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Sedation & Analgesia for Canine Emergencies

Profile

Definition

- Procedural sedation and analgesia (PSA) techniques include a broad spectrum of protocols from anxiolysis and pain relief to deep sedation for patients undergoing diagnostic or therapeutic procedures.
- In many emergency situations, general anesthesia may be preferable to PSA because it allows complete control of the airway and the ability to assist ventilation and/or provide 100% oxygen. The following guidelines are based on the assumption that the veterinarian has appropriately selected sedation rather than general anesthesia.
- One challenge when discussing guidelines for PSA is covering the wide mix of patient situations, operator skills, procedures, and conditions under which a particular patient is treated. As such, these guidelines may require modification for individual case scenarios.
- Despite the commonality of PSA, no controlled veterinary trials are available. Therefore, recommendations provided in this article are based on the author's personal experiences and on consensus opinions from academic and private practice specialists.

Objective

The goal is to provide maximum patient comfort in the absence of general anesthesia and with minimal complications when performing painful or stressful procedures. Scenarios include:

- Necessary sedation to assess a patient or to complete a diagnostic or therapeutic procedure
- Necessary analgesia to relieve pain or anxiety caused by the underlying pathology or the required procedure or treatment.

Examination/Assessment

The needs of the patient and the concomitant procedure must be considered simultaneously when designing the protocol, selecting the procedural and monitoring equipment, and transitioning to postsedation care.

- First, establish the **degree of urgency**. Determine if the situation is life-threatening (in which case, general anesthesia may be faster and safer) or if the patient is stable but requires rapid treatment.
- Then, determine the **degree of presedation** preparation (hydration, electrolyte and metabolic status) necessary to stabilize the patient prior to the procedure. While it is always prudent to "fast" a patient when time permits, the fasting guideline is based upon consensus opinion rather than case-based evidence.¹ Often action must be taken imme-

diately, regardless of the patient's fasting status. The risk of aspiration or regurgitation can be minimized by controlling the depth of sedation and by protecting the airway (head elevated and/or short-term intubation).

- Estimate **degree of sedation** necessary to perform the required procedure. This will be a main parameter in selection of the drugs and their dosages.
- Assess **severity of pain** caused by the underlying pathology or anticipated during and after the proposed procedure. Several articles provide detailed methods of quantifying pain in dogs.²⁻⁴

Medications

Applications

- Being familiar with the specifics of a particular drug, its potential side effects, and the degree of sedation and analgesia at different doses is an important factor in preventing complications. Unfamiliar drugs should not be used in critical situations.
- The route of administration (IV or IM) is case-dependent. IV administration is more potent, provides a more rapid onset, and has a shorter duration of effect. Therefore, it is generally the favored route of administration in acute care scenarios.
- Logically, a lower dose will provide lighter sedation of shorter duration. However, in

PSA = procedural sedation & analgesia

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severely debilitated patients, even a low dose may result in oversedation or even induction of general anesthesia. It is important to administer the dose slowly and progressively until the desired effect is achieved.

- The recommendations for PSA in the dog (listed below) are based on the author's personal experiences. They are neither exhaustive nor without controversy. See **Table 1** for suggested doses.

Hydromorphone + Diazepam or Fentanyl + Diazepam

- **Indications:** Provides analgesia and sedation; effect is similar to the combination of oxymorphone and diazepam with reported acceptable cardiovascular parameters in moderately hypovolemic dogs (30 mL/kg blood loss).⁵
- **Contraindications:** Fentanyl + diazepam should not be used in healthy dogs as excitation may occur. Due to mild respiratory depression and possible hypercapnia, avoid heavy sedation in dogs with head trauma since an increase in intracranial pressure may occur. Alternatively, these drugs can be used in a patient with head trauma but the patient should be intubated and ventilated to maintain normocapnia.
- **Monitoring:** Monitor for respiratory depression (pulse oximeter, respiratory rate, mucous membrane color, depth and quality of chest excursions) and treat as necessary (ie, intubation and ventilation, oxygen supplementation); also monitor for bradycardia and treat as necessary (ie, anticholinergic).
- **Duration:** Relatively short acting (5–20 min), depending upon dose and underlying condition of dog. Fentanyl combinations are of shorter duration (5–15 min) than hydromorphone combinations (10–20 min).
- Since dogs receiving any opioid/benzodiazepine combination are highly sensitive to noise, place cotton in ears or keep room quiet.

