A summary of prescribing recommendations from NICE guidance

Diabetes (type 1 and 2) in children and young people

This guideline discusses the management of type 1 and 2 diabetes in children and young people. Recommendations throughout this bulletin may refer to type 1 or 2 diabetes or both. This is clearly stated in each section.

Definition of terms

- HbA1c: glycated haemoglobin (A1c)
- CV: cardiovascular
- DKA: diabetic ketoacidosis
- BP: blood pressure
- CSII: continuous subcutaneous insulin infusion
- MDI: multiple daily injection
- IM: intramuscular
- ACR: albumin:creatinine ratio

Diagnosis

- Characteristics of type 1 diabetes in children/young people include:
  - hyperglycaemia (random plasma glucose >11 mmol/litre),
  - polyuria,
  - polydipsia,
  - weight loss,
  - excessive tiredness.
- Refer children/young people with suspected type 1 diabetes immediately (on the same day) to a multidisciplinary paediatric diabetes team with the competencies needed to confirm diagnosis and provide immediate care.
- At diagnosis, assume type 1 diabetes unless there are strong indications of type 2, monogenic or mitochondrial diabetes.
- Confirm type 1 diabetes using plasma glucose criteria in the World Health Organisation's 2006 report.
- Think about the possibility of type 2 diabetes in children/young people with suspected diabetes who:
  - have a strong family history of type 2 diabetes,
  - are obese at presentation,
  - are of black or Asian family origin,
  - have no insulin requirement, or have an insulin requirement of <0.5 units/kg body weight/day after the partial remission phase,
  - show evidence of insulin resistance e.g. acanthosis nigricans.
- Think about the possibility of types of diabetes other than types 1 or 2 – see NICE pathway.
- Do NOT measure C-peptide and/or diabetes-specific autoantibody titres at initial presentation to distinguish type 1 diabetes from type 2 diabetes.
- Consider measuring C-peptide after initial presentation if there is difficulty distinguishing type 1 diabetes from other types of diabetes. Be aware that C-peptide concentrations have better discriminative value the longer the interval between initial presentation and the test.
- Perform genetic testing if atypical disease behaviour, clinical characteristics or family history suggest monogenic diabetes.

Education and information; Type 1 and 2 diabetes

- Offer children/young people and their family members/carers a continuing programme of education from diagnosis:
  - Type 1 diabetes - see NICE pathway.
  - Type 2 diabetes – see box on page 3.

Smoking and substance misuse

- Explain general health problems associated with smoking in particular the risks of developing vascular complications.
- Encourage children/young people not to smoke.
- Offer smoking cessation programmes to children/young people who smoke. See NICE pathway: smoking prevention and cessation.
- Explain the general dangers of substance misuse and possible effects on blood glucose control.

Immunisation

- Recommend annual immunisation against influenza for children/young people with diabetes >6 months old.
- Recommend immunisation against pneumococcal infection for children/young people with diabetes who need insulin or oral hypoglycaemic medicines.

Monitoring

Blood glucose; Type 1 diabetes

- Advise children/young people to aim for:
  - fasting plasma glucose level of 4 to 7 mmol/litre on waking,
  - a plasma glucose level of 4 to 7 mmol/litre before meals at other times of the day,
  - a plasma glucose level of 5 to 9 mmol/litre after meals,
  - a plasma glucose level of at least 5 mmol/litre when driving.
- Advise that achieving and maintaining blood glucose levels towards the lower end of the target optimal ranges will help achieve the lowest attainable HbA1c.
- Ensure problematic hypoglycaemia or undue emotional distress is not experienced when achieving, or attempting to achieve, blood glucose and HbA1c targets.
- There may be conflict between children/young people and their family members/carers about blood glucose and HbA1c targets, and an agreed compromise may be needed.
- Advise children/young people to routinely perform at least 5 capillary blood glucose tests per day.
- Advise that more frequent testing is often needed e.g. with physical activity and during intercurrent illness, and ensure they have enough test strips for this.
- Offer a choice of equipment for monitoring capillary blood glucose, so blood glucose control can be optimised in response to adjustment of insulin, diet and exercise.
- Explain that blood glucose levels should be interpreted in the context of the ‘whole child’, which includes social, emotional and physical environment.
- Offer ongoing real-time continuous glucose monitoring with alarms to children/young people who have:
  - frequent severe hypoglycaemia, OR
  - impaired awareness of hypoglycaemia associated with adverse consequences e.g. seizures or anxiety, OR
  - inability to recognise, or communicate about, symptoms of hypoglycaemia e.g. because of cognitive or neurological disabilities.

