Using Glargine in Diabetic Cats

MEDICAL FAQS

INTRODUCTION

Glargine insulin is a relatively new form of sustained release insulin that has found popularity in diabetic cats. These instructions for using glargine are based on a small number of cats, and caution should be exercised with the insulin until it has been used in a larger number of cats. Because glargine is very long-acting, there is the potential for prolonged hypoglycemia if overdosed.

REFERENCES

Related Info

Feedback: VINFAQ@vin.com

CLINICAL USE INFORMATION

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Basic information

- Glargine (Lantus) is readily available from most pharmacies with a script, is not licensed for use in cats.
- Glargine must not be diluted or mixed with anything because the prolonged action is dependent on its pH.
- Insulin glargine should be kept refrigerated to prolong its life.
- Insulin glargine has a shelf-life of 4 weeks once opened and kept at room temperature. Opened vials stored in the refrigerator can be used for up to 6 months.
- Discard vial immediately if there is any discoloration. Bacterial contamination and precipitation associated with pH change can cause cloudiness.
- If using an insulin pen, the manufacturer recommends that the pen and cartridge be kept at room temperature and not refrigerated. This is to reduce the changes in volume of insulin dispensed associated with changes in temperature.
- When performing a blood glucose curve, samples probably only need to be taken every 4hrs over 12 hr in many cats (ie. 0h [before morning insulin], 4h, 8h and 12h after morning insulin).
- Dose changes should be made based on pre-insulin glucose concentration, nadir (lowest) glucose concentration, daily water drunk, and urine glucose concentration.
- Better glycemic control is achieved with twice daily dosing rather than once daily.
- Some pharmacies stock insulin syringes (Wal-Mart) with gradations in ¼ U, which are ideal for cats.
- Some cats that have been treated with other insulin will go into remission, usually within 1-4 months after instituting glargine. Remission in cats that have been treated for more than 2 years is extremely rare.
- Remission is likely to occur if the nadir glucose is in the normal range and pre-insulin blood glucose is less than 216 mg/dL (12 mmol/l). However, for some cats to achieve remission, the dose needs to be very gradually reduced, tapering off to ½ U SID before being withdrawn. Too rapid withdrawal often requires restabilizing at a higher dose for some weeks.

**Storing and handling glargine**

Insulin glargine must not be diluted or mixed with anything because the prolonged action is dependent on its pH.

Insulin glargine should be kept refrigerated to prolong its life.

Insulin glargine has a shelf-life of 4 weeks once opened and kept at room temperature. Opened vials stored in the refrigerator can be used for > 6 months.

If using an insulin pen, the manufacturer recommends that the pen and cartridge be kept at room temperature and not refrigerated. This is to reduce the changes in volume of insulin dispensed associated with changes in temperature.

More accurate dosing may be achieved using 0.3ml U-100 insulin syringes.

**Indications for using glargine**

- All newly diagnosed diabetic cats (to increase chance of remission)
- Poorly controlled or unstable diabetic cats (glargine’s long duration of action is likely to benefit these cats)
- When SID dosing is desired or demanded (It is important to note that better glycemic control and higher remission rates will be obtained with BID dosing. SID dosing only provides similar control and remission rates to lente BID)
- Ketoacidosis - combined with regular insulin IM or IV

When corticosteroid administration is required in cats in remission. Similarly in cats at high risk of developing clinical signs of diabetes with corticosteroid administration.

**Starting a cat on glargine insulin**

If [glucose] > 360mg/dL (20mmol/L) begin glargine at an initial dose of 0.5U/kg ideal body weight q12hrs (BID)

If [glucose] < 360mg/dL (20mmol/L) begin at 0.25U/kg ideal body weight q12hrs (BID)

Perform a 12hr glucose curve with samples taken every 4hrs **DO NOT** increase dose for the first week.

Decrease dose if biochemical or clinical hypoglycemia occurs

It is suggested that cats stay in hospital for 3 days to check the initial response to insulin, or home glucose curves are obtained for the first 3 days

Recheck at 1, 2, 3 and 4 weeks after the cat is sent home, and then as required.

