal rates late in the evening and early in the night (reversed dawn phenomenon) while older teenagers needed a higher dose in the late night, corresponding to a "true" dawn phenomenon.

O-28

CSII in patients with childhood onset type 1 diabetes (T1D) in Slovenia

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Background: CSII is an important treatment modality for children with T1D. By March 2003, 92 patients below the age of 15 with T1D are using CSII, representing 49.5% of all patients in this age group in our country. A total of 143 patients with T1D (79 boys and 64 girls) in all age groups from our center are currently on CSII therapy (17.9% of all patients).

Methods: Data for patients using CSII for more than 12 months were analyzed. The primary endpoint was metabolic control determined by glycosylated hemoglobin (HbA1c).

Results: The duration of T1D at the start of the CSII therapy was 6.24 years (range 0.3-25.1), with an average age at onset of T1D of 7.54 years (range 0.75-13.9 years). HbA1c data are presented in the figure. The decrease in HbA1c at 12 mo was statistically significant ($p < 0.001$). Patients reported fewer hypoglycemic events. No serious hypoglycemic event was recorded during the observation period.

Conclusion: During the first 12 months on CSII therapy, HbA1c fell significantly and remained stable in the following months, with a concomitant decrease in the number and severity of hypoglycemic events.
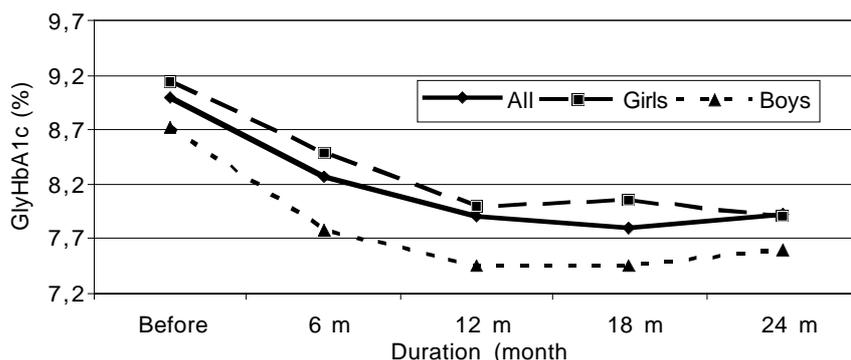
O-29

**Insulin dosing in children with type 1 diabetes
and continuous subcutaneous insulin infusion**

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Background: In the past years there has been an increasing use of insulin pump therapy (CSII) in children and adolescents with type 1 diabetes (T1D). Guidelines established for CSII dosing in adults do not necessarily apply to children in different age groups, where insulin needs vary widely.

Aim: To review clinical and metabolic characteristics of a large nationwide cohort of children and adolescents with T1D and CSII.

Methods: Since 1995, external comparisons of process and outcome in paediatric diabetology have been carried out using a uniform electronic DPV database in Germany and Austria (Vienna). Until December 2002, data of 11,599 patients with T1D (age < 20 years) from 117 centres were included.

Results: In 1995, only 26 patients used CSII, whereas up to 2002 a total of 631 (47% male) patients with CSII were registered in the DPV database. The mean diabetes duration (±SD) was 6.4±3.6 years, the age at start of CSII 13.1±3.7 years and the CSII-duration 0.3±0.2 years. 34 patients (60% male) were younger than 5 years, 56 (45% male) 5 to 9 years old, 287 (47% male) 10 to 14 years old and 255 (45% male) older than 15 years. The HbA1c in the whole cohort was 8.9±4.9%, in the age group 0-4 years 7.8±1.6%, 5-9 years 7.6±1.2%, 10-14 years 8.9±6.8%, 15-19 years 9.4±2.7%, p<0.0001. The bolus/total daily dose ratio was 0.52±0.14 in the whole cohort being significantly different in the age groups: 0-4 years 0.49±0.22, 5-9 years 0.55±0.19, 10-14 years: 0.53±0.12, 15-19 years 0.50±0.14, p<0.001. The overall incidence of severe hypoglycaemia was 0.09 per year without significant differences between the groups (p=0.234).

Conclusion: In Germany and Austria, the use of CSII has been steadily increasing in children with T1D. Insulin dosing (basal/bolus ratio) seems to be different in the several age groups. Glycaemic control in preschool children with CSII is superior compared to adolescents, while severe hypo-glycaemia is a rare event in all paediatric patients with CSII.

O-30

Mobile diabetes education and care for children with type 1 diabetes mellitus: Results of a new concept of diabetes management in a rural community

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Background: Quality of diabetes management is dependent on the structure of the diabetes care system. To optimize diabetes care in a rural community, mobile diabetes education and care was established in northern Germany in 1999. The mobile team provides care for five days a week, 24 weeks per year at eight different hospitals.

