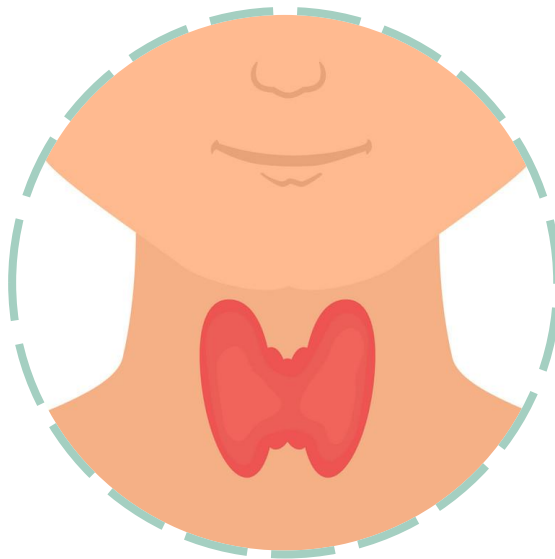


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Endocrine Block

Pharmacology team 438

Management of Diabetic ketoacidosis and Hypoglycemia

Objectives:

By the end of the lecture , you should know:

- Identify the different characters of diabetic ketoacidosis
- Know the different lines of treatment for hyperglycemia, dehydration, electrolyte deficits and ketoacidosis
- Recognize the characters of hypoglycemia and how it can be prevented.
- Describe the different treatment of hypoglycemia
- Be able to differentiate between hypoglycemia and hyperglycemia coma

Color index:

Black : Main content

Red : Important

Blue: Males' slides only

Purple: Females' slides only

Grey: Extra info or explanation

Green : Dr. notes

Diabetic Ketoacidosis “DKA”

- It 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.

In absence of insulin, many metabolic changes can occur:

