Glycaemic Emergencies (Adults)

1. Introduction

- A non-diabetic individual maintains their blood glucose level within a narrow range from 3.0 to 5.6 mmol per litre.
- This is achieved by a balance between glucose entering the blood stream (from the gastrointestinal tract or from the breakdown of stored energy sources) and glucose leaving the circulation through the action of insulin.

SECTION 1 – Hypoglycaemia

- A low blood glucose level is defined as <4.0 mmol/L, but the clinical features of hypoglycaemia may be present at higher levels and clinical judgement is as important as a blood glucose reading.
- Correction of hypoglycaemia is a medical emergency.
- If left untreated hypoglycaemia may lead to the patient suffering permanent brain damage and may even prove fatal.
- Hypoglycaemia occurs when glucose metabolism is disturbed – see Table 3.57 for risk factors.
- Any person whose level of consciousness is decreased, who is having a convulsion, is seriously ill or traumatised should have hypoglycaemia excluded.
- Signs and symptoms can vary from patient to patient (Table 3.58) and the classical symptoms may not be present.
- Some patients are able to detect the early symptoms for themselves, but others may deteriorate rapidly and without apparent warning.
- Abnormal neurological features may occur, for example, one-sided weakness, identical to a stroke.
- Symptoms may be masked due to medication or other injuries, for example, with beta-blocking agents.

2. Assessment and Management

For the assessment and management of hypoglycaemia refer to Table 3.59 and or Figure 3.12.

SECTION 2 – Hyperglycaemia

- Hyperglycaemia is the term used to describe high blood glucose levels.
- Symptoms include unusual thirst (polydipsia), urinary frequency, and tiredness (Table 3.60). They are usually of slow onset in comparison to those of hypoglycaemia.

Diabetic ketoacidosis (DKA)

- A relative lack of circulating insulin means that cells cannot take up glucose from the blood and use it to provide energy. This forces the cells to provide energy for metabolism from other sources such as fatty acids.
- This produces acidosis and ketones. The body tries to combat this metabolic acidosis by hyperventilation to blow off carbon dioxide. High blood glucose level means glucose spills over into the urine dragging water and electrolytes with it causing dehydration and glycosuria.
- New onset diabetes type 1 may present with DKA. More frequently it complicates intercurrent illness in a known diabetic. Infections, myocardial infarction (which may be silent) or a CVA may precipitate the condition.
- Omissions or inadequate dosage of insulin or other hypoglycaemic therapy may also contribute or be responsible. Some medications, particularly steroids may greatly exacerbate the situation.
- Patients may present with one or more signs and symptoms (Table 3.60) and this should alert the pre-hospital provider to the possibility of hyperglycaemia and DKA.

Table 3.57 – RISK FACTORS FOR HYPOGLYCAEMIA

Medical
- Insulin or other hypoglycaemic drug treatments.
- Tight glycaemic control.
- Previous history of severe hypoglycaemia.
- Undetected nocturnal hypoglycaemia.
- Long duration of diabetes.
- Poor injection technique.
- Impaired awareness of hypoglycaemia.
- Preceding hypoglycaemia (< 3.5 mmol/L).
- Severe hepatic dysfunction.
- Renal dialysis therapy.
- Impaired renal function.
- Inadequate treatment of previous hypoglycaemia.
- Terminal illness.
- Metabolic illness.
- Endocrine illness (including Addisonian crisis).
- Drug ingestion e.g. oral hypoglycaemic drugs, beta-blockers, alcohol.
- Sudden cessation of peritoneal dialysis.
- Hypothermia.
- Sudden cessation of tube or IV feeding.

Lifestyle
- Inadequate carbohydrate intake.
- Increased exercise (relative to usual)/excessive physical activity.
- Irregular lifestyle.
- Increasing age.
- Excessive or chronic alcohol intake.
- Early pregnancy.
- Breast feeding.
- Injection into areas of lipohypertrophy.
- Inadequate blood glucose monitoring.

