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DIABETES MELLITUS IN DOMESTIC CATS: CLINICAL CASES FROM VETERINARY PRACTICE

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The aim: to analyze clinical cases of diabetes mellitus in cats and establish the effectiveness of clinical and laboratory research and treatment of animals with the help of insulin therapy.

Materials and methods. The material for the study were domestic cats admitted to the veterinary medicine clinic "Doctor Vet" (Lviv).

Results. Clinical case 1. Cat Bonya, age 10 years, body weight 4 kg, symptoms: polyuria/polydipsia and weight loss. Examination: cachexia, weakness, pale mucous membranes, unsteady gait. Blood glucose – 20.4 mmol/l, urine analysis – pH=6.0, glucose +++++, no ketones detected. Diagnosis: diabetes. For glycemic control - caninsulin at 0.25 IU/kg every 12 hours. After the start of insulin therapy, the animal's condition improved, after 2 months - an attack of hypoglycemia, blood glucose 3.0 mmol/l. The introduction of insulin was stopped for 10 days, after 10 days the cat's appetite is normal, polyuria and polydipsia are not observed, body weight gain is 300 g, blood glucose without insulin therapy is 8.0 mmol/l.

Clinical case 2. Cat Eva, age 12 years, body weight 6.7 kg, symptoms: polyuria/polydipsia during the last two weeks, increased appetite, diet - raw meat, meatballs, buckwheat porridge, boiled carrots, beets. Blood glucose 22.9 mmol/l, urine analysis – pH = 6.0, glucose +++++, ketones +. Diagnosis: diabetes. Treatment: Lantus 2 IU subcutaneously every 12 hours. After the start of insulin therapy, the condition improved, after 2 months, blood glucose was 9.00 – 13.0 mmol/l; 15.00 – 8.0 mmol/l, 21.00 – 12.0 mmol/l, glucose and ketones are absent in the urine.

Conclusions. In the first clinical case, the cat there was a decrease in demand in insulin "Caninsulin" on the background of insulin therapy. In the second clinical case, insulin therapy with the help of "Lantus" insulin allows you to reach a level of glycemia at which diabetes stops progressing, the clinical condition of the animal normalizes, which indicates the effectiveness of the prescribed treatment. Thus, we can say that diabetes in small domestic animals is a rather severe endocrine pathology, which has typical clinical and laboratory symptoms and can be successfully treated with the help of a complex medical and diagnostic approach, based on insulin therapy

Keywords: cats, diabetes mellitus, insulin therapy, caninsulin, lantus

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1. Introduction

Diabetes mellitus is a common endocrine disease in cats. Although type 2 diabetes is the most common form seen in cats, other underlying causes may contribute to insulin resistance [1]. An important influence on the development of diabetes mellitus in cats is exerted by genetic factors, housing conditions, feeding, and also the age of animals: diabetes is mainly diagnosed in cats older than 7 years, and the peak incidence occurs in animals aged 10 to 13 years [2]. It was found that in cats with diabetes mellitus, morphological changes occur in the pancreatic tissue, and the activity of hepatobiliary system enzymes (ALT, AST, GGT), the content of urea, creatinine and globulins increases in the blood, which indicates a violation of the functional state of the liver and kidneys. [3, 4]. The treatment of diabetes mellitus in cats consists of insulin therapy in combination with maintain-

ing a normal body condition of the animal, since overweight is one of the main risk factors for the development of diabetes [5, 6]. According to M. Clark [7], up to 40 % of the domestic cat population are overweight or obese. This leads to insulin resistance through several mechanisms, with each extra kilogram of body weight resulting in a 30 % decrease in insulin sensitivity. Recent studies show that the simultaneous use of a low protein and moderate carbohydrate diet significantly improves the effectiveness of insulin therapy in diabetic cats [8]. According to recent studies, insulin glargine is effective and safe for the treatment of feline diabetes [9]. At the same time, insulin therapy protocols using porcine insulin tape and human recombinant protamine-zinc-insulin are used in practice [10].

The aim of the research to analyze clinical cases of diabetes mellitus in cats and to establish the

effectiveness of clinical and laboratory research and treatment of animals with the help of insulin therapy.