Carbohydrates

↑ Glycogenolysis
↑ Gluconeogenesis

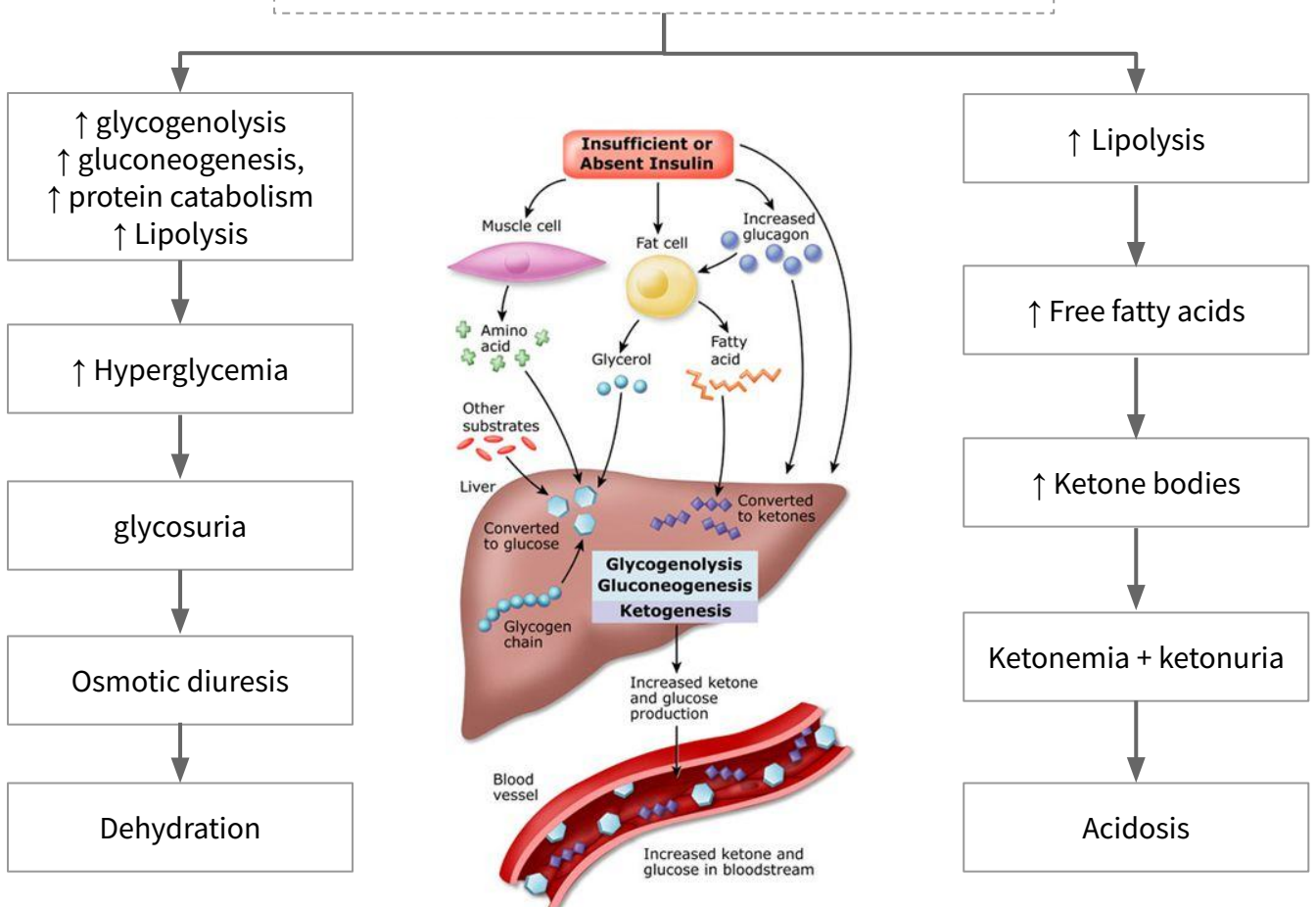
Proteins

↑ proteolysis thus providing amino acid as precursors for gluconeogenesis

Fats

↑ Lipolysis & ketogenesis:
Fat breakdown to **free fatty acids** then to acetyl CoA that is converted to ketone bodies (Acetoacetic acid, β-hydroxybutyric acid and acetone)

Insulin deficiency lead to :



- Hyperglycemia-induced **glucosuria, osmotic diuresis & severe fluid loss**
- Fluid loss induces **dehydration & electrolyte imbalance**
- Metabolic acidosis induces **hyperventilation** (Kussmaul Breathing)

Characters of diabetic ketoacidosis

1. **Hyperglycemia**
2. Glucosuria
3. Osmotic diuresis
4. Polyuria
5. Thirst
6. Polydipsia
7. **Dehydration**
8. Electrolytes imbalance
9. **Metabolic acidosis**
10. Ketogenesis (**ketonemia**, ketonuria)

Clinical symptoms for diabetic ketoacidosis

- 1 Classic features of hyperglycemia (thirst, polyuria)
- 2 Nausea, vomiting, abdominal pain
- 3 Tachycardia
- 4 Kussmaul–Kien respiration (rapid & deep)
- 5 Ketotic breath (**fruity, with acetone smell**)
- 6 Mental status changes (confusion, coma)

Diagnostic Criteria in diabetic ketoacidosis

Blood glucose level > 250 mg/dl

Arterial pH < 7.35

Serum bicarbonate level <15 mmol/L

- Ketonemia
- Ketonuria

Treatment of diabetic ketoacidosis ¹

Adequate correction of:

1. **Dehydration by: (fluid therapy)**
2. **Hyperglycemia by: (insulin)**
3. **Electrolyte deficit: (potassium therapy)**
4. **Ketoacidosis: (bicarbonate therapy)**

Rehydration (fluid therapy)

01 >

- Restore blood volume and perfusion of tissues.
- Infusion of isotonic saline (0.9% sodium chloride) at a rate of 15–20 ml/kg/hour or lactated Ringer solution.

Insulin therapy (short acting insulin)

02 >

- **Regular insulin**, should be administered by means of **continuous I.V infusion in small doses** through an infusion pump (0.1 U/kg/h).
- Subcutaneous absorption of insulin is reduced in DKA because of dehydration therefore, **intravenous routes are preferable**.
- Insulin stops lipolysis and promotes degradation of ketone bodies.

