Disorders of glucose metabolism/Questions and case studies

Questions

1. **During fasting, which enzyme is responsible for the production of free glucose in the liver**
   - A – Glucagon
   - B – Glucose-6-phosphate dehydrogenase
   - C – Glucokinase
   - D – Hexokinase
   - E – Glucose-6-phosphatase
2. **Which of the following metabolites cannot provide carbon atoms for gluconeogenesis?**
   - A – Alanine
   - B – Pyruvate
   - C – Lactate
   - D – Palmitate
   - E – Oxaloacetate
3. **Insulin accelerates**
   - A – glucose production by the liver
   - B – uptake of glucose in the muscles
   - C – excretion of fatty acids from adipose tissue
   - D – conversion of glycogen into glucose in the liver
   - E – conversion of amino acids to glucose in muscles
4. **Which of the following enzymes has a role in the Cori cycle?**
   - A – Lactate dehydrogenase
   - B – Glucose-6-phosphate dehydrogenase
   - C – Pyruvate dehydrogenase
   - D – Glucokinase
   - E – Hydroxymethylglutaryl–CoA reductase
5. **After taking food (mixed food), insulin is secreted. This rise in insulin causes a normal person to: (fill in correctly if something rises, falls or does not change)**
   - A – release of glucose from the liver...
   - B – uptake of glucose by muscle and fat tissue...
   - C – gluconeogenesis in the liver...
   - D – synthesis of fatty acids...
   - E – glucagon secretion...
6. **Glucagon controls the function of target cells by first binding to a specific membrane receptor and thus increases inside the cell:**
   - A – neurotransmitter
   - B – a specific peptide that activates certain enzymes
   - C – cAMP (cyclic adenosine monophosphate)
   - D – nucleic acids
   - E – synthesis of enzymes
7. **What are the metabolic causes of hyperglycemia in diabetes mellitus?**
   - A – Reduction of glucose utilization in tissues
   - B – Gluconeogenesis in muscles
   - C – Gluconeogenesis in the liver
   - D – Glucose transfer across the hepatocyte membrane conditioned by insulin deficiency
   - E – Increased renal threshold for glucose
   - F – Increasing the effect of glucagon over the effect of insulin
   - G – Inhibition lipolysis (breakdown of fatty acids)
8. **What are the metabolic causes diabetic ketoacidosis? (more options)**
   - A – Reduced degradation ketone body in the liver
   - B – Combination of insulin deficiency with glucagon excess
   - C – Conversion of acetoacetate to acetone
   - D – Catabolism of fatty acids (lipolysis)
   - E – Increased production of acetyl CoA in the liver
   - F – Increased formation of hydroxymethylglutaryl-CoA in mitochondria
9. **What are the main causes of hyperosmolar coma in diabetes mellitus?**
   - A – Osmotic diuresis for hyperglycemia with insufficient water intake
   - B – Complete lack of insulin combined with an excess of glucagon
   - C – A lack of insulin will reduce the utilization of glucose in the brain, causing a malfunction in the brain's centers controlling water and electrolyte metabolism
   - D – Glycation of collagen in the glomerular basement membrane, which leads to increased permeability

Answers

Case reports

Female patient with overweight and abdominal pain

49-year-old woman, long history of obesity without dieting and weight reduction. She has pelvic pain. Gynecologist. find: chron. pelvic inflammation. At the last visit, elevated blood pressure, fasting blood glucose 15.8 mmol/l.

Questions:

1. What type of diabetes does the patient probably suffer from?
2. What does elevated glucagon do?
3. What is the cause of increased excretion of urea in the urine in diabetes mellitus?

Answers

Female, 21 years old with type 1 diabetes

Admitted to hospital in a delirious state with tachypnea. A fruity smell on the breath. History of acute respiratory infection. Laboratory findings:

- blood: glucose 22 mmol/l, bicarbonate 9.5 mmol/l
- serum: urea 11.8 mmol/l, Na^+ 136 mmol/l, K^+ 5.7 mmol/l

Questions:

1. What diagnosis is involved
2. How can a low bicarbonate level be explained (pathobiochemical basis)
3. Why is the level of urea and K^+ elevated.

Answers

Nurse, 24 years old

She had repeated episodes of hypoglycemia. Laboratory examination showed the following results: B-glucose repeatedly 0.9 - 1.1 mmol/l, C-peptide: 0.01 pmol/l to undetectable (repeatedly)

Questions:

1. What is the most likely cause of hypoglycemia?

Answers

Patient on parenteral nutrition

A 32-year-old man with an advanced stage of Crohn's disease (ileitis terminalis) and severe malnutrition was on parenteral nutrition. Laboratory examination:

- B-glucose (not fasting): 9.8 mmol/l
- S-phosphate: 0.3 mmol/l
- S-albumin: 27 g/l
- S-Ca: 1.96 mmol/l

Questions:

1. What is the explanation of the laboratory values

Answers

Links

Related Articles

- Inherited metabolic glycogen storage diseases
- Energy metabolism and its disorders

Source

- MASOPUST, Jaroslav – PRŮŠA, Richard. *Patobiochemie metabolických drah.* 1. edition. Praha : Univerzita Karlova, 1999. 182 pp. pp. 24−33. ISBN 80-238-4589-6.