

Endocrine & Anesthesia Protocols: An Exclusive Series  
This series focuses on anesthesia considerations for dogs and cats with conditions of the pancreas, thyroid, parathyroid, & adrenal glands.

# Anesthesia for Pancreatic Disease

Khursheed Mama, DVM, DACVA  
Colorado State University



You have asked...  
What is the best approach for anesthetizing patients with pancreatic disease?

## The expert says...

The best approach is tailored to the specific disease of the pancreas, including insulinoma, diabetes mellitus, and pancreatitis.

## Q&A What Is the Suggested Protocol for Patients with Insulinoma?

Insulin-secreting tumors of beta pancreatic islet cells (insulinoma) unresponsive to negative feedback can result in a progressive increase in insulin release and hypoglycemia. When blood glucose values drop significantly, clinical signs consistent with CNS hypoglycemia (eg, confusion, nervousness, trembling, seizures) become evident. Initial seizure duration may be self-limiting because of a sympathetically mediated antiinsulin response. As the disease progresses, lower blood glucose values may result in coma and, ultimately, death. In patients with gradually developing disease, signs may not be seen until blood glucose levels are extremely low (30–40 mg/dL). In these asymptomatic patients, a large meal or treatment with a bolus dose of IV dextrose may precipitate an insulin surge and worsen hypoglycemia, resulting in clinical signs. Surgery may be diagnostic or directed at removal of visible tumor cells.

## Considerations & Management

Management of hypoglycemia and attention to CNS function are the primary foci in patients with uncomplicated insulinoma. Although anesthetic medications can influence glucose (eg, sympathomimetic actions of ketamine increase blood glucose) and insulin homeostasis (eg,  $\alpha_2$ -agonists have reported antiinsulin effects) in patients with normal pancreatic function, their impact in patients with insulinoma is unknown. General anesthesia frequently results in increased blood

**In patients with gradually developing disease, signs may not be seen until blood glucose levels are extremely low (30–40 mg/dL).**

MORE ►

glucose concentrations related to increased circulating epinephrine, cortisol, and glucagon.

### Insulinoma Anesthetic Plan

The following anesthetic plan was designed for an otherwise healthy patient undergoing celiotomy for evaluation and removal of an insulin-secreting tumor:

#### Premedication

Opioid and anticholinergic (if warranted)

#### Anesthesia Induction

Propofol at 2 to 4 mg/kg IV and benzodiazepine at 0.1 to 0.3 mg/kg IV can provide a smooth transition from awake to anesthetized and can decrease cerebral metabolic oxygen consumption and glucose utilization.

#### Anesthesia Maintenance

Inhaled agent

#### Periprocedural Analgesics

Opioid administration may be repeated as necessary for analgesia. Local anesthetic may be placed directly on the pancreas before closing the incision.

#### Support & Monitoring

In addition to standard anesthetic support and monitoring (eg, heart rate and rhythm, blood pressure, temperature, oxygenation, ventilation, IV fluid therapy, inotropes [if necessary]), monitoring and maintenance of normal blood glucose values are essential. Managing patients (eg, with feeding frequent, small meals) that show signs of hypoglycemia generally begins preoperatively. Because glucocorticoids antagonize insulin effects and can stimulate glycogenolysis, they may be administered to help alleviate hypoglycemia. During preanesthetic fasting, a balanced electrolyte solution with 2.5% to 5% dextrose\* IV may be used to help maintain blood glucose. This is continued (and dextrose concentration adjusted) during the anesthetic period to maintain blood glucose concentrations within an asymptomatic range (commonly 40–60 mg/dL in this population of patients).

#### Recovery

Because insulinomas are often metastatic, removal of the primary or visible tumor may not resolve signs. Patients should be closely monitored during recovery, as the concentration of dextrose in IV fluids is titrated down and the food-intake regimen is normalized. Patients tend to be painful after pancreatic manipulation, frequently necessitating intensive analgesic therapy.

## Q&A What Is the Suggested Protocol for Patients with Diabetes Mellitus?

This absolute or relative deficiency of insulin is common in both dogs and cats; insulin-dependent diabetes is most common in dogs, and noninsulin-dependent diabetes is more common in cats. Many cats will, however, require insulin therapy. While the cause is not clear and may be multifactorial, infection, pancreatitis, obesity, and immune mechanisms are all implicated.

