Abstracts from ABCD Diabetes Update

31st January - 2nd February 2024, Loughborough, UK

Top 8 scoring abstracts were published in the June issue, the following are the remaining abstracts that were presented

Br J Diabetes 2024;24:ONLINE PUBLICATION
https://doi.org/10.15277/bjd.2024.455

Abstract ID: 1

Early diagnosis of HNF1beta-MODY in a 33-year-old female with an atypical presentation

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This case study highlights the importance of considering atypical presentations of diabetes, conducting comprehensive genetic testing, and involving family history in the diagnostic process. Early diagnosis of monogenic diabetes (maturity-onset diabetes of the young, MODY) is essential for timely interventions to minimise the risk of complications and to provide personalised care.

Case description: We present the case of a 33-year-old female who was initially diagnosed with diabetes following the discovery of glycosuria during an unrelated visit to the Accident and Emergency Department. On further investigation and follow-up with her general practitioner (GP), she reported the classical diabetes symptoms of polyuria, excessive thirst and unexplained weight loss. Given a family history of type 1 diabetes (T1DM) in a cousin, the patient was initially diagnosed with T1DM. Remarkably, she had experienced these symptoms for as long as she could remember, although she did not exhibit ketonuria, and her HbA_{1c} level was measured at 70 mmol/mol. Over the subsequent 12 months, her insulin requirements to maintain adequate blood glucose control escalated, with HbA_{1c} levels continuing to rise. She was ultimately referred to secondary care diabetes specialists, by which point she required Levemir 30 units twice daily and Novorapid 12 units with meals. Unfortunately, the patient missed her appointment with the hospital diabetes team and continued to consult with the practice nurse at her GP surgery, with whom she had a strong rapport. In 2022, she was provided with a Libre sensor for continuous glucose monitoring.

The patient was referred back to secondary care following the finding of the HNF1beta gene in a family member. Notably, all of the patient's diabetes-related antibodies tested negative, and her urinary C-peptide:creatinine ratio was 3.53. The calculated MODY risk was 12.6%.[1] Genetic testing confirmed the presence of the same gene variant. Additional imaging studies, including ultrasound (USS) and CT scan, revealed pancreatic agenesis and renal cysts. Her plasma C-peptide level was significantly elevated at 1310 pmol/L, indicating marked insulin resistance. Additionally, deranged liver function and elevated creatinine levels were observed, along with background retinopathy.

Conclusion: This case underscores the significance of considering MODY in cases with atypical diabetes presentations. The management of MODY is unique to each patient, and timely genetic screening and pre-conception genetic counselling are critical in the care of affected individuals.[2]

Key messages:

1. Do not hesitate to adjust the treatment plan upon a MODY diagnosis.
2. Consider including antibody testing in the period closer to diagnosis, and C-peptide 3-5 years post-diagnosis, in the evaluation of diabetes cases.[3]
3. Family history is a crucial component in the diagnostic process.[4]
4. Individualise the management of MODY patients to optimise their care.[2]

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Abstract ID: 2

Lipoatrophic diabetes: case report on monogenic diabetes linked to FPLD 2

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Background: Monogenic diabetes accounts for 0.5-1.2 % of all diabetes cases and is often undiagnosed. The UNITED study team reports that 80% of monogenic diabetes are initially misdiagnosed as either type 1 diabetes (T1DM) or type 2 diabetes (T2DM) and are inappropriately managed. There is an average 13-year delay from initial diagnosis to correct genetic diagnosis. Monogenic familial partial lipodystrophy is an important but rare cause of insulin resistance causing diabetes.

Case presentation: A 50-year-old man was admitted to hospital with diabetes-related foot infection despite no prior diagnosis of diabetes. He required amputation of the right fourth and fifth toes after being diagnosed with wet gangrene and osteomyelitis of the toes. The diagnosis of monogenic diabetes linked to familial partial lipodystrophy (LMNA variant) was established later. Although there was a family history of monogenic diabetes in a sibling, there was a delay in screening and diagnosis in the community, resulting in a

serious complication.

Conclusion: Although rare, cases of monogenic diabetes linked to familial partial lipodystropy (FPLD) are often underdiagnosed and the first presentation may be a metabolic complication, as shown in this case. It is important to diagnose monogenic diabetes, especially if there is a family history of monogenic diabetes or any clinical suspicion. Not only can this alter the treatment regime and prognosis, but it can also save money by targeting appropriate cost-effective treatment. Family genetic screening should be considered as well.

Abstract ID: 4

A case of NeuroD1 MODY concealed as type 1 diabetes mellitus through three pregnancies

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Maturity-onset diabetes of the young (MODY), which has been associated with mutations in 14 different genes, is a clinically heterogenous group of monogenic disorders characterised by β-cell dysfunction.[1] An estimated 1-2% of patients diagnosed with diabetes have MODY as an underlying cause. It is important to distinguish MODY from type 1 and type 2 diabetes because optimal treatments are different.[2]

Pregnant women with diabetes may have underlying β-cell dysfunction due to mutations/rare variants in genes associated with MODY, and this may be undiagnosed. Genetic screening is paramount to reveal MODY in genetically predisposed women that would otherwise be unrecognised. This would help with further clinical management, family screening and genetic counselling.[3]

Case report: We present the case of a 29-year-old patient diagnosed at the age of 21 as type 1 diabetes mellitus (T1DM). At diagnosis, her HbA_{1c} was 12.5%, ketones were present in her urine, and she had a fairly high plasma C-peptide of 1125 pmol/L (reference range 371-1470). Autoantibodies were not measured at the time of diagnosis. She was started on Levemir BD 30 units (later titrated up to 42 units) and Novorapid 38-48 TDS. She had three successful pregnancies managed on insulin; birth weights were between 2.8-3.0 kg. There was a family history of diabetes affecting her mother and her maternal grandfather.

Results: She was lost to follow-up, and on re-referral at age 28 was found to have stopped taking her insulin for the three years after she last gave birth. In 2023 she had a BMI of 26 kg/m^2; her GAD, IA-2 and Zinc transporter 8 were negative, and her C-peptide was 951 pmol/L. MODY was suspected and she was found to be heterozygous for a likely pathogenic NEUROD1 frameshift variant after genetic testing by the Exeter Genomic laboratory.

