

Emergency management of hyperglycaemia in primary care



RACGP and ADS joint clinical position statement

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Position statement: Management of hyperglycaemic emergencies

Hyperglycaemic emergencies require urgent assessment and management to reduce preventable morbidity and mortality. Hyperglycaemic emergencies may occur as the first presentation of diabetes (undiagnosed), as well as an acute metabolic decompensation in those already diagnosed with diabetes. Identification of at-risk patients, together with access to point-of-care checking, can reduce delays to hospital presentation.

The objectives of this position statement are to:

- Raise clinical awareness of hyperglycaemic emergencies by identifying clinically important patient presentations and risk factors.
- Ensure management of hyperglycaemic emergencies is optimised to prevent serious adverse outcomes.
- Provide action flow charts to inform management of hyperglycaemic emergencies **before** patients arrive at hospital.

Context

This document should be read in conjunction with the relevant management flow charts (Figures 1 and 2), which provide information for the management of hyperglycaemic emergencies in primary care.

This position statement should integrate with, **but not replace**, existing sick day, ambulance and hospital-based management protocols.¹⁻⁴ Clinicians should consult existing local/regional or health pathways/protocols for inpatient management. For specific information for the management of diabetic ketoacidosis and hyperosmolar hyperglycaemia, visit the *National evidence-based clinical care guidelines for type 1 diabetes in children, adolescents and adults* or the Therapeutic Guidelines. This statement does not replace existing diagnostic guidelines for routine (non-emergency) presentations, and should not be used for evaluating hyperglycaemia associated with pregnancy where specialist advice on assessment and management must be sought.

Clinical presentations for hyperglycaemic emergencies

Recognition of hyperglycaemic emergencies in primary care is imperative to facilitate timely management.

- **In people not known to have diabetes:**
 - Undiagnosed diabetes can lead to hyperglycaemic emergencies at **all ages**.
 - Symptoms and signs, especially polyuria, polydipsia and/or weight loss (Boxes 1 and 2), particularly in children and young adults, should prompt **urgent** point-of-care capillary blood glucose checking. Refer to the management flow chart in Figure 1 for further action required.
- **In people with an existing diagnosis of diabetes:**
 - Symptoms and signs described in Boxes 1 and 2 found in the patient with an acute illness and/or persistent hyperglycaemia (defined as capillary blood glucose >15 mmol/L for greater than 8–12 hours, monitored every two hours)⁴ should be considered a potential hyperglycaemic emergency (unless clinical discretion suggests otherwise), and the management flow chart in Figure 2 should be referred to for further action.
 - A high index of suspicion of a hyperglycaemic emergency is required in patients who are pregnant and in those who use sodium glucose co-transporter 2 inhibitors (SGLT2i), as diabetic ketoacidosis (DKA) may occur without hyperglycaemia.

There are two main hyperglycaemic emergencies.

1. Diabetic ketoacidosis

- **DKA** is an acute, life-threatening emergency characterised by hyperglycaemia and acidosis that most commonly occurs in people with type 1 diabetes. DKA can be the presenting feature of type 1 diabetes, especially in younger children, but can also occur in type 2 diabetes.

People with DKA can deteriorate very quickly and develop an altered state of consciousness. Symptoms suggestive of emerging metabolic crisis with DKA are shown in Box 1.

Suspected DKA is an emergency; transfer to an appropriate treating facility/hospital **should not be delayed**.

- **Euglycaemic ketoacidosis** refers to ketosis and acidosis in the presence of normal blood glucose levels (or minor elevations of blood glucose levels) in symptomatic patients. This rare condition is more likely to occur in patients with type 1 or type 2 diabetes who are pregnant, patients on a low-carbohydrate diet or using SGLT2i, or patients who have just undergone surgery.

Box 1. Symptoms suggestive of emerging metabolic crisis associated with DKA²

| Symptoms | Signs |
|----------------------------|--|
| Polyuria/polydipsia/thirst | Altered conscious state |
| Nausea/vomiting | Kussmaul breathing, rapid respiratory rate |
| Abdominal pain | Ketotic breath – smells like acetone |
| Weight loss | Dehydration* |

*Clinical signs of dehydration include poor skin turgor, tachycardia, hypotension, dry mouth and tongue, oliguria or anuria. Atypical symptoms (eg pain, fever) related to the aetiology, such as sepsis, may be present. Resources to assist in assessing dehydration in children⁵ and adults^{6,7} are provided in the reference list.