Regardless of cause, lack of insulin and subsequent lack of glucose use predispose patients to catabolic states resulting from unopposed actions of other hormones (eg, cortisol, glucagon). Ketone formation results in and, with excess blood glucose, can cause osmotic diuresis and compensatory polydipsia. Dehydration and azotemia can occur if fluid intake is not maintained. Polyuria, polydipsia, and polyphagia are common; hepatomegaly and lipemia are also noted. Hyperglycemia and concurrent glycosuria can help confirm diagnosis. Further testing is needed to differentiate insulin- or noninsulin-dependent disease. Ketoacidotic patients may present with weakness, depression or abnormal mentation, and tachypnea; these patients are typically fluid depleted and may have significant electrolyte abnormalities predisposing to other complications (eg, hypokalemia may result in cardiac arrhythmias).

#### Considerations & Management

Diabetic patients may be anesthetized for various reasons (eg, correction of diabetes-associated cataracts). In patients that are well managed with diet and insulin therapy, the goal is to minimally impact this regimen in the perianesthetic period. The type and frequency of insulin administered must be identified to maintain normal blood glucose levels, as the onset and duration of action of insulin analogs can vary. Patients typically receive a normal meal and insulin dose the night before surgery, and half the insulin dose the morning of surgery. Ideally, surgery should be completed in the morning to allow close observation during recovery and, if appropriate, return to the normal feeding and insulin schedule by evening.

Frequent blood glucose monitoring during the perianesthetic period is recommended. Regular insulin may be administered if blood glucose is significantly elevated (>300–400 mg/dL), whereas dextrose supplementation may be necessary in hypoglycemic patients. In consistently hyperglycemic patients, urine ketone concentration measurements can help determine whether there is risk for ketoacidosis. Because diabetic patients are predisposed to infection, it is essential to follow aseptic technique when placing catheters and managing IV solutions.

\*5% dextrose in water is a hypotonic solution and should not be administered in large volumes.



### Anesthetic Plan for Diabetes Mellitus

The following anesthetic plan is designed for a well regulated diabetic patient:

#### Premedication

Opioids and anticholinergics may be administered as warranted. Reversible drugs, or those with a short duration of action, are suggested for prompt recovery and return to a normal feeding schedule. Because of their antiinsulin effect,  $\alpha_2$ -agonists are generally not recommended. Acepromazine has a long duration of action; therefore, its use must be weighed carefully. Benzodiazepines may be considered as premedicants as long as the user recognizes that excitement (vs tranquilization) may be seen in some patients; the ability to reverse their actions is advantageous.

#### Anesthesia Induction

Propofol is recommended at 2 to 4 mg/kg IV with or without benzodiazepine at 0.1 to 0.3 mg/kg IV. Propofol has a short duration of action and facilitates a smooth recovery. Benzodiazepine helps reduce the dose. Of note, one study suggested that the propofol dose was not altered by the addition of benzodiazepine midazolam<sup>1</sup>; however, this was likely a result of study methodology, in which midazolam was given 2 minutes before propofol and resulted in excitement in dogs in this group.

Ketamine has a sympathomimetic effect and may increase blood glucose; thus, it is not generally recommended but may be used if blood glucose is monitored and hyperglycemia can be treated.

#### Anesthesia Maintenance

An inhaled anesthetic agent is recommended. Adjunct drugs (eg, opioid, lidocaine CRI) may be used to provide analgesia and/or decrease the inhaled anesthetic dose if warranted.

#### Periprocedural Analgesics

These analgesics are procedure dependent. NSAIDs are ideal if they are not contraindicated (eg, hypotension, renal or GI disease, concurrent steroid use), as they provide analgesia without sedation.

#### Support & Monitoring

In addition to routine support and monitoring, blood glucose concentrations should be monitored. Fluids may be supplemented with dextrose in hypoglycemic patients, whereas hyperglycemic patients may warrant insulin therapy.

#### Recovery

Recovery should be smooth and timely. Blood glucose concentrations are monitored until the patient is ambulatory and eating. Nighttime insulin doses should be adjusted in patients that are not eating well or have restricted food intake.

## Q&A What Is the Suggested Protocol for Patients with Pancreatitis?

Pancreatitis is most common in dogs. Anesthesia may be of short (eg, placement of feeding tube) or longer duration (eg, for exploratory laparotomy). Because these patients are often extremely ill with evident pain, the anesthetic protocol should focus on cardiovascular support and analgesia.

