Transitioning insulin in diabetic cats

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Feline diabetes: Goals of therapy

- Minimize clinical signs
  - Polyuria, polydipsia, weight loss
- Avoid complications of hyperglycemia
  - Diabetic ketoacidosis, neuropathy
- Avoid hypoglycemia
  - Insulin overdose
  - Diabetic remission

Choosing an insulin

- Try to find the “best fit”
  - Type of insulin
  - Dose per administration
  - Frequency of administration
Choosing an insulin: Type

- Basic insulin molecule is modified to affect absorption and duration of effect

- Newer insulins are engineered
  - Amino acid substitutions affect absorption and kinetics

Choosing an insulin: Types

<table>
<thead>
<tr>
<th>Insulin</th>
<th>Species</th>
<th>Duration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular</td>
<td>Human</td>
<td>Short</td>
<td>IV, IM, SQ</td>
</tr>
<tr>
<td>Lente</td>
<td>Porcine</td>
<td>Intermediate</td>
<td>U40: Vetsulin®</td>
</tr>
<tr>
<td>NPH</td>
<td>Human</td>
<td>Intermediate</td>
<td>U100: Various</td>
</tr>
<tr>
<td>PZI</td>
<td>Human</td>
<td>Long</td>
<td>U40: ProZinc®</td>
</tr>
<tr>
<td>Glargine</td>
<td>N/A</td>
<td>Very long</td>
<td>U100: Lantus®</td>
</tr>
</tbody>
</table>

Choosing an insulin: Type

- Choices for cats presently on Vetsulin
  - PZI
    - FDA approved for cats
    - U40 preparation
  - Insulin glargine
    - Effective choice
    - U100 preparation
## Choosing an insulin: Type

### How do these insulins differ?
- **Duration**
  - Vetsulin generally lasts <10 hours
  - PZI and insulin glargine last longer
    - Some cats managed on SID therapy
    - Most do better on BID dosing

<table>
<thead>
<tr>
<th>Insulin</th>
<th>Duration</th>
<th>Nadir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vetsulin</td>
<td>&lt;10 hours</td>
<td>Vetsulin: 30% amorphous zinc insulin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This works quickly after injection</td>
</tr>
<tr>
<td>PZI</td>
<td></td>
<td>PZI and insulin glargine have slower onset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insulin glargine can take 48 hours</td>
</tr>
</tbody>
</table>

### How will the glucose curve differ?
- Higher pre-injection glucose with Vetsulin
- More variation over the day with Vetsulin
Sample glucose curve: Vetsulin

Sample glucose curve: PZI

Sample glucose curve: Glargine
Choosing an insulin: Dose

- Published data is very useful
  - Information provided about average doses
- Tailor dose to patient
  - Based on clinical response
  - Measurements of glycemic control

- Cannot extrapolate when changing insulin
  - Effect may vary substantially
- Need to essentially start again
  - Recommend 0.25 units/kg twice daily
    - Dose is based on lean body weight
    - 1 unit BID for most cats

Choosing an insulin: Dose

- Must use appropriate syringes
  - U40 for PZI / ProZinc
  - U100 for glargine / Lantus
  - Do not dilute!
- 0.3 ml syringes facilitate accuracy
Making the switch

- No “wash out” period is required
- Evaluate response
  - Ideal to monitor BG following first dose
  - May not be possible in some cats
- Re-evaluate status after 7 days
- Evaluate every 1-2 weeks until stable

Evaluate response

- Glucose curve
  - Concern about stress hyperglycemia
  - Consider at-home monitoring
    - Very helpful
    - Most clients can do this

- Glucose curve
  - If nadir is <70 mg/dl, decrease dose
  - Glargine may take 2 days to kick in
  - Caution with dose increases in first weeks
    - Cat needs time to adjust to new insulin
Evaluate response

- Urine glucose / ketones
  - Ketonuria indicates insulin under-dose
  - Persistent negative urine glucose may indicate overdose
  - Also occurs in well controlled cats!

Evaluate response

- Clinical signs
  - Paramount for assessing glycemic control
  - Monitor water intake and urine output

Evaluate response

- Serum fructosamine
  - Estimates glycemic control for 2-3 weeks
  - If fructosamine is in the normal range
    - Insulin overdose
    - Diabetic remission
Hypoglycemia

- Clinical signs may be subtle
  - Sleepiness, ataxia
- Decrease dose by 25-50%
- Monitor closely for remission

“Insulin resistant” cats

- Start PZI or glargine at 0.25 U/kg BID
  - Frequent monitoring for urine ketones
- Check thyroid status, urine culture
- Consider concurrent endocrinopathies
  - Acromegaly, hyperadrenocorticism
- Consider referral

Take-Home Messages

- Understand the insulin type
- Start cautiously
  - 0.25 U/kg BID for PZI and glargine
- Monitor as appropriate
- Watch for hypoglycemia
Changing Insulin Preparations in Diabetic Dogs

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University of California, Davis

Canine Diabetes Mellitus
Changing Insulin Preparations

Changing insulin is not indicated if the diabetes is well controlled
- Minimal clinical signs
- Good body condition
- Stable body weight
- No diabetic complications

Canine Diabetes Mellitus
Changing Insulin Preparations

Changing the insulin type is indicated if:
- The diabetes is poorly controlled and the problem is related to duration of insulin effect (short or long)
- The insulin preparation is no longer available
Canine Diabetes Mellitus

Changing Insulin Preparations

Recombinant human NPH insulin
0.25 U/kg lean body weight
Modify on a case by case basis
Administer NPH twice daily

Median effective dosage: 0.5 U/kg
range: 0.2 to 1.0 U/kg

Canine Diabetes Mellitus

Changing Insulin Preparations

Day 1: Evaluate BG’s every 2 to 3 hrs
Decrease dose if glucose nadir < 100 mg/dl

Subsequent adjustments in insulin dosage are based on clinical response, physical exam findings and blood glucose and serum fructosamine results
**Canine Diabetes**

**Goals of Treatment**

- Satisfied client and healthy pet
- Minimal clinical signs of diabetes
- No problems with hypoglycemia
- Optimal body weight

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**Canine Diabetes**

**Goals of Treatment**

- Maximum BG 300 mg/dl or less
- Blood glucose nadir 80 to 150 mg/dl
- Average BG 250 mg/dl or less
- Serum fructosamine 450 µmol/l or less

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**Canine Diabetes Mellitus**

**Changing to NPH Insulin**

- No washout period is required
- NPH is a U100 not U40 insulin
- NPH can be diluted but not recommended
- No change in diet or feeding schedule
- Most common problem is short duration of effect
Canine Diabetes Mellitus
Alternative Insulin Preparations

- Recombinant human PZI (ProZinc®)
- Insulin glargine (Lantus®)
- Detemir (Levemir®)