Recommendations

- wording used such as ‘offer’ and ‘consider’ denote the strength of the recommendation.

Drug recommendations – the guideline assumes that prescribers will use a drug’s Summary of Product Characteristics (SPC) to inform treatment decisions.
Blood glucose; Type 1 diabetes continued…..

- Consider ongoing real-time continuous glucose monitoring:
  - for neonates, infants and pre-school children,
  - for children/young people who undertake high levels of physical activity e.g. sport at a regional, national or international level,
  - for children/young people with comorbidities e.g. anorexia nervosa, or who are receiving treatments that can make blood glucose control difficult e.g. corticosteroids.
- Consider intermittent (real-time or retrospective) continuous glucose monitoring to help improve blood glucose control in children/young people who continue to have hyperglycaemia despite insulin adjustment and additional support.

HbA1c measurement and targets

**Type 1 and 2 diabetes**

- Use methods to measure HbA1c that have been calibrated according to International Federation of Clinical Chemistry standardisation.
- Explain the benefits of safely achieving and maintaining the lowest attainable HbA1c and give support to achieve this.
- Explain that an HbA1c target level of ≤48 mmol/mol (6.5%) is ideal to minimise the risk of long-term complications.
- Explain to children/young people who have an HbA1c level >48 mmol/mol (6.5%) that any reduction in HbA1c level reduces the risk of long-term complications.
- Agree an individualised lowest achievable HbA1c target taking into account daily activities, individual life goals, complications, comorbidities and the risk of hypoglycaemia.
- Measure HbA1c levels:
  - every 3 months in type 1 diabetes and type 2 diabetes. More frequent testing may be appropriate if there is concern about suboptimal blood glucose control.
- Document the proportion of children/young people who achieve an HbA1c of ≤53mmol/mol (7%).

**Treatment and management; Type 1 diabetes**

**Diet – see NICE pathway**

- Support children/young people to develop a good working knowledge of nutrition and how it affects their diabetes.
- Explain regularly how healthy eating (including eating foods with a low glycaemic index, fruit and vegetables, and appropriate types and amounts of fats) can reduce risk of CV disease.
- Encourage children/young people to eat at least 5 portions of fruit and vegetables each day.
- At each clinic visit measure height and weight, and plot on an appropriate growth chart. Calculate BMI.
- Check for normal growth and/or significant changes in weight because these may reflect changes in blood glucose control.
- Provide arrangements for weighing children/young people that respect their privacy.

**Exercise**

- Encourage regular exercise to reduce risk of developing CV disease in the long term.
- Explain that children/young people can take part in all exercise, provided appropriate attention is given to changes in insulin and dietary management.
- Explain the effects of exercise on blood glucose levels and about strategies for avoiding hypo- or hyperglycaemia during or after physical activity.
- Encourage the monitoring of blood glucose levels before and after exercise. See NICE pathway.
- Explain that additional carbohydrate should be consumed as appropriate to avoid hypoglycaemia.
- Carbohydrate-based foods should be readily available during and after exercise. Consume additional carbohydrate if plasma glucose level is <7mmol/litre before exercising.
- Any changes in daily exercise patterns may require insulin dose and/or carbohydrate intake to be altered.

**Insulin regimens**

There are three basic types of insulin regimen.

- **MDI basal–bolus insulin regimens:** injections of short-acting insulin or rapid-acting insulin analogue before meals, together with one or more separate daily injections of intermediate-acting insulin or long-acting insulin analogue.
- **CSII (insulin pump therapy):** a programmable pump and insulin storage device that gives a regular or continuous amount of insulin (usually a rapid-acting insulin analogue or short-acting insulin) by a subcutaneous needle or cannula.
- **One, two or three insulin injections per day:** usually injections of short-acting insulin or rapid-acting insulin analogue mixed with intermediate-acting insulin.