2. Hyperosmolar hyperglycaemic states

Hyperosmolar hyperglycaemic states (HHS) refer to **severe persistent hyperglycaemia, in the absence of ketosis, and accompanied by profound dehydration**. HHS is more common in type 2 diabetes in the presence of acute sepsis (eg urinary tract infection, pneumonia), after a cardiovascular event (myocardial ischaemia or stroke) or in people with renal dysfunction. HHS usually affects older people. Coma may develop in some patients and neurological impairment is common.⁸ Mortality in HHS is higher than in DKA and relates to the precipitating cause. Symptoms suggestive of emerging metabolic crisis with HHS are shown in Box 2. While metabolic acidosis present in a person with HHS will usually be due to a lactic acidosis related to the precipitant and to any renal impairment, HHS may sometimes occur with DKA in a mixed clinical picture of ketoacidosis and a hyperosmolar state.

Box 2. Symptoms suggestive of emerging metabolic crisis associated with HHS⁹

| Symptoms | Signs |
|---|---|
| May have atypical symptoms (eg pain, fever) associated with aetiology | Altered state of consciousness |
| Dry mouth/thirst/reduced urination | Dehydration* (may be extreme in HHS) |

*Clinical signs of dehydration include decreased skin turgor, tachycardia, hypotension, oliguria or anuria. Resources to assist in assessing dehydration in children⁵ and adults^{6,7} are provided in the reference list.

Comorbidities and conditions associated with an increased risk of hyperglycaemic emergencies are summarised in Box 3. These include children and young people with known type 1 diabetes, users of insulin pumps and medications including corticosteroids, atypical antipsychotics and SGLT2i medication.

Box 3. Factors associated with an increased risk of hyperglycaemic emergencies

- Children and young people with known type 1 diabetes
- Unstable glycaemic control
- Diabetes medication omission – especially insulin
- Use of an insulin pump – as only rapid-acting insulin is administered by pumps (no long-acting insulin is used), any interruption to use of the pump can rapidly lead to hyperglycaemia and DKA
- Past DKA
- Acute infection and sepsis
- Pancreatitis
- Myocardial infarction/unstable angina
- Trauma, surgery or burns
- Medications – corticosteroids, atypical antipsychotics, immunosuppressive agents, SGLT2i
- Alcohol and recreational drugs
- In elderly people – signs of DKA may be subtle, mortality rates may be higher¹⁰ and type 1 diabetes can present at any age
- Pregnancy

Clinical assessment

Clinical assessment of the patient should include temperature, blood pressure, heart rate, respiratory rate, Glasgow Coma Scale and **urgent point-of-care assessment**.

Measurement of both blood glucose and blood ketone levels is critical in the assessment of potential hyperglycaemic crises. It is the opinion of this working group that primary care practices should apply best practice standards of care and ensure they have access to **point-of-care capillary blood glucose and ketone monitoring meters and strips**. This access is particularly important because of the significant risks identified in the management of these clinical presentations in primary care.

Preferred:

- **Capillary (finger prick) blood glucose level (critical level >15 mmol/L)**
- **Capillary blood ketones (betahydroxybutyrate) (critical level >1.5 mmol/L)**

Less preferred:

- Urine ketones (acetoacetate) (critical level 1+)
- Urine dipstick measurement may be used when blood ketone test strips are unavailable
- **Urine ketone tests may be misleading when using SGLT2i agents, so blood ketone checking is preferred^{11–13}** (for a comparison between urine and capillary ketone measurement, refer to reference 13)
- Dehydration may preclude urine testing. **If capillary blood glucose is >15 mmol/L and the person is symptomatic as per information in Boxes 1 or 2, urgent consultation and/or transfer to hospital is advised.** Refer to the management flow charts (Figures 1 and 2) for further actions

Avoid delays

- ▶ Refer to the management flow charts (Figures 1 and 2) for further actions.

