

Feline Diabetes Mellitus

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Diabetes mellitus (DM) is a disease of relative or absolute insulin deficiency. Insulin is produced by pancreatic beta cells within specialized endocrine areas known as “islets of Langerhans” and is best known for its facilitation of glucose uptake into cells (in particular, within muscular tissue) for energy production. Insulin is also critically involved in handling multiple nutrients (eg, fats, proteins) and electrolytes.

Diabetes develops when the pancreatic beta cells produce insufficient insulin (ie, absolute deficiency) or when cells are unresponsive to insulin (ie, resistance, relative deficiency). The lack of insulin action elevates blood glucose concentration and impairs the metabolism of other nutrients.

Insulin dependence is far more common than long-term diabetic remission.



Most diabetic cats (70%–75%) are clinically insulin-dependent at diagnosis,¹ meaning that their pancreatic beta cells are permanently unable to secrete enough insulin. These patients will require lifelong insulin injections.

The remaining 25%–30% have a form of DM similar to type 2 DM in humans.¹ These patients initially have functional beta cells that produce insulin; however, many factors (eg, obesity, high-carbohydrate diet, sedentary lifestyle) are hypothesized to contribute to the development of peripheral insulin resistance. Over time, beta cells are damaged through mechanisms associated with hyperglycemia (eg, glucose

toxicity), abnormal fat metabolism (eg, lipotoxicity), and reactive oxidative injury from inflammation. If dietary and insulin therapy are not instituted in a timely manner, the remaining beta cells will become nonfunctional and permanently lose their insulin-secreting ability.

Insulin therapy may eventually be discontinued in some patients whose glycemic control is rapidly corrected with insulin and dietary therapy before all functional beta cells are lost (ie, the patient is in diabetic remission). However, although remission rates of up to 75% have been reported,² in the author’s experience, insulin dependence is far more common than long-term diabetic remission.

Noninsulin therapies (eg, maintenance of ideal body weight; exercise; low-carbohydrate, high-protein diet) should be continued indefinitely for patients that achieve remission to minimize the chance for relapse and future insulin dependence. Unfortunately, relapse is common in these patients, and clients should be vigilant of clinical signs suggestive of diabetic recurrence.

STEP 2
Team Education Primer ▶

Diabetes Management *at a Glance*

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Diagnosis of feline DM requires documentation of persistent hyperglycemia and glycosuria, as well as clinical signs consistent with DM. When the blood glucose concentration surpasses the renal tubular reabsorption threshold (200–300 mg/dL¹), clinical signs of polyuria with corresponding polydipsia, weight loss despite an increased appetite, poor coat quality, and behavior changes (eg, lethargy, weakness) are commonly observed. Patients may also develop a neurodegenerative condition that causes a plantigrade stance (ie, dropped hocks or carpi).

Excess urinary glucose on urinalysis, or an elevated glucose concentration on routine bloodwork or a glucometer reading, may warrant an investigation of DM. However, stress may rapidly increase blood glucose and urinary glucose excretions in healthy cats, termed “stress hyperglycemia”³; therefore, it may be appropriate to assess the patient’s blood or urinary glucose in a low-stress or home environment to document the persistence of the abnormality, particularly in patients lacking concurrent clinical signs. Measuring the serum fructosamine concentration provides critical retrospective information of the patient’s average blood glucose concentration.

Feline DM is managed with a combination of dietary and insulin therapy. Dietary therapy aims for

weight loss, when appropriate, and a more physiologic nutrient profile. Because cats are obligate carnivores, the carbohydrate content of most commercial maintenance diets exceeds feline requirements. Most diets for diabetic cats are relatively carbohydrate- and fat-restricted but contain greater amounts of dietary protein.

The author routinely institutes subcutaneous insulin therapy with either glargine (Lantus; lantus.com) or PZI (ProZinc; prozinc.com). It is important to understand which syringe is used for each insulin type; for example, glargine is a U-100 human insulin requiring 100 units/mL insulin syringes for injection, while PZI is a veterinary-specific U-40 insulin requiring 40 units/mL syringes for administration. Insulin dosing is adjusted based on blood glucose



curves, which are determined by glucose readings obtained every 1–2 hours following feeding and insulin administration for 8–12 hours. Curves should be performed 7–10 days after starting insulin and after any future insulin dose adjustments.

Insulin overdose can cause profound hypoglycemia with clinical signs of weakness, collapse, and seizures. Clients should be counseled on these signs and the appropriate responses, and educated about proper insulin handling, storage, and injection techniques.