2. Materials and methods

The material for the study was domestic cats, which were admitted to the clinic of veterinary medicine Doctor Vet (Lviv) for diagnosis and treatment by selecting a course of insulin therapy in 2022. The animals underwent a clinical examination, a clinical urinalysis and a biochemical blood test using an automatic biochemical analyzer Abaxis. On the basis of the studies performed, the animals were diagnosed with diabetes mellitus. The treatment was carried out according to the following scheme: the animals were placed in a hospital for 24 hours, during which the dosage and frequency of insulin administration were selected by monitoring the concentration of glucose in capillary blood every 6 hours. In the first clinical case, Kaninsulin was administered at a dose of 0.25 IU/kg of body weight 2 times a day, in the second - Lantus followed by feeding at 9.00 at a dose of 2 IU/kg of body weight 1 time per day. Blood glucose control was performed by measuring capillary blood glucose using an Accu-Chek Active device. Venous blood for hematological and biochemical studies was taken in the amount of 2 ml on an empty stomach from the veins of the forearm, glucose was measured during the selection of the dose of insulin in capillary blood, which was taken from the inner surface of the ear. Urine was collected by cystocentesis under ultrasound guidance.

All manipulations with animals were carried out in compliance with the rules of asepsis and antiseptis, in accordance with the European Convention for the Protection of Vertebrate Animals used for experiments or for other scientific purposes (1986) and the Law of Ukraine "On the Protection of Animals from Cruelty" (2006). The study was reviewed and praised by the bioethics committee "Sytenko Institute of Spine and Joint Pathology National Academy of Medical Sciences of Ukraine", protocol No. 8, date 09/12/2022.

3. Research results

The main clinical and laboratory symptom of diabetes in cats is persistent hyperglycemia. When insulin stops functioning, glucose does not enter the tissues. There is an increase in glucose in the blood, but the body tries to lower its level by excreting it with urine. In turn, glucosuria develops. After all, it is known that glucose has a diuretic effect, due to which a compensatory mechanism develops, increased thirst – polydipsia. Persistent hyperglycemia causes three main effects: oxidative glycosylation of tissues, disruption of the structure of blood vessels – diabetic angiopathy, and starvation of tissues. Classic clinical symptoms of diabetes in cats are polyuria, polydipsia, polyphagia and weight loss. Confirmation of the diagnosis of diabetes mellitus is carried out with the help of a biochemical blood test: the content of glucose in the blood is determined, a general analysis of urine with a mandatory determination of glucose and ketones. A steady increase in the level of glucose in the blood and glucosuria in combination with the corresponding clinical symptoms indicate the development of diabetes mellitus in a cat.

Insulin therapy is an effective method of treating diabetes in dogs and cats. The main tasks of insulin therapy are the elimination of clinical symptoms of diabetes (polyuria and polydipsia), normalization of body weight, appetite and general condition of the animal. It should be remembered that any scheme of insulin therapy does not imitate normal insulin secretion: the patient receives an urgent injection of insulin in 1–2 doses. Thus, acceptable hyperglycemia is created in the range of values from 6.0 to 18.0 mmol/l – this is a safe range that prevents diabetic ketoacidosis, eliminates clinical symptoms of the disease, and normalizes tissue nutrition. During insulin therapy, the doctor must achieve the following indicators: in the morning (9.00) – 12.0–18.0 mmol/l, in the afternoon (15.00) – 6.0–10.0 mmol/l, in the evening (21.00) – 12.0–18.0 mmol/l. Initially, the animal is prescribed a minimum dose to prevent hyperglycemia. At each subsequent stage of treatment, the dose is increased by 25–50 % if necessary. Blood glucose measurement is carried out for 2–3 days in a row and no earlier than 3–4 days after changing the insulin dose, at three time points: before the morning injection, 6 hours after the morning injection and 12 hours after morning injection.