Table 3.58 – SIGNS AND SYMPTOMS OF HYPOGLYCAEMIA

Autonomic	Neurological
Sweating	Confusion
Palpitations	Drowsiness
Shaking	Odd behaviour
Hunger	Speech difficulty
	In-coordination
	Aggression
General malaise	Fitting
Headache	Unconsciousness
Nausea	

Table 3.59 – ASSESSMENT and MANAGEMENT of:

Hypoglycaemia in Adults

ASSESSMENT	MANAGEMENT
• Undertake ABCD assessment • Consider and look for medical alert/information signs (alert bracelets, chains and cards)	• Start correcting ABC problems (**refer to medical overview guideline**).
• Assess blood glucose level	• Measure and record blood glucose level (pre-treatment measure).
• Treatment **SEVERE:** patient unconscious (GCS ≤8)/convulsing, very aggressive	• When treating hypoglycaemia, use all available clinical information to help decide between glucagon IM, oral glucose gel (40%), or glucose 10% IV. • Keep nil by mouth as there is an increased risk of aspiration/choking. • Administer IV glucose 10% by slow IV infusion (**refer to glucose 10% guideline**). • Titrate to effect – an improvement should be observed rapidly. • Re-assess blood glucose level after 10 minutes. • If <5.0 mmol/L administer a further dose of IV glucose – if IV route not possible administer IM glucagon (onset of action 5–10 minutes). • Re-assess blood glucose level after a further 10 minutes. • Transfer immediately to the nearest suitable receiving hospital. • Continue patient management en-route. • Provide an alert/information call.
MODERATE: Patient with impaired consciousness: uncooperative, an increased risk of aspiration or choking	• If capable and cooperative, administer 15–20 grams of quick acting carbohydrate (sugary drink, chocolate bar/biscuit or glucose gel). • If NOT capable and cooperative, but able to swallow, administer 1–2 tubes of Dextrose Gel 40% or intra-muscular glucagon. • Re-assess blood glucose level after a further 10 minutes. • Ensure blood glucose level has improved to at least 5.0 mmol/L in addition to an improvement in level of consciousness. • If no improvement, repeat treatment up to three times. • If no improvement after three treatments, consider intravenous glucose 10%. • Refer to care pathway below.
MILD: Patient consciousness, orientated, able to swallow	• Administer 15–20 grams of quick acting carbohydrate (sugary drink, chocolate bar/biscuit or glucose gel). • Ensure blood glucose level has improved to at least 5.0 mmol/L. • If no improvement, repeat treatment up to three times. • If no improvement after three treatments, consider intravenous glucose 10%. • Refer to care pathway below.
	Care Pathway: **The following patients may be appropriate to leave at home:** • Patients whose episode was mild or moderate and who are now fully recovered after treatment, with a blood glucose level of > 5.0 mmol/L, who have been able to eat/drink a glucose and carbohydrate containing food, and are in the care of a responsible adult. • Advise patients to call for help if any symptoms of hypoglycaemia recur. • Ambulance services must arrange locally for a message to be forwarded to the local diabetic nurse/primary healthcare team. • Leave an advice sheet. **Transfer the following patients to further care – continue patient management en-route:** • Those who have had recurrent treatment within previous 48 hours. • Those patients taking **glibenclamide**. • Those patients with no previous history of diabetes and have suffered their first hypoglycaemic episode. • Those patients with a blood glucose level <5.0 mmol/L after treatment. • Those patients who have not returned to normal mental status within 10 minutes of IV glucose. • Those patients with any additional disorders or other complicating factors, e.g. renal dialysis, chest pain, cardiac arrhythmias, alcohol consumption, dyspnoea, seizures or focal neurological signs/symptoms. • Those patients with signs of infection (urinary tract infection, upper respiratory tract infections) and/or unwell (flu-like symptoms).

- Diabetic patients may present with significant dehydration resulting in reduced fluid in both the vascular and tissue compartments. Often this has taken time to develop and will take time to correct. Rapid fluid replacement into the vascular compartment can compromise the cardiovascular system particularly where there is pre-existing cardiovascular disease and in the elderly. Gradual rehydration over hours rather than minutes is indicated.
- Ketone measurement (blood or urine) is useful in the diagnosis of DKA.

3. Assessment and Management

For the assessment and management of hyperglycaemia refer to Table 3.61.

Methodology

For details of the methodology used in the development of this guideline refer to the guideline webpage.