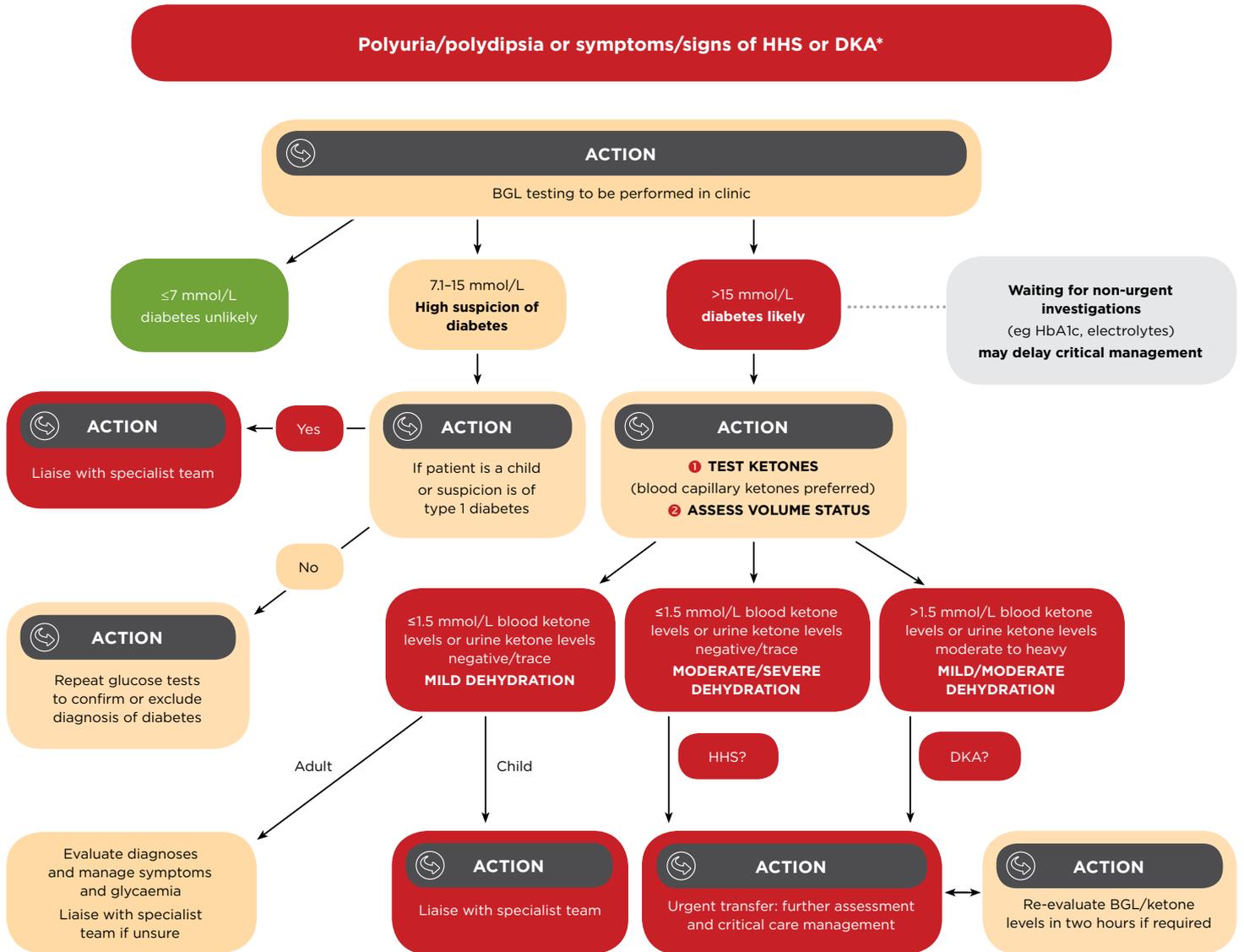
Delays in assessment and management may occur when clinical focus is diverted by **non-urgent investigations** (such as glycated haemoglobin [HbA1c], C-peptide, islet cell antibodies or an oral glucose tolerance test). Hyperglycaemic crises can be rapidly fatal, and whenever they are suspected, emergency management must override any non-urgent investigation.

Management

- ▶ Refer to the management flow charts (Figures 1 and 2) for recommended actions.

Some people with known type 1 diabetes in particular may have a pre-existing sick day management plan (a written document provided by their treating specialist, healthcare professional or team). If clinical conditions do not require a rapid transfer to hospital, a pre-existing sick day plan may be put into place. This should include urgent contact with the relevant specialist healthcare professional or team.

