



Diabetic protocols: useful or not?

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Practice protocols dictating the glycaemic targets and the insulin dose changes depending on set specific blood glucose (or other glycaemic) values can help provide certainty to those that feel out of their depth in the field of diabetes management. Studying the various recommendations from various experts in the field, a multitude of differing protocols could be (and have been) designed for this purpose, undoubtedly leading to owners (and veterinarians) being confused when comparing these different recommendations between practices and hospitals. There is a big problem with using these protocols though.

Firstly, it should be remembered that no two patients are the same; each patient will have a different insulin sensitivity (which will also vary over time) and therefore will behave differently to a dose change (compared to the next patient, often also as compared to the same patient a month ago). There are many daily changing factors that influence the blood glucose concentrations, more than just food and insulin, creating a dynamic environment with a limit to the predictability of the insulin response. The author therefore does not have a set detailed hospital protocol for the management of diabetes (apart from when performing randomised clinical trials). Whether to design a protocol for one's own practice is an individual choice and can certainly be justified despite the above concerns, especially when there is lacking experience in dealing with the disease within the attending veterinary team. Overall, however, a few aspects should be born in mind during such design.

One of these aspects is the following: clinicians should always ensure the clinical picture is being incorporated in any assessment; all too often having a practice protocol for diabetes tries to make this a mathematical disease, a disease of numbers, which given the variability concerns inherent to all measurable biological glycaemic parameters will lead to problems. For instance, the time and depth of the nadir (the lowest point on a glucose curve) has been shown to vary from day to day in both diabetic dogs and cats treated with insulin. Additionally, there are technical limitations in measuring these glycaemic parameters. For instance, the use of glucometers validated for humans is emphatically discouraged, given their inherent inaccuracy compared to veterinary validated ones. Lipaemia, often present in the diabetic patient, and other artefacts can affect fructosamine, stress can affect a blood glucose curve. The main characteristics and limitations of the main monitoring tools available are summarised in Table 1 and should be considered when designing an individualised treatment protocol.

Therefore, although assessment of these glycaemic parameters is still recommended, their interpretation should always start by looking at the clinical picture first. The use of the newly validated Diabetic Clinical Score (a system that scores 4 main clinical signs adding to a maximal score of 12; more info: www.facebook.com/RVC.Diabetic.Remission.Clinic), helps standardising, quantifying and communicating the clinical picture between pet owners, different veterinarians and nurses.



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Table 1

Tool	Details	Advantages	Disadvantages
History, Diabetic Clinical Score (DCS) and physical examination including body weight and body condition score	Key prior to assessing any glycaemic parameter. The DCS is a validated tool to quantify the main clinical signs	Clinical picture never lies Cheap Scoring system available	Quality is owner and clinician dependent
Serial blood glucose measurements (blood glucose Curve)	Usually taken 2–3 hourly from injection till next injection, more often when glucose <10 mmol/l	Only tool with potential to show nadir, percentage of time in target zone and duration of insulin action Can be done at home	Susceptible to stress Financial and time costs Impossible in some cats Biological day-to-day variation in values
Fructosamine	Serum sample reflecting the average glycaemic control over the last 1–4 weeks	Single blood sample Not affected by stress hyperglycaemia Often smaller investment in time and money than glucose curve	Does not provide detailed information about nadir and thus hypoglycaemia risk Can also be higher with hypoglycaemia-induced hyperglycaemia Assay and sample issues
Spot blood glucose test	Single blood glucose determination — sometimes performed at estimated time of nadir	If low, overdosing or remission possible; insulin should be reduced Could be used preinsulin: assess for insulin overdosing	Not useful for assessing whether insulin dose needs to be increased, since time of nadir cannot be predicted (day-to-day variability of nadir) Affected by stress

Urine glucose	Urine glucose concentration determined by dipstick; the concentration depends on glucose spillover and volume of urine produced	Easy and cheap Can be done at home Absence of urine glucose implies overdosing and/or remission	Exact concentration rarely useful: can be high e.g. if urine volume low Can be affected by stress Presence of glucose even with well controlled pets
Urine ketones	Urine ketone concentration determined by dipstick	Easy and cheap Can be done at home	Ketones sometimes present in well controlled diabetic pets

The advantages and limitation of glucose curves

The option of home blood glucose monitoring (HBGM) is probably currently underused in many countries, including the UK. Nevertheless, there is great potential to make things easier when the owner has the ability to generate valuable monitoring data in a relatively stress-free environment, could prove more economical to the pet owner compared to frequent clinic visits as well as an aide in preventing dangerous hypoglycaemia. However, Quality of Life investigations suggest that clinicians should ensure to not force HBGM upon ALL pet-owner combinations. In fact, HBGM could prove to be an unwanted extra burden for some, on top of the daily necessity of insulin injections. In a modern veterinary practice this option should however be offered, also since it might reduce the costs involved in the monitoring process. Several handheld glucometer devices are currently available, although clinicians should be aware of significant under- and over-estimation of blood glucose values when using particular brands. Recent research has emphasised that clinicians should guard themselves against over-interpretation of one single blood glucose curve, especially if the curve is in contrast with the clinical picture. The latter is likely explained by observed significant day-to-day variation in serial blood glucose determinations. The so-called “nadir-check” or “spot blood glucose check” at times of the previously established nadir is out of date practice.



