

## Appendix 3. Detailed information on glycaemic emergencies

### Hypoglycaemia

#### Managing an episode of hypoglycaemia

If a patient with diabetes is showing signs of potential hypoglycaemia, first make sure that the patient is safe (eg seated securely and not at risk of falling).

If possible, confirm that the symptoms are due to hypoglycaemia by performing a finger-prick blood glucose level (BGL). If the person is awake, alert and can swallow, hypoglycaemia may be managed according to the Rule of 15 (Box A3.1). If the patient is symptomatic, but blood glucose or capillary glucose cannot be performed to confirm that the episode is due to hypoglycaemia, use the Alternative Rule of 15 (Box A3.2).

#### Box A3.1. Rule of 15 (hypoglycaemia confirmed)

BGL <4.0 mmol/L:

- Provide 15 g of quick-acting carbohydrate that is easy to consume (eg half a can of regular – non-diet – soft drink, half a glass of fruit juice, three teaspoons of sugar or honey, six or seven jellybeans, three glucose tablets)
- Wait 15 minutes and repeat blood glucose check – if the level is not rising, suggest eating another quick-acting carbohydrate from the above list
- Provide some longer acting carbohydrate if the patient's next meal is more than 15 minutes away (eg a sandwich; one glass of milk or soy milk; one piece of fruit; two or three pieces of dried apricots, figs or other dried fruit; one tub of natural low-fat yoghurt; six small dry biscuits and cheese)
- Test glucose every 1–2 hours for the next four hours

#### Box A3.2. Alternative Rule of 15

Patients and carers should be made aware of the use of an alternative Rule of 15.

If the patient is symptomatic, but blood glucose or capillary glucose cannot be performed to confirm that the episode is due to hypoglycaemia, treat the patient as if they have hypoglycaemia:

- administer 15 g of quick-acting carbohydrate
- if there is no improvement after 15 minutes, the patient could have another cause for the episode and further medical assistance may be necessary.

## Severe hypoglycaemia

Severe hypoglycaemia is an emergency. Clinical status can progress to impaired consciousness or coma.

Management is as follows:

- Commence appropriate resuscitation protocols.
- If available, give an injection of glucagon 1 mg intramuscularly or subcutaneously into the thigh, buttock or upper arm (with usual precaution to avoid vulnerable anatomical structures).
- If intravenous access is obtained, deliver glucose 50% – 20 mL intravenously via a securely positioned cannula (optimally the antecubital veins). Use 10% glucose in children, as hyperosmolality has caused harm.
- Phone for an ambulance (dial 000) stating a 'diabetic emergency'.
- Wait with the patient until the ambulance arrives.
- When the person regains full consciousness and can swallow, they can be orally given a source of carbohydrate.

If glucagon is administered, always review the monitored capillary glucose after 15 minutes to ensure effective management of hypoglycaemia has occurred and the blood glucose remains  $\geq 4$  mmol/L. Test again one hour after severe hypoglycaemia to ensure stable glucose levels.

## Post-hypoglycaemia

After any severe hypoglycaemic episode, a patient review is mandatory. Reassess the patient's circumstances, medication dosages and dietary intake, as well as overall need for glucose monitoring, with the patient and/or with their immediate family or support persons. Also discuss implications for driving competence and other similar areas (eg operation of machinery). The patient should be advised not to drive for at least six weeks while diabetes re-stabilisation is undertaken. If a patient's healthcare professional believes they will not follow this advice, the relevant driving authority should be notified.

Refer to the discussion of driving in the section '[Managing risks and other impacts of type 2 diabetes](#)', and the Austroads and National Transport Commission publication [Assessing fitness to drive](#).

# Managing hyperglycaemic emergencies

## Diabetic ketoacidosis

Diabetic ketoacidosis (DKA) is a medical emergency requiring specialist care and should generally be managed in hospital. Whatever the setting, it is important that treatment commences as early as possible.

Biochemical criteria for DKA are shown in Box A3.3. Once thought to typify type 1 diabetes, DKA can occur in patients with type 2 diabetes under stress (eg during surgery, trauma, infections, high-dose steroids). The very young, older people and pregnant people are also at greater risk of DKA.<sup>1</sup>

There is a small but definite risk of DKA with sodium glucose co-transporter 2 (SGLT2) inhibitor use. This can sometimes occur without significantly raised blood glucose levels (euglycaemic DKA).<sup>1,2</sup> Because of the absence of extreme hyperglycaemia, euglycaemic DKA may be overlooked and diagnosis and treatment delayed.