Patient was started on gliclazide 40 mg once daily, which was later reduced to 20 mg od due to hypoglycaemia. Her latest HbA_{1c} was 50 mmol/mol (7.7%). The patient's mother was also contacted for genetic testing.

NEUROD1 MODY is rare and there is little evidence on how best to manage these individuals, let alone how to manage them in pregnancy. Phenotypically, these patients resemble type 2 diabetes (T2DM) and there is scarce evidence that any particular oral treatment works best. Making a specific genetic diagnosis, including a diligent review of family history of diabetes, is crucial since it alters the treatment given, thus potentially improving prognosis and reducing ketosis and neurological abnormalities.

Conclusion: Most cases of NEUROD1 diabetes in Europeans behaves like T2DM but some individuals develop diabetic ketoacidosis. This explains why the patient was thought to have T1DM at diagnosis.

For management of NeuroD1 MODY, measurement of non-fasting C peptide is recommended, with a trial on metformin, sulphonylurea or gliptins if good endogenous insulin production is observed.

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Abstract ID: 6

It is never too late to re-classify diabetes: an atypical case of MODY (HNF4A)

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A 43-year-old male was referred to our diabetes outpatient service for optimisation of his glycaemic control, with a pre-clinic diagnosis of type 2 diabetes (T2DM) made six years previously. He was asymptomatic, with an HbA_{1c} of 94 mmol/mol at the time of diagnosis. He was commenced on metformin 1g daily in the community. Upon review in the clinic, he remained asymptomatic, and his HbA_{1c} had improved to 57 mmol/mol with metformin monotherapy over a period of three years.

There was no history of pancreatitis, deafness, implicating medication or family history of diabetes. Importantly, there were no weight changes even at the time of diagnosis. His medical history included background diabetic retinopathy and hypertension, for which he was on ramipril 10mg OD.

He led an active lifestyle, was a non-smoker and did not consume alcohol. His body mass index (BMI) was 21.7 kg/m^2 and his weight was 65.9 Kg.

A normal BMI prompted further investigations. His urine C-peptide/creatinine ratio was 0.36 nmol/mol, suggesting reduced but preserved endogenous insulin secretion (intermediate). The plasma C-peptide was 559 pmol/L, which is normal for healthy individuals. His diabetes-related antibodies, which included anti GAD, anti IA2 and ZnT8, were all negative. This excluded the diagnosis of type 1 diabetes (T1DM). Table 1. shows other relevant investigations.

The plasma C-peptide and urine C-peptide/creatinine ratio suggested a reduced but preserved endogenous insulin secretion. Taken with the BMI of 21.7, this challenged the diagnosis of T2DM. Therefore a genetic test was organised to look for a possibility of maturity-onset diabetes of the young

Table 1. Investigations and results

Investigation	Result	Reference range
TSH	3.3 mU/L	0.35 – 4.7
eGFR	85 ml/min/1.73m^2	>90
Creatinine	94 umol/L	65 - 114
Total cholesterol	4.9 mmol/L	-
Non-HDL cholesterol	3.6 mmol/L	-
Triglycerides level	1.8 mmol/L	-
Urine albumin/creatinine ratio	<0.2 mg/mmol	< 2.5

(MODY), which returned heterozygous for a pathogenic HNF4A missense variant.

Age of 37 years at the time of diagnosis, the absence of a family history of diabetes and a BMI within the normal range were unique features of this case.

In scenarios where the clinical picture does not fit T1DM or T2DM, it is prudent to probe for a diagnosis of MODY as the treatment varies according to the subtype isolated. Accurate diagnosis assists in early optimisation of glycaemic control, prevention of long-term complications and appropriate genetic counselling.

Abstract ID: 7

Dilemma of neuropathy

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We present an interesting case of a flare-up of diabetic sensory neuropathy with myonecrosis. The patient ia a 35-year-old female with type 1 diabetes mellitus (T1DM) diagnosed at the age of eight years and generally poorly controlled. She has a complex history of complications related to diabetes mellitus. She has renal and retinal complications, is on renal replacement therapy, has a peripheral sensory neuropathy, had a right below-knee amputation for Charcot foot, osteomyelitis and mononeuritis affecting the third nerve. She has hypothyroidism and hypertension and is on treatment for these. There is no significant family history.

She is now suffering from recurrent myonecrosis: she is under the care of the orthopaedics team for conservative management with analgesics. The patient was started on oxycodone and Fentanyl patches for pain. Her symptoms of peripheral neuropathy worsened, with phantom limb pain, stabbing and sharp pins and needle sensations. She was started on a trial of duloxetine, with tapering of the Fentanyl patches, after discussion with the pain team.

This is an interesting case of young lady with many complications of diabetes mellitus. Her case signifies the importance of good glycaemic control and how poor diabetic control is linked to complications of diabetes mellitus, affecting quality of life of this young patient. Our patient developed a recurrent rare muscle inflammatory disorder, myonecrosis of the thigh muscles. After MDT discussion she had conservative management with analgesia. However, sensory neuropathy worsened during this period so she was referred to the pain team for further management .

Abstract ID: 8

Preconception counselling and successful diabetes care in a 31-year-old woman with a background of significant hypoglycaemia

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Diabetes affects 1 in 20 pregnancies in the UK.[1] Gestational diabetes accounts for the largest proportion of diabetes in pregnancy, and the prevalence is increasing.[2] There are now more pregnancies in women with type 2 diabetes (T2DM) than type 1 diabetes (T1DM).[2] When pregnancy is planned alongside the guidance of the diabetes team, the risk of a serious complication, including major congenital malformations and perinatal mortality, is lowered.[3] However, data show that only 32% of women access preconception care.[4] By accessing preconception care, women are provided with a thorough optimisation of factors including lifestyle advice on: weight, smoking, alcohol intake, medication review to avoid teratogenicity, glycaemic targets and treatment intensification, diabetic retinopathy and nephropathy, and timely booking into the joint antenatal care clinic as soon as pregnancy is confirmed.