Table 3.60 – SIGNS AND SYMPTOMS OF HYPERGLYCAEMIA

Symptoms
- Polyuria
- Polydipsia
- Increased appetite

Signs
- Fruity odour of ketones on the breath (resembling nail varnish remover)

NB Not everyone can detect this odour
- Lethargy, confusion and ultimately unconsciousness
- Dehydration, dry mouth and possible circulatory failure due to hypovolaemia
- Hyperventilation
- Kussmaul breathing
- Weight loss

Table 3.61 – ASSESSMENT and MANAGEMENT of:

Hyperglycaemia in Adults

ASSESSMENT	MANAGEMENT
• Undertake ABCD assessment	• Start correcting ABC problems (**refer to medical overview guideline**).
• If the patient is **TIME CRITICAL**	• Correct life-threatening conditions, airway and breathing on scene. • Then commence transfer to nearest suitable receiving hospital. NB These patients have a potentially life-threatening condition – they require urgent hospital treatment including insulin and fluid/electrolyte therapy.
• Consider and look for medical alert/information signs (alert bracelets, chains and cards)	
• Assess for blood glucose level	• Measure and record blood glucose level.
• Assess for signs of dehydration	**Signs may include:** • The skin of the forearm remains tented following a gentle pinch, only returning to its normal position slowly. • Dry mouth. • In severe cases this may lead to hypovolaemic shock – If the patient is shocked, with poor capillary refill, tachycardia, reduced Glasgow Coma Score (GCS) and hypotension, then **refer to the intravascular fluid therapy guideline**. • **DO NOT** delay at scene for fluid replacement.
• Assess heart rhythm	• Undertake ECG.
• Measure oxygen saturation (SpO_2)	• Administer supplemental oxygen if the patient is hypoxaemic SpO_2 <94%. • **Refer to oxygen guideline**.
	• Provide a pre-alert/information message. • If the patient has records of their blood or urine glucose levels, ensure these accompany the patient.

KEY POINTS

Glycaemic Emergencies in Adults

- **Clean skin prior to obtaining blood glucose reading (using either soapy solution or an alcohol wipe, allowing the finger to dry).**
- **If blood glucose reading of <4.0 mmol/L treat with oral solids (glucose drinks, chocolate or hypostop solutions) if GCS >13.**
- **If GCS ≤13 consider IM glucagon or 10% IV glucose 100 ml bolus and review patient's condition titrate to effect.**
- **Consider fluid therapy to counteract the effects of dehydration.**

Glycaemic Emergencies (Adults)

MILD

Patient conscious, orientated and able to swallow.

Administer 15–20 grams of quick acting carbohydrate (sugary drink, chocolate bar/biscuit or glucose gel).

Test blood glucose level if <4 mmol/L, repeat up to 3 times.

Consider intravenous glucose 10% or 1 mg glucagon.

MODERATE

Patient conscious, but confused/ disorientated or aggressive and able to swallow.

If capable and cooperative, administer 15–20 grams of quick acting carbohydrate (sugary drink, chocolate bar/biscuit or glucose gel). Test blood glucose level.

Continue to test after 15 minutes and repeat up to 3 times consider intravenous glucose 10%. (Repeat up to 3 times until BGL above 4 mmol/L.)

Test blood glucose level, if <4 mmol/L administer 15–20 grams of quick acting carbohydrate.

Continue to test after 15 minutes and repeat up to 3 times, consider intravenous glucose 10% (Repeat up to 3 times until BGL above 4 mmol/L.)

SEVERE

Patient unconscious/ convulsing or very aggressive or nil by mouth or where there is an increased risk of aspiration/choking.

Assess ABCD Measure and record blood glucose level.

Administer IV glucose 10% by slow IV infusion (refer to glucose 10% guideline) – titrate to effect.

Re-assess blood glucose level after 10 minutes.

If <5 mmol/L administer a further dose of IV glucose – if IV not possible administer IM glucagon (onset of action 5–10 minutes).

Re-assess blood glucose level after a further 10 minutes.

If no improvement transfer immediately to nearest suitable receiving hospital. Provide alert/ information call.

Figure 3.12 – Hypoglycaemic emergencies algorithm.