Many cats have negligible glucose lowering effect in the first 3 days (**DO NOT** increase dose), although by day 10 after beginning insulin, most cats have good glycemic control.
Ketoacidotic cats may be treated with glargine s/c at the above dose rates in combination with regular insulin IM or IV (we have found 1U regular insulin IM every 2-4hrs based on glucose conc works best). This regime is continued until hydration restored and appetite returns, which usually occurs in 1-3 days.

**Monitoring cats receiving glargine insulin**

When performing a blood glucose curve, samples probably only need to be taken every 4hrs over 12 hr in many cats (i.e. 0h [before morning insulin], 4h, 8h and 12h after morning insulin).

With the long duration of action of glargine, there should be minimal periods when blood glucose is >14mmol/L (240mg/dL) for cats treated for more than 2 to 3 weeks, and hence well controlled cats should almost always be 0 or 1+ for urine glucose. A value 2+ or greater likely indicates that an increase in dose is required.

Dose changes should be made based on pre-insulin glucose concentration, nadir (lowest) glucose concentration, daily water drunk, and urine glucose concentration.

**Adjusting glargine insulin dose**

Once a cat has been stabilized on glargine insulin (i.e. after a week of therapy), the dose may need to be increased or decreased.

1. **Indications for increasing** the dose of glargine insulin
   a. If pre-insulin glucose conc. is >216 mg/dL (12mmol/L), then increase dose by 0.25-1.0U/injection
   **AND/OR**
   b. If nadir glucose conc. is >180 mg/dL (10mmol/L) then increase dose by 0.5-1.0U/injection
   c. For well controlled cats after several weeks of therapy, an immediate "pre-insulin" glucose measurement >126 mg/dl (7 mmol/L) suggests that the dose should be increased.

2. **Indications for maintaining** the same dose of glargine insulin
   a. If pre-insulin glucose conc. >180 - <216 mg/dL (>10 - <12mmol/L)
   **AND/OR**
   b. If nadir glucose conc. 90-160 mg/dL (5-9mol/L)
   c. For well controlled cats after several weeks of therapy, aim for a nadir of 72 -126 mg/dL (4-7 mmol/L)

3. **Indications for decreasing** the dose of glargine insulin
   a. If pre-insulin glucose conc <180mg/dL (<10 mmol/l) decrease 0.5-1.0U
   b. If nadir glucose conc < 54mg/dL (<3 mmol/l) decrease 1U
   c. If clinical signs of hypoglycemia develop, then reduce dose by 50%
   d. If **mild clinical hypoglycemia** develops, it can often be managed by feeding the cat, preferably a higher carbohydrate containing food, such as a some dry foods. However, it must be palatable enough to eat. Most weight reducing and renal diets are high carbohydrate diets, as are many grocery lines of dry food.
   e. For cats with unexpected **biochemical hypoglycemia** (not clinical signs), some owners find that they can manage the hypoglycemia by delaying the insulin injection until blood glucose increases to 180 mg/dL (10 mmol/L) and then give the same dose (the following dose of insulin may need to be reduced), while others find it best to reduce the dose once glucose is 180 mg/dL (10 mmol/L), although this may result in subsequent hyperglycemia.

In some cases, there is a "grey zone" of peak (198 - 252 mg/dL (11 - 14 mmol/L)) and nadir (54 - 72 mg/dL (3 - 4 mmol/l)) glucose concentrations. In these cases, the glargine insulin dose may be
maintained or decreased depending on the water intake, urine glucose, **clinical signs** and length of time the cat has been treated with insulin.

4. Insulin dose may be **maintained, increased or decreased** depending on the **water intake, urine glucose, clinical signs** and length of time the cat has been treated with insulin.
   a. If pre-insulin glucose conc. 198 - 252 mg/dL (11 - 14 mmol/L), or if nadir 54 - 72 mg/dL (3 - 4 mmol/l), clinical parameters are essential for adjustment of insulin dose.