Methods: 107 families participated into the project and gave consent for evaluation of metabolic control, rate of hospitalisation, knowledge about diabetes, and quality of life at time of education (t0), then at 6 weeks (t1), and again 6 months later (t2).

Results: Initial increased HbA1c levels > 8% decreased significantly (t0: $9.4 \pm 0.9\%$; t1: $8.7 \pm 1.0\%$; t2: $8.6 \pm 1.5\%$; t0-t1, t0-t2: $p < 0.01$). The rate of hospitalisation dropped significantly by 9.41% ($p < 0.05$). The children report significantly better diabetes related quality of life (t0: 66.2 ± 14.4; t1: 69.1 ± 15.6; t2: 71.0 ± 16.0 (of hundred$\pm$SD) t0-t1 $p < 0.05$; t0-t2 $p < 0.01$). Knowledge of diabetes increased significantly short- ($p < 0.05$) and long-term ($p < 0.05$). The original number of 35 participants for diabetes education could be increased to 100 per year. Cooperation with local hospitals and education of doctors and nursing staff established a common standard diabetes management program.

Conclusion: Structure and quality of diabetes care and quality of outcome of children with type 1 diabetes can be improved substantially by a mobile diabetes education and care team.

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Comparing 12 month outcomes in the management and education of type 1 and type 2 diabetes in adolescents

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Background: In 2000-2001, nine (5%) of 174 patients presenting with new onset diabetes were diagnosed with T2D. These patients were in the age group 13-16 years, which comprised 33% of the 27 presenting with new onset diabetes in this group. The remainder were diagnosed with T1D.

Aim: To compare management and patient outcomes 12 months from diagnosis (Dx) in adolescents with TID and T2D.

Methods: Patients were identified through clinician/educator reports in 2000-2001. The focus of management varied greatly between the groups. Educator, dietitian and social worker reviewed both groups. Lifestyle changes were the main foci of education in the T2D group, resulting in regular dietitian review. Diabetes educator time was halved in the T2D group. Both groups had follow up at 1 and 2 months and then 3 monthly. The T2D group was managed with metformin; the T1D group was managed with insulin - median insulin dose 1 unit/kg at 12 mo.

Results: HbA1c was not significantly different between T1D and T2D at Dx or at 12 mo. BMI SDS was significantly greater in the T2D group at Dx and at 12 mo (see table), but did not increase further in T2D.

At Dx:	T1D	T2D	At 12 mo:	T1D	T2D
BMI SDS	-1.49	+2.27 *		+0.12	+2.16 **
	[-1.82 to -0.10]	[0.69-3.27]		[-0.57 to 0.40]	[0.88-2.45]
SBP	--	132 [110-146]		121 [118-128]	110 [110-116]#

Comparing T1D and T2D: *p < 0.0001, **p = 0.0015, #p = 0.022

Systolic BP improved significantly in T2D at 12 mo (p=0.03). Micro-albuminuria (present at Dx in 3/4 T2D) resolved in one case at 12 mo.

Conclusion: These results reinforce the importance of early differentiation between T1D and T2D. Tailoring management at diagnosis to the type of diabetes results in better use of staff resources and more relevant patient education, reducing subsequent weight gain in T2D and improving cardio-vascular risk factors.

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The effect of the use of a slide rule containing a colour-coded algorithm on metabolic control, knowledge and quality of life in children with diabetes mellitus

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Background: Self-management is important in the treatment of children with diabetes. To help them with the interpretation of blood glucose values and adjustment of the insulin dosage, we developed a slide rule containing a colour scheme representing a treatment algorithm. This study evaluates its effects on metabolic control, knowledge and quality of life in children with diabetes.

Methods: Patients aged 1 to 16 years with type 1 diabetes using insulin injections were invited to participate in this randomized multicentre intervention trial. 79 children (mean age 11.1 years) were randomly assigned to the intervention group, in which they immediately received the slide rule, or the control group, in which they started using the slide rule after 3 months. The intervention group used the slide rule for 6 months, the control group only for 3 months. Changes in HbA1c, blood glucose levels, knowledge about blood glucose values and in quality of life were compared.

Results: There were no overall effects of use of the slide rule shown on any outcome, although there was a stronger and almost significant effect in the group with a higher baseline HbA1c. No negative side effects were found; the number of hypoglycaemic episodes did not change during use. Patients in general liked using the slide rule and referred to it as a good aid in the day-to-day care of their diabetes.

Conclusions: The slide rule was designed to help with the self-management of diabetes in children. Although it is safe and patients liked using it, no significant effect of use could be demonstrated on metabolic control, knowledge of the interpretation of blood glucose values or quality of life.