THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

CENTRE FOR COMPANION ANIMAL HEALTH
The School of Veterinary Science, The University of Queensland
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CATS

Dosing protocol for cats on glargine or detemir using daily home monitoring of blood glucose concentrations to adjust insulin dose

Roomp K, RAND JS Evaluation of intensive blood glucose control using glargine in diabetic cats. Vet Intern Med 2008; 22 (3):770; Roomp K, RAND JS Factors predictive of non-insulin dependence in diabetic cats initially treated with insulin. Vet Intern Med 2008; 22 (3):791; and Roomp and Rand, unpublished data

Table 3A. Parameters for changing insulin dosage when using insulin glargine (Lantus) or detemir (Levemir) together with **home monitoring of blood glucose concentrations** in a protocol aimed at achieving intensive blood glucose control. Blood glucose should be measured at **least 3 times daily** with a glucometer. This protocol was tested in 55 diabetic cats for glargine and 18 diabetic cats for detemir. Owners measured blood glucose an average of 5 times daily and adjusted insulin dose based on the protocol. This has not been tested with veterinarian-measured blood glucose curves once every week or two weeks, and Table 2 is recommended if intensive home monitoring is not being performed.

NB. The blood glucose values were based on using portable glucose meters (Ascensia Contour, Bayer, Leverkusen, Germany; Accu-Chek Aviva, Roche Diagnostics, Basel, Switzerland) which use ≤0.6 µL of blood per test. **These meters measure blood glucose concentration in whole blood and are calibrated for use with human blood.** Measurements from meters calibrated for human blood which provide plasma-equivalent values are approximately 10% higher.

NB. It is very important to note that blood glucose concentrations measured using a whole blood glucose meter calibrated for human blood may measure 30-40% lower in the low end of the range than glucose concentrations measured using a serum chemistry analyser or a plasma-equivalent meter calibrated for feline use. **Therefore, if using a meter calibrated for feline use (eg. AlphaTRAK, Abbott Laboratories, CA, USA), or a serum chemistry analyzer,** add approximately 30 mg/dL (1.7 mmol/L) to the target glucose concentrations (see Table 3B). For example, a target > 50 mg/dL (2.8 mmol/L) becomes > 80 mg/dL (4.4 mmo/L) when using a meter calibrated for feline use. **Instead of aiming for 50-100mg/dL (2.8-5.6 mmol/L) , aim for 80-130 mg/dL (4.4-7.2 mmol/L [round numbers 4.5-7.0 mmol/L). Meters calibrated for feline use may read higher or lower than the actual value, in contrast to consistently lower readings for meters validated for human blood.**

NB Mean median maximum dose in cats on detemir is about 30% less than for glargine (1.7 U/cat BID; range 0.5 to 4.0 IU versus 2.5 U/cat BID; range 1.0 to 9.0 IU BID).

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TABLE 3A: Target blood glucose concentrations when using a blood glucose meter calibrated for human blood which measures glucose concentrations in whole blood. DO NOT USE THESE TARGET GLUCOSE CONCENTRATIONS IF USING A METER CALIBRATED FOR FELINE USE (eg. Abbott AlphaTRAK) or a serum chemistry analyzer – use table 3B instead).

Dose increases are per injection per cat.

Parameter used for dosage adjustment	Change in dose
Phase 1: Initial dose and first 3 days on glargine or detemir	
Begin with 0.25 IU/kg of ideal weight BID OR If the cat received another insulin previously, increase or reduce the starting dose taking this information into account. Glargine has a lower potency than lente insulin and PZI in most cats.	
Cats with a history of developing ketones that remain >300 mg/dL (17 mmol/L) after 24-48 hours	Increase by 0.5 IU
If blood glucose is < 50 mg/dL (2.8 mmol/L)	Reduce dose by 0.25-0.5 IU depending on if cat on low (<3 IU/cat) or high dose (≥ 3 IU/cat) of insulin
Phase 2: Increasing the dose	
If nadir blood glucose concentration >300mg/dL (17 mmol/L)	Increase every 3 days by 0.5 IU
If nadir blood glucose concentration 200-300mg/dL (11-17 mmol/L)	Increase every 3 days by 0.25-0.5 IU depending on if cat on low or high dose of insulin
If nadir blood glucose concentration < 200mg/dL but peak is > 200mg/dL (11 mmol/L)	Increase every 5-7 days by 0.25-0.5 IU depending on if cat on low or high dose of insulin
If blood glucose is < 50 mg/dL (2.8 mmol/L)	Reduce dose by 0.25-0.5 IU depending on if cat on low or high dose of insulin
If blood glucose at the time of the next insulin injection 50-100 mg/dl (2.8-5.6 mmol/L)	Initially test which of the alternate methods is best suited to the individual cat: **a.** Feed cat and reduce the dose by 0.25-0.5 IU depending on if cat on low or high dose of insulin **b.** Feed the cat, wait 1-2 hours and when the glucose concentration increases to >100 mg/dL give the normal dose. If the glucose concentration does not increase within 1-2 hours, reduce the dose by 0.25 IU or 0.5 IU (as above). **c.** Split the dose: feed cat, and give most of dose immediately and then give the remainder 1 to 2 hours later, when the glucose concentration has increased to >100 mg/dL. If all these methods lead to increased blood glucose concentrations, give the full dose if pre-insulin blood glucose concentration is 50-100 mg/dL and observe closely for signs of hypoglycemia. In general for most cats, the best results in phase 2 occur when insulin dose is as consistent as possible, giving the full normal dose at the regular injection time.