#### Pancreatitis Anesthetic Plan

Opioid-based protocols, such as the following, are ideal for this condition

#### Premedication

Nonhistamine-releasing opioids (eg, hydromorphone or oxymorphone at 0.05–0.1 mg/kg SC) with anticholinergic, if warranted, for bradycardia

#### Anesthesia Induction

For patients with significant compromise, a nonhistamine-releasing opioid (eg, fentanyl at 10  $\mu$ g/kg IV) with benzodiazepine (eg, midazolam at 0.25 mg/kg IV) is recommended for anesthesia induction to maintain cardiovascular stability and

MORE ►

provide perioperative analgesia. An anticholinergic should be available in case of opioid-induced bradycardia. Ventilatory support may be needed.

For patients that are more stable, ketamine at 5 to 7 mg/kg and a benzodiazepine at 0.2 to 0.3 mg/kg is a reasonable alternative, with ketamine having the added benefit of potentially decreasing spinal facilitation of pain. Combination of fentanyl and ketamine would also be appropriate. Propofol is generally not recommended in compromised patients because of its cardiovascular adverse effects and potential for intralipid formulation to exacerbate lipemia, which may be evident in these patients.

#### Anesthesia Maintenance

An inhaled agent supplemented with opioid may be warranted. Additional drugs (eg, ketamine, lidocaine) may be systemically infused.

#### Periprocedural Analgesics

In addition to systemic drugs, epidural administration of preservative-free morphine at 0.1 mg/kg and bupivacaine at 0.3 to 0.7 mg/kg or ropivacaine at a similar dose range and/or intraabdominal infusion of local anesthetic (2 mg/kg lidocaine) before closure appear to be beneficial.

#### Support & Monitoring

Heart rate and rhythm and blood pressure (direct if the condition is considered serious and the procedure long) should be monitored and abnormalities addressed. IV fluids and/or colloids should be administered and body temperature monitored and supported. Mechanical ventilation may be warranted with cranial abdominal surgery, especially if high-dose opioids are used during anesthesia maintenance. Electrolytes, acid-base balance, PCV, TP, and glucose should be checked and abnormalities treated.

#### The Bottom Line

Patients with endocrine disease may be anesthetized to facilitate resolution of the inciting cause (eg, adrenal tumor), disease-related cause (eg, cataracts), or unrelated causes. Any additional considerations specific to the procedure and concurrent condition must also be evaluated and managed in the perianesthetic period. If the veterinarian does not have the necessary resources, referral to a board-certified anesthesiologist is recommended.

■ **cb**

See **Aids & Resources**, back page, for references & suggested reading.

#### Practice Hotline

◀ FROM page 88

International Small Animal Cardiac Health Council classification for feline heart failure and may also be used to determine effectiveness of new drugs and treatments. Visit [tufts.edu](http://tufts.edu) for more information.—*Press release 4/2013*

#### Heartworm Symposium Announced

The **American Heartworm Society** has announced the date for its **14<sup>th</sup> Triennial Heartworm Symposium**, which will be held September 8–10, 2013, in New Orleans. Titled **Heartworms Today: The Search for Solutions**, the symposium will feature discussions on heartworm diagnosis, research, and resistance, with topics that include diagnostics, epidemiology, lack of efficacy, heartworm disease management, feline heartworm, and clinical issues. The program will provide 20 hours of CE credit. Attendees are encouraged to register before the early-bird deadline of August 11, 2013; more information and online registration are available at [heartwormsociety.org](http://heartwormsociety.org).—*Press release 5/2013*

#### Dermatology Products Return with New Addition

**Bayer Healthcare** has reintroduced 6 dermatology products to the market following its recent acquisition of Teva Animal Health: **Chlorhexiderm 4% Shampoo**, **Free Form Liquid**, **Malaseb Flush**, **OtiRinse**, **Relief Creme Rinse**, and **Relief Spray**. The company also launched **Preva Medicated Wipes**, which contains nisin, a naturally derived antimicrobial used to treat skin conditions associated with bacterial infections or for general cleaning and maintenance of the skin and hair coat; the wipes are intended for daily cleaning of interdigital areas; nail, armpit, neck, facial, and skin folds; and the anal area. Visit [bayer.com](http://bayer.com) for more.—*Press release 5/2013* ■ **cb**

Send Information



For Practice Hotline to [editor@cliniciansbrief.com](mailto:editor@cliniciansbrief.com)