King Saud University

College of Medicine

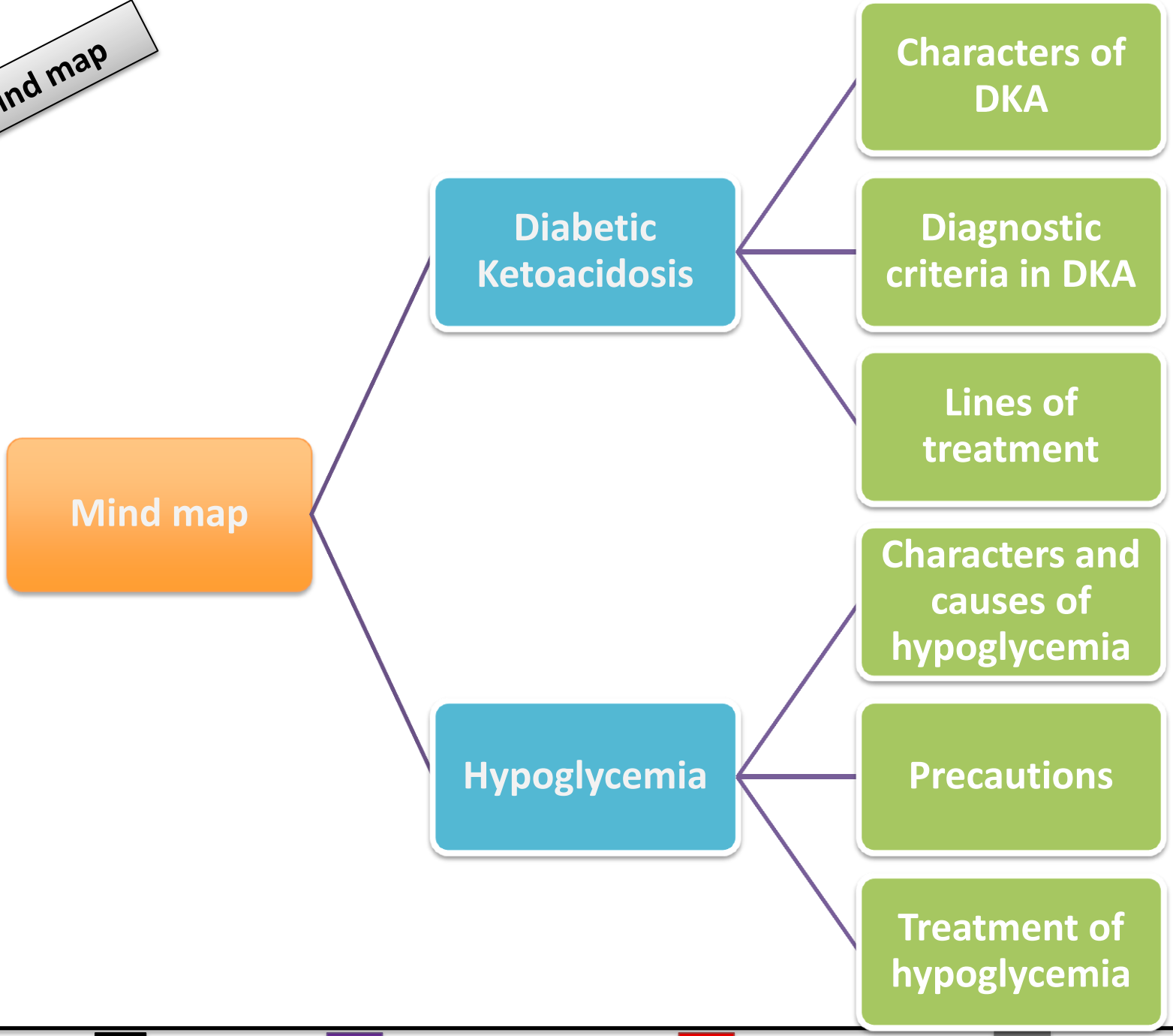
2nd Year, Endocrine Block

PHARMACOLOGY 433

MED 433 Teams

L7 -Management of diabetic ketoacidosis and hypoglycemia

Mind map



slide | doctor's note | important | explanation

Diabetic Ketoacidosis

- ✓ Its a serious acute emergency situation with a risk of death.
- ✓ Develops as a result of insulin deficiency
- ✓ A characteristic feature of type I diabetes (could occur with type II (especially during stress))

✓ **Metabolic Changes :**

- **Carbohydrates**
  - Increase Glycogenolysis
  - Increase Gluconeogenesis
- **Protein**
  - Increase proteolysis thus providing amino acid for gluconeogenesis.
- **Fats**
  - Increase Lipolysis& ketogenesis
  - Fat > free fatty acids > acetyl-CoA > ketone bodies > Ketonemia > Ketonuria & Acidosis
  - acetoacetic acid, β-hydroxybutyric acid and acetone (↑ ketogenesis).

introduction

Diabetic ketoacidosis

- ✓ Hyperglycemia induced glucosuria, osmotic diuresis & severe fluid loss.
- ✓ Fluid loss induces dehydration & electrolyte imbalance.
- ✓ Metabolic acidosis induces hyperventilation.

- ✓ Diagnostic Criteria:
  - Blood glucose level > 250 mg/dl
  - Arterial pH < 7.35
  - Serum bicarbonate level < 15 mmoL
  - Ketonemia+ Ketonuria

- ✓ Symptoms:

-Thirst, Polyuria, Polydipsia (increased drinking).

-Nausea, Vomiting, Abdominal pain

-Tachycardia,

-Kussmaul–Kien respiration (rapid & deep), Ketotic breath (fruity, with acetone smell).

- Mental status changes (confusion, coma).

