Management of diabetic ketoacidosis and hypoglycemia

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Diabetic ketoacidosis

- **Is a serious acute emergency situation that requires admission to hospital with a risk of death.**
- **It develops as a result of insulin deficiency**
- **It is a characteristic feature of *type I diabetes* but may occur with *type II especially during stress*.**

Diabetic ketoacidosis

In absence of insulin, many metabolic changes occur:

Carbohydrates

- **↑ glycogenolysis, ↑ gluconeogenesis**

Protein

- **↑ proteolysis thus providing amino acid as precursors for gluconeogenesis.**

(hyperglycemia)

Diabetic ketoacidosis

Fats

- ↑ **Fat breakdown to free fatty acids then to acetyl-CoA that is converted to acetoacetic acid and β-hydroxybutyric acid and acetone *(ketone bodies).***

(ketonemia, ketonuria & metabolic acidosis).

Diabetic ketoacidosis

- **Hyperglycemia-induced → glycosuria → osmotic diuresis & severe fluid loss.**
- **Fluid loss → dehydration & electrolyte imbalance**
- **Metabolic acidosis induces hyperventilation**

Diabetic ketoacidosis

Insulin deficiency

↑ glycogenolysis
↑ gluconeogenesis,
↑ protein catabolism
↑ Lipolysis

↓

↑ Hyperglycemia

↓

Glycosuria

↓

Osmotic diuresis

↓

Dehydration

↑ Lipolysis

↓

↑ Free fatty acids

↓

↑ Ketone bodies

(ACAC, β-OHB, Acetone)

↓

Ketonemia

↓

Ketonuria & Acidosis

Characters of diabetic ketoacidosis

- **Hyperglycemia**
- **Glycosuria**
- **Osmotic diuresis**
- **Polyuria**
- **Thirst**
- **Polydipsia (increased drinking).**
- **Dehydration**
- **Electrolyte imbalance**
- **Ketogenesis (Ketonemia, Ketonuria)**
- **Metabolic acidosis**

Diagnostic Criteria in diabetic ketoacidosis

- **Blood glucose > 250 mg/dl**
- **pH < 7.35**
- **$HCO3^{--}$ < 15 mEq/L**
- **Ketonemia**

Precipitating factors for diabetic ketoacidosis

- **Infections**
- **Missed insulin treatments**
- **Newly diagnosed diabetes.**
- **Use of medications: as steroids, thia zide diuretics.**
- **Trauma, stress, surgery**

Clinical symptoms for diabetic ketoacidosis

- Classic features of hyperglycemia
  - Thirst, polyuria
- Vomiting/abdominal pain
- Ketotic breath (fruity, with acetone smell)
- Confusion
- Coma

Lines of treatment of diabetic ketoacidosis

Adequate correction of :

- **Dehydration** ***(fluid therapy)***
- **Hyperglycemia** ***(insulin)***
- **Electrolyte deficits** ***(potassium therapy)***
- **Ketoacidosis** ***(bicarbonate therapy)***

Treatment of diabetic ketoacidosis

- **Fluid therapy (Rehydration)**
  - **Infusion of isotonic saline (0.9% sodium chloride) at a rate of 15–20 mL/kg/hour to restore blood volume and renal perfusion.**

Treatment of diabetic ketoacidosis

- **Insulin therapy (Short acting insulin)**
  - **Regular insulin, should be administered by means of continuous intravenous infusion in small doses through an infusion pump (0.1 U/kg/h).**
  - **Insulin stops lipolysis and promotes degradation of ketone bodies.**

Treatment of diabetic ketoacidosis

- **Potassium therapy**
  - **potassium replacement must be initiated.**
  - **potassium is added to infusion fluid to correct the serum potassium concentration.**

Treatment of diabetic ketoacidosis

- **Bicarbonate therapy**
  - **bicarbonate therapy should be used Only if the arterial pH < 7.0 after 1 hour of hydration, *(sodium bicarbonate should be administered in every 2 hours until the pH is at least 7.0).***

Hypoglycemia

- Blood sugar of less than 70 mg/dl is considered hypoglycemia.
- Is a life threatening disorder that occurs when blood glucose level becomes < 50 mg/dl
- One of the common side effects of insulin in treating type I diabetes.

Causes of Hypoglycemia

- **Overdose of insulin or oral hypoglycemic drugs *(sulfonylureas - meglitinides).***
- **Excessive physical exercise**
- **Missed or delayed meal.**
- **Drug-induced hypoglycemia.**

Causes of Hypoglycemia

- **Hypoglycemia can be an early manifestation of other serious disorders (sepsis, congenital heart disease, brain hemorrhage).**

Characters of Hypoglycemia

Autonomic features

- ↑ **sympathetic**: tachycardia, palpitation, sweating, anxiety, tremor.
- ↑ **parasympathetic**: nausea, vomiting.

Characters of Hypoglycemia

Neurological defects:

- **Headache, visual disturbance, slurred speech, dizziness.**
- **Tremors, mental confusion, convulsions.**
- **Coma due to ↓ blood glucose to the brain.**

Precautions

Hypoglycemia can be prevented by:

- **Blood sugar level should be checked routinely**
- **Patients should carry glucose tablets or hard candy to eat if blood sugar gets too low.**

Precautions

- **Diabetic patient should wear a medical ID bracelet or carry a card.**
- **Patient should not skip meals or eat partial meals.**
- **Patient should eat extra carbohydrates if he will be active than usual.**

Treatment of Hypoglycemia

Conscious patient:

- **Sugar containing beverage or food (30 g orally).**

Unconscious patient:

- **Glucagon (1 mg S.C. or I.M.)**
- **20-50 ml of 50% glucose solution I.V. infusion *(risk of possible phlebitis).***

	Hypoglycemic coma	Hyperglycemic coma Diabetic ketoacidosis
Onset	Rapid	Slow - Over several days
Insulin	Excess	Too little
Acidosis & dehydration	No	Ketoacidosis
B.P.	Normal	Subnormal or in shock
Respiration	Normal or shallow	air hunger
Skin	Pale & Sweating	Hot & dry
CNS	Tremors, mental confusion, sometimes convulsions	General depression
Blood sugar	Lower than 70 mg/100cc	Elevated above 200 mg/100cc
Ketones	Normal	Elevated

SUMMARY

- **Hyperglycemic ketoacidosis: is treated by insulin, fluid therapy, potassium supplementation and bicarbonate.**

- **Hypoglycemia: is treated by oral tablets, juice or honey *(if patient is conscious)* and by glucagon (1 mg S.C. or I.M.) or 20-50 ml of 50% glucose solution I.V. infusion *(if patient is unconscious).***