**Pharmacological treatment; Type 1 diabetes**

**Insulin therapy**

- Take into account the personal and family circumstances of the child/young person and discuss personal preferences with them when choosing an insulin regimen.
- **First-line:** offer MDI basal–bolus insulin regimens. If a MDI regimen is not appropriate, consider CSII (insulin pump therapy).
- Encourage adjusting the insulin dose if appropriate after each blood glucose measurement.
- Explain that injecting rapid-acting insulin analogues before eating (rather than after eating) reduces blood glucose levels after meals and helps to optimise blood glucose control.
- Encourage children/young people using twice-daily injection regimens to adjust insulin dose according to general trend in pre-meal, bedtime and occasional night-time blood glucose.
- Explain to newly diagnosed children/young people that a partial remission phase (a ‘honeymoon period’) may be experienced during which a low dosage of insulin (0.5 units/kg body weight/day) may be sufficient to maintain an HbA1c level ≤48 mmol/mol (6.5%).
- Provide rapid-acting insulin analogues for use during intercurrent illness or episodes of hyperglycaemia.
- If a child/young person does not have optimal blood glucose control:
  - offer appropriate additional support such as increased contact frequency with their diabetes team, AND
  - if necessary, offer an alternative insulin regimen (MDI, CSII or once-, twice- or three-times daily mixed insulin injections).

**Insulin delivery**

- Offer a choice of insulin delivery systems that takes account of insulin requirements and personal preferences.
- Provide insulin injection needles that are of an appropriate length for the body fat of the child/young person.
- Offer a review of injection sites at each clinic visit.
- Provide suitable containers for collecting used needles and other sharps. Arrangements should be available for disposal of these containers.

This bulletin summarises key prescribing points from NICE guidance. Please refer to the full guidance at www.nice.org.uk for further detail. This is an NHS document not to be used for commercial purposes.
Diabetes (type 1 and 2) in children and young people........continued

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CSII (insulin pump)

- Provide specific training in its use.
- Provide ongoing support from a specialist team, particularly in the period immediately after starting CSII. Specialist teams should agree a common core of advice for CSII users.
- Consider automatic blood glucose monitoring to improve safety and enable adherence to therapy.

Oral medicines

- Do NOT offer acarbose or sulphonylureas (glibenclamide, gliclazide, glipizide, tolaazamide or glyburide) in combination with insulin because they may increase risk of hypoglycaemia without improving blood glucose control.
- Metformin in combination with insulin is only suitable within research studies because effectiveness of this combined treatment in improving blood glucose control is uncertain.

Hypoglycaemia; Type 1 diabetes

- Explain strategies for avoiding and managing hypoglycaemia.
- Offer education for children/young people, their family members/carers, and schoolteachers about recognising and managing hypoglycaemia.
- Explain that they should always have access to an immediate source of fast-acting glucose and blood glucose monitoring equipment for immediate confirmation and safe management of hypoglycaemia.
- Family members/carers and, where appropriate, school nurses and other carers should be trained and equipped to give IM glucagon for severe hypoglycaemia in an emergency.
- See NICE pathway for further advice on acute management.

Hyperglycaemia, blood ketone and intercurrent illness; Type 1 diabetes

- Provide clear individualised oral and written advice (‘sick-day rules’) about managing type 1 diabetes during intercurrent illness or episodes of hyperglycaemia, including:
  - monitoring blood glucose,
  - monitoring and interpreting blood ketones (beta-hydroxybutyrate),
  - adjusting insulin regimen,
  - food and fluid intake,
  - when and where to seek further advice or help.
- Revisit the advice at least annually.
- Offer blood ketone testing strips and a meter, and advise to test for ketonaemia if the child/young person is ill or has hyperglycaemia.
- Explain that it is important to ensure that blood ketone testing strips are not used after the specified (‘use-by’) date.

Difficulties maintaining blood glucose control; Type 1 diabetes

- Think about the possibility of non-adherence to therapy in children/young people who have suboptimal blood glucose control, especially in adolescence. Adolescence can be a period of worsening blood glucose control, which may in part be due to non-adherence to therapy.
- Raise the issue of non-adherence in a sensitive manner.
- Be aware of the possible negative psychological impact of setting targets that may be difficult for some children/young people to achieve and maintain.

Monitoring for complications; Type 1 diabetes

- Monitor for thyroid disease at diagnosis and annually thereafter until transfer to adult services.
- Offer annual monitoring from 12 years for:
  - diabetic retinopathy,
Monitoring for complications; Type 2 diabetes
- Explain the importance of, and offer annual monitoring for:
  - hypertension starting at diagnosis,
  - dyslipidaemia starting at diagnosis,
  - diabetic retinopathy from 12 years,
  - moderately increased albuminuria (ACR 3 to 30 mg/mmol; ‘microalbuminuria’) to detect diabetic kidney disease, starting at diagnosis.

