**Diabetes Mellitus**

 **Management of Diabetic Emergencies**

* Patients with diabetic ketoacidosis (DKA) and hyperglycaemic hyperosmolar non ketotic coma are treated with intravenous fluids and insulin and Potassium supplement if required.
* Both DKA and hyperglycaemic hyperosmolar non ketotic coma are often precipitated by another illness, frequently infection. An attempt should be made to search for and treat any precipitating illness.
* When treating patients with hyperglycaemic hyperosmolar non ketotic coma, it is important to follow sodium and serum osmolality measurements to document return to normal values.

**Diabetic Ketoacidosis**

**Definition:** Severe uncontrolled diabetes with ketonaemia / ketonuria, metabolic acidosis, usually with hyperglycaemia.

**Goals of therapy**

Treatment goals of DKA consist of reversing the underlying metabolic abnormalities, rehydrating the patient, and normalizing the serum glucose

**Management of Diabetic Ketoacidosis**

1. Confirm diagnosis (↑ plasma glucose, positive serum ketones, metabolic acidosis).

2. Admit to hospital; intensive-care setting may be necessary for frequent monitoring or if pH less than 7.0 or unconscious.

3. Assess: Serum electrolytes (K+, Na+, Mg2+, Cl–, bicarbonate, phosphate) Acid-base status—pH, HCO3 –, PCO2, *b*-hydroxybutyrate, Renal function (creatinine, urine output)

4. Replace fluids: 2–3 L of 0.9% saline over first 1–3 hours (5–10 mL/kg per hour); subsequently, 0.45% saline at 150–300 mL/hour; change to 5% glucose and 0.45% saline at 100–200 mL/hour when plasma glucose reaches 250 mg/dL (14 mmol/L).

5. Administer regular insulin: IV (0.1 units/kg) or IM (0.4 units/kg), then 0.1 units/kg per hour by continuous IV infusion; increase 2- to 10-fold if no response by 2–4 hours. If initial serum potassium is less than 3.3 mmol/L (3.3 mEq/L), do not administer insulin until the potassium is corrected to greater than 3.3 mmol/L (3.3 meq/L).

**Insulin infusion rate: on hourly blood glucose check**

• If > 14 mmol/L, increase insulin rate by 1 unit/hour

• If < 9 mmol/L, decrease insulin rate by 1 unit/hour

• If < 3.5 mmol/L, stop insulin for an hour, restart at 1 unit/hour if > 3.5mmol/L

• If persistently above 14 mmol/L, despite increasing insulin to 6 units/hour, ask for medical review and check pump devices, IV lines and IV cannulae to ensure patient is getting prescribed insulin dose.

6. Assess patient: What precipitated the episode (non-compliance, infection, trauma, infarction, cocaine)? Initiate appropriate work-up for precipitating event (cultures, CXR, ECG).

7. Measure capillary glucose every 1–2 hours; measure electrolytes (especially K+, bicarbonate, phosphate) and anion gap every 4 hours for first 24 hours.

8. Monitor blood pressure, pulse, respirations, mental status, and fluid intake and output every 1–4 hours.

9. Replace K+: 10 mEq/hour when plasma K+ less than 5.5 mEq/L, ECG normal, urine flow and normal creatinine documented; administer 40–80 mEq/hour when plasma K+ less than 3.5 mEq/L or if bicarbonate is given.

10. Continue above until patient is stable, glucose goal is 150–250 mg/dL, and acidosis is resolved. Insulin infusion may be decreased to 0.05–0.1 units/kg per hour.

11. Administer intermediate or long-acting insulin as soon as patient is eating. Allow for overlap in insulin infusion and subcutaneous insulin injection.

**Key steps in the management of DKA**

1. Ensure all paediatric / adolescent patients are managed using a paediatric protocol.

2. Confirm the diagnosis (H+ > 45 mEq/L or HCO3 - < 18 mmol/L or pH < 7.3 on venous gas with ketonaemia or ketonuria).

3. Initiation of IV fluids within 30 minutes of arrival.

4. Initiation of IV insulin within 1 hour of arrival.

5. Regular monitoring of K+ level and appropriate replacement.

6. Commence IV glucose infusion once BG < 14 mmol/L.

7. Convert back to usual mealtime SC insulin regimen when HCO3- within normal reference range and patient is eating normally (stop IV fluids and IV insulin 30 minutes after usual injection of pre-meal SC insulin).

8. **WBC count**: This is often raised in DKA. Only give antibiotics if there is clear evidence of infection

**9. Cerebral oedema**: Children and adolescents are at the highest risk. Consider if:

headaches, or reduced conscious level. Monitoring for signs of cerebral oedema should start from the time of admission and should continue until up to at least 12 hours after admission. If there is a suspicion of cerebral oedema or the patient is not improving as expected, within 4 hours of admission, call the consultant. Check arterial blood gases and dminister **Mannitol IV (100 ml of 20% over 20 minutes) or dexamethasone IV 8 mg (discuss with** **Consultant)** and undertake CT scan to confirm findings.

**Hyperglycaemic Hyperosmolar Non Ketotic coma**

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In hyperglycaemic hyperosmolar non ketotic coma, the average fluid deficit is 8- 12 L. Use 0.9 NS for the initial resuscitation (1 L). Switch to 0.45 NS at a rate of 200-500 mL/hr. Goal is 3-4 L over the initial 4-hour period. The corrected serum sodium and the serum osmolarity should be gradually returned to normal over a 24- to 36-hour period. Insulin infusion can be started after initiating infusion of fluids. A total of 0.1 U/kg/hr of regular insulin is given if the K >3.3 mEq/L. Potassium replacement is similar to that in patients with DKA. Frequent monitoring of glucose and electrolytes is necessary to avoid iatrogenic electrolyte abnormalities, such as hypokalemia.

 **(Insulin)**