





Case studies

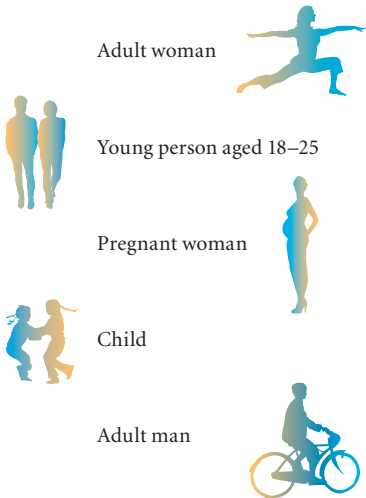
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Colour key to case studies

The headings and appropriate NICE Guidelines for the case studies are colour-coded as follows:

-  Type 1 diabetes in adults
-  Type 1 diabetes in children and young people
-  Type 2 diabetes
-  Diabetes in pregnancy

The icon on each case study identifies the patient group:



1: Diagnosis and early management of type 1 diabetes in a young child

Julie A. Edge, Consultant in Paediatric Diabetes, Oxford, UK

Background

A four-year-old child was seen by her GP with a two-week history of polyuria and polydipsia, as well as bedwetting at night. Capillary blood glucose at the time was 23.2 mmol/l. The GP diagnosed diabetes and referred the girl on the same day to the children's diabetes team at the local hospital. On admission the child was clinically well, a little dry but eating and drinking with no nausea or vomiting. Her parents felt that she had lost a little weight, therefore no intravenous fluid or insulin was required. A clinical diagnosis of type 1 diabetes was made.

Treatment plan

IFCC 91 \equiv DCCT 10.5%

Baseline tests taken at the time later found an IFCC HbA_{1c} level of 91 mmol/mol, and positive islet-cell antibodies, confirming type 1 diabetes. She was started on subcutaneous insulin in a multiple injection regimen, using a preprandial rapid-acting analogue with once-daily basal long-acting analogue, given in the morning because of her age. Her parents were taught carbohydrate counting within the first week.

Follow-up

For the first two weeks on this regimen, the child's appetite was ravenous but blood glucose levels were all within the normal range (4–7 mmol/l) with an insulin dose of around 0.7 units/kg/day. By two months the dose had fallen to 0.3 units/kg/day and the child's appetite had returned to normal. IFCC HbA_{1c} had fallen to 71 mmol/mol.

IFCC 71 \equiv DCCT 8.6%

Three months after diagnosis, IFCC HbA_{1c} was down to 46 mmol/mol and the family were beginning to become accustomed to the new regimen. One year after diagnosis, her IFCC HbA_{1c} remained within the target range at 52 mmol/mol. The teachers and teaching assistants at her new school had been taught how to test blood glucose levels and to administer her lunchtime insulin dose.

IFCC 46 \equiv DCCT 6.4%

IFCC 52 \equiv DCCT 6.9%



NICE Guidelines: Type 1 diabetes in children and young people

HbA_{1c} target: IFCC <59 mmol/mol \equiv <7.5%

2: Management of an elderly patient, housebound and living alone

Chris Cottrell and Helen Green, Diabetes Specialist Nurses, Llanelli, Wales, UK

Background

An 89-year-old man with type 2 diabetes, diagnosed in 1992, had a history of hypertension and chronic renal disease stage 4 (estimated glomerular filtration rate 27ml/min/1.73m²). He lived alone in a bungalow. With IFCC HbA_{1c} at 65 mmol/mol, he was started on a once daily long acting insulin analogue. He was also taking aspirin 75 mg daily; bisoprolol 2.5 mg daily; quinine 200 mg at night; furosemide 80 mg daily; simvastatin 20 mg at night. His lipid profile was within the target range. Blood pressure was 138/50 mmHg and he was asymptomatic.

IFCC 65 ≡ DCCT 8.1%

The patient was referred to the diabetes nurse within the chronic disease management team about 12 months after starting insulin, because his daughter reported that her father was afraid of having a hypoglycaemic attack and was taking a high-calorie drink during the day following his insulin injection. He may have been having hypoglycaemic episodes due to a cumulative effect of insulin and renal disease. IFCC HbA_{1c} was down to 52 mmol/mol.