Fentanyl/Ketamine/Midazolam Combination

- **Indications:** Provides analgesia and sedation; primarily for debilitated dogs or those with mild to severe degree of shock. Dose likely to be inadequate for normal, healthy dogs and administering higher dose to healthy dogs may result in profound respiratory depression, necessitating intubation and possible ventilation.
- **Contraindications:** Ketamine combinations should be avoided in head trauma patients or those with corneal lacerations due to potential for an elevation in intracranial or intraocular pressure.
- **Dosages & Duration:**
 - *Single injection:* 1 mL each of ketamine (100 mg/mL) and midazolam (5 mg/mL) plus 2 to 3 mL of fentanyl (50 µg/mL), mixed in the same syringe and administered to effect (0.05–0.1 mL/kg IV). The higher dose results in about 2 hours of deep sedation. Reversal of midazolam using flumazenil (0.05–0.1 mg/kg slow IV) generally results in rapid recovery.
 - *CRI for procedures lasting longer than 2 hours:* Ketamine (0.5–1.5 mg/kg/H), midazolam (1–3 mg/kg/H), and fentanyl (10–20 µg/kg/H)

CRI = constant rate infusion; PSA = procedural sedation and analgesia

Table 1. Suggested Dosages

Medication Combination	Dose
Acepromazine + Buprenorphine	0.02–0.05 mg/kg IV 0.01 mg/kg IV
Acepromazine + Butorphanol	0.02–0.05 mg/kg IV 0.2 mg/kg IV
Acepromazine + Diazepam	0.02–0.05 mg/kg IV 0.1–0.2 mg/kg IV
Acepromazine + Hydromorphone	0.02–0.05 mg/kg IV 0.05–0.2 mg/kg IV
Acepromazine + Midazolam	0.02–0.05 mg/kg IV 0.05–0.1 mg/kg IV
Buprenorphine + Diazepam	0.01–0.05 mg/kg IV 0.1–0.2 mg/kg IV
Butorphanol + Diazepam	0.2 mg/kg IV 0.1–0.2 mg/kg IV
Fentanyl + Diazepam	5–20 µg/kg IV 0.1–0.2 mg/kg IV
Fentanyl/ketamine/midazolam	0.05–0.1 mL of solution/kg IV (see text for preparation instructions)
Hydromorphone + Diazepam	0.05–0.2 mg/kg IV 0.1–0.2 mg/kg IV
Ketamine + Diazepam	3–10 mg/kg IV 0.1–0.2 mg/kg IV
Ketamine + Midazolam	3–10 mg/kg IV 0.05–0.1 mg/kg IV
Propofol	2–6 mg/kg IV
Propofol + Ketamine	1–4 mg/kg IV 0.5–2 mg/kg IV

- Drugs should be combined immediately prior to use (in any order) as stability has not been established.
- **Monitoring:** Monitor for respiratory depression and treat as necessary (ie, intubation and ventilation, oxygen supplementation). Due to inclusion of ketamine, bradycardia is not as likely to occur as with the hydromorphone or fentanyl + diazepam combination.

Ketamine + Diazepam or Ketamine + Midazolam

- **Indications:** Provides analgesia and sedation; acceptable for both healthy and critically ill dogs when administered to effect.
- **Contraindications:** Ketamine combinations should be avoided in patients with head or corneal lacerations due to potential for an elevation in intracranial or intraocular pressure. These combinations should be avoided in dogs that are already very tachycardic (since dysrhythmias may occur) or in dogs with hypertrophic cardiomyopathy (where elevations in heart rate may reduce cardiac output).

- **Monitoring:** This combination is less likely to require airway interventions than an opioid combination.
- **Duration:** Sedation lasts 10 to 15 minutes.

Acepromazine + Opioid *or* Acepromazine + Benzodiazepine

- **Indications:** Acepromazine/benzodiazepine combinations provide only sedation; acepromazine/opioid combinations provide analgesia and sedation. Most useful for a healthy to mildly sick patient requiring PSA.
- **Contraindications:** Acepromazine combinations should be avoided in dogs in shock.
- **Monitoring:** Acepromazine combinations may cause hypotension due to associated vasodilation; therefore, volume replacement and monitoring of blood pressure are especially important.
- **Duration:** When acepromazine is used with an opioid, the result is a deeper and longer lasting sedation when compared to a combination of acepromazine and a benzodiazepine. This is most pronounced with acepromazine and hydromorphone.

Propofol

- **Indications:** Sedation only, no analgesia provided; most useful for a relatively healthy patient.
- **Contraindications:** Should not be used in hypovolemic dogs due to its detrimental cardiovascular effects (vasodilation, reduced cardiac output) or in hypoxemic dogs (ie, pneumothorax) because profound cyanosis may occur inconsistently (other drugs are adequate without having the potential to cause cyanosis). Oxygen supplementation (ie, oxygen mask) should be provided to all dogs receiving propofol PSA and, if dose results in oversedation, intubation may be required.

- **Dosages & Duration:** For procedures longer than a few minutes, a single dose may not provide sedation for entire procedure. Repeat doses, slowly to effect, may be necessary or CRI (6–15 mg/kg/H, starting at the low dose and adjusting to effect) can be used. Care must be taken to titrate this drug or general anesthesia, requiring intubation, may result.

Propofol + Ketamine

While this drug combination is not in most veterinary anesthesia textbooks, preliminary reports in human literature indicate it is a safe and effective protocol for induction or maintenance of anesthesia (the latter when administered via a CRI). It seems likely that this drug combination, while needing more investigation, may be quite useful for canine PSA as well.