Diabetic retinopathy; Type 2 diabetes – see NICE pathway
- Consider referring children/young people with type 2 diabetes who are <12 years to an ophthalmologist for retinal examination if blood glucose control is suboptimal.

Diabetic kidney disease; Type 2 diabetes
- Monitoring for moderately increased albuminuria (ACR 3 to 30 mg/mmol; ‘microalbuminuria’) to detect diabetic kidney disease begins at 12 years because diabetic kidney disease under 12 is extremely rare.
- Use the first urine sample of the day (‘early morning urine’) to screen for moderately increased albuminuria, as this reduces the risk of false positive results.
- If moderately increased albuminuria is detected, improving blood glucose control will reduce the risk of this progressing to significant diabetic kidney disease.
- Annual monitoring from 12 years is important because, if diabetic kidney disease is found, early treatment will improve the outcome.
- If initial albumin:creatinine ratio is >3 mg/mmol but <30 mg/mmol, confirm by repeating the test on 2 further occasions using first urine samples of the day (‘early morning urine’) before starting further investigation and therapy.
- Investigate further if the initial albumin:creatinine ratio is ≥30 mg/mmol (proteinuria).

Dyslipidaemia and hypertension; Type 2 diabetes
- Explain that monitoring is important because if dyslipidaemia or hypertension is found, early treatment will reduce the risk of complications.
- When monitoring for dyslipidaemia, measure total cholesterol, high-density lipoprotein (HDL) cholesterol, non-HDL cholesterol and triglyceride concentrations.
- Confirm dyslipidaemia using a repeat sample (fasting or non-fasting) before deciding on further management strategies.
- When measuring BP, use a cuff large enough for the child/young person.
- If repeated resting BP measurements are greater than the 95th percentile for age and sex, confirm hypertension using 24-hour ambulatory blood pressure monitoring before starting antihypertensive therapy.

Diabetic ketoacidosis; Type 1 and 2 diabetes – see NICE pathway
Assessment
- Measure capillary blood glucose at presentation in children/young people without known diabetes who have increased thirst, polyuria, recent unexplained weight loss or excessive tiredness and any of the following:
  - nausea or vomiting,
  - abdominal pain,
  - hyperventilation,
  - dehydration,
  - reduced level of consciousness.
- If the plasma glucose level is >11 mmol/litre in a child/young person without known diabetes, and they have symptoms that suggest DKA, immediately send them to a hospital with acute paediatric facilities.
- Children/young people taking insulin for diabetes may develop DKA with normal blood glucose levels.
- Suspect DKA even if the blood glucose is normal in a child or young person with diabetes and any of the following:
  - nausea or vomiting,
  - abdominal pain,
  - hyperventilation,
  - dehydration,
  - reduced level of consciousness.
- When DKA is suspected in a child/young person with known diabetes:
  - measure the blood ketones (beta-hydroxybutyrate), using a near-patient method if available. If this is not possible or if the level is elevated, immediately send them to a hospital with acute paediatric facilities.
  - If DKA is suspected or confirmed explain that DKA is a serious matter that needs urgent hospital assessment.
  - When a child/young person with suspected or known DKA arrives at hospital, measure their:
    - capillary blood glucose,
    - capillary blood ketones (beta-hydroxybutyrate) if near-patient testing is available, or urine ketones if it is not,
    - capillary or venous pH and bicarbonate.
- Diagnose DKA in children/young people with diabetes who have:
  - acidosis (indicated by blood pH <7.3 or plasma bicarbonate <18 mmol/litre) AND
  - ketonaemia (indicated by blood beta-hydroxybutyrate >3 mmol/litre) or ketonuria (++ and above on the standard strip marking scale).
- Diagnose severe DKA in children and young people with DKA who have a blood pH <7.1.

Treatment and management – see NICE pathway
Avoiding future episodes
- When a child/young person with known diabetes has recovered from an episode of DKA, discuss factors that may have led to the episode.
- Consider the possibility of non-adherence to therapy in children/young people with established type 1 diabetes who present with DKA, especially if this is recurrent.
- Provide advice on reducing the risk of future episodes. In particular, the importance of managing intercurrent illnesses.

Managing foot problems in children/young people with diabetes – see NICE pathway

Surgery for children/young people with diabetes – see NICE pathway

Psychological and social issues – see NICE pathway

Transition from paediatric to adult care – see NICE pathway

Further resources
Resources and tools, including slide sets, audit tools, uptake reports are available to help put the guidance into practice:
www.nice.org.uk/guidance/ng18/resources

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