Revised & Approved

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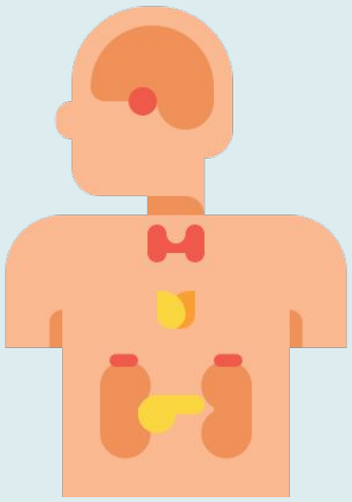
Pharmacology 439

MED439



Endocrine Block

Pharmacology Team 439

Color index:

Main Text

Important

Dr's Notes

Female Slides

Male Slides

Extra

Management of Diabetic ketoacidosis & Hypoglycemia

Objectives:

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

Editing file | Summary

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) And this is the cause of low PH (acidosis)

Insulin deficiency lead to:

↑ glycogenolysis
Farther increase in glucose level which make the condition worse
↑ gluconeogenesis,
↑ protein catabolism
↑ Lipolysis

↓

↑ Hyperglycemia

↓

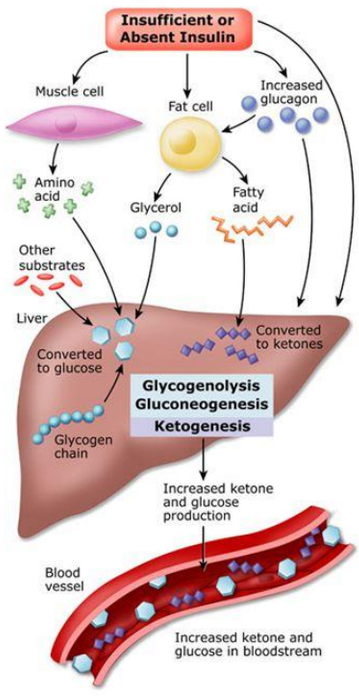
Glycosuria
Glucose level Exceed renal reabsorption capacity (180ml/dL)

↓

Osmotic diuresis
Remember in Renal when we studied (Mannitol) which is sugar and it is used as diuretic

↓

Dehydration



↑ Lipolysis

↓

↑ Free fatty acids

↓

↑ Ketone bodies

↓

Ketonemia + ketonuria

↓

Acidosis

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

Diabetic Ketoacidosis "DKA", cont.

Characteristic of DK

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 of DK

- Classic features of hyperglycemia (thirst, polyuria)
- Nausea, vomiting, abdominal pain
- Kussmaul–Kien respiration (rapid & deep) hyperventilation as a physiological response
- Tachycardia
- Ketotic breath **(fruity, with acetone smell)**
- Mental status changes (confusion, coma)

Diagnostic criteria of DK

Blood glucose level > 250 mg/dl, Arterial pH < 7.35
Serum bicarbonate level <15 mmol/L, Ketonemia, Ketonuria

Treatment of diabetic ketoacidosis

Adequate correction of (stepwise therapy)**:**

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

1. Rehydration (fluid therapy)

- 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.

2. Insulin therapy (short acting insulin)

- **Regular insulin** (Ultra short can also be used), 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.

3. Potassium therapy

- potassium replacement must be initiated, added to infusion fluid to correct serum potassium concentration (to fix hypokalemia which can be worsened by insulin therapy)
  why not give other electrolytes? Because they will be in the fluid therapy previously given

4. Bicarbonate therapy

- **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).

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. Also seen in T2DM patient on Insulin secretagogues.

Causes of hypoglycemia

01 Overdose of insulin or oral hypoglycemic drugs (**sulfonylureas - meglitinides**)
Insulin secretagogues

02 Hypoglycemia can be an early manifestation of other **serious disorders** (sepsis, congenital heart disease, cerebral hemorrhage)

03 Missed or **delayed meal**

04 Excessive physical **exercise**

Characters of hypoglycemia

- Headache, visual disturbance, slurred speech, dizziness
- Tremors, mental confusion, convulsions
- **Coma** due to low glucose delivery to the brain

Autonomic

- ↑ **Sympathetic**: tachycardia*, palpitation, sweating, anxiety, tremor.
*Seen in DKA too
- ↑ **Parasympathetic**: N&V

Neurological

The symptoms of sympathetic system in case of diabetic/cardiac patients who take non selective beta blockers might be masked (not felt) due to blockage of beta adrenergic receptors..

So we should avoid beta blockers in diabetic patients or we can use a very selective beta blockers

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
   Also insulin daily dosage can be reduced under physician supervision if the patient start to exercise regularly

Treatment of hypoglycemia

Drugs	Glucagon	Sugar
P.K	• Glucagon (1 mg S.C or I.M) • 20-50 ml of 50% glucose solution I.V infusion.	• Sugar containing beverage or food (30g orally).
Uses	• **Unconscious** patient	• **Conscious** patient.
ADR	• Risk of possible phlebitis with glucose solution	-

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 (Kussmaul)
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	• **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.)	• Fluid therapy • Insulin • Potassium supplement • Bicarbonate

If you cannot discriminate whether the patient is hypo or hyperglycemic, **you should prioritize treating as hypo.**

SUMMARY From Dr slide

Hyperglycemic ketoacidosis:
treated by insulin, fluid therapy, potassium supplement and bicarbonate.

