UNIVERSITY OF CALGARY
FACULTY OF VETERINARY MEDICINE

*This review accompanies the relevant episode of the Cutting Edge veterinary podcast. In each episode of this podcast, 3rd year students in the University of Calgary's veterinary medicine program fill you in on the most up-to-date literature and evidence-based practices on topics that matter to you, the practising veterinarian.*

# Diabetes Management for Cats: how can we make it easier and more affordable?

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## Introduction

Diabetes mellitus (DM) is an umbrella term used to describe various disease states characterized by persistent hyperglycemia. In cats DM is usually caused by a loss of insulin production by beta cells in the pancreas and/or loss of insulin sensitivity in tissues (Sparkes et al., 2015). This loss or dysfunction of beta cells is thought to be caused by insulin resistance, amyloidosis or chronic pancreatitis. Risk factors for cats to develop DM include obesity (and the resulting insulin resistance in tissues), acromegaly, and certain medications like corticosteroids (Behrend et al., 2018). Classical clinical signs of DM include polyuria, polydipsia, polyphagia and weight loss. Less common clinical signs include diabetic polyneuropathy which often manifests as a plantigrade stance. These clinical signs give a strong clinical suspicion of DM but diagnosis is based on the principle of proving persistent hyperglycemia because of the potential for stress hyperglycemia cats. Project ALIVE (Agreed Language in Veterinary Endocrinology) focuses on bringing experts together to have common terminology and consensus on diagnostic criteria(*Project ALIVE | ESVE*, 2021). ALIVE criteria for diagnosis separates patients into two possible criteria to confirm DM:

1. A patient with spot blood glucose (BG) > 15mmol/L with classical clinical signs of hyperglycemia and at least one of either: increased glycated proteins (fructosamine) or glucosuria*
2. A patient with spot BG between 7-15mmol/L and at least two of: classic clinical signs of hyperglycemia or hyperglycemic‡ crisis (with other causes ruled out), increased glycated proteins, or glucosuria*

*This glucosuria must be in a naturally voided sample on more than one occasion in their home environment and at least 2 days after any stressful events
‡Hyperglycemic crisis includes diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic state, can see Rand (2013) for more detail

Treatment for DM usually involves twice daily injections with long-acting insulin and feeding a low carbohydrate diet(Sparkes et al., 2015). This paper won't discuss insulin types or diet as part of DM management. Unlike dogs who generally need to be fed at the same time as their insulin injections, cats can maintain a grazing habit throughout the day. There are newer anti-hyperglycemic medications such as velagliflozin (Senvelgo®) that are a once daily oral medication. These work by increasing the excretion of glucose in the urine but require endogenous insulin production to avoid hyperglycemic crisis. These newer medications as a treatment option won't be covered in this paper. Generally, treatment aims to have the glucose level in the blood as close to the normal range for as long of the day as possible, without episodes of hypoglycemia. These blood glucose levels are sometimes monitored through blood glucose curves (BGC) which aims to find the lowest BG (also called the nadir) and highest BG throughout the day. Fructosamine can also be used for monitoring, in addition to being utilized for diagnosis. More in-depth discussion on monitoring methods is covered later in the paper.

Many guides with protocols already exist for managing DM, so why revisit this topic? A large survey of veterinarians in multiple countries showed that the cats who had the highest risk of euthanasia due to a DM diagnosis were at rural veterinary clinics in Canada (Niessen et al., 2017). While research is lacking on information directly from owners on decisions to euthanize due to DM, common concerns from owners include cost and quality of life for both the cat and the owner(Albuquerque et al., 2020). We suggest it is worthwhile for practitioners to be flexible in their treatment and monitoring of DM in cats as the nature of this disease allows for favourable clinical outcomes with multiple different management methods. This being said, a humane peaceful death is not a poor outcome for a diabetic animal, there needs to be considerable commitment of time and money from the owner and it's understandable that commitment may not be possible for all clients or all cats.

This paper aims to explore treatment and monitoring options for owners who are willing to treat by may be limited by the cost and time commitment of traditional diabetes management. The Feline Diabetic Remission Clinic at Royal Vet College in the UK has published diabetes guidelines that focus on general treatment principles instead of strict or rigid protocols (Hazuchova et al., n.d.). Every diabetic cat and owner are different and adhering to one protocol for every case may not be best for them. Ultimately having multiple treatment options means we can increase the amount of happy and healthy pets staying with their happy owners. We tackle three aspects of DM management: how do we help owners successfully manage this disease, options for monitoring treatment success, and concurrent disease and remission.

## Owners and Diabetic Cats

Most information on an owner's reason for euthanasia are around discontinuing treatment within the first year versus not starting treatment for DM at all. We think there is a research gap on reasons owners decide to euthanize at diagnosis and wonder how clinicians can help support owners better during diagnosis of DM. In a large survey of veterinarians on frequency and reasons for euthanasia of diabetic animals, by Neissen et al. (2017), they reported that a median 1/10 animals are euthanized at diagnosis for DM and another 1/10 within 1 year.

