Insulin Resistant Diabetes in Dogs and Cats

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Diet

There is a considerable amount of reliable research data showing that diets high in carbohydrates, low in fat and high in fiber are helpful in regulating diabetic dogs. These types of diets lower the average insulin dose, the average blood sugar, the amount of urine being produced and glycosolated hemoglobins and fructosamine levels.

The carbohydrates in these diets are complex carbohydrates. It is important to avoid diets high in simple sugars, which includes any commercial semi-moist food, primarily those packaged in foil packets. Diets high in simple sugars are absorbed very rapidly before the insulin has time to work. The goal with diet is to balance the absorption of sugar with the onset of action of the insulin. A high carbohydrate/low fat diets also decreases plasma free fatty acid and cholesterol concentrations, and increases the number and activity of insulin receptors.

High fiber diets reduce insulin resistance. The fiber acts to decrease post prandial hyperglycemia, primarily because it delays gastric emptying. A high fiber diet also decreases absorption of glucose and increases insulin action at the receptor.

It has recently been suggested that diabetic cats be fed a high protein/low carbohydrate diet. This can be accomplished with several commercially available canned diets (Hill's M/D, IVD Development, Purina DM, many other canned kitten diets). These diets may result in remission of the diabetes and elimination of the need for exogenous insulin and/or oral hypoglycemic agents. High protein/low carbohydrate diets more closely resemble the diet of felines in the wild and may help reduce glucose intolerance, insulin resistance and obesity.

Feeding

Ideally, the feeding schedule should be coordinated with the onset of action of the insulin. With dogs, this is fairly easy to regulate, but with cats, it is nearly impossible due to their "grazing" style of eating. For cat owners who may not be able to follow a strict feeding schedule or those with multiple pet households, insulin therapy will have to be adjusted to meet the owner's needs. The most important component of the dietary plan is to stress consistency in the diet. The following feeding schedule can be used for dogs and some cats. With insulin given once a day, feed three meals a day (of equal calories) at six-hour internals. Give the first meal at the time of the insulin injection. For animals receiving insulin twice a day, feed four meals a day. Schedule them to coincide with the insulin injections and feed mid-afternoon and late evening.

If the owner is unable to follow this schedule, advise them to feed twice a day, at the time of injection and 8-10 hours later (for once a day insulin patients); or at the times of insulin injections (for twice a day insulin patients).

Home management

1. Instruct owner on proper injection techniques, injection locations, storage and handling of insulin.
2. Instruct owner on how to monitor clinical signs.
3. Continue feeding schedule and dietary therapy.
4. Instruct owners to initially monitor urine glucose/ketone levels daily, usually in the morning or evening prior to feeding. If persistent glycosuria or ketonuria is observed, ask owner to contact the veterinary hospital.
5. Advise owners of the signs of and treatment for hypoglycemia. Have owners keep a bottle of Karo syrup on hand if signs occur (i.e., weakness, ataxia, seizures) so they can rub syrup on the gums immediately. Instruct them to call the veterinary hospital.
6. Home monitoring of a diabetic cat is frequently based on observance of clinical signs only.
7. Serial sugars after the first week of home management.

Re-check evaluations

1. Obtain owner assessment of clinical signs.
2. Serial blood sugars are helpful due to:
    - Variability of insulin action in a given patient.
    - Inaccuracy of random blood or urine sugars in monitoring the degree of glycemic control.
    - Not particularly helpful as a routine procedure in animals that are well controlled clinically.
3. Body weight
4. Physical examination/ophthalmic exam
5. Discuss urine log book with owner
6. Laboratory work as clinically indicated
7. Role of glycosylated hemoglobin and frustosamine:
    - Fructosamine may be helpful in distinguishing stress-induced hyperglycemia from diabetes in cats. These tests can be used every 3 – 4 months as an indicator of long term (2-3 weeks fructosamine; 4-6 weeks glycosylated hemoglobin) glucose control. Rising values indicate the need for further evaluation.

Problems with insulin therapy

1. Insulin induced hyperglycemia (Somogyi phenomenon)
    - Hypoglycemia (<65mg/dl) followed by hyperglycemia (>300mg/dl) within 24 hours of insulin injection.
    - Suspect when insulin requirements exceed 2 U/kg and clinical signs persist.
    - Suspect when animal has signs of hypoglycemia in afternoon.
    - Diagnosis with serial sugars.
    - Treat by decreasing insulin dose 25-50% and review insulin administration with the owner to rule out management problems.
    - Re-check serial sugars in one week.
2. Rapid insulin metabolism
    - Duration of insulin less than 18 hours.
    - Signs return in the evening.
    - Diagnosis is with serial sugars. Hyperglycemia (>250) within 18 hours of insulin injection without previous hypoglycemia.
    - Treatment:
        - Review management with owner
        - Switch to twice daily insulin administration. Most dogs and cats require insulin twice a day to achieve adequate glycemic control. Consider switching to PZI in cats.
3. Insulin Resistance
    - Hyperglycemia (>300) throughout the day, despite insulin dosages > 2 U/kg.
    - Diagnosis based on serial sugars.
        - Potential causes of insulin resistance:
        - Management problems
        - Hyperadrenocoticism
        - Steroid or Ovaban administration
        - Diestrus or pregnancy
        - Acromegaly
        - Concurrent illness, infection
        - Anti-insulin antibodies
        - Hypothyroidism (dogs), hyperthyroidism (cats)
    - If insulin dose exceeds 2U/kg, the animal should be evaluated for one of these causes of resistance.
4. Hypoglycemia
    - Insulin overdosage
    - Suspect if animal shows weakness, shaking, ataxia, seizures at time of insulin's peak effect.
    - Therapy (instructions for owners)
        - Mild signs - give food and call veterinarian
        - Moderate signs - apply Karo syrup to the mouth, offer food when alert and then notify veterinarian.
        - Comatose - apply Karo syrup to mouth and take animal to hospital.
    - When hypoglycemia occurs, serial sugars should be performed to re-assess insulin dose

Summary

Diabetes mellitus is a common endocrine disorder in both the dog and the cat. An understanding of the pathogenesis of diabetes is crucial to understanding how to best manage the disease in both dogs and cats. Diet is playing an even larger role in the management of diabetes in cats. While oral hypoglycemic agents may have a place in both dogs and cats, the mainstay in treatment remains exogenous insulin administration.