IFCC 52 ≡ DCCT 6.9%

Treatment plan

The main aim was to prevent hypoglycaemia, falls and reduce his anxiety level. Frequent visits, carers in attendance twice daily and an education plan were implemented. A 'lifeline' system was introduced to ensure safety, and home modifications made to maintain his safety and independence. In view of his chronic renal disease, it was not appropriate to start him on ACE/ARB therapy. Because of this, IFCC HbA_{1c} of 52 mmol/mol was defined as too low and his insulin regimen was reduced accordingly.

IFCC 52 ≡ DCCT 6.9%

Follow-up

The patient was housebound, but able to self-administer his insulin and medication. He had no further hypoglycaemic episodes. IFCC HbA_{1c} was 65 mmol/mol with no symptoms of hyperglycaemia. He had regular follow-up visits by the diabetes nurse and a contact number for advice. He remained happy because his main wish was to remain in his own home.

IFCC 65 ≡ DCCT 8.1%

NICE Guidelines: Type 2 diabetes

HbA_{1c} targets: IFCC 48 mmol/mol ≡ 6.5% to IFCC 59 mmol/mol ≡ 7.5%



3: Gestational diabetes

Jonathan Webber, Consultant Physician, Birmingham, UK

Background

IFCC 59 \equiv DCCT 7.5%

A 29-year-old obese Asian woman (BMI 28kg/m²), with a family history of type 2 diabetes became pregnant. At 26 weeks' gestation her fasting whole blood glucose was 7.3mmol/l and two-hour value at OGTT 11.4mmol/l (GDM \geq 7.8mmol/l). She was referred to the antenatal diabetes clinic, where her initial IFCC HbA_{1c} at diagnosis of gestational diabetes was 59mmol/mol. The raised HbA_{1c} at diagnosis suggested she may have had impaired glucose tolerance or diabetes prior to pregnancy.

Treatment plan

After assessment by a diabetologist and obstetrician, she was given dietetic and lifestyle advice by a dietician. She was also given a glucose meter and shown how to use it. Targets were given for fasting and pre-meal glucose (between 3.5 and 5.9mmol/l) and for less than 7.8mmol/l one hour after meals.

At 28 weeks' gestation, most of her post-meal glucose values were above 10.0mmol/l and her fasting and pre-meal glucose values were between 6.0 and 7.0mmol/l. The growth scan showed an increased abdominal circumference and a fetal weight above the 90th centile. She was started on short-acting insulin three times a day with meals, and an isophane insulin before going to bed.

Over the next ten weeks her insulin doses were regularly monitored and adjusted. Subsequent scans showed growth above the 90th centile. Labour was induced between 38 and 39 weeks, but she required a Caesarean section and delivered a boy of 4.5kg. Insulin treatment was stopped immediately after delivery.

Follow-up

IFCC 42 \equiv DCCT 6.0%

Six weeks after the birth her fasting glucose was 6.6mmol/l with 10.3mmol/l after two hours. She was told she had impaired glucose tolerance. IFCC HbA_{1c} was 42mmol/mol. She was discharged to the care of her GP, with further advice on dietary and lifestyle changes to reduce her high risk of subsequent type 2 diabetes. Annual fasting glucose testing was recommended. If planning further pregnancies she should be seen in the pre-conception diabetes clinic, and restart home blood glucose monitoring.



NICE Guidelines: Diabetes in pregnancy

HbA_{1c} target pre-pregnancy*: IFCC <43 mmol/mol \equiv <6.1%

*(if safely achievable)

4: Weight loss and improved glycaemic control

Pamela Dyson, Dietician, Oxford, UK

Background

A 56-year-old woman weighing 89.3 kg (BMI 36.5 kg/m²), who had been diagnosed four years previously with type 2 diabetes was referred to a diabetes specialist dietician for lifestyle advice and weight loss. At diagnosis, she had been prescribed metformin 500 mg once daily, and after three months her IFCC HbA_{1c} values decreased from 69 to 59 mmol/mol. Over the next four years, metformin doses had been titrated up and gliclazide added, until she was taking maximum dose of both agents. At her latest appointment, glycaemic control was suboptimal with IFCC HbA_{1c} value of 77 mmol/mol. It was recommended that she start insulin therapy, but she was very resistant to this idea and insisted that she have a trial of weight loss for 3 months before insulin was initiated.