Based on the veterinarians' perceptions, the most likely cause for euthanasia were: concurrent disease, costs, animal age, issues managing DM, pet welfare and impact on owners lifestyle. These perceived concerns give us an idea on where flexibility in our diabetic management may help owners, but without directly surveying the clients themselves, it is very possible veterinarians do not get the whole truth on why a client decides on euthanasia for a diabetic animal. It is known that owners are worried about judgement when deciding on treatment options and the skill of veterinarians to present options non-judgmentally varies (Hughes et al., 2018).

Albuquerque et al. (2020) used owner questionnaires to assess the owners' perceptions and priorities when it comes to treatment and monitoring of DM, the effectiveness of the communication with the veterinary team on essential DM information, and what impact DM had on owners' everyday lives with their pets. This study revealed owners were most concerned about costs and care for their cat while travelling. It was also found that less than half of veterinarians discussed how to recognize an unstable diabetic animal, diabetic remission, or options to monitor blood glucose at home. Instructions to draw up and give insulin were also not demonstrated for a quarter of clients and only 45% felt confident recognizing hypoglycemia. The authors did acknowledge there is a vast amount of information to cover when discussing a newly diabetic animal, so the use of follow up by clinic team members and handouts with the information should be utilized so owners have access to accurate information.

Interestingly this study also noted that the owners concern about costs, boarding, impact on daily life and potential for negative impact on the bond with their cats reduced significantly after initiating treatment; owners felt that caring for a diabetic animal had less impact on their daily lives than they thought it would before starting treatment. In a stable newly diagnosed diabetic, starting the patient on only once a day insulin for the initial days of treatment helps the owner become more comfortable with the process and see how their cat reacts in their home environment to the injections, before committing to twice a day administration and long term care (Dr.E. Ruelle, personal communication, 2024). For a client with concerns about their cat's quality of life when receiving treatment, committing to a week or two of treatment with a scheduled follow up with the veterinary team for a longer-term plan may be easier to accept instead of euthanizing the pet without attempting treatment. Attempting this approach takes good communication between the client and veterinary team to ensure the patient continues to receive treatment or a decision to euthanize is made.

## Monitoring

Project ALIVE (Agreed Language in Veterinary Endocrinology) focuses on bringing experts together to have common terminology and consensus on diagnostic criteria(*Project ALIVE | ESVE*, 2021). They have also compiled agreed upon monitoring methods and treatment goals for DM patients. The treatment goals they recommend don't include specific target blood glucose parameters, counter what is the common method for monitoring DM patients. The four main goals they present are:

1. Good quality of life of pet and owner

2. Resolution of the classical clinical signs of diabetes mellitus
3. Avoidance of hypoglycemia and DKA
4. Normalization of body condition score

ALIVE suggests assessing the success of treatment by using a clinical scoring system (see Table 2) and assessment of glycemic parameters in blood, interstitium or urine. They note that there is no high-level evidence that specific glycemic parameters are correlated with successful treatment outcome, including remission (see remission discussion below). The right strategy to monitor control of DM will be different for each cat and owner, and it may change over time as the patient health status changes or the owners' circumstance or treatment goals change (Hazuchova et al., n.d.). For example, a cat who is left alone during the day should probably be managed in a way to limit the chance of an episode of hypoglycemia when no one is around. A difficult to treat or semi-feral cat may benefit from a more hands off approach. There are multiple ways to monitor treatment success for diabetic cats, each with advantages and disadvantages. These are briefly explored in Table 1. There is also data to support that all methods should be discussed with the owner, up to 76% of owners prefer to have some kind of home blood glucose monitoring, however only 40% of veterinarians discussed it and owners wished it has been recommended by their veterinarian (Albuquerque et al., 2020).

| Monitoring Method | Pros | Cons |
|---|---|---|
| Fructosamine | No affected by stress hyperglycemia<br>Single sample<br>Usually less expensive than BGC | Issues with reliability (ref)<br>Must use same assay for repeat assessments in same patient<br>Can miss DM if very recent<br>Will appear normal if patient is experiencing very high and very low values as it's an average |
| Blood Glucose Curve (BGC)-in clinic | Only tool that can show nadir*, % time in target zone and duration of insulin | Substantial day to day variation<br>Influenced by stress of being in the clinic<br>Some cats will not tolerate |
| Home Blood Glucose Curve | Not stressed in clinic<br>Can perform on a "normal" day | Substantial day to day variation<br>Equipment required<br>Concerns of impact to human-animal bond, some cats will not tolerate |
| Urine Glucose | Easy to collect and test at home<br>No urine glucose can suggest overdosing/remission | Exact concentration impacted by urine volume<br>Can be influenced by stress<br>Well controlled cats will often have urine glucose |

| | | |
|---|---|---|
| Clinical Signs | Whole picture of how the cat is doing clinically<br>Can be owner reported<br>Can be connected to a numerical score for tracking changes over time (see Table 2) | Quality depends on owner instructions/reporting and clinician skill<br>Multiple animals in the house may make tracking food/water intake and urine volume difficult |