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Phase 3: Holding the dose. Aim to keep blood glucose concentration within 50-200 mg/dL (2.8 – 11 mmol/L) throughout the day.	
If blood glucose is < 50 mg/dL (<2.8 mmol/L)	Reduce dose by 0.25-0.5 IU depending on if cat on low or high dose of insulin
If nadir or peak blood glucose concentration > 200mg/dL (11 mmol/L)	Increase dose by 0.25-0.5 IU depending on if cat on low or high dose of insulin and the degree of hyperglycemia
Phase 4: Reducing the dose. Phase out insulin slowly by 0.25-0.5U depending on dose.	
When the cat regularly (every day for at least one week), has its lowest blood glucose concentration in the normal range of a healthy cat, and stays under 100 mg/dL overall	Reduce dose by 0.25-0.5 IU depending on if cat on low or high dose of insulin
If the nadir glucose concentration is 40 - <50 mg/dL (2.2-<2.8 mmol/L) at least three times on separate days	Reduce dose by 0.25-0.5 IU depending on if cat on low or high dose of insulin
If the cat drops below 40 mg/dL once (2.2 mmol/L)	Reduce dose immediately by 0.25-0.5 IU depending on if cat on low or high dose of insulin
If peak blood glucose concentration > 200mg/dL (11 mmol/L)	Immediately increase insulin dose to last effective dose
Phase 5: Remission. Euglycemia for a minimum of 14 days without insulin.	

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TABLE 3B: Target blood glucose concentrations when using a blood glucose meter calibrated for **feline use** (eg. AlphaTRAK Abbott Laboratories).

Dose increases are per injection per cat.

NB Mean median maximum dose in cats on detemir is about 30% less than for glargine (1.7 U/cat BID; range 0.5 to 4.0 IU versus 2.5 U/cat BID; range 1.0 to 9.0 IU BID).

Parameter used for dosage adjustment	Change in dose
Phase 1: Initial dose and first 3 days on glargine or detemir	
Begin with 0.25 IU/kg of ideal weight BID OR If the cat received another insulin previously, increase or reduce the starting dose taking this information into account. Glargine has a lower potency than lente insulin and PZI in most cats.	
Cats with a history of developing ketones that remain >300 mg/dL (after 24-48 hours	Increase by 0.5 IU
If blood glucose is < 80 mg/dL (4.5 mmol/L)	Reduce dose by 0.25-0.5 IU depending on if cat on low or high dose of insulin
Phase 2: Increasing the dose	
If nadir blood glucose concentration >300mg/dL (17 mmol/L)	Increase every 3 days by 0.5 IU
If nadir blood glucose concentration 200-300mg/dL (11-17 mmol/L)	Increase every 3 days by 0.25-0.5 IU depending on if cat on a low (<3 IU/cat) or high dose (≥ 3 IU/cat) of insulin
If nadir blood glucose concentration < 200mg/dL but peak is > 200mg/dL (11 mmol/L)	Increase every 5-7 days by 0.25-0.5 IU depending on if cat on low or high dose of insulin
If blood glucose is < 80 mg/dL (4.5 mmol/L)	Reduce dose by 0.25-0.5 IU depending on if cat on low or high dose of insulin
If blood glucose at the time of the next insulin injection 80-130 mg/dl (4.5-7.2 mmol/L)	Initially test which of the alternate methods is best suited to the individual cat: **a.** Feed cat and reduce the dose by 0.25-0.5 IU depending on if cat on low or high dose of insulin **b.** Feed the cat, wait 1-2 hours and when the glucose concentration increases to >100 mg/dL give the normal dose. If the glucose concentration does not increase within 1-2 hours, reduce the dose by 0.25 IU or 0.5 IU (as above). **c.** Split the dose: feed cat, and give most of dose immediately and then give the remainder 1 to 2 hours later, when the glucose concentration has increased to >100 mg/dL. If all these methods lead to increased blood glucose concentrations, give the full dose if pre-insulin blood glucose concentration is 50-100 mg/dL and observe closely for signs of hypoglycemia. In general for most cats, the best results in phase 2 occur when insulin dose is as consistent as possible, giving the full normal dose at the regular injection time.

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Phase 3: Holding the dose. Aim to keep blood glucose concentration within 80-200 mg/dL (4.5 – 11 mmol/L) throughout the day.	
If blood glucose is < 80 mg/dL (<4.5 mmol/L)	Reduce dose by 0.25-0.5 IU depending on if cat on low or high dose of insulin
If nadir or peak blood glucose concentration > 200mg/dL (> 11 mmol/L)	Increase dose by 0.25-0.5 IU depending on if cat on low or high dose of insulin and the degree of hyperglycemia
Phase 4: Reducing the dose. Phase out insulin slowly by 0.25-0.5U depending on dose.	
When the cat regularly (every day for at least one week), has its lowest blood glucose concentration in the normal range of a healthy cat, and stays under 130 mg/dL (7.2 mmol/L) overall	Reduce dose by 0.25-0.5 IU depending on if cat on low or high dose of insulin
If the nadir glucose concentration is 70 - <80 mg/dL at least three times on separate days (3.9-<4.5 mmol/L)	Reduce dose by 0.25-0.5 IU depending on if cat on low or high dose of insulin
If the cat drops below 70 mg/dL once (4.5 mmol/L)	Reduce dose immediately by 0.25-0.5 IU depending on if cat on low or high dose of insulin
If peak blood glucose concentration > 200mg/dL (>11 mmol/L)	Immediately increase insulin dose to last effective dose
Phase 5: Remission. Euglycemia for a minimum of 14 days without insulin.	