University of Jordan - Faculty of Medicine
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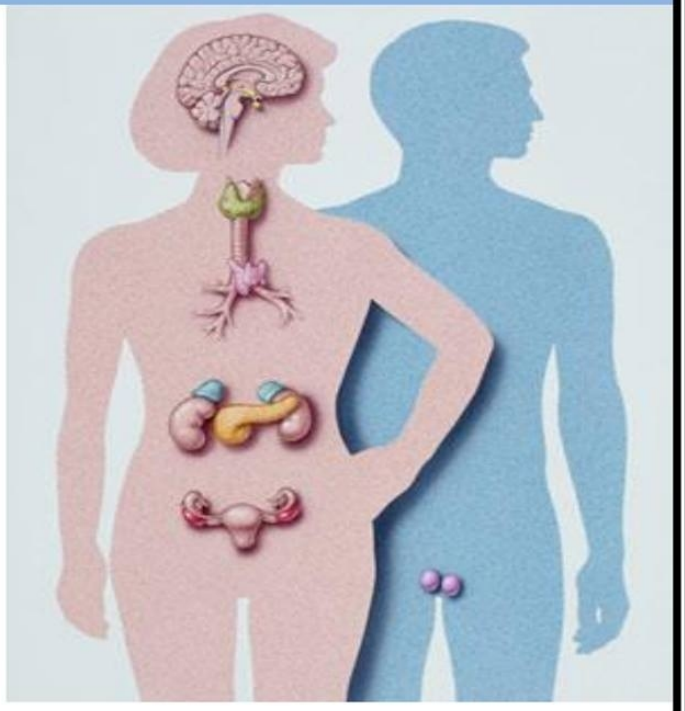
Medical Committee
The University of Jordan

Endocrine System



- ☐ Anatomy/Embryology/Histology
- ☐ Biochemistry
- ■ Physiology
- ☐ Pharmacology
- ☐ Pathology
- ☐ PBL

☐ Slide ■ Sheet ☐ Handout ☐ Other

Lecture #: **8**

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INSULIN DEFICIENCY

- effects of insulin defiency:-

- abnormality or disorder in metabolism of lipids:-

-The lipid metabolism is affected and the most important effect is that the enzyme Hormone sensitive lipase is activated causing hydrolysis of the stored triglyceride and a lot of fatty acids and glycerol are released into the blood.

-At insulin lack stage the body totally depends on the energy from these free fatty acids, but when there is a lot of free fatty acids utilizing, there will be production of Ketone Bodies(acidosis).

-Ketone Bodies are:

1. Beta-hydroxybutyric acid.
2. Acetone.
3. Acetoacetic acid.

-some of these Ketone Bodies are excreted in the urine sometimes bind with Na+, the Na+ excreted is replaced by H+, and this is another cause of acidosis.

-so, there're two causes make acidosis more serious:

1. Production of Ketone bodies.
2. Replacement of Na+ by H+.

- abnormality or disorders in protein metabolism:-

-no insulin = no protein synthesis (increase protein catabolism), thus Increasing the amino acids in blood, these amino acids either utilized for:-

* energy.
* or production of glucose (Gluconeogenesis) causing more hyperglycemia.

-this degredation of protiens inhance the increase of glucose in the urine(increase osmotic Pressure), resulting in:

*severe diabetes mellitus.
*weakness
*urination

- The effect of insulin deficiency on carbohydrate metabolism :

If you consider a patient with 300 mg/dL glucose concentration there will be :
-Hyperglycemia and there is a disorder in blood glucose homeostasis. However brain isn't affected it takes glucose spontaneously.
-Entering to adipose tissue is affected.
- Some enzymes are activated.
- Glucose coming from liver more than that transferred into the liver.
- Glucose transferring into muscles and other tissues are affected.
- Glucose will be seen in urine (glycosuria) because concentration of glucose is above 180 mg/dL which is above renal threshold.

ϖ There are 4 causes of coma that can occur due to complication of diabetes :

1. Acidosis and dehydration.
2. Hyperosmolar coma: in which glucose will be elevated to such a degree that (independent of the pH) leads to coma.
3. Lactic acidosis: where there is accumulation of the lactate in blood, also may cause diabetic ketoacidosis if the tissue become hypoxic.
4. Brain edema: occurs in 1% of children with ketoacidosis and can cause coma.

** The 4 types of coma cause unsettled but serious complications with mortality rate about 25%. There is a coma because of hypoglycemia (diabetic cause).
Coma occurs if blood glucose become below 40 mg/dL usually between 30-40 mg/dL, and that depends on individual, sometimes reach 25 mg/dL without coma, and sometimes coma can occur even when it is about 45- 50 mg/dL.

**People who has diabetes and take insulin injuction, sometimes glucose level drops lead to coma, not because of hyperglycemia or dehydration, but because of low glucose in the blood(hypoglycaemia), so patients are advised to have sweets in their pocket.

<u>To sum up the results of insulin deficiency :</u>

1. **On carbohydrates metabolism (decreased glucose uptake)** :
   1- Hyperglycemia.
   2- Glycosuria.
   3- Osmotic Diuresis: which is increased concentration of glucose in renal tubules, resulting in:
   * Reabsorbing water can't be done and water will be excreted.

* increased osmotic pressure.

4- Electrolytes depletion.