STEP 3
Communication Keys ►

An Educated Team Helps Ensure Committed Clients

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When the entire team is educated about the key issues of DM, clients more likely will accept the recommended treatment plan and understand how to manage their pet's condition. Every team member plays a part in educating and supporting clients.

Managing a diabetic cat requires dedication and clear communication between clients and team members about treatment, follow-up visits, associated costs, and home care. DM can be managed with appropriate client commitment, regular monitoring, and a clear understanding of the variables that can be controlled.

THE BASICS

Educating clients about diabetes management is crucial. Consider developing a protocol that includes a combination of face-to-face communication and written

instructions on the following key issues:

- The importance of appropriate nutrition and weight management
- Proper insulin handling and storage
- Proper injection techniques
- Signs of hypoglycemia (eg, weakness, collapse, seizures) and appropriate client responses
- Home monitoring
- Follow-up visits.

Many websites and educational materials are available for team members and clients (see **Educational Resources**).

EDUCATIONAL RESOURCES

For veterinary team members

- AAHA/AAFP Feline Life Stage Guidelines: aahanet.org; catvets.com
- ACVIM Referral Resources: acvim.org
- University of Queensland Diabetes Information:
 - <http://www.uq.edu.au/vetschool/content/ccah/diabetesinfo/article4.pdf>
 - <http://www.uq.edu.au/vetschool/content/ccah/diabetesinfo/article5.pdf>

For clients

- Washington State University: <http://www.vetmed.wsu.edu/ClientEd/diabetes.aspx>
- Winn Feline Foundation: http://www.winnfelinehealth.org/Health/Diabetes.html?gclid=CK3R9_T8p4CFQklswodAhcdLA

TREATMENT PLAN GUIDE

In 2010, the American Animal Hospital Association (AAHA) issued guidelines that clarified treatment of diabetic patients.⁴ These guidelines can be used to create customized educational handouts for the team and clients, and can help ensure that treatment protocols are up-to-date with professional guidelines.

HELP CLIENTS UNDERSTAND

Give clients a clear understanding of the commitment involved in managing their pet's diabetes. Encourage them with phrases such as *Take a deep breath and relax; we're here to help you. Feline diabetes is a treatable, manageable condition. You can maintain your cat's health on a reasonable budget.*

FINANCIAL CONCERNS

Cost is a common concern for clients with a diabetic pet. The initial "sticker shock" can be overwhelming, and the expense of caring for such a pet can be substantial and is often unexpected. Discuss treatment options and their associated costs to foster client buy-in and commitment.

STEP 4 Team Workflow ►

Team Workflow

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RECEPTIONIST

- ✓ Recognize the signs of diabetic complications to rapidly direct phone calls to the appropriate care team (eg, veterinary technicians, veterinarians, emergency facility)
- ✓ Remind clients about correct food and water amounts

TECHNICIAN/ASSISTANT

- ✓ Obtain a thorough history from the client, including the presence or absence of clinical signs, signs of hypoglycemia, and a complete list of the patient's medications and treats
- ✓ Facilitate the performance of blood glucose curves
 - Minimize the patient's stress to maximize the accuracy of the results
 - Obtain venous blood through standard venipuncture, or capillary blood via an ear tip or footpad stick

VETERINARIAN

- ✓ Select the combination of tests most appropriate for diagnosing diabetes for the particular patient
- ✓ Institute dietary and/or insulin therapies based on the patient's need
- ✓ Decide which long-term monitoring tools most accurately assess the patient's level of glycemic control to best direct therapeutic decision-making

Minimize the patient's stress to maximize the accuracy of the results.

STEP 5
Team Roles ►

Team Roles

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TEAM MEMBER	ROLE	RESPONSIBILITIES
RECEPTIONIST	Initial client point of contact	<ul style="list-style-type: none"> ✓ Be familiar with diabetes signs and complications ✓ When contacting clients about appointments, remind them that: <ul style="list-style-type: none"> – Patients should have access to water at all times – Patients should have small amounts of food available at all times; if the patient is fasting before anesthesia, the client should give only half the normal insulin dose the morning of the appointment
TECHNICIAN/ ASSISTANT	Client educator, patient caregiver	<ul style="list-style-type: none"> ✓ Demonstrate handling, drawing up, and administering insulin ✓ Educate clients about hypoglycemia signs and appropriate responses ✓ Provide clients with handouts or direct them to quality educational material
VETERINARIAN	Medical expert, client and team educator	<ul style="list-style-type: none"> ✓ Educate and counsel clients during the diagnostic and management processes ✓ Facilitate the veterinary technicians' continued education and interest in diabetic care by involving them in patient management and client education
PRACTICE MANAGER	Supervisor of team and client education	<ul style="list-style-type: none"> ✓ Support continuing education about diabetes for all team members ✓ Ensure the availability of client educational resources (eg, handouts, websites, an assigned "diabetes educator") ✓ Set competitive but fair fee schedules that allow and encourage clients to give their pet appropriate long-term diabetic care

