Sedation of Emergency Patients
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Sedation is often necessary in the emergency patient in order to obtain diagnostics or perform minor surgical procedures. In addition, pain control is essential in treating animals with traumatic injuries, painful medical conditions, or surgical disorders. A thorough knowledge and understanding of the drugs used in sedation, anesthesia, and pain management are necessary in order to choose a safe, yet effective, sedation protocol.

The purpose of this handout is to outline an approach on precautions to take in sedating emergency patient, how to make the decision when to sedate an emergency patient, and which sedative/analgesic drugs are most appropriate to use for sedation or pain management.

Initial stabilization
Sedating the emergency patient is a task that should be taken seriously and with precaution. Many animals that present to the emergency room are in shock or are on the verge of going into shock. The sympathetic nervous system is stimulated during an emergency in an attempt to maintain blood flow and oxygen delivery to the tissues. Almost all sedatives and anesthetics blunt the response of the sympathetic nervous system. Therefore, the patient that is in compensatory shock may decompensate when given a sedative or anesthetic agent. In addition to interfering with the cardiovascular system, sedatives and anesthetics can compromise the respiratory system, which could be detrimental to a patient that is in respiratory distress. That said, some patients in respiratory distress will benefit from mild sedation in order to reduce anxiety and allow proper administration of oxygen and other therapeutics. Oxygen therapy and treating shock are goals of the initial stabilization period.

For many emergency patients, hypovolemic shock and distributive shock are the most common forms of shock. Treatment requires immediate oxygen and fluid therapy. Flow-by oxygen is a good rule of thumb in any emergency patient until the situation is fully assessed. Intravenous or intraosseous catheter placement is crucial for rapid administration of fluids. Animals in cardiogenic shock may need oxygen, lasix therapy, and/or thoracocentesis. Disease-specific treatment will aid in the initial stabilization. For example, decompressing a GDV, placing a belly wrap on a hemoabdomen, and stopping external arterial bleeds will all aid in resuscitation of the shock patient.

The decision for sedation
The decision as to when a patient is stable enough for sedation is somewhat subjective. Objective parameters that indicate response to shock therapy and oxygen are a positive sign. These signs might include the heart rate coming down to normal or near-normal range, blood pressure in the normal range and stable after therapy, mentation improving, pulses easily palpable and strong, mucous membrane color becoming pink, normal capillary refill time (1.5 to 2 seconds), and body temperature approaching the normal range. The closer the animal is to being physiologically normal prior to sedation, the better the animal will do during the procedure. However, occasionally a patient needs to be sedated in order to achieve hemodynamic stability. For example, this may occur during uncontrollable femoral or metatarsal artery bleed. Therefore, the veterinarian must weigh the pros and cons of inducing sedation on a case-by-case basis.

In addition to physical examination parameters, lab values should be assessed and normalized as much as possible prior to the sedation. Minimally, parameters that should be assessed include packed cell volume, total protein, glucose, and BUN or creatinine. Ideally, other parameters that should be assessed include acid-base status, lactate, electrolytes, urine specific gravity if possible prior to fluid administration, coagulation status, oxygenation-ventilation status, platelet count, and white blood cell counts. Any major abnormalities should be attempted to be corrected prior to sedation.

Obviously, depending on how urgent the problem is, it may not be possible to correct every single abnormality prior to sedation. Attentiveness during sedation, which requires a person dedicated to the monitoring and potentially performing frequent point-of-care blood testing is necessary in these critically ill patients. Ideally, all sedated animals should have IV access, flow-by oxygen, ECG, and some measure of pulse conduction and breathing. Arrhythmias are common in emergency patients, so this should be monitored closely. In the author’s experience, the most critical blood parameters to keep normal during sedation are acid-base status, electrolyte status, oxygenation-ventilation, and hemoglobin levels.

There are some situations in which sedation should be delayed. Some specific situations in which sedation should be avoided or delayed if possible include head trauma, severe pulmonary contusions, and severe arrhythmias. Hyperkalemia is frequently detrimental under sedation and should be addressed with medical management prior to the procedure. Therefore, appropriate judgment needs to be utilized and each case needs to be treated individually. The pros and cons of the patients condition, how sedation will affect the patient, the nature of the problem, the patient’s response to treatment, whether or not the patient continues to decompensate after resuscitation, and the consequences of proceeding or waiting to fix the problem need to be carefully weighed in each situation.
Sedation

Sedation is defined as an awake, but calm state, in which an animal can be aroused and is sometimes used interchangeably with tranquilization. The term sedation is commonly misused to indicate light anesthesia, and these terms should not be used interchangeably. There are only three true sedative categories that are commonly used in small animal veterinary medicine. These include the benzodiazepines, phenothiazines, and alpha-2 agonists. The butyrophenones are also sedatives, but currently are not commonly used in small animal medicine and will not be discussed. The opioids are not technically considered sedatives, but are commonly used in sedation protocols because they have sedative properties, in addition to their ability to control pain.