We present a case of a 31-year-old woman, diagnosed with T1DM at the age of 7. She underwent preconception counselling prior to the birth of her first child in 2023. Her preconception HbA_{1c} in 2022 was 42mmol/mol. She was counselled on the risks associated with diabetes in pregnancy, including the risk of major malformation, miscarriage, large for gestational age baby, and the increased likelihood of Caesarean section and stillbirth. Healthy lifestyle factors such as the importance of abstaining from alcohol, not smoking, vitamin D supplementation and folic acid use were emphasised, alongside exercising glycaemic control within pregnancy targets. Due to a previous diagnosis of mild background retinopathy, she underwent same-day retinal screening. Associated conditions such as hypothyroidism with specific pregnancy targets were optimised, including dose adjustment of levothyroxine for hypothyroidism to maintain a target TSH level. Managing blood glucose targets during pregnancy can be challenging, and special attention was paid due to the mother's history of severe hypoglycaemia prior to starting on continuous glucose monitoring with alarm functionality.

Maternal hypoglycaemia is more pronounced in the first trimester, and is often associated with a loss of warning symptoms and nocturnal occurrence. The cause may be due to impaired normal counter-regulatory hormone response and an increase in insulin sensitivity.[5] Awareness of the propensity for maternal hypoglycaemia is paramount, as this poses a risk of maternal death.

The mother successfully gave birth to a healthy baby boy, with no antenatal or postnatal complications.

In conclusion, effective pre-pregnancy care for all women with diabetes improves pregnancy outcomes and has been highlighted by NICE as a key priority.[1]

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Abstract ID: 10

Don't jump to conclusions - considerations of classification of diabetes type in practice

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Introduction: Correctly diagnosing the type of diabetes soon after presentation can be challenging in many patients when there is overlap in clinical characteristics. Further investigations, including autoantibody testing, C-peptide levels and genetic testing can be used, where appropriate. The use of prediction tools such as the Exeter Diabetes MODY probability calculator can help when considering further investigations and a clear family history can also provide vital clues to the diagnosis.

Case report: A 20-year-old male of Asian ethnicity presented with polydipsia, fatigue, nocturia and 4 kg weight loss following a self-limiting diarrhoeal illness. He had no other past medical history. Family history revealed a history of insulin-treated diabetes mellitus in his mother (diagnosed age 31), two maternal uncles and maternal grandmother. His father had ulcerative colitis but no other autoimmune disease history. His mother had a detectable urine C-peptide creatinine ratio 26 years after initial diagnosis, consistent with a diagnosis of T2DM. In the patient's medical records T1DM and T2DM had been recorded at different times.

Initial results demonstrated HbA_{1c} 74 mmol/mol and fasting glucose 9.3mmol/L. Clinical examination revealed no signs of insulin resistance or secondary diabetes. His BMI was 30kg/m^2. Further investigations demonstrated urine ACR 0.7mg/mmol, total cholesterol 5.5mmol/L, HDL 1.1 mmol/L. Autoantibody testing for possible T1DM demonstrated: GAD antibodies 1.0 U/ml (normal range <5 U/ml), IA-2 antibodies 1.9 U/ml (normal range <7.5 U/ml) and Zinc transporter 8 antibody 15.3 U/ml (normal range < 15 U/ml).

Results and management: The Exeter Diabetes MODY probability calculator revealed a 62.4% probability of MODY. On genetic testing no genetic cause was found for his diabetes. Urine C-peptide/creatinine ratio was 1.97nmol/mmol.

He was commenced on metformin and referred for the NHS Type 2 Diabetes Path to Remission Programme once his diagnosis of T2DM was confirmed.

Discussion: This case reveals some of the challenges with defining diabetes subtype in individual cases. This scenario reminds us of the importance of a detailed family history and of revisiting historical type of diabetes diagnosis in clinic when there is clinical uncertainty. It highlights considerations when interpreting investigations, including time from diagnosis in the case of C-peptide and whether using age-related cut-offs for the 99th and 97.5th centiles for Zinc transporter 8 antibody titres may reduce false positives and avoid misdiagnosis.[1]

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Abstract ID: 11

Everolimus-induced diabetes

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Jack is a 19-year-old man living with tuberous sclerosis complex (TSC). He receives care from the specialist centre in Bath. In Jack, TSC is associated with epilepsy, severe learning disability and visual impairment. He can tolerate pureed food but is also PEG-fed. He lives at home with his family, where he receives 24-hour care from his mother and a live-in carer. His medications included everolimus and other antiepileptics.

I met Jack when he was admitted with sleep disturbance and hyperglycaemia. His HbA1c was 94mmol/mol, and there was no ketonaemia or evidence of raised inflammatory markers. Capillary glucose monitoring gave readings of 18-25 mmol/L. He was diagnosed with everolimus-induced diabetes, and liquid gliclazide (40mg BD) and metformin (500mg daily) were commenced.

On the advice of the specialist centre, everolimus was continued as its initiation had been associated with a marked reduction in his seizure frequency. The centre also explained that the preferred glucose-lowering therapy in everolimus-induced diabetes is metformin due its additional benefits in reducing cerebral subependymal giant cell astrocytoma (SEGA) volume and seizure frequency compared with placebo in a randomised trial in TSC patients. In view of this, we discontinued gliclazide treatment and uptitrated his metformin dosage.

He was discharged from hospital with Freestyle Libre 2 sensors to facilitate ongoing monitoring of his diabetes. Jack's HbA1c three months post-discharge was 61 mmol/mol. He continues to be followed up by the local community diabetes service.

Learning points: TSC is a genetic disorder characterised by the development of benign tumours secondary to loss of inhibitory

regulation of the mTOR (mechanistic target of rapamycin) intracellular growth pathway.

1. Everolimus is an immunosuppressant that inhibits the mTOR pathway.
2. It is used in TSC, post-transplant and in treatment of cancer.
3. The development of diabetes is one of the most common side effects of everolimus.
4. Treatment with mTOR inhibitors is associated with a high incidence of hyperglycaemia and new-onset diabetes, ranging from 13% to 50% in clinical trials.
5. Mechanisms responsible for hyperglycemia with mTOR inhibitors are likely due to the combination of impaired insulin secretion and insulin resistance.
6. Everolimus-induced diabetes is reversible on discontinuation of the drug.
7. Metformin also inhibits the mTOR pathway.

Conclusion: In this scenario, it is clearly evident that use of everolimus has improved Jack's quality of life. In future should metformin be used instead of mTOR inhibitors? More studies are required to reach a firm conclusion.

