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ORAL SESSIONS OF ORIGINAL PAPERS
Session of Original Papers 1 – Pharmacotherapy for type 2 diabetes or obesity?
Chairs: Małgorzata Godziejewska-Zawada, Monika Karczewska-Kupczewska, Katarzyna Nabrdalik

U1
QUALITY OVER QUANTITY. ARE ALL GLP-1 RECEPTOR AGONISTS MADE EQUAL? FAT AND LEAN MASS LOSS DURING WEIGHT MANAGEMENT – A SYSTEMATIC REVIEW

Jakub Gołacki[1], Wiktor Biłat[2], Beata Matyjaszek-Matuszek[1]

[1]Department of Endocrinology, Diabetology and Metabolic Diseases, Medical University of Lublin, Lublin, Poland
[2]Faculty of Electrical Engineering, Warsaw University of Technology, Warsaw, Poland

Introduction: Glucagon-like peptide-1 (GLP-1) receptor agonists are a fundamental pharmacotherapeutic option for individuals with overweight or obesity. Differences between them, such as pharmacokinetics, efficacy, market availability, and price, are well-known. In obesity therapy, increasing importance is being placed on targeted reduction of fat tissue while simultaneously retaining lean mass, which may be crucial in normalising neurohormonal disturbances characteristic of obesity and preventing obesity relapse. The aim of this study was to compare GLP-1 receptor agonists registered for obesity treatment (selective: liraglutide and semaglutide, and non-selective: tirzepatide) in their effect on fat and lean mass loss.

Material and methods: A systematic review was conducted in the PubMed database, where out of 298 publications found, 23 met inclusion criteria – containing information on body composition before and after intervention with GLP-1 receptor agonists use. The ratio of fat to lean mass loss was calculated along with standard deviations and compared for different doses of the analysed substances.

Results: The analysis showed differences in the impact of GLP-1 receptor agonists on the degree of fat and lean mass loss. The use of tirzepatide at a dose of 15 mg/week resulted in an average 84% reduction in fat mass and 17% reduction in lean mass *per* each kilogram of body weight reduced; the ratio calculated for semaglutide (1 mg/week) was 72% and 28% respectively, for semaglutide (2.4 mg/week) 61% and 39%, for liraglutide (3 mg/day) 61% and 39%, for liraglutide (1.8 mg/day) 56% and 44%.

Conclusions: The use of tirzepatide in obesity therapy has the most favourable effect on body composition, resulting in the greatest relative reduction in fat mass with the highest retention of lean mass, which may be due to its unique mechanism of action (dual GLP-1 and GIP agonism/modulation). This issue requires further research with greater methodological and population precision.

U2
CARDIOPROTECTIVE EFFECT OF EMPAGLIFLOZIN AND MODIFICATION OF SIRTUINS AND THEIR NON-CODING RNAS REGULATORS IN PATIENTS WITH MYOCARDIAL INFARCTION

Anna Nowak[1], Zofia Wicik[2], Ceren Eyileten[3], Sara Ahmadova[4], Jolanta Siller-Matula[5], Dirk Von Lewinski[6], Harald Sourij[7], Marek Postuła[4]

[1]Department of Experimental and Clinical Pharmacology, Medical University of Warsaw, Center for Preclinical Research and Technology CEPT, Warsaw, Poland
[2]Department of Diabetology and Internal Medicine, Medical University of Warsaw, Warsaw, Poland
[3]Department of Neurochemistry, Institute of Psychiatry and Neurology, Warsaw, Poland
[4]Genomics Core Facility, Centre of New Technologies, University of Warsaw, Warsaw, Poland
[5]Department of Internal Medicine II, Division of Cardiology, Medical University of Vienna, Vienna, Austria
[6]Department of Internal Medicine, Division of Cardiology, Medical University of Graz, Graz, Austria
[7]Division of Endocrinology and Diabetology, Interdisciplinary Metabolic Medicine Trials Unit, Medical University of Graz, Graz, Austria

Introduction: Studies have demonstrated direct cardio-protective effect of SGLT2 inhibitors, but the mechanism of action is unclear. We hypothesize that cardioprotective effects of SGLT2 inhibitors are due to increased expressions of Sirtuins and their regulator-miRNAs.

Material and methods: We conducted in silico prediction analysis using a computational approach. We identified/ranked the most promising ncRNAs associated with sirtuin pathways and SGLT2. We identified top miRNAs by preparing a gene list of all SIRT genes, 1st and 2nd level SGLT2 interactors, and genes involved in inflammation, fibrosis, oxidative stress, hypoxia-ischemia, MI and HF based on DisGeNet database. We validated our findings through qRT-PCR using selected plasma samples (empagliflozin/placebo = 24/24; baseline, 26-weeks after treatment) collected from the double-blinded EMMY clinical trial (NCT03087773), conducted in Vien and Graz, Austria.

Results: Our in silico analysis identified six miRNAs; miR-34a-5p, miR-27a-3p, miR-302a-3p, miR-146a-5p, miR-182-5p and miR-124-3p, which target the highest number of SIRT1-7 genes, SGLT2 and first-level SGLT2 interactors. qRT-PCR analysis showed that after 26 weeks of treatment, patients taking empagliflozin had significantly higher expression of miR-214, miR-34a, miR-146a, miR-182-5p and SIRT2 compared to baseline.

Conclusions: We also found that patients taking empagliflozin had significantly higher expression of SIRT6, and significantly lower expression of miR-214 and miR-302a-3p compared to placebo.

U3
COMPARISON OF PRE- AND POSTOPERATIVE MEDICATION COSTS (WITH PARTICULAR EMPHASIS ON MEDICATIONS USED BY PATIENTS WITH TYPE 2 DIABETES) IN PEOPLE WHO UNDERWENT BARIATRIC SURGERY – A NATIONWIDE DATA ANALYSIS

Magdalena Osińska[1], Yaroslav Sanchak[1], Andrzej Śliwczyński[2], Edward Franek[1], Magdalena Walicka[3]

[1]Department of Internal Diseases, Endocrinology and Diabetology, National Medical Institute of the Ministry of Interior and Administration, Warsaw, Poland
[2]National Medical Institute of the Ministry of Interior and Administration, Warsaw, Poland
[3]Medical Research Institute, Polish Academy of Sciences, Warsaw, Poland

Introduction: Bariatric surgery has known health benefits among others, improves control of diabetes (even in some cases induces remission of the disease) and its comorbidities like arterial hypertension and hyperlipidemia. Consequently, obesity surgery may lower the medication-related costs, especially in type 2 diabetes patients. This study aimed to assess the cost of medications before and after bariatric surgery in the Polish nationwide registry.

Material and methods: The study included 2,390 adults who underwent bariatric surgery. The analysis was conducted separately for a twelve-month pre-operative period and a twelve-month postoperative period. The total costs of medication and cost per anatomical therapeutic chemical group were assessed and the mean cost per patient in the preoperative and postoperative periods was compared.

Results: Concerning preoperative costs, the total cost for the treatment of the entire group of patients in the year preceding surgery amounted to PLN 6.91 million. The cost attributed to medications accounted for PLN 1,03 million. The highest cost was incurred for medications used to treat diseases of the alimentary tract and metabolism (group A according to the ATC classification) – PLN 262, 010, followed by drugs used in diseases of the cardiovascular system (group C) – PLN 238,989. The study showed a significant increase in the overall medication costs and mean costs of medications *per* patient in the year after bariatric surgery. Concerning the postoperative period, the total treatment cost for the entire group of patients in the year post-surgery totaled PLN 31.4 million, and most of it was related to the cost of the bariatric surgery itself (PLN 26.29 million). The cost attributed to medications accounted for almost PLN 1.3 million (4% of total cost). The highest cost was incurred for medications used in the treatment of blood and blood-forming organs (group B) – PLN 329,136, followed by drugs used in the diseases of the alimentary tract and metabolism (group A) – PLN 199,388. Next was the cost of drugs used in diseases of the cardiovascular system (group C) – PLN 168,488. Costs of medication used in the cardiovascular system diseases and anti-infectives decreased significantly. The total costs of hypoglycemic agents were reduced by 46%, antihypertensive medications by 29%, and lipid-lowering drugs by 38%. The total cost of glucometer strips has not changed. Costs of pharmacotherapy in the first 30 days after surgery accounted for PLN 302,945 and were generated mainly by low-molecular-weight heparins (PLN 240,645) and proton pump inhibitors (PLN 42,668).

Conclusions: In general, medication costs are higher in the first year after surgery. The increase results from the perioperative use of low-molecular-weight heparins, whereas a significant cost reduction of medications used by patients with type 2 diabetes (glucose-, lipid-lowering, and antihypertensive) was observed.

U4
ASSESSMENT OF MONOCYTES SUBPOPULATIONS IN WHOLE BLOOD AND INTERFERON γ RECEPTORS ON THEIR SURFACE IN OBESE SUBJECTS WITH AND WITHOUT GLUCOSE INTOLERANCE

Marta Dobrzycka[1], Magdalena Stefanowicz[2], Natalia Matulewicz[2], Agnieszka Nikołajuk[3], Alicja Walewska[4], Krzysztof Waczyński[1], Marcin Moniuszko[4], Andrzej Eljaszewicz[4], Irina Kowalska[1], Monika Karczewska-Kupczewska[1]

[1]Department of Internal Medicine and Metabolic Diseases, Medical University of Białystok, Białystok, Poland
[2]Department of Metabolic Diseases, Medical University of Białystok, Białystok, Poland
[3]Department of Prophylaxis of Metabolic Diseases, Polish Academy of Sciences, Olsztyn, Poland
[4]Department of Regenerative Medicine and Immune Regulation, Medical University of Białystok, Białystok, Poland

Introduction: Obesity and type 2 diabetes (T2D) are associated with increased susceptibility to viral infections, such as SARS-CoV-2, and their worse course. Obesity is characterized by adipose tissue infiltration with proinflammatory macrophages (M1) and the development of chronic low-grade inflammation associated with the induction of insulin resistance, a major pathogenic factor of T2D. Experimental studies showed that interferon γ (INFγ) plays an important role in increasing the number of M1 in adipose tissue. IFNγ is a protein involved in the body's early immune response to viruses, and it acts on monocytes by interacting with specific receptors (IFNGR1) on their surface. Thus, IFNγ may be a factor linking chronic low-grade inflammation and inappropriate antiviral response in humans with obesity and impaired glucose tolerance. Assessment of peripheral monocyte subpopulations and IFNGR1 on their surface in subjects with obesity and various degrees of impaired glucose tolerance.

Material and methods: Eighty-eight subjects: 18 with normal weight (control group; BMI 21.47 ±1.29 kg/m^2), 29 obese with normal glucose tolerance (BMI 36.66 ±4.65 kg/m^2), 23 with prediabetes (impaired fasting glucose and/or impaired glucose tolerance) (BMI 37.24 ±6.16 kg/m^2) and 18 with newly diagnosed T2D (BMI 34.57 ±5.20 kg/m^2) were included in the study. The blood samples were analyzed by flow cytometry using antibodies directed against surface markers enabling detection of monocyte subpopulations (classical, intermediate, and nonclassical) and IFNGR1. The absolute number of cells, with the expression of surface receptors for IFNγ, was assessed by analyzing their percentage concerning the morphological examination.

Results: A higher percentage of nonclassical monocytes was found in the obese subjects with normal glucose tolerance (p = 0.0034), with prediabetes (p = 0.0002) and T2D (p = 0.0003) compared to normal-weight subjects. There was a higher expression of IFNGR1 on nonclassical monocytes in obese subjects with normal glucose tolerance (p = 0.0034), prediabetes (p = 0.0002), and T2D (p = 0.0003) compared to the control group. The percentage of nonclassical monocytes and the expression of IFNGR1 did not differ between other study groups. In the entire study population, IFNGR1 expression on the nonclassical monocytes correlated positively with BMI, WHR, body fat percentage, HOMA-IR, fasting glucose and insulin, HbA_{1c} percentage, CRP, LDL-cholesterol and negatively with HDL-cholesterol (all $p < 0.05$). Multiple regression analysis indicated that BMI, but not glycemia or HbA_{1c} percentage, was an independent predictor of the nonclassical monocytes number and the expression of IFNGR1 on their surface.

Conclusions: Increased expression of IFNGR1 on the nonclassical monocytes is mainly dependent on obesity and may suggest an altered antiviral response in obese individuals, even without impaired glucose tolerance.

U5
PROBIOTICS REDUCE THE RISK OF GASTROINTESTINAL SIDE EFFECTS IN PATIENTS TREATED WITH METFORMIN

Izabela Szymczak-Pajor[1], Sylwia Wenclewska[2], Agnieszka Śliwińska[1]

[1]Department of Nucleic Acid Biochemistry, Medical University of Łódź, Łódź, Poland.
[2]Provincial Hospital named after Primate Cardinal Stefan Wyszyński, Sieradz, Poland

Introduction: Metformin is one of the most frequently used oral hypoglycemic drugs (OHDs) in the treatment of type 2 diabetes. Unfortunately, approximately 20% of metformin users experience undesirable effects from the digestive system, including: diarrhea, abdominal pain, nausea, vomiting, flatulence and constipation. The aim of the meta-analysis was to assess whether adding OHDs or probiotics to metformin therapy affects the risk of gastrointestinal side effects.

Material and methods: The material for the meta-analysis consisted of data from 29 randomized controlled clinical trials published in English, including patients with type 2 diabetes taking only metformin, metformin and other OHDs or probiotics. The PubMed, Cochrane Library and Clinical Trials databases were thoroughly searched to identify randomized controlled trials. The population, intervention, comparison, outcomes, and study type (PICOT) framework was used to formulate study selection criteria and the research question. The inclusion criteria included: (P) – patients with type 2 diabetes, (I) – metformin, (C) – placebo or metformin and other OHDs from the group of sulfonylurea derivatives, glitazones and DPP-IV inhibitors or metformin and probiotics, (O) – adverse events from the gastrointestinal tract, such as: diarrhea, abdominal pain, nausea, vomiting, flatulence, constipation, (T) – randomized controlled clinical trials. Collected data were extracted and linked into a standardized database using Cochrane Review Manager Software 5.4. Outcomes included in the meta-analysis included dichotomous data and were presented as relative risk (RR) and 95% confidence interval (95% CI) for each group. The results were considered statistically significant when $p < 0.05$.

Results: As expected, the use of metformin compared to placebo was associated with a significantly higher risk of abdominal pain (RR = 1.64 [95% CI: 1.02–2.66], $p = 0.04$), nausea (RR = 3.09 [95% CI: 1.77–5.39], $p < 0.0001$), vomiting (RR = 3.11 [95% CI: 1.74–5.56], $p = 0.0001$). In relation to other OHDs, metformin treatment was associated with an increased risk of diarrhea (RR = 1.37 [95% CI: 1.12–1.69], $p = 0.002$), abdominal pain (RR = 1.49 [95% CI: 1.04–2.12], $p = 0.03$), while decreased risk of vomiting (RR = 0.44 [95% CI: 0.24–0.80], $p = 0.007$) and bloating (RR = 0.62 [95% CI: 0.39–0.99]), $p = 0.05$). Adding other OHDs to metformin was associated with an increased risk of nausea (RR = 5.00 [95% CI: 2.30–10.83], $p < 0.0001$) and vomiting (RR = 8.57 [95% CI: 2.10–34.91], $p = 0.003$) compared to treatment with metformin alone. In turn, adding probiotics to metformin compared to metformin alone was connected with a lower risk of diarrhea (RR = 0.37 [95% CI: 0.27–0.52], $p < 0.00001$), bloating (RR = 0.26 [95% CI: 0.12–0.60], $p = 0.001$) and constipation (RR = 0.56 [95% CI: 0.42–0.73], $p < 0.0001$).

Conclusions: The obtained results suggest that combined therapy with OHDs and metformin increases the risk of nausea and vomiting. In turn, combination of probiotics with metformin is associated with a reduced risk of diarrhea, bloating and constipation. Therefore, metformin-treated patients who experience gastrointestinal side effects may benefit from taking probiotics.

Source of funding: This study was supported by the grant from Medical University of Łódź (No. 503/1-159-01/503-21-001).

U6
INFLUENCE OF MICROENCAPSULATED SODIUM BUTYRATE ON GASTROINTESTINAL SYMPTOMS, SIBO, AND HBA$_{1c}$ – RANDOMIZED, PLACEBO CONTROLLED CLINICAL STUDY

Paulina Panufnik[1], Martyna Więcek[1], Paulina Szwarc[1], Magdalena Kaniewska[1], Konrad Lewandowski[1], Edward Franek[2], Grażyna Rydzewska-Wyszkowska[1]

[1]Department of Gastroenterology, National Medical Institute of the Ministry of Interior and Administration, Warsaw, Poland
[2]Department of Endocrinology and Diabetology, National Medical Institute of the Ministry of Interior and Administration, Warsaw, Poland

Introduction: Patients with type 2 diabetes suffer frequently from gastrointestinal (GI) signs and symptoms and small intestinal bacterial overgrowth (SIBO), which may be connected with an impaired short-chain fatty acids (SCFA) production in the gut. The present study aimed to evaluate the influence of microencapsulated oral sodium butyrate on GI signs and symptoms, SIBO incidence, and diabetes control.

Material and methods: In this randomized, placebo-controlled, double-blind prospective study fifty two patients with type 2 diabetes suffering from abdominal pain were randomly assigned to microencapsulated sodium butyrate (1.5 g/day, *n* = 29) or placebo (*n* = 23). Treatment phase duration was 12 weeks. Before and after the treatment phase the presence of abdominal pain, diarrhoea, constipation and flatulence was assessed, laboratory tests (HbA$_{1c}$) and hydrogen breathing tests were performed.

Results: After the intervention there was significantly more patients relieved from GI signs and symptoms in the butyrate as in the placebo group. There was also a significant decrease of the prevalence of SIBO (22–7 patients) in the butyrate group after 12 weeks of treatment, which was not observed in the placebo group (13 vs. 13 patients). In the patients treated with sodium butyrate a slight but significant decrease in BMI (28.5+/–4.3 vs. 27.9+/–4.0) and significant improvement in HbA$_{1c}$ level (6.38+/–1.24 do 6.0+/–1.1) was also observed (Table 1).

Conclusions: Oral microencapsulated sodium butyrate supplementation is effective in relieving abdominal symptoms, treating SIBO and improving body mass and metabolic control in patients with type 2 diabetes with gastrointestinal symptoms.

Source of funding: The study was financed by own sources. Placebo was supplied by Bioton Company.

Table 1. Comparison between basal and after 12 week- intervention results.

Parameter	A Before butyrate (n=29)	B Before placebo (n=23)	C After 12 weeks butyrate (n=26)	D After 12 weeks placebo (n=21)	E Difference between C and A	F Diference between D and B	Significance of difference between E and F
BMI (kg/m^2); mean±SD	28.54 ± 4.27	27.46 ± 5.11	27.92±4.0	27.88±1.49	-0.60	0.0	<0.001
Abdominal pain; n(%)	29 (100)	23 (100)	12 (46.2)	20 (95.2)	-14	-1	0.001
Diarrhea; n(%)	17 (58.6)	17 (73.9)	5 (19.2)	15 (71.4)	-10	0	0.001
Constipation; n(%)	16 (55.2)	9 (39.1)	8 (30.8)	8 (38.1)	-7	0	0.012
Flatulence; n(%)	29 (100)	19 (82.6)	9 (34.6)	16 (76.2)	-17	-1	<0.001
SIBO; n(%)	22 (75.9)	13 (54.2)	7 (26.9)	13 (61.9)	-14	-1	0.001
HbA1c (%); mean±SD	6.38±1.24	5.88±0.8	6.00±1.1	5.91±0.75	-0.30	0.00	0.002

Session of Original Papers 2 – New technologies vs. hypoglycemia

Chairs: Elektra Szymańska-Garbacz, Bogumił Wolnik, Elżbieta Wójcik-Sosnowska

U7
ISLET AFTER KIDNEY TRANSPLANTATION RESTORES INSULIN INDEPENDENCE IN PATIENTS WITH TYPE 1 DIABETES

Agnieszka Zawada[1], Sarah Gondek[2], Joseph Tomecki[2], Nicole Wojcik[2], William Lin[2], Kamila Milejczyk[2], Braden Juengel[2], Lindsay Basto[2], Ling-jia Wang[2], Martin Tibudan[2], John Fung[2], Rolf Barth[2], Piotr Witkowski[2]

[1]Poznań University of Medical Sciences, Poznań, Poland
[2]University of Chicago Medicine, Chicago, USA

Introduction: Islet after kidney transplantation (IAK) could be an alternative to pancreas transplant in patients with T1DM but clinical outcomes of IAK are inconsistent and the experience is very limited.

Here, we present our pilot study of islet after kidney transplantation, which provided insulin independence and optimal blood glucose control.

Material and methods: Islet transplantation was performed 5 (0–5.5) years after initial kidney transplant in five T1DM patients at a median age of 50 (45–59) with median BMI of 25 (23–26) and median HbA_{1c} of 8.6 (6.8–10.2). Median serum creatinine and eGFR were 1.5 (0.9–2.1) and 50 (31–91), respectively. All patients received basiliximab induction and standard for kidney transplant maintenance immunosuppression. Etanercept administered subcutaneously was used in the peri-transplant period.

Results: Single islet infusion led to insulin independence in all five patients. Insulin independence at 1 year follow up with HbA_{1c} < 6.0 was maintained in 4/5 (80%) patients. One patient with a high BMI of 30 required a second islet transplant four months after the first one, maintaining insulin independence for the subsequent 5 years. Remaining four patients have remained insulin independent for 28, 20, 14, 10 months after the transplant. Patients achieved optimal clinical outcome with islet mass and donors comparable to those offered to islet transplant alone recipients with a mean IEQ transplanted of 396,000 (6,121 IEQ/k) and donor BMI 36 (33–37). None of the patients have experienced short or long term adverse events related to islet transplantation. Kidney graft function remained stable without progression to macroproteinuria.

Conclusions: Islet after kidney transplantation allows for the restoration of insulin independence in type 1 diabetic patients without compromising kidney graft function.

Source of funding: University of Chicago Medicine.

U8
GLYCAEMIC CONTROL IN CHILDREN WITH TYPE 1 DIABETES MELLITUS (T1D) TREATED WITH AN ADVANCED CLOSED-LOOP HYBRID (AHCL) SYSTEM FROM ONSET OF ILLNESS – A ONE-YEAR, RETROSPECTIVE TWO-CENTRE STUDY

Sebastian Seget[1], Agata Chobot[2], Mateusz Tarasiewicz[1], Anna Bielawska[1], Ewa Rusak[1], Halla Kamińska[1], Eliza Skała-Zamorowska[1], Agnieszka Ochab[2], Joanna Polańska[3], Przemysława Jarosz-Chobot[1]

[1]Department of Children's Diabetology, Medical University of Silesia, Katowice, Poland
[2]Department of Pediatrics, Institute of Medical Sciences, University of Opole, Opole, Poland
[3]Department of Data Science and Engineering, Silesian University of Technology, Gliwice, Poland

Introduction: The first AHCL system available in Poland was the MiniMed 780G system from Medtronic. Although it has so far been quite extensively studied in long-term groups of people with T1D, relatively less is known about its use in the treatment of children from the very onset of T1D. The aim of the study was to assess glycemic control in children treated from the onset of the T1D with MiniMed 780G in comparison to the use of a pump with a predictive low-glucose suspend (SAP-PLGS).

Material and methods: Data from 50 children newly diagnosed with T1D (22 treated with AHCL, 28 with SAP-PLGS) were retrospectively analyzed. The mean age at T1D onset in the AHCL group was 9.66 ±3.76, in the SAP-PLGS group 8.13 ±4.2 years. The analysis of CGM parameters and system readings in all studied children included two-week periods immediately after connecting the insulin pump, and then after 3, 6 and 12 months of using the insulin pump. Additionally, parameters such as body weight, height, HbA_{1c}, C-peptide at T1D onset and one year after the diagnosis were analyzed.

Results: HbA_{1c} at onset of T1D in the AHCL-treated group was 13.03 ±2.32% and in the SAP-PLGS group 11.86 ±2.17% (p = 0.07). After one year of treatment it was 6.75 ±0.54% and 7.45 ±1.18%, respectively (p = 0.01). We observed differences in the distribution of HbA_{1c} values between groups – at T1D onset, the standard deviations of HbA_{1c} levels were similar – 2.32 and 2.17 in the groups treated with AHCL and SAP-PLGS, respectively, while after a year these values were 0.54 and 1.18 (p = 0.01). After a year, the average glucose concentration from the sensor was lower (131.31 ±9.75 mg/dl vs. 145.80 ±23.43 mg/dl, p = 0.01) and time in range 70–180 mg/dl (TIR) was higher (85.72 ±6.8% vs. 74.43 ±13.9%. (p = 0.001) in the AHCL group compared to the SPA-PLGS group; and 29.63 ±5.19 vs. 32.63 ±4.78, p = 0.1, respectively); CV was comparable.

Conclusions: The investigated children using AHCL MiniMed 780G from the onset of T1D compared to those using SAP-PLGS had better glycemic control parameters.

U9
IMPACT OF THE FREESTYLE LIBRE 2® SYSTEM ON GLYCAEMIC OUTCOMES IN PATIENTS WITH TYPE 1 DIABETES

Katarzyna Rutkowska[1], Agnieszka Łoś-Stegienta[1], Michał Bagiński[2], Ewa Zięba[2], Adrianna Baran[2], Monika Żurawska-Kliś[3], Marcin Kosiński[3], Katarzyna Cypryk[3]

[1]Department of Internal Disease and Diabetology, Medical University of Łódź, Łódź, Poland
[2]Faculty of Medicine, Medical University of Łódź, Poland
[3]Department of Internal Disease and Diabetology, Medical University of Łódź, Łódź, Poland

Introduction: Regular glycaemic control is one of the most important aspects of diabetes management, especially in type 1 diabetes. It enables appropriate therapeutic interventions aimed at achieving proper metabolic regulation of diabetes, reducing the risk of hypo- and hyperglycaemic episodes, and preventing the development of serious complications resulting in premature decline in health and quality of life. Reimbursement changes introduced in Poland as of 1 January 2023 for flash glucose monitoring (FGM) systems for patients over 18 years of age with diabetes requiring intensive insulin therapy have expanded patient access to modern continuous glucose monitoring methods. To evaluate glycaemic control in patients with type 1 diabetes during the first three months of use of the FGM system. To evaluate which patients derived the greatest benefit from the use of the continuous glucose monitoring system based on age, duration of diabetes and treatment modality.

Material and methods: Patients with type 1 diabetes who met the reimbursement criteria for the FGM system were included in the study. Study participants used the FreeStyle Libre 2® sensor continuously for a period of 3 months, starting no earlier than 1 January 2023. All patients remained under the care of the Diabetology Clinic, they did not undergo specialized training, they only received essential technical guidance. The effectiveness of using the FreeStyle Libre 2® system was assessed using AGP reports at two time points (3–4 weeks and 11–12 weeks of system use). Electronic medical record data were also collected.

Results: The study included 81 patients with type 1 diabetes, 51% of whom were female. The mean age was 41 ±12 years and the mean duration of diabetes was 21 ±12 years. 48 patients (59%) were treated with multiple daily insulin injections, while the rest used personal insulin pumps. Mean sensor glucose did not differ between the study periods (150 ±28 mg/dl vs. 151 ±27 mg/dl, $p = 0.856$). There were no differences in GMI, TIR, TAR and TBR between the groups. In the first month of FGM use, patients scanned the sensor significantly more often than in the following two months (13.5 ±7.9 vs. 119 ±7.4, $p = 0.021$).

Patients < 40 years of age scanned the sensor significantly less in the following weeks of system use (–2.77 ±4.36 vs. –0.14 ±4.16, $p = 0.007$). No significant differences were found in the change of the evaluated parameters over the 3-month period of FGM use when comparing patients by duration of diabetes and treatment method.

Conclusions: The knowledge regarding self-monitoring of diabetes using glucose meters is insufficient to improve glycemic outcomes with the assistance of data derived from FGM. The decreasing number of scans *per* day over time with FGM use appears to be a result of "habituation", a diminishing interest in the device as a "technical novelty", and represents a dangerous trend. Further research and development of patient training methods is needed to realise the full potential of FGM's capabilities.

U10
IMPACT OF THE INITIATION OF IS-CGM SOON AFTER TYPE 1 DIABETES MELLITUS DIAGNOSIS IN ADULTS ON GLYCEMIC INDICES AND FEAR OF HYPOGLYCEMIA – DATA FROM RCT

Jerzy Hohendorff[1], Marta Wrobel[2], Agata Grzelka-Wozniak[3], Michał Kania[1], Lidia Lapinska[4], Dominika Rokicka[2], Irina Kowalska[5], Krzysztof Strojek[2], Dorota Zozulinska-Ziolkiewicz[3], Maciej T. Malecki[1]

[1]Jagiellonian University Medical College, Kraków, Poland
[2]Medical University of Silesia, Zabrze, Poland
[3]Poznań University of Medical Sciences, Poznań, Poland
[4]Medical University of Białystok, Białystok, Poland
[5]Medical University of Białystok, Białystok, Poland

Use of CGMS has become the standard of glucose control in patients with T1DM. It was shown that use of CGM improves TIR and TBR, and QoL. We aimed to assess the impact of soon after diagnosis (within 1–6 months) initiation of is-CGM on glycemic indices and fear of hypoglycemia (FoH) in adults newly diagnosed with T1DM. After 14 days of wearing the blinded sensor, participants were randomly assigned (1 : 1) to is-CGM (intervention group) or to self-monitoring of blood glucose (SMBG) with glucometers and blinded CGM (control group). The primary outcomes were change in TB70 and FoH assessed in HFS and main secondary outcomes were change in mean glucose, TIR, TAR between baseline and 4 weeks after randomization. Finally, in this RCT, 23 patients aged 25.6 ±5.1 were analyzed (14 males, 9 females). All participants were on MDI. Main results of the study are shown in Table 1. The study was terminated early due to changes in reimbursement policy in Poland, as during the study groups of patients eligible for reimbursement were significantly expanded and next generation of is-CGMS was introduced on market. However, our study has shown that, in T1DM patients early after diabetes diagnosis, TIR is high and hypoglycemia risk low. In spite small study group, our data suggest that introducing is-CGM decreases mean glucose; additionally, trend to further increase TIR and decrease TAR was seen.

Source of funding: Diabetes Poland Grant 2021.

Table 1. Comparison between study groups – baseline and 4 weeks after randomization

	Baseline			End of study			
	Intervention group (is-CGM) N=12	Control group (SMBG) N=11	p	Intervention group (is-CGM) N=12	Control group (SMBG) N=11	Difference between therapies	p
Mean glucose	7.03±0.90	7.07±1.43	0.937	6.73±0.83	7.43±1.47	-0.66±0.30	0.041
TB54	0.08±0.29	0.00±0.00	0.350	0.17±0.39	0.00±0.00	0.08±0.16	0.598
TB70	2.42±2.71	2.81±2.32	0.354	2.25±2.05	1.82±1.60	0.83±0.81	0.317
TIR	88.00±8.44	85.18±15.77	0.297	90.00±7.42	84.09±16.6	3.09±2.52	0.233
TA180	9.00±7.82	10.27±11.88	0.762	6.92±6.52	11.45±12.23	-3.27±2.20	0.152
TA250	0.50±1.00	1.72±4.45	0.181	0.67±0.89	2.64±5.03	-0.74±0.55	0.192
CV	42.84±5.45	28.53±3.88	0.198	27.18±5.77	29.01±4.39	-16.14±16.68	0.344
HFS-Worry	17.3±7.7	20.5±10.0	0.409	12.3±5.3	17.0±10.4	-1.6±3.2	0.614
HFS-Behavior	18.5±6.1	18.0±8.0	0.867	14.3±5.1	12.7±7.3	1.0±2.2	0.643

U11
UTILITY OF SELECTED SCALES IN THE ASSESSMENT OF IMPAIRED AWARENESS OF HYPOGLYCAEMIA IN ADULTS WITH TYPE 1 DIABETES

Magdalena Michalak[1], Aleksandra Cieluch[1], Mateusz Michalski[1], Michał Michalak[2], Dorota Zozulińska-Ziółkiewicz[1], Aleksandra Araszkiewicz[1]

[1]Department of Internal Medicine and Diabetology, Poznań University of Medical Sciences, Poznań, Poland
[2]Department of Computer Science and Statistics, Poznań University of Medical Sciences, Poznań, Poland

Introduction: Insulin therapy is associated with a higher risk of hypoglycaemia. The prodromal symptoms of hypoglycaemia allow for early recognition and effective response. Some patients develop impaired awareness of hypoglycaemia (IAH), which increases the risk of severe hypoglycaemia. The gold standard for assessing awareness of hypoglycaemia is the hyperinsulinemic-hypoglycaemic clamp. This is a complicated, costly, and time-consuming procedure, so alternative test should be sought. The use of questionnaires may allow for easy identification of patients with IAH and appropriate intervention. Assessment of IAH occurrence and clinical utility of commonly used questionnaires in adults with type 1 diabetes (T1D).

Material and methods: The study included consecutive adults with T1D, duration > 10 years, under the care of the Department of Internal Medicine and Diabetology in Poznań in 2022 and 2023. Awareness of hypoglycaemia using the validated questionnaires (Clarke scale, Gold scale and the Hypoglycemia Awareness Questionnaire (HypoA-Q)), anthropometric data, metabolic control, and the presence of chronic complications of diabetes were evaluated. On the Clarke and Gold questionnaires, a score of 4 or more indicated IAH. To estimate the optimal cut-off point for the diagnosis of IAH in HypoA-Q Impaired Awareness subscale (HypoA-Q IA), the receiver operating curve (ROC) analysis was used. The optimal threshold value was determined using Youden index. For the obtained cut-off point we presented the sensitivity and specificity.

