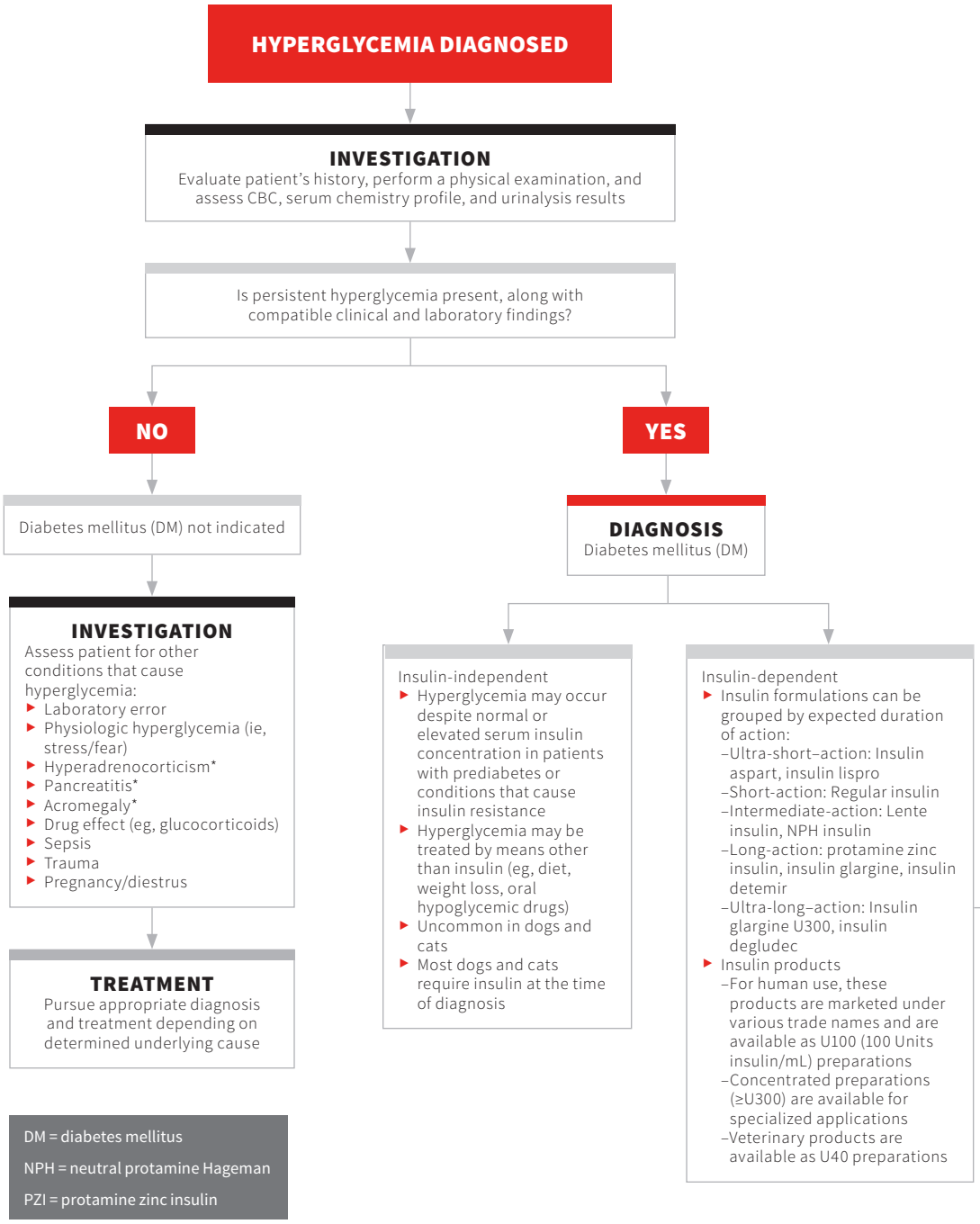
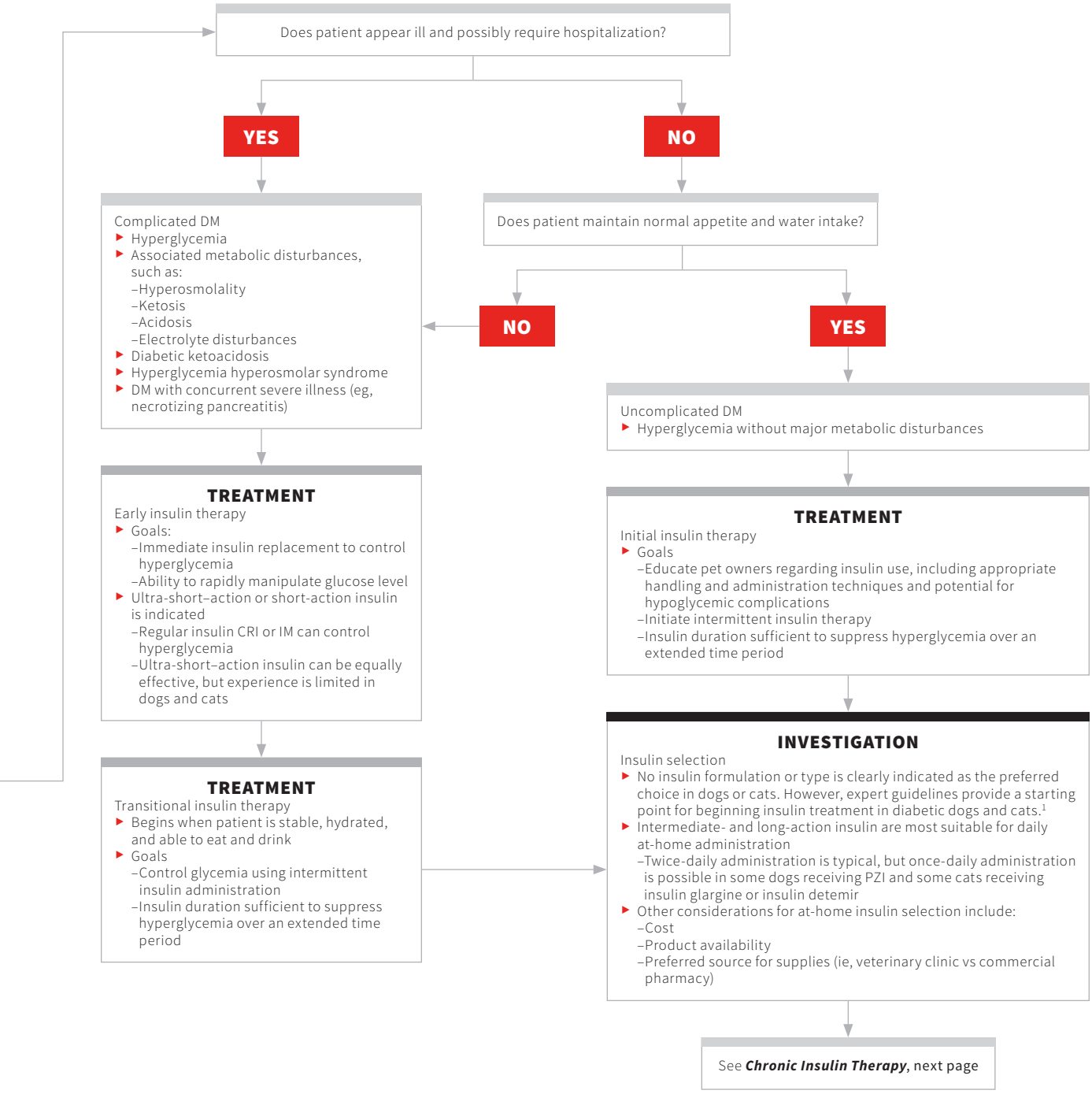
INSULIN SELECTION IN DIABETIC DOGS & CATS