Abstract ID: 13

Type 3c diabetes secondary to immunotherapy

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A 71-year-old male presented to the emergency department feeling generally unwell, with shortness of breath for one day and a history of polyuria, polydipsia and nocturia for the last five days. He was taking oral antibiotics for a chest infection. His past medical history included COPD, atrial fibrillation and malignant epithelioid mesothelioma, which had progressed. Due to his cancer progression, the patient had been started on immunotherapy, a combination of ipilimumab and nivolumab. The first cycle was given 10 days before the current ED presentation. There was no previous history of diabetes, and his last HbA_{1c} measured two weeks previously was 37mmol/mol (normal range less then 42mmol in non-diabetic patients). There was no previous history of steroid use and no known family history of diabetes.

He was tachycardic, tachypneic and clinically dehydrated on admission. Chest examination revealed right lower zone crepitations but the rest of the examination was within normal limits. Blood glucose on presentation was 28 mmol/L, with ketones of 5.6. His venous blood gases showed uncompensated metabolic acidosis with pH 7.30 and HCO3 14. His blood results showed acute kidney injury and raised inflammatory markers with C-reactive protein 89 mg/dL and a raised white cell count of 14. Initial diagnosis was diabetic ketoacidosis precipitated by lower respiratory infection (LRTI) and the patient was started on fixed-rate insulin infusion and antibiotics. The patient was due his second cycle of immunotherapy in two days but it was stopped after consulting with the oncology team.

Diabetes consult was undertaken, and further workup included HbA_{1c}, serum C-peptide levels and a type 1 antibody panel that included anti-GAD antibody and anti-islet cell antibodies. A complete pituitary hormonal profile was sent to rule out hypophysitis: the results were normal except morning cortisol levels which were borderline low at 226 nmol/L. After these borderline low cortisol levels a short synActhen test was performed which was normal, ruling out cortisol deficiency. Once the DKA was resolved and the patient was eating and drinking, he was started on a basal bolus insulin regime. He was started on insulin glargine 12 units and insulin Novorapid with meals 4 units thrice daily. Insulin administration education and hypoglycemia education were provided. The patient was started on Free style Libre blood glucose monitoring.

On clinic follow-up the diabetes workup showed negative anti GAD antibodies and negative antiislet cell antibodies. Stimulated blood C peptide was low at 200, indicating low pancreatic reserve. The final diagnosis was DKA secondary to nivolumab-induced new diabetes.

Abstract ID: 15

SGLT2 inhibitor-induced euglycemic diabetic ketoacidosis in the perioperative period: being vigilant about the diagnosis and cessation of medication in the perioperative period

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Introduction: Euglycemic ketoacidosis (eDKA) is a side effect associated with the use of sodium glucose cotransporter 2-inhibitors (SGLT2i) in patients with diabetes. UK guidelines offer advice on the management of patients on SGLT2i in the perioperative period.[1] This case describes a patient who developed eDKA within 24 hours post-operatively.

Case report: A 71-year-old man was admitted to hospital for elective laparoscopic anterior resection for rectal carcinoma under general anaesthesia the following morning. Type 2 diabetes (T2DM) had been diagnosed six years before; it was managed with dapagliflozin 10mg OD, metformin 1G BD, saxagliptin 5mg OD, and insulin isophane biphasic 22 units BD, achieving HbA_{1c} of 49mmol/mol. All diabetic medications were discontinued without variable insulin regimen on the morning of the operation, and he was fasted from midnight on the day of the operation. The surgery lasted for nine hours. During the operation, serial arterial blood gas results showed progressive metabolic acidosis from 7.33 at 10 am to 7.17 (anion gap of 19) at 8 pm post-operatively. Venous lactate levels were consistently lower than 1.6 mEq/L, peak glucose was 10.7 mmol/L, nadir bicarbonate level was 17 mEq/L whilst blood ketones were 3.4 mmol/L. Variable rate insulin was commenced, with resolution of acidosis in 12 hrs. Dapagliflozin was resumed 10 days later.

Discussion: This case demonstrates that it is crucial to discontinue SGLT2i prior to surgery and to be mindful of ketone monitoring peri-operatively. A systematic retrospective audit of perioperative use of SGLT2i in our Trust revealed two cases of eDKA from 90 patients with diabetes on SGLT2i. Our local Trust guidelines, in line with UK guidance, recommend omitting

SGLT2i on the day before surgery and the day of surgery, while other authorities recommend earlier discontinuation three or four days prior to surgery.[2] With increasing awareness of the issue and cumulative experience, increased awareness and a risk stratification score to predict the risk of eDKA in patients on SGLT2i in perioperative assessment would be useful.

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Abstract ID: 16

Diabetic control between distress and comfort

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Background: Controlling diabetes during the final days of life presents a significant challenge for the treatment team, the patients and their caregivers. Throughout their lives, individuals with diabetes are accustomed to managing their condition closely but as they near the end of life they may need to stop all measures and habits related to diabetes management. This cessation of monitoring and treatment can lead to concerns about comfort, especially regarding fluctuations in blood glucose levels.

The treatment team faces constraints in addressing these concerns due to various restrictions. The primary aim is to avoid hyperglycaemia, which can lead to ketosis, particularly in individuals with type 1 diabetes (T1DM), and hypoglycaemia. Balancing these considerations is essential to alleviate the burdens associated with managing diabetes in the final days of life and to ensure the comfort of the patient.

Case report: A 61-year-old man with a background of type 2 diabetes (T2DM) requiring insulin, an old stroke and a right arm amputation, who is housebound, was brought to the hospital due to decreased mobility and generalized weakness. In the Emergency Department (ED), he presented with spiking temperatures and increased oxygen requirements. He was admitted and initially treated with antibiotics for a suspected lower respiratory infection. However, on the next day, his condition deteriorated further, accompanied by hypotension. He received intravenous fluids and the antibiotic treatment was escalated. Throughout the night, his condition continued to worsen, marked by increasing breathlessness and a significant rise in oxygen requirements. An X-ray revealed fluid overload, prompting the cessation of intravenous fluids and the initiation of diuretics. Despite these interventions, the patient's condition did not improve significantly, leading to the decision to initiate end-of-life care. His level of consciousness deteriorated, and he stopped eating and drinking. The patient's wife was monitoring the patient glucose through her phone, which added more distress to her as she receiving a lot of alarms regarding hypoglycaemia. To address this, insulin doses were reduced, and eventually insulin therapy was discontinued entirely and the continuous glucose monitoring (CGM) sensor was removed to avoid unnecessary distress to the family and the patient due to frequent fingerpricks to confirm CGM readings.