Results: We analyzed data from 252 subjects (134 men) aged 41 years (IQR: 30–52) with diabetes duration of 22 years (IRQ: 16–30). Body mass index was 24.9 kg/m^2 (IQR: 22.8–28.2). HbA_{1c} was 8.1% (IRQ: 7.2–9.2%). Diabetic retinopathy was diagnosed in 99 patients (39%), diabetic kidney disease in 24 patients (9.5%), peripheral neuropathy in 85 patients (34%), and cardiac autonomic neuropathy in 39 patients (15%). IAH was diagnosed in 48 people (19%) using the Clarke scale, and in 57 people (23%) using the Gold scale. The HypoA-Q IA subscale score was 6 points (IQR: 3–9). We found the cut-off point of 9 points for diagnosing IAH on HypoA-Q (sensitivity of 79%, specificity of 82%, area under the curve (AUC) 0.898). Based on the proposed cut-off point, IAH was diagnosed in 75 patients (30%). Out of all those tested, just 30 individuals exhibited positive results on all three scales for diagnosing IAH, accounting for 35% of patients diagnosed with IAH through any test.

Conclusions: IAH presents a significant challenge for individuals with T1D. Particular scales detected IAH in different patients. The highest sensitivity in diagnosing IAH had HypoA-Q IA subscale with 9 points cut-off. HypoA-Q can be considered the most valuable screening test for IAH.

U12
GLYCEMIC CONTROL AND METHODS OF ITS MONITORING IN ADULT MEN WITH TYPE 1 DIABETES DURING A MARATHON

Michał Kulecki[1], Marcin Daroszewski[2], Paulina Birula[1], Anna Kreczmer[1], Monika Pietrzak[3], Anna Adamska[1], Magdalena Michalak[1], Anita Kaczmarek[1], Alicja Sroczyńska[3], Mateusz Michalski[1], Dorota Zozulińska-Ziółkiewicz[1], Andrzej Gawrecki[1]

[1]Department of Internal Medicine and Diabetology, Poznań University of Medical Sciences, Poznań, Poland
[2]University Centre for Sports and Medical Studies, Poznań University of Medical Sciences, Poznań, Poland
[3]Department of Diabetology and Internal Medicine, Raszeja City Hospital, Poznań, Poland

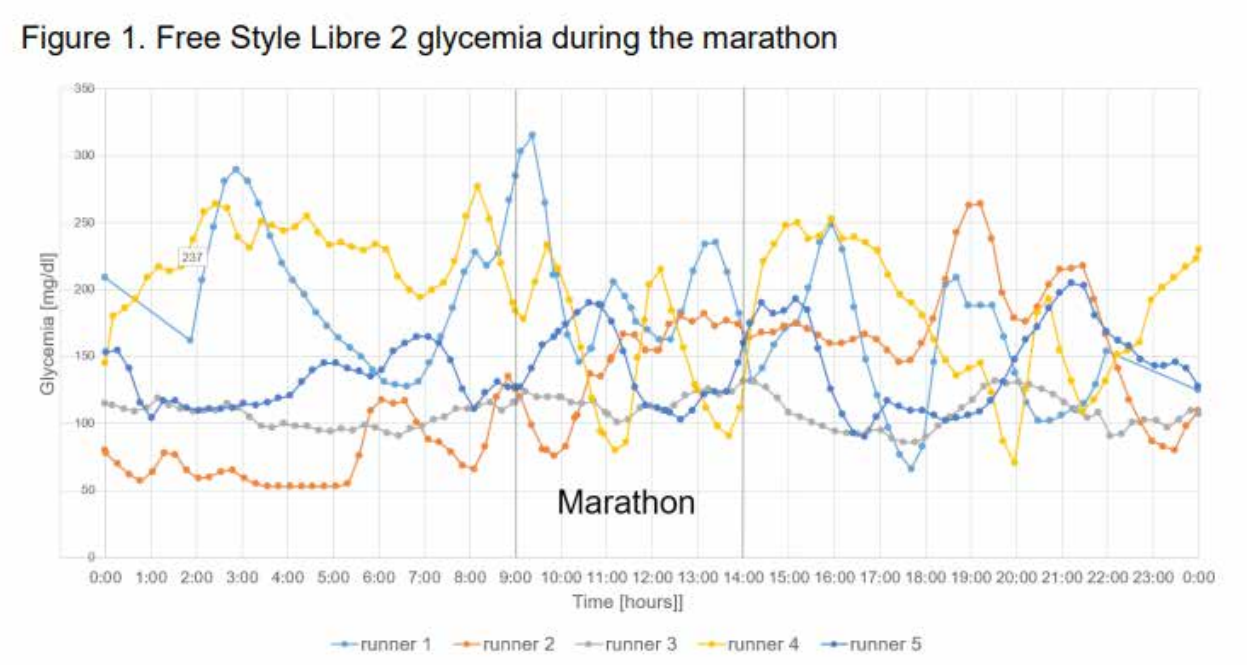
Introduction: Marathons, demanding 42,195 km of aerobic endurance, challenge even healthy individuals. Increased insulin sensitivity during such activity raises the risk of hypoglycemia for people with type 1 diabetes mellitus (T1DM). Limited data on managing this risk during marathons hinders recommendations for these individuals. This study assessed capillary blood glucose (CBG) and continuous glucose monitoring (CGM) use in adults with T1DM during a marathon.

Material and methods: We included five male participants with T1DM participating in the 22 Poznań Marathon. All participants completed a health questionnaire and received training on exercise-related glycemic control. They reduced their insulin dose and consumed breakfast 2.5–3 hours before the marathon. Five checkpoints along the course (start, 10. km, 19. km, 30 km, finish) provided CBG and ketone level measurements, carbohydrate and fluid supplementation, and insulin adjustments for hyperglycemia. They used FreeStyle Libre 2 (FSL2) – 5 participants and Dexcom G6 (DG6) CGM systems – 4 participants.

Results: Five men, aged 44.0 (34.00–48.0) years with diabetes duration of 10.0 (6.0–14.0) years and BMI of 22.5 (22.0–23.3), participated in the study. All used intensive functional insulin therapy and finished the marathon in an average of 4:02:56 (00:43:11) hours. Average CBG was 125.6 (43.5) mg/dl, FSL2 readings averaged 149.6 (17.9) mg/dl, and DG6 readings averaged 155.4 (12.9) mg/dl for 4 participants. One participant experienced sustained CBG below 70 mg/dl in 5 measurements, but CGM did not detect hypoglycemia. Another participant had symptomatic hypoglycemia detected by the CGM between CBG measurements. Maximum ketonemia was 0.3 mmol/l.

Conclusions: Completing a marathon safely requires tailored insulin adjustments and interventions like carbohydrate supplementation. Combining CGM with periodic CBG measurements enhances participants' safety during marathons.

Figure 1. Free Style Libre 2 glycemia during the marathon



Source of funding: Project "Development of the University Centre for Sports and Medical Studies in Poznań" (NdS/544750/2021/2022) as part of the Science for Society of the Minister of Education and Science.

Tabela 1. Glycemia and ketonemia during the marathon

Runner	START - time [h:min:s]	Start - capillary blood glucose [mg/dl]	Start - ketonemia [mmol/l]
1	00:00:00	64	0
2	00:00:00	160	0
3	00:00:00	124	0,1
4	00:00:00	188	0
5	00:00:00	375	0,1
Runner	**10km- time [h:min:s]**	**10km - capillary blood glucose [mg/dl]**	**10km - ketonemia [mmol/l]**
1	00:41:02	62	0
2	00:55:33	134	0
3	59:52:00	109	0,1
4	00:57:00	92	0,1
5	00:50:04	130	0
Runner	**19km- time [h:min:s]**	**19km - capillary blood glucose [mg/dl]**	**19km - ketonemia [mmol/l]**
1	01:18:16	43	0
2	01:52:40	95	0
3	02:01:50	77	0,1
4	01:49:28	82	0,1
5	01:40:12	147	0,1
Runner	**30km- time [h:min:s]**	**30km - capillary blood glucose [mg/dl]**	**30km - ketonemia [mmol/l]**
1	02:04:59	43	0
2	02:49:47	95	0
3	03:06:26	77	0,1
4	03:17:12	82	0,1
5	02:32:07	147	0,1
Runner	**META- time [h:min:s]**	**Finish - capillary blood glucose [mg/dl]**	**Finish - ketonemia [mmol/l]**
1	03:08:51	59	0
2	03:59:18	148	0
3	04:28:38	98	0,3
4	04:59:52	300	0,3
5	03:38:02	209	0,1

h- hour ; min – minute; s - second

Session of Original Papers 3 – Type 1 diabetes has many faces

Chairs: Andrzej Gawrecki, Adam Krętowski, Beata Mianowska

U13
A POPULATION PREVENTIVE STUDY OF EARLY DETECTION OF TYPE 1 DIABETES IN ASYMPTOMATIC CHILDREN IN THE PODLASKIE VOIVODESHIP

Artur Bossowski[1], Klaudyna Noiszewska[1], Milena Jamiołkowska-Sztabkowska[1], Agnieszka Polkowska[1], Aneta Zasim[1], Angelika Buczyńska[2], Aleksandra Wiatr[3], Aleksandra Dyszkiewicz[4], Aleksandra Lobacz[4], Miłosz Nesterowicz[5], Katarzyna Anikiej[5], Filip Bossowski[5], Magda Skorupska[6], Adam Krętowski[7], Tobiasz Sikora[8], Piotr Trzonkowski[9]

[1]Department of Pediatric Endocrinology and Diabetes with a Cardiology Division Medical University in Białystok, Białystok, Poland
[2]Center for Clinical Study, Medical University in Białystok, Białystok, Poland
[3]Department of Endocrinology, Diabetology and Internal Medicine, Medical University in Białystok, Białystok, Poland
[4]Scientific Circle in Department of Pediatric Endocrinology and Diabetes with a Cardiology, Medical University in Białystok, Białystok, Poland
[5]Neuca Fundation for Health, Toruń, Poland
[6]Department of Clinical Immunology and Transplantology, Medical University in Gdańsk, Gdańskl, Poland
[7]PolTREG S.A.

The population-based study of early detection of type 1 diabetes in asymptomatic children in the Podlaskie region is an extension of the Pre-diabetes Study conducted by our clinic between 2019 and 2023 in collaboration with 14 diabetes centres in the country. A total of 1288 patients aged between 7 months and 18 years were studied at that time. Positive 3-screen ELISA values were observed in 112 patients (8.69%). During analysis of individual antibody types, 76 children with multiple (two or more) antibodies were identified, constituting a pre-diabetes group (5.9%). In the observational group, diabetes was diagnosed in 11 patients on the basis of HbA_{1c} score and seven patients on the basis of OGTT, for a total of 17/47 patients (36%). None of the patients developed symptoms of ketoacidosis! Currently, from April 2023, we are conducting a populationbased study for the early detection of type 1 diabetes in all children aged 1–9 years, thanks to the UMB grant, in cooperation with the local government units of the Podlaskie Voivodeship. The aim of the project is to identify high-risk patients (presence of antidiabetic autoantibodies) among healthy pre-school and primary school children in Podlaskie Voivodeship. The project has already recruited 3,000 patients. Blood samples (serum) collected from children in the cooperating counties of the Podlaskie Voivodeship are frozen at –20'. After being transported to Białystok, the samples are analysed in the CBK at the Department of Internal Medicine, Endocrinology and Diabetology of the Białystok MU. A 3 screen RSR ELISA (Cardiff, UK) is performed and in case of a positive result, further analysis is performed on positive samples for specific detailed antibodies: GAD, anti-ZnT8, anti-IA2 and IAA (anti-insulin). The results are communicated back to the Department of Paediatrics, Endocrinology , Diabetology with Cardiology Subdivision and then to the patients with follow-up instructions according to the follow-up form. Positive results of the study indicating the likelihood of developing type 1 diabetes in the future will allow for appropriate education of families on the recognition of early symptoms of disorders of carbohydrate metabolism, early implementation of the principles of healthy nutrition, the need to maintain stable body weight, regular physical activity and the inclusion of the patient in the close care of the Diabetology Clinic. Eight districts were selected for the pilot (Białystok, Kolno, Hajnówka, Augustów, Suwałki, Łomża, Gródek, Kobylin-Borzymy). In just ten months, approximately 3,000 children were screened, with a positive result in 85 (3.46%) of subjects. In addition, 0.44% had two and 0.65% had two or more Abs giving the highest risk of developing DT1 among the children tested. This coincides with data from Sweden and Denmark presented recently at ISPAD 18–21.10.23 in Rotterdam. The research we are conducting is the first in Poland and unique in Europe and the World. Education and prevention activities aim to prevent acute complications of type 1 diabetes, the development of ketoacidosis, which is life-threatening, and to minimise the risk of chronic complications.

Source of funding: Białystok MU subsidy for 2024.

U14
LONG-TERM CONSEQUENCES OF ADHD IN CHILDHOOD-ONSET TYPE 1 DIABETES

Agnieszka Butwicka[1,2,3], Shengxin Liu[4], Wojciech Fendler[5]

[1]First Department of Medical Epidemiology and Biostatistics, Karolinska Institutet, Solna, Sweden
[2]Division of Mental Health Services, R and D Department, Akershus University Hospital, Lorenskog, Norway
[3]Institute of Clinical Medicine, Faculty of Medicine, University of Oslo, Oslo, Norway
[4]Department of Medical Epidemiology and Biostatistics, Karolinska Institutet, Solna, Sweden
[5]Department of Biostatistics and Translational Medicine, Medical University of Łódź, Łódź, Poland

Introduction: Attention deficit hyperactivity disorder (ADHD) is a condition that affects 5–10% of the pediatric population and is more commonly observed in children with type 1 diabetes (T1D). ADHD symptoms may hinder an individual's ability to effectively manage their diabetes. The aim of this study was to investigate whether the presence of comorbid ADHD in individuals with T1D is associated with long-term poor glycemic control, diabetic complications, and worse educational outcomes.

Material and methods: We conducted a population-based cohort study using longitudinally collected data from Swedish registers. Multinomial logistic regression was employed to calculate odds ratios (ORs) of having poor glycemic control (measured by glycated hemoglobin [HbA_{1c}]), while Cox regression was used to estimate hazard ratios (HRs) of nephropathy and retinopathy. Associations between T1D, ADHD, and educational milestones and school performances were examined using logistic and linear regression models.

Results: A total of 11 326 individuals with childhood-onset type 1 diabetes (diagnosed < 18 years of age during 1990–2013) were included in this study. Among them, 415 (3.7%) had ADHD without other neurodevelopment disorder (males 68.4%) and 10,562 (93.3) had no diagnosis of neurodevelopmental disorders (males 54.3%). Mean age at diabetes diagnosis, was 9.5 (interquartile range, IQR: 5.7–13.4) and 9.9 (IQR: 6.5–12.9) respectively for children with ADHD and those without neurodevelopmental disorders. During the median clinical follow-up was 7.5 years (interquartile range [IQR] 3.9, 11.2) the presence of ADHD (adjusted aOR 2.31, 95% CI: 1.54–3.45) was associated with poor glycemic control (mean HbA_{1c} > 8.5%). Patients with ADHD had an increased risk of diabetic complications (adjusted aHR 1.90, 95% CI: 1.20–3.00 for nephropathy, adjusted aHR 1.33, 95% CI: 1.07–1.66 for retinopathy). Of the 1,474,941 individuals (51.2% male) included in the educational study cohort, 9450 (0.6%) were diagnosed with T1D (54.2% male), 24,146 (1.6%) with ADHD (67.4% male), and 263 (0.02%) with T1D + ADHD (70.7% male) before 18 years of age. The median age at diabetes diagnosis was 10.5 (IQR:, 6.6–13.8) years. Compared to their peers, children with both T1D and ADHD had lower likelihoods of achieving educational milestones, including completing compulsory school (aOR 0.43, 95% CI: 0.26–0.72), being eligible for and finishing upper secondary school (aOR 0.26, 95% CI: 0.19–0.36 and aOR 0.24, 0.17, –0.35, respectively), and starting university (aOR 0.38, 95% CI: 0.17–0.90). Children with ADHD alone also had significantly reduced odds of achieving these educational milestones (aORs: 0.14–0.44), while children with T1D alone showed slightly worse or no differences (aORs: 0.86–1.08).

Conclusions: Comorbid ADHD was found to be associated with poor glycemic control and an increased risk of diabetic complications in childhood-onset type 1 diabetes. Individuals with both T1D and ADHD experienced long-term educational underachievement, with ADHD being the primary contributor. These findings highlight the importance of assessing ADHD in children with T1D and providing targeted support to minimize the risk of long-term complications and educational disparities between affected children and their peers.

Source of funding: Financial support was provided through the Swedish Research Council (No. 2017-00788).

U15
DOES BETTER CARDIORESPIRATORY FITNESS EXTEND THE DURATION OF PARTIAL CLINICAL REMISSION IN ADULTS WITH TYPE 1 DIABETES? DIAB1FIT STUDY RESULTS (NCT04968171)

Justyna Flotyńska[1], Dariusz Naskręt[1], Paweł Niedźwiecki[1], Agata Grzelka-Woźniak[1], Anita Kaczmarek[1], Aleksandra Pypeć[1], Aleksandra Cieluch[1], Dorota Zozulińska-Ziółkiewicz[1], Aleksandra Uruska[1]

[1]Department of Internal Medicine and Diabetology, Poznań University of Medical Sciences, Poznań, Poland

Introduction: The occurrence of clinical remission and its duration significantly influence the course of type 1 diabetes (DM1). There are many factors that contribute to DM1 remission. One of the most important is physical activity. Maximum oxygen capacity (VO2max) is an objective measure of the body's aerobic capacity. Evaluation of physical capacity in adults with DM1 and its relationship with the time of partial clinical remission (pCR) (DIAB1FIT STUDY NCT04968171).

Material and methods: The study included adults with newly diagnosed DM1 confirmed by positive autoantibody results, treated from the beginning with intensive functional insulin therapy. Recruitment for the DIAB1FIT STUDY study lasted two years (2019–2021). pCR was assessed at each follow-up visit (3, 6, 12, 24 months after diagnosis) using the IDAA1c (Insulin Dose Adjusted A1c) index: HbA_{1c} (%) + [4 x insulin dose (U/kg/d)]. By definition, a score ≤ 9 was considered as occurrence or ongoing pCR. VO_2max was assessed between the 6^{th} and 24^{th} month of diabetes duration in an ergospirometery test using equipment (COSMED K5 System) and during an exercise test performed on a cycloergometer (RAMP incremental exercise test).

Results: The study group consisted of 32 adults (4 women and 28 men) with DM1, aged 27 (22.0–30.5) years with an HbA_{1c} value of 6.9 (6.1–7.5) % on the day of the exercise test. The median VO2max of the subjects was 34.6 ml/min/kg. People with VO2max above the median had longer remission [15 (9–24) vs. 9 (0–12) months; p = 0.043]. There was a positive correlation between the duration of remission and VO2max (rs = 0.484, p = 0.005). Multivariate linear regression confirms a significant relationship between the duration of remission and VO2max [ml/min/kg] (β = 0.595, p = 0.002), regardless of gender, age, smoking and BMI.

Conclusions: The higher VO2max, the longer time of partial clinical remission at two years of type 1 diabetes. The obtained results confirm the importance of physical activity in promoting partial clinical remission of type 1 diabetes.

Source of funding: Diabetes Poland Grant.

U16
INTENSE PHYSICAL ACTIVITY MAY FAVORABLY INFLUENCE THE SIZE OF OLFACTORY BULBS IN ADULTS WITH TYPE 1 DIABETES

Maciej Chudziński[1], Anna Duda-Sobczak[1], Katarzyna Karmelita-Katulska[2], Tatiana Fijałkowska-Ratajczak[3], Jakub Kopeć[3], Dorota Zozulińska-Ziółkiewicz[1], Aleksandra Araszkiewicz[1]

[1]Department of Internal Medicine and Diabetology, Poznań University of Medical Sciences, Poznań, Poland
[2]Department of General Radiology and Neuroradiology, Poznań University of Medical Sciences, Poznań, Poland
[3]Department of Otorhinolaryngology, Raszeja City Hospital, Poznań, Poland

Introduction: Olfactory disturbances are frequently described in diabetes. Olfactory impairment is connected with reduction in the size of central olfactory structures including olfactory bulbs. Physical activity is a known factor modifying olfaction in healthy adults. The main goal of the study was to assess the connection between declared level of weekly physical activity, olfactory performance and size of central olfactory structures in patients with type 1 diabetes.

Material and methods: The study group comprised adult patients with T1DM, 18–65 years and disease duration ≥ 10 years. The group was than divided according to the level of declared, weekly physical activity. Control group included otherwise healthy adults. Declared physical activity was measured using international physical activity questionnaire – short form (IPAQ-SF) where time spent on intense and moderate physical activity, walking and sitting was assessed. Results were given in MET minutes a week. Based on this results high, moderate and low activity groups were distinguished in subjects with T1DM. Patients underwent full otolaryngological examination. Olfactory testing using Sniffin'Sticks and MRI (T1, T2 3D MPRANGE sequence) of the head with olfactory bulbs and pyriform cortices measurements were performed.

Results: 32 patients (24 male) with type 1 diabetes, median age of 43.5 years (IQR: 37.0–48.5) and disease duration of 24.5 years (IQR: 20.5–27.0), HbA_{1c} 7.9% (IQR: 7.4–8.4) were enrolled in the study. The control group consisted of 6 (4 male) otherwise healthy adults in median age of 41.0 years (IQR: 36.0–48.0). All evaluated groups did not differ in declared level of weekly physical activity. In Kurskall-Wallis analysis for many independent samples no statistically significant differences in olfactory test results and structural measurements of central olfactory structures were found between T1DM groups of high, moderate and low physical activity profile. Spearman's rank correlation test revealed that in patients with T1DM higher result in declared intense physical activity correlated positively with the summarized volume of olfactory bulbs (RS: 0.37; $p = 0.04$).

Conclusions: In adults with type 1 diabetes the longer the time of declared intense physical activity the bigger the size of olfactory bulbs.

Source of funding: The study was funded thanks to Scientific grant of Diabetes Poland, 2019.

U17
PEOPLE WITH TYPE 1 DIABETES ARE VASCULARLY OLDER THAN THEIR CHRONOLOGICAL AGE. RESULTS FROM THE POZNAŃ PROSPECTIVE STUDY (POPROSTU) AFTER 25 YEARS

Agata Grzelka-Woźniak[1], Dariusz Naskręt[1], Aleksandra Araszkiewicz[1], Aleksandra Cieluch[1], Aleksandra Uruska[1], Dorota Zozulińska-Ziółkiewicz[1]

[1]Department of Internal Medicine and Diabetology, Poznań University of Medical Sciences, Poznań, Poland

Introduction: People with type 1 diabetes are at increased risk of mortality compared to the general population, mainly due to cardiovascular risk. Hyperglycemic environment, glycemic fluctuations, and reduced insulin sensitivity accelerate the precocious atherosclerosis process. It has been shown that vascular age (VA) might better identify and stratify cardiovascular risk than chronological age. To assess VA and its relation with chronic diabetes complications and cardiovascular risk factors.

Material and methods: In 71 participants of PoProStu (Poznań Prospective Study) aged 47 [43–51] years and median type 1 diabetes duration of 25 [24–26] years we took medical history, collected anthropometric data, ran laboratory tests and assessed chronic diabetes complications among which we measured intima-media thickness of the right common carotid artery (cIMT). Using Vascular Age Calculator by QUIPU based on cIMT, age, and sex we calculated vascular age that expresses the age of the arteries based on cIMT reference intervals from healthy populations.

Results: Median VA in the whole group was 82 [62–106] years and it was higher in people diagnosed with retinopathy, diabetic kidney disease, hypertension and in ever smokers 93.5 (70.1–158.9) vs. 74.3 (60.9–91.6), $p = 0.04$; 91.6 (76.1–226.2) vs. 72.4 (60.9–93.5), $p = 0.039$; 7.4 (82.0–226.2) vs. 70.5 (59.4–84.0), $p = 0.02$; 88.7 (68.5–226.2) vs. 74.3 (58.0–89.7), $p < 0.001$ years, respectively. VA correlated with age Rs = 0.38, $p = 0.001$ and waist circumference Rs = 0.28, $p = 0.02$. Moreover, VA correlated with measures calculated for the whole a 25 year follow-up period of PoProStu study: mean estimated glucose disposal rate (eGDR) Rs = –0.50, $p < 0.001$ and mean HbA_{1c} Rs = 0.26, $p = 0.03$.

Conclusions: Increased VA in people with type 1 diabetes, especially in individuals with chronic diabetes complications could reflect subclinical atherosclerosis and denote higher cardiovascular risk. The better the long-term glycemic control and the greater sensitivity to insulin, the lower the vascular age.

U18
METABOLIC DYSFUNCTION-ASSOCIATED STEATOTIC LIVER DISEASE AND HEART FUNCTION IN PATIENTS WITH TYPE 1 DIABETES – AN EXPLORATORY STUDY

Klaudia Czarnik[1], Zbigniew Sablik[2], Anna Borkowska[3], Jarosław Drożdż[2], Katarzyna Cypryk[1]

[1]Department of Internal Diseases and Diabetology, Medical University of Łódź, Łódź, Poland
[2]Second Department of Cardiology, Medical University of Łódź, Łódź, Poland
[3]Department of Digestive Tract Diseases, Faculty of Medicine, Medical University of Łódź, Łódź, Poland

Introduction: Cardiovascular diseases are the dominant cause of mortality and morbidity in patients with type 1 diabetes (T1D). Metabolic dysfunction-associated steatotic liver disease (MASLD) correlates with cardiovascular risk in various populations. Given that MASLD may interact with the complex effects of insulin deficiency and subsequent hyperglycemia, we aimed to investigate the impact of MASLD on heart function in patients with T1D without heart failure (HF) symptoms.

Material and methods: Study participants were recruited at the inpatient clinic from 1.10.2021 through 1.09.2022 in admission order. The inclusion criterion was the T1D diagnosis. Patients with other types of diabetes, treated with metformin, pregnant, presenting symptoms of or being treated for HF, patients with active hepatitis, alcoholism, and either AST or ALT ≥ 2x the upper reference limit were excluded from the study. The analysis included medical history, anthropometric measurements, biochemical tests, echocardiography, and an potential MASLD biomarker – apolipoprotein C3. To estimate MASLD risk we used fatty liver index (FLI) calculated as FLI = ($e^{0.953 \times \ln(TG[mmol/L])+0.139 \times BMI+0.718+\ln(GGT[U/L])+0.053 \times \text{waist circumference [cm]}-15.745}$)/(1 + $e^{0.953 \times \ln(TG[mmol/L])+0.139 \times BMI+0.718+\ln(GGT[U/L])+0.053 \times \text{waist circumference [cm]}-15.745}$) x 100. Then we stratified study participants into the high MASLD risk group (FLI ≥ 60) and low or intermediate MASLD risk group (FLI < 60). Data was statistically analyzed according to its distribution.

Results: There were 55 patients included in the study. There were 55 patients included, 11 with high MASLD risk, and 44 with low or intermediate MASLD risk. The mean age in the whole study was 38 (±9.6) years, the mean diabetes duration was 21.8 (±11.3) years, the median BMI was 23.39 kg/m^2 (IQR: 21.5–27.0), and the median HbA_{1c} level was 8.05% (IQR: 7.15–9.90).

Patients with a high risk of MASLD presented with significantly higher waist circumference (110 vs. 79 cm, $p < 0.001$), BMI (30.5 vs. 22.8 kg/m^2, $p < 0.001$), and had more atherogenic lipid profile. 7 (64%) of patients with a high risk of MASLD were obese and 4 (36%) were overweight. On the contrary, in the low and intermediate MASLD risk group there were no obese patients, and only 20% of them were overweight. On echocardiography, patients with a high MASLD risk exhibited a significantly lower mitral E/A ratio (0.93 vs. 1.29, $p = 0.009$) and reduced mitral annulus velocities. There were no differences between groups regarding age, diabetes duration, renal, heaptic or thyroid performance as well as HbA_{1c}, NT-proBNP and APOC3 concentrations.

In univariable models, age, APOC3, and NT-proBNP independently correlated with the E/e' ratio increase. Multivariable model constructed using stepwise backward elimination comprised of age, APOC3, NT-proBNP, and BMI, of which all were statistically significant (R2 = 0.649, $p < 0.001$).

Conclusions: MASLD may be associated with a worsened diastolic heart function among patients with T1D. T1D patients with a high risk of MASLD presented with worsened mitral E/A ratio and altered mitral annulus velocities. However, further longitudinal studies are needed to comprehensively depict the extent of MASLD's effect on the risk of heart failure.

Source of funding: Diabetology Clinic's funds.

Session of Original Papers 4 – From diabetes to pregnancy and back

Chairs: Katarzyna Cyganek, Paweł Gutaj, Marta Wróbel

U19
GLYCEMIC CONTROL AND PREECLAMPSIA AMONG PREGNANT PATIENTS WITH LONG-LASTING TYPE 1 DIABETES – A SINGLE-CENTER OBSERVATIONAL COHORT STUDY

Daniel Boroń[1], Rafał Sibiak[1,2,3], Urszula Mantaj[1], Aleksandra Gładych-Macioszek[4], Paweł Gutaj[1], Ewa Wender-Ożegowska[1]

[1]Department of Reproduction, Poznań University of Medical Sciences, Poznań, Poland
[2]Department of Histology and Embryology, Poznań University of Medical Sciences, Poznań, Poland
[3]Doctoral School, Poznań University of Medical Sciences, Poznań, Poland
[4]Gynecological Obstetric Clinical Hospital of Poznań University of Medical Sciences, Poznań, Poland

Introduction: The use of continuous glucose monitoring (CGM) devices is linked with improved maternal and neonatal outcomes in patients with type 1 diabetes. Preeclampsia can be diagnosed from 20 weeks of pregnancy; however, the pathological changes in placental vessels, responsible for its pathogenesis, appear in the early first trimester. Pathogenesis of preeclampsia is multifactorial. Nonetheless, it is believed that bad glycemic control in the early first trimester may promote oxidative stress that invokes the antiangiogenic effect in the placental compartment. The main study objective was to analyze the glycemic control among pregnant patients with long-lasting type 1 diabetes with and without vascular complications (nephropathy and retinopathy) throughout gestation. The second aim of the study was to assess the incidence of preeclampsia in that population. We also aimed to compare the gestational glycemic control between the patients who developed preeclampsia and the non-affected control group.

Material and methods: We conducted a single-center observational cohort study. We recruited 70 eligible pregnant women with type 1, class D (n-48), or R and F (n-22) diabetes according to White's classification. All recruited patients were treated with sensor–augmented pumps with suspend–before–low function. The pregnant patients were admitted for at least 1 control hospital visit in each trimester of gestation for anthropometric and laboratory measurements and collection of sensor data. Then, we analyzed the CGM data and perinatal outcomes in the recruited cohort.

Results: Median HbA_{1c} values in the first, second, and third trimester were 6.55%, 5.63%, and 5.86% respectively. Median time-in-range (TIR) was close to or exceeded 70% in each trimester (69.2%, 70.8%, and 74.1%, respectively). Despite that, 18.6% (13/70) of pregnancies were complicated by preeclampsia. Patients who developed preeclampsia presented significantly decreased TIR values in the first trimester compared to the control group (63.3% (54.3– 68.5%) vs. 70.2% (67.35–76.6%); $p = 0.03$). The were no differences in the glycemic control in the second and third trimesters. There were 12.5% (6/48) preeclampsia cases among patients with class D diabetes, and 31.8% (7/22) in the group with vascular complications (R and F class) ($p = 0.054$). Nonetheless, we did not detect significant differences in glycemic control (HbA_{1c}, TIR) between those two groups.

Conclusions: Worse glycemic control at the early stage of pregnancy may play a role in the pathogenesis of preeclampsia. Patients with vascular diabetes complications are at high risk of preeclampsia development.

U20
THE IMPACT OF NOCTURNAL PERIPARTUM GLYCAEMIC CONTROL IN WOMEN WITH TYPE 1 DIABETES MELLITUS ON NEWBORN HEALTH

Milena Skibińska[1], Urszula Mantaj[2], Ewa Wender-Ożegowska[2], Katarzyna Cypryk[3]

[1]Department of Internal Diseases and Diabetology, Central Clinical Hospital of The Medical University, Łódź, Poland
[2]Department of Obstetrics and Gynecology, Polish Mothers Memorial Hospital Research Institute, Łódź, Poland
[3]Department of Reproduction at the Gynaecological and Obstetric University Hospital of Poznań University of Medical Sciences, Poznań, Poland

Introduction: Despite the efforts to optimize therapy in pregnant T1DM women, there is still a high rate of mothers' and newborns' complications. The aim of this study was to assess the impact of glycaemic control over a 14-day prepartum period using the continuous glucose monitoring system (CGMS) on newborn health in pregnant T1DM patients treated with continuous subcutaneous insulin infusion.

Material and methods: In view of the inclusion and exclusion criteria, 45 women were eventually included in the study. Patients' CGMS records 14 days prior to delivery were examined to mark the glycaemic fluctuation parameters together with their circadian characteristics. Obstetric and neonatal results were examined. A p-value < 0.05 was considered statistically significant.

Results: A statistically significant relationship was found between the nocturnal perinatal glycaemic fluctuation parameters and the incidence of premature birth (SD, $p = 0.010$; TIR, $p = 0.003$; TAR > 140, $p = 0.005$), as well as a correlation with the neonates' birth weight centile [TBR < 54 (rho = –0.35; $p = 0.020$); TBR < 63 (rho = –0.34; $p = 0.020$)], the infants' lowest blood sugar level in the 48-hour period after birth [average glycaemia (rho = –0.40; $p = 0.007$); median glycaemia (rho = –0.44; $p = 0.003$); TBR < 63 (rho = 0.38; $p = 0.011$)], the newborns' highest bilirubin concentration levels during hospitalisation [average glycaemia (rho = 0.38; $p = 0.011$)], median glycaemia (rho = 0.40; $p = 0.006$); TBR < 63 (rho = –0.30; $p = 0.047$)]. No such relationship was found with regard to the daytime parameters.

