Diabetes Mellitus - Diabetic Ketoacidosis (DKA) - Full Clinical Guideline

Reference No: CG-T/2023/052

Does my patient have confirmed DKA?

ALL three of the following **must** be present to confirm DKA:

1. Capillary blood glucose (CBG) > 11.0mmol/l or known diabetes
2. Capillary blood ketones > 3.0 mmol/l OR 2+ ketonuria (on urinary ketone sticks)
3. Venous pH < 7.3 and/or venous bicarbonate < 15mmol/l

What are the immediate actions required?

- ABC assessment including all routine observations including GCS
- Capillary blood glucose check and ketone check
- Obtain urgent IV access and commence fluids (As per box A, action 2)
- Venous bloods obtained for U&E, bicarbonate , FBC and venous blood gas and blood cultures
- Urinalysis for ketones (if capillary ketones not available), MSU, βHCG (*if applicable*)
- VTE prophylaxis - unless contraindicated

What are the areas of prescribing/management that need consideration?

Assess the patient and using this DKA full guideline or the DKA summary guideline, formulate a plan for the following:

1. Prescribe IV fluids as appropriate
2. Assess K+ level and add K+ to fluids if appropriate
3. Commence Fixed rate insulin infusion (FRII) at 0.1units/kg/hr
4. Ensure that the medical team and nursing staff know what monitoring is required
5. Be clear about what resolution of DKA looks like (the exit strategy)

When should a patient's care be escalated?

Severe DKA is a life-threatening emergency (pH < 7.1 or ketones > 6 or HCO_3 < 5/anion gap >16)

If ketone/glucose levels do not fall as expected, **call for senior advice**. A HDU bed may be sought if:

- Hypokalaemia (K+ < 3.5mmol/l)
- GCS < 12
- Shocked pulse > 100 or SBP < 90
- Young (18-25yr)
- Pregnant (ketones kill babies, NOT glucose)

What do we ultimately want to achieve?

- Resolution of ketonaemia <0.6mmol/l **and**
- Venous bicarbonate >15mmol/l **and**
- Diabetes controlled with SC insulin **and**
- Patient eating and drinking **and**
- Patient has been seen by the Diabetes Team, or there is a plan in place to do so
- OR exit from pathway has been recommended by the diabetes team

Box A: Immediate management 0 to 60 minutes	
Action 1	**URGENT INITIAL ASSESSMENT AS ABOVE** **Assess for precipitating factors:** Non-compliance, sepsis/infection, stress, idiopathic, others (steroids, alcohol, pregnancy, pump failure) **Stop all nephrotoxic drugs and ketoacidosis causing medications (eg SGLT2 inhibitors, dapagliflozin ®, cannagliflozin ®, empagliflozin)** **CONTINUE BASAL INSULIN (See Box A Action 3 for insulin brand names)** If patient is using pump therapy - stop the pump and completely disconnect. Refer to diabetes specialist nurses for input.
Action 2	**IV FLUIDS** Ensure 0.9% Sodium Chloride is administered via infusion pump **Is the patient shocked?** If systolic BP<90mmHg: • Give 1 litre of 0.9% sodium chloride over 15 minutes (**Bag 1**) • If systolic BP remains<90mmHg repeat and inform Medical colleague for advice If Systolic BP>90mmHg • Give 1 litre of 0.9% sodium chloride over 1 hour (**Bag 1**) Subsequent bags are prescribed as follows: • The rate of fluid replacement dependent on age/fitness/dehydration of the patient and the **potassium content** of the bag: Plan fluid replacement and use clinical judgement. PLEASE REFER TO ACTION 4 BELOW TO DETERMINE IF POTASSIUM SHOULD BE ADDED TO THE BAG OF FLUIDS **Bag 2** - 0.9% sodium chloride 1L +/- 20mmol/l KCl over 2hrs **OR** 0.9% sodium chloride 1L +/- 40mmol/l KCl over 4hrs **Bag 3** - 0.9% sodium chloride 1L +/- 20mmol/l KCl over 2hrs **OR** 0.9% sodium chloride 1L +/- 40mmol/l KCl over 4hrs **Bag 4** - 0.9% sodium chloride 1L +/- potassium chloride over 4 hours **Add 10% glucose given at 125ml/hr if the blood glucose falls below 14mmol/l.** This fluid