After two days, there was some improvement in the patient's condition, and he began to eat. Consequently, his capillary blood glucose (CBG) levels started to rise. Insulin was reintroduced gradually, based on the patient's oral intake. However, due to infrequent monitoring, the family had many questions regarding symptoms like sweating and heavy breathing and their relation to CBG levels and they felt unsatisfied with the ongoing monitoring level. The palliative team and Diabetes Specialist Nurse (DSN) played a significant role in managing this patient's care, particularly in addressing concerns related to diabetes control and alleviating distress. Their expertise and support were invaluable in navigating the complexities of end-of-life care while ensuring optimal management of the patient's diabetes. Additionally, adhering to guidelines provided by Diabetes UK helped guide the treating team in making informed decisions regarding the patient's care, further contributing to his overall wellbeing during this challenging time.

Discussion: End-of-life (EOL) care presents unique challenges, particularly when managing chronic illnesses such as diabetes. Achieving comfort and minimizing distress from chronic illness management is paramount in such situations. One effective approach involves early involvement of both the palliative team and the diabetes team. By engaging these specialized teams from the outset, patients and their caregivers can receive comprehensive support tailored to their specific needs.

Educating patients and their caregivers about the current situation and discussing options to mitigate the burden related to diabetes management is crucial. This includes addressing concerns related to symptom management, medication adjustments and lifestyle modifications to ensure optimal comfort and quality of life during the end-of-life period. Open communication and shared decision-making between healthcare providers, patients and their families are essential to effectively address the challenges associated with chronic illness management in the context of EOL care.

Abstract ID: 19

Effective use of CGM and the latest technology

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Background: Recent technological advances in continuous glucose monitoring (CGM) have revolutionised diabetes care. Studies have shown overall improvement in glycaemic control, a reduction in number of hypoglycaemic episodes and an improvement in quality of life.

Case report: We present a 66-year man with type 1 diabetes (T1DM) who had a notable pattern of hyperglycaemia over working hours, followed by disabling overnight hypoglycaemia.

He was on a basal bolus regimen (NovoRapid and Degludec) and had a significant history of impaired hypoglycaemia unawareness, with multiple ambulance callouts leading to 10 hospital admissions within a year.

He completed DAFNE training, and his basal insulin was switched to Levemir in order to provide more flexibility with adjusting his basal insulin dose to match his day and night requirements. Despite continuing to practise DAFNE principles and demonstrating an initial improvement with his glucose variability, the disabling hypoglycaemia persisted, and the decision was made to initiate pump therapy following NICE criteria. He was initially started on a Medtronic 670G pump, with smartguard technology providing the linked CGM Guardian 3 sensor to suspend function when glucose values fell below the predefined threshold.

A reduction in hospital admission was noted with the adoption of the pump but over time it became clear that the smartguard had limitations. Although able to discontinue insulin delivery with low readings, there was no automated insulin delivery for stress-related hyperglycaemia, which continued at work and often resulted in external boluses of insulin to overcome when he became frustrated, leading to more concerning hypoglycaemia. It was decided to move him to the more advanced Medtronic 780G pump with guardian 4 sensor hybrid closed-loop system once it became available. It is still early days, but initial tracings demonstrate that control is better, with the system automatically providing higher insulin delivery for the stress-related hyperglycaemia and a reduced rate overnight when the risk of hypoglycaemia was highest. This has led to an improved quality of life and has avoided hospital admissions.

Conclusion: This case highlights the use of real-time CGM linked to different types of insulin pumps, helping the patient towards a better quality of life.

Abstract ID: 20

A case of autoimmune diabetes with significant endogenous insulin secretion: challenges in diagnosis and management

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A 27-year-old female diagnosed with type 2 diabetes (T2DM) at the age of 25 was referred to the high BMI/young-onset type 2 diabetes clinic at Kettering General Hospital. HbA_{1c} at diagnosis was 55 mmol/mol. She was started on metformin 1g twice daily and at her first hospital appointment, her HbA_{1c} was 44 mmol/mol. Her weight was 155kg, BMI was 50.9 kg/m^2. Her mother developed diabetes at a young age and she passed away from diabetes-related complications.

The patient's past medical history included polycystic ovarian syndrome, anxiety and depression. Other medications included mirtazapine 30mg and propranolol. There was no evidence of microalbuminuria and retinal screening was R0M0 bilaterally.

She was started on oral semaglutide at the clinic to support weight loss and bariatric surgery was discussed as an option.

Due to the young age at diabetes diagnosis, antibodies for type 1 diabetes (T1DM) were requested. Anti-GAD and anti-ZnT8 were negative but anti-IA2 were positive. A random urine C-peptide/creatinine ratio (performed two years after diagnosis) was high (5.4), suggesting significant endogenous insulin secretion. It was thought that she might have latent autoimmune diabetes of adults (LADA), despite the fact that she was <30 years old.

A Libre 2 device was provided to her for glucose monitoring and a ketone meter was also provided, with education on when to check for ketones. Novorapid and a Toujeo pen were provided for use in case her glucose levels increased and/or she had blood ketones. Meanwhile, she continued on metformin and oral semaglutide 14mg once daily.

Six months after the initial assessment at the clinic (2.5 years since diabetes diagnosis), her glucose control remains excellent (100% time in range) without the need for insulin. She successfully lost 8 kg and will have a repeat urinary C-peptide at three years from diagnosis.

Key points:

1. Autoimmune forms of diabetes may be present in people with high BMI and young-onset T2DM, even if they do not require insulin in the first year of the diagnosis
2. Selected cases of autoimmune diabetes with substantial endogenous insulin secretion may be treated based on T2DM guidelines during the first years after diagnosis (with appropriate education for diabetic emergencies)

Discussion points:

1. Should CGM be offered to these people as part of autoimmune diabetes diagnosis?
2. How often she will require urine C-peptide/creatinine ratio monitoring (if ratio remains >0.6)?
3. Are SGLT-2 inhibitors an appropriate next step of her management?