Conclusions: Due to the relationship between increased maternal glycemia levels in the perinatal period and complications in newborns shown in the study, special attention should be paid to the need for strict glycemic control during the hours of night rest and perhaps to verify the current treatment goals during this period. obstetric and neonatal results in pregnant T1DM patients.

Source of funding: The study was conducted with the funds assigned to the Research Project at the Faculty of Health Sciences at the Medical University of Łódź (no. 503/8-072-03/503-81-001-19-00).

U21
COMPARISON OF CONVENTIONAL SELF-BLOOD GLUCOSE MONITORING (SBGM) VS. FLASH GLUCOSE MONITORING (FGM) ON GLYCEMIC CONTROL IN PATIENTS WITH GESTATIONAL DIABETES MELLITUS– THE SINGLE CENTER EXPERIENCE

Magdalena Kwiatkowska[1], **Marianna Kopka**[1], **Katarzyna Cyganek**[1]

[1]Department of Metabolic Diseases and Diabetology, Jagiellonian University Medical College, Kraków, Poland

Introduction: Gestational diabetes mellitus (GDM) is one of the most common diseases complicating pregnancy, which may result in severe maternal and infant complications. The variety of technologies available for diabetic patients, including continuous glucose monitoring systems, has been constantly and rapidly increasing throughout recent years. New technologies became more avalaible for pregnant women in Poland because of their insurance coverage. The aim of our study was to compare of effectiveness of new technologies based on a comparison between flash glucose monitoring (FGM) and self-blood glucose monitoring (SBGM) in clinical outcomes in perinatal complications for mother and child.

Material and methods: In a retrospective analysis of 277 women with GDM admitted to the Department of Metabolic Diseases, University Hospital in Kraków, Poland, in January of 2023 year we compared effectiveness of FGM vs. SBGM in improving the clinical maternal outcomes measured by total daily insulin dose and body weight gain, mean blood glucose and newborns outcomes assessed by body weight, APGAR score, cesarean sections.

Results: We analysed 277 date of GDM women, 224 in SMBG and 77 in FGM group. The SMBG group was older (33 [30–36] vs. 32 [29–34]; $p = 0.027$), later admitted at first pregnancy visit (26 [14–29] vs. 20 [12–27]; $p = 0.001$), diagnosis of GDM was later week of pregnancy (24 [10–25] vs. 11 [8–23,5] weeks; $p < 0,001$). The group did not differ in pre-pregnancy body weight (70 [60–83] vs. 67 [59–79] $p = 0.358$), number of pregnancy (2 [1–3] vs. 2 [1–3]; $p = 0.118$). Thewomen using SMGB had lower pregnancy weight gain (10 [5.5–13.0] vs. 12 [8–14.8]; $p = 0.033$) and followed less visits during pregnancy (5 [4–7] vs. 8 [5–9]; $p < 0.001$) from which were less teleconsultations (1 [0–3] vs. 2 [1–5]; $p = 0.03$). Women in FGM group received insulin earlier (15 [11.5–27] vs. 27 weeks [16–30], $p < 0,001$) and more frequently (52 [98.1%] vs. 183 [81.3%], $p = 0.005$), but there was no significant difference in maximum daily dose of insulin (26,5 [11.5–39.2] vs. 21 [9–39], $p = 0.325$). There were no differences in birth weight, gestational week at delivery, preterm births, APGAR score in 1st minute, the frequency of cesarean sections, prevalence of perinatal complications.

Conclusions: We demonstrated that there were no differences in maternal and newborns outcomes between group using standard SMBG in compare to flash continouse glucose monitoring. Women using CGM had more visits in the form of teleconsultations

U22
EARLY MARKED ANTHROPOMETRICAL AND BIOCHEMICAL PARAMETERS AS PREDICTORS OF THE COURSE OF GESTATIONAL DIABETES

Agnieszka Przezak[1], Weronika Bielka[1], Piotr Molęda[1]

[1]Department of Diabetology and Internal Diseases, Pomeranian Medical University, Szczecin, Poland

Introduction: Gestational diabetes (GDM) is an impairment of glucose tolerance that firstly occurs during pregnancy. It is a well-documented risk factor of maternal and fetal complications. Hence, exploring the factors that may predict the course of GDM is essential. The aim of this study was to check whether there exists any anthropometrical or biochemical parameter easily used in everyday clinical practice which could be marked at the first visit and allow to predict the course of GDM.

Material and methods: Data about 500 women that had been diagnosed and treated with GDM in Diabetology Outpatient Clinic in years 2019–2021 were collected. Mean age of the study population 30.9 ±5.7; mean BMI before pregnancy 26.6 ±5.7 kg/m^2; mean glycated haemoglobin (HbA_{1c}) 5.1 ±0.4%; mean uric acid (UA) 3.7 ±0.8 mg/dl; mean triglycerides (TGs) 162.2 ±77.7 mg/dl; mean number of pregnancy 2.2 ±1.3; mean weight gain 8.8 ±5.8 kg; mean duration of gestation 37.8 ±3.1 weeks. 83.2% of women were treated with insulin with average maximal daily dose of insulin (DDI) 21.9 ±29.5 units. Mean week of pregnancy of insulin treatment initialization 15.9 ±10.7. Analyzed parameters: anthropometrical (age, BMI before pregnancy and at the first visit), metabolic [fasting glycaemia (FG), oral glucose tolerance test (OGTT) results, HbA_{1c}, TGs, UA, thyreotropin (TSH)], others (number of pregnancy, maximal DDI during pregnancy, weight gain, duration of gestation, risk factors for GDM). Adverse end-points of GDM were defined as the necessity of insulin treatment, the excessive weight gain, pre-term delivery.

Results: Patients who were treated with insulin differed with age (31.2 ±5.5 vs. 29.1 ±5.5; $p = 0.002$), BMI before pregnancy (27.3 ±5.8 vs. 25.1 ±5.3; $p = 0.01$), FG (95.1 ±9.9 vs. 90.2 ±9.6; $p = 0.001$), HbA_{1c} (5.2 ±0.4 vs. 4.9 ±0.3; $p = 0.001$) from patients that were treated only with diet. Women with an excessive weight gain differed with BMI at the first visit (30.1 ±5.5 vs. 27.6 ±5.6; $p < 0.002$), UA (3.9 ±0.8 vs. 3.7 ±0.8; $p < 0.04$), TGs (173.7 ±97.3 vs. 141.2 ±67.6; $p < 0.05$), maximal DDI (44.3 ±56.9 vs. 20.9 ±22.6; $p = 0.003$) from women with an adequate increase of body weight. Women with pre-term delivery differed with the number of pregnancy (2.6 ±1.6 vs. 2.1 ±1.1; $p < 0,05$) from women with proper gestational time duration. There is a positive correlation between BMI before pregnancy, number of pregnancy, FG, HbA_{1c} and maximal DDI (rs = 0.25; rs = 0.24; rs = 0.13; rs = 0.30; $p < 0.05$). There exists a negative correlation between BMI before pregnancy and weight gain during pregnancy (rs = –0.48; $p < 0,05$).

Conclusions: Some early clinical parameters which are easily used in everyday clinical practice such as BMI or UA may serve as predictors of the adverse outcome of GDM.

U23
METABOLIC STATE AT THE BEGINNING OF GESTATION COMPLICATED BY GESTATIONAL DIABETES MELLITUS AND GLUCOSE METABOLISM DISORDERS AFTER GESTATION – SHORT-TERM OBSERVATION

Weronika Bielka[1], Agnieszka Przezak[1], Piotr Molęda[1]

[1]Department of Diabetology and Internal Diseases, Pomeranian Medical University, Szczecin, Poland

Introduction: Gestational diabetes mellitus (GDM) is the impairment of glucose tolerance that firstly occurs during gestation. It is a risk factor for maternal and fetal complications in the future such as overweight, obesity or type 2 diabetes development. It is recommended to plan a control visit 6–12 weeks after pregnancy to check oral glucose tolerance test (OGTT) and to seek early complications. Exploring the factors that may predict the occurrence of glucose metabolism disorders after pregnancy is crucial. The aim of this study was to check if there exists any anthropometrical or biochemical parameter easily used in everyday clinical practice which could be a marker of and allow to predict the impairment of glucose metabolism after pregnancy.

Material and methods: Study group consisted of 104 women diagnosed and treated because of GDM in Diabetology Outpatient Clinic during three subsequent years. Mean age of the study population 32.2 ±5.1 years, mean BMI before pregnancy 25.8 ±4.8 kg/m^2, mean HbA_{1c} (glycated haemoglobin) at the first visit 5.1 ±0.4%, mean number of pregnancy 2.1 ±1.0, mean weight gain during pregnancy 9.0 ±5.2 kg, mean duration of gestation 38.4 ±0.9 weeks. 90 women were treated with insulin with average maximum daily dose of insulin 23.4 ±23.8 units. The data were obtained from the electronic documentation of the Outpatient Clinic. Analyzed parameters were: anthropometrical (age, BMI before pregnancy), metabolic at the beginning of pregnancy (fasting glycemia, OGTT results, HbA_{1c}, triglycerides (TGs), uric acid (UA), thyreotropin (TSH)) and after pregnancy at the control visit (OGTT, HbA_{1c}, insulin, HOMA2-IR (homeostatic model assessment 2 for insulin resistance), TSH).

Results: 20 women (19.2%) developed prediabetes diagnosed by OGTT. Patients who developed glucose disorders differed significantly with following metabolic tests marked at the beginning of the pregnancy: glycemia in the 0. (101.2 ±8.1 vs. 92.7 ±9.2; $p < 0.0005$) and 60. minute of OGTT (172.4 ±32.7 vs. 152.1 ±33.4; $p < 0.04$), HbA_{1c} (5.7 ±0.4 vs. 5.1 ±0.3; $p < 0.05$) from patients without glucose disorders. Women with diagnosed prediabetes after birth differed significantly with maximal dose of basal insulin (20.9 ±14.6 vs. 15.0 ±15.1; $p < 0.05$), glycemia in the 0. (101.1 ±10.8 vs. 89.3 ±6.3; $p < 0.05$), 60. (167.1 ±32.5 vs. 124.8 ±34.8; $p = 0.0001$) and 120. minute of OGTT performed after the birth (125.0 ±35.6 vs. 94.7 ±20.3; $p < 0.0003$) and HOMA2-IR (1.7 ±0.8 vs. 1.3 ±0.6; $p < 0.02$) from women who stayed healthy. Uric acid and HbA_{1c} at the first visit correlated positively with controlled HbA_{1c} (respectively, rs = 0.31 and rs = 0.54; $p < 0.05$).

Conclusions: Some early clinical parameters which are easily used in everyday clinical practice may indicate the risk of glucose metabolism disorders after gestation complicated by GDM.

U24
RETROSPECTIVE ANALYSIS OF TRENDS IN THE CLINICAL CHARACTERISTICS OF PATIENTS WITH GESTATIONAL DIABETES UNDER THE CARE OF A CLINICAL DIABETES CENTRE

Magdalena Wilk-Gajc[1], Marianna Kopka[1], Magdalena Kwiatkowska[1], Katarzyna Cyganek[1], Maciej Małecki[1]

[1]Department of Metabolic Diseases, Jagiellonian University Collegium Medicum, Kraków, Poland

Introduction: Hyperglycaemia is the most common condition complicating pregnancy. In Poland every pregnant woman is screened to diagnose carbohydrate metabolism disorders according to WHO criteria. Proper glycaemic control aims to reduce maternal and neonatal complications during pregnancy. Identification of trends in the clinical characteristics of patients in range of years 2007 to 2023. We recently published the results of a comparative analysis over a one-decade period (2007–2017), which showed increasing tendencies for patients' age at diagnosis of gestational diabetes mellitus (GDM) and decreasing results for gestational weight gain and gestational week at diagnosis. Now, the aim of our study was to evaluate the trends occurring covering the COVID-19 pandemic period (2020–2021) and the year 2023 important in terms of the widespread use of continuous glycemic monitoring systems.

Material and methods: On a basis of medical records a retrospective analysis of the data of 937 patients treated for GDM was performed: 55 patients (2007), 100 (2008), 140 (2012), 132 (2013), 126 (2016), 108 (2017), 69 (2020), 107 (2021), 100 (2023). We analysed: patient age at diagnosis, pre-pregnancy BMI, gestational weight gain, gestational week at diagnosis and percentage of patients treated with insulin. To determine trends for the above time criteria, the Mann-Kendall test was used in Python v.3.9.6.

Results: The following trends were observed: increasing in pre-pregnancy BMI 23.3 (2007), 24.1 (2008), 24.9 (2012), 24.8 (2013), 24.4 (2016), 24.0 (2017), 25.7 (2020), 26.6 (2021), 26. 7 (2023) $p = 0.03$, decreasing in gestational weight gain in kilograms 13.5 (2007), 11.7 (2008), 10.3 (2012), 9.8 (2013), 10.4 (2016), 10.6 (2017), 9.4 (2020), 8. 3 (2021), 8.9 (2023) $p = 0.02$, decreasing in gestational week at diagnosis 27.8 (2007), 28.2 (2008), 23.8 (2012), 23.7 (2013), 25.9 (2016), 26.0 (2017), 21.7 (2020), 20.8 (2021), 16.5 (2023) $p = 0.02$. No trends were observed for patient age at GDM diagnosis and percentage of patients treated with insulin.

Conclusions: The data confirm a problem in the increase of obesity among patients treated for GDM reflecting population trends. Nevertheless, it seems that the model of care for pregnant patients now makes it possible to detect carbohydrate disturbances more effectively and to start hypoglycaemic and obesity treatment earlier. The deepening trend of earlier diagnosis of GDM for our clinic in recent years can also be related to the close cooperation with the Department of Gynecology starting in 2020, where many patients require an oral glucose tolerance test in the first trimester of pregnancy.

SHORT ORAL PRESENTATIONS OF ORIGINAL PAPERS
Two diabetes gentlemen „N"

Chairs: Piotr Liszkowski, Katarzyna Madziarska, Dariusz Moczulski

P1
IMPACT OF PRIOR CHRONIC KIDNEY DISEASE AND NEWLY DETECTED EGFR IMPAIRMENT AT ADMISSION ON OUTCOMES AND PROGNOSIS OF HOSPITALIZED COVID-19 PATIENTS – A SINGLE-CENTER COHORT STUDY FROM POLAND

Michał Kania[1], Michał Terlecki[2], Krzysztof Batko[3], Marek Rajzer[2], Maciej Małecki[1], Marcin Krzanowski[4]

[1]Department of Metabolic Diseases and Diabetology, Jagiellonian University Medical College, Kraków, Poland
[2]Department of Cardiology, Interventional Electrocardiology and Arterial Hypertension, Jagiellonian University Medical College, Kraków, Poland
[3]Department of Dermatology, University Hospital, Kraków, Poland
[4]Departament of Nephrology, Jagiellonian University Medical College, Kraków, Poland

Introduction: Chronic kidney disease (CKD) is a major prognostic factor in COVID-19. Little is known about the significance of newly detected renal impairment (RI) for COVID-19 patient outcomes. We aimed to assess the impact of both of these factors – prior CKD and at admission RI- on in-hospital mortality of COVID-19 patients.

Material and methods: 5191 consecutive patients with COVID-19 admitted between March 6, 2020 and May 31, 2021, to the University Hospital in Kraków were analyzed. The main outcome was in-hospital death from any cause compared between the three study groups – patients with a prior history of CKD (group A), no history of CKD and eGFR on admission < 60 ml/min/1.73 m^2 (group B) and no history of CKD and eGFR on admission > 60 ml/min/1.73 m^2 (group C).

Results: Of 5191 patients, 2348 (45.2%) were women and 2409 (46.4%) were older than 65 years (mean age of 61.98 ±16.66 years). There were 483 (9.3%) patients in group A, 1009 (22.2%) in group B and 3699 (68.5%) in group C. As compared to group C, the patients from groups A and B were older and had greater cardiometabolic burden. In a multivariable logistic regression model predicting in-hospital mortality, older age, higher CRP, WBC and D-dimer concentrations on admission, HF and being in groups A or B, were associated with higher in-hospital mortality, with patients from group B having the highest risk of in-hospital death (OR 2.879, 95% CI: 2.208–3.754, group C as reference).

Conclusions: The odds of in-hospital death were higher for COVID-19 patients with previous CKD and newly-detected RI than in subjects with adequate kidney function. Newly detected cases of COVID-19 and RI should be treated with special attention.

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P2
RAMAN SPECTROSCOPY ANALYSIS OF EXTRACELLULAR VESICLES IN URINE DIFFERENTIATES PATIENTS WITH TYPE 1 DIABETES WITHOUT DIABETIC KIDNEY DISEASE FROM HEALTHY PEOPLE

Paulina Suduł[1], Agnieszka Kamińska[2], Andrzej Wróbel[2], Tomasz Klupa[1], Maciej Małecki[1], Ewa Stępień[3,4]

[1]Department of Metabolic Diseases, Jagiellonian University Medical College, Kraków, Poland; University Hospital, Kraków
[2]Department of Medical Physics, Marian Smoluchowski Institute of Physics, Jagiellonian University, Kraków, Poland
[3]Department of Medical Physics, Marian Smoluchowski Institute of Physics, Jagiellonian University, Kraków, Poland
[4]Centre for Theranostics, Jagiellonian University, Kraków, Poland

Type 1 and type 2 diabetes very often lead to many serious, chronic complications, such as diabetic retinopathy, neuropathy and kidney disease. Implementation of effective and cost-effective systematic diabetes complications screening strategies is essential to ensure their early detection of diabetes and reduce the risk of progression to advanced, life-threatening stages. Extracellular vesicles in urine are being considered as potential biomarkers of early complications of diabetes such as diabetic kidney disease and retinopathy. Patients with type 1 diabetes mellitus (n = 59) and healthy subjects (n = 41) were included in the study.

Patients were recruited in the Clinical Department of Metabolic Diseases and Diabetology. The exclusion criteria were diabetic kidney disease diagnosed according to: nephrological standards, absence of abnormalities in the general urine test and other significant concomitant diseases First morning urine samples (50 ml) were from patients with diabetes and healthy subjects. To isolate EVs, urine samples were centrifuged at 2000 × g and room temperature and the supernatant collected from the sediment was filtered by low pressure filtration method. The UEV solution retained after filtration (1 ml) was ultracentrifuged at 150,000 × g for 1.5 hour at 4°C and the sedimented UEV pellet was resuspended in deionized water.

The qNano system was used to determine size, concentration and zeta potential of UEVs. Raman spectra of UEVs were collected and post-processed by smoothing, backgroud substracting and normalization. Principal Component Analysis (PCA) was used to find out the wavenumbers in Raman spectra (biomarkers) responsible for the difference between diabetes and control groups. Next, the supervised Linear Discriminant Analysis (LDA) learning algorithm was applied to maximize the separation between study groups. Analysis of clinical data showed significant difference in HbA_{1c} (5.1 ±0.4 vs. 6.9 ±0.97, $p < 0.0001$) and triglycerides (1.1 ±0.4 vs. 0.8 ±0.2, $p < 0.001$) concentration between patients and control group. No significant differences were observed in the age, serum creatinine, estimated glomerular filtration rate (eGFR), urine albumin, LDL, HDL and cholesterol level. qNano measurements showed no difference in mean diameter and concentration, but significant difference in zeta potential (–26.2 ±6.2 mV vs. –18.8 ±6.1 mV, $p < 0.0001$) between patients and control group. The PCA analysis revealed that bands in the spectrum for tryptophan (1542–1547 cm^{-1}) and amides and lipids (1629–1711 cm^{-1}) had the greatest implication in the differentiation of groups. In turn after application of LDA-PCA learning algorithm for the whole spectrum range (800–3200 cm^{-1}), we received the value of the proper assignment to a given group (healthy vs. diabetes) at the level 90.6%. Likelihood-ratio test (LHR) for canonical variable (parameter obtained from LDA analysis) showed the sensitivity, specificity and accuracy of our test at the level 86%, 100% and 92%, respectively. Raman spectroscopy supported by machine learning analysis of urinary extracellular vesicles can be applied as a screening test to distinguish between healthy individuals and type 1 diabetic patients without diabetic kidney disease. However, whether the analysis of extracellular vesicles from urine using Raman spectroscopy can be a promising tool in the diagnosis of of early stages of diabetic kidney disease requires further research.

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P3
DEMONSTRATION OF CHANGES IN EXTRACELLULAR VESICLES' LIPID COMPOSITION IN URINE OF TYPE 1 DIABETES MELLITUS

Magdalena E. Skalska[1,2], Agnieszka Kamińska[3], Paulina Suduł[4,5], Jakub Kurdziel[6], Tomasz Klupa[4,5], Maciej Małecki[4,5], Ewa Stępień[1]

[1]Department of Medical Physics, Marian Smoluchowskiego Institute of Physics, Jagiellonian University, Kraków, Poland
[2]Centre for Theranostics, Jagiellonian University, Kraków, Poland
[3]Department of Medical Physics, Marian Smoluchowskiego Institute of Physics, Jagiellonian University, Kraków, Poland
[4]Department of Metabolic Diseases, Jagiellonian University Medical College, Kraków, Poland
[5]University Hospital, Kraków, Poland
[6]University Hospital, Kraków, Poland

Introduction: Kidney damage remains a significant clinical issue in type 1 (T1DM) and type 2 diabetes. The diagnosis of such damage as diabetic kidney disease (CKD) is based on the assessment of glomerular filtration rate (eGFR) and albumin excretion. There is a need for an early marker of kidney damage, and one of the proposed parameters is nanometric extracellular vesicles (EVs). These vesicles undergo changes in their structure, such as amino acid and lipid profile, and transported cargo, which provide useful information about the onset or presence of a disease in the biological system, such as CKD. Our study utilized time-of-flight secondary ion mass spectrometry (ToF-SIMS) to assess changes in lipid content for six different lipid groups and selected amino acids. Comparison and assessment of changes in the amino acid and lipid profile of extracellular vesicles in urine in people with well-controlled T1DM and the control group.

Material and methods: Urinary EVs (uEVs) were collected from 33 patients with T1DM who had good metabolic control, in whom CKD was excluded (15 years duration, using personal insulin pumps and HbA_{1c} ~7%) and 13 healthy individuals. The patients were recruited from the Clinical Department of Metabolic Diseases and Diabetology of the University Hospital. The uEVs were concentrated and purified using low-pressure filtration, pelleted by ultracentrifugation, and suspended in a PBS solution. ToF-SIMS measurements were conducted after placing the uEVs on cleaned silicon surfaces and analyzed them using a Bi_3^+ gun. The ToF-SIMS technique enables the comparative analysis of lipids without the need for extraction or specific determination. The study involved two biological replications and examined three areas on sample surfaces.

Results: This study presents the results of a comparative ToF-SIMS analysis of uEVs, focusing on changes in the percentage of amino acids and six lipid groups. The clinical data analysis revealed a significant difference in HbA_{1c} concentration (5.1 ±0.3 vs. 6.25 ±1.15, $p < 0.0001$) between the patient and control groups. In contrast, no significant differences were observed in age, serum creatinine, estimated glomerular filtration rate (eGFR), urine albumin, LDL, HDL, total cholesterol and triglycerides level. The results of the comparative ToF-SIMS analysis demonstrate statistically significant changes in the content of lipids from the group of sterols (cholesterol fragments), glycerolipids (DAG and TAG), and fatty acids (myristic, palmitic, oleic, stearic acids), which differentiate the patient group from healthy individuals. Furthermore, the content of all lipid groups was summarized, indicating that the lipid profile of the patient group differs from that of the healthy group.

Conclusions: Studies suggest that in the urine of patients with T1DM without CKD there are modifications in the content of individual lipid groups, as well as changes in the percentage composition of individual amino acids in patients compared to the control group. This means that uEVs can provide information about pathological processes taking place in the body of a patient with T1DM, but whether uEVs will become a marker of diabetic kidney disease requires further research.

P4
ASSESSMENT OF FOOT-AFFECTING CONDITIONS – DIABETIC ANGIOPATHY AND NEUROPATHY

Izabela Kuberka[1], Katarzyna Malewicz[2], Małgorzata Janków[3]

[1]Division of Anaesthetic and Surgical Nursing, Faculty of Health Sciences, Wrocław Medical University, Wrocław, Poland
[2]Division of Family and Pediatric Nursing, Faculty of Health Sciences, Wrocław Medical University, Wrocław, Poland
[3]A. Falkiewicz Specialist Hospital in Wroclaw, Diabetology Outpatient Clinic, Wrocław, Poland

Foot-affecting conditions in patients with diabetes called diabetic foot syndrome (DFS) are among the most common and challenging problems for both diagnosis and treatment due to their lack of uniformity. One of the more severe complications of diabetes is angiopathy, which involves the narrowing of arterial vessel walls as a result of progressive atherosclerosis of the peripheral arteries, referred to in the literature as PAD (Peripheral Artery Disease). PAD is characterised by symptoms such as, but not limited to, intermittent claudication, limb pallor especially in the early stages, abnormalities in a physical examination (the absence of a palpable pulse in the lower limbs during palpation) and impaired capillary refill. It is crucial to note that diabetic angiopathy may present a subclinical course in its early stages, making it essential to supplement the diagnosis with the ankle-brachial or toe-brachial index. Diabetic neuropathy, leading to nerve fibre damage, can manifest as sensory, motor, or autonomic neuropathy. Distinctive symptoms include hammer toes, calluses at the foot's support points, and Charcot-type joint deformities. Identifying superficial and deep sensory abnormalities through a comprehensive history and physical examination with specialized equipment is a key element in diagnosing diabetic neuropathy. Diabetic angiopathy and neuropathy can be the primary cause of an ulcer formation on the foot and can significantly impair the healing process. These conditions can occur independently or simultaneously, leading to complications such as infections, gangrenes, Charcot's neuroarthropathy, osteolysis, and ultimately, amputation of the foot due to the progression of lesions. Therefore, early diagnosis and the implementation of preventive measures are crucial elements in averting these complications. The aim of this study is to provide a practical overview of conditions affecting the foot specific to diabetic neuropathy and angiopathy. In conclusion, understanding the symptoms specific to diabetic angiopathy and neuropathy, along with diagnostic capabilities, can aid the early detection of conditions affecting the foot and the implementation of targeted education based on prevention and specialised treatment. This approach can significantly reduce the risk of developing full-blown DFS and the associated risk of amputation.

P5
ASSESSMENT OF PROTEIN GENE PRODUCT 9.5 IMMUNOREACTIVE NERVE FIBERS AND VASCULAR MARKERS CD34 IN THE SKIN OF ADULTS WITH TYPE 1 DIABETES AND THEIR ASSOCIATION WITH PERIPHERAL NEUROPATHY

Anna Adamska[1], Agata Grzelka-Woźniak[1], Aneta Konwerska[2], Michał Nowicki[2], Dorota Zozulińska-Ziółkiewicz[1], Aleksandra Araszkiewicz[1]

[1]Department of Internal Medicine and Diabetology, Poznań University of Medical Sciences, Poznań, Poland
[2]Department of Histology and Embryology, Poznań University of Medical Sciences, Poznań, Poland

Introduction: The research hypothesis assumes the existence of a neurovascular unit, which underlies the chronic complications of diabetes. Protein gene product 9.5 (PGP 9.5) is a marker of small nerve fibers, their impairment can occur at an early stage of diabetes. Skin biopsy and the assessment of the density of intraepidermal nerve fibers is the gold standard confirming the diagnosis of peripheral neuropathy. Furthermore, the skin is recognized as a model of microcirculation, hence the biopsy material was also assessed for CD34 antigen (vascular marker). Assessment of the density of PGP 9.5 nerve fibers and the density of CD34+ microcirculation vessels in skin biopsy material from adults with type 1 diabetes and their relationship with the occurrence of peripheral neuropathy (diabetic peripheral neuropathy – DPN).

Material and methods: The study included 160 people with type 1 diabetes (91 men), aged 41 (31–49) years, with a duration of diabetes of 21 (16.5–30) years, 62 with DPN and 97 without DPN. A skin biopsy taken from the lower limb was subjected to an immunohistochemical reaction using monoclonal PGP9.5 and vascular anti-CD34 antibodies. Density of intraepidermal nerve fibers is given as the average number of fibers *per* 1 mm^2. Blood microvessel density (MVD) was assessed using the hot spot technique. The diagnosis of DPN was based on the Toronto Definition (TCNS).

Results: Density of intraepidermal nerve fibers was significantly lower in patients with vs. without DPN [30 (26–36)/1 mm^2 vs. 36 (31–44)/1 mm^2, $p = 0.001$]. The density of PGP 9.5 nerve fibers correlated with the duration of diabetes (Rs –0.28; $p = 0.005$), age (Rs –0.27, $p = 0.007$), eGFR (Rs = 0.28, $p = 0.007$), AGE (Rs –0.35, $p = 0.002$) and MVD CD 34+ (Rs = –0.24, $p = 0.01$). The occurrence of DPN depended on the density of PGP 9.5 nerve fibers [OR 0.939 (95% CI: 0.886–0.995), $p = 0.04$] and AGE value [OR 2.957 (95% CI: 1.175–7.438), $p = 0.02$] regardless of sex, duration of diabetes, and HbA_{1c}.

Microvessel density CD 34+ was significantly higher in patients with vs. without DPN [129 (100–162.5) vs. 121 (96–142)/1 mm^2, $p = 0.03$]. Microvessel density CD 34+ correlated with BMI (Rs = 0.16, $p = 0.04$), WHR (Rs = 0.22, $p = 0.005$) and HDL (Rs = –0.27, $p = 0.005$). In univariate logistic regression, DPN was found to be associated with MVD CD34+ [OR 1.009 (95% CI: 1.001–1.017), $p = 0.04$] and duration of diabetes [OR 1.109 (95% CI: 1.061–1.158), $p < 0.001$]. In the multivariate regression model, the occurrence of DPN depended only on the duration of diabetes [OR 1.108 (95% CI: 1.059–1.159), $p < 0.001$] regardless of CD34+ vessel density, HbA_{1c}, and sex.

Conclusions: The density of intraepidermal PGP 9.5 immunoreactive nerve fibers in the skin is lower, while the density of microcirculation vessels CD34+ is higher in adults with DPN compared to patients without DPN. The simultaneous occurrence of changes at the level of innervation and vascularization in the histological material confirms the hypothesis of a neurovascular pathogenesis of chronic complications of diabetes.

Source of funding: Grant funded by the Poznań University of Medical Sciences, Scientific Grant from Diabetes Poland.

P6
EXPRESSION OF A-SYNUCLEIN AND CARBOXYMETHYLLYSINE IN THE EPIDERMIS OF DIABETIC PATIENTS

Judyta Juranek[1], Bernard Kordas[1], Wojciech Matuszewski[2], Elżbieta Bandurska-Stankiewicz[2]

[1]Department of Human Physiology and Pathophysiology, School of Medicine, University of Warmia and Mazury, Olsztyn, Poland
[2]Clinic of Endocrinology, Diabetology and Internal Medicine, School of Medicine, Collegium Medicum, University of Warmia and Mazury, Olsztyn, Poland

Introduction: A-synuclein (aSyn), mainly known for its role in the pathogenesis of Parkinson's disease (PD), has in recent years attracted attention as a potential modulator of glucose homeostasis but also as a key glycation target in both diabetic and PD patients. The aSyn deficiency impairs glucose metabolism and increases the risk of developing insulin resistance linked to metabolic syndrome and diabetes. Carboxymethyllysine (CML) is a classical advanced glycation end-product, and its presences substantiates for assessing glycation levels. The study's main objective was to examine the protein expression of aSyn in conjunction with the presence of CML in the epidermis of diabetic patients and to evaluate differences and correlations in their expression between healthy and diabetic subjects.

Material and methods: Seven healthy volunteers and seven diabetic patients treated at the Clinic of Endocrinology, Diabetology and Internal Medicine, Department of Internal Medicine, University of Warmia and Mazury in Olsztyn, Poland, were enrolled in the study. The University Institutional Ethics Committee approved the study, and before enrollment, all subjects provided informed consent. Skin specimens were obtained under local anesthesia using sterile disposable biopsy punchers, fixed 4% paraformaldehyde, transferred to 20% sucrose, sectioned at the cryostat and analyzed by immunohistochemical staining specific for aSyn and CML. Analysis was performed by measuring the area fraction stained for a given substance. The measurements were conducted using Fiji, an enhanced version of ImageJ – NIH microscope image analyzing software. The statistical analysis and data visualization were performed using GraphPad Prism statistical software.

Results: Obtained data revealed a significantly increased presence of CML and a trend towards a higher expression of aSyn in the diabetic epidermis. Furthermore, a strong correlation in staining patterns between aSyn and CML in diabetic epidermis was noted. In control samples, both CML and aSyn were mainly observed at the surface and cellular junctions of epidermal basal cells, while in diabetics, both substances were also noted in basal cell cytoplasm as well as in deeper layers of epidermis.

Conclusions: The results of our preliminary analysis highlight the importance of aSyn research in diabetes. Despite not reaching statistical significance, our observations accentuate noticeable changes in aSyn expression in conjunction with the increased presence of CML and thus provide background information for further probing of the role of aSyn in glucose homeostasis in diabetic patients and evaluation of their risk of developing other co-morbidities such as PD.

Source of funding: National Science Centre in Poland, Grant Number: UMO-2018/30/E/NZ5/00458.

P7
TOE FLEXION TEST TO ASSESS FOREFOOT INSUFFICIENCY IN PATIENTS WITH NEUROPATHY SYMPTOMS

Ewa Kostrzewa-Zabłocka

Diabetes Outpatient Clinic, Independent Public Provincial Specialist Hospital, Chełm, Poland
Diabetes Outpatient Clinic, Non-Public Healthcare Centre "Zdrowie", Chełm, Poland
Diabetology Clinic, Institute of Rural Health, Lublin, Poland

Introduction: Diabetic neuropathy causes degenerative changes to nerve receptors of foot muscles leading to motor neuropathy. Impaired function of the lower limb muscles contributes to the development of foot deformities and stiffness. When walking, the foot is incorrectly loaded and the pressure forces shift. Specialised diagnostic tests play a key role in the assessment of foot pathologies. One such test is a flexion test used to assess forefoot insufficiency. The ankle brachial index (ABI) test is used to diagnose chronic lower limb ischaemia. To diagnose the degree of forefoot insufficiency in patients with type 2 diabetes using the ankle-brachial index and the toe flexion test.