IFCC 69 ≡ DCCT 8.5%

IFCC 59 ≡ DCCT 7.5%

IFCC 77 ≡ DCCT 9.2%

Treatment plan

Despite receiving dietary advice at diagnosis, she freely admitted that she had never attempted to change her dietary intake or to lose weight. During consultation, she identified that she consumed a high fat diet with frequent snacks and that she had a sedentary lifestyle. She decided that she would opt for a reduced fat, reduced sugar diet, avoid snacks and purchase a pedometer with the aim of walking 10 000 steps each day. Her target IFCC HbA_{1c} was <53 mmol/mol.

IFCC 53 ≡ DCCT 7.0%

Follow-up

Three months after changing her lifestyle by increasing physical activity and reducing dietary intake, she had reduced her weight by 7.4 kg (8.2%), her IFCC HbA_{1c} had decreased to 57 mmol/mol and she had halved her gliclazide dose to 80 mg twice daily. Over the next year, she continued to lose weight and maintained her IFCC HbA_{1c} levels with values of 53 and 55 mmol/mol. She now accepts that although she has been able to improve her glycaemic control by lifestyle change, she will probably need insulin therapy at some time in the future.

IFCC 57 ≡ DCCT 7.4%

IFCC 53 ≡ DCCT 7.0%

IFCC 55 ≡ DCCT 7.2%

NICE Guidelines: Type 2 diabetes

HbA_{1c} targets: IFCC 48 mmol/mol ≡ 6.5% to IFCC 59 mmol/mol ≡ 7.5%



5: Type 2 diabetes in a child

Timothy G. Barrett, Professor of Paediatric Endocrinology, Birmingham, UK

Background

An eight-year-old girl was diagnosed in 2003 with type 2 diabetes on the basis of fasting glucose of 11 mmol/l and two-hour glucose of 17.8 mmol/l. She was obese from the age of six years and developed acanthosis nigricans in her neck and limb flexures. By the time of the glucose tolerance test she had developed thirst and was waking at night for a drink. She had primary nocturnal enuresis and some accidents during the day. Both her parents were well but both maternal grandparents had diabetes. Her ethnic origin was from India via East Africa. Her fasting insulin was 281 pmol/l (raised) and IFCC HbA_{1c} 68 mmol/mol. Her GAD and islet cell antibodies were negative. She weighed 60 kg (BMI above 99.6th centile for age).

IFCC 68 \equiv DCCT 8.4%

Treatment plan

In view of her obesity, she was given an intensive lifestyle education programme, and started on metformin. Initially her IFCC HbA_{1c} fell to 53, but as lifestyle began to revert, it increased to 68 mmol/mol and metformin was increased to 500 mg, 12-hourly. She was screened for retinopathy, microalbuminuria, liver function and fasting lipids (all normal). A random glucose check on her mother gave a result of 11.2 mmol/l; so she was referred to the adult diabetes team, although very reluctant to acknowledge that she also had diabetes.

IFCC 53 \equiv DCCT 7.0%

IFCC 68 \equiv DCCT 8.4%

Follow-up

The daughter's IFCC HbA_{1c} increased to 89 mmol/mol in 2005, at which point insulin was added at 0.5 units/kg/day. Her IFCC HbA_{1c} improved to 76 mmol/mol initially, but within six months was back up to 89 mmol/mol and her weight was 80.6 kg. Over the next six months she stopped taking insulin; IFCC HbA_{1c} increased to 112 mmol/mol and she lost 4 kg in weight. She was admitted to the ward for continuous intravenous insulin infusion and recalculation of her insulin requirements, and with play therapy support she overcame her fear of injections. Her current IFCC HbA_{1c} is 74 mmol/mol. CSII pump therapy is recommended.