Figure 1. People not known to have diabetes

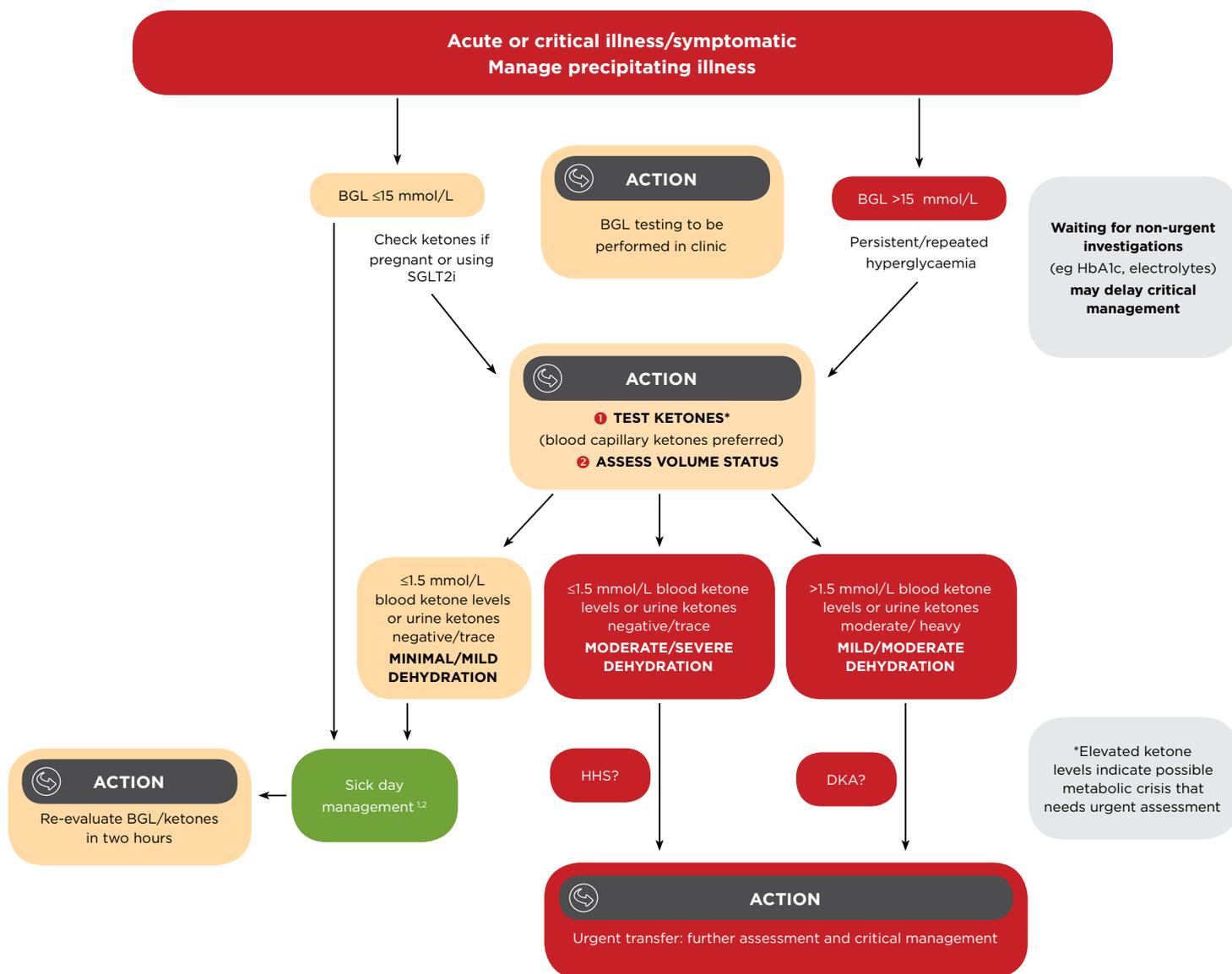


| Legend | |
|--------------|-----------------------------------|
| BGL | blood glucose level |
| DKA | diabetic ketoacidosis |
| HbA1c | glycated haemoglobin |
| HHS | hyperosmolar hyperglycaemic state |

| Classical features | HHS | DKA |
|---------------------|-----|-----|
| *Symptoms | | |
| Polyuria/polydipsia | ✓ | ✓ |
| Nausea/vomiting | ✓ | ✓ |
| Abdominal pain | ✓ | ✓ |
| Weight loss | | ✓ |

| Classical features | HHS | DKA |
|-------------------------|-----|-----|
| *Signs | | |
| Altered conscious state | ✓ | ✓ |
| Dehydration | ✓ | ✓ |
| Kussmaul breathing | | ✓ |
| Rapid respiratory rate | | ✓ |
| Ketotic breath | | ✓ |

Figure 2. People known to have diabetes



Legend

| | |
|---------------|---|
| BGL | blood glucose level |
| DKA | diabetic ketoacidosis |
| HbA1c | glycated haemoglobin |
| HHS | hyperosmolar hyperglycaemic state |
| SGLT2i | sodium glucose co-transporter 2 inhibitor |

| Classical features | HHS | DKA |
|---------------------|-----|-----|
| Symptoms | | |
| Polyuria/polydipsia | ✓ | ✓ |
| Nausea/vomiting | ✓ | ✓ |
| Abdominal pain | ✓ | ✓ |
| Weight loss | | ✓ |

| Classical features | HHS | DKA |
|-------------------------|-----|-----|
| Signs | | |
| Altered conscious state | ✓ | ✓ |
| Dehydration | ✓ | ✓ |
| Kussmaul breathing | | ✓ |
| Rapid respiratory rate | | ✓ |
| Ketotic breath | | ✓ |

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