GPs should inform all patients commencing SGLT2 inhibitors about the risks of DKA/euglycaemic DKA, including potential symptoms and signs, and provide management advice. Please refer also to the section '[Managing risks and other impacts of type 2 diabetes](#)' and the Australian Diabetes Society [alert regarding SGLT2 inhibitors and DKA](#),<sup>2</sup> for specific recommendations pertaining to SGLT2 inhibitor use perioperatively, and/or in the presence of significant intercurrent illness.

### Box A3.3. Biochemical criteria for DKA

- Hyperglycaemia, defined by a BGL >11 mmol/L\*
- Venous pH <7.3 or bicarbonate <15 mmol/L
- Presence of blood ketones or urinary ketones (abnormal ketone level is  $\geq 0.6$  mmol/L, severe ketosis is >3.0 mmol/L)

\*Note that euglycaemic DKA, characterised by only mild–moderately elevated BGL, can occur in people who are taking SGLT2 inhibitors, people who are pregnant, after excessive alcohol intake, post-surgery/colonoscopy, or people on extremely low carbohydrate diets.

## Assessment and management

Blood ketone testing is preferred. Blood ketone testing equipment should be made available for medical practices and 'at-risk' patient use.

Where possible, patients with DKA should be urgently transferred to a specialist medical unit in a hospital, due to the complexity of metabolic disturbances, especially in people aged >60 years, or in the presence of diabetes complications or comorbidity.<sup>3,4</sup>

The main aim in treating DKA is to progressively normalise the blood pH and clear the body of excessive ketones, achieved by aggressive fluid replacement and insulin therapy. This also improves blood glucose concentration. Hyperglycaemia corrects before acidosis; therefore, intravenous glucose is required to allow insulin infusion to continue to suppress ketone production while acidosis resolves.<sup>5</sup>

## Hyperosmolar hyperglycaemic state

Hyperosmolar hyperglycaemic state (HHS) in type 2 diabetes occurs most often in the elderly or those with newly diagnosed type 2 diabetes. It is characterised by severe hyperglycaemia (usually >25 mmol/L), hyperosmolality, dehydration and a change in mental state, with little or no ketoacidosis. It may present as hypovolaemic shock and coma in severe cases.<sup>5</sup> HHS is usually a result of illness or infection; however, it can also be due to sub-optimal use of diabetes medications.

## General outline for the management of HHS

Wherever possible, the patient with HHS should be managed in a specialist medical unit, due to the risk of hypovolaemic shock and coma.<sup>6</sup> It is important to note that blood glucose meters do not register very high glucose levels, so access to a laboratory is necessary to monitor the correction of hyperglycaemia as well as to monitor sodium and potassium levels. Rapid correction of the hyperosmolar state is dangerous and should not be attempted.

## Rural practice: Management of DKA and HHS

In remote rural practice, with both DKA and HHS, management in a specialist medical unit may not be possible. In this situation it is advisable to contact the most appropriate diabetes resource person (an endocrinologist or similarly qualified specialist) or regional tertiary hospital for advice while promptly commencing treatment.

## References

1. Rosenstock J, Ferrannini E. Euglycemic diabetic ketoacidosis: A predictable, detectable, and preventable safety concern with SGLT2 inhibitors. *Diabetes Care* 2015;38:1638–42.
2. Australian Diabetes Society and New Zealand Society for the Study of Diabetes. Alert update January 2020: Periprocedural diabetic ketoacidosis (DKA) with SGLT2 inhibitor use. ADS and NZSSD, 2020.
3. Umpierrez G, Korytkowski M. Diabetic emergencies: Ketoacidosis, hyperglycaemic hyperosmolar state and hypoglycaemia. *Nat Rev Endocrinol* 2016;12:222–32.
4. Fayfman M, Pasquel F, Umpierrez G. Management of hyperglycemic crises: Diabetic ketoacidosis and hyperglycemic hyperosmolar state. *Med Clin North Am* 2016;101:587–606.
5. Expert Group for Endocrinology. Endocrinology guidelines, version 5. In: eTG complete [Internet]. Melbourne: Therapeutic Guidelines Limited, 2014.
6. The Royal Australian College of General Practitioners and Australian Diabetes Society. Emergency management of hyperglycaemia in primary care. East Melbourne, Vic: RACGP and ADS, 2018.

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