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

Summary

diabetic ketoacidosis

Emergency condition develops as a result of **insulin deficiency**
Symptoms: Ketotic breath (fruity w\acetone smell) polyuria and thirst, tachycardia, Kussmaul–Kien respiration, Nausea, vomiting, abdominal pain, Mental status changes (confusion, coma)

Treatment

Rehydration	- To restore blood volume and perfusion of tissues. - Infusion of isotonic saline (0.9% sodium chloride) lactated Ringer solution
Insulin (short acting)	- Regular insulin, should be administered by means of continuous I.V infusion in small doses through an infusion pump (0.1 U/kg/h). - Insulin stops lipolysis and promotes degradation of ketone bodies.
Potassium therapy	- potassium replacement must be initiated, added to infusion fluid to correct serum potassium concentration
Bicarbonate therapy	- For correction of metabolic acidosis - bicarbonate therapy should be used only if the arterial pH < 7.0 after 1 hour of hydration

hypoglycemia

Is a **life threatening disorder** that occurs when blood glucose level becomes < 50 mg/dl
Caused by: Overdose of insulin or oral hypoglycemic drugs , Missed or delayed meal, Excessive physical exercise.

Symptoms:
1-Autonomic:
↑sympathetic: tachycardia, palpitation, sweating, anxiety, tremor.
↑parasympathetic: nausea, vomiting.
2-Neurological:
-coma due to low glucose delivery to the brain
-headache, visual disturbance, slurred speech, dizziness, tremors, mental confusion, convulsions

Treatment

Drug	P.K	Uses	ADRs
Glucagon	• Glucagon (1 mg S.C or I.M) • 20-50 ml of 50% glucose solution I.V infusion.	**Unconscious** patient	Risk of possible phlebitis
Sugar	• Sugar containing beverage or food (30 g orally).	**Conscious** patient.	

MCQs

Q1: Which of the following causes hypoglycemia			
A- balance diet	B- eat chocolate	C- Lack exercise	D- delayed meal
Q2: what is the first step in the management of diabetic ketoacidosis ?			
A- Insulin therapy	B- Fluid therapy	C- Potassium therapy	D- Bicarbonate
Q3: Which of the following electrolyte deficiency happen in Diabetic ketoacidosis ?			
A- Ca	B- Potassium	C- Uranium	D- PO4
Q4: Which of the following is criteria for DKA ?			
A- Serum bicarbonate level > 15 mmol/ L	B- Arterial PH > 7.35	C- Blood glucose level > 250 mg/dl	D- All of them
Q5: Which of the following metabolic changes occur in the absence of insulin ?			
A- decrease lipolysis	B-decrease glycogenolysis	C- conserving proteins	D- increase gluconeogenesis
Q6: A 58 years old male who fall down due to hypoglycemic coma. What is the treatment in this situation ?			
A- By giving him insulin	B- By giving him Orally glucagon	C- By giving him S.C insulin	D- By giving him I.M glucagon
Q7: DKA associate with Type 2 diabetes mellitus But may occur with Type 1 ?			
A- True	B- False	C-	D-

1	2	3	4	5	6	7
D	B	B	C	D	D	B

SAQ

Q1)10 year old diabetic child came to the ER with tachycardia, hyperventilation and fruity smelling breath. His parents told the doctors that he has been passing urine more than usual and that he's constantly thirsty. Investigations showed the following:
blood glucose level 260 mg\dL Arterial pH is 7.0
Serum bicarbonate level 10 mmol/L Blood pressure 97/60 mmHg

A) What is the name of the condition ?
B) What is the appropriate management for this condition ?

Q2) A 48 years old woman who lost consciousness due to hypoglycemic coma

A) What is the treatment to manage this case
B) List 3 characteristics of Hypoglycemia

Answers

A1) Diabetic ketoacidosis

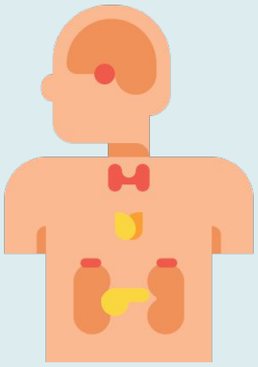
B1) 1- fluid therapy (Rehydration) with isotonic saline. 2- Insulin therapy Intravenously. 3- potassium therapy

4- bicarbonate therapy if the arterial pH is <7.0 after 1 hour of hydration.

2A) I.M glucagon or I.V. Glucose solution

2B) Rapid onset , blood sugar lower than > 70 mg/100cc, normal ketones

Feedback Form



Endocrine Block

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