	runs alongside the 0.9% NaCl infusion. Note: Hypotension is likely to be low circulating volume but consider other causes such as sepsis/heart failure
Action 3	**Insulin:** RDH: Prescribe 30 units soluble insulin in 30ml NaCl - prefilled syringes (ready-made). These must be obtained from Pharmacy. QHB: Prescribe 50 units soluble insulin (Actrapid) in 49.5mls NaCl. This is manufactured by nursing staff on the ward Commence on a **FIXED RATE** insulin infusion at 0.1/units/Kg/hr **MAXIMUM rate 15ml/hr** **If patient takes long acting insulin eg Insuman Basal®, Humulin I®, Glargine®, Levemir®, Degludec®, Toujeo® Semglee® , Abasaglar® continue alongside fixed rate insulin infusion (FRII)** **Disconnect** all continuous subcutaneous insulin infusion pumps and do not use without specialist advice
Action 4	**Potassium (KCl):** Life-threatening hypokalaemia can occur with insulin infusion **Venous potassium level** — **Potassium Chloride(KCL) replacement** >5.3mmol/L — NONE 3.5-5.3mmol/L — 10mmol/hr (Eg. 20mmol over 2 hrs) <3.5 — Senior advice required **If KCl rate of infusion >10mmol/hr cardiac monitoring is recommended.** Senior input should be sought if cardiac monitoring is unavailable
Action 5	**Reassess patient:** **Poor urine output for > 2 hours** → Bladder scan/Catheterise **Persistent vomiting AND reduced GCS** → Consider NGT **SpO_2 <94% on air** → ABG/CXR **Persistent acidosis** → Consider other causes **GCS <13** → Consider CT Head **Seek senior review if patient not responding to treatment or is deteriorating**

Box B: Management 60 minutes to 6 hours	
Aims	• Venous bicarbonate rise of at least 3mmol/L/hr OR a rate of fall of ketones at least 0.5mmol/L/hr and blood glucose fall of at least 3mmol/L/hr • Maintain serum potassium within normal range • Avoid hypoglycaemia
Action 1.	**Monitoring requirements** CBG → Hourly VBG → 2, 4, 6, 12, 18 hours Fluid balance → Hourly NEWS → Hourly
Action 2.	**IV FLUIDS** Follow fluid prescription as per **Box A Action 2** Refer to **Box A Action 4** to determine if potassium is required **When CBG <14mmol/L add 125mls/hr of 10% glucose (to run alongside NaCl)** **You can consider reducing the rate of NaCl to reduce the risk of fluid overload**
Action 3.	**REASSESS PATIENT** Assess volume status hourly, HR, BP, urine output, JVP, chest auscultation and adjust fluid rates accordingly
Action 4.	**ENSURE TREATMENT TARGETS ARE BEING MET** 1. Fall of CBG of >3mmol/L until CBG <14mmol/l 2. Fall of capillary blood ketones of >0.5mmol/l/hr Rise in venous bicarbonate of >1.0mmol **If patient is not improving as expected, check the patency of cannula and IV lines, check the rate of the insulin infusion and check the infusion pumps BEFORE increasing insulin by 1-2 units (ml)/hr**

Box C: Management 6 to 12 hours	
Action 1.	**IV fluids** **Bag 5 -** 1L 0.9% NaCl +/- KCl over 4 hours (after completion of previous 4 hour bag**)** **Bag 6** - 1L 0.9% NaCl +/- KCl over 6 hours If CBG <14mmol/l add 10% glucose at a rate of 125ml/hr (using separate IV access)
Action 2.	**REASSESS PATIENT** Consider DKA resolution Reassess CV status Check CBG,blood ketones,VBG,chloride,U&E, and signs of DKA resolution
Action 3.	Refer **early** to Diabetes Team Diabetes specialist nurse referral

Box D: Management 12 to 24 hours	
Actions	RESOLUTION OF DKA **Resolution is defined as pH >7.3 AND/OR blood ketones of <0.6mmol/L Bicarbonate of 15mmol**
	If DKA has resolved and the patient is **eating and drinking** switch to SC insulin and continue insulin infusion for at least 1 hour after administration of subcutaneous insulin **with a meal** If DKA has resolved but the patient **cannot eat** or has another indication for IV insulin (severe sepsis/MI) use variable rate insulin infusion Inform the Diabetes Specialist Nurse and the Diabetes Team
By 24 hours	If the Ketonaemia and acidosis have not resolved • Seek urgent senior review or diabetes team support Consider starting Levemir® in newly diagnosed diabetes at a dose of 0.25 units per Kg once daily subcutaneously

Development of Guideline:	**Diabetes safety group**
Consultation with:	**Diabetes consultants** **Diabetes specialist nurses**
Approved by:	**Diabetes Safety Group - October 2020** **Medical Division - 17/12/2020** **Reviewed no change – Diabetes Safety Group – Dec 2023** **Medicine Division -**
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Key Contact:	**Dr Suma Sugunendran – Consultant** **Amy Redfern – Diabetes specialist nurse (RDH)** **Zara Redfern – Diabetes specialist nurse (QHB)** **Gavin Bohan – Pharmacist prescriber**