IFCC 89 \equiv DCCT 10.3%

IFCC 76 \equiv DCCT 9.1%

IFCC 89 \equiv DCCT 10.3%

IFCC 112 \equiv DCCT 12.4%

IFCC 74 \equiv DCCT 8.9%



NICE Guidelines: Type 2 diabetes

HbA_{1c} targets: IFCC 48 mmol/mol \equiv 6.5% to IFCC 59 mmol/mol \equiv 7.5%

6: Weight reduction

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Background

This lady had been diagnosed with type 2 diabetes in 2001 at the age of 45 years. She had no symptoms related to diabetes, but weighed 144.5 kg (BMI 50.7 kg/m²). Initially, fasting venous glucose was 11.1 mmol/l, IFCC HbA_{1c} 73 mmol/mol, creatinine 84 µmol/l, cholesterol 7.5 mmol/l, triglycerides 2.21 mmol/l, HDL-cholesterol 0.8 mmol/l; thyroid function normal. Blood pressure was normal, and she did not smoke cigarettes or drink alcohol.

IFCC 73 ≡ DCCT 8.8%

Treatment plan

She was started on metformin 500 mg three times daily and simvastatin 40 mg daily, and given close dietetic support with the aim of weight reduction (no target specified) and achievement of IFCC HbA_{1c} 53 mmol/mol.

IFCC 53 ≡ DCCT 7.0%

Follow-up

Initial weight loss led to a progressive fall in HbA_{1c} and by November 2005 weight had leveled off at 125 kg (BMI 43.8 kg/m²) and IFCC HbA_{1c} 51 mmol/mol. Thereafter, although her weight remained steady, HbA_{1c} started to rise slowly, even with metformin increased to 1000 mg twice daily. By April 2008 her IFCC HbA_{1c} was 67 mmol/mol. At this stage subcutaneous exenatide 5 mg twice daily was added until June 2008, then rising to 10 mg twice daily. The lady's weight fell steadily and by April 2009 was 102 kg (BMI 35.9 kg/m²), with IFCC HbA_{1c} 38 mmol/mol.

IFCC 51 ≡ DCCT 6.8%

IFCC 67 ≡ DCCT 8.3%

IFCC 38 ≡ DCCT 5.6%

The patient has suffered from nausea with the exenatide but is keen to persist with this treatment. The dose has now been cut back to 5 mg subcutaneously twice daily to try to minimise any risk of hypoglycaemia, and close monitoring will continue. Serum lipids are now controlled with rosuvastatin 20 mg daily.

NICE Guidelines: Type 2 diabetes

HbA_{1c} targets: IFCC 48 mmol/mol ≡ 6.5% to IFCC 59 mmol/mol ≡ 7.5%



7: Improved glycaemic control

Steven Creely, Specialist Registrar in Diabetes and Endocrinology,
Birmingham, UK

Background

A 58-year-old man was diagnosed in 2003 with type 2 diabetes on the basis of two fasting plasma glucose results over 7 mmol/l. He had no osmotic symptoms of diabetes (excessive urination, thirst), but was lethargic and had a BMI of 33 kg/m². He had a strong family history of diabetes, as one brother and his mother had developed diabetes in their 50s and 60s. He had a history of hypertension treated with atenolol 50 mg, but his lipid profile had not been assessed. He smoked 15 cigarettes a day and drank 38 units of alcohol in a week. At diagnosis, his glycaemic control was suboptimal with IFCC HbA_{1c} 89 mmol/mol. His total cholesterol was 5.4 mmol/l with HDL 0.9 mmol/l and triglycerides 2.3 mmol/l, and baseline creatinine 96 µmol/l.