Material and method: The study used a proprietary 5-question questionnaire and a physical examination of the toes of both feet. The subjects demonstrated symptoms associated with diabetic neuropathy. All patients had their plantar flexion angle of the toes measured with a protractor and their pulses in the dorsal, tibial and digital arteries checked using Veno Doppler system. The study included 100 patients with type 2 diabetes, aged 50–80 years, of both sexes (60 women, 40 men). The study was held at the Diabetes Outpatient Clinic in Chełm from January to December 2023.

Results: The examined patients were divided into two groups. The first group (50 subjects) had no toe deformities. The flexion test showed that the angle of plantar flexion of the big toe and remaining toes was normal and was within the range of 40–60°, while ABI was within the range of 0.91–1.30. The second group included patients (50 subjects) diagnosed with finger deformities such as: hallux valgus, mallet toes, hammer toes, claw toes and crossover toe. In this group of subjects, the angle of plantar flexion of the big toe and remaining toes ranged 10–30°, indicating forefoot insufficiency. The ankle-brachial index (ABI) ranged 0.5–0.90, indicating foot ischaemia, while the TBI index below 0.6 implied toe ischaemia.

Conclusions: Forefoot insufficiency can be assessed by measuring the angle of plantar flexion of the big toe and remaining toes (flexion test) in patients with type 2 diabetes and diagnosed with toe deformities. A low ankle-brachial index (ABI) was observed in patients with foot deformities and a plantar flexion angle of toes ranging 10–30°.

P8
"QUESTIONNAIRE 4ZET FOR THE EVALUATION OF VASCULAR COMPLICATIONS AND NEUROPATHY IN THE FEET" IN THE PRACTICE OF THE IWOUND TELEMEDICAL SYSTEM

Beata Stepanow[1], Elżbieta Krupińska[1], Wioletta Zych-Haglauer[1], Bożena Rabowicz[1], Krzysztof Karaś[1]

[1]Diabetes Education Poland

Introduction: Diabetic neuropathy is the most significant factor in the development of Diabetic Foot Syndrome. Screening for neuropathy should be conducted at the time of type 2 diabetes diagnosis and, in type 1 diabetes, after 5 years of the disease, provided there are no symptoms. Telemedicine tools become part of the diagnostic and therapeutic proces, allowing for telemonitoring of patients and remote care. The study aimed to assess the functionality of the "4ZET Questionnaire for the Evaluation of Vascular Complications and Neuropathy in the Feet" introduced in the iWound telemedical system and used in daily practice by the nursing and medical team.

Material and methods: The study utilized an author-designed questionnaire allowing for the assessment of vascular complications and neuropathy risk in the feet in accordance with the 4Z principle – See (footwear, socks, gait), Collect medical history (therapy type, diabetes type, knowledge level, and health behaviors), perform examination (clinical examination of the foot, touch, pain, temperature, and vibration sensation, as well as ABI measurement and pulse examination), Recomendations (educatiion along with providing results and recommendations to the attending physician). The questionnaire includes both diagnostic-therapeutic and educational-preventive sections. The description of foot care practiced by the patient allows for the assessment of their knowledge.

Results: The "4ZET Questionnaire for the Evaluation of Vascular Complications and Neuropathy in the Feet" introduced in the iWound telemedical system facilitated remote collaboration of a team of nurses and doctors employed at various levels of the healthcare system. Access to the obtained data allowed for sharing experiences within the team, making joint therapeutic decisions, and preparing coherent recommendations for the patient. Visualization of individual modules supports the diagnostic-therapeutic process.

Conclusions: The "4ZET Questionnaire for the Evaluation of Vascular Complications and Neuropathy in the Feet" in the iWound telemedical system saves specialists' time, increases patient engagement in collaboration with the nurse-medical team. The diabetic neuropathy diagnostic module allows for its early detection and taking steps to prevent the development of the disease.

Youth is coming!

Chairs: Irina Kowalska, Maciej Małecki, Aleksandra Uruska

P9
CLINICAL EVALUATION OF TYPE 1 DIABETIC PATIENTS EDUCATED WITH STRUCTURED DIABETES EDUCATION PROGRAM GOPUMP DURING „INSULIN PUMP WEEK"

Weronika Gajda[1], Marta Najmanowicz[1], Aleksandra Nowatkowska[1], Mikołaj Kamiński[2], Aleksandra Cieluch[1], Alicja Sroczyńska[3], Anna Kreczmer[3], Magdalena Michalak1, Anna Adamska[1], Urszula Frąckowiak[3], Mateusz Michalski[1], Aleksandra Araszkiewicz[1], Dorota Zozulińska-Ziółkiewicz[1], Andrzej Gawrecki[1]

[1]Department of Internal Medicine and Diabetology, Poznań University of Medical Sciences, Poznań, Poland
[2]District Hospital in Kościan, Department of Rheumatology, Kościan, Poland
[3]Department of Diabetology and Internal Medicine, Raszeja City Hospital, Poznań, Poland

Introduction: Therapeutic education constitutes the foundation of comprehensive care for individuals with type 1 diabetes (T1D), especially in continuous subcutaneous insulin infusion (CSII) therapy. Structured diabetes education programs (SPED) are recommended in diabetes guidelines. This study aims to clinically assess CSII patients with poorly controlled T1D educated using the SPED GoPump during hospitalization.

Material and methods: We included adult patients with T1D who participated in the "Insulin Pump Week" during the years 2022–2023. Clinical characteristic, anthropometric data, metabolic control (HbA_{1c}, lipid profile), standardized Diabetes Treatment Satisfaction Questionnaire (DTSQ) data, reports from personal pumps and glucometer/CGM were evaluated.

Results: The study included 107 patients (65 women) aged 26.7 (19.0–30.75) years with a duration of T1D 13 (10.0–18.0) years. Twenty-one individuals (19.6%) reported smoking. Diabetic retinopathy was found in 9.3% of the participants and neuropathy in 4.7%. DTSQ score was 27 (22–29). BMI was 23.9 (21.8–26.3) kg/m^2, HbA_{1c} 7.9 (6.8–8.5)%, total serum cholesterol 166.0 (145–189.5) mg/dl, HDL-C 60.0 (50.0–70.5) mg/dl, LDL-C 85.0 (69.0–110.0) mg/dl and TAG 77.0 (63.5–105.0). Fifty-six individuals (52.3%) used CGM/FGM. CSII treatment duration was 8.0 (5.0–12.0) years, TIR (70–180 mg/dl) was 57.0 (45.0–69.5)%, DDI/kg/b.w. was 0.7 (0.5–0.8) U, and the basal rate in the proportion of basal/bolus was 40.0 (34–46)%.

P10
EVALUATION OF SERUM ZINC CONCENTRATION AND ITS ASSOCIATION WITH THE OCCURRENCE OF CLINICAL REMISSION IN ADULTS WITH TYPE 1 DIABETES DURING THE FIRST YEAR OF THE DISEASE (InLipoDiab1 Study)

Maja Miętkiewska-Dolecka[1], Agata Grzelka-Woźniak[1], Justyna Flotyńska[1], Justyna Marcickiewicz[1], Dorota Zozulińska-Ziółkiewicz[1], Aleksandra Uruska[1]

[1]Department of Internal Medicine and Diabetology, Poznań University of Medical Sciences, Poznań, Poland

Introduction: Type 1 diabetes (T1DM), as other autoimmune diseases, is characterized by reduced zinc concentration. The potential impact of zinc on clinical remission may arise from its role in reducing oxidative stress and its integral role in insulin synthesis, storage, and secretion. There is a lack of studies describing the relationship between zinc levels and clinical remission in adults with T1DM. The study aims to assess serum zinc concentration in individuals with newly diagnosed T1DM and evaluate its association with clinical remission during the first year of the disease.

Material and methods: Eighty individuals with newly diagnosed T1DM were enrolled in the study (58 males, 72.5%), participating in the InLipoDiab1 trial (NCT02306005), with an age range of 30 (26.0–35.0) years and BMI of 22.27 (20.04–24.37) kg/m^2. Clinical remission was evaluated at 3, 6, and 12 months post-diagnosis (using the formula: A_{1c} (%) + [4 × DDI (U/kg/day)]. Serum zinc concentration was determined using the Elisa – Zinc Colorimetric Assay Kit (Elabscience) at 3 weeks, 6, and 12 months post-diagnosis. Zinc variability was calculated as the difference between baseline and one-year values.

Results: Clinical remission was observed in 56.92%, 56.72%, 74.32% of individuals at 3, 6, and 12 months of observation, respectively. Mean serum zinc concentrations were below the reference range for the general population. Zinc level increased throughout the observation period in the overall cohort and among males, with no discernible trend in females, while no increasing trend was observed in females. Mean zinc concentrations did not differ between individuals with and without remission at 3, 6, and 12 months. When stratified by the median initial zinc concentration, remission frequency at 3 months did not differ, but after one year, remission was more frequent in the lower zinc group. For males, remission after 12 months was more frequent in those with higher initial zinc concentration. Zinc variability did not differ between those with and without remission after one year [3.78 (–2.52–8.90) vs. 3.11 (–2.75–9.28) µg/dl, p = 0.84]. Gender-based stratification also revealed no substantial differences in this regard [F: 1.22 (–0.61–6.53) vs. M: 4.04 (–2.89–9.28) µg/dl, p = 0.67].

Conclusions: In adults with newly diagnosed T1DM, the observed low and variable zinc concentrations do not demonstrate an association with partial clinical remission.

Source of funding: The project was conducted with the support of research grants provided by Poznań University of Medical Sciences.

Table 1A Serum zinc concentration (µg/dl) in the overall group during the observation period. (ANOVA test)

3 weeks	26.14 (19.56 -31.53)	P=0.02
6 months	27.78 (23.07 - 34.95)	
12 months	28.93 (22.15 - 32.45)	

Table 1B. Serum zinc concentration in males (µg/dl) during the observation period. (ANOVA test)

3 weeks	27.90 (19.80-33.29)	P=0.02
6 months	29.50 (24.74-36.67)	
12 months	30.61 (24.94-35.62)	

Table 1C. Serum zinc concentration in females (µg/dl) during the observation period. (ANOVA test)

3 weeks	24.11 (17.13-28.28)	P=0.56
6 months	23.81 (17.35-27.01)	
12 months	24.06 (19.97 – 29.45)	

Table 2. Serum zinc concentration after stratification based on the presence of remission at 3 months from diabetes diagnosis. (U Mann-Whitney)

	Remission at 3 months post-diagnosis		p
	Yes	No	
Zinc , after 3 weeks, µg/dl	27.86 (17.47-30.73)	24.27 (20.05-29.55)	0.97

Table 3. Serum zinc concentration after stratification based on the presence of remission at 6 months from diabetes diagnosis. (U Mann-Whitney)

	Remission at 6 months post-diagnosis		p
	Yes	No	
Zinc after 3 weeks, µg/dl	27.76 (17.71-31.18)	23.29 (19.52-28.92)	0.56
Zinc after 6 months, µg/dl	27.17 (23.11-34.44)	27.41 (22.52-33.19)	0.9

Table 4. Serum zinc concentration after stratification based on the presence of remission at 12 months from diabetes diagnosis. (U Mann-Whitney)

	Remission at 12 months post-diagnosis		p
	Yes	No	
Zinc, after 3 weeks µg/dl	25.92 (19.55-31.18)	27.07 (20.80-34.36)	0.4
Zinc after 6 months, µg/dl	27.33 (23.07-34.78)	31.72 (22.52-36.67)	0.5
Zinc after 12 months, µg/dl	27.75 (21.23-32.21)	31.69 (24.16-37.78)	0.2

P11
EFFECTIVENESS OF SPED "GOPUMP" EDUCATION IN PATIENTS TREATED WITH A PERSONAL INSULIN PUMP – EVALUATION AFTER 6 MONTHS

Aleksandra Nowatkowska[1], Weronika Gajda[1], Marta Najmanowicz[1], Mikołaj Kamiński[2], Aleksandra Cieluch[1], Alicja Sroczyńska[3], Anna Kreczmer[3], Magdalena Michalak[1], Anna Adamska[1], Urszula Frąckowiak[3], Mateusz Michalski[1], Aleksandra Araszkiewicz[1], Dorota Zozulińska-Ziółkiewicz[1], Andrzej Gawrecki[1]

[1]Department of Internal Medicine and Diabetology, Poznań University of Medical Sciences, Poznań, Poland
[2]District Hospital in Kościan, Department of Rheumatology, Kościan, Poland
[3]Department of Diabetology and Internal Medicine, Raszeja City Hospital, Poznań, Poland

Introduction: Patient education in type 1 diabetes (T1D) is crucial for achieving optimal metabolic control, particularly in individuals undergoing continuous subcutaneous insulin infusion (CSII). Recommendations emphasize the benefits of structured diabetes education programs (SDEPs), such as GoPump. GoPump is an educational program provided to therapeutic teams. Research is needed to evaluate the impact of GoPump SDEP on patient treatment outcomes. The aim of the study is to evaluate the influence of education using the GoPump SDEP on the treatment comfort in adults with T1D, utilizing CSII, and hospitalized due to poorly controlled T1D.

Material and methods: The study included initially 107 adults with T1D participants of the "Insulin Pump Week" between the years 2022-2023. Patients underwent 9–11 hours of group training following the 18 GoPump modules. Clinical, anthropometric, and laboratory data (HbA_{1c}, lipid profile) were assessed six months after the ending of education. The standardized Diabetes Treatment Satisfaction Questionnaire (DTSQ), reports from personal insulin pumps, and glucose meters/continuous glucose monitoring (CGM) were utilized.

Results: At the time of analysis, 71 patients had surpassed the 6-month post-hospitalization period. Complete data were obtained from 23 patients, incomplete from 45, and no data from 3 patients; 4 individuals were excluded (1 pregnancy, 2 CSII treatment discontinuations, 1 health deterioration unrelated to T1D). Comparisons of selective parameters at baseline and after 6 months are presented in Table 1. Statistical significance was

Table 1.

Parameters	Number of complete data	Comparison 0 vs. 6 months	p
Statistically significant changes (p<0,05):			
% CGM use / 4 weeks	29	89,0 (77,0-84,4) vs. 93,0 (86,0-89,7)	0,037
CGM %<54 [mg/dl]	29	1,0 (0,0-1,4) vs. 0,0 (0,0-0,7)	0,039
Episodes of hypoglycemia <70 mg/dl from the glucose meter / 4 weeks	7	15,0 (10,5-15,9) vs. 6,0 (3,5-6,1)	0,047
Average number of boluses per day	43	5,5 (4,6-5,7) vs. 5,9 (4,6-6,3)	0,004
HDL-C [mg/dl]	33	64,0 (55,0-65,7) vs. 68,0 (59,0-71.9)	0,01
No statistically significant change (p>0,05):			
HbA1c	38	7,7 (6,8-7,6) vs. 7,4 (6,8-7.5)	0,6
CGM % 70-180 [mg/dl]	29	57,0 (48,0-57,9) vs. 58,0 (50,0-57,1)	0,8

established at the $p < 0.05$ level. The DTSQc after 6 months was 14.00 (11.50–12.69). The DTSQc for hyperglycemia was 1.00 (0.00–0.77), and for hypoglycemia, it was 0.00 (–1.00–0.14). The remaining parameters did not differ significantly statistically 0–6-month groups.

Conclusions: DTSQc results indicated that six months post-hospitalization, patients subjectively experienced hyperglycemia more frequently, with no change in hypoglycemia perception. Despite this, they exhibited significantly greater satisfaction with diabetes treatment. Time and frequency of hypoglycemic episodes decreased with an increased percentage of CGM utilization. The assessment of the effectiveness of education using GoPump requires further research and observation planned after 12 months.

P12
ASSESSMENT OF CHANGES IN QUALITY OF LIFE, METABOLIC CONTROL, AND SELECTED PSYCHOLOGICAL PARAMETERS AFTER THE INITIAL IMPLEMENTATION OF A CONTINUOUS GLUCOSE MONITORING SYSTEM IN PATIENTS WITH TYPE 1 DIABETES

Bartłomiej Matejko[1], Anna Drynda[2], Katarzyna Cyranka[1], Katarzyna Nabrdalik[3], Hanna Kwiendacz[3], Janusz Gumprecht[3], Alicja Strzała-Kłeczek[4], Aleksandra Araszkiewicz[5], Dorota Zozulińska-Ziółkiewicz[5], Anna Juza[6], Maciej Małecki[1], Tomasz Klupa[1]

[1]Department of Metabolic Diseases, Jagiellonian University Medical College, Kraków, Poland
[2]Student Scientific Group at the Department of Metabolic Diseases and Diabetology, Jagiellonian University Medical College, Kraków, Poland
[3]Department of Internal Medicine, Diabetology and Nephrology, Faculty of Medical Sciences in Zabrze Medical University of Silesia, Katowice, Poland
[4]Department of Diabetology, Zagłębiowskie Centrum Onkologii, Dąbrowa Górnicza, Poland
[5]Department of Internal Medicine and Diabetology, Poznań University of Medical Sciences, Raszeja City Hospital, Poznań, Poland
[6]Clinical Provincial Hospital of Frederic Chopin No. 1 in Rzeszów, Rzeszów, Poland

Introduction: January 2023 marked a pivotal moment for type 1 diabetes treatment in Poland, as the reimbursement of continuous glucose monitoring (CGM) was initiated for patients aged 26 and above. While CGM improves glycemic control, its impact on psychological wellbeing of patients with diabetes type 1 remains uncertain. Assessment of changes in quality of life, fear of hypoglycemia, selected psychological parameters and glycemic control 3 months after the implementation of CGM system in patients with type 1 diabetes aged 26 and above.

Material and methods: The study involved 57 patients with type 1 diabetes from five Polish diabetes centers. To be included in the study, each patient had to be at least 26 years old with a minimum of two years of diabetes history, and be treated with multiple insulin injections or a personal insulin pump. The exclusion criterion from the study was the use of CGM for more than two weeks prior to the study. Patients completed a set of validated and custom questionnaires (FSH-II, PSS10, DTSQs, WHO-5, sociodemographic survey), downloaded 14-day pump/glucometer data, and underwent HbA_{1c} measurement during diabetologist visits. After 3 months of CGM use, patients repeated assessments and sent CGM reports. All types of CGM systems were allowed, depending on the patients' and doctors' choice.

Results: More than half of the patients were male (n = 29, 50.9%). The median age of the group was 37.5 years (IQR: 29.5–46.0 years), while the median duration of diabetes was 16 years (IQR: 29.5–46.0 years). After 3 months of using CGM, patients reported higher treatment satisfaction measured by DTSQs (median 27.0 vs. 30.0, p = 0.01) and less frequently experienced unacceptably high glycemia (median 4.0 vs. 3.0, $p < 0.001$). Well-being assessment according to WHO-5 was also higher (mean 13.1 vs. 14.3, p = 0.04), and the level of diabetes burnout (median 3.0 vs. 1.0, $p < 0.001$) as well as fear of hypoglycemia (median 41.0 vs. 30.5, p = 0.03) significantly decreased. However, the average stress level measured by PSS-10 did not change (p = 0.94). The percentage of HbA_{1c} after three months of using the system was also significantly lower (7.3% vs. 7.1%, p = 0.01).

Conclusions: The use of CGM translates into improved quality of life, reduced fear of hypoglycemia and diabetes burnout, as well as a lower HbA_{1c} percentage in patients with type 1 diabetes above the age of 26. The psychological and metabolic benefits of CGM advocate for its application in a broader group of patients.

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P13
THE LEVEL OF PHYSICAL ACTIVITY AND BARRIERS TO BEING PHYSICALLY ACTIVE IN PATIENTS WITH EXCESSIVE BODY WEIGHT AND PATIENTS WITH DIABETES

Edyta Sutkowska[1], Karolina Biernat[1], Justyna Mazurek[1], Katarzyna Hap[1], Natalia Kuciel[1], Magdalena Sutkowska[2], Dominik Marciniak[3]

[1]University Rehabilitation Centre, Wrocław Medical University, Wrocław, Poland
[2]Faculty of Medicine, Wrocław Medical University, Wrocław, Poland
[3]Department of Drugs Form Technology, Wrocław Medical University, Wrocław, Poland

Introduction: Physical activity (PA) is recommended as a prevention or treatment for many individuals but can be limited by various factors. The analysis of the level of PA and its limitations

Material and methods: Patients aged 18–64 years with diabetes or at least overweight if without diabetes. Assessment by two questionnaires: IPAQ (International Physical Activity Questionnaire) for the objective level of PA and an Accompanying Survey (AS) to assess barriers to undertaking PA and demographic and epidemiological data. Patients were asked to complete AS twice to test the reliability of this author's tool and to minimise the risk of randomisation of responses. For statistical analysis: non-parametric Mann-Whitney *U* test, χ^2 Pearson, correspondence analysis, meta-analysis (OR, ±95% CI) were used and $\alpha = 0.05$ was assumed.

Results: 191 questionnaires were analysed (67% from women), median(MD) age was: 50.5 years. Based on IPAQ: 16.23% subjects scored insufficient, 46.07% sufficient, 37.7% high PA, and MD for METs was 2079 min/week. Internal consistency and split-half reliability were considered sufficient to use the AS questionnaire (0.73 and 0.93 respectively). The most common limitations indicated for not taking up PA were lack of time: due to professional work (49%) and additional duties (32%); also fatigue from daily duties (44%). Participants < 45 years old were more likely to indicate additional duties ($p = 0.013$), participants > 45 yo illnesses ($p = 0.04$), and people with BMI ≥ 30 kg/m^2 – "fatigue from daily duties" ($p = 0.019$) as an obstacle to undertake PA."Lack of suitable conditions" was indicated more often by patients with primary education ($p < 0.01$), diabetes ($p = 0.037$), after myocardial infarction ($p = 0.039$) and those under psychiatric care ($p = 0.039$). Lack of motivation was more often declared by women ($p = 0.018$). Individuals from big cities and with BMI ≥ 30 were more likely to assess their PA as "insufficient" ($p = 0.0260$ and $p = 0.0081$, respectively). A correlation between the level of PA based on IPAQ and self-esteem based on AS was confirmed (χ^2; $p = 0.00047$).

Conclusions: The percentage of people with at least sufficient levels of PA by IPAQ was high. The patients who rated their PA as "sufficient" should be verified by a more objective IPAQ, because they inaccurately assessed their PA level. The individuals with BMI ≥ 30 kg/m^2, residing in a provincial city, are most critical of their PA level, which is not confirmed by IPAQ. The most common barriers to undertaking PA are lack of time and fatigue, related to both work and non-work activities. In the female group, lack of motivation is an additional significant factor.

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P14
THE ASSOCIATION BETWEEN G PROTEIN-COUPLED RECEPTOR 146 (GPR146) AND LIPID HOMEOSTASIS IN TYPE 2 DIABETES

Aleksandra Ryk[1], Anna Marcinkiewicz[2], Izabela Dróżdż[3], Krystyna Wyka[4], Arkadiusz Michalak[5], Wojciech Fendler[1]

[1]Department of Biostatistics and Translational Medicine, Medical University of Łódź, Łódź, Poland
[2]Cardiac Surgery Department, Medical University of Łódź, Łódź, Poland
[3]Department of Clinical Genetics, Medical University of Łódź, Łódź, Poland
[4]Department of Pediatrics, Oncology and Hematology, Medical University of Łódź, Łódź, Poland
[5]Department of Pediatrics, Diabetology, Endocrinology and Nephrology, Medical University of Łódź, Łódź, Poland

Introduction: The orphan G-protein coupled receptor 146 (GPR146) is a candidate receptor for proinsulin C-peptide (CP) and a promising therapeutic target against atherosclerosis. Taking into consideration the increased risk of macroangiopathy in people with type 2 diabetes (T2DM), we investigated the association between the expression of GPR146 in tissues associated with the pathogenesis or complications of diabetes and lipid metabolism parameters as well as clinical characteristics of patients with T2DM.

Material and methods: The study recruited adults with T2DM and without diabetes with significant coronary artery stenosis or multivessel disease qualified for coronary artery bypass grafting (CABG). Exclusion criteria included: eGFR < 30 ml/1.73 m^2, C/D in Child-Pugh classification, use of sulphonylurea derivatives. During the procedure, the surgeon collected fragments of the following tissues: aorta, saphenous vein, right atrial appendage, periaortic (TKO), epicardial (TKN) and athymic (TKP) adipose tissue. Clinical data were collected including: age, BMI, total cholesterol, low-density lipoprotein (LDL) , high-density lipoprotein (HDL) , triglycerides, glycated haemoglobin (HbA_{1c}), fasting CP levels and data on diabetes treatment and complications. GPR146 expression was measured at mRNA level (RT-PCR, RNaeasy Mini Kit, Qiagen, Germany, GAPDH-reference gene) and protein level (ELISA, Human GPR146 ELISA Kit, Abbexa, USA). Receptor expression was compared between the study groups and the association between receptor expression in individual tissues and other clinical parameters was examined. The required sample size was estimated at n = 46, assuming a difference in GPR146 expression between groups at 1.5 standard deviation and |R|> 0.5 for correlations with statistical assumptions (α < 0.05, statistical power 90%).

Results: The study was carried out on n = 24 participants with T2DM and n =30 without diabetes [44 men, 81.48%, aged 68 (25–75% = 64.00–72.00) years]. The T2DM group had significantly higher HbA_{1c} levels [median+ 25–75%: 6.80% (6.20–7.70%) vs. 5.60% (5.40–5.80%), p < 0.01] and significantly lower LDL levels (mean+/–SD: 2.25 ±0.80 vs. 2.83 ±1.07, p = 0.03). GPR146 expression in studied tissues ranged from 2.66 × 10–4 to 3.39 × 10–4% of total protein (ELISA), with lowest expression in TKO and highest in TKN. Receptor expression did not differ significantly between groups. Receptor protein levels in right atrial appendage correlated with total cholesterol (R = 0.41, p = 0.03) and LDL cholesterol (R = 0.44, p = 0.02) in all patients. In the T2DM group, triglyceride levels negatively correlated with GPR146 protein levels in TKN (R = –0.41, p = 0.03) and TKP (R = –0.64, p < 0.01). Additionally, in T2DM group, CP levels negatively correlated with GPR146 protein levels in TKP (R = –0.55, 0.01). These correlations did not occur in the control group (all –0.15 < R < 0.15, p > 0.05). Considering the entire study group, BMI (median= 28.57, 25–75% = 26.06–31.14) correlated with GPR146 mRNA expression in aorta (R = 0.31, p = 0.02), right atrial appendage (R = 0.39, p = 0.01) and TKN (R = 0.28, p = 0.04). CP concentration (median = 1.32 nmol/l, 25–75% = 0.88–2.25 nmol/l) correlated with GPR146 mRNA expression in TKP (R = 0.31, p = 0.03). In T2DM group, total cholesterol (median = 4.01 mmol/l, 25–75% = 3.10–4.25 mmol/l) and LDL (mean = 2.57 mmol/l, SD = 1.00 mmol/l) correlated with GPR146 mRNA expression in TKO (R = 0.54, p = 0.01; R = 0.59, p < 0.01) and TKN (R = 0.47, p = 0.02; R = 0.49, p = 0.02). These associations were not observed in the control group (all 0.25 < R < 0.25, p > 0.05).

Conclusions: Obtained data support the hypothesised association between GPR146 and lipid homeostasis, especially in T2DM patients. However, the exact mechanism of action can only be determined after additional *in vitro* tests.

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P15
ARTIFICIAL INTELLIGENCE – BASED CLASSIFICATION OF CARDIAC AUTONOMIC NEUROPATHY FROM RETINAL FUNDUS IMAGES IN PATIENTS WITH DIABETES

Krzysztof Irlik[1,2,3], Hanna Kwiendacz[4], Mirela Hendel[2], Julia Piaśnik[2], Paweł Ignacy[1,4], Justyna Kulpa[2], Mikołaj Herba[2], Sylwia Boczek[2], Kamil Kegler[2], Janusz Gumprecht[4], Gregory YH Lip[3,5], Alam Uazman[3,6], Katarzyna Nabrdalik[3,4]

[1]Doctoral School, Department of Internal Medicine, Diabetology and Nephrology, Faculty of Medical Sciences in Zabrze, Medical University of Silesia, Katowice, Poland.
[2]Students' Scientific Association by the Department of Internal Medicine, Diabetology and Nephrology in Zabrze, Faculty of Medical Sciences in Zabrze, Medical University of Silesia, Katowice, Poland
[3]Liverpool Centre for Cardiovascular Science at University of Liverpool, Liverpool John Moores University and Liverpool Heart and Chest Hospital, Liverpool, United Kingdom
[4]Department of Internal Medicine, Diabetology and Nephrology, Faculty of Medical Sciences in Zabrze, Medical University of Silesia, Katowice, Poland
[5]Department of Clinical Medicine, Aalborg University, Aalborg, Denmark
[6]Diabetes and Endocrinology Research and Pain Research Institute, Institute of Life Course and Medical Sciences, University of Liverpool and Liverpool University Hospital NHS Foundation Trust, Liverpool, United Kingdom

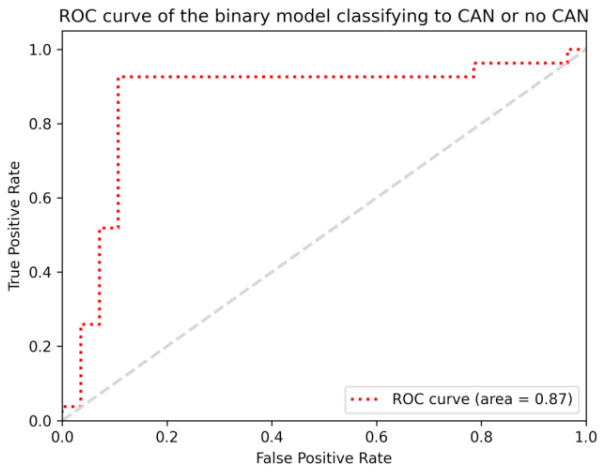
Introduction: Cardiac autonomic neuropathy (CAN) in diabetes mellitus (DM) is independently associated with cardiovascular (CV) events and CV death. Diagnosis of this complication of DM is timeconsuming and not routinely performed in the clinical practice, in contrast to fundus retinal imaging which is accessible and routinely performed. Whether artificial intelligence (AI) utilizing retinal images collected through diabetic eye screening can provide an efficient diagnostic method for CAN is unknown. In this study, we aimed to develop AI model that identifies patients with CAN based on retinal images.

Material and methods: This was a single center, observational study in a cohort of patients with DM as a part of The Silesia Diabetes-Heart Project (NCT05626413). The study included patients with type 1 DM who had received their diagnosis at least five years prior and individuals with type 2 DM, regardless of the time of diagnosis. To diagnose CAN, we used standard cardiovascular autonomic reflex tests. In this analysis we implemented AI-based deep learning techniques with non-mydriatic 5-field color fundus imaging to identify patients with CAN. Two experiments have been developed utilizing Multiple Instance Learning and primarily ResNet 18 as the backbone network. Models underwent training and validation prior to testing on an unseen image set.

Results: In an analysis of 2275 retinal images from 237 patients, the ResNet 18 backbone model demonstrated robust diagnostic capabilities in the binary classification of CAN, correctly identifying 93% of CAN cases and 89% of non-CAN cases within the test set. The model achieved an area under the receiver operating characteristic curve (AUCROC) of 0.87 (95% CI: 0.74–0.97). For distinguishing between definite or severe stages of CAN (dsCAN), the ResNet 18 model accurately classified 78% of dsCAN cases and 93% of cases without dsCAN, with an AUCROC of 0.94 (95% CI: 0.86–1.00). An alternate backbone model, ResWide 50, showed enhanced sensitivity at 89% for dsCAN, but with a marginally lower AUCROC of 0.91 (95% CI: 0.73–1.00).

Conclusions: AI-based algorithms utilising retinal images can differentiate with high accuracy patients with CAN. AI analysis of fundus images to detect CAN may be implemented in routine clinical practice to identify patients at the highest CV risk.

Figure 1. **ROC curve of the model classifying patients to CAN or no CAN**



P16
MORPHOMETRIC ANALYSIS OF SCIATIC NERVE IN DIAPH1 AND DIAPH1-RAGE KNOCKOUTS IN PROLONGED HYPERGLYCEMIA

Bernard Kordas[1], Kamila Zglejc-Waszak[1], Bogdan Lewczuk[2], Krzysztof Wąsowicz[3], Judyta Juranek[1]

[1]Department of Human Physiology and Pathophysiology, School of Medicine, University of Warmia and Mazury, Olsztyn, Poland
[2]Department of Histology and Embryology, Faculty of Veterinary Medicine, University of Warmia and Mazury, Olsztyn, Poland
[3]Department of Pathophysiology, Forensic Veterinary Medicine and Administration, Faculty of Veterinary Medicine, University of Warmia and Mazury, Olsztyn, Poland

Introduction: Diaph1 (Diaphanous-related formin 1) and RAGE (Receptor for Advanced Glycation End-products) are proteins implicated in the modulation of cellular structures and functions, with Diaph1 involved in actin polymerization and microtubule stabilization and RAGE contributing to inflammatory responses in cells. Morphometric analysis offers precise insights into the architecture of cells and tissues. This approach sheds light on the impacts of Diaph1 and Diaph1-RAGE gene knockouts on peripheral nerve structure, which is crucial for unraveling the mechanisms by which diabetes leads to diabetic neuropathy (DN). This study focused on exploring morphometric changes in the sciatic nerve of wild-type (WT), Diaph1 knockout (DKO), and Diaph1-RAGE knockout (DRKO) mice in streptozotocin(STZ)-induced hyperglycemia, assessing the impact of Diaph1 and Diaph-RAGE gene deletion on structural changes in DN.