STEP 6 Team Training Plan ►

Topics for Team Training

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Hold a team meeting to develop standard protocols for diagnosing, treating, and educating clients about feline diabetes. Having standards in place gives each team member responsibility for educating clients about their diabetic cat's needs and gaining the client's acceptance. Consider the following topics:

The team's goal is to listen to each client and deliver what he or she needs.

SIGNS & SYMPTOMS

- Frequent, copious urination with increased water intake
- Weight loss despite a large appetite
- Poor coat quality
- Behavior changes (eg, lethargy, weakness)
- Sweet odor on the breath
- Impaired ability to jump and abnormal gait (eg, dropped hocks or carpi).

DIAGNOSIS

- Elevated glucose concentration on routine bloodwork and glucometer reading
- Excess urinary glucose on urinalysis
- Elevated serum fructosamine.

TREATMENT


- Diet modification
- Insulin therapy.

CLIENT EDUCATION

- Determine team members' roles for educating clients about DM key issues (see **Step 5**, page 33).
- Appoint a "diabetes educator."

- Assign a team member to develop client education materials and resources.

PRACTICE NEW SKILLS

- Quiz team members on key information to ensure they can accurately educate clients.
- Implement a role-play exercise to fine-tune the client education process. Every client is different; some want only the "bottom line" information while others want every detail. The team's goal is to listen to each client and deliver what he or she needs. Training should focus on explaining the services offered in clear, concise, consistent terms. Clients will perceive value when they recognize that the team cares about them and their relationship with their pet. 

See **Aids & Resources**, back page, for references & suggested reading.

STEP 7
Client Handout ►

Frequently Asked Questions: Feline Diabetes Mellitus

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1

What is diabetes mellitus?

Diabetes mellitus is a condition caused by a lack of insulin action, which makes a cat unable to use glucose for energy. This increases weakness, hunger, thirst, and urination.

2

How did my cat get this disease?

Diabetes in cats, similar to type 2 diabetes in humans, is often associated with genetics, excess body weight, and a sedentary lifestyle. It is believed that the cat's body first becomes resistant to the effects of insulin and eventually loses the ability to make insulin altogether.

3

How do you treat diabetes mellitus?

Most patients are treated with 2 insulin injections per day and changed to a low-carbohydrate, high-protein diet, which also helps with weight management.

4

How long does treatment last?

Most diabetic cats will require lifelong dietary and insulin therapy. Although early diagnosis and management with insulin and diet change provide the greatest chance of reversing diabetes (termed "diabetic remission"), a patient that has not gone into diabetic remission within 6–10 months of diagnosis will likely always require insulin therapy.

5

How do I monitor my diabetic cat's health?

Initially, diabetic patients need regular veterinary monitoring. Your observations of your cat's health in conjunction with blood testing (eg, fructosamine levels, blood glucose curves) help ensure the most effective treatment. While veterinary visits may be more frequent directly after diagnosis, most diabetic cats require visits only every 4–6 months once they are stable.

6

Does diabetes predispose my cat to other health problems?

Diabetic patients have a suppressed immune system and can easily develop secondary infections (commonly, urinary tract infections). They also have a high occurrence of pancreatic inflammation, which can cause gastrointestinal upset and temporary disruption of glucose control. Routine veterinary monitoring helps catch problems early and minimize their impact.

7

Do I need to change how I care for my cat?

- Diabetic animals are predisposed to dehydration and should always have access to fresh, clean water.
- The timing of insulin injections should be consistent day-to-day.
- Similarly, the timing and content of meals should be consistent, and small amounts of food should be available at all times.
- High blood glucose (ie, hyperglycemia) is seldom life-threatening, but low blood sugar (ie, hypoglycemia) is an emergency situation. Be familiar with the signs of hypoglycemia (eg, weakness, tremors, twitching, collapse, seizures), and immediately seek veterinary assistance if you see any.