Abstract ID: 21

A case of diabetes misclassification unravelled by recurrent episodes of hypoglycaemia

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A 39-year-old African-Caribbean female who was diagnosed with type 2 diabetes (T2DM) at the age of 30 was referred to the high BMI/young onset T2D clinic at Kettering General Hospital. HbA_{1c} at the time of referral was 107 mmol/mol; she was on metformin 1g twice daily and Humulin M3 32 units am and 36 units pm. She started on insulin one year after the diabetes diagnosis and there were no previous acute admissions to hospital due to diabetes. She reported recurrent episodes of hypoglycaemia, especially before lunch, which she was able to manage on her own. Her pre-lunch glucose levels ranged between 2.6 – 4.4 mmol/L and she reported up to four episodes of hypoglycaemia per week. The GOLD score was 3, BMI was 40 kg/m^2 and weight 94 kg. Her father has T2DM and her niece has been diagnosed with T1DM.

Her past medical history included asthma, polycystic ovary syndrome and keratoconus. Her current medications included Salamol, Fobumix and the combined contraceptive pill. There was no evidence of microalbuminuria and retinal screening was R0M0 bilaterally.

Humulin M3 was changed to basal bolus insulin (Toujeo 40 units and Novorapid 6 units with meals). Antibodies for T1DM and a random urine C-peptide/creatinine ratio were requested. Anti-GAD was strongly positive at 1051 (>11), with negative anti-IA2 and anti-ZnT8, and the random urine C-peptide/creatinine ratio was 0.45 (showing a relative insulin deficiency). Based on these results, she was classified as T1DM/ LADA and a Libre device was provided to her. She was also referred for carbohydrate counting and DAFNE training and was signposted to educational material from ABCD-DTN.

After three months, HbA_{1c} improved to 76 mmol/mol without hypoglycaemia. Novorapid was changed to Fiasp as she was forgetting to take rapid-acting insulin 15 minutes before meals, leading to postprandially elevated glucose levels. Nine months after initial assessment, her glucose control has significantly improved (54% time in range, 0% below range) with mean glucose levels 10.1 mmol/L and estimated HbA_{1c}: 60 mmol/mol. A referral to the weight management service has also taken place.

Key points:

1. Recurrent episodes of hypoglycaemia in a person with elevated HbA_{1c} and a diagnosis of T2DM may be due to internal insulin deficiency and may require further investigation
2. Basal bolus treatment and Libre 2 for glucose monitoring minimised risk for hypoglycaemia and improved glycaemic control significantly in this case

Abstract ID: 22

Managing problematic hyper- and hypo-glycaemia in diabetes after total pancreatectomy

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Background: Diabetes following total pancreatectomy (TP) is characteristically brittle due to the absolute deficiency of insulin and counterregulatory hormones alongside malabsorption secondary to exocrine dysfunction. Adequate pancreatic enzyme replacement therapy (PERT) to enable predictable nutrient absorption, alongside careful insulin replacement and close glycaemic monitoring, are key for diabetes management and quality of life.

Clinical case: A 28-year-old female with acute-on-chronic pancreatitis secondary to genetically confirmed PRSS-1 hereditary pancreatitis diagnosed at the age of 23, proceeded to definitive management via TP. Preoperatively her BMI was18.1kg/m^2 (6kg loss in 12 months) and HbA_{1c} 33mmol/mol.

Postoperatively she was started on parenteral nutrition with variable-rate insulin, and taught to use Flash glucose monitoring. At discharge she was on 12-hourly supplemental enteral nutrition, with 14 units Humulin I at the start of feed, 10 units Lantus at night, and carbohydrate-counting on a 1:10 insulin-to-carbohydrate ratio (ICR). She was on PERT. Her BMI was 18.53kg/m^2.

Four months postoperatively she was off supplemental feed, BMI was 17.9kg/m^2 and HbA_{1c} 56mmol/mol. She remained on 10units Lantus with a 1:10 ICR. Half-unit dosing pens were used for corrections with an insulin sensitivity factor 4. Her brittle diabetes necessitated multiple correction boluses daily, and recent severe hypoglycaemia had led to hypoglycaemia anxiety; her diabetes distress score was 3.5. Her Flash glucose monitor report showed 36% time in range, 33% high and 31% very high. Glucose variability was 33.1%. Her total daily dose of insulin was 22 units.

A bolus-advisor was suggested to mitigate the risks of insulin stacking, ICR relaxed, and a referral to structured education made. Given her small insulin requirements, frequent boluses and problematic hypoglycaemia, she was referred for continuous subcutaneous insulin infusion (CSII) integrated with continuous glucose monitoring (hybrid closed-loop system).

Discussion: The onset of diabetes after TP is guaranteed unless a concomitant islet cell auto-transplant (IAT) is performed. This gives 22-47% insulin independence at five years.[1,2] In patients such as ours, with a hereditary pancreatitis syndrome associated with risk of progression to pancreatic cancer, thresholds for consideration of IAT after TP for chronic pancreatitis are reduced. Despite this, IAT was not considered in our case. The resulting diabetes is associated with high glycaemic variability, risking both ketoacidosis and severe hypoglycaemia.

Management is stepwise. First-line treatment is centred on minimising medical causes of glycaemic variability by ensuring adequate PERT, and the use of structured education to allow effective use of flexible insulin dose adjustments. Continuous glucose monitoring may be a useful adjunct in achieving this. Hybrid closed-loop systems represent a therapeutic option if first-line management fails.

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Abstract ID: 26

Initiation of hybrid closed-loop therapy in an adult with cystic fibrosis-related diabetes

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Summary: We review initiation of hybrid closed-loop (HCL) therapy and management of hypo- and hyperglycaemia in an adult with cystic-fibrosis related diabetes (CFRD) with high HbA_{1c}.

Background: CFRD occurs because pancreatic destruction causes progressive insulin deficiency and hyperglycaemia. It is associated with increased frequency of pulmonary infections, decrease in body weight and early mortality.[1,2] Current recommended management of CFRD is insulin therapy, although this can be difficult to manage due to highly variable day-to-day insulin requirements.[3] HCL systems are revolutionising management of type 1 diabetes (T1DM),[4] and may also benefit people with CFRD.

Clinical case: A 34-year-old Caucasian male was started on HCL as part of a clinical trial. He was diagnosed with CFRD 12 years before and used a basal-bolus regimen and Freestyle Libre 2 sensor. However, he rarely administered his Insulatard and only sporadically injected Novorapid. He had not completed any training in carbohydrate counting. His initial HbA_{1c} was 142mmol/mol and baseline time in range (3.9-10mmol/L) was <1%. He had proteinuria but no other micro- or macrovascular diabetes complications. He was established on CFTR modulators for the past three years and in addition to CFRD had CF-related gastrointestinal disease with reflux and constipation. He had been struggling to maintain his weight and was unable to go to the gym and work due to the burden of disease.