What quality of life research teaches us

Recent quality of life research highlights the second big problem with using rigid protocols. Studies highlight the many specific areas in life where having a diabetic pet can be troublesome for an owner and which can lead to dissatisfaction and ultimately treatment cessation/ failure. Whenever diabetes mellitus (DM) is diagnosed in a pet, the life of that pet changes significantly. However, the life of the owner of that pet also changes significantly. Instead of merely walking and/or cuddling their pet, owners suddenly have to inject their cat or dog and deny them the dinner left-overs they have been giving for 9 years. From a practical point of view, owners now also need to be at home twice daily at a fixed time for food and insulin. Going away on holiday now requires sorting out a place for their cat or dog that also manages to maintain the insulin and food regimen. And then there are the costs involved, especially in terms of blood glucose monitoring and possibly prescription food...Nevertheless, once treatment for DM has been initiated, clinicians often primarily focus on the biological side of things, i.e. control of blood glucose levels. Indeed, for many clinicians treatment success is often solely defined as obtaining “close to normal” serial blood glucose values and/or “normalising” fructosamine in conjunction with improvement in clinical signs (polyuria, polydipsia, polyphagia and weight loss). No wonder that recent data suggest that up to 30% of all diabetic pets have their treatment ceased within one year after diagnosis, which basically equates to elective euthanasia. This appalling fail rate will not just be due to lack of biological success.

In light of the above, when evaluating diabetic treatment success in dogs and cats, we should probably also include paying a lot more attention to these earlier mentioned psychological and social effects of the impact of DM and its relatively complex daily treatment regimen, as well as the owner's perceptions of the disease and its management. Indeed, should an owner experience a particularly negative impact on his or her quality of life (QoL) or the QoL of their pet as a result of the DM, a decision to cease therapy may be the inevitable outcome regardless of the apparent clinical success.

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Research involving hundreds of veterinary practices and hundreds of diabetic pet owners has started to unravel the intricacies of the quality of life of the diabetic pet and the quality of life of the owner of such pet. We can now start to use this knowledge to our advantage to improve our short-term as well as long-term success rates when it comes to DM treatment. The table below shows the top 10 areas in life that were identified to be impacted after a diagnosis of DM in a dog. The order of the items indicates how important the items are thought to be for diabetic dog owners, with the top items being perceived to most negatively impacting QoL of a diabetic dog and his or her owner. The QoL impact score (final column) represents a simplification of a validated scientific measure that quantifies how severe the impact is perceived to be: the more negative the number, the more negative the impact and the bigger the need for the veterinary team to try to influence this area.

Item number	Abbreviation	Item	QoL impact score
1.	Worry	Do you worry about your pet's diabetes?	-6
2.	Friends & family	Do you ever choose not to leave your pet to stay with friends or family because of the diabetes?	-6
3.	Worry vision	Do you ever worry about your pet getting vision problems due to cataracts or did you worry about this prior to your pet suffering from such problems?	-6
4.	Boarding kennels	Do you ever choose not to put your pet into boarding kennels because of the diabetes?	-5
5.	Worry hypo	Do you ever feel worried about your pet suffering from an episode of low blood glucose?	-5
6.	Social life	Do you ever find you need to fit your pet's diabetes into your social life? (e.g. carrying needles, food, insulin, providing food on time)	-5
7.	Costs	Do you ever worry about how much money your pet's diabetes costs you and your family?	-4
8.	Future care	Do you ever feel worried you will not be able to take care of your pet in the future because of the diabetes?	-4
9.	Working life	Do you ever find you need to fit your pet's diabetes into your working life? (e.g. having to make special arrangements when you need to work late or need to start working earlier)	-4
10.	Restrict your activities	Do you ever find the diabetes of your pet restricts or limits what you are doing or what you want to do, like going on holidays, away for weekends, away for the day/night, working?	-4



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Therefore, ideally, this, or similar surveys, should be conducted with every diabetic pet owner in order to find out what they are struggling with and what their desires are when it comes to their ideal, individualised, diabetes management strategy. The free RVC Pet Diabetes App for iPhones, tablets and Android smart phones allows owners to complete this survey and send the results to the veterinary practice, as well as record and share the more traditional biological parameters and observations. Using the App has been shown to make the pet owner part of the treatment team and fosters empowerment, which in turn fosters treatment compliance. Pet owners can download it here: for Android - <http://bit.ly/1q3jCV5> ; for iPhone: <http://apple.co/203OoK2>

Principles – not protocols

In summary, it seems appropriate to have "guidelines" and "principles", though we have to watch out that a "protocol" leads us to deal with these patients in a simplified and therefore an incorrect way, because they more often than not do not fit with the protocol, their glycaemic parameters might be deceiving us or the pet owners have trouble complying with the suggested protocol. Some pets and owners will benefit from more intense or more complete monitoring and others will benefit from a more pragmatic approach and less intense management (e.g. when working to a tight budget or working with a very busy or unmotivated owner or 'feisty' cat). Key words to remember are therefore: individualisation, treatment principles, not protocols.