IFCC 89 ≡ DCCT 10.3%

Treatment plan

In view of his obesity and hyperglycaemia, appropriate first-line glucose-lowering therapy would be metformin titrated to maximum treatment effect, with a target of 53 mmol/mol for IFCC HbA_{1c}. Treatment with simvastatin 40 mg should be initiated. As atenolol, his antihypertensive medication, is no longer considered appropriate within NICE/BHS ACD guidelines, an ACE inhibitor should be considered for first-line treatment. In addition, advice should be offered on smoking cessation, reduction in alcohol consumption, weight loss and diet.

IFCC 53 ≡ DCCT 7.0%

Follow-up

The patient was counselled with lifestyle and dietary advice and started on metformin 500 mg once daily, which was then titrated to 500 mg three times daily within two months. His IFCC HbA_{1c} five months after diagnosis was 68, and subsequently over the next year 71, 76 and 74 mmol/mol. The GP referred the patient to hospital diabetes services. After outpatient review, he was started on 30/70 mixed insulin, 16 units twice daily and his antihypertensive medication optimised. His IFCC HbA_{1c} at follow-up after 4 months was 63 mmol/mol. Regular hospital follow-up was continued and his IFCC HbA_{1c} remained between IFCC 53 and 64 mmol/mol.

IFCC 68 ≡ DCCT 8.4%

IFCC 71 ≡ DCCT 8.6%

IFCC 76 ≡ DCCT 9.1%

IFCC 74 ≡ DCCT 8.9%

IFCC 63 ≡ DCCT 7.9%

IFCC 53 ≡ DCCT 7.0%

IFCC 64 ≡ DCCT 8.0%



NICE Guidelines: Type 2 diabetes

HbA_{1c} targets: IFCC 48 mmol/mol ≡ 6.5% to IFCC 59 mmol/mol ≡ 7.5%

8: Risk of hypoglycaemia in a patient in a unit for the elderly mentally ill in a nursing home

Chris Cottrell and Helen Green, Diabetes Specialist Nurses, Llanelli, Wales, UK

Background

A 72-year-old man with dementia and type 2 diabetes (diagnosed in 1982), hypertension and retinopathy was referred for annual review to the diabetes nurse in the chronic disease management team. He was living in a unit for the elderly mentally ill in a private nursing home. Staff at the home advised that he was aggressive and that he would not allow an examination to be conducted.

His blood glucose levels were determined daily within the home, and his fasting blood glucose levels were all <4.0 mmol/l. He was usually in a hypoglycaemic state on waking. He was unable to converse appropriately and was therefore unable to convey his symptoms without being aggressive, which was attributed to his mental state. His IFCC HbA_{1c} was 46 mmol/mol. He was being treated with gliclazide 80 mg daily.

IFCC 46 \equiv DCCT 6.4%

Treatment plan

Gliclazide was stopped. His creatinine level was 233 μ mol/l (normal range 62–106 μ mol/l). NICE guidelines suggest metformin should not be initiated if creatinine level is above 150 μ mol/l, therefore metformin would have been inappropriate to use. He was a thin gentleman, weighing 58 kg with BMI 21.5 kg/m². The main treatment aim was to prevent hypoglycaemia.

An education programme was started for all staff within the nursing home. It covered the nature of diabetes and its complications, causes, symptoms of hypoglycaemia and hyperglycaemia and their treatment, and blood glucose monitoring.

Follow-up

When reviewed one month later, nursing home staff reported that he was now very pleasant and approachable, and was agreeable to interventions since stopping gliclazide. There was no further history of hypoglycaemia. At his diabetes annual review, which included a foot examination, his IFCC HbA_{1c} was 44 mmol/mol. There has been no further history of hypoglycaemia and he continues to be pleasant and manageable within the home environment. He is followed up annually and as required by the chronic disease management team.