Clinical case 1. Cat Bonya, age 10 years, body weight 4 kg. Owner complaints: polyuria/polydipsia and weight loss during the last month. Examination results: cachexia, weakness, pallor of mucous membranes, unsteady gait. In the clinical blood analysis – lymphocytosis, blood glucose 20.4 mmol/l, creatinine – 148.0 $\mu\text{mol/l}$, urea – 6.7 mmol/l, urine analysis – pH = 6.0, glucose +++++, no ketones were detected. Diagnosis: diabetes mellitus. Treatment: sodium chloride 0.9 % and glucose 5 % subcutaneously every 12 hours – 7 days, torasemide 0.15 mg/kg orally every 24 hours in the morning, Caninsulin 0.25 IU/kg every 12 hours, therapeutic diet – Purina NF canned food – according to the appropriate dosage (to maintain the functional state of the kidneys, since the creatinine level corresponded to the II stage of chronic kidney disease according to IRIS; blood glucose control: 9.00 – 13.0 mmol/l; 15.00 – 8.0 mmol/l, 21.00 – 15.0 mmol/l. After the start of insulin therapy, the clinical condition of the animal improved, polyuria and polydipsia stopped, appetite normalized, the animal stopped losing body weight. 2 months later – an attack of hypoglycemia, blood glucose 3.0 mmol/l 3 hours after administration insulin and feeding. Insulin therapy was stopped for 10 days, after 10 days the cat's appetite is normal, polyuria and polydipsia are not observed, body weight gain is 300 g, blood glucose without insulin therapy is 8.0 mmol/l. Thus, the cat there was a decrease in demand in insulin on the background of insulin therapy.

Clinical case 2. Cat Eva, age 12 years, body weight 6.7 kg, came to the veterinary clinic with the following complaints: polyuria/polydipsia for the past two weeks, increased appetite, diet – home food: raw meat, processed kip' meatballs, buckwheat porridge, boiled vegetables (carrots, beets). The results of the examination: the coat is dull, the activity is slightly reduced, the animal has excessive body weight. There were no changes in the clinical blood analysis, blood glucose 22.9 mmol/l, creatinine – 128.1 $\mu\text{mol/l}$, urea –

15.6 mmol/l, total protein – 93.2 g/l, ALT activity – 186, 7 units/l (normally – up to 75 units/l), AsAT – 104.5 units/l (normally – up to 50.0 units/l). Urine analysis – pH = 6.0, glucose + + + +, ketones +. Diagnosis: diabetes mellitus.

Treatment: Lantus 2 IU subcutaneously every 12 hours; no diet was prescribed; blood glucose control: 9.00 – 12.0 mmol/l; 15.00 – 7.0 mmol/l, 21.00 – 14.0 mmol/l. After the start of insulin therapy, activity increased, polyuria and polydipsia completely sopped, after 2 months the control measurement of blood glucose level against the background of insulin therapy 9.00 – 13.0 mmol/l; 15.00 – 8.0 mmol/l, 21.00 – 12.0 mmol/l, glucose and ketones are absent in the urine. Thus, insulin therapy with the help of "Lantus" insulin allows you to reach a level of glycemia at which diabetes stops progressing, the clinical condition of the animal normalizes, which indicates the effectiveness of the prescribed treatment.

4. Discussion

Modern studies confirm the effectiveness of insulin-glargine for the treatment of diabetes in cats, which allows preventing ketoacidosis [11]. There are data on the higher efficiency of insulin lispro compared to regular insulin when it is administered intravenously [12]. It was also shown that the dosage of insulin-glargine also affects the control of diabetes [13]. The presence of obesity as a risk factor for the development of diabetes is also of particular importance in the development of insulin resistance [14]. Taking into account the research of other authors, it should be noted that insulin therapy can have different options for the use of insulin, but other drugs for correcting the level of glycemia in cats are not considered. Therefore, the use of

insulin-glargine and caninsulin for the control of diabetes in cats is relevant in clinical practice.

Research limitations. The research was analytical in nature and based on the clinical experience of the authors in the diagnosis and treatment of diabetes mellitus in domestic cats.

Prospects for further research. A promising direction of research is the study of the effectiveness of the treatment of diabetes in domestic cats on a larger number of animals with the determination of the most effective scheme of insulin therapy.

5. Conclusions

In the first clinical case, the cat there was a decrease in demand in insulin "Caninsulin" on the background of insulin therapy. In the second clinical case, insulin therapy with the help of "Lantus" insulin allows you to reach a level of glycemia at which diabetes stops progressing, the clinical condition of the animal normalizes, which indicates the effectiveness of the prescribed treatment. Thus, we can say that diabetes in small domestic animals is a rather severe endocrine pathology, which has typical clinical and laboratory symptoms and can be successfully treated with the help of a complex medical and diagnostic approach, based on insulin therapy.

Conflict of interests

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this article.

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