Material and methods: The three genotypes were each divided into control and diabetic groups, totaling 24 animals. Six months after the confirmed induction of diabetes, the sciatic nerve samples were collected for morphometric and ultrastructural analysis using scanning electron microscopy. Semithin cross-sections were stained and imaged, and nerve fiber analysis was performed, including measurements of fiber numbers and diameters, G-ratios (axon-to-fiber diameter ratio), myelin-to-axon core area ratios, and structural abnormalities. Each sample was examined in three repeats, followed by statistical evaluation of means using ANOVA and non-parametric Kruskal-Wallis test with *post hoc* analysis.

Results: Morphometric analysis revealed that STZ-induced diabetes significantly alters the morphometry of the sciatic nerve across all genotypes. Diabetic DRKO, compared to diabetic WT, exhibited a higher large axon (> 8 µm) diameter (6.83 ±0.051(SEM) vs. 5.80 ±0.133(SEM)) and higher G-ratio (0.69 ±0.005(SEM) vs. 0.55 ±0.009(SEM)). There were more structural deformations in DKO under diabetic conditions than in other genotypes with confirmed hyperglycemia (1008 ±26.13(SEM) vs. 231.3 ±11.97(SEM) vs. 602.1 ±47.67(SEM) for DKO, DKRO, and WT, respectively). DRKO showed stabilized intragroup G-ratios (0.688 ±0.005(SEM) for the controls vs. 0.6945 ±0.001(SEM) for the diabetic mice) and total fiber numbers (26448 ±649(SEM) vs. 26563 ±1097(SEM)).

Conclusions: The analysis indicated that both genotype modifications attenuate some deleterious impacts of diabetes on neuronal fibers, with variations in the degree and nature of protection each genotype provides. These findings underscore the significance of Diaph1 and Diaph1-RAGE gene deletions in moderating the impacts of DN, suggesting a protective or modulating role of these genes in preserving neuronal fiber integrity under hyperglycemic conditions. Posing a potentially significant value for future therapeutic approaches, the complex nature of Diaph1 and RAGE interactions requires further investigation.

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Diabetes rarities

Chairs: Liliana Majkowska, Magdalena Szopa, Agnieszka Zmysłowska

P17
NEONATAL DIABETES MELLITUS WITH AN UNKNOWN CAUSE IN 1-MONTH INFANT – CASE REPORT

Mateusz Tarasiewicz[1], Anna Pietrzykowska[1], Julia Włodarczyk[1], Sebastian Seget[1], Przemysława Jarosz-Chobot[1], Maciej Borowiec[2], Karolina Gadzalska[2], Paulina Jakiel[2], Sebastian Skoczylas[2]

[1]Department of Pediatrics Children's Diabetology, Medical University of Silesia, Katowice, Poland
[2]Department of Clinical Genetics, Medical University of Łódź, Łódź, Poland

Introduction: Transient neonatal diabetes mellitus (TNDM) is a genetically heterogeneous form of neonatal diabetes characterized by hyperglycemia that remits during infancy with a tendency to recur in later life.

Material and methods: This case report presents the history of a male infant with transient neonatal diabetes mellitus. Due to recognition of hyperglycemia in the neonatal period the diagnostic process was made to differentiate the etiology of the disease. The insulin therapy was conducted and modified according to variable insulin demand. This case presentation focuses on various genetic mutations and clinical features connected with them causing TNDM and highlights difficulties in the diagnostic process of this disease. The aim of the report is also to show therapeutic possibilities in case of variable insulin demand.

Results: The patient at the beginning was treated with intravenous insulin therapy. In the next period there was successful modification of treatment to continuous subcutaneous insulin infusion (CSII) and continuous glucose monitoring (CGM). With the observed reduction of insulin demand together with a patient's proper weight gain the therapy was modified to subcutaneous injection of insulin Degludec. Finally the insulin therapy was continued till the age of 2 months, when the normoglycemia connected with a withdrawal of treatment was noted. The genetic tests results excluded the majority of known mutations related to TNDM.

Conclusions: The genetic basis of one-third of cases of TNDM remains unknown. The insulin therapy using the CSII and CGM system seems to be a safe and effective treatment option in such patient's with an unknown cause and low insulin demand.

P18
IMMUNE CHECKPOINT INHIBITOR – INDUCED DIABETICKETOACIDOSIS IN THE TREATMENT OF NON-SMALL CELL LUNG CANCER – CASE REPORT

Katarzyna Mordarska[1],
Małgorzata Godziejewska-Zawada[2],
Elżbieta Karpińska-Gasztoł[2],
Magdalena Knetki-Wróblewska[3],
Beata Mrozikiewicz-Rakowska[2]

[1]First Department of Internal Diseases, Subdivision of Diabetology, Bielański Hospital, Warsaw, Poland
[2]Endocrinology Clinic, Medical Centre of Postgraduate Education, Warsaw, Poland
[3]Department of Lung Cancer and Chest Tumors, The Maria Sklodowska-Curie Memorial Cancer Centre and Institute, Warsaw, Poland

Introduction: Immune checkpoint inhibitors (ICI) have been used in the treatment of various types of cancers worldwide. ICI – related autoimmune diabetes is a rare endocrine adverse event and can be associated with a life-threatening condition - diabetic ketoacidosis.

Case report: A 73-year-old female with previous history of type 2 diabetes, well-controlled with Metformin, visited the emergency room due to general weakness, polydipsia and polyuria that had started a few days prior. She started durvalumab 6 weeks earlier (3 cycle), used as a consolidation treatment for non-small cell lung cancer. Laboratory findings showed a serum glucose level of 510 mg/dl, pH of 7.14,ketonuria and glucosuria. She was initially treated with fluids – a continuous intravenous insulin infusion, followed by functional intensive insulin therapy. Her general condition improved and the diabetes was well-controlled with insulin therapy. The Flash Continuous Glucose monitoring system (FGM) provided the patient with information on the glucose level. She tested positive for the presence of GAD antibodies and serum C-peptide level was low (0.15 ng/ml). These laboratory findings allowed the diagnosis of type 1 diabetes, most likely related to immunotherapy. She continued with durvalumab after diabetic keto-acidosis, with good response to this treatment. During further observation, she showed another endocrine dysfunction – thyroid dysfunction with rapidly developing hypothyroidism (TSH 75), requiring substitution with levothyroxine. This is the most common endocrinopathy developing during immune checkpoint inhibitors therapy.

Conclusions: It is worth remembering about the possibility of the manifestation of type 1 diabetes as a complication of immunotherapy. Previous reports of this complication in the literature are few. Typically, it presents course with a short duration of symptoms and frequent occurrence of ketoacidosis clinically resembling fulminant diabetes. Also characteristic is a very low concentration of C-peptide at the time of diagnosis, and the presence of anti-GAD antibodies occurs in only about 50% of patients. Vigilance in monitoring patients undergoing immunotherapy for signs of diabetes is crucial for early detection and management. It is worth recommending routine glycemic control for these patients. Increased awareness and timely intervention can mitigate the impact of these adverse events on the overall well-being of individuals receiving immunotherapy.

P19
DIABETIC CARE FOR A PATIENT WITH MEN1 SYNDROME

Olga Wajtryt[1], Joanna Januszkiewicz-Caulier[1], Klaudia Zajkowska[1], Marek Dedecjus[1]

[1]Department of Nuclear Medicine and Endocrine Oncology, Maria Sklodowska-Curie National Research Institute of Oncology, Warsaw, Poland

MEN I is a genetically determined neuroendocrine tumor syndrome affecting mainly the pituitary gland, parathyroid glands, and pancreas. Changes that occur during life require diagnosis, observation, and appropriate surgical interventions. Pancreatic neuroendocrine tumors constitute one of the most important diagnostic and therapeutic challenges; decisions regarding pancreatic lesions should be individual and based mainly on symptoms, location, and degree of malignancy of the lesions.

A 30-year-old man without any chronic diseases, who previously felt healthy, came to the Endocrinology Clinic for the diagnosis of consciousness disorders resulting from recurrent hypoglycemia. Laboratory tests revealed hypoglycemia, hyperinsulinemia, and hypercalcemia. During diagnostic imaging, the following was found: computed tomography and PET/CT Ga – 3 focal pancreatic lesions, parathyroid scintigraphy revealed 2 adenomas- and MRI of the pituitary gland showed microadenoma. An endoscopic biopsy of the pancreatic lesions. Pancreaticoduodenectomy, splenectomy, and left-sided adrenalectomy were performed with reoperation the next day due to abdominal bleeding. The patient will begin functional intensive insulin therapy and CGM monitoring. A few months later, a subtotal parathyroidectomy was performed. Based on the case report of a patient under the care of our Clinic, we present the course of glycemic problems, from hypoglycemia as a manifestation of insulinoma to diabetes after pancreatectomy.

P20
FOR MONOGENIC CAUSES OF DIABETES USING NEXT-GENERATION SEQUENCING

Sebastian Skoczylas[1], Leszek Czupryniak[2], Katarzyna Gadzalska[1], Barbara Glowinska-Olszewska[3], Monika Gorządek[1], Paulina Jakiel[1], Przemysława Jarosz-Chobot[4], Ewa Juścińska[1], Irina Kowalska[5], Liliana Majkowska[6], Artur Mazur[7], Małgorzata Mysliwiec[8], Joanna Nazim[9], Tomasz Płoszaj[1], Bogda Skowronska[10], Agnieszka Szadkowska[11], Agnieszka Szypowska[12], Mieczysław Walczak[13], Agnieszka Zmysłowska[1]

[1]Department of Clinical Genetics, Medical University of Łódź, Łódź, Poland
[2]Department of Diabetology and Internal Diseases of Medical University of Warsaw, Warsaw, Poland
[3]Department of Pediatrics, Endocrinology, Diabetology with Cardiology Division, Medical University of Białystok, Białystok, Poland
[4]Department of Children's Diabetology, Medical University of Silesia, Katowice, Poland
[5]Department of Internal Medicine and Metabolic Diseases, Medical University of Białystok, Białystok, Poland
[6]Department of Rheumatology and Internal Medicine, Pomeranian Medical University, Szczecin, Poland
[7]Department of Pediatrics Endocrinology and Pediatric Diabetology, University of Rzeszów, Rzeszów, Poland
[8]Department of Pediatrics, Diabetology and Endocrinology, Medical University of Gdańsk, Gdańsk, Poland
[9]Department of Pediatric Endocrinology, Jagiellonian University Medical College, Kraków, Poland
[10]Department of Pediatric Diabetes and Obesity, Poznań University of Medical Sciences, Poznań, Poland
[11]Department of Pediatrics, Diabetology, Endocrinology and Nephrology, Medical University of Łódź, Łódź, Poland
[12]Department of Pediatrics, Medical University of Warsaw, Warsaw, Poland
[13]Department of Pediatrics, Endocrinology, Diabetology, Metabolic Diseases and Cardiology of the Developmental Age, Pomeranian Medical University, Szczecin, Poland

Introduction: Monogenic diabetes mellitus is a rare disease, but may account for up to 7% of all types of diabetes. The WHO 2019 classification divides monogenic diabetes into three categories: monogenic defects of β-cell function, monogenic defects in insulin action, and other genetic syndromes sometimes associated with diabetes. In the vast majority of cases, the first two subcategories of disease are inherited an autosomal dominant manner. Aim of this study was to identify the molecular background of impaired carbohydrate metabolism in patients with clinical features characteristic for monogenic hyperglycaemia/diabetes.

Material and methods: The study group consisted of 154 patients with clinically suspected monogenic diabetes (68 women and 84 men, mean age: 18 years). The study was performed using tNGS (targeted next generation sequencing; Illumina). Data analysis consisted of searching for pathogenic/potentially pathogenic variants in the selected genes.

Results: Most pathogenic or likely pathogenic variants were identified in the genes: *GCK, HNF1A* and *INSR*. Variants in genes such as *KCNJ11, RFX6, CEL, PAX4* and *HGFAC* were also detected in individual patients. Missense variants accounted for 70%, frameshift for 20% and splicing and nonsense variants for 10% of the results obtained.

Conclusions: The results clearly highlight the important role of genetic testing in patients with well-defined clinical suspicion of broad monogenic diabetes. The use of the tNGS technique allows a comprehensive analysis of genes involved not only in pancreatic β-cell function, but also those causing monogenic defects in insulin action, with a measurable benefit of a global efficiency of 47%.

P21
UNEXPECTED FINDINGS IN A PATIENT WITH GCK-MODY DIABETES – CASE REPORT

Julia Grzybowska-Adamowicz[1], Karolina Gadzalska[1], Paulina Jakiel[1], Ewa Juścińska[1], Monika Gorządek[1], Sebastian Skoczylas[1], Tomasz Płoszaj[1], Agnieszka Zmysłowska[1]

[1]Department of Clinical Genetics, Medical University of Łódź, Łódź, Poland

Introduction: Monogenic diabetes are rare diseases, in which causative variant in one gene is responsible for abnormal function or β-cell loss. It is estimated that monogenic diabetes cause 3–6% of all diabetes. GCK-MODY diabetes is the most common type of monogenic diabetes. It is part of MODY (maturity onset diabetes of the young) group and is characterized by mild course with slowly-progressive hyperglycemia. Very rare monogenic diabetes includes WFS1-related disorders, in which other additional symptoms are present. A single causative variant in *WFS1* gene might be responsible for number of disorders: Wolfram like syndrome, low-frequency sensorineural hearing loss (LFSNHL), isolated diabetes in adults, nonsyndromic optic atrophy and isolated congenital cataracts. The aim of this study was to discuss diagnostic difficulties in the patient initially referred with suspected MODY diabetes.

Case report: A 32-year-old female was referred to the Genetic Outpatient Clinic due to diabetes identified basing on oral glucose tolerance test with uncharacteristic symptoms at 14 years of age. In relation to positive family history (diabetes mellitus and deafness in the parents), mild course of the disease and absence of autoantibodies characteristic for type 1 diabetes the MODY diabetes was suspected. The patient was treated with diet. Because of insufficient glycemic control sulfonylurea derivative was added. At 29 years of age, vertigo has occurred. Optical Coherence Tomography (OCT) found no abnormalities. Audiometry revealed a slight hearing loss in the high frequency range. Additionally, the patient has anxiety. Molecular tests conducted by NGS (next-generation sequencing) searching for the cause of diabetes and hearing loss has found pathogenic variant in *GCK* gene, confirming GCK-MODY diabetes and heterozygous pathogenic variant in *GJB2* gene that identifies the patient as a carrier of nonsyndromic hearing loss and variant of unknown significance (VUS) in *WFS1* gene. Analysis of variants within the family revealed the father to have homozygous pathogenic variant in *GJB2* gene, which clarified the cause of his hearing loss and heterozygous variant in *GCK* gene, responsible for GCK-MODY diabetes. In addition, a VUS variant was found in the *WFS1* gene in the patient's mother, which may indicate the potentially causal nature of this variant in the patient as well.

Conclusions: In patients with suspected monogenic diabetes, it is important to pay attention to symptoms that coexist with hyperglycemia/diabetes, such as at least hearing impairment, the presence of which can focus the correct diagnosis and indicate the complexity of the final molecular diagnosis.

P22
THE RESULTS OF THE FIRST USE OF THE INHALED INSULIN IN POLAND – CASE REPORT

Anna Poradzka[1], Anna Śniady[1]

[1]First LuxMed Group, Warsaw, Poland

Introduction: The long-term use of insulin in injections in patients with diabetes can lead to the appearance of lipohypertrophy of subcutaneous tissue. Surgical treatment is recommended; however, it is not easy to find an experienced medical centre. According to the literature, other methods aren't effective. In the United States, the inhaled insulin is registered by the FDA. It allows people to take insulin injections with lower frequency. The study aims to provide better metabolic control and comfort to a patient with long-term type 1 diabetes and significant lipohypertrophy with the help of insulin injection reduction, replacing them with inhaled insulin.

Material and methods: The patient with type diabetes for 37 years and significant lipohypertrophy, monitored by FGM. The patient was treated with insulins: ultrafast aspart (20–30 units) and degludec (18 units).

The patient had seemingly good control (HbA_{1c} 6.9%, TIR 70%), but large daily glycaemic fluctuations and low quality of life caused by difficult-to-predict insulin activity. A patient was diagnosed with diabetic retinopathy and hypertension. Consent was obtained to import inhaled insulin, and the medication started to be delivered. The first two inhalations were taken in the presence of a diabetologist. Thanks to the high frequency of control visits and excellent patient compliance, insulin dosages were modified in the first two months of treatment. The dose of basal insulin was also adjusted.

Results: The initial dose selection of inhaled and basal insulin took about seven weeks. After the first two months, a small improvement in metabolic control was achieved (estimated HbA_{1c} 6.7%, TIR 77%). However, the quality of the patient's life improved significantly. The insulin dosage has become more predictable, and the patient could expand the diet. No complications of the treatment were observed. The main risk of taking inhaled insulin is worsening of lung function. The patient's initial assessment included RTX and spirometry. Additionally, total IgE and morphology were taken due to the reported periodic nasal congestion. No abnormalities were found in the performed tests. The patient denied bronchospastic symptoms and symptoms of bronchial irritation, such as coughing or excessive expectoration. The following-up spirometry test showed no significant change compared to the initial test. Before the therapy, the patient took daily 20–30 units ultrafast insulin aspart and 18 units deglutec. Now it is about 20 units of inhaled insulin and 21 units of deglutec.

Conclusions: Inhaled insulin can effectively and safely decrease the number of daily insulin injections by diabetic patients with advanced lipohypertrophy.

Diabetes is a woman

Chairs: Anna Juza, Hanna Kwiendacz, Dominika Rokicka

P23
EFFECTS OF THERAPY WITH A HYBRID CLOSED-LOOP SYSTEM IN A PATIENT WITH DIABETES SECONDARY TO CYSTINOSIS – CASE REPORT

Dominik Porada[1], Aneta Szafraniec-Porada[1], Beata Matyjaszek-Matuszek[1]

[1]Chair and Department of Endocrinology, Diabetology and Metabolic Diseases, Medical University of Lublin, Lublin, Poland

Introduction: Cystinosis is a rare, genetically determined metabolic disease that leads to the accumulation of excess cystine deposits and the resulting damage and impairment of the functions of many different organs. The most common complication of cystinosis is progressive renal failure, which ultimately leads to end-stage renal failure and the need for dialysis and an allogeneic kidney transplant procedure. Another complication of this disease may be secondary diabetes, directly related to the etiology of cystinosis or resulting from the immunosuppressive treatment used in the case of a transplant procedure in such patients.

Case report: A 37-year-old patient with cystinosis diagnosed at the age of 2, after two kidney transplants, and additionally diagnosed at the age of 16. secondary diabetes. From the moment of diagnosis, insulin therapy was performed in the conventional model and then semi-intensive with the use of human insulin with a daily requirement of less than 25 units, which was continued until the age of 25 (13th week of pregnancy). After the diagnosis of pregnancy, intensive functional insulin therapy (IFIT) was implemented in the CSII model using the Accu Check Spirit Combo insulin pump. After a successful delivery, for the next few years, proper control of carbohydrate metabolism was observed using a personal insulin pump. However, for approximately 2 years, most likely due to the gradual progression of ocular complications in the course of cystinosis, ultimately leading to total blindness, a progressive deterioration of metabolic control has been observed. For this reason, in November 2023, the patient was hospitalized at the Clinical Department of Endocrinology, Diabetology and Internal Diseases SPSK 4 in Lublin. Based on the data from the last 90 days obtained from the CGM system (FreeStyle Libre 2) used by the patient at that time, a complete imbalance of carbohydrate metabolism was found (TIR 52%, TAR 46% [> 180 mg/dl – 25%; > 250 mg/dl – 21%], TBR 2%, CV 41.1%, GMI 7.7%, with a daily insulin requirement (DDI) of approximately 45 units. Therefore, it was decided to use the AHCL system using the MiniMed 780G pump, after 2 months of therapy the results were achieved. full carbohydrate compensation TIR 86%, TAR 12%, TBR 2%, GMI 6.5%, CV 30.7%, at standard settings (target: 100 mg/dl; insulin action duration: 2 hours).

Conclusions: Application of a hybrid closed loop system (AHCL) in patients with rare genetic diseases and concomitant secondary diabetes requiring intensive insulin therapy is currently the best treatment model to achieve full carbohydrate control and the associated reduction of the risk of development or progression of chronic complications, also in the case of visual disturbances or blindness.

P24
TYPE 2 DIABETES IN PERIMENOPAUSAL WOMEN

Katarzyna Strawa-Zakościelna[1],
Beata Matyjaszek-Matuszek[1]

[1]Medical University of Lublin, Lublin, Poland

Introduction: Type 2 diabetes is accompanied by the development of many chronic complications and increased mortality, mainly due to cardiovascular disease. The risk of development of type 2 diabetes and cardiovascular diseases increases with age, and the menopausal transition period seems to be an important time point in this respect in the female population. Higher risk of cardiovascular complications and mortality are observed in the population of postmenopausal females with type 2 diabetes in comparison with males with type 2 diabetes and non-diabetic postmenopausal females. These facts prompt the necessity to search for factors triggering the development and influencing the clinical course of type 2 diabetes and its complications in this particular period of woman's life. The aim of this study was to assess the clinical course of type 2 diabetes in perimenopausal women, with special emphasis on the occurrence risk factors and cardiovascular complications.

Material and methods: The analysis involved 4136 records of patients hospitalised in the Endocrinology Clinic of SPSK 4 in 2010–2014. Among them, 468 postmenopausal patients were isolated, including: 328 patients with type 2 diabetes (study group) and 140 patients without diabetes (control group I). Additionally, 64 patients with type 2 diabetes and regularly menstruating were identified (control group II). The study group and control group II were assessed in terms of age at diagnosis of diabetes, its duration and the degree of metabolic control. In the study group and both control groups, the occurrence of risk factors for type 2 diabetes and comorbidities, especially cardiovascular ones, was analyzed.

Results: The study group differed significantly from the control groups in terms of the age, height, BMI, age at diagnosis, and duration of diabetes. In the assessment of metabolic control, the study group exhibited the worst results, in terms of lipid profile, HbA_{1c}, glycemic values and renal parameters. The results confirmed the role of the recognised type 2 diabetes risk factors, in particular excessive body weight, a positive family history of the disease, age and hypertension. There was no close correlation with the menopausal transition period. Cardiovascular complications were significantly more frequent in the study group than in the controls.

Conclusions: The menopausal status worsens the metabolic control of type 2 diabetes and may be a negative prognostic factor of its clinical course. Obesity and a positive family history of diabetes are one of the most important risk factors for the development of type 2 diabetes, regardless of the patient's gynaecological status. Short stature may be a potential negative prognostic factor for the development of type 2 diabetes in postmenopausal females. The positive correlation between the presence of type 2 diabetes in the postmenopausal period and cardiovascular events strongly increases with the age and duration of diabetes rather than with the menopausal transition period.

P25
THE TRIGLYCERIDE/GLUCOSE (TyG) INDEX AS AN ALTERNATIVE METHOD FOR ASSESSING INSULIN RESISTANCE IN PATIENTS AFTER GESTATIONAL DIABETES MELLITUS (GDM)

Andrzej Zieleniak[1], Monika Kliś-Żurawska[2], Katarzyna Cypryk[2], Lucyna Woźniak[1], Marzena Wójcik[1]

[1]Department of Structural Biology, Medical University of Łódź, Łódź, Poland
[2]Department of Internal Medicine and Diabetology, Medical University of Łódź, Łódź, Poland

Introduction: In recent years, the clinical potential of the triglyceride-to-glucose (TyG) index, calculated based on triglyceride (TG) and glucose concentrations, has attracted increasing interest as a simple, non-invasive, rapid and relatively inexpensive method for the estimation of insulin resistance (IR) in patients with metabolic disorders, including women with gestational diabetes (GDM). The aim of the study was to verify whether TyG index values could be an alternative to HOMA-IR index values for the assessment of IR in patients with GDM during and after pregnancy.

Material and methods: The study included 110 patients with GDM at the second trimester of pregnancy (25.4 ±2.4 weeks) and 6 months after delivery. Based on the HOMA-IR index value, patients were divided into the following groups: HOMA-IR < 2.5 (n = 62) and HOMA-IR ≥ 2.5 (n = 48) during pregnancy and pHOMA-IR < 2.5 (n = 83) and pHOMA-IR ≥ 2.5 (n = 27) after a pregnancy complicated by GDM. In both study periods, anthropometric and biochemical parameters were determined in all women (blood glucose at fasting and at 60 and 120 min of the OGTT (75 g), HbA_{1C}, fasting insulin concentration, lipid profile). The HOMA-IR index (fasting insulin concentration [μIU/ml] x fasting glucose concentration [mg/dl]/405) and the TyG index [Ln(fasting TG concentration [mg/dl] x glucose concentration fasting [mg/dl]/2)] were calculated. The diagnostic value of TyG index for IR was estimated using logistic regression models with V-fold cross-validation and ROC curves.

Results: The TyG index, blood glucose, insulin, and TG concentrations at fasting and BMI were all significantly higher, whereas the HDL concentration was lower in the HOMA-IR ≥ 2.5 and pHOMA-IR ≥ 2.5 groups vs. HOMA-IR < 2.5 and pHOMA-IR < 2.5, respectively. The HOMA-IR ≥ 2.5 group also displayed higher glycemia at 60 and 120 min of the OGTT and HbA_{1C}, as compared to the HOMA-IR < 2.5 group. The TyG index strongly correlated with the logarithm of the HOMA-IR index both during pregnancy (r = 0.51; p < 0.001) and after delivery (r = 0.70; p < 0.001). The ROC curve analysis showed that the TyG index was a satisfactory diagnostic criterion for IR during pregnancy (AUC = 0.755, p < 0.001; cut-off point = 9.01) and very good after pregnancy (AUC = 0.886, p < 0.001, cut-off point = 4.85). Logistic regression models confirmed the diagnostic properties of the TyG index in pregnancy (OR: 13.0; p < 0.001, AUC for the cross-validation sample = 0.727) and after pregnancy (OR: 48.6; p < 0.001; AUC for the cross-validation sample = 0.874).

Conclusions: The TyG index discriminated better between the pHOMA-IR < 2.5 and pHOMA-IR < 2.5 groups after pregnancy than in pregnancy complicated by GDM. Therefore, it seems to be more beneficial than the HOMA-IR index for the assessment of IR in the clinical care of patients after GDM. However, assessing its usefulness requires validation on a larger group of patients.

P26
AGER-1 LONG NON-CODING RNA LEVELS CORRELATE WITH THE EXPRESSION OF THE ADVANCED GLYCOSYLATION END-PRODUCT RECEPTOR, A REGULATOR OF THE INFLAMMATORY RESPONSE IN VISCERAL ADIPOSE TISSUE OF WOMEN WITH OBESITY AND TYPE 2 DIABETES MELLITUS

Klaudia Gutowska[1], Krzysztof Koźniewski[2], Michał Wąsowski[3], Zbigniew Bartoszewicz[4], Wojciech Lisik[5], Maurycy Jonas[6], Artur Binda[7], Paweł Jaworski[7], Wiesław Tarnowski[7], Bartłomiej Noszczyk[8], Monika Puzianowska-Kuźnicka[2], Krzysztof Czajkowski[9], Alina Kuryłowicz[10]

[1]Second Department of Obstetrics and Gynecology, Warsaw Medical University, Warsaw, Poland
[2]Department of Human Epigenetics, Mossakowski Medical Research Centre, Polish Academy of Sciences, Warsaw, Poland
[3]Department of General Medicine and Geriatric Cardiology, Medical Centre of Postgraduate Education, Warsaw, Poland
[4]Department of Internal Medicine and Endocrinology, The Medical University of Warsaw, Warsaw, Poland
[5]Department of General and Transplantation Surgery, The Medical University of Warsaw, Warsaw, Poland
[6]Department of General Surgery, Barska Hospital, Warsaw, Poland
[7]Department of General, Oncological and Bariatric Surgery, Medical Centre of Postgraduate Education, Warsaw, Poland
[8]Department of Plastic Surgery, Medical Centre of Postgraduate Education, Warsaw, Poland
[9]Department of Geriatrics and Gerontology, Medical Centre of Postgraduate Education, Warsaw, Poland

The advanced glycosylation end-product receptor (AGER) is involved in the development of metabolic inflammation and related complications in type 2 diabetes mellitus (T2DM). Tissue expression of the AGER gene (*AGER*) is regulated by epigenetic mediators, including a long non-coding RNA AGER-1 (lncAGER-1). This study aimed to investigate whether human obesity and T2DM are associated with an altered expression of *AGER* and lncAGER-1 in adipose tissue and, if so, whether these changes affect the local inflammatory milieu. The expression of genes encoding AGER, selected adipokines, and lncAGER-1 was assessed using real-time PCR in visceral (VAT) and subcutaneous (SAT) adipose tissue. VAT and SAT samples were obtained from 62 obese (BMI > 40 kg/m^2; n = 24 diabetic) and 20 normal weight (BMI = 20–24.9 kg/m^2) women, while a further 15 SAT samples were obtained from patients who were 18–24 months post-bariatric surgery. Tissue concentrations of adipokines were measured at the protein level using an ELISA-based method. Obesity was associated with increased *AGER* mRNA levels in SAT compared to normal weight status (p = 0.04) and surgical weight loss led to their significant decrease compared to pre-surgery levels (p = 0.01). Stratification by diabetic status revealed that *AGER* mRNA levels in VAT were higher in diabetic compared to non-diabetic women (p = 0.018). Elevated *AGER* mRNA levels in VAT of obese diabetic patients correlated with lncAGER-1 (p = 0.04, rs = 0.487) and with interleukin 1β (p = 0.008, rs = 0.525) and resistin (p = 0.004, rs = 0.6) mRNA concentrations. In conclusion, obesity in women is associated with increased expression of *AGER* in SAT, while T2DM is associated with increased *AGER* mRNA levels and pro-inflammatory adipokines in VAT.

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P27
THE ALTERATION IN AROMATIC AMINO ACIDS LEVELS IN POLYCYSTIC OVARY SYNDROME

Katarzyna Paczkowska[1], Dominik Rachoń[2], Andrzej Berg[3], Jacek Rybka[4], Katarzyna Kapczyńska[4], Marek Bolanowski[1], Jacek Daroszewski[1]

[1]Department of Endocrinology, Diabetes and Isotope Therapy, Wrocław Medical University, Wrocław, Poland
[2]Department of Clinical and Experimental Endocrinology, Medical University of Gdańsk, Gdańsk, Poland
[3]Department of Pharmaceutical Chemistry, Medical University of Gdańsk, Gdańsk, Poland
[4]Laboratory of Medical Microbiology, Hirszfeld Institute of Immunology and Experimental Therapy, Polish Academy of Sciences, Wrocław, Poland

Introduction: Polycystic ovary syndrome (PCOS) is a heterogeneous endocrinopathy, conventionally linked mostly to women in childbearing age, however, it affects women health through lifespan. Apart from the well-known reproductive manifestations, it is associated with an increased risk of metabolic disorders. It has been suggested that an alteration in the amino acid profile might be involved in PCOS pathogenesis.

Material and methods: 208 PCOS patients and 118 healthy individuals were included to the study and control group, respectively; PCOS was diagnosed based on the revised Rotterdam criteria. All women met inclusion criteria such as: age more than 18 and less than 40 years old, no history of hormonal contraception 6 months prior to tests and no history of diabetic or hypolipemic therapy. Multiple anthropometrical, biochemical, and hormonal parameters were assessed. Amino acids levels were measured with the gas-liquid chromatography, combined with tandem mass spectrometry.

Results: PCOS women had significantly higher concentrations of all aromatic amino acids: phenylalanine 47.37 ±7.0 vs. 45.4 ±6.09 nmol/ml ($p = 0.01$), tyrosine 61.69 ±9.56 vs. 58.08 ±8.89 nmol/ml ($p < 0.01$), and tryptophan 53.66 ±11.42 vs. 49.81 ±11.18 nmol/ml ($p < 0.01$). On the other hand, there was no significant difference in the "tryptophan ratio" between the PCOS and control group ($p = 0.88$). Moreover, aromatic amino acids levels were compared between PCOS and healthy individuals in the subpopulations of women with insulin resistance, abdominal obesity, or obesity. In all subpopulations, PCOS women had significantly higher level of tryptophan and aromatic amino acids analyzed as a group.

Conclusions: Alteration of amino acid profile in the group of PCOS women holds potential clinical implications. Amino acids may be additional biomarkers for assessing the metabolic status of PCOS patients. Disturbances in aromatic amino acids metabolism might be involved in PCOS pathogenesis, however, underlying mechanism needs further investigation.

P28
CIRCULATING LEVELS OF IRISIN AND METEORIN-LIKE PROTEIN IN POLYCYSTIC OVARY SYNDROME AND THEIR CONNECTION TO METABOLIC PARAMETERS

Katarzyna Paczkowska[1], Joachim Sobczuk[1], Katarzyna Zawadzka[2], Diana Jędrzejuk[1], Agnieszka Zemska[2], Jacek Konieczny[3], Dorota Kaszubkiewicz-Wardęga[4], Marek Bolanowski[1], Jacek Daroszewski[1]

[1]Department of Endocrinology, Diabetes and Isotope Therapy, Wrocław Medical University, Wrocław, Poland
[2]Wrocław Medical University, Wrocław, Poland
[3]CodeAI, Poznań, Poland
[4]First Clinical Department of Gynaecology and Obstetrics, University Clinical Hospital, Wrocław, Poland

Introduction: Research on obesity, has lately focused on the aspect of increasing energy expenditure. In this context, muscle tissue is being studied as an organ with endocrinological activity, secreting molecules called myokines. In recent years, myokine concentrations have been assessed in various disorders, including diabetes and metabolic syndrome. Irisin and meteorin-like peptide (Metrnl) seem to play an important role in adipose tissue browning thus increasing energy expenditure and improving insulin sensitivity.

