A pilot study comparing a protocol using intermittent administration of glargine and regular insulin to a continuous rate infusion of regular insulin in cats with naturally occurring diabetic ketoacidosis

Brandi R. Gallagher, DVM; Orla M. Mahony, MVB, DACVIM; Elizabeth A. Rozanski, DVM, DACVIM, DACVECC; Siylee Buob, DVM, DACVIM and Lisa M. Freeman, DVM, PhD, DACVIM

Abstract

Objective – The goal of this pilot study was to compare regular insulin administered by continuous rate infusion (CRI) to an approach using insulin glargine and regular insulin administered intermittently.
Design – Prospective randomized clinical trial.
Setting – University teaching hospital.
Animals – Sixteen cats with diabetic ketoacidosis (DKA).
Interventions – Cats with DKA were randomized to either low-dose regular insulin CRI (CRI group; n = 8) or intermittent short- and long-acting insulin injections (subcutaneous [SC] glargine plus intramuscular [IM] regular insulin; SC/IM group; n = 8).

Measurements and Main Results – Time of normalization of pH, bicarbonate, hyperglycemia, ketonemia, and appetite, as well as duration of hospitalization were recorded. Eleven of 16 cats (69%) survived to discharge, with no difference in survival between groups (P = 0.95). Times of resolution of hyperglycemia (P = 0.02) and ketonemia (P = 0.04), and normalization of pH (P = 0.04), and bicarbonate (P = 0.03) were significantly shorter in the SC/IM group. Cats in the SC/IM group also had a significantly shorter duration of hospitalization (SC/IM: median = 54 hr [range, 33–118 hr]; CRI: median = 111 hr [range, 58–271 hr]; P = 0.04). Time of first meal was not significantly different between groups.

Conclusions – Although further research is required, an approach using intermittent short- and long-acting insulin injections appeared to be an effective option for treatment of DKA in cats.

Rationale

- Human medicine has seen trend towards simplification of DKA treatment
  - DKA is #1 cause of death in type 1 diabetic children
  - CRI is standard of care
  - Some prelim studies show that SC long acting and CRI resulted in shorter hosp

Prospective randomized clinical trial

- Two treatment arms
  - Low dose CRI group
    - Sliding scale (table 1)
  - SC glargine with IM regular insulin group
    - Glargine @ 0.25U/kg SQ Q12h
    - 1U reg insulin IM up to every 6 hours if BG >250 mg/dl
      - BG at other times did NOT result in insulin administration regardless of value
    - Dextrose added if BG was <250

- All other treatments for DKA were allowed and clinician decided
- BG Q2-4, ketones Q8
- Blood gas, electrolytes and renal values monitored q8

<table>
<thead>
<tr>
<th>Glucose (mg/dL)</th>
<th>Fluids</th>
<th>Insulin – 1 U/kg regular insulin/24 h 0.6% NaCl (mL/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;500</td>
<td>0.9% NaCl</td>
<td>20</td>
</tr>
<tr>
<td>400-500</td>
<td>0.9% NaCl</td>
<td>15</td>
</tr>
<tr>
<td>250-400</td>
<td>0.9% NaCl</td>
<td>10</td>
</tr>
<tr>
<td>80-240</td>
<td>0.9% NaCl + 2.5% dextrose</td>
<td>0</td>
</tr>
<tr>
<td>&lt;80</td>
<td>0.9% NaCl + 5% dextrose +</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>bolus IV 0.5 ml/kg 50% dextrose</td>
<td></td>
</tr>
</tbody>
</table>

Table 1

Endpoints
- Primary endpoint was pH normalization defined as 7.35-7.44
- 2’ endpoints were
  - Duration of hospitalization
  - Time until first meal
  - Time until resolution of hyperglycemia and ketonemia
  - Time until normalization of bicarb

Results
- 16 cats
  - No significant difference in baseline ketones, pH, bicarb, or biochem
  - Overall survival was 70%
    - 1 cat diet, 4 were euthanized
- No difference in 1’ endpoint
- Shorter time in hospital and to normalization of bicarb, resolution of hyperglycemia, and ketonemia for the SC/IM group

Discussion
- Appears the the SC/IM is at least no worse than standard of care, and has potential benefits
Questions

1. Based on this study and others, what is the overall survival of cats with DKA
   a. 50%
   b. 60%
   c. 70%
   d. 80%

2. True/False: Cats with DKA are most often simultaneously diagnosed as diabetics (as in, new diabetics)