

# UNCOMPLICATED DIABETES MELLITUS IN DOGS

## BASICS

### OVERVIEW

- Increased levels of glucose (sugar) in the blood (known as “hyperglycemia”) when the dog has been fasted, combined with the presence of glucose (sugar) in the urine (known as “glucosuria”)
- Disorder of carbohydrate, fat, and protein metabolism caused by an absolute or relative insulin deficiency
- The pancreas is an organ of the body, located near the upper small intestine; the pancreas produces insulin to regulate blood sugar
- Type I diabetes mellitus is characterized by destruction of insulin-secreting pancreatic  $\beta$ -cells by the body’s own immune system (that is, it is an autoimmune destruction of the  $\beta$ -cells) and results in a dependence on insulin treatment (also known as “insulin-dependent diabetes mellitus” or “IDDM”)
- Type II diabetes mellitus is characterized by a relative insulin deficiency (either inadequate insulin secretion or lack of response of the body to insulin [known as “insulin resistance”]); type II may result in “insulin-dependent diabetes mellitus” or “IDDM;” “non-insulin dependent diabetes mellitus” or “NIDDM;” or both through the course of the disease
- Insulin-dependent diabetes mellitus or IDDM patients are prone to developing diabetic ketoacidosis (condition in which levels of acid are increased in the blood due to the presence of ketone bodies secondary to diabetes)
- Non-insulin dependent diabetes mellitus or NIDDM patients may respond to treatment with medications administered by mouth to decrease blood glucose (known as “oral hypoglycemic agents”)
- “Uncomplicated” diabetes mellitus is a designation that indicates the dog has diabetes mellitus, but does not have secondary problems (such as ketoacidosis, vomiting, or diarrhea) that makes the dog “more sick” and requires more aggressive treatment
- Diabetes mellitus also is known as “sugar diabetes”

### GENETICS

- Familial (runs in certain families or lines of animals) associations in some breeds of dog

### SIGNALMENT/DESCRIPTION of ANIMAL

#### *Species*

- Dogs

#### *Breed Predilections*

- The keeshond, puli, miniature pinscher, and Cairn terrier are at higher risk than other breeds
- The poodle, dachshund, miniature schnauzer, and beagle possibly are at higher risk than other breeds

#### *Mean Age and Range*

- Mean, approximately 8 years of age; range, 4 to 14 years (excluding rare juvenile form)

#### *Predominant Sex*

- Female

### SIGNS/OBSERVED CHANGES in the ANIMAL

- Early signs—increased urination (known as “polyuria”) and increased thirst (known as “polydipsia”), increased appetite (known as “polyphagia”), and weight loss
- Later signs—lack of appetite (known as “anorexia”), sluggishness (lethargy), depression, and vomiting
- Enlargement of the liver (known as “hepatomegaly”)
- Cataracts—less common finding

### CAUSES

- Genetic susceptibility
- Infectious (viral) diseases
- Immune-mediated pancreatic  $\beta$ -cell destruction
- Inflammation of the pancreas (known as “pancreatitis”)
- Diseases that increase the likelihood of developing diabetes mellitus (such as increased production of steroids by the adrenal glands [known as “hyperadrenocorticism” or “Cushing’s disease”] and a condition caused by excessive levels of growth hormone, leading to enlargement of bone and soft-tissues in the body [known as “acromegaly”])
- Medications (such as steroids and progestogens [substance capable of producing the effects of the female hormone, progesterone])

### RISK FACTORS

- Diestrus (time period following the end of standing heat [when the female is receptive to breeding] and when the female hormone, progesterone, is being secreted by the yellow body of the ovary) in the female dog (known as a “bitch”)

## TREATMENT

### HEALTH CARE

- Most dogs with uncomplicated diabetes mellitus can be managed as outpatients; they are alert, hydrated, and eating and drinking without vomiting
- Fluid therapy may be needed in some cases

### ACTIVITY

- Strenuous activity may lower insulin requirements
- Consistent amount of activity each day is helpful