Table 1. Pros and Cons of various monitoring methods for DM. Resources used: ALIVE, ISFM Consensus on Feline DM, AAHA Consensus on DM, RVC Diabetes Remission Clinic Guidelines. (Behrend et al., 2018; Hazuchova et al., n.d.; *Project ALIVE | ESVE*, 2021; Sparkes et al., 2015)
*Nadir is the lowest blood glucose dips after insulin administration

Often with these objective/numerical monitoring methods, if the numbers are not ideal but the patient is clinically well, it is not recommended to change the insulin dose. Perhaps if a patient is clinically doing well (where clinical signs of DM are controlled, no evidence of episodes of hypoglycemia, and body condition score is maintained) a BGC or fructosamine test could be held off until one of these parameters changes, instead of a set interval when it needs to be repeated. A standard questionnaire can be used to monitor clinical signs over time, an example is in Table 2, adapted from the RVC Diabetic Remission Clinic scoring chart (Hazuchova et al., n.d.).

| Diabetic Clinical Score | | |
|---|---|---|
| Clinical Signs | Severity (compared to pre-diabetes onset) | Score |
| Unintended weight loss over the past 2 months (based on body weight measurement) | None or weight gain<br>Mild<br>Moderate<br>Severe | 0<br>1<br>2<br>3 |
| Increased drinking and/or urination (owner question) | None<br>Mild- some increase noted<br>Moderate- increased filling of water bowl<br>Severe- constantly seen to drink | 0<br>1<br>2<br>3 |
| Increased appetite (owner question) | Normal appetite<br>Mild- finishes food eagerly<br>Moderate- finishes food eagerly and begs for more<br>Severe- obsessed with food | 0<br>1<br>2<br>3 |
| Decreased activity/attitude (owner question) | Normal or increased activity<br>Mild- slightly less active<br>Moderate- certainly less active<br>Severe- mainly lying around | 0<br>1<br>2<br>3 |
| | Total Score | /12 |

Table 2. Clinical Scoring for Diabetic Cats, adapted from the RVC Diabetic Remission Clinic

## Should remission be the goal?

The goal of treating diabetic cats is usually to give them enough insulin to control clinical signs, like polydipsia, polyuria and weight loss, to maintain good quality of life for both cat and caregivers. In some literature, high intensity DM treatment programs (meaning multiple BG measurements a day and insulin treatment to keep the BG level in a very narrow range) are presented for cats because of the ability of cats with well controlled DM to enter remission for the disease and no longer require insulin treatment (Roomp & Rand, 2012, 2013). However, remission is reported using multiple treatment protocols and remission rates are quite variable from 17-100% depending on protocol and the study. RVC reports a remission rate of 30-40% from their Diabetic Remission Clinic. Gostelow et all (2014) report that higher rates of remission are often associated with poor study design, and the RVC Remission Clinic themselves acknowledge remission should be seen as a bonus, but not a treatment goal. For cats who do achieve remission, relapse of diabetes is reported to be around 30% (Gottlieb et al., 2015). Based on the lack of compelling data, the authors agree with RVC that remission is a bonus but treatment plans should not be made with remission as a goal.

Diabetes, as it is usually seen in feline patients, is not a disease that occurs on it's own, it is secondary to another disease or set of clinical factors (Hazuchova et al., n.d.). Many guides for DM management stress the importance of addressing any concurrent disease such as obesity or diseases affecting the pancreas (IBS, triaditis) (Behrend et al., 2018; Hazuchova et al., n.d.; *Project ALIVE | ESVE*, 2021; Sparkes et al., 2015). Concurrent disease is often recorded as a reason for euthanasia of a cat with DM, however data is lacking on the specific co-morbidities the patient has and how often the initial disease is related to the DM diagnosis. Diabetogenic-drugs are often listed as a risk factor for development of DM, these drugs include: glucocorticoids, progestins and cyclosporin (Behrend et al., 2018). Guides for DM management recommend discontinuing these drugs for hopes of remission but this is another scenario where quality research is lacking on rates of remission when removing these drugs. It is important to note that patients on these medications generally require them to manage another condition that most likely does not go away when diagnosed with DM. For example, if a cat has an inflammatory disease well controlled with steroids, should the risk of relapse of that disease by taking them off the steroids to better control the DM be tolerated? It is likely that destabilizing another disease process while trying to control diabetes could make it harder to manage the clinical signs from the DM and potentially lead to treatment failure. We suggest that it should be a conversation with the owners on the chance of remission versus their willingness to change management of another disease. The 30-40% chance of remission may be the most important to some owners whereas not risking relapse in vomiting/diarrhea/atopy may be more important to other owners.

## Conclusion

This review discussed three areas where clinician flexibility and creativity can improve the quality of life for both diabetic cats and their caregivers, while also making management of this disease more affordable. Hopefully this review has offered new ideas for the care of these cases and how to involve owners in the management decisions around their diabetic animals. Adopting

treatment principles will hopefully lead to more open conversations with clients on their own goals for DM treatment and how we can best support them.

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