Potassium therapy

03 >

- potassium replacement must be initiated, added to infusion fluid to correct serum potassium concentration (to fix hypokalemia which can be worsened by insulin therapy too)

Bicarbonate therapy

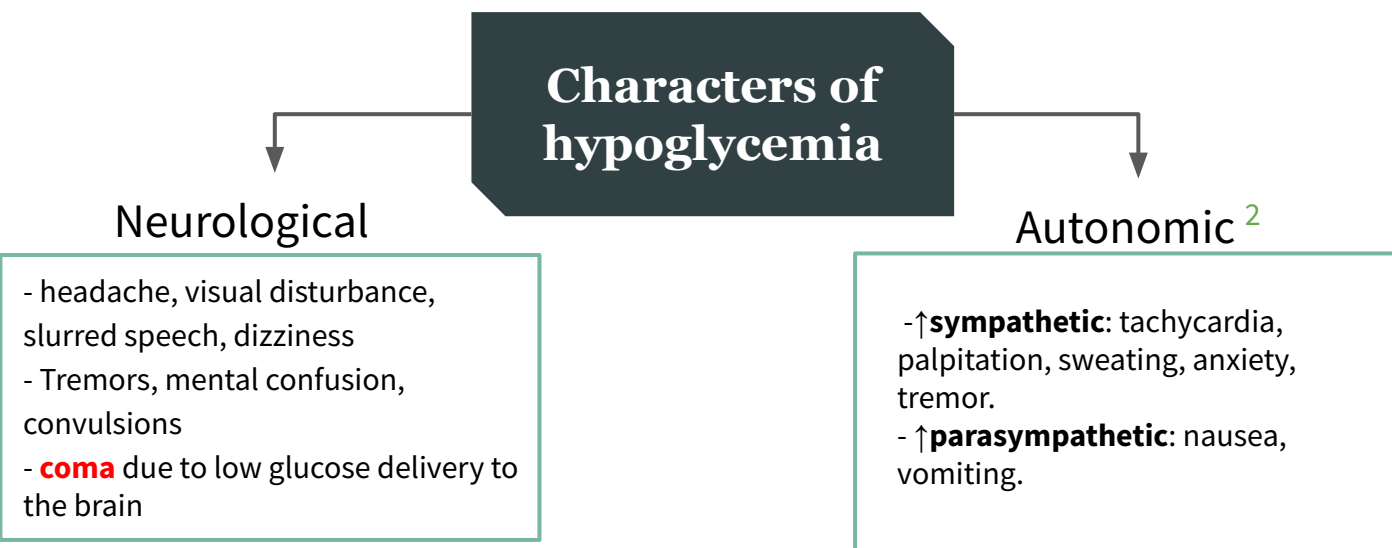
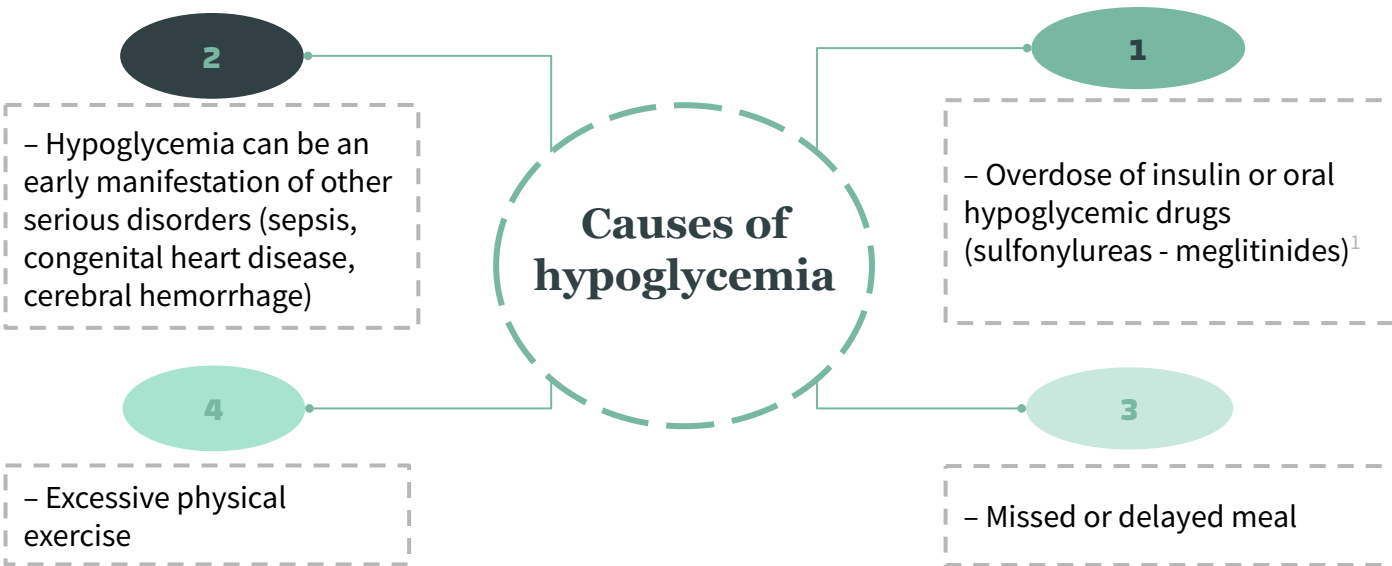
04 >

- **For correction of metabolic acidosis**
- bicarbonate therapy should be used **only if the arterial pH < 7.0 after 1 hour of hydration**, (sodium bicarbonate should be administered every 2 hours until the pH is at least 7.0).

