

Early management of diabetic ketoacidosis (DKA) in children

adapted from NICE guidelines August 2015 (updated December 2020) NG18

Recognition

History of polyuria, polydipsia and weight loss.
May have confusion, abdominal pain and hyperventilation.

- Blood glucose > 11 mmol L⁻¹
- pH < 7.3
- Blood bicarbonate < 15 mmol L⁻¹
- Ketones: blood beta-hydroxybutyrate > 3 mmol L⁻¹ or urine ketonuria ++ and above

Note: Usually not vomiting, acidotic or drowsy unless more than 5% dehydrated

Severity of DKA and degree of dehydration

Mild: 5% dehydration	Venous pH 7.2–7.29 or Bicarbonate < 15 mmol L ⁻¹
Moderate: 7% dehydration	Venous pH 7.1–7.19 or Bicarbonate < 10 mmol L ⁻¹
Severe: 10% dehydration	Venous pH < 7.1 or Bicarbonate < 5 mmol L ⁻¹

Management

Resuscitation

A ensure airway patency, insert NG tube if reduced conscious level or vomiting to decrease gastric distension

B 100% oxygen via a face mask with reservoir bag + titrate to oxygen saturations 94–98%; avoid intubation unless respiratory arrest or respiratory failure when anaesthetic assistance urgently required

C establish IV access, take venous bloods (pH, PaCO₂, bicarbonate, sodium, potassium, urea, creatinine, beta-hydroxybutyrate levels, glucose), monitor ECG, identify shock

- Give a fluid bolus 10 mL kg⁻¹ of balanced isotonic crystalloid or 0.9% sodium chloride over 60 min to children with NO shock
- Give a fluid bolus 10 mL kg⁻¹ of balanced isotonic crystalloid or 0.9% sodium chloride over 5–10 min and re-assess; repeat to a maximum of 40 mL kg⁻¹; inform PICU if shock is persists

D seek and identify signs and symptoms of raised intracranial pressure – headache, confusion, irritability, posturing, falling GCS, rising BP with bradycardia. Treat with 3% sodium chloride or mannitol, seek PICU advice and call an anaesthetist. Consider CT brain to determine the cause.

E Consider sepsis if fever, hypothermia, hypotension, lactic acidosis, refractory acidosis

Intravenous therapy: fluids and insulin

For children with dehydration, nausea and vomiting:

Calculate fluid requirements (FR) for each child

Aim: to correct fluid deficit over 48 h
FR = Maintenance fluids for 48 h + fluid deficit

Subtract 10 mL kg⁻¹ from fluid requirement for children who did not present with shock

Do not subtract resuscitation fluid volumes from fluid requirements for children who presented in shock
Isotonic balanced crystalloids or 0.9% sodium chloride initial fluid of choice - add potassium once passing urine. Add 5% dextrose to fluid when glucose less than 14 mmol L⁻¹

1–2 h after intravenous fluids commenced, start insulin infusion at 0.05–0.1 units kg⁻¹ h⁻¹

Monitor serum potassium and treat hypokalaemia

Do not give intravenous bicarbonate to correct acidosis

Observations

Strict fluid balance

Hourly capillary blood gas and blood glucose measurements

Capillary blood ketone levels 1–2 h (ideally point of care testing)

Initially two-hourly U+E's

Hourly BP, HR, RR, temperature

Hourly assessment of level of consciousness

Half hourly neuro observations including level of consciousness in children with severe DKA and children < 2 years old.

Urgently escalate symptoms of headache, bradycardia, changes in level of consciousness or changes in ECG (ST and T wave changes may indicate hypokalaemia)

Maintenance fluids calculation

4 mL kg⁻¹ h⁻¹ for first 10 kg of body weight

2 mL kg⁻¹ h⁻¹ for second 10 kg of body weight (11–20 kg)

1 mL kg⁻¹ h⁻¹ for each kg of body weight above 20 kg (up to max of 80 kg)

Fluid deficit (mL) = % dehydration x weight (kg) x 10

Fluid requirement (FR) over 48 h
10 kg child

= Maintenance requirement for 48 h + (fluid deficit – initial fluid given) (if no shock)

Example:

5% dehydrated, no shock at presentation, given 10 mL kg⁻¹ 0.9% saline

= (5 x 4 x 48) + [(5 x 10 x 10) – (10 x 10)]
= 1360 mL over 48 h = 28 mL h⁻¹