Material and methods: The study included 31 women with PCOS and matched 18 healthy individuals. PCOS was diagnosed based on the revised Rotterdam criteria from 2003. Various anthropometric, hormonal and biochemical parameters were determined, including an oral glucose tolerance test; additionally body composition was assessed using dual-energy X-ray absorptiometry. Serum concentrations of Metrnl and irisin were determined using commercially available immunoassays.

Results: We found that irisin levels were negatively correlated with BMI, body fat mass, fasting glucose and insulin levels. On the other hand there were no correlations between Metrnl levels and metabolic parameters. PCOS and control group do not differ in terms of age, BMI, WHR, fasting glucose, HOMA-IR or body composition. Evaluation of Metrnl and irisin levels showed no significant differences between patients diagnosed with PCOS and healthy women.

Conclusions: Irisin is a promising biomarker; however, inconsistencies in previous studies limit its clinical value in the diagnosis or treatment of obesity. Metrnl concentration did not differ between the study and control groups, which may be associated with the exacerbation of metabolic disorders in both groups. Bearing in mind similar physiological functions of irisin and Metrnl, no correlation between circulating levels of those myokines suggests individual roles rather than synergetic actions in physiological adaptation to metabolic disease

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Straight to the heart

Chairs: Edward Franek, Michał Hoffmann, Jan Ruxer

P29
THE RELATION BETWEEN CARDIOVASCULAR AUTONOMIC NEUROPATHY AND OTHER CHRONIC COMPLICATIONS OF DIABETES

Paweł Ignacy[1,2], Hanna Kwiendacz[2], Krzysztof Irlik[3,4], Julia Piaśnik[5], Mirela Hendel[5], Justyna Kulpa[5], Mikołaj Herba[5], Sylwia Boczek[5], Kamil Kegler[5], Martyna Gut-Misiaga[5], Aleksandra Gil[5], Janusz Gumprecht[2], Gregory Lip[4,6], Uazman Alam[4,7], Katarzyna Nabrdalik[2,4]

[1]Doctoral School, Department of Internal Medicine, Diabetology and Nephrology, Faculty of Medical Sciences in Zabrze, Medical University of Silesia, Katowice, Poland
[2]Department of Internal Medicine, Diabetology and Nephrology, Faculty of Medical Sciences in Zabrze, Medical University of Silesia, Katowice, Poland
[3]Doctoral School, Department of Internal Medicine, Diabetology and Nephrology, Faculty of Medical Sciences in Zabrze, Medical University of Silesia, Katowice, Poland
[4]Liverpool Centre for Cardiovascular Science at University of Liverpool, Liverpool John Moores University and Liverpool Heart and Chest Hospital, Liverpool, United Kingdom
[5]Students' Scientific Association by the Department of Internal Medicine, Diabetology and Nephrology in Zabrze, Faculty of Medical Sciences in Zabrze, Medical University of Silesia, Katowice, Poland
[6]Department of Clinical Medicine, Aalborg University, Aalborg, Denmark
[7]Diabetes and Endocrinology Research and Pain Research Institute, Institute of Life Course and Medical Sciences, University of Liverpool, Liverpool, United Kingdom

Introduction: Cardiovascular autonomic neuropathy (CAN) is an underdiagnosed complication of diabetes mellitus (DM) and is associated with increased mortality. Despite its significance, the relationship between chronic diabetic complications and CAN remains underexplored. To examine the relationship between chronic diabetic complications, namely chronic kidney disease (CKD), diabetic retinopathy (DR), coronary artery disease (CAD), stroke and CAN.

Material and methods: The study is a part of The Silesia Diabetes-Heart Project (ClinicalTrials.gov NCT05626413). The study recruited patients from outpatient diabetes clinics in Silesia region. Demographic, laboratory (HbA_{1c}, albumin to creatinine ratio, estimated glomerular filtration rate and lipid profile) and clinical data of the patients were collected. The cardiac autonomic function tests were employed to assess CAN. Subsequently, logistic regression models were used to investigate the association between CKD, DR, CAD, history of stroke and CAN. *P*-value of < 0.05 was considered statistically significant.

Results: So far, 518 people (53 % women; median age 58 and median DM duration of 10 years) underwent examination. Most of the participants (67%) had type 2 DM. The median HbA_{1c} value was 8.0%. The prevalence of any CAN was 46%. CKD, DR and CAD were associated with higher risk of CAN with ORs of 2.12 (95% CI: 1.24–3.62), 2.20 (95% CI: 1.17–4.16) and 2.05 (95% CI: 1.18–3.54), respectively. History of stroke was not significantly associated with the presence of CAN (OR: 1.08; 95% CI: 0.48–2.41).

Conclusions: The occurrence of chronic diabetic complications such as CKD, DR and CAD but not stroke are associated with the greater risk of CAN.

Table 1. Participants characteristics

Characteristic	**Overall**, N = 518 (100%)	**No CAN**, N = 278 (54%)	**CAN**, N = 240 (46%)	p-value
Male	245 (47%)	128 (46%)	117 (49%)	0.5
Age	58 (42, 67)	49 (32, 64)	63 (54, 69)	<0.001
BMI	28.4 (24.5, 32.9)	27.9 (24.2, 32.4)	29.1 (25.2, 33.1)	0.055
Type of diabetes				<0.001
1	169 (33%)	117 (42%)	52 (22%)	
2	349 (67%)	161 (58%)	188 (78%)	
Diabetes duration	10.0 (5.0, 17.0)	10.0 (4.0, 15.0)	12.0 (7.0, 20.0)	<0.001
Diabetic retinopathy	47 (9.1%)	17 (6.1%)	30 (13%)	0.011
Chronic kidney disease	68 (15%)	26 (10%)	42 (20%)	0.005
Coronary artery disease	63 (12%)	24 (8.7%)	39 (16%)	0.009
History of stroke	27 (5.2%)	14 (5.0%)	13 (5.4%)	0.8
HBA1C [%]	8.0 (6.8, 9.7)	7.8 (6.6, 9.2)	8.6 (7.2, 10.2)	<0.001

BMI = body mass index; HbA1c = glycated hemoglobin;

P30
THE SILESIA DIABETES-HEART PROJECT – MACHINE LEARNING IN CARDIOVASCULAR EVENT RISK PREDICTION IN PATIENTS WITH DIABETES

Oliwia Janota[1], Hanna Kwiendacz[2], Krzysztof Irlik[3,4], Julia Piaśnik[5], Mirela Hendel[5], Anna Olejarz[5], Aleksandra Włosowicz[5], Patrycja Pabis[5], Wiktoria Wójcik[5], Paulina Szromek-Białek[2], Agata Wijata[6], Jakub Nalepa[7], Uazman Alam[4,8], Janusz Gumprecht[2], Gregory Lip[4,9], Katarzyna Nabrdalik[2,4]

[1]Doctoral School, Department of Internal Medicine, Diabetology and Nephrology, Faculty of Medical Sciences in Zabrze, Medical University of Silesia, Katowice, Poland
[2]Department of Internal Medicine, Diabetology and Nephrology, Faculty of Medical Sciences in Zabrze, Medical University of Silesia, Katowice, Poland
[3]Doctoral School, Department of Internal Medicine, Diabetology and Nephrology, Faculty of Medical Sciences in Zabrze, Medical University of Silesia, Katowice, Poland
[4]Liverpool Centre for Cardiovascular Science at University of Liverpool, Liverpool John Moores University and Liverpool Heart and Chest Hospital, Liverpool, United Kingdom
[5]Students' Scientific Association by the Department of Internal Medicine, Diabetology and Nephrology in Zabrze, Faculty of Medical Sciences in Zabrze, Medical University of Silesia, Katowice, Poland
[6]Faculty of Biomedical Engineering, Silesian University of Technology, Zabrze, Poland
[7]Faculty of Automatic Control, Electronics and Computer Science, Department of Algorithmics and Software, Silesian University of Technology, Gliwice, Poland
[8]Diabetes and Endocrinology Research and Pain Research Institute, Institute of Life Cou
[9]Department of Clinical Medicine, Aalborg University, Aalborg, Denmark

Introduction: The global population of patients with diabetes mellitus (DM) is projected to surge to 783 million by 2045 and cardiovascular (CV) complications remain the primary cause of mortality. The pressing need in contemporary medicine is the development of a strategy to pinpoint individuals of high-risk of CV events using readily accessible clinical data. Unlike traditional statistical methods, machine learning (ML) algorithms offer the potential to predict medical events, demonstrating their utility in clinical settings. These advanced predictive models could revolutionize patient care, enabling personalized treatment plans and improving health outcomes. To predict the occurrence of new CV events in a group of 3,056 patients with DM over a minimum follow-up period of six months from the hospital discharge using ML techniques.

Material and methods: The Silesia Diabetes-Heart Project (ClinicalTrials.gov NCT05626413) involves demographic, clinical, laboratory, and imaging data of patients with DM hospitalized at the Department of Internal Medicine and Diabetology in years 2015–2023. The study plans a minimum 10-year follow-up for each patient. To analyze the gathered data Multiple Linear Regression (MLR) was used. The aim is to pinpoint patients who are most susceptible to CV incidents, using routinely collected medical information. Following their discharge from the hospital, patients are prospectively evaluated for new CV events. This evaluation is carried out *via* a phone interview, conducted at least six months post-discharge, with MLR being used to predict potential outcomes based on the collected data.

Results: We included 3,056 patients (mean age 58.25, SD 18.41; diabetes duration 11.08 years, SD 9.41; HbA_{1c} 9.15%, SD 2.45; 51% women). The majority of patients (76.86%) were diagnosed with DM type 2. A predictive algorithm was developed using 4 clinical variables (selected from 65 available ones) to identify patients at high risk of CV events. Predictors include DM type 2, coronary artery disease, age and peripheral artery disease. The algorithm correctly predicted CV events in 63.45% of patients (AUC: 0.69, 95% CI: 0.62–0.75).

Conclusions: The initial analysis indicates that the application of ML techniques allows to identify of patients with DM who are at an elevated risk of experiencing new CV incidents. These patients might not be detected through conventional clinical assessments. The predictive model is built upon a small set of easy-to-acquire clinical parameters.

P31
THE IMPACT OF INSULIN RESISTANCE ON MARKERS OF LEFT VENTRICLE FUNCTION IN PATIENTS WITH DIABETES TYPE 1

Klaudia Czarnik[1], Zbigniew Sablik[2], Anna Borkowska[3], Jarosław Drożdż[2], Katarzyna Cypryk[1]

[1]Department of Internal Diseases and Diabetology, Medical University of Łódź, Łódź, Poland
[2]Second Department of Cardiology, Medical University of Łódź, Łódź, Poland
[3]Department of Digestive Tract Diseases, Faculty of Medicine, Medical University of Łódź, Łódź, Poland

Introduction: Patients with type 1 diabetes (T1D) are prone to developing cardiac dysfunction early in the course of the diabetes due to complex interactions between metabolic disturbances such as increased oxidative stress, cardiomyocytes low-grade inflammation and disturbed signalling due to diabetic neuropathy. Insulin resistance (IR) is an established risk factor for development and worsened course of heart failure (HF). To explore the impact of IR on heart function in T1D patients without HF symptoms.

Material and methods: Study participants were recruited at the Diabetology Clinic from 1.10.2021 through 1.09.2022 in admission order. The inclusion criterion was the diagnosis of T1D. Patients with other types of diabetes, treated with metformin, pregnant, presenting symptoms of HF or being treated for HF, patients with active hepatitis, alcoholism, and either AST or ALT ≥ 2x the upper limit were excluded from the study. The analyzed data included medical history, anthropometric measurements, biochemical tests and echocardiography. To approximate IR we used lipid accumulation product (LAP) calculated for men as (waist circumference [cm] – 65) x (TG [mmol/l]) and for women as (waist circumference [cm] – 58) x (TG [mmol/l]). The cutoff value for IR was set at LAP ≥ 42.5.

Results: There were 55 patients included in the study. 11 had LAP ≥ 42.5 indicating insulin resistance and 44 patients were considered non-insulin-resistant. The mean age in the study was 38 (±9.6) years, the mean diabetes duration was 21.8 (±11.3) years, the median BMI was 23.39 kg/m^2 (IQR: 21.5–27.0), and the medianHbA_{1c} level was 8.05% (IQR: 7.15–9.90).

Insulin resistance participants had higher BMI(29.3 vs. 22.3 kg/m^2, $p < 0.001$), waist circumference (110 vs. 79 cm, $p < 0.001$), and more atherogenic lipid profile. On echocardiography, IR patients presented with significantly higher LV mass index (79 vs. 68 g/m^2, $p < 0.001$) and lower mitral E/A ratio (0.944 vs. 1.298, $p = 0.003$), a potential predictor of diastolic heart failure. Moreover, IR participants exhibited altered mitral annular velocities (early diastolic mitral annular velocity at septal part of mitral annulus [9 vs. 8 cm/s, $p = 0.02$], systolic mitral annular velocity at lateral part of mitral annulus [8 vs. 10 cm/s, $p = 0.02$]). In univariate linear regression models LAP index and age significantly correlated with E/A ratio ($p = 0.03$ and $p = 0.01$, respectively). Multivariable regression model including LAP index, age, ALT, uric acid, HbA_{1c}, CRP, total cholesterol, LDL, BMI and diabetes duration explained 62% of E/A variability with $p < 0.001$.

Conclusions: Patients with type 1 diabetes and insulin resistance present with significantly worsened mitral E/A ratio and distinctly affected mitral annular velocities that might modify the risk of HF development.

Source of funding: Diabetology Clinic's Funds.

P32
THE RELATIONSHIP BETWEEN CARDIAC REMODELING AND KYNURENINE CONCENTRATIONS IN A GROUP OF PATIENTS WITH HEART FAILURE WITH PRESERVED EJECTION FRACTION AND TYPE 2 DIABETES

Janina Lewkowicz[1], Anna Tankiewicz-Kwedlo[2], Dariusz Pawlak[2], Małgorzata Kiluk[1], Katarzyna Łagoda[1], Irina Kowalska[1]

[1]Department of Internal Medicine and Metabolic Diseases, Medical University of Białystok, Białystok, Poland
[2]Department of Pharmacodynamics, Medical University of Białystok, Białystok, Poland

Introduction: Type 2 diabetes (T2D) increases the risk of heart failure (HF). Approximately 50% of members with HF have preserved left ventricular ejection fraction (HFpEF), characterized by diastolic dysfunction and cardiac remodeling due to myocardial hypertrophy and myocardial fibrosis. The leading cause of the development of HFpEF is systemic, chronic inflammation, but the pathophysiological mechanisms are still not fully understood. Recently, there has been growing interest in tryptophan (TRP) metabolites *via* the kynurenine pathway (KP) because they are closely related to inflammation. The aim of the study was to assess the relationship between echocardiographic parameters of cardiac morphology in patients with HFpEF and T2D and the serum concentration of selected TRP metabolites.

Material and methods: The study included 120 [median age 66.50 (62–72) years, median BMI 30.25 (27.53–33.25)] patients with HFpEF, including 60 subjects with T2D [median age 66 (60–71) years, median BMI 31.65 (29/58–35/05)] and 55 subjects without HFpEF and without T2D constituting the control group, matched in terms of age, gender and BMI. All subjects underwent a clinical examination, analysis of body mass composition using the electrical bioimpedance method, and basic biochemical parameters were determined. Liquid chromatography was used to quantify metabolites of KP in plasma. The morphology and function of the left ventricle (LV) were assessed in every participant with the use of transthoracic echocardiography (TTE).

Results: In the group of patients with HFpEF and T2D, the concentrations of TRP, kynurenine (KYN) and anthranilic acid (AA) were statistically significantly higher compared to controls as well as to subjects with HFpEF without T2D. TTE showed no statistically significant differences in the morphology of the left ventricle (LV) and atrium between both HFpEF groups (with and without T2D). Also, parameters of LV diastolic function were comparable in the group of people with HFpEF and HFpEF and T2D. In patients with HFpEF and T2D, the TPR concentration positively correlated with the interventricular septum (IVS) thickness (r = 0.275; p = 0.034), the KYN concentration positively correlated with both the IVS (r = 0.375; p = 0.003) and the posterior wall thickness in diastole (PWT) (r = 0.361; p = 0.005), AA concentration positively correlated with IVS (r = 0.291; p = 0.024) and negatively with left ventricular late diastolic thickness (LVEDD) (r = –0.262; p = 0.044).

Conclusions: The presented results suggest a probable relationship between cardiac remodeling in HFpEF and T2D and changes in tryptophan metabolism *via* the kynurenine pathway.

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P33
OCCURRENCE AND EFFECT OF HYPOGLYCEMIA ON ELECTROCARDIOGRAPHIC RECORDING IN PATIENTS UNDERGOING BARIATRIC SURGERY

Katarzyna Szmygel[1], Justyna Bigda[2], Beata Graff[3], Michał Hoffmann[3], Monika Proczko-Stepaniak[2], Jacek Wolf[3], Krzysztof Narkiewicz[3]

[1]Department of Hypertension and Diabetology, University Clinical Center, Gdańsk, Poland
[2]Division of General, Endocrine and Transplant Surgery, Medical University of Gdańsk, Gdańsk, Poland
[3]Department of Hypertension and Diabetology, Medical University of Gdańsk, Gdańsk, Poland

Introduction: Obesity is currently one of the main health threats. Metabolic surgery, regardless of the method used, is currently the most effective method of treating obesity, but like any surgical treatment, it is associated with complications. One of them is the occurrence of hypoglycemia. Data on the incidence of hypoglycemia after bariatric surgery (PBH) are contradictory due to the lack of clear criteria for its diagnosis and recognized diagnostic tools.

Large clinical observations have shown that hypoglycemia induced by drugs used in the treatment of diabetes – insulin, sulfonylurea derivatives – is associated with a significant risk of mortality. However, there are few observations showing whether reactive hypoglycemia or hypoglycemia related to bariatric surgery has an impact on the cardiovascular system, and the data obtained from them are contradictory. The aim of this study was to assess the incidence of hypoglycemia (defined as a glycemia level < 70 mg/dl), including asymptomatic hypoglycemia, in patients undergoing bariatric surgery, as well as its impact on the electrocardiographic recording.

Material and methods: 21 patients under the care of the surgical outpatient clinic of the Department of Oncological, Transplantation and General Surgery of the University Clinical Center in Gdańsk were recruited for the study. All participants underwent a detailed medical interview and underwent a physical examination and anthropometric measurements. Each patient was subjected to continuous glycemia monitoring, classical ECG examination and 48-hour Holter recording before the procedure and one year after the procedure.

Results: 21 patients came for postoperative follow-up, including 4 patients with preoperatively diagnosed type 2 diabetes. The time from surgery to follow-up was on average 12.6 ±1.96 months. Roux-en-Y gastric bypass surgery was performed in 6 patients, and sleeve gastrectomy in 15 patients. The average body weight at the follow-up visit was 77.7 ±12.32 kilograms. The weight loss in the entire group of patients after the procedure was on average 41.75 ±17.22 kilograms. Analyzing data obtained from continuous glucose monitoring systems, the occurrence of hypoglycemia, defined as a glycemia level < 70 mg/dl, lasting at least 15 minutes, was found in 33.3% of patients in the preoperative period and in 81.0% after bariatric surgery. The vast majority of hypoglycemia episodes were asymptomatic. One patient (4.7%) reported symptoms of hypoglycemia in the preoperative period and three (14.3%) in the postoperative period. When analyzing the impact of hypoglycemia on the circulatory system, no statistically significant differences were found in the number of additional supraventricular and ventricular beats or heart rate variability. No statistically significant changes were observed in the parameters in the resting ECG.

Conclusions: The incidence of hypoglycemia after bariatric surgery in the study group was 81%, of which only 14.3% reported symptoms of hypoglycemia. Continuous glucose monitoring systems are a simple PBH diagnostic tool. Hypoglycemia induced by bariatric surgery does not appear to have a negative impact on electrocardiographic recordings.

Source of funding: Polish Diabetes Society Scientific Grant of prof. A. Czyżyk.

P34
PSEUDO-MYOCARDIAL INFARCTION PATTERN IN DIABETIC KETOACIDOSIS – CASE REPORT

Elżbieta Karpińska-Gasztoł[1], Katarzyna Mordarska[2], Małgorzata Godziejewska-Zawada[3], Beata Mrozikiewicz-Rakowska[3]

[1]Department of Endocrinology, Medical Centre of Postgraduate Education, Warsaw, Poland
[2]First Department of Internal Diseases, Subdivision of Diabetology, Bielański Hospital, Warsaw, Poland
[3]Department of Endocrinology, Medical Centre of Postgraduate Education, Warsaw, Poland

Introduction: Transient ECG changes in the setting of diabetic ketoacidosis are described in literature rarely. In the past, the ECG has been used to control potassium levels – both hypo- and hyperkalemia cause typical changes in the ECG. Chest pain was associated with pseudopericarditis, similar to abdominal pain is pseudoperitonitis cases. However, there are also medical reports of heart attacks in patients with diabetic ketoacidosis, as well as of transient ECG changes, not associated with myocardial injury. It is one such case that we attempt to investigate.

Case report: We would like to present the case of a 30-year old woman with hyperthyroidism due Graves disease, diagnosed 2 weeks prior and having been treated with methimazole, at the time when she was admitted to the ward due to ketoacidosis in the setting of newly diagnosed diabetes. She had been experiencing polydipsia, polyuria, weakness, and nausea for several days. On admission, she was dehydrated, significantly weakened, sluggish, but with no disturbances of consciousness. Laboratory tests showed ketoacidosis (pH 7.048), hyperglycemia – 838 mg/dl, HbA_{1c} – 11.2%; increased renal parameters (creatinine 1.74; GFR 34.4 ml/min/1.73 m^2), without severe hypokalemia (K-4.6 … 3.8 … 4.2 mmol/l). The tests performed: C-peptide – 0.8 ng/ml, positive anti-GAD antibodies – confirmed type 1 diabetes. Following fluid therapy, electrolyte supplementation and continuous intravenous insulin therapy, the patient's condition improved and good glycemic control was obtained. On the second day of treatment, the patient reported chest pain, shortness of breath and heart palpitations. ECG HR 75/min, negative T waves in I, aVL, V3-6 leads, non-specific ST-T changes. Echocardiography revealed no contractility disorders and no fluid in the pericardium. Troponin levels were normal. Due to the ambiguous clinical picture of myocardial ischemia, deterioration of renal parameters and hyperthyroidism, invasive coronary angiography was not performed and the patient continued to be monitored. The chest symptoms resolved spontaneously and did not recur. In the following days, the patient's well-being improved significantly, and ECG changes normalized in a series of recordings. Normalization of thyroid hormonal function and renal parameters was also observed.

Discussion: Although T wave inversion is most often associated with hypokalemia in cases of ketoacidosis, it can also occur without a significant decrease in potassium levels. Acute hyperglycemia and acidosis may impair endothelial functions and disturb coronary microcirculation, and the lack of insulin may promote thrombotic processes. The diagnosis of pseudo-infarction is difficult, especially in patients with cardiovascular diseases. Furthermore, qualification for invasive cardiac procedures with iodine contrast may complicate the treatment of both prerenal kidney failure and coexisting thyroid diseases.

Conclusions: Ketoacidosis and hyperglycemia may cause transient changes in ECG, even in patients without electrolyte imbalance.

GLP-1 analogs and SGLT2 inhibitors – a new version

Chairs: Janusz Gumprecht, Magdalena Walicka, Dorota Pisarczyk-Wiza

P35
THE EFFECT OF LIRAGLUTIDE ON INSULIN SENSITIVITY AND LIPID ACCUMULATION IN SKELETAL MUSCLE AND LIVER – PRELIMINARY RESULTS

Adrian Kołakowski[1], Krzysztof Waczyński[1], Radosław Zawadzki[2], Magdalena Stefanowicz[3], Błażej Pogorzelski[1], Anna Krentowska[1], Michał Zawadzki[1], Agnieszka Nikołajuk[4], Irina Kowalska[1], Monika Karczewska-Kupczewska[1]

[1]Department of Internal Medicine and Metabolic Diseases, Medical University of Białystok, Białystok, Poland
[2]Department of Radiology, Medical University of Białystok, Białystok, Poland
[3]Department of Metabolic Diseases, Medical University of Białystok, Białystok, Poland
[4]Department of Prophylaxis of Metabolic Diseases, Polish Academy of Sciences, Olsztyn, Poland

Introduction: Excessive accumulation of toxic forms of lipids in peripheral tissues leads to impaired insulin signaling, which results in decreased skeletal muscle glucose uptake and enhanced hepatic glucose production. Recent cohort studies have revealed that the use of glucagon-like peptide-1 receptor agonists (GLP-1 RA) improves insulin sensitivity (IS) measured by indirect methods – homeostatic model assessment for insulin resistance (HOMA-IR) and Matsuda index. However, there is limited data regarding ectopic lipid accumulation in relation to IS measured by direct method (gold standard; hyperinsulinemic euglycemic clamp (HEC)) after GLP-1 RA treatment. To evaluate the effect of a 12-week therapy with GLP-1 RA, liraglutide, on IS and quantitative lipid content in the liver (IHL) and skeletal muscles (IMCL).

Material and methods: The study included 23 overweight/obese subjects with or without prediabetes divided into two groups: patients treated with liraglutide and low-calorie diet (D + L group; median BMI 36.4 kg/m^2; n = 12) and patients undergoing low-calorie diet (D group; median BMI 33.8 kg/m^2; n = 11). Anthropometric measurements and body composition analysis with bioelectrical impedance were performed in all subjects. Insulin sensitivity was assessed using HOMA-IR and HEC, while IHL content and IMCL content were assessed using magnetic resonance spectroscopy (MRS). All procedures were performed before and after the intervention.

Results: None of the assessed parameters differed significantly between the groups before the start of the intervention ($p > 0.05$). The decrease in body weight after a 12-week intervention was observed in the entire group, significantly greater in the D + L group (–11.5kg vs. –6.6 kg, $p = 0.016$). Body composition analysis showed a significant reduction of fat mass ($p = 0.003$), fat-free mass ($p = 0.041$) and muscle mass ($p = 0.002$) in D + L group after treatment, while only fat mass changed in the D group ($p = 0.018$). HOMA-IR and HbA_{1c} decreased in both groups ($p < 0.05$). The 12-week intervention in the D + L group resulted in an increase in IS measured by HEC ($p = 0.012$) and a decrease in IMCL content ($p = 0.022$). The reduction in IHL content was observed in both groups (D + L: $p = 0.002$, D: $p = 0.029$). The reduction in IHL was correlated with body weight loss ($p = 0.020$), independent of the assigned treatment, while the reduction in IMCL did not correlate with weight reduction.

Conclusions: The administration of liraglutide improves IS and alters lipid content in peripheral tissues.

P36
THE EFFECT OF LIRAGLUTIDE ON BODY COMPOSITION, INSULIN SENSITIVITY, METABOLIC FLEXIBILITY AND NON-OXIDATIVE GLUCOSE METABOLISM IN PEOPLE WITH OVERWEIGHT AND OBESITY – PRELIMINARY RESULTS

Anna Krentowska[1], Maciej Krysztofiak[1], Natalia Matulewicz[2], Marta Dobrzycka[1], Krzysztof Waczyński[1], Lidia Łapińska[1], Dominika Szczepańska[3], Karol Kamiński[4], Irina Kowalska[1], Monika Karczewska-Kupczewska[1]

[1]Department of Internal Medicine and Metabolic Diseases, Medical University of Białystok, Białystok, Poland
[2]Department of Metabolic Diseases, Medical University of Białystok, Białystok, Poland
[3]Students' Scientific Group at the Department of Internal Medicine and Metabolic Diseases, Medical University of Białystok, Białystok, Poland
[4]Department of Population Medicine and Lifestyle Diseases Prevention, Medical University of Białystok, Białystok, Poland

Introduction: Overweight and obesity are associated with insulin resistance and metabolic inflexibility, defined as impaired ability to change between lipid and glucose oxidation and reduced non-oxidative glucose metabolism in response to insulin. Published studies indicate that liraglutide treatment effectively reduces body weight and improves indirect indices of insulin resistance, although their influence on metabolic flexibility and non-oxidative glucose metabolism has not been fully explained. To investigate the effect of liraglutide treatment on body composition, insulin sensitivity, metabolic flexibility, and non-oxidative glucose metabolism in overweight/obese subjects.

Material and methods: The study group comprised 23 volunteers with overweight or obesity, with or without prediabetes, who were randomly assigned to one of the groups: receiving liraglutide s.c. in combination with dietary intervention for 12 weeks (n = 12) or undergoing only 12-week dietary intervention (n = 11). Before and after the intervention, all participants underwent hyperinsulinemic euglycemic clamp (HEC), indirect calorimetry, and body composition analysis with dual energy X-ray absorptiometry.

Results: The studied groups did not differ in terms of age, baseline weight, body composition, or insulin sensitivity ($p > 0.05$). After 12 weeks of intervention, reduction of body weight was observed in both groups, although it was significantly higher in the liraglutide group (–11.5 kg vs. –6.6 kg, $p = 0.016$). We observed a significant reduction in total fat mass and regional fat content in both studied groups (all $p < 0.05$). In both groups, subcutaneous adipose tissue (SAT) mass and fat mass index (FMI; calculated as total fat mass/height^2) decreased significantly, although the reduction was greater in the liraglutide group, while the decrease in visceral adipose tissue (VAT) mass was comparable between the groups. Reduction in total lean mass ($p = 0.003$) and appendicular lean mass ($p = 0.002$) was observed only in the group treated with liraglutide. Insulin sensitivity assessed with HEC improved only in the liraglutide group (2.34 vs. 4.94 mg/kg/min, $p = 0.006$). Neither glucose and lipid oxidation nor metabolic flexibility assessed by indirect calorimetry changed after any of the interventions, although non-oxidative glucose metabolism increased in the liraglutide group ($p = 0.008$). The increase in insulin sensitivity and non-oxidative glucose metabolism was associated with the reduction of FMI ($p = 0.033$ and $p = 0.010$, respectively). No association with VAT or SAT reduction was observed.

Conclusions: The effect of liraglutide on insulin sensitivity was dependent on fat mass reduction and might be related to the increase in non-oxidative glucose metabolism in insulin-stimulated conditions.

P37
EFFECT OF LIRAGLUTIDE ON CARDIOVASCULAR RISK FACTORS IN OVERWEIGHT OR OBESE PATIENTS – PRELIMINARY RESULTS

Michał Zawadzki[1], Błażej Pogorzelski[1], Magdalena Stefanowicz[2], Adrian Kołakowski[1], Anna Krentowska[1], Maciej Krysztofiak[1], Agnieszka Nikołajuk[3], Irina Kowalska[1], Monika Karczewska-Kupczewska[1]

[1]Department of Internal Medicine and Metabolic Diseases, Medical University of Białystok, Białystok, Poland
[2]Department of Metabolic Diseases, Medical University of Białystok, Białystok, Poland
[3]Department of Prophylaxis of Metabolic Diseases, Polish Academy of Sciences, Olsztyn, Poland

Introduction: Obesity is a chronic low-grade inflammatory state leading to an increased risk of cardiovascular diseases (CVD). Factors such as C-reactive protein (CRP), dyslipidaemia, insulin resistance and arterial hypertension take part in the development of atherosclerosis, which is a key factor involved in CVD pathophysiology and the development of heart failure. Recent studies prove that treatment with GLP-1 analogues decreases CVD risk not only in diabetes, but also in obesity. However, the mechanisms underlying these effects are not fully understood and it is unclear to what extent they are dependent on weight loss. To investigate the association between liraglutide administration and cardiovascular risk factors in overweight/obese subjects without diabetes.

Material and methods: The analysed group comprised 23 overweight or obese participants, with or without prediabetes, divided into 2 groups: study group receiving liraglutide combined with dietary intervention (n = 12) and control group undergoing dietary intervention only (n = 11). Both groups were studied under supervision of dietitians and physicians for twelve weeks. All patients underwent anthropometric measurements including blood pressure, body composition analysis with bioelectrical impedance, oral glucose tolerance test, and hyperinsulinaemic-euglycemic clamp before and after the intervention. Serum concentrations of CRP, N-terminal pro-brain natriuretic peptide (NT-proBNP) and lipids were assessed in all participants.

Results: Before the intervention, there were no differences in age, BMI, body composition, blood pressure, insulin sensitivity, or other laboratory parameters between the groups ($p > 0.05$). After twelve weeks, there was significant weight loss in both groups, although significantly higher in the group receiving liraglutide. Moreover, both the group treated with liraglutide and the group treated with diet showed a reduction in diastolic blood pressure and fat mass, while fat-free mass and muscle mass were reduced in liraglutide group only. Only the study group presented improvement in insulin sensitivity measured in hyperinsulinaemic-euglycemic clamp ($p = 0.012$), which was dependent on body weight reduction. The concentrations of CRP ($p = 0.012$), total cholesterol ($p = 0.004$), non-HDL cholesterol ($p = 0.013$) and triglycerides ($p = 0.023$) decreased only in the liraglutide + diet group. There were no significant changes in NT-proBNP, LDL- and HDL-cholesterol concentrations or systolic blood pressure in any of the groups. The changes in diastolic blood pressure were associated with weight reduction ($p = 0.019$), independent of treatment group assignment or the improvement in insulin sensitivity. The changes in other analysed parameters were not related to weight loss.

Conclusions: Liraglutide treatment is associated with improvements in insulin sensitivity and cardiovascular risk factors in overweight or obese subjects without diabetes.