Pain control in the emergency patient should be a high priority. Pain can adversely affect a patient by causing potentially detrimental sympathetic stimulation. If pain is left uncontrolled for excessive periods of time, the pain will be harder to treat in the long-run due to wind-up phenomenon. A painful animal is also more difficult to assess and puts animal handlers at risk for misdirected aggression from the patient. Fortunately, most opioid analgesics are relatively cardiopulmonary sparing and can be given at reasonable doses in the majority of emergency patients.

Benzodiazepines

The most commonly used injectable benzodiazepines include diazepam, midazolam, and zolazepam. Injectable zolazepam is only available in combination with tiletamine (Telazol) and therefore won’t be discussed as a separate benzodiazepine. The advantages of the benzodiazepines include the fact that they are cardiopulmonary sparing, amnestic, anxiolytic, provide mild tranquilization/sedation, they significantly decrease the amount of other drugs needed for sedation, they provide good muscle relaxation, and they are anti-convulsant. Disadvantages include potential excitement in cats and some dogs, the effects may be prolonged in animals with liver disease, and no analgesia is provided. The difference between midazolam and diazepam is that midazolam is water soluble, yet expensive, and diazepam is inexpensive, but is not water soluble and therefore may cause unreliable IM/SQ absorption, it can be painful on IM injection, and can cause sterile abscessation if given IM due to the propylene glycol carrier. Benzodiazepines alone do not cause great sedation.

Phenothiazines

The most common phenothiazine used for sedation is acepromazine. It is a great sedative and is anti-emetic. The main disadvantages include the fact that it is not reversible, it is long acting (especially with liver disease), and it causes alpha blockade, vasodilation, and hypotension. Acepromazine alone can cause nice sedation, but is better in combination with an opioid.

Alpha-2 Agonists

The alpha-2 agonists used in small animal medicine include xylazine and medetomidine. They both provide excellent sedation, excellent muscle relaxation, are mild analgesics (especially GI pain), and they are reversible. They are particular useful in aggressive animals or if more profound restraint is necessary. Disadvantages include hypertension (from initial vasoconstriction) followed by hypotension from sympathetic blockade, severe bradycardia may result, and they can cause AV block. The cardiovascular effects occur even at micro-doses of alpha-2 agonists. Therefore, they should only be used in young, healthy animals that have no evidence of cardiovascular disease or shock.

Opioids

The opioids are usually part of a sedation protocol because they are generally cardiopulmonary sparing, have excellent analgesic properties, and are reversible. They do have a tendency to cause dysphoria in high doses, in certain breeds of dogs (e.g. Northern breed dogs), and in cats. The use of agonist-antagonist (butorphanol), partial agonist opioids (buprenorphine), or using them in combination with other sedatives may decrease the development of dysphoria. It is important to keep in mind that butorphanol’s analgesic effects only last about 30-60 minutes. Opioids by themselves do not tend to cause great sedation, unless they are used at very high doses or in very sick animals.

In the emergency setting, the safest sedatives are cardiopulmonary sparing, titratable, and reversible. Adding an opioid to a sedative is probably one of the most common sedation combinations that is used in emergency veterinary medicine and is termed neuroleptanalgesia. Because the benzodiazepines are cardiopulmonary sparing, reversible, and decrease the amount of other sedative drugs that are needed, they are the safest sedative to use in a neuroleptanalgesia protocol. Opioid/benzodiazepine combinations are great for emergency sedation or for animals that may have cardiac, liver, or renal disease. Some of my favorite combinations in the emergency room are: hydromorphone/diazepam IV, hydromorphone/midazolam IV, SQ or IM, morphine/midazolam IM (if more profound sedation is needed or the animal is aggressive), and butorphanol/diazepam or midazolam (great for cats and minor, non-invasive procedures). Phenothiazines and alpha-2 agonists can cause significant cardiovascular compromise and therefore are not recommended for sedation in an unstable or critical patient. This is true even though the alpha-2 agonists are reversible.

