Hyperglycaemic Emergencies

Diabetic Ketoacidosis (DKA)

DKA occurs due to relative or absolute lack of insulin. Common precipitants include a new diagnosis of type 1 diabetes, infection and deliberate omission of insulin.

Diagnosis

- elevated plasma and/or urinary ketones
- metabolic acidosis (raised H⁺/low serum bicarbonate)

The presence of the following features should alert you to the possibility of DKA:

- ketonuria
- rapid and deep sighing respirations, smell of ketones
- vomiting/abdominal pain
- drowsiness/reduced conscious level
- intra and extra-vascular volume depletion with reduced skin turgor, tachycardia and hypotension (late features)

Immediate management

In the early stages, where patient is fully conscious and able to take adequate oral fluids, an increased insulin dose may stabilise the situation. However in most cases an emergency admission to hospital is required where the treatment with intravenous insulin, fluids and electrolytes is required to restore the metabolic equilibrium.

Patients aged less than 16 years old should be admitted to the Royal Hospital for Sick Children.

Acute complications

- Hypokalaemia: due to insulin and fluid administration, resolution of acidosis and inadequate potassium replacement. All of which are predictable and therefore avoidable.
- Cerebral oedema: rare but potentially fatal. More common in children, but is seen in young adults. Characteristically, the patient has initially responded well to treatment prior to the development of severe headache and neurological deterioration.
- Acute respiratory distress syndrome – may require temporary non-invasive or invasive ventilatory support.
- Thromboembolism – presentation and management as standard.

Diabetic Hyperosmolar Non-Ketotic Syndrome (HONK)

- common in frail elderly
- high mortality (30%)
- may be previously undiagnosed diabetes, but can also develop in people with known type 2 diabetes
- significant hyperketonaemia, ketonuria and acidosis are usually absent
- acute intercurrent illness is common
Diagnosis of HONK

Typical features include:
• severe hyperglycaemia (> 50 mmol/l)
• hyperosmolarity (> 320 mosmol/kg) with profound dehydration and prerenal uraemia
• depression of the level of consciousness; coma is well recognised

Hyperosmolar syndrome requires immediate hospital admission and is managed in a similar way to diabetic ketoacidosis. Patients may be discharged on insulin or oral hypoglycaemic agents.

Management of Intercurrent Illness in Insulin Treated Diabetes

THE GOLDEN RULE: Insulin should NEVER be omitted. Extra doses of fast-acting insulin are often required during illness

This advice applies to adults; for children, contact the Paediatric Diabetes team

• Maintain an adequate fluid intake (sugar free, i.e. water) of 100-200mL (approximately 1 glass) every hour.

• Maintain a regular intake of carbohydrate, regardless of blood glucose. At mealtimes, if unable to eat, but tolerating fluids, take carbohydrate in the form of 200mL of one of the following:
  - Regular diluting juice
  - Fruit juice
  - Drinking Chocolate or Ovaltine
  - Milk
  - Flat (sugary) fizzy Drink or Lemonade.

• Increase blood glucose monitoring to at least 4 hourly and test for ketones twice daily if able to do so. Ensure that glucose monitoring technique and equipment is accurate and arrange to review patient.

• Do not be afraid to increase insulin; in general, as much as doubling the dose may be necessary. Remember to taper dose back to normal when recovered.

• Ketonuria/ketonaemia is an early sign of decompensation and if acted upon promptly, it will often prove possible to avert hospital admission.

• If vomiting, hospital admission may be necessary: Consider administering an anti-emetic injection, also “Dioralyte/Rehidrat” may also be required.

The hospital diabetes team is there for advice.
When in doubt – please phone or
NHS 24: 08454 24 24 24
Indications for Hospital Admission

- Inability to swallow or keep fluids down
- Vomiting
- Persistent diarrhoea
- Persistently raised glucose (>28 mmol/L) despite increasing insulin
- Strongly positive ketonuria
- When ketoacidosis is clinically obvious (dehydration, abdominal pain, intractable vomiting, rapid or laboured respirations)

Use of Blood Ketone Testing In the Management of Intercurrent Illness in Insulin Dependent Diabetes

- Ketoacidosis can occur in the presence of normal blood glucose levels
- Type 2 diabetes patients treated with insulin very rarely become ketotic as they invariably have some residual insulin secretion

Test for Ketones in Type 1 Diabetes when:

- evidence of intercurrent infection
- Symptoms of ketoacidosis – thirst, polyuria, vomiting, confusion, blurred eyesight
- If blood glucose levels remain high (>10mmol/l) despite increasing insulin doses

<table>
<thead>
<tr>
<th>Blood Ketone Level</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.6 mmol/l</td>
<td>Nil</td>
</tr>
<tr>
<td>0.6 – 1.5 mmol/l</td>
<td>Test again in 2 – 4 hours</td>
</tr>
<tr>
<td>1.5 – 3.0 mmol/l</td>
<td>Increase insulin if ketones no decreasing in 2 hours, admit</td>
</tr>
<tr>
<td>&gt;3.0 mmol/l</td>
<td>Check for ketoacidosis, measure H+, will usually need admission</td>
</tr>
</tbody>
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Management of Intercurrent Illness in Patient with Type 2 Diabetes

Patients who are taking Metformin and/or ACE inhibitors or ARBs must be reminded to discontinue these medications during any severe illness, particularly if dehydrated or septic to avoid the development of lactic acidosis and/or acute renal failure.
Algorithm for Management of intercurrent illness in Type 1 Diabetes Mellitus

Unwell or

High blood sugar \( \geq 17\text{mmol/L} \)

\[ \text{Test urine for ketones***} \]

\[ \text{Large} \]

\[ \text{Small or moderate} \]

\[ \text{Repeat blood glucose after 2-4hrs - if still elevated may need extra insulin*} \]

\[ \text{Blood glucose high} \]

\[ \text{Requires extra short acting insulin*} \]

\[ \text{Blood glucose low Or normal} \]

\[ \text{Requires extra short acting insulin*} \]

\[ \text{Insufficient oral intake} \]

\[ \text{Encourage oral intake then give extra insulin according to blood glucose} \]

\[ \text{Test blood glucose 4 times daily and ketones twice daily until stable**} \]

* The diabetes team will advise patients individually on how much extra insulin should be taken in the event of ketonuria or sustained hyperglycaemia, usually 10% of TDD.

** Refer to hospital if clinical deterioration

*** Blood ketones may be tested for instead of urine ketones, see page 77 for interpretation of results.