- ✓ Character of DKA:

-Hyperglycemia.
-Glucosuria .
-Osmotic diuresis.
-Polyuria.
-Thirst.
-Polydipsia (increased drinking).
-Dehydration.
-Electrolyte imbalance.
-Ketogenesis (ketonemia, ketonuria).
-Metabolic acidosis.

Treatment of diabetic ketoacidosis

Treatment step	Indication
1- Fluid therapy (Rehydration)	dehydration
2- Potassium therapy*	to correct the serum potassium concentration
3- Insulin therapy (Short acting insulin)	to stop lipolysis, promotes degradation of ketone bodies
4- Bicarbonate therapy	to correct metabolic acidosis

*The patient may develop **hypokalemia** due to the **fluid therapy** so to prevent this action we have to give him **K BEFORE the insulin therapy** because insulin will ↑ **the entry of K to the tissue** which will cause more **hypokalemia**.

Explanation of the treatment steps

1- Dehydration means ↓ECF. So we have to restore blood volume and perfusion of tissues by infusion of isotonic saline (0.9% sodium chloride)

2-potassium replacement must be initiated, is added to infusion fluid to correct the serum potassium concentration.

3- Regular insulin, should be administered by means of continuous intravenous infusion in small doses through an infusion pump.

4- bicarbonate therapy should be used only if the arterial pH is less than 7.0 after 1 hour of rehydration (1st step). sodium bicarbonate should be administered every 2 hours until the pH is at least 7.0

slide | doctor's note | important | explanation

Hypoglycemia

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

Causes	• Overdose of insulin, or oral hypoglycemic drugs such as (sulfonylureas and meglitinides) • Excessive physical exercise • Missed or delayed meal • Hypoglycemia can be an early manifestation of other serious disorders (sepsis, congenital heart disease, brain hemorrhage).
Characters	• Autonomic features: - ↑ sympathetic: tachycardia, palpitation, sweating, tremor, anxiety. - ↑ parasympathetic: nausea, vomiting • Neurological defects: - Headache, visual disturbance, slurred speech, dizziness - Tremors, mental confusion, convulsions - Coma due to ↓ blood glucose to the brain *
Precautions	• Monitoring of blood glucose level (blood sugar level should be checked routinely). • Patients should carry glucose tablets or hard candy to eat if blood sugar gets too low • 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

* therefore hypoglycemic coma is more dangerous than hyperglycemic coma (عشان كذا لما تلاقي مريض سكر مغمى عليه و ما تدري اذا هو هايبو او هايبر، بسرعة افرض انه هايبو و اديلوو سكر)

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Hypoglycemia (continued..)

Treatment	1. **Conscious patient:** **Sugar containing beverage or food** 2. **Unconscious patient:** **Glucagon (1 mg S.C. or I.M.)** . Or 20-50 ml of **50% glucose solution I.V. infusion** (risk of possible phlebitis).

Comparison	Hypoglycemic coma (Excess insulin)	Hyperglycemic coma Diabetic ketoacidosis (Too little insulin)
Onset	Rapid	Slow -Over several days
Acidosis & dehydration	No	Ketoacidosis
B.P	Normal	Subnormal or in shock
Respiration	Normal or shallow	Kussmaul–Kien respiration (rapid & deep) ((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

Lines of treatment of diabetic ketoacidosis

- **Dehydration** → **By giving fluid therapy :**
  - Infusion of isotonic saline(0.9% Na chloride)
  - To restore blood volume and perfusion of tissue and also to correct Na
- **Electrolyte deficits** → **Mainly Potassium therapy** is added to infusion fluid to correct the serum potassium concentration.
- **Hyperglycemia** → **Insulin therapy** **Regular insulin**, should be administered by means of continuous intravenous infusion in small doses through an infusion pump (0.1 U/kg/h).
- **Ketoacidosis** → **Bicarbonate therapy**
  - Correct for metabolic acidosis.
  - bicarbonate therapy should be used only if the arterial pH < 7.0 after 1 hour of hydration.

Summary

Characters of Hypoglycemia
Autonomic features -↑ sympathetic: tachycardia, palpitation, sweating, anxiety, tremor. -↑ parasympathetic: nausea, vomiting.
Neurological defects: - Headache, visual disturbance, slurred speech, dizziness. -Tremors, mental confusion, convulsions. -Coma due to ↓ blood glucose to the brain.

Treatment of hypoglycemia	Conscious patient	Unconscious patient
	treated by oral glucose tablets, juice or honey	20-50 ml of 50% glucose solution I.V. infusion
		glucagon (1 mg, S.C. or I.M.)

Quiz yourself

1/Which one of the following is used first in the treatment of DKA:
A. Fluid therapy.
B. Regular insulin.
C. Potassium therapy.
D. A+C .

2/Which one of insulin preparations is used in case of DKA:
A.Lente.
B.Lispro
C.Regular insulin.
D. B+C

3\The main purpose of prescribing Bicarbonate therapy to a DKA patient is:
A.Correct the metabolic alkalosis.
B.Correct the metabolic acidosis.
C.To restore blood volume.

4/A 14 years old patient is brought to the ER with nausea, vomiting, hyperventilation, hyperglycemia, ketonemia and dehydration. What's the diagnosis:
A.DKA.
B.DM type 1.
C. DM type 2.

5/An unconscious patient is brought to the ER with shallow breath, sweating, tachycardia and convulsions, which of the following treatment you should use:
A.Sugar containing food.
B.Regular insulin.
C.Glucagon (1 mg S.C).

6/In case of conscious patient with hypoglycemia we use:
A.Glucagon.
B.Glucose solution.
C.Sugar containing food.

Answers: 1.D 2.D 3.B 4.A 5.C 6.C

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We hope that we made this lecture easier for you
Good Luck !