Sedation may be required in animals that are postoperative and are anxious, in animals that are nervous at the veterinarian and need sedation in order to perform minor diagnostics, in stable emergency patients, or in aggressive animals. Using alpha-2 agonists or low doses of acepromazine in addition to opioids are common sedation protocols in these non-critical emergency situations and are excellent sedatives in young, healthy animals that don’t have cardiovascular disease. Opioid/acepromazine or opioid/medetomidine combinations will cause better sedation than opioid/benzodiazepine combinations. Occasionally these sedatives need to be used in aggressive animals, in which their cardiovascular status may be unknown, which is clearly not ideal.
Occasionally, additional sedation is needed and it certainly is okay to combine a neuroleptanalgesia with another sedative (i.e. benzodiazepine/opioid with an alpha-2 agonist or acepromazine). In addition, a sedative can be combined with another sedative (i.e. benzodiazepine/acepromazine) for sedation. Just recall that if an opioid is not part of the protocol, the analgesic effects will be minimal to absent.

The decision to add an anticholinergic to the sedative protocol is controversial. The pros and cons of the anticholinergics need to be weighed (see table below). Procedures that cause significant vagal stimulation should be recognized and the patient should be preemptively treated with an anticholinergic in these situations. Types of procedures that may stimulate significant vagal reflexes include ocular surgery or manipulation, esophageostomy tube placement, manipulation of the gastrointestinal, urinary, or genital tracts, joint capsule manipulation, or chest-tube placement. Regardless of the decision to give an anticholinergic, one should always be available and a dose ready to be given intravenously if a problem arises with bradycardia.

### Atropine and glycopyrrolate

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<tr>
<th>PROS</th>
<th>CONS</th>
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<tr>
<td>Increase heart rate</td>
<td>May cause tachycardia and increase myocardial oxygen consumption</td>
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<tr>
<td>Antisialogogue (glyco &gt; atropine)</td>
<td>Decreased GI motility</td>
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<tr>
<td>Glycopyrrolate does not cross BBB or placental barrier</td>
<td>At low doses may cause AV block</td>
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<tr>
<td>Decreases response to vagal stimulation</td>
<td>Mydriasis</td>
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<td>Bronchodilation</td>
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Keep in mind that there is no perfect way to sedate a patient. The availability of the drug, familiarity with the drug, the procedure being performed, and the ability to monitor the patient for complications will all contribute to the relative “safeness” of a drug. In addition, being proactive about oxygen supplementation and proper monitoring (e.g. ECG, pulse oximetry, blood pressure) during the sedation will ensure a safe sedation.

### Chemical restraint

The term chemical restraint is frequently defined as a drug(s) used to control acute, episodic behavior that restricts the movement or function of an animal. It is normally related to a short-term immobility (usually 20-30 minutes) that allows the veterinarian to perform necessary diagnostics or minor procedures. Many veterinarians would prefer chemical restraint (or light anesthesia - a type of chemical restraint) as opposed to true sedation in order to treat or diagnose the problem. The reason for this preference is because most animals that are simply sedated will still be arousable during minor surgical procedures, which may be undesirable. Recall that the definition of general anesthesia is loss of consciousness, muscle relaxation, immobility, and analgesia.

Chemical restraint is frequently administered via the subcutaneous, intramuscular (IM), or intravenous (IV) route, with the IM and IV routes being the most effective. Most chemical restraint protocols are used in combinations of 2-4 different drugs. Chemical restraint is theoretically a “spin off” of sedation. It is simply a little more restraint than true sedation alone and usually combines sedative drugs, opioids, and the addition of a general anesthetic. The most common general anesthetics used for chemical restraint are the dissociative anesthetics (ketamine or tiletamine), since they can be given intramuscularly. Recall that all the other general anesthetics (propofol, thiopental, etomidate) need to be given IV. Certainly, if IV access if available, low doses of propofol may be used to aid in the chemical restraint. Propofol is used frequently for IV chemical restraint due to the fact that it does not accumulate after repeat doses. It is important to remember that propofol has no analgesic properties, can cause hypotension, and can cause apnea.

Chemical restraint is commonly used in aggressive animals, or for minor surgical procedures. Chemical restraint in these situations would frequently consist of a one-time injection of a combination of drugs that will allow for immobility for a period of time. The aggressive dog or cat castration may respond well to a combination of an alpha-2 agonist, opioid, and ketamine combination. High doses of opioids work well in combination with other drugs to aid in chemical restraint of dogs, but may not work well in cats due to their propensity for hyperexcitability from high-dose opioids