Treatment and clinical lessons: The insulin pump was set up based on the total daily insulin dose (80 units) and boluses were programmed using pre-set meal size icons within the closed-loop app. Following training and initiation, data were reviewed remotely at 48 hours and one week. There was high glucose variability over the first 48 hours, with episodes of mild hypoglycaemia being over-treated, followed by administration of corrective insulin to manage the resultant hyperglycaemia. Increasing his daytime glucose target to 7.0mmol/L reduced the frequency of hypoglycaemia and broke this cycle. We also advised regarding appropriate management of hypoglycaemia. Persistent overnight hyperglycaemia was attributed to snacking without bolusing, which was confirmed by the patient. He was reminded to bolus before eating or use the "boostâ"™ function. Use of HCL for one week led to clinically significant improvements in time in range to 34% and he reported finding his diabetes much easier to manage with less worry.

Conclusions: This case illustrates the potential benefits of using HCL in people with CFRD, including in those previously using multiple daily insulin injections and without training in carbohydrate counting.

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Abstract ID: 31

Addressing fear of hyperglycemia

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Background: We present a case of a 22-year-old male who was diagnosed with type 1 diabetes (T1DM) when aged 17, confronted with an increasing number of hypoglycaemic episodes and hypo unawareness. He currently works in railway maintenance. A few months after the diagnosis, he was started on Omnipod DASH with fingerprick blood glucose monitoring. He expressed extreme fear of hyperglycaemia, resulting in a high burden of hypoglycaemia due to repeated, untimely and unnecessary corrections.

Case report: On review in clinic in April 2017, his time in range was 64% with time below range of 25% and very low 16%. His time above range was 9%. He was finger pricking on average six times per day. He showed good understanding of diabetes management but his ideas were quite fixed. He was far more concerned about blood glucose above 10 mmol/L because of stories of people with diabetes living with complications. He could not appreciate the risk of hypoglycaemia. It resulted in very frequent bolusing correcting capillary glucose above 10 mmol/L, culminating in multiple hypos (25%). The team was very concerned about the high burden of hypos, his lack of concern and hypo unawareness (he was getting symptoms only when glucose was less than 3 mmol/L). It was dangerous for him whilst he was working on rail tracks. He was offered structured education, which he declined. He also declined Flash CGM as he could not see the benefit and did not like the idea of two things attached to his body. He only agreed to real-time CGM (DEXCOM G6) because he liked the idea of the hybrid closed-loop system.

He was sent home with DEXCOM G6, with low alarms in place. His basal rates and carb ratios were reduced as appropriate. He was seen weekly by DSNs. He was prioritised for an Omnipod 5 upgrade.

He was started on Omnipod 5 in August 2023, and there was a dramatic reductions in hypos. His latest ambulatory glucose profile in November 2023 showed 4% low, 1% very low, 75% time in range, 19% high, 3% very high, GMI of 6.7 and average glucose of 7.8 mmol/L.

Conclusion: A hybrid closed-loop system improved this patient's quality of life by improving his GOLD score from 3 to 2, and it improved his anxiety about hyperglycaemia.

This case demonstrates that a hybrid closed-loop system enhanced with SmartAdjust technology can allow automated insulin delivery and greatly reduce the burden of T1DM self-management.

Abstract ID: 33

New diagnosis of diabetes: don't always assume the phenotype

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A 35-year-old South-Asian female with a BMI of 26.4 kg/m^2 was referred for secondary care diabetes management six years after diagnosis of gestational diabetes in 2017 (which resolved after delivery). She restarted metformin in 2022 within primary care due to a rise in HbA_{1c} to 58 mmol/mol and a reasonable suspicion of T2DM. There was a strong family history of T2DM (it affected her brother, maternal grandmother and maternal aunt). When reviewed in the clinic, there were no osmotic symptoms, noted previous weight loss or attendance with diabetic ketoacidosis. Her calculated MODY risk was 32.9%, and MODY screening had been planned. No signs of insulin resistance were present. Her HbA_{1c} was 48mmol/mol at the time of consultation (on metformin 1 gram twice daily), and there was no evidence of dyslipidaemia or thyroid dysfunction. Although her history/phenotype was in keeping with a diagnosis of T2DM, as part of the pre-MODY investigation, glutamic acid decarboxylase and islet cell antibodies were sent. These returned as positive (over 2000 and 1753, respectively), in keeping with a diagnosis of autoimmune diabetes, possibly latent autoimmune diabetes of adult-onset (LADA).

She was continued on metformin, was provided with glucose and ketone meters, and advised to monitor both meters regularly with the caveat that a rise in either would warrant initiation of basal insulin. Her ongoing management will be tailored as per the clinical picture, glucose testing, ketone testing and a C-peptide result. However, patient education, monitoring and lifestyle modification advice under secondary diabetes care will be pivotal to long-term management.

Conclusion: Correct identification of diabetes aetiology and type is difficult.[3] Misclassification may occur in up to 40% of adults presenting with autoimmune diabetes. No fixed criteria can identify one form of diabetes from another within this age group and a detailed history with a high degree of suspicion even within ethnicities strongly associated with T2DM remains important. Clinicians need to remain vigilant in their approach to diagnosis to ensure safe and correct diabetes management long term.[4]

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Abstract ID: 34

First presentation of gestational diabetes mellitus with impending DKA and hypertriglyceridemia

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Introduction: The triad of diabetic ketoacidosis, hypertriglyceridemia and acute pancreatitis, referred to as the 'enigmatic triangle', is a rare phenomenon. It is extremely rare in previously undiagnosed diabetic patients. Here we report a case with impending diabetic ketoacidosis (DKA), hypertriglyceridemia and a clinical suspicion of pancreatitis. The metabolic derangement improved quickly with fixed- rate insulin infusion (FRII).

Case report: A 29-year-old gravida 3 presented at 32 weeks of gestation with complaints of epigastric pain radiating to the back. She had recently moved to the UK and this was her first presentation to a NHS hospital. There was no previous medical history apart from gallstones. There was no history of alcohol intake or illicit drug use. There was a family history of type 2 diabetes mellitus (T2DM) but no history of familial hypercholesterolemia. Clinical examination revealed body mass index of 35 kg/m^2, normal vitals and epigastric tenderness.