**Determining if the cat is in remission**

1. Insulin dose should be gradually reduced by 0.25-1 U/cat/injection if nadir blood glucose is in the normal range of 72 -126 mg/dL (4-7 mmol/L) or pre-insulin glucose concentration is <180 mg/dL (< 10 mmol/L). Withdraw insulin **SLOWLY** until dose is 0.25 - 1 U once daily (SID). Some cats require only small doses of insulin (<1 U/cat BID) and only go into remission if the dose is reduced **VERY SLOWLY** giving few remaining beta cells a chance to recover.

2. After a minimum of 2 weeks of insulin therapy, if the pre-insulin blood glucose is <180mg/dL (<10mmol/L) and insulin dose is 0.25-1 U SID, insulin should be withheld and a 12hr glucose curve performed. If at the next due dosing time the blood glucose is >200mg/dL (12mmol/L), then insulin can be re-administered at 1U BID and then gradually reduced as indicated. If blood glucose is <200mg/dL then continue to withhold insulin and discharge with a follow-up visit in 1 week. Water intake and urine glucose should be closely monitored and insulin reinstituted if glycosuria returns or water intake increases.

3. Some cats may have a pre-insulin glucose concentration <180mg/dL (<10mmol/L) within 2 weeks, but insulin therapy should be maintained for a **MINIMUM** of 2 weeks to give beta cells a better chance to recover from glucose toxicity. Use 0.5-1U BID or once daily until insulin is withdrawn.

4. Some cats that have been treated with other insulin will go into remission, usually within 1-4 months after instituting glargine. Remission in cats that have been treated for more than 2 years is extremely rare. Remission is **MORE likely** to occur if the nadir glucose is in the normal range and pre-insulin blood glucose is less than 216 mg/dL (12 mmol/L). However, for some cats to achieve remission, the dose needs to be very gradually reduced, tapering off to ½ U SID before being withdrawn. Too rapid withdrawal often requires restabilizing at a higher dose for some weeks.

**Urine Glucose**

With the long duration of action of glargine, there should be minimal periods when blood glucose is >240mg/dL (14mmol/L) for cats treated for more than 2 to 3 weeks, and hence well controlled cats should almost always be 0 or 1+ for urine glucose. A value 2+ or greater likely indicates that an increase in dose is required. This should be confirmed with blood glucose evaluation.

**Fructosamine or Glycated Hb**

Urine and blood glucose and water intake (i.e., clinical signs) are usually the easiest way to monitor therapy with glargine insulin. Since many cats go into remission after a few weeks, long-term measures of glycemic control, such as fructosamine or glycated Hb, are of less value in monitoring patients.

**Treating cats with diabetic ketoacidosis**

Until experience is gained in ketoacidotic cats, these should be treated initially with a shorter acting insulin.

**General observations from preliminary use of glargine insulin**

**Starting doses may be high.** Some cats initially require a dose of 5 or 6 U/cat BID to establish glycemic control. This dose can usually be reduced as insulin sensitivity returns. **Cats on these high doses**
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need to be carefully monitored for hypoglycemia.

**Some cats require only small doses of insulin** (<1 U/cat BID) and only go into remission if the dose is reduced very slowly giving the few remaining beta cells a chance to recover.

**Nadirs can be variable.** For many cats, the time at which the nadir (lowest) glucose concentration occurs is often not consistent from day to day, or between cats. Sometimes it occurs somewhere between the two doses, but sometimes the nadir occurs around the time of the next dose. Some cats consistently have their nadir glucose concentration in the evening just before the next insulin injection, and less commonly, it occurs around the time of their morning injection.

**BID dosing to start.** Better glycemic control is achieved with twice daily dosing rather than once daily.

**To increase the chance of remission,** we suggest aiming for perfect control or possibly slightly overdosing during the first 2 months, provided the veterinarian and owner can carefully monitor the cat. There is the potential risk of hypoglycemia, but we believe this is outweighed by the benefit of diabetic remission to the cat and owner.

Cats requiring **intermittent or chronic corticosteroid administration** that are either in remission or at risk of developing diabetes can usually safely be placed on 1U SID or BID.

It is a very common observation by owners that **when long-term stable diabetic cats are changed over to glargine,** usually they do better clinically, even if blood glucose results do not support the clinical improvement.

**REFERENCES**

**Website**

**Journal Articles**

**Proceedings**

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