Nerve Blocks

In many situations, a nerve block may be used to provide additional analgesia and reduce the dose, and therefore side effects, of PSA. Specific information on techniques for nerve blocks is outside the scope of this article but excellent reviews on peripheral and regional nerve blocks are found in most veterinary anesthesia textbooks (see also Peripheral Nerve Block Techniques in the March 2004 issue of *Clinician's Brief*, available at www.cliniciansbrief.com).

Dexmedetomidine & Pure μ -Receptor Agonists

The use of low-dose dexmedetomidine in combination with a pure μ -receptor agonist (ie, hydromorphone) is a controversial topic among anesthesiologists. This protocol is beyond the scope of this article and will be covered in a future issue of *Clinician's Brief*.

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When to Use—Common Examples

Drug/Drug Combination	Examples
Hydromorphone <i>or</i> fentanyl + Diazepam	Wound care (inspection, debriding, cleansing), bandaging
Fentanyl/ketamine/midazolam	Broad range of dose-dependent applications ranging from debriding superficial burns to chest tube placement to closed reduction of limb fracture and cast application
Ketamine + Diazepam <i>or</i> midazolam	Foreign body removal (thorn in footpad, quills in oral cavity or on muzzle), radiographs for gastrointestinal foreign body in elderly dog, lance & lavage of superficial abscess, insertion of nasal tube for oxygen supplementation
Acepromazine/opioid <i>or</i> Acepromazine/benzodiazepine	Examination or radiographs of rambunctious, healthy dog needing orthopedic exam (ie, acute lameness)
Propofol	Nonpainful, minor procedure such as removal of minor foreign body (stick in roof of mouth, thorn in footpad), bandage change in stable patient

CRI = constant rate infusion; PSA = procedural sedation and analgesia

Follow-Up

Monitoring

- Depth of sedation:
 - Preservation of laryngeal reflex is essential or intervention to protect the airway is required.
 - Depth determined by muscle relaxation, jaw tone, palpebral reflex, eye positioning.
 - It is NOT necessary to prevent mild responses to the procedure unless strict immobility is required for patient safety or procedural success. Frequently, the depth of sedation necessary to achieve nonresponsiveness is also likely to result in adverse side effects (ie, loss of laryngeal reflex, hypoventilation, regurgitation, hypotension).
- Respiratory function:
 - Pulse oximetry
 - Respiratory rate and quality
 - Capnography for intubated patients
- Hemodynamic measures:
 - Indirect blood pressure monitoring
 - ECG for heart rate, rhythm, and signs of myocardial ischemia (hypoxemia)
- Post-PSA:

- If patient is being admitted, monitor as per the standard hospital postanesthesia protocol.
- If PSA is for outpatient procedure, assess patient for adequate recovery prior to hospital discharge.
- Based on specifics of the case, a postprocedural analgesic plan should be established.

Complications

- The most common complications from PSA are hypoxia and vomiting. A cuffed endotracheal tube, laryngoscope blade with light, and method of manual ventilation should be available when PSA is used.
- Oversedation may occur, increasing the risk of cardiopulmonary complications and aspiration. It is essential that serial qualitative assessment of depth of sedation be made to decide whether or not to intubate, provide oxygen supplementation, or give the antidote to reversible drugs.
- **Table 2** lists some specific side effects of different individual drugs. ■

See **Aids & Resources, back page, for references, contacts, and appendices.**

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Table 2. Side Effects of Individual Drugs

Drug	Side Effects	Notes
Propofol	Respiratory depression, hypoxia, cyanosis; ⁶ causes vasodilation and reduced cardiac output	<ul style="list-style-type: none"> • All dogs should receive oxygen supplementation by oxygen mask; if dose results in anesthesia, patient should be intubated. • Since cerebral perfusion pressure may be decreased in dogs with head trauma, propofol should not be used in affected patients.
Ketamine	<ul style="list-style-type: none"> • Poor recovery, hallucination, hypersalivation, tachycardia • Potential for elevation in intracranial or intraocular pressure (avoid use in patients with head trauma or corneal laceration) • Direct depressant effects (negative inotropic effects) may be observed when administered to critically ill patients who have no additional catecholamine stores (more likely to be observed when used at higher doses; ie, induction or maintenance of anesthesia). 	<ul style="list-style-type: none"> • Should not be used in cases where elevations in heart rate or blood pressure may be contraindicated • While hypersalivation can be offset with an anticholinergic, the author does not recommend its use because heart rate is further increased. • To minimize other side effects, ketamine should always be given in combination with another drug. • Less respiratory depression but more vomiting are present with ketamine/benzodiazepine combinations compared to ketamine/fentanyl combinations.⁷
Opioid	Respiratory depression (hypoxia and hypercapnia), bradycardia	<ul style="list-style-type: none"> • The need for respiratory support and airway intervention is dose-dependent and likely to be more common when fentanyl combinations are used instead of another opioid. • Heart rate should be monitored during the procedure or treatment and also during recovery. • Bradycardia can be treated prophylactically with a standard anticholinergic in dogs with normal heart rates but should not be administered to dogs with preexisting tachycardia or if elevations in heart rate are contraindicated.

ECG = electrocardiography; PSA = procedural sedation and analgesia