

## Management of Diabetic Ketoacidosis

### Introduction of Diabetic Keto Acidosis

It is a disorder mainly in patient with **type 1 Diabetes Mellitus**, but may occur in Type 2 Diabetes Mellitus also. It may result from increased insulin requirements in Type 1 Diabetes mellitus **during infection, trauma, Myocardial Infarction, or surgery**. It is a life-threatening medical emergency with mortality rate  $<5\%$  individual under 40 years of age, but more severe prognosis in older people with mortality rate  $>20\%$ .

### Essential criteria for diagnosis of Diabetic Ketoacidosis

- Hyperglycaemia (Blood glucose level  $>250$  mg/dl).
- Metabolic acidosis- blood pH  $<7.3$  & serum  $\text{HCO}_3^- <15$  mg/L.
- Ketone bodies +ve in serum.

### Therapeutic Goal

- To restore plasma volume.
- To reduce blood glucose level and osmolality.
- To correct acidosis.
- To replenish electrolyte losses.
- To identify and treat precipitating factors.

### Treatment

- Admit in ICU.
- A- Maintain patency of airway.
- B- Breathing,  $\text{SpO}_2 >90\%$ . Intubation and mechanical ventilation.
- C- Circulation, IV-line access.
- D- Drugs (Insulin).
- E- Electrolytes replacement.
- F- Fluid replacement.

### Fluid replacement

- Fluid deficit 4 to 5 L.
- Fluid of choice 0.9% NS.
- Should be started in emergency department as soon as diagnosis is established.
- Should be infused @ 1 L/hour over the first 1 to 2 hour.

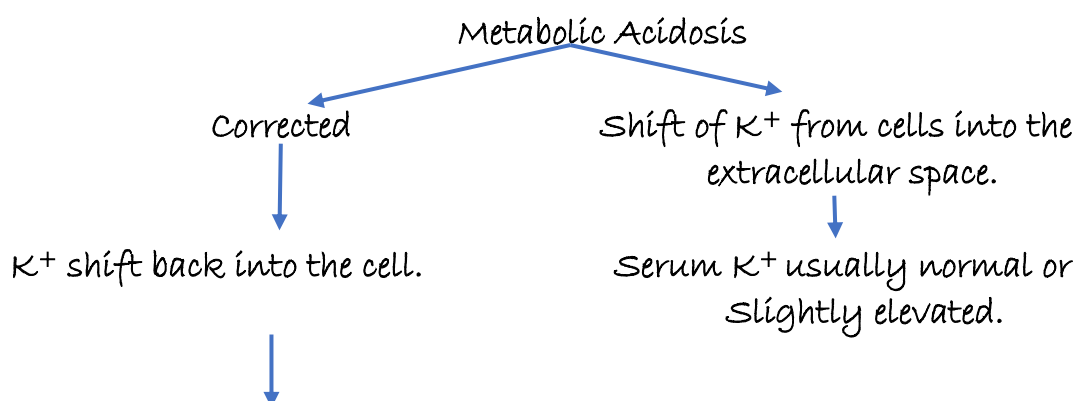
- After the first 2 L of fluid have been given, IV fluid infusion should be @ 300 to 400 ml/hour.
- Use 0.9% NS unless the serum sodium is  $>150\text{mEq/L}$ , then 0.45% of NS should be used.
- The volume status should be monitor Clinically.
- If volume replacement  $< 3$  to 4 L in 8 hours, difficult to restore normal perfusion.
- If volume replacement  $> 5$  litre in 8 hours, Acute Respiratory Distress Syndrome (ARDS) and cerebral oedema may occur.
- When blood glucose levels fall to Approx. 250 mg/dl, the fluid should be changed to 5% glucose containing solution to maintain serum glucose in the range of 250 to 300 mg/dl. This will prevent development of hypoglycaemia and cerebral oedema due to rapid decline of blood glucose level.

### Insulin replacement

- Immediately after initiation of fluid replacement.
- Type of insulin- HIR
- Loading dose- 0.1 unit/kg IV bolus prime the tissue insulin receptors.
- Followed by 0.1 unit/kg/hour continuously IV infused to replace the deficit of insulin.
- If blood glucose level fails to fall at least 10% in the first hour, repeat loading those (0.1 unit per kg) recommended.
- The insulin dose should be adjusted to lower the blood glucose level by about 50 to 70 mg/dl/hour.

### Potassium

- Total body potassium loss from polyuria and vomiting may be as high as 200mEq.



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Hypokalaemia.

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Need K<sup>+</sup> replacement.

- Potassium replacement should be started as soon as metabolic acidosis starts to resolve.
- Potassium Chloride (KCl)- 10 to 30mEq/hour should be infused during 2nd and 3rd hours after beginning of therapy.
- Food high in potassium content should be prescribed when the patient has recovered sufficiently to take food orally.
- Tomato juice has 14mEq of K<sup>+</sup>/240 ml, and a medium sized banana contains about 10mEq of potassium.

### Sodium Bicarbonate (NaHCO<sub>3</sub><sup>-</sup>)

The use of sodium bicarbonate in the management of DKA has been questioned because of the following potentially harmful consequences:

- Development of hypokalaemia from rapid shift of K<sup>+</sup> into the cells due to overcorrected metabolic acidosis.
- Tissue anoxia from reduced dissociation of oxygen from haemoglobin when metabolic acidosis is rapidly reversed.
- Cerebral acidosis resulting from lowering of CSF pH.

Therefore, it is recommended that HCO<sub>3</sub><sup>-</sup> should be administered in DKA, if the arterial blood pH is ≤ 7.0

One or two ampoules of NaHCO<sub>3</sub><sup>-</sup> (1 ampoule contains 44mEq/50ml) should be added to 1 L of 0.45% saline with 20mEq KCl and infused over 1 to 2 hour.

### Phosphate

- Phosphate requirement is seldom required in treating DKA.
- However, if severe hypophosphatemia of less than 1mEq/dl develops during insulin therapy, or small amount of phosphate can be replaced per hour as the potassium salt.

### Hyperchloremic acidosis during therapy

- A portion of the bicarbonate deficit is the placed with chloride ions infused in large amounts as NS to correct the dehydration.

- Plasma Lyte solution (pH- 7.4, Cl- 98mEq/L) instead of NS (pH- 5.5, Cl- 154mEq/L) should be used to prevent hyperchloremic acidosis.

#### Treatment of associated infections

- **Antibiotics** should be prescribed as causative organisms identified.

#### Transition to subcutaneous insulin regimen

- Once the DKA is **controlled** and the patient is awake and able to eat, subcutaneous insulin therapy can be initiated.

References: - CMDT.

Harrison's Principle of Internal Medicine.

Katzung, Basic & Clinical Pharmacology.