Thomas Schermerhorn, VMD, DACVIM (SAIM)
Kansas State University



*Hyperglycemia may be partly caused by DM in these conditions, as DM may be present at the same time as or as a consequence of these disorders.


Does patient appear ill and possibly require hospitalization?
YES
NO
Complicated DM
▸ Hyperglycemia
▸ Associated metabolic disturbances, such as:
–Hyperosmolality
–Ketosis
–Acidosis
–Electrolyte disturbances
▸ Diabetic ketoacidosis
▸ Hyperglycemia hyperosmolar syndrome
▸ DM with concurrent severe illness (eg, necrotizing pancreatitis)
Does patient maintain normal appetite and water intake?
NO
YES
Uncomplicated DM
▸ Hyperglycemia without major metabolic disturbances
TREATMENT
Early insulin therapy
▸ Goals:
–Immediate insulin replacement to control hyperglycemia
–Ability to rapidly manipulate glucose level
▸ Ultra-short–action or short-action insulin is indicated
–Regular insulin CRI or IM can control hyperglycemia
–Ultra-short–action insulin can be equally effective, but experience is limited in dogs and cats
TREATMENT
Initial insulin therapy
▸ Goals
–Educate pet owners regarding insulin use, including appropriate handling and administration techniques and potential for hypoglycemic complications
–Initiate intermittent insulin therapy
–Insulin duration sufficient to suppress hyperglycemia over an extended time period
TREATMENT
Transitional insulin therapy
▸ Begins when patient is stable, hydrated, and able to eat and drink
▸ Goals
–Control glycemia using intermittent insulin administration
–Insulin duration sufficient to suppress hyperglycemia over an extended time period
INVESTIGATION
Insulin selection
▸ No insulin formulation or type is clearly indicated as the preferred choice in dogs or cats. However, expert guidelines provide a starting point for beginning insulin treatment in diabetic dogs and cats.[1]
▸ Intermediate- and long-action insulin are most suitable for daily at-home administration
–Twice-daily administration is typical, but once-daily administration is possible in some dogs receiving PZI and some cats receiving insulin glargine or insulin detemir
▸ Other considerations for at-home insulin selection include:
–Cost
–Product availability
–Preferred source for supplies (ie, veterinary clinic vs commercial pharmacy)
See Chronic Insulin Therapy, next page

TREATMENT

Chronic insulin therapy

Long-term insulin therapy is guided by information obtained through periodic monitoring.

- Goals:
  - –Acceptable glycemic control and hypoglycemia avoidance
  - –Acceptable patient quality of life
  - –Treatment protocol balances patient needs and owner convenience
- Monitoring may include:
  - –Clinical assessment of DM signs, body weight, BCS, activity level, and general health
    - Periodic use of urine glucose and ketone monitoring is occasionally recommended. Large changes in urine glucose and/or the appearance of ketonuria may indicate deterioration of diabetes control in previously regulated dogs and cats. Absence of glucosuria can indicate hypoglycemia.
  - –Glycated protein assessment
    - Serum fructosamine and/or blood hemoglobin A1c levels provide information on blood glucose concentrations over preceding several weeks and months, respectively.
  - –Glycemic profile assessment
    - Can be assessed using standard 12- or 24-hour glucose curve(s) or continuous glucose monitoring (eg, interstitial glucose monitoring device) methods. These are the only routine methods that assess the pharmacodynamic profile of injected insulin in diabetic dogs and cats and are important to evaluate before making a change in insulin formulation (eg, intermediate- to long-action insulin) or type (eg, insulin glargine to insulin detemir).
    - Indications for performing a glucose curve include:
      - —Concern for hypoglycemia
      - —Requiring information not available through other assessments (eg, glycated protein measurement)
      - —Determining the time–action profile of insulin used
    - Curve results can be markedly influenced by the circumstances under which the curve is performed. Steps taken to minimize stress and anxiety (eg, performing measurements at home rather than in the clinic) may improve the reliability of information provided by the curve.

INVESTIGATION

- DM signs persist or signs of hypoglycemia are noted?
- Laboratory assessments indicate persistent hyperglycemia or frequent/intermittent hypoglycemia?
- Patient quality of life not optimal?

NO → No change needed

YES → Dose change may be needed

Dose adjustment guidelines:

- Reduce insulin dose by 25%-50% if hypoglycemia associated with clinical signs (eg, lethargy, weakness, seizure, among others) is noted or if there is clear evidence for biochemical hypoglycemia
  - –Discontinue insulin if there is evidence of persistent hypoglycemia
  - –Some cats receiving long-term insulin may develop persistent, often subclinical hypoglycemia, which may indicate diabetes remission
- Dose increase is typically done in 10%-20% increments in dogs
- Minimal dose change in cats is usually 0.5 Unit because of difficulty in accurately providing smaller volumes
- Switching to twice-daily administration is an option when patients on once-daily insulin administration require a dose increase due to persistent hyperglycemia. Dividing the daily dose may reduce the risk for hypoglycemia following a dose increase

Insulin (ie, formulation, type) change

- Switch insulin based on:
  - –Evidence for insufficient insulin duration
  - –Substantial peak effect that produces hypoglycemia
  - –Whether reduction in administration frequency is desired
- New insulin should have characteristics or features that address the identified deficiencies
  - –For example, if NPH has abbreviated duration of action in a dog, PZI may be selected as the new insulin because of its generally longer duration of action

Re-evaluate 1-2 weeks after any adjustment to the insulin protocol

Reference

1. Behrend E, Holford A, Lathan P, Rucinsky R, Schulman R. 2018 AAHA diabetes management guidelines for dogs and cats. *J Am Anim Hosp Assoc*. 2018;54(1):1-21.

DM = diabetes mellitus

NPH = neutral protamine Hageman

PZI = protamine zinc insulin