Investigations showed blood glucose 13.6mmol/L, ketones 4.2mmol/L, pH 7.36, bicarbonate 16.4mmol/L. Initial amylase was 89 IU/l(28-100 IU/l) but this increased to 112 IU/l; C-reactive protein increased from 55 to 223mg/dL. Glycated haemoglobin (HbA_{1c}) was 78mmol/mol (no previous results were available). As the serum sample had a lipemic appearance, the triglycerides were checked and were found to be 70.40 mmol/L. Apo B levels were normal. Ultrasound could not visualize the pancreas. MRI abdomen, done 11 days after presentation, showed non-obstructive gall bladder calculus with no evidence of pancreatitis.

The patient was managed on the obstetric ward by a multidisciplinary team which included obstetrics, diabetes and metabolic teams. She was kept nil by mouth and started on FRII. Triglyceride levels improved to 17.45 mmol/L after 48 hours of insulin infusion. FRII was stopped when triglycerides dropped below 20 mmol/L. She was also started on humulin I, fenofibrate and omega-3-acid ethyl esters. The patient had a rebound increase in TG whenever the FRII was stopped and it had to be recommenced multiple times. The foetal scan showed a large for gestational age baby and polyhydramnios. CTG was done 4-6 hourly while in the delivery suite and continuously when she had FRII. She underwent a Caesarean section at 34 weeks of gestation and delivered a healthy baby. After delivery, glucose and triglycerides improved. The patient was discharged with Omacor and metformin, and advised to follow a healthy diet. The triglyceride level one month post- delivery was 3mmol/L and fasting blood glucose was 5.7mmol/L.

Discussion: In this patient, it is likely that obesity, unhealthy dietary habits and new-onset diabetes led to the hypertriglyceridemia. Though variable rate insulin infusion is the commonly used treatment we started her on FRII, which helped to lower triglyceride levels rapidly and achieve good

glycaemic control. The combination of hyperglycemia and hypertriglyceridemia puts the foetus at high risk of toxicity and stillbirth.

Abstract ID: 36

Is must be the adrenaline, or so she said: an insight into the highs and lows while playing sport on CGM

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Background: Advances in technology have been a game changer in the management of diabetes in the past few years, and people with diabetes are now living good-quality lives without diabetes being at the forefront of their existence. The advent of continuous glucose monitoring (CGM) devices and automated insulin delivery systems have helped most people to manage their diabetes well, minimise complications and take part in most activities without hindrance. It is therefore paramount that they are supported in this journey, to ensure they are enabled and confident to manage their daily glucose excursions without ambiguity.

Case: A 48-year-old female with known type 1 diabetes (T1DM) for 30 years was reviewed in the clinic. She was an avid sportswoman who trained and competed with horse jumping and training on most days of the week. Her main concerns were hypoglycaemic episodes (GOLD score 1-2), with symptoms beginning when blood glucose was around 5mmol/L after intense physical activity. She tended to overcorrect these, resulting in rebound high blood glucose levels.

She was started on CGM five years previously and was recently transitioned to Dexcom G6 from Libre 2, Omnipod pump with Fiasp insulin and used the Eros handset in the run-up to starting on a hybrid closed-loop system given her glucose excursions.

She admitted to not using the bolus calculator as she said the pump often did not know what she was doing, and that a lot of her hyperglycaemic episodes occurred during training due to adrenaline. Her daily insulin requirements ranged between 22 and 40 units, depending on her activity.

CGM sensor data revealed that she was 57% time in range, 24% high and 18% very high, with <1% low and very low readings in the past two weeks. Her average glucose was 10.2 mmol/L and GMI 7.7% and variability of 37.5%. Her target glucose was set at 6.3 (to correct over 9mmol/L). Her blood glucose tended to fall during activity and to rise at mealtimes and also around 2am in the morning. She also had significant hypoglycaemic events towards late afternoon/early evening in relation to her exercise. She was advised to resist over-treating hypoglycaemic events and to consider a temporary reduction in basal rates in relation to activity well before starting exercise. She was recently initiated on a hybrid closed-loop system, which she hopes will help her navigate the highs and lows of her diabetes control.

Abstract ID: 37

Conception and pregnancy in diabetes: challenges and lessons

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We present the case of a 24-year-old nursing student who has been reviewed in our young adults' diabetes clinic since diagnosis of type 1 diabetes (T1DM) in 2017. She presented with diabetic ketoacidosis and has been managed with Tresiba and Novorapid. She seldom used Freestyle libre for blood glucose monitoring. She attended clinics infrequently and over the years her HbA_{1c} has been in the range of 100-135 mmol/mol. She was self-conscious about testing in public, reported fear of hypoglycaemia and was worried about weight gain with insulin. She has been reviewed by different health care professionals within our team and has received support from our health and well-being practitioners, diabetes dieticians and counsellor over the years. A recent retinal screening demonstrated retinopathy, stage R1M1 in the right eye and R1M0 in the left eye. She also reported painful peripheral neuropathy. Clinic attendances started to improve whilst she was being assessed for new diabetes-related complications. In June 2023 she was admitted with abdominal pain and was found to be pregnant.

Antenatal care: Although a candidate for an insulin pump with hybrid closed-loop, the patient chose to continue to use insulin injections. During pregnancy she started using her Tresiba more regularly and was advised to take fixed doses of Novorapid to begin with. She felt better than before. Her nausea was improving and the vomiting had settled but her fear of hypoglycaemia remained. Slowly and steadily we re-introduced the concept of carbohydrate counting and correction doses. Libre data in August showed average glucose of 5.8 mmol/L, time in range 83% and lows 5%, and her HbA_{1c} was 33 mmol/mol in September 2023.

Learning outcome: A multidisciplinary approach, perseverance, good compliance with and proper titration of insulin via injections resulted in good glycaemic control. Her pregnancy advanced well, she delivered after an elective Caesarean section, and her baby was healthy with a birth weight of 2.5Kg. Her repeat retinal screening has shown improvement in retinopathy and her neuropathy improved substantially. This case shows that pregnancy can have positive impacts on diabetes management, even in young adults whose control can be challenging. A non-judgmental approach to patients and an open-door policy allows patient engagement at any stage in life and can improve outcomes.