1. symptomatic treatment

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.



Precautions:

Hypoglycemia can be prevented by:

- 1 Monitoring blood glucose level (blood sugar level should be checked routinely).
- 2 Patients should carry **glucose tablets or hard candy** to eat it if blood sugar gets too low.
- 3 Diabetic patient should wear a medical ID bracelet or carry a card.
- 4
 - Patient should not skip meals or eat partial meals.
 - Patient should eat extra carbohydrates if he will be more active than usual

1. Induced by insulin secretagogues only, and not insulin sensitizers (e.g. metformin, TZD)
2. If the patient is on beta-blockers he may not experience the typical adrenergic warning symptoms

Treatment of hypoglycemia

Drugs	Glucagon	Sugar
P.K	<ul style="list-style-type: none"> • Glucagon (1 mg S.C or I.M) • 20-50 ml of 50% glucose solution I.V infusion. 	<ul style="list-style-type: none"> • Sugar containing beverage or food (30 g orally).
Uses	<ul style="list-style-type: none"> • Unconscious patient 	<ul style="list-style-type: none"> • Conscious patient.
ADR	<ul style="list-style-type: none"> • Risk of possible phlebitis 	-

Comparison between Hypoglycemic and Hyperglycemic coma

Type of Coma	Hypoglycemic coma	Hyperglycemic coma (Diabetic Ketoacidosis)
Cause	Excess insulin	Too little insulin
Onset	Rapid	Slow - Over several days
Acidosis and 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
Treatment	<ul style="list-style-type: none"> • Conscious patient: oral glucose tablet, juice or honey. • Unconscious patient: Treated by 20-50 ml of 50% glucose solution I.V infusion or glucagon (1 mg , S.C. or I.M.) 	<ul style="list-style-type: none"> • Fluid therapy • Insulin • Potassium supplement • Bicarbonate

Quiz

MCQ

1. A patient presented with nausea, vomiting and persistent thirst, he had fruity smelling breath, blood glucose level was 330 mg/dL and arterial PH was 6.7. What is the first management step?

A. bicarbonate therapy B. rehydration C. antiemetic D. admission for monitoring

2. Which of the following used to correct the acidosis in diabetic ketoacidosis after hydration?

A. Potassium B. Insulin C. Glucagon D. Bicarbonate

3. Which of the following electrolyte deficiency happen in Diabetic ketoacidosis?

A. Calcium B. Sulfate C. Uranium-235 D. Potassium

4. Which one of the following ADR caused by glucagon treatment for hypoglycemia?

A. hypothermia B. Hypercalcemia C. Phlebitis D. Bradycardia

5. A 58 years old male who fall down due to hypoglycemic coma. What is the treatment in this situation?

- A. By giving him orange juice.
- B. By giving him I.V regular Insulin.
- C. By giving him I.M Glucagon.
- D. All of them.

SAQ

1- A 10 years old child came to ER with fruity breath, he was with hot and dry skin, his mother said that his child tend to be thirsty all the time. The biochemical investigation shows (Blood glucose level : 267 mg/dl, Arterial PH :6.9, dehydration with ketonuria).

Q1: What is the diagnosis?

Q2: Mention all the lines of treatment to manage this case (STEPWISE)

2- A 48 years old woman who lost consciousness due to hypoglycemic coma.

Q3: What is the treatment to manage this case?

3- A 13 years old girl with tremors and headache, she is known case for DM1, you suspect hypoglycemia.

Q4: what is the management of this case?

MCQ

Q1 B

Q2 D

Q3 D

Q4 C

Q5 C

SAQ

Q1 Diabetic ketoacidosis

Q2 1. Isotonic saline (fluid therapy) 2. Insulin 3. Potassium replacement 4. Bicarbonate

Q3 I.M glucagon or I.V. Glucose solution

Q4 Oral glucose tablet, juice or honey

Answers:



*Thank you for all your
love and support.*

Good luck future doctors!

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