P38
EVALUATION OF THE EFFECT OF SGLT-2 INHIBITOR OR GLP-1 ANALOGUE USE ON BIOCHEMICAL METABOLIC PARAMETERS, BODY MASS COMPOSITION MODIFICATION, BLOOD PRESSURE REGULATION AND SELECTED VASCULAR PARAMETERS IN OBESE PATIENTS WITH TYPE 2 DIABETES

Elżbieta Wójcik-Sosnowska[1], Katarzyna Wójcik[1], Damian Sieńko[1], Leszek Czupryniak[1], Piotr Sobieraj[2], Jacek Lewandowski[2], Maciej Siński[2]

[1]Department of Diabetology and Internal Medicine, Medical University of Warsaw, Warsaw, Poland
[2]Department of Internal Disease, Hypertension and Vascular Diseases, Medical University of Warsaw, Warsaw, Poland

Introduction: Diabetes mellitus is a group of metabolic diseases characterised by abnormally high blood glucose levels arising from a deficiency of properly functioning insulin. A patient with diabetes who develops complications should be treated with SGLT2 inhibitors, GLP-1 inhibitors or a combination of these medicaments. The new drugs are antidiabetic, but in a series of studies a significant reduction in cardiovascular risk is observed, regardless of the mechanism of glycaemic regulation. The aim of this study is to evaluate the effect of an SGLT-2 inhibitor or GLP-1 analogue on blood pressure regulation and selected vascular parameters in obese patients with type 2 diabetes.

Material and methods: The study will be an observational, prospective study. No randomisation will be used, as the drugs will be used according to medical indications. The patient's profile and the benefits of the appropriate drug group will be the deciding factor. Patients with type 2 diabetes mellitus in association with obesity BMI > 30, requiring immediate hospitalisation, with glycated haemoglobin (HbA_{1c}): ≥ 7%, and BMI: ≥ 30 kg/m^2. After qualifying for the study, all patients underwent a medical examination during which RR, HR, weight, height, waist circumference and hip circumference were measured. A body composition analysis was carried out using a bioimpedance body composition analyser. A basic laboratory profile was performed (peripheral blood count, HbA_{1c}, creatinine, urea, uric acid, electrolytes, lipidogram, NTproBNP, CRP, TSH, ALT, general urine examination). The assumed duration of the study is 36 months. The first examination will take place during hospitalisation, followed by follow-up visits at 3, 6, 9, 12, 18, 24 and 36 months of the study. The specified time intervals will allow differences in the measured parameters to be observed.

Results: So far, an observation period of 18 months has been carried out. In the first study group of patients using I-SGLT-2, the following were observed: a reduction in HbA_{1c} of approximately 4.5%, slight changes in cholesterol levels, a 16% reduction in NTproBNP, 1.5% increase in BMI. The mean age was 56 years. In the second study group of patients using a GLP-1 analogue, a 23% reduction in HBa_{1c}, an 9% reduction in BMI, a 16% reduction in total cholesterol and a 34% reduction in tri glycerides were observed. The mean age was 51 years. In the third study group of patients using GLP-1 analogue and SGLT2 inhibitor together, the greatest reduction in HBa_{1c} of approximately 46% was observed. Total cholesterol was reduced by about 40%, LDL by about 60%, TG by 50%, BMI was reduced by 8%. The mean age was 48 years.

P39
EFFECTIVENESS OF GLUCAGON-LIKE PEPTIDE 1 RECEPTOR AGONIST THERAPY ON BIOCHEMICAL MARKERS OF METABOLIC-DYSFUNCTION-ASSOCIATED STEATOTIC LIVER DISEASE (MASLD) – PLEIOTROPIC EFFECTS OF NEW ANTIDIABETIC AGENTS IN DIABETIC PATIENTS

Marcin Hachuła[1], Michał Kosowski[1], Marcin Basiak[1], Bogusław Okopień[1]

[1]Department of Internal Medicine and Clinical Pharmacology, Medical University of Silesia, Katowice, Poland

Introduction: Metabolic Dysfunction-associated Steatotic Liver Disease (MASLD) involves the excessive accumulation of lipids in hepatocytes. Over 75% of diabetes patients typically suffer from MASLD, and its presence increases the risk of diabetes by more than twofold. Type 2 diabetes and MASLD are independent risk factors for cardiovascular diseases (CVD). New diabetes treatments should also consider pleiotropic effects that reduce cardiovascular risk and the development of hepatic steatosis. The aim of our study is to investigate whether glucagon-like peptide 1 receptor agonists (GLP1-RA) have pleiotropic metabolic effects and a global impact on reducing cardiovascular risk, as well as decreasing the risk of hepatic fibrosis in patients with MASLD.

Material and methods: This study involved 50 patients with diabetes and dyslipidemia who also had atherosclerotic plaque in carotid artery and hepatic steatosis verified by ultrasonography and who were eligible to begin one of the GLP1 receptor agonists treatments (semaglutide $n = 16$ dulaglutide $n = 36$). at a typical hypoglycemic dose and administered every week at the same time of day. Therapy duration time was 180 days.

Results: We observed statistically significant decreases in various anthropometric measures: body mass index (BMI) ($p < 0.001$), waist and hip circumference ($p < 0.001$), and biochemical markers such as glycated hemoglobin, which decreased 8.58–7.56% ($p < 0.001$). Most importantly, we noted reductions in the Fibrosis-4 Index (FIB-4) ($p < 0.001$) and the De Ritis index (AST/ALT aminotransferase ratio) ($p < 0.05$). Furthermore, there was a notable decrease in AST levels, approaching statistical significance with $p = 0.051$. Additionally, we observed a positive correlation between FIB-4 values and BMI, waist-to-hip ratio (WHR), waist circumference, aspartate transaminase (AST), alanine transaminase (ALT) and γ-glutamyl transpeptidase (GGTP).

Conclusions: Overall, GLP-1 receptor agonists demonstrated a favorable impact on metabolic and cardiovascular risk factors among patients diagnosed with type 2 diabetes. Furthermore, these drugs exhibited a beneficial influence on biochemical markers associated with MASLD.

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P40
SEVERE KETOACIDOSIS WITH HYPERMOLAR STATUS IN A PATIENT WITH DIABETES WITH ASSOCIATED OBESITY TREATED WITH GLP-1 AGONIST AS THE FIRST MANIFESTATION OF TYPE 1 DIABETES

Beata Mrozikiewicz-Rakowska[1], Joanna Gątarek[2], Katarzyna Mordarska[2], Elżbieta Karpińska-Gasztoł[1], Karolina Dziurdziak[2]

[1]Medical Centre of Postgraduate Education, Warsaw, Poland
[2]First Department of Internal Diseases, Bielański Hospital, Warsaw, Poland

Introduction: The treatment with GLP-1 agonists in type 2 diabetics, especially associated with obesity constitutes a standard of therapy in this group of patients. High dynamics of weight loss with simultaneous deterioration of metabolic control in a patient treated with a GLP-1 agonist may indicate the development of type 1 diabetes. A progressive lack of metabolic efficiency during the treatment with noninsulin agents should impel the doctor do search for its causes, among them the development of type 1 diabetes.

Case report: A 50-year old female with obesity, was admitted to hospital due to severe ketoacidosis ((pH 6,9, HCO_3 – 5.6 mmol/l, BE-28 mmol/l, urine ketones 150 mg/dl), glycaemia 1408, 80 mg/dl, with accompanying hypermolal status (360 mOsm/kg). In additional labolatory tests: Na 128 mmol/l, K 4,2mmol/l, creatinine 3.39 mg/dl, CRP 16.52 mg/l, procalcitonin 2.82, AST and ALT within the normal ranges. In the admission ward after initial hydration, intravenous insulin therapy with a pump, antithrombotic prophilaxy with low molecular heparin, broad-spectrum antibiotic therapy (tazobactam) achieving acid-base and hydro-electrolyte improvement. In the physical assessment the patient presented sleepiness , with superficial verbal and linguistic contact, with furuncles in the area of her axilla. Intensive insulin therapy was continued finally with clinical improvement and evacuation of purulent lesions by incision, no pathogenic pathogens were identified in the blood. Imaging tests (chest X-ray, abdominal CT, head CT) showed no pathological changes. Primarily the patient was diagnosed with type 2 diabetes 2 years ago, initially treated with flozin with poor clinical effect, then semaglutide with improvement in glycemia and significant reduction in body weight within last 2 months (20 kg). In laboratory research after recovering the patient from a serious condition, low levels of C-peptide, high titer of anti-GAD antibodies were found (2,000 IU/ml), HbA_{1c} – 14.2%. The previous diagnosis was verified and type 1 diabetes was diagnosed.

Conclusions: The described clinical situation indicates the need for full diagnosis of the etiology of diabetes, even in an extremely obese person. Accelerated depletion of β-cell reserves may go unnoticed, especially in initially obese patients treated with GLP-1 agonists. Ignoring this fact may result in a life-threatening condition in the form of severe ketoacidosis deepened by hypermolal state.

What the eyes cannot see

Chairs: Elżbieta Bandurska-Stankiewicz, Michał Holecki, Iwona Partyka

P41
NEUROVASCULAR DEGENERATION IN TYPE 1 DIABETES. 25 YEARS OF POPROSTU STUDY

Aleksandra Cieluch[1], Aleksandra Araszkiewicz[1], Jadwiga Bednarczyk-Meller[2], Dariusz Naskręt[1], Agata Grzelka-Woźniak[1], Aleksandra Uruska[1], Dorota Zozulińska-Ziółkiewicz[1]

[1]Department of Internal Medicine and Diabetology, Poznań University of Medical Sciences, Poznań, Poland
[2]BON-MEDIC Private Ophthalmology Unit, Poznań, Poland

Introduction: Retinal neural loss and changes in the choroid thickness are associated with the development of diabetic retinopathy. To assess retina thickness (RT), retinal nerve fiber layer (RNFL) thickness, ganglion cell layer (GCL), and choroidal thickness (CT) obtained by *optical coherence tomography* (OCT) in patients with type 1 diabetes (T1D), participants of Poznań Prospective Study (PoProStu).

Material and methods: The study involved 70 participants of the PoProStu study (44 men, 26 women); at age 46.5 years [interquartile range (IQR): 43–51]; and with a disease duration of 25 years (IQR: 24–26). We assessed metabolic control of diabetes and late complications. We divided patients into subgroups: with diabetic retinopathy (DR) and without retinopathy. In OCT RT, RNFL, GCL, and CT were assessed.

Results: After 25 years of diabetes DR was diagnosed in 23 (33%) patients. Patients with DR had higher HbA_{1c} level (8.4 vs. 7.8%; $p = 0.02$), higher level of γ-glutamyl tranferase (24.0 vs. 20.0 U/l; $p = 0.02$), higher accumulation of advanced glycation end products in the skin expressed as the autofluorescence ratio (2.9 vs. 2.5 AU; $p = 0.03$), lower glucose disposal rate (5.09 vs. 7.84 mg/kg/min; $p < 0.01$) and had more often hypertension (69.6 vs. 38.2%; $p = 0.01$) as compared to those without DR. In the DR group there was significant negative correlation between CT and body weight ($r = –0.51$; $p = 0.02$). Moreover, we found a negative correlation between nasal RNFL and diabetes duration ($r = –0.54$; $p = 0.01$).

Conclusions: In people with long duration of type 1 diabetes neurodegenerative changes in the retina are related to worse metabolic control of diabetes and insulin resistance.

P42
ASSOCIATION OF ESTIMATED GLUCOSE DISPOSAL RATE AND DIABETIC RETINOPATHY

Wojciech Matuszewski[1], Jan Marek Górny[1], Robert Modzelewski[1], Elżbieta Bandurska-Stankiewicz[1]

[1]Department of Internal Medicine, Clinic of Endocrinology, Diabetology and Internal Medicine, University of Warmia and Mazury, Olsztyn, Poland

Introduction: Diabetes mellitus is an epidemic in the modern world, but a challenge of the 21st century are chronic vascular complications. The number of adults in the world suffering from diabetic retinopathy (DR) is estimated at 103.12 million, including over a quarter with DR threatening vision loss. Impaired insulin sensitivity is considered a risk factor for vascular complications. Insulin resistance (IR) can be indirectly assessed in patients with diabetes based on the estimated glucose disposal rate ($eGDR_{BMI}$) calculated using the formula: eGDR BMI = 19.02 – (0.22 × BMI) – (3.26 × HT) – (0.61 × HbA_{1c}). Assessment of the relationship between an indirect indicator of insulin resistance $eGDR_{BMI}$ DR BMI and diabetic retinopathy.

Material and methods: The study included 1069 patients, including 315 with DM1 age 37.1 ±13.5 and 892 patients DM2 with mean age 61.2 ±11.1. Carried out measurements: blood pressure, BMI, waist circumference and control indicators were assessed metabolic diabetes. The evaluation of the eye fund was performed based on colour, two-field photos (50o degree) taken with a Topcon TRC NW8 fundus camera. The degree of retinopathy has been assessed on the Diabetic Retinopathy Disease Severity Scale. IR was assessed indirectly by e $eGDR_{BMI}$. Statistical analysis carried out using IMB SPSS version 23.

Results: In the entire study group, the incidence of DR was 26%. DM1 33%, in the DM2 group 23%. In the group of patients with DM1 compared to DM 2 significantly higher HbA_{1c} values were found: 8.45 ±2.06 vs. 7.83 ±1.65 ($p < 0.0001$). In both groups of diabetic patients showed significantly lower values $eGDR_{BMI}$ in subgroups with DR vs. without DR features: in the DM1 group 6.75 ±2.24 vs. 7.94 ±1.95 ($p < 0.001$), in DM2 4.54 ±2.05 vs. 4.95 ±2.27 ($p = 0.001$). In the entire study group using the Spearman method, a statistically significant inverse correlation was demonstrated $eGDR_{BMI}$ with the age of patients ($r = –0.342$, $p = 0.001$) and the duration of diabetes ($r = –0.098$, $p = 0.001$).

Conclusions: The $eGDR_{BMI}$ in patients with diabetes may be useful and simple prognostic tool for assessing the risk of developing DR in everyday clinical practice.

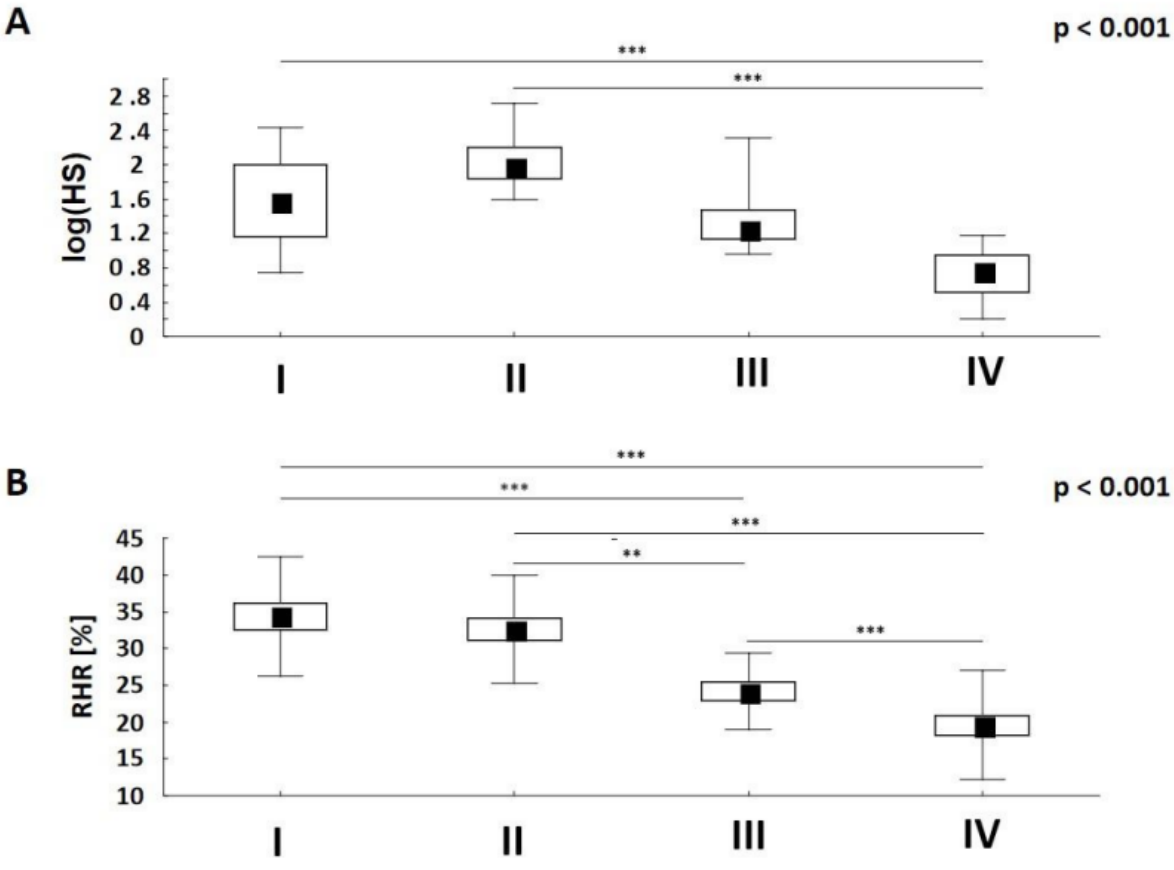
P43
ASSESSMENT OF MICROVASCULAR FUNCTION USING A NOVEL TECHNIQUE FLOW MEDIATED SKIN FLUORESCENCE IN PATIENTS WITH DIABETIC RETINOPATHY – A PRELIMINARY STUDY

Agnieszka Łoś-Stegienta[1], Katarzyna Cypryk[1]

[1]Department of Internal Diseases and Diabetology, Medical University of Łódź, Łódź, Poland

Introduction: Diabetic retinopathy (DR) affects over one third of all people with diabetes mellitus (DM) and is the leading cause of vision loss in adults. Early detection of hypoxia in the retinas of diabetic patients could help clinicians identify problems in patients before irreversible damage has occurred. Currently, potential techniques can be used for this purpose such as retinal oximetry, oxygen sensitive electrodes, and phosphorescence-lifetime imaging. All mentioned are invasive methods and their use is limited. The Flow Mediated Skin Fluorescence (FMSF) method is an innovative, non-invasive tool for assessing the microcirculation function (especially microcirculatory response to hypoxia), also in patients with complications of DM. This preliminary study aimed to evaluate microvascular function using a novel FMSF technique in patients with diabetes complicated by DR.

Material and methods: A total of 90 participants (42.22% male), aged 21–88 (52.89 ±14.01 years), divided into 4 groups: 21 healthy subjects (I), 23 with DM without complications (II), 17 patients with DR only (III), 29 with DR and other complications (IV). Microvascular function was assessed in each of the studied subjects using FMSF. This technique measures changes in the intensity of nicotinamide adenine dinucleotide (NADH) fluorescence from the skin on the forearm as a function of time, in response to blocking and releasing blood flow in the forearm. In this study, we assess two key parameters: hypoxia sensitivity [log(HS)] and reactive



Rycina: Parametry FMSF – log(HS) i RHR w grupach: zdrowych osób (I), DM bez powikłań (II), tylko DR (III), DR i inne powikłania (IV). (A) mediana log(HS) (B) średnia RHR, *p < 0.01, **p < 0.001, ***p < 0.001.
Skróty: DM – cukrzyca, DR – retinopatia cukrzycowa, log(HS) – Hypoxia Sensitivity, RHR – Reactive Hyperemic Response.

hyperemia response (RHR) to characterize vascular circulation in patients with DR and their response to transient ischemia. A *p*-value of < 0.05 was considered statistically significant. The normality of data distribution was tested with the Shapiro-Wilk test. Data were analyzed using one-way ANOVA with a *post hoc* Scheffé test.

Results: The median value of the log(HS) parameter was significantly lower in group IV (0.77 [0.52–0.95]) compared to both I (1.57 [1.17–2.00], $p < 0.001$) and II groups (1.98 [1.84–2.21], $p < 0.001$). The mean value of the RHR parameter was significantly lower in IV (19.58% ±7.43) compared to I (34.37% ±8.18, $p < 0.001$), II (32.68% ±7.31, $p < 0.001$), and III (24.19% ±5.19, $p < 0.001$) groups. Similar trends were noted with the mean value of the RHR parameter in III (24.19% ±5.19) vs. I (34.37% ±8.18, $p < 0.001$) and II (32.68% ±7.31, $p < 0.01$).

Conclusions: The FMSF technique makes it possible to identify impairments of the microvascular function in patients with DR. These preliminary results require further validation in a larger patient cohort to assess the FMSF technique can be recommended to predict vascular complications including DR.

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P44
THE EFFECT OF RAGE DELETION ON THE PROGRESSION OF RETINOPATHY IN DIABETES

Patryk Mizia[1], Bernard Kordas[1], Julia Jarosławska-Miszkiewicz[2], Natalia Szyryńska[3], Natalia Ziółkowska[3], Bogdan Lewczuk[3], Judyta Juranek[1]

[1]Department of Human Physiology and Pathophysyology, Faculty of Medicine, University of Warmia and Mazury, Olsztyn, Poland
[2]Department of Biological Functions of Food, Institute of Animal Reproduction and Food Research, Polish Academy of Sciences, Olsztyn, Poland
[3]Department of Histology and Embryology, Faculty of Veterinary Medicine, University of Warmia and Mazury, Olsztyn, Poland

Introduction: RAGE, the receptor for advanced glycation end-products, a member of immunoglobulin superfamily, is primarily known for its interactions with AGEs (advanced glycation end-products). RAGE-AGE binding initiates cellular responses leading to inflammation, oxidative stress, an increase in the permeability of the blood-retinal barrier, and endothelial dysfunction. These processes lead to alterations in the retina's neural and vascular structures, potentially resulting in diabetic retinopathy. The study aimed to assess the neuroprotective impact of RAGE deletion on the retinal structure in prolonged hyperglycemia and to evaluate how this deletion affects the morphology of retinal layers in both diabetic and non-diabetic mice.

Material and methods: We used six C57BL/6 (wild type – WT) mice and RAGE knockout (RKO) mice with Streptozotocin (STZ) induced diabetes. Three mice from each group were injected with STZ. The hyperglycemia was confirmed by testing blood sugar levels. After six months of the experiment, retinas were collected fixed in 2.5% glutaraldehyde and 1% paraformaldehyde, postfixed in 2% osmium tetroxide, dehydrated and embedded in Epon 812. Semi-thin sections were stained with toluidine blue and examined. The morphometric analysis of the retina was conducted using CaseViewer. The depth and structural abnormalities were measured across five retinal layers: inner plexiform layer (IPL), inner nuclear layer (INL), outer plexiform layer (OPL), outer nuclear layer (ONL), photoreceptor layer (PL).

Results: Both WT and RKO controls had significant changes only in the INL (WT: 23.69 ±3.51 µm; RKO: 29.20 ±6.56 µm). The WT and WT STZ mice differed in the thickness of IPL (43.72 ±10.92 µm; 33.39 ±8.87 µm), OPL (14.67 ±3.56 µm; 10.67 ±2.84 µm), ONL (40.17 ±4.06 µm; 34.27 ±3.88 µm) whereas RKO and RKO STZ differed in IPL (47.67 ±11.27 µm; 39.57 ±8.41 µm), INL (29.20 ±6.56 µm; 24.94 ±3.49 µm), OPL (15.42 ±3.33 µm; 11.62 ±2.55 µm), PL (48.77 ±7.46 µm; 42.83 ±9.37 µm).

Conclusions: Our findings reveal that both WT and RKO diabetic groups experienced a reduction in retinal layer thickness due to hyperglycemia, with more pronounced decrease in WT mice as compared to RAGE knockout mice. This observation indicates that blocking AGE-RAGE signaling could have a protective effect on the retina in prolonged hyperglycemia.

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P45
RELATIONSHIP BETWEEN DIABETES AND DISORDERS OF THE VISUAL SYSTEM – INTERDYSCYPLINAR PERSPECTIVE

Katarzyna Malewicz[1], Izabela Kuberka[2,3], Małgorzata Janków[4]

[1]Division of Family and Pediatric Nursing, Faculty of Health Sciences, Wrocław Medical University, Wrocław, Poland
[2]Division of Anaesthetic and Surgical Nursing, Faculty of Health Sciences, Wrocław Medical University, Wrocław, Poland
[3]Department of Angiology and Internal Diseases, University Clinical Hospital, Center for Civilization Diseases, Wrocław, Poland
[4]A. Falkiewicz Specialist Hospital in Wroclaw, Diabetology Outpatient Clinic, Wrocław, Poland

Introduction: Diabetes is a metabolic disorder that affects the functioning of patients' visual system. Symptoms as well as complications of diabetes significantly affect the functioning and visual functions of patients. Suffering from diabetes entails a number of negative health consequences. One of them is the impairment of good, sharp binocular vision in this group of patients. This study analyzed the occurrence of disorders of the visual system in patients with diabetes. Presenting visual problems of patients with diabetes considering pathological changes within the eyeball, ocular surface, and the entire visual system, including the function of vision itself.

Material and methods: Materials available in the PubMed and Google Scholar databases were analyzed using keywords: diabetes: blurred vision; dry eye syndrome, stye, glaucoma, conjunctivitis, diabetic macular edema, diabetic retinopathy, cataracts, color vision disorders, eye refractive disorders, ocular surface, function of vision itself in various configurations. A comprehensive analysis of publications was conducted to identify research on disorders of the visual system considering pathological changes in the eyeball, disorders of the ocular surface, and abnormalities in the functioning of the entire visual system of patients with diabetes.

Results: Disorders of the visual system occur in patients with diabetes and significantly affect their health status and quality of vision. The results of numerous studies indicate a clear influence of the duration of diabetes on the frequency of visual disorders. The longer patients have diabetes, the greater the likelihood of serious complications in the visual system. Vision in this group of patients can be severely impaired and restricted. Disorders of the visual system in patients with diabetes require an interdisciplinary approach. The spectrum of visual problems in patients with diabetes may affect the quality of their vision and visual functioning in daily life.

Conclusions: An integrated approach to patient care provided by an ophthalmologist, diabetologist, diabetes nurse, and optometrist seems to be a very important element in the care of patients with diabetes. An essential element of care for this group of patients is education and preparation for self-care. In future research, it would be beneficial to further assess the scale of visual disorders in patients with diabetes, as well as to identify factors influencing the quality of vision in this group of patients. Developing an integrated, multidisciplinary care strategy for patients with diabetes who have visual system disorders or are at risk of developing such disorders seems to be a good idea.

Diabetes – at the beginning of the journey

Chairs: Beata Mianowska, Agnieszka Szypowska, Agnieszka Zubkiewicz-Kucharska

P46
CLINICAL PICTURE OF NEWLY DIAGNOSED TYPE 1 DIABETES IN CHILDREN DURING A 12-YEAR SINGLE-CENTER OBSERVATION

Milena Jamiołkowska-Sztabkowska[1], Michał Okruszko[2], Maciej Szabłowski[2], Artur Bossowski[1], Barbara Głowińska-Olszewska[1]

[1]Department of Pediatrics, Endocrinology, Diabetology with Cardiology Division, Medical University of Białystok, Białystok, Poland
[2]Medical University of Białystok, Białystok, Poland

Introduction: Over recent years, a significant increase in the type 1 diabetes (T1D) incidence has been observed in the pediatric population. The clinical picture at the time of diagnosis varies from accidentally detected carbohydrate intolerance, through overt symptoms of the disease, to a severe ketoacidosis (DKA). The aim of this study was to analyze the clinical picture of patients aged 0–18 years at the time of diagnosis of T1D and to determine the possible influencing factors.

Material and methods: The medical records of patients (n = 777, 369 boys and 408 girls) who were admitted to the Clinic with a new diagnosis of T1D in the years 2010–2022 were retrospectively analyzed. Statistical analyzes were performed using the Statistica 13.3.

Results: In the years 2010–2022, an increase in the number of new cases of T1D was observed – from 48 patients in 2010 to 88 and 78 in 2021–2022 respectively. Considering the incidence of DKA at the time of disease diagnosis, a statistically significant increasing trend was observed (p = 0.016), the most marked in relation to the occurrence of severe acidosis (p = 0.034). DKA was observed significantly more often in younger children, with lower body weight and BMI, with a higher HbA_{1c} percentage and lower C-peptide secretion (all p = 0.000). The pH value at diagnosis correlated positively with age, body weight, BMI, BMI-SDS and C-peptide concentration, and negatively with HbA_{1c} and the symptoms duration. The observation time of prodromal symptoms correlated positively with patients' age and HbA_{1c}. Most often, the diagnosis of T1D was accompanied by HbA_{1c} 8–12%. In children aged 10–18 years, HbA_{1c} values > 12% and > 16% were observed more frequently. Interestingly, the highest HbA_{1c} values in the DKA group were most often observed ina state of mild DKA. The presence of an additional autoimmune disease at the time of T1D diagnosis was associated with a significantly lower pH (p = 0.0086) and more frequent occurrence of DKA (p = 0.035), but also with older age (p = 0.026). Children from families with a history of diabetes in a first-degree relative were characterized by a significantly lower rate of DKA (p = 0.0000), shorter symptoms duration (p = 0.0055), lower HbA_{1c} (p = 0.0001), and higher C-peptide (p = 0.0001).

Conclusions: Not only is there an increase in the incidence of T1D in children, but also in the occurrence of DKA at the time of diagnosis. The youngest children are at the greatest risk of DKA, and its occurrence is associated with low residual function of pancreatic β-cells. The presence of an additional autoimmune disease increases the risk of developing DKA. Patients with a positive family history of diabetes are diagnosed earlier, in a better clinical condition and with a lower incidence of DKA, most likely due to greater awareness of the patienta and their parents about the symptoms of the disease.

P47
EVALUATION OF THE COCHLEAR AND HEARING PATHWAY FUNCTION IN CHILDREN WITH TYPE 1 DIABETES- PRELIMINARY RESULTS

Olga Kamińska-Jackowiak[1], Aleksandra Niemczyk[2], Paula Zemła-Szten[1], Klaudia Rak-Grabowska[2], Krzysztof Morawski[2], Agata Chobot[1]

[1]Department of Pediatrics, University Clinical Hospital in Opole, Opole, Poland
[2]Department of Otolaryngology, University Clinical Hospital in Opole, Opole, Poland

Introduction: Glycemic control has a significant impact on the risk of developing microvascular complications of type 1 diabetes (T1D). Hearing and cochlear impairment may result, among others, from microvascular changes of various etiology. Subclinical hearing and cochlear disorders may develop already in the pediatric age. We present preliminary results of a study aiming to evaluate the potential associations between the glycemic control metrics assessed using continuous glucose monitoring (CGM) and the function of the cochlea and hearing pathway.

Material and methods: All children 6–18 years old, treated in the pediatric diabetes center in Opole, with T1D for > 36 months, and not meeting the exclusion criteria are eligible to participate in the study. Until now 36 children (13.4 ±3.2 years, T1D duration 90 ±41 months, time in range 70–180 mg/dl (TIR%)) underwent laryngological examination, after which pure tone audiometry (PTA), distortion product otoacoustic emissions (DPOAE), and auditory brainstem responses (ABR) were performed to evaluate the auditory function. DPOAE decrease suggests cochlear dysfunction, while ABR results indicate potential subclinical neuropathy. CGM readings from the last 90 days by the time of the above examination were recorded.

Results: PTA values for the majority of frequencies and PTA4 showed significant positive correlations with time spent above range > 180 mg/dl (r = 0.3–0.45, p < 0.05). Slightly weaker negative correlations of PTA for higher frequencies were shown for the TIR (r = –0.3, p < 0.05). DPOAE revealed a positive association with TIR (r = 0.29; p = 0.024). A positive correlation between ABR for click and TAR > 180 mg/dl (r = 0.25, p = 0.05) was found. Other associations were not statistically significant.

Conclusions: Our preliminary results reveal an association between deteriorating audiometric measurement outcomes and glycemic parameters: decreasing time in range (TIR) and increasing time above range (TAR) in children with T1D.

Source of funding: Diabetes Poland Grant.

P48
SKIN REACTIONS IN CHILDREN WITH TYPE 1 DIABETES ASSOCIATED WITH THE USE OF NEW DIABETES TECHNOLOGIES – OBSERVATIONS FROM A REGIONAL PEDIATRIC DIABETES CENTER

Paula Zemła-Szten[1,2], Ewa Ledwoń[1,3], Krzysztof Nalewajko[4], Anna Korsgaard Berg[5], Agata Chobot[1,2]

[1]Department of Pediatrics, University Clinical Hospital, Opole, Poland
[2]Department of Pediatrics, Institute of Medical Sciences, University of Opole, Opole, Poland
[3]Faculty of Health Sciences, University of Opole, Opole, Poland
[4]Department of Cardiology, Institute of Medical Sciences, University of Opole, Opole, Poland
[5]Steno Diabetes Center Copenhagen, Copenhagen University Hospital, Herlev, Denmark

Introduction: Modern technologies such as personal insulin pumps (IP) and continuous glucose monitoring (CGM) require permanent placement in the subcutaneous tissue and attachment to the skin. Their high and constant popularity obliges us to pay attention to the dermatological complications associated with using these devices. The study aimed to estimate the incidence of skin lesions in children with T1D using IP and/or CGM in our center and to analyze their association with the duration of device use and anthropometric parameters.

Material and methods: As part of the international JENIOUS SKIN-Pedic project, we prospectively obtained data according to a systematic interview and examination scheme regarding the use of IP and/or CGM and the presence of skin problems and complications (dry skin, follicular keratosis, presence of wounds, old scars, lipoatrophy, lipohypertrophy, infection) in all pediatric patients visiting the Diabetes Clinic and the Pediatrics Department of the University Clinical Hospital in Opole for 4 weeks in a row. Anthropometric measurements were obtained retrospectively from medical records from the day of SKIN-Pedic skin assessment.

Results: Among 119 individuals (52 (43.7%) girls), 99 (83.2%) children used IP and 114 (95.8%) used CGM. Only 5 (5%) children using IP and CGM simultaneously (94/119, 79%) had no skin lesions. Isolated old scars were most frequently found (51/96, 53.1% for IP users and 73/110, 66.4% for CGM users), less frequently ≥ 2 types of lesions co-occurred 39/96 (40.6%) for IP and 30/110 (27.3%) for CGM). The incidence of skin lesions did not differ depending on gender and age group. Skin complications occurred significantly more often in children with dry skin (56 vs. 2, $p = 0.017$ for IP injections and 67 vs. 3 children, $p = 0.023$ for CGM). The frequency of skin complications varied depending on the duration of OPI use (5/10, 50% for IP < 1 year, 52/53, 98.1% – IP 1–3 years, 33/33, 100% for IP > 3 years; $p > 0.001$). There were no significant differences depending on the duration of CGM use and the frequency of different skin lesions at the sensor site ($p = 0.052$). The analysis did not show that subgroups of patients with varying skin lesions differed regarding body weight or BMI.

