

Diabetes Mellitus

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Diabetes mellitus is a serious disease that, although typically easy to diagnose, can be frustrating for owners and veterinarians to manage. With a reported incidence of approximately 0.5%, more than a half-million dogs and cats in the United States alone have, or will develop, diabetes mellitus.



Placement of a long, centrally located catheter in advance is useful for obtaining blood samples during a glucose curve or hospitalization. It also helps reduce patient stress related to restraint and multiple phlebotomies.

Why & When to Refer

The most common reasons for referral are apparent failure of patients to adequately respond to standard insulin doses or occurrence of life-threatening disease complications, such as ketoacidosis, hyperosmolar diabetes mellitus, or severe hypoglycemia secondary to exogenous insulin therapy. Other disease-related complications, such as infections, cataract formation, retinopathy, neuropathy, nephropathy, and gastrointestinal disorders, may also occur in diabetic animals and may be reason for referral.

Inadequate response to insulin therapy or insulin resistance is probably the most common reason for referral of diabetic patients. Insulin resistance is defined as the need for more than 2.2 units of insulin/kg/dose (1 unit per pound) to maintain adequate glycemic control. Most dogs and cats require a dose less than 1 unit of insulin/kg to attain adequate glycemic control. Insulin resistance should be suspected when hyperglycemia persists throughout the day despite doses exceeding 1.5 units/kg. When this is observed, it may be time to refer or begin looking for underlying causes of insulin resistance after ruling out some owner- and insulin-related problems:

- Thoroughly review insulin administration and handling and feeding practices to determine whether errors are being made; recent changes in insulin vials, or older vials of insulin, should be suspect.
- Determine precisely where insulin is being administered, as absorption may be suboptimal if it is given in the shoulder region as compared with the flank.
- Discuss whether any topical or systemic drugs or supplements are being given; these can affect disease control.

What Information to Supply

When referring a diabetic patient for evaluation and treatment, clearly state the primary concern for the visit, particularly whether the goal is to address disease complications, to evaluate diabetes regulation through performance of glucose curves, and/or to search for underlying causes of insulin resistance. Historical information on changes in body weight, appetite, and degree of polyuria and polydipsia is helpful in trying to determine the level of disease control. Most important is an accurate

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history of insulin therapy, including insulin type, source, dosages, and dosage interval. Known concomitant conditions and additional drug or supplement therapy should also be reported. Diagnostic information that has been collected to monitor disease control, including glucose curve results and glycosylated protein measurements—such as fructosamine or glycosylated hemoglobin—will also be needed. Any additional physical or diagnostic information related to the patient, including recent laboratory data or other test results, is helpful when searching for causes of poor disease control.

What to Ask For

Specific evaluation or diagnostic testing requests should be made as deemed appropriate based on the primary reason for referral. As the referral veterinarian proceeds in his or her evaluation, alterations in this initial plan may occur. Requesting and receiving results and interpretation of data obtained during the evaluation, feedback on alterations in therapy, and plans for follow-up monitoring and care should be anticipated.

What to Expect

Such complications as ketoacidosis or hyperosmolar diabetes mellitus can result in the need for emergency management (see **Treatment of Diabetic Emergencies**).

For cases in which insulin resistance is suspected, a review of the history, treatment, glucose curve, and laboratory data previously collected will be pursued. It is likely that a glucose curve will be done to assess current response to therapy and help differentiate insulin resistance from rapid insulin metabolism as well as prolonged rebound hyperglycemia (Somogyi phenomenon). If insulin resistance is suspected, diagnostic procedures to look for comorbid factors may be pursued (see **Factors That May Contribute to Insulin Resistance**). Based on review of all these variables, changes in insulin therapy, diet, or additional therapies to address comorbid disease will probably be recommended.

Treatment of Diabetic Emergencies

- **Diabetic emergencies require replacement of body fluids, restoration of electrolyte and acid–base balance, and reduction of excessive blood glucose levels.**
- **Appropriate fluid and insulin therapy are critical in achieving these goals.**
- **Identifying and treating any underlying disease that may have precipitated a diabetic emergency may also begin to be addressed during the initial stages of diagnosis and treatment.**
- **Several days of hospitalization will probably be required.**
- **At discharge, changes in diet, insulin therapy, additional therapies, and follow-up monitoring recommendations will probably be made.**

Follow-up Communication

The referring veterinarian should expect timely and regular updates about the patient from the time of the specialist's first visit throughout the course of diagnosis and treatment at the referral practice. Changes in insulin therapy are frequently needed, and should be expected, especially during initial management of diabetes mellitus. Alterations in body weight and resolution of the phenomenon known as glucose toxicity play important roles in changing a patient's insulin requirements.

Typically, no changes in insulin dose are made sooner than 4 to 6 days after a new dose regimen is begun, unless hypoglycemia occurs. This period is required for blood glucose concentrations to equilibrate. Whether further changes in insulin therapy are needed is often best determined by performing a blood glucose curve, a procedure that may be recommended as standard follow-up by the referral specialist. Glucose curves may also be recommended as a routine monitoring tool every few months for long-term management of diabetic patients or at any time when clinical signs recur. Additional monitoring or therapy changes may be suggested by the specialist, depending on identification of and treatments required for comorbid conditions and individual patient factors. Communicating with the referral veterinarian on the results of postreferral procedures is helpful in determining appropriate alterations in the prescribed treatment and monitoring recommendations.

As a final note, insulin options are changing. With the discontinuation of Humulin-L and Humulin-U insulins, many dogs and cats with previously well-controlled diabetes will need to be re-regulated with a different insulin. Discuss current insulin options and recommendations with your specialist. (See Ask the Expert, January 2006, page 67.) ■

Factors That May Contribute to Insulin Resistance

- **Drugs: Glucocorticoids, progestins**
- **Endocrine disorders: Hyperadrenocorticism, hyperthyroidism, hypothyroidism, acromegaly**
- **Diestrus**
- **Infection—For example, urinary tract, respiratory, skin**
- **Ketoacidosis**
- **Pancreatitis**
- **Hyperlipidemia**
- **Obesity**
- **Malnutrition**
- **Neoplasia**
- **Insulin antibodies**
- **Renal disease**
- **Hepatic disease**
- **Heart disease**

See Aids & Resources, back page, for references, contacts, and appendices.