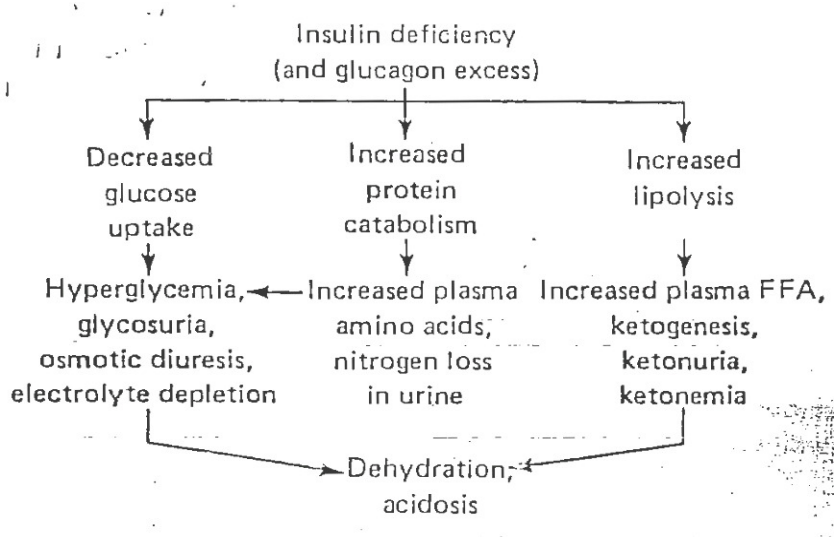
2. On proteins metabolism (increased protein catabolism) :

1- Increased amino acids in blood.
2- Nitrogen loss.
3- Increase uria.

3. On lipids metabolism (increased lipolysis) :

1- Increased fatty acids and glycerol in blood.
2- Ketogenesis.
3- Ketonuria.
4- Ketonemia (increase Ketone bodies in the blood).

All results will lead to acidosis then dehydration (increased urination) that lead to coma and this can lead to death.



Diabetes

*There're two types of diabetes:

Type 1: -Insulin-dependent diabetes or Juvenile diabetes mellitus.
Type 2: - non-insulin dependent.

~ type one:
- It's genetic
- In children
- Ketosis prone diabetes
- Low to normal body mass
- Low plasma insulin
- Therapy: insulin

~ type two:
- in adult >40 years
- Obesity onset diabetes
- ketosis resistant diabetes
- normal to high plasma insulin
- therapy: weight loss, control their diet and exercise (the patient become normal), if not we give them medications and the last choice will be insulin.

• Symptoms of diabetic patients (used for diagnosis of diabetes) :
1. Urination.
2. Increased food consumption.
3. Weight loss.

Clinical Characteristics of Patients with Type I and Type II Diabetes Mellitus

Feature	Type I	Type II
Age at onset	Usually <20 years	Usually >40 years
Body mass	Low (wasted) to normal	Obese
Plasma insulin	Low or absent	Normal to high
Plasma glucagon	High, can be suppressed	High, resistant to suppression
Plasma glucose	Increased	Increased
Insulin sensitivity	Normal	Reduced
Therapy	Insulin	Weight loss, thiazolidinediones, metformin, sulfonylureas, insulin

We must give them drugs , these drugs depend on the tissue that we want to affect:

*The available oral anti-diabetic drugs can be divided by mechanism of action to:
1- Insulin sensitizer with primary action on liver .
2- Insulin sensitizer with primary action on peripheral tissues.
3- Insulin secretagogues: stimulate insulin secretion, commonly used, it may cause exhaustion of the B-cells and lack of insulin totally!
4-Agents that slow absorption of carbohydrates.

*Usually we use one of them, rarely use two,so these drugs action depends on liver or muscle to prevent absorption of glucose.
* in obesity there will be increased fat cell size (not number).

The complications of diabetes:

- If untreated lead to:
  1- renal failure.
  2-increased risk of cancer.
  3-primary coronary arterial disease.
  4-blindness

-more than 65% of people with diabetes die from heart disease.
- Adults with diabetes have death rate due to heart diseases 2-4 times more than people without diabetes.
- Also strokes accounts for approximately 20% of diabetes related death, and risk of stroke is also 2-4 times higher among people with diabetes.

Measures of obesity

1. Body Mass Index (BMI): -
   BMI = Mass (kg) / (Height (m)) ^2
   - If it was :
     less than 18.5: under-weight
     18.5-24.9: normal
     25-29.9: over-weight
     More than 30: obesity

2. The relationship between height and weight: -the normal weight is equal to
   -in males: weight = height - 100
   -In females: weight = height – 105

3. Measuring the waist:-
   in normal people waist measure must be less than the half of the height, not very proper.
   -^-this is very important because people with long waist measure are exposed to stroke more than others because the fat in abdomen captures many vitamins (such as vit.D) .

Glucagon

** We talked about two examples of antagonists :
1-insulin and glucagon
2-PTH and CT

-glucagon is the most potent hyperglycemic .
-the half-life of glucagon is 20 minutes.
-the main stimulator of glucagon secretion is ingestion of protein, although The Primary action of it is the metabolism of carbohydrate and lipid in liver.

- Main function of glucagon: 1- Glycogenolysis 2- Gluconeogenesis 3- Ketogenesis 4- Lipolysis
- Stimulator of glucagon: 1- Amino acids 2- Hypoglycemia 3- Acetylcholine 4- Norepinephrine and Epinephrine
- Inhibitors of glucagon: 1- Fatty acids 2- Somatostatin 3- Insulin

THANK YOUU :D

~~~ a dedication to:
Nadira turk, sura abu saleem, rand khawaldeh, dema nsour, baraa malhas, ibtehal hiary, alaa sukhni, sura quqazeh, leen yunis, shatha khader, areej jaber, noor hamad, nadia bataineh, Sophia haddaden, noor yousef <3

وكل عام وانتم بخير, ونلتقي بسنة ثالثة ان شاء الله
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