IFCC 44 \equiv DCCT 6.2%

NICE Guidelines: Type 2 diabetes

HbA_{1c} targets: IFCC 48 mmol/mol \equiv 6.5% to IFCC 59 mmol/mol \equiv 7.5%



9: Structured education for type 1 diabetes

Pamela Dyson, Dietician, Oxford, UK

Background

A 32-year-old man was referred for a structured education programme to develop skills for carbohydrate counting and insulin adjustment. He had been diagnosed with type 1 diabetes when aged 12 and had recently expressed concern about his glycaemic control, following routine eye screening which had identified background retinopathy. His recent IFCC HbA_{1c} value was 70 mmol/mol but he had seen a report on the Diabetes UK website recommending a target IFCC HbA_{1c} of 48 mmol/mol. In the past, he had found that reducing his blood glucose levels resulted in increased hypoglycaemia. His current insulin regimen was: long-acting insulin 26 units once daily and insulin aspart 8–10 units three times daily with meals.

IFCC 70 \equiv DCCT 8.6%
IFCC 48 \equiv DCCT 6.5%

Treatment plan

He took part in a group education programme designed for people with type 1 diabetes. The course consisted of 15 hours' education over four weeks and was based upon adult learning theories. The course was facilitated jointly by a diabetes specialist nurse and a diabetes specialist dietician. In addition to carbohydrate counting and insulin adjustment, it addressed management of hypoglycaemia, hyperglycaemia, exercise, alcohol and illness. At the end of the course, his basal insulin remained at 26 units and he adopted the regimen of injecting 1 unit of insulin aspart for every 10 g carbohydrate eaten. As hypoglycaemia was of concern, he decided to aim for a target IFCC HbA_{1c} of 53 mmol/mol.

IFCC 53 \equiv DCCT 7.0%

Follow-up

Six months after completing the course, his glycaemic control had improved and his IFCC HbA_{1c} was 55 mmol/mol. In the two years following the course, he has had his HbA_{1c} measured at six-monthly intervals and, by adopting the approach of carbohydrate counting and insulin adjustment, has maintained his IFCC HbA_{1c} at just above his target with values between 54 and 57 mmol/mol, without significant increase in hypoglycaemia.

IFCC 55 \equiv DCCT 7.2%
IFCC 54 \equiv DCCT 7.1%
IFCC 57 \equiv DCCT 7.4%



NICE Guidelines: Type 1 diabetes in adults

HbA_{1c} targets: IFCC 48 mmol/mol \equiv 6.5% to IFCC 59 mmol/mol \equiv 7.5%

10: Woman with family history of raised cholesterol and diabetes

Robert Cramb, Consultant Chemical Pathologist, Birmingham, UK

Background

A 60-year-old woman was referred to the lipid clinic for review. She had been diagnosed with hypertension ten years previously and was prescribed a diuretic, bendroflumethiazide 2.5 mg once daily, and an ACE inhibitor to control her blood pressure, lisinopril 20 mg once daily. She reported an episode of chest pain that was investigated. She was discovered to have an aortic murmur but an exercise electrocardiogram, ECG, and concurrent echocardiogram showed no abnormalities. There was a family history of increased cholesterol but no history of early heart disease. Her 72-year-old sister was known to be hypertensive and her 70-year-old brother had been diagnosed with diabetes.

Treatment plan

Serum cholesterol measurement was requested by the GP practice and was 7.2 mmol/l at presentation. Her GP commenced statin treatment, simvastatin (40 mg once daily) but referred her to the lipid clinic for advice. After the use of simvastatin for at least 6 weeks, her total cholesterol was reviewed in the Lipid Clinic and showed a decrease of 21%, to 5.7 mmol/l. As this decrease in cholesterol was smaller than expected, other relevant parameters were reviewed. Her fasting plasma glucose concentration was found to be 7.9 mmol/l, indicating diabetes, and her IFCC HbA_{1c} was 63 mmol/mol.

IFCC 63 \equiv DCCT 7.9%

Follow-up

The patient was prescribed metformin at 500 mg twice daily. After a further two months with no additional lipid-lowering therapy, her total cholesterol concentration was reduced to 3.4 mmol/l and her IFCC HbA_{1c} to 53 mmol/mol.

IFCC 53 \equiv DCCT 7.0%

NICE Guidelines: Type 2 diabetes

HbA_{1c} targets: IFCC 48 mmol/mol \equiv 6.5% to IFCC 59 mmol/mol \equiv 7.5%