### DIET

- Avoid soft, moist foods because they cause increased glucose (sugar) in the blood following meals (known as “postprandial hyperglycemia”)
- Non-obese dogs—feed a consistent diet that the pet will eat reliably; keep daily caloric intake constant
- Obese dogs—reduce the caloric intake to 60% of the requirement for the animal’s ideal body weight (technique 1) or feed a high-fiber, low-calorie food in an amount similar to what the pet is accustomed to eating (technique 2); try to achieve the desired target weight over 2 to 4 months
- Thin dogs—avoid reduced-calorie diet; starvation worsens ketoacidosis (condition in which levels of acid are increased in the blood due to the presence of ketone bodies secondary to diabetes) and immune function
- Role of fiber—key role is in weight loss and obesity prevention; another benefit may be improved glycemic control; recommended diet is high in fiber, low in fat, and high in complex carbohydrates
- Feed the pet half its daily food every 12 hours to coincide with twice-daily insulin injections or medications administered by mouth to decrease blood glucose or sugar (oral hypoglycemic agents); give animals on once-daily insulin injections half the food with the injection and the remainder in 8 to 10 hours or at the time of peak insulin activity, if that is known
- Discuss the dietary needs and feeding protocol with your pet’s veterinarian

### SURGERY

- Intact females (that is, capable of reproducing) should have their ovaries and uterus removed surgically (known as a “spay” or “ovariohysterectomy”), when stable
- Progesterone (a female hormone) secreted during diestrus (time period following the end of standing heat [when the female is receptive to breeding] and when progesterone is being secreted by the yellow body of the ovary) makes management of diabetes mellitus difficult

## MEDICATIONS

Medications presented in this section are intended to provide general information about possible treatment. The treatment for a particular condition may evolve as medical advances are made; therefore, the medications should not be considered as all inclusive.

- Insulin—required for treatment of insulin-dependent diabetes mellitus; frequently utilized as part of management of non-insulin dependent diabetes mellitus; various types, including Vetsulin™ (porcine origin lente insulin); Humulin® N; Novolin® N; PZI VET® (Protamine Zinc Insulin—beef/pork insulin)
- Insulin is administered by injection; your pet’s veterinarian will explain proper handling, storage, and administration of insulin
- Glargine: rarely used in canine diabetics
- Oral administration of medications to decrease blood glucose (hypoglycemic agents) generally is not recommended in canine diabetes

## FOLLOW-UP CARE

### PATIENT MONITORING

- Glucose curve—“gold standard;” can provide information on insulin effectiveness, duration of action, and nadir (that is, the lowest blood glucose level achieved during dosing interval); used most frequently when establishing initial control, changing insulin type, dose, or frequency, or problem solving the diabetic that is difficult to control
- Glycated proteins—“glycosylated hemoglobin” or “fructosamine;” glucose binds irreversibly to hemoglobin (glycosylated hemoglobin) or albumin (fructosamine); extent of binding or glycosylation directly related to blood glucose concentration over lifespan of protein in blood (5 to 9 weeks for hemoglobin, 1 to 3 weeks for fructosamine); not affected by stress of hospitalization or dietary intake on the day of obtaining blood samples for testing; requires single blood draw, best used for ongoing management of stable diabetic patient; fructosamine of 400 mg/dl is consistent with adequate glycemic control
- At-home monitoring—urine glucose and/or blood glucose (lancet device for capillary blood from the ear) requires significant owner commitment and compliance; most useful as early indicator of need for reduction in dose with persistent

absence of glucose (sugar) in the urine (glucosuria); should never be used as the sole basis for adjustment of insulin; minimal evidence supports the need for the extent of monitoring, frequency of dose adjustments, or exactness of control in pets as is required in the management of human diabetics

- Clinical signs—assess the degree of polyuria/polydipsia, appetite, and body weight; if these are normal, the disease likely is well controlled

#### **PREVENTIONS AND AVOIDANCE**

- Prevent or correct obesity
- Avoid unnecessary use of steroids or megestrol acetate in treating various medical conditions

#### **POSSIBLE COMPLICATIONS**

- Cataracts can occur, even with good glycemic control
- Seizure or coma with insulin overdose
- Low red-blood cell count (known as “anemia”) and presence of excessive hemoglobin in the plasma (known as “hemoglobinemia”) with severe low levels of phosphorus in the blood (known as “hypophosphatemia”), which can occur after initial insulin therapy; “hemoglobin” is the compound in red-blood cells that carries oxygen to the tissues of the body

#### **EXPECTED COURSE AND PROGNOSIS**

- Dogs have permanent disease
- Prognosis with treatment is good; most animals have a normal life span

#### **KEY POINTS**

- Discuss daily feeding and medication schedule, home monitoring, signs of low levels of glucose (sugar) in the blood (known as “hypoglycemia”) and what to do if hypoglycemia develops with your pet’s veterinarian
- Understand when it is necessary to call or visit your pet’s veterinarian
- Keep a chart of pertinent information about the pet, such as urine dipstick results, daily insulin dose, and weekly body weights