Conclusions: Dermatological complications are a significant problem among children using IP and/or CGM under the care of our center. After using an IP for over 3 years, they were already observed in all study participants. The frequency and type of skin lesions were not associated with BMI in the study group.

P49
INDIVIDUAL PREDISPOSITION AS A DETERMINANT OF COPING WITH CHILDREN WITH TYP 1 DIABETES

Małgorzata Marć[1], **Magdalena Kordowska**[2]

[1]Department of Nursing and Public Health, Institute of the Health Sciences, Medical College, University of Rzeszów, Rzeszów, Poland
[2]None

Introduction: Type 1 diabetes is usually diagnosed in children and teenagers and recent research shows that the number of young patients is still rising. Diabetes education is a key element in the therapy of patients and their family. The skills needed to deal with the disease depending on child personality and individual and environmental factors. The purpose of this study is to show the differences in dealing with diabetes among young patients depending on individual preferences.

Material and methods: The study used the method of diagnostic survey, survey technique. Research tools were used in the form of an author questionnaire for children and their parents, as well as questionnaires for standardized tools.

Results: Based on the research the hypotheses were verified.

Conclusions: High level of children' skills and knowledge about type 1 diabetes has an influence on active dealing with the stress of diabetes management. Children with lower levels of knowledge and skills have no statistically higher feelings of anger. Children without family support are not accepted by peers do not have a statistically lower level of coping with illness. Long time disease and the age of children does not significantly affect the opinions of children who are good at dealing with the disease. It has not been found that regular participation in diabetes education contributes to better coping with illness in children.

P50
PREPARING TEACHERS TO CARE FOR STUDENTS WITH TYPE 1 DIABETES

Monika Zamarlik

Faculty of Health Sciences, Jagiellonian University Medical College, Kraków, Poland

Introduction: This resarch is about children and adolescents with type 1 diabetes, many of whom were diagnosed so early that they will not know or remember life without this disease. These individuals will confront their incurable condition throughout their lives, becoming experts on their own disease. However, today it is the duty of adults: parents, caregivers and teachers, to ensure that, despite the illness, these children can lead normal lives and experience a typical, happy childhood. In kindergarten and school, they require the support of trained and committed teachers. The aim of this study is to assess the readiness of teachers in kindergartens and primary schools in Kraków to care for students with type 1 diabetes, and to identify the barriers and factors determining the ability to provide this care appropriately.

Material and metods: The study used a self-developed survey questionnaire containing 35 closed and open-ended questions and a metric. The χ^2 test or Fisher's exact test was used to determine the relationship between the study characteristics. The distributions of the knowledge index and skills related to caring for a child with diabetes between categories were compared using the Mann-Whitney *U* test and Kruskal-Wallis's test. Additionally, multivariate models (regression) were performed to test whether gender, age, work experience, and training participation were independently associated with the delineated index.

Results: The study included 1018 teachers of local government institutions (281 kindergarten teachers and 787 primary school teachers). Only 5% of teachers rated the opportunity to gain the preparation for working with chronically ill students during their studies as very high or high. Only 30% of teachers stated that they were trained in how to handle a child with diabetes. Among the surveyed teachers, 28.9% declared that they were able to recognize the symptoms of hypoglycemia in a child, while 37.5% declared not being able to recognize the symptoms. In case of hypoglycemia in a student, 22% of teachers would take correct action, 20% gave an extremely incorrect answer: administering insulin. In case of a child with T1DM losing consciousness, less than 10% would administer glucagon, while over a third would call an ambulance. The barriers to proper care for a child with T1DM identified by teachers included the lack of school nurses, lack of training, and unclear legislation. A significant correlation was observed between the level of knowledge and skills and the declaration of engagementin helping students with T1DM. Individuals with a higher level of knowledge and skills and participating in training were more willing to assist students in self-monitoring their diabetes.

Conclusions: The study revealed that the level of knowledge and skills of teachers in Kraków's kindergartens and schools about type 1 diabetes is low and insufficient to provide proper care for students with T1DM. It is necessary to increase teachers' knowledge by providing opportunities for them to participate in training. It is also necessary to implement the recommendations for the care of children with diabetes in educational institutions developed by the Polish Diabetic Association and to make them official.

Type 1 diabetes on the move

Chairs: Maciej Pawłowski, Małgorzata Szelachowska, Dorota Zozulińska-Ziółkiewicz

P51
EVALUATION OF NUTRITION AND SUPPLEMENTATION IN LONG-DISTANCE RUNNERS WITH TYPE 1 DIABETES

Kamil Suwała

Faculty of Medicine, Dietetics, Jagiellonian University Medical College, Kraków, Poland

Improved and more effective approaches to insulin administration have empowered individuals with type 1 diabetes to lead their daily lives and participate in physical activities at levels comparable to the general population. The objective of this study was to investigate the dietary patterns and supplementation practices among long-distance runners with type 1 diabetes (T1D) between the ages of 18 and 50, and to compare them with a healthy control group of similar age and body weight. Additionally, the study examined the overall quality of life, sleep patterns, and physical activity levels of the participants throughout the week. The research employed four different questionnaires to assess various aspects, including: the frequency of consuming specific food groups (FFQ-6), quality of life (WHOQOL-BREF), physical activity (WHO-GPAQ), and strategies related to nutrition, supplementation, and insulin management during exercise (author's questionnaire). Results indicated that both long-distance runners with type 1 diabetes and their healthy counterparts opted to increase carbohydrate intake prior to planned physical exertion. The majority of individuals with type 1 diabetes did not seek guidance from dieticians and typically reduced or omitted insulin administration before engaging in physical exercise. Notably, no significant disparities were observed in the level of physical activity throughout the week or in the quality of life dimensions between the runners with type 1 diabetes and the healthy individuals. The majority of respondents, regardless of diabetes status, utilized dietary supplements in the form of vitamins and minerals. It was found that runners with diabetes maintained consistent body weight, adhered to dietary guidelines for their condition, and maintained an optimal level of glycated hemoglobin. Furthermore, individuals with diabetes reported comparable sleep quality and consumed similar quantities of sweets and salty snacks as their healthy counterparts. The research showed that regularly engaging in long-distance running and appropriate education of patients on managing physical activity leads to many benefits for mental and physical health.

P52
ASSESSMENT OF PHYSICAL CAPACITY AND METABOLIC PARAMETERS OF MARATHON RUNNERS WITH TYPE 1 DIABETES

Michał Kulecki[1], Marcin Daroszewski[2], Paulina Birula[1], Anna Kreczmer[1], Monika Pietrzak[3], Anna Adamska[1], Magdalena Michalak[1], Anita Kaczmarek[1], Alicja Sroczyńska[3], Mateusz Michalski[1], Dorota Zozulińska-Ziółkiewicz[1], Andrzej Gawrecki[1]

[1]Department of Internal Medicine and Diabetology, Poznań University of Medical Sciences, Poznań, Poland
[2]University Centre for Sports and Medical Studies, Poznań University of Medical Sciences, Poznań, Poland
[3]Department of Diabetology and Internal Medicine, Raszeja City Hospital, Poznań, Poland

Introduction: Individuals with type 1 diabetes mellitus (T1DM) participate in extreme physical exertion, posing unique challenges for both participants and their healthcare teams. In recent years, there have been published reports of individuals and groups of people with T1DM completing a marathon. Understanding the metabolic characteristics and physical performance of these athletes could lead to safer and more effective management strategies. This study aimed to evaluate the physical capacity and metabolic parameters in T1DM individuals who completed a marathon.

Material and methods: We included five male participants with T1DM participating in the 22 Poznań Marathon. The runners filled dedicated health questionnaire. We performed indirect calorimetry to measure metabolic parameters, spiroergometry to assess physical capacity, and densitometry to analyze body composition.

Results: The participants were all men aged 44.0 (34.00–48.0) years and with diabetes duration of 10.0 (6.0–14.0) years. They had a body mass index of 22.5 (22.0–23.3) and demonstrated good glycemic control with glycated hemoglobin of 5.8 (5.6–6.9)%. Three out of five participants achieved a time in range exceeding 70% for 90 days before the marathon. Their glycemic variability coefficient was 34.6 (27.8–39.5)%. The median fat tissue content was 21.8 (20.2–24.7)%. and muscle tissue content was 73.6 (70.5–74.1)%. The basal metabolic rate was 1932.0 (1859.0–2046.0) kcal. and the VO2 max was 44.2 (36.5–44.3) ml/kg^{-1}/min^{-1}.

Table 1. Characteristics of marathon participants

parameter	Wszyscy uczestnicy
HbA1c [%]	5.8(5.6-6.9)
TIR [%]	70(65-90)
CV [%]	34.6(27.8-39.5)
age [years]	44(34-48)
diabetes duration [years]	10(6-14)
time of sport per week [hours]	6(4-12)
running time [years]	8(8-11)
BMR (Kcal/day)	1932(1859-2046)
height (m)	1.8(1.8-1.8)
weight (kg)	73(73-78)
FVC (L)	5.3(5.2-5.6)
VC max [L]	5.7(5.6-5.7)
FEV1[%]	76.7(73.8-78)
VO2 max	44.2(36.5-44.3)
body fat content [%]	21.8(20.2-24.7)
muscle tissue content [%]	73.6(70.5-74.1)
BMD (g/cm2)	1.2(1.2-1.2)
BMI [kg/m^2]	22.5(22-23.3)

HbA1c - glycated hemoglobin
TIR - time in range
CV - coefficient of variation of glycemia
BMR - basal metabolic rate
FVC - forced vital capacity
VC max - maximal vital capacity
FEV1 - forced expiratory volume in 1 second
VO2 max - maximal oxygen uptake –
BMD - bone mineral density
BMI - body mass index

Conclusions: T1DM individuals who complete marathons demonstrate good metabolic control and high physical capacity.

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P53
IS A POSITIVE ANTI-THYROID ANTIBODY TITER IN SCREENING TESTS AMONG PATIENTS WITH TYPE 1 DIABETES ASSOCIATED WITH AN INCREASED RISK OF DEVELOPING HYPOTHYROIDISM IN A 9-YEAR FOLLOW-UP?

Anita Rogowicz-Frontczak[1], Joanna Prośniewska[2], Dorota Zozulińska-Ziółkiewicz[1]

[1]Department of Internal Medicine and Diabetology, Poznań University of Medical Sciences, Poznań, Poland
[2]Poznań University of Medical Sciences, Poznań, Poland

Introduction: Autoimmune thyroiditis (AT), commonly known as Hashimoto's thyroiditis, is frequently associated with type 1 diabetes and is characterized by elevated anti-thyroid antibodies, potentially leading to thyroid dysfunction. This study aims to evaluate the progression of AT over a nine-year follow-up period among individuals with type 1 diabetes.

Material and methods: The study involved 100 adult patients with type 1 diabetes from the Department of Internal Medicine and Diabetology at Poznań University of Medical Sciences (2013–2015). Participants had a diabetes duration of over 5 years and no prior history of thyroid disease. Hashimoto's AT diagnosis relied on anti-thyroid peroxidase (anti-TPO) and anti-thyroglobulin (anti-TG) autoantibodies and ultrasound examination findings. Initial thyroid autoimmunity incidence in the study group was 31% (26% were positive for anti-TPO 19% only for anti-TG, 58% for both antibodies, and 3% for TRAb).

Results: After nine years, 18 patients (11 women, 7 men) aged 24–49 with a duration of diabetes of 21 ±6 years participated in the evaluation. During screening, 33% (5 women, 1 man) were diagnosed with hypothyroidism, and 1 woman exhibited Hashitoxicosis. Over the follow-up, 44% (4 women and 4 men) developed hypothyroidism, with an average duration of 5 years. All patients showed elevated anti-thyroid antibodies, with titers increasing significantly (anti-TG titer by 182%, anti-TPO titer by 252%), in 94% of cases a typical picture characteristic of chronic thyroiditis was observed in the ultrasound image, and a reduction in thyroid volume from 14.62 ±8.12 ml to 12.28 ±10.93 ml. The initial dose of L-thyroxine (n = 15) was 25–75 µg (mean 33 ±21.5 µg) and required an increase to 37.5–150 µg (mean 62.5 ±48.7 µg). Symptoms of Hashimoto's disease were declared by 11 participants (61%), of which 7 people (38%) had more than 4 symptoms. Common symptoms included chronic fatigue (50%), weakness (44.4%), hair loss (38.9%), and excessive sweating (38.9%).

Conclusions: This study underscores the progressive nature of AT in type 1 diabetes patients. Most individuals diagnosed with Hashimoto's disease developed hypothyroidism and associated symptoms over nine years. Elevated anti-thyroid antibodies and their increasing titers highlight the importance of screening tests for thyroid function and antibodies in type 1 diabetes patients.

P54
NONALCOHOLIC FATTY LIVER DISEASE IN PEOPLE NEWLY DIAGNOSED WITH TYPE 1 DISEASE

Aleksandra Pypeć[1*], Agata Grzelka-Woźniak[1*], Przemysław Dalski-Szeląg[2], Ada Kaczmarek[2], Wiktor Szymajda[2], Dorota Zozulińska-Ziółkiewicz[1**], Aleksandra Uruska[1**]

[1]Department of Internal Medicine and Diabetology, Poznań University of Medical Sciences, Poznań, Poland
[2]Poznań University of Medical Sciences, Poznań, Poland
[*] Equal first authors
[**]Equal senior authors

Introduction: Nonalcoholic fatty liver disease (NAFLD) is the most common liver disease in adults. The main causes of hepatocyte steatosis are metabolic disorders accompanied by insulin resistance and alcohol. Liver diseases may be caused by diabetes, worsen its course, coexist or be its result. While the occurrence of fatty liver disease in people with type 2 diabetes is understandable due to the often comorbid obesity, the issue of fatty liver disease in people with type 1 diabetes who are normoweightis an interesting and not fully researched issue. To assess the incidence of NAFLD in people with a new diagnosis of type 1 diabetes and to determine the clinical parameters associated with the occurrence of steatosis.

Material and methods: The retrospective analysis included 90 people, including 25 women and 65 men, with a new diagnosis of type 1 diabetes confirmed by the presence of antibodies, hospitalized in the years 2015–2022 at the Department and Clinic of Internal Medicine and Diabetology, Poznań University of Medical Sciences. Based on abdominal ultrasound, the participants were divided into groups with and without present NAFLD. Selected clinical parameters found at the diagnosis of diabetes were analyzed: glycated hemoglobin (HbA_{1c}), body mass index (BMI), waist to hip ratio (WHR), alanine aminotransferase (ALT), aspartate aminotransferase (AST), clinical parameters describing insulin sensitivity: daily insulin dose (DDI) andvisceral adipose tissue index (VAI).

Results: The prevalence of NAFLD was 18% (16 people). There were no differences in HbA_{1c} values between the groups with and without NAFLD: 11.3 (10.1–12.6)% vs. 11.4 (10–12.7)%, $p = 0.889$, DDI: 0.18 (0.13–0.22) vs. 0.17 (0.13–0.30) units/kg body weight/day, $p = 0.877$, VAI: 7.19 (4.41–14.56) vs. 3.97 (2.56–6.28), $p = 0.037$. People with diagnosed NAFLD differed from people without NAFLD in terms of BMI25.74 (23.2–29.7) vs. 22.48 (19.6–24.8) kg/m^2, $p = 0.002$, WHR 0.91 (0.87–0.99) vs. 0.86 (0.80–0.91), $p = 0.004$, ALT/AST ratio 1.48 (1.18–1.81) vs. 1.18 (0.96–1.47), $p = 0.03$. In the multivariate regression model, the occurrence of NAFLD depended on BMI [OR 1.28 (95% CI: 1.08–1.51)], $p = 0.004$ and ALT/AST ratio [OR 5.09 (95% CI: 1.06–24.2)], $p = 0.04$, regardless of HbA_{1c}, WHR and VAI.

Conclusions: People with a new diagnosis of type 1 diabetes and comorbid NAFLD differ in their metabolic profile from people without diagnosed NAFLD. It is worth conducting diagnostics for NAFLD among people with newly diagnosed type 1 diabetes and BMI and ALT/AST ratio may be helpful.

P55
METFORMIN IN TYPE 1 DIABETES WITH IATROGENIC INSULIN RESISTANCE AND HYPERINSULINEMIA. DETERMINATION OF DRUG CONCENTRATION IN PLASMA AND ITS RELATIONSHIP WITH THERAPEUTIC EFFECT – PILOT STUDY

Małgorzata Bekier[1], Aleksandra Uruska[2,3], Dorota Zozulińska-Ziółkiewicz[2], Edmund Grześkowiak[1], Danuta Szkutnik-Fiedler[1]

[1]Department of Clinical Pharmacy and Biopharmacy, Poznań University of Medical Sciences, Poznań, Poland
[2]Department and Clinic of Internal Diseases and Diabetology, Medical University of Poznań, , Poznań, Poland
[3]Department of Diabetology and Internal Diseases, Raszeja City Hospital, Poznań, Poland

Introduction: The "double diabetes" and features of iatrogenic insulin resistance in type 1 diabetes, such as increased demand for insulin, often require the use of additional active substances, such as metformin. Although this drug is very well known and safe, in many situations its introduction does not always allow for the expected results. The aim of the pilot study was to observe the effectiveness of the use of metformin in order to optimize the daily insulin requirement in people with type 1 diabetes treated with insulin and to answer the question whether the observed effect may depend on the concentration of metformin in the blood. An additional parameter was to determine the minimum therapy time needed to improve the patient's condition.

Material and methods: 11 adults with type 1 diabetes and insulin resistance indicators such as daily insulin requirement ≥ 0.8 U/kg body weight were treated with additional metformin therapy at a dose of 500, 1000 or 2000 mg/day. The concentration of metformin in the blood was determined at the time of inclusion in the study and after 14 days, 28 days, 3 months, 6 months and one year after the initiation of therapy. The drug concentration was determined by mass spectrometry UPLC-MS/MS. Patients were tested for: HbA_{1c} (glycated hemoglobin), TIR (time in range, 70–180 mg/dl, TBR (time below range, < 70 mg/dl), BMI, WHR, % body fat, total cholesterol, LDL, HDL, non-HDL, TG and DDI. In the first month of using the drug, each person had access to an educational meeting with a dietitian.

Results: The combination of metformin with intensive insulin therapy was not associated with a significant increase in TBR. An increase in TIR was observed in 6 patients, a decrease HbA_{1c} in 5 and a decrease in body weight with a decrease in % of body fat in 9 patients. In 7 patients, a decrease in daily insulin requirement was observed 3 months after starting metformin, and in 1 person the drug concentration in the blood during this period was below 100 ng/ml (below the limit of detection), and in 3 people it was below 1000 ng/ml. The highest concentrations were observed between the 2 week and the 6 month of the study and the lowest average concentration of metformin in the blood was observed 12 months after the start of therapy. The highest median concentration was observed in the 2nd week of drug use.

Conclusions: The combination of metformin with insulin therapy was not associated with a significant increase in TBR, which allows us to consider this type of therapy as safe in terms of the risk of hypoglycemia. The use of metformin in people with type 1 diabetes and signs of insulin resistance may help reduce DDI along with HbA_{1c}, body weight and lipid parameters. The optimal treatment duration seems to be at least 3 months, because only after this time we observed a significant decrease in the daily insulin requirement. We need to conduct a study involving a larger group of patients.

Younger and older diabetes head

Chairs: Maria Górska, Andrzej Kokoszka, Anna Majchrzak

P56
MNEMONICS FOR ELDERLY PATIENTS ON INSULIN THERAPY

Ewa Kostrzewa-Zabłocka

Diabetes Outpatient Clinic, Independent Public Provincial Specialist Hospital, Chełm, Poland
Diabetes Outpatient Clinic, Non-Public Healthcare Centre "Zdrowie", Chełm, Poland
Diabetology Clinic, Institute of Rural Health, Lublin, Poland

Introduction: Mnemonics can improve the ability of elderly patients on insulin therapy to encode and retrieve new information. Mnemonics are a set of mental activities designed to permanently acquire and efficiently use knowledge. The use of mnemonics is based on the core knowledge about the memorization process and the natural mechanisms of acquiring new information. The use of mnemonic techniques, both during training and in everyday life, contributes to improvement of the natural memory mechanisms. To determine the impact of mnemonics on the process of remembering insulin doses taken by elderly patients.

Material and methods: The study used a proprietary questionnaire of 10 questions and an analysis of the respondents' test results concerning fasting and postprandial glycemia as well as glycated haemoglobin. The study involved 20 patients of both sexes (12 women, 8 men), aged 70–90 years, with type 2 diabetes, who repeatedly forgot to take insulin. More than half of the participants lived alone at home. The study was held at the Diabetes Outpatient Clinic in Chełm from June to December 2023.

Results: All the study patients were on insulin therapy and had memory problems. The average fasting blood glucose was 160 mg% and the average postprandial blood glucose was 240 mg%. Glycated haemoglobin levels were within the range of 9–10% at baseline. Half of the patients took insulin twice a day, five people took it once a day at bedtime, and five people took it four times a day. All participants were provided with hand-made mnemonic aids to help them remember to take their insulin. Patients taking insulin several times a day were given clocks with a hand or abacuses with beads designed to indicate the time of day (breakfast, lunch, dinner, night) to be moved after insulin intake. People taking injections once a day were provided with balls with the name of the day on them to be put in a cup after taking insulin. All participants were satisfied with the creative aids designed to improve their memory. By the end of the study in December, half of the patients had reduced their glycated haemoglobin levels to 8%.

Conclusions: People who used mnemonic aids increased their motivation to learn and confidence in their own memory. Patients who used mnemonic aids did not make any mistakes or fail to take their insulin at the right time of day.

P57
THE RELATIONSHIP BETWEEN DEPRESSIVE AND ANXIETY SYMPTOMS AND INSULIN SENSITIVITY IN OVERWEIGHT OR OBESE INDIVIDUALS

Lidia Łapińska[1], Anna Krentowska[1], Dominika Szczepańska[2], Michał Zawadzki[1], Marta Dobrzycka[3], Natalia Matulewicz[4], Monika Karczewska-Kupczewska[1], Irina Kowalska[1]

[1]Department of Internal Medicine and Metabolic Diseases, Medical University of Białystok, Białystok, Poland
[2]Student Research Group, Department of Internal Medicine and Metabolic Diseases, Medical University of Białystok, Białystok, Poland
[3]Department of Internal Medicine and Metabolic Diseases, Medical University of Białystok, Białystok, Poland
[4]Department of Metabolic Diseases, Medical University of Białystok, Białystok, Poland

Introduction: The prevalence of depression is estimated at 6% and anxiety disorders 4%. People with obesity have an increased risk of developing mood disorders and anxiety. The relationship between depression, anxiety and obesity is complex and bidirectional. Psychological, lifestyle, hormonal and inflammatory factors may impact on co-occurrence of these diseases. The results from previous studies showed that people with mood disorders have high risk of prediabetes and diabetes compared to the general population. The present study aim is to examine the association of depressive and anxiety symptoms with insulin sensitivity (IS) in overweight or obese people.

Material and methods: The study comprised 20 individuals with body mass index (BMI) ≥ 27 kg/m^2. Current antipsychotic or antidepressant medication use and prediabetes or diabetes were the main exclusion criteria in this study. All participants underwent general physical examination, anthropometric measurements and biochemical blood tests. The subjects completed the Beck Depression Inventory (BDI) and the Hospital Anxiety and Depression Scale (HADS). IS was assessed by hyperinsulinemic-normoglycemic clamp. Participants were divided into subgroups based on the median IS: subgroup with decreased IS (n = 10, M = 4.61 mg/kg fat free mass/min) and increased IS (n = 10, M = 6.73 mg/kg fat free mass mass/min).

Results: The median age and BMI in the study group were 36 years and 35.45 kg/m^2. The subgroups of individuals with decreased and increased IS did not differ in age and BMI (36.50 vs. 36.00 years, p = 1.000, 36.45 vs. 34.45 kg/m^2, p = 0.173). Participants with decreased IS more often had depressive symptoms in the BDI (≥ 10 points) and depressive and anxiety symptoms in the HADS (≥ 8 points) (70% vs. 20%, p = 0.025 and 90% vs. 30%, p = 0.006). In the entire group, the severity of depressive symptoms in the BDI correlated with IS (R = –0.45, p = 0.047). The relationship remained statistically significant after adjustment for age, gender, BMI and waist-hip ratio in multivariate linear regression (β = –0.53, p = 0.006). In the subgroup of individuals with decreased IS, the severity of anxiety symptoms in HADS was associated with IS (R = –0.81, p = 0.004).

Conclusions: People with overweight or obesity and decreased insulin sensitivity may have an increased risk of depressive and anxiety disorders.

P58
ASSESSMENT OF DIETARY HABITS AND LIFESTYLE AMONG PATIENTS WITH TYPE 2 DIABETES

Marietta Pastucha[1], Marta Pelczyńska[1], Paweł Bogdański[1]

[1]Chair and Department of Treatment of Obesity, Metabolic Disorders and Clinical Dietetics, Poznań University of Medical Sciences, Poznań, Poland

Introduction: The increasing incidence of diabetes mellitus type 2 (DMT2) is associated with excessive consumption of processed foods, sedentary lifestyles, and overweight and obesity. Proper nutrition is a crucial factor in maintaining optimal body weight and a key element of DMT2 behavioural therapy. A lasting lifestyle modification should be accompanied by the patient throughout the treatment, including dietary habits changes and regular physical activity. The objective of the study was to understand and evaluate the dietary habits and lifestyle of individuals with type 2 diabetes.

Material and methods: In a study conducted in the first quarter of 2023, a custom questionnaire consisting of 32 questions was used. The examination included 150 participants (115 females and 35 males). Basic descriptive statistics were applied and the χ^2 test was used to assess the relationship between two variables, with a significance level set at $p < 0,05$. Statistical analysis was conducted using Excel 2016 and Statistica 13.3.

Results: More than half of the respondents had an excessive body weight (32.67% with BMI ≥ 25 kg/m^2; 37.33% with BMI ≥ 30 kg/m^2). The most commonly adopted dietary strategies were normocaloric diets with low glycemic index (39.33%) and low-carbohydrate diets (24%). Only 18.67% of respondents reported following a calorie-restricted diet. Less common dietary strategies included intermittent fasting, Mediterranean, vegetarian, and DASH diets. Positive dietary behaviours observed among respondents included regular breakfast consumption, limiting the consumption of highly processed food, and daily consumption of vegetables and fruits. There was a trend towards reducing intake of simple sugars, but only 36.67% replaced them with low-calorie sweeteners. It has been demonstrated that older individuals used fewer sugar substitutes ($p = 0.0021$). Unfavourable dietary habits included snacking, low fish, legumes and nuts consumption. Snacking was more frequent in individuals with BMI ≥ 25 kg/m^2 ($p = 0.0413$). Most respondents reported taking an additional physical activity, as well as abstaining from alcohol and tobacco use. It was observed that among individuals not taking additional daily physical activity, the majority (52.38%) struggled with obesity. A significant relationship has been shown between practising additional physical activity and BMI ($p = 0.0479$)

Conclusions: Due to the diversity of dietary habits and lifestyles, as well as the prevalence of excessive body weight among respondents, it is important to increase the awareness of people with DMT2 about the health benefits resulting from achieving and maintaining proper body weight, as well as from the impact of behavioural therapy on the treatment process.

P59
RANDOMIZED CONTROLLED TRIALS DEDICATED TO OLDER PATIENTS WITH TYPE 2 DIABETES – PARTICIPANTS CHARACTERISTICS AND ENDPOINTS

Jan Borysowski[1], Maksymilian Sito[1], Danuta Kłosowska[1], Leszek Pączek[1]

[1]Medical University of Warsaw, Warsaw, Poland

Introduction: Older patients with type 2 diabetes comprise a very abundant and diverse population. The main factors that may affect the safety and effectiveness of glucose-lowering treatments in older adults include their age, comorbidities, and frailty. Treatment goals and risks in older patients may be different from those typical of younger individuals. Unfortunately, older patients have been underrepresented in clinical research in type 2 diabetes. An important source of data on the effects of antidiabetic drugs in older adults are clinical trials enrolling solely patients at advanced age and taking into account their heterogeneity and specific needs. To analyze randomized controlled trials (RCTs) dedicated to older patients with type 2 diabetes, especially participants characteristics and the primary endpoints.

Material and methods: RCTs in type 2 diabetes enrolling solely patients aged 60 years or older, published from 1994 through 2023. Systematic review of RCTs searched for in Pubmed, Embase, Cochrane Central Register of Controlled Trials, and the World Health Organization (WHO) International Clinical Trials Registry Platform (ICTRP). The review was performed in accord with the PRISMA standards and was registered at Prospero (CRD42023490827).

Results: The study included 35 RCTs (9,068 participants). Weighted mean age of the participants was 71.4 years. Proportion of patients aged ≥ 75 years was reported in 11 (31%) RCTs; it was 27%. Proportion of patients with frailty was provided by 2 (6%) RCTs; it was 9% and 95%. Proportion of patients with different comorbidity burden was reported in 1 (3%) RCTs (35% of the participants with TIBI ≥ 5). Proportion of participants with renal function impairment was provided by 19 (55%) RCTs. Moreover few RCTs included analyses to assess the efficacy of the investigational treatments in clinically important subgroups of patients (age ≥ 75 years, renal insufficiency, frailty). The primary endpoints mostly (n = 26; 74%) involved HbA_{1c} assessment. Composite primary endpoint involving reduction in HbA_{1c} concentration without significant hypoglycemia was used in 2 (6%) RCTs.

Conclusions: Most RCTs dedicated to older patients with type 2 diabetes do not report the key data essential to assess the generalizability of the results and their translation into optimal clinical care taking into account patients age, their comorbidities, and frailty. The primary endpoints mostly do not involve the outcome measures particularly relevant to older patients with type 2 diabetes, especially hypoglycemia. Substantial modifications of the endpoints and reporting of participants characteristics should be considered.

P60
ASSESSMENT OF QUALITY OF LIFE, QUALITY OF SLEEP AND DIABETES DISTRESS IN PATIENTS WITH TYPE 2 DIABETES MELLITUS AT THE EARLY STAGE OF THE DISEASE DURING THERAPY WITH NON-INSULIN DRUGS – PRELIMINARY RESULTS

Magdalena Płonka-Stępień[1,2], Katarzyna Cyranka[1,3], Anna Drynda[4], Magdalena Kwiatkowska[5], Maciej Małecki[1]

[1]Department of Metabolic Diseases, Jagiellonian University Medical College, Kraków, Poland
[2]Doctoral School of Medical and Health Sciences, Faculty of Medicine, Jagiellonian University Medical College, Kraków, Poland
[3]Department of Psychiatry, Jagiellonian University Medical College, Kraków, Poland
[4]Students' Scientific Group, Department of Metabolic Diseases, Jagiellonian University Medical College, Kraków, Poland
[5]University Hospital in Kraków, Kraków, Poland

Introduction: Type 2 diabetes mellitus is a chronic disease that can be associated with numerous inconveniences, deterioration of quality of life and sleep. There are quite a few scientific papers which prove that a long-term disease with complications significantly reduces the quality of life. On the other hand, patients with newly diagnosed type 2 diabetes without complications may also have a reduced quality of life due to the stress of the diagnosis, the need to introduce lifestyle changes, and regular medical visits. The scientific and clinical assessment of the quality of life in patients with newly diagnosed type 2 diabetes on non-insulin medications is still needed as number of studies concerning this subject is still limited. The purpose of this study is to assess quality of life and sleep as well as diabetes distress in patients with newly diagnosed type 2 diabetes on non-insulin medications.

Material and methods: 35 patients, aged 18–65 years, who had been diagnosed with type 2 diabetes for up to a year were included in the study. Patients remained on therapy with non-insulin drugs, i.e. oral medications or injectable GLP-1 receptor agonists. Validated tools were used for psychological assessment: Polish version of the 'QoL-Q Diabetes' questionnaire, The Diabetes Distress Scale and the Athens Insomnia Scale. Statistical analysis was performed using IBM SPSS software. The Shapiro-Wilk test was used to evaluate the normality. Due to the non-normal distribution, the results are presented as median and interquartile range (IQR).

Results: The characteristics of the group are shown in Table 1. The 'QoL-Q Diabetes' questionnaire assessed 23 areas of life. The highest median values were obtained within family/friendship and partner/marriage relationships: 12 (IQR: 8–15). The lowest median value was obtained within eating as I would like: 4 (3–6). In the DDS, the median score was 2.29 (1.47–4.18), indicating moderate diabetes-induced distress. 20 participants (57.14%) scored above 2, corresponding to at least moderate inconvenience caused by diabetes. 15 participants of them (75.00%) scored above 3, indicating severe diabetes-related distress. When analyzing the areas of diabetes-related inconvenience – emotional burden, regimen, interpersonal and physician distress, the medians were respectively: 2.8 (1.6–4.2), 3.0 (1.8–4.2), 1.67 (1.0–3.67), 1.75 (1.0–4.75). In the AIS, the median score was 5 (4–7). 18 patients (51.43%) scored below 6–13 patients (37.14%) scored 6–10, borderline normal. 4 patients (11.43%) scored > 10 points.

Conclusions: Patients with newly diagnosed T2DM showed highly variable quality of life in individual areas with the lowest value within eating what I feel like. Patients already in the early stages of T2DM show symptoms of diabetic stress. Insomnia problems can affect about half of T2DM patients. Discussing sleep problems should be a routine part of the doctor's visit for this group of patients.

Table 1 – Characteristics of the studied population (N=35; 12 women, 23 men)

Variable	Mean ± SD / Mediana (IQR)
Age [years]	47,42 ± 10,47
Diabetes duration [months]	7 (5-12)
HbA1c at enrollment [%]	6,0 (5,6-6,5)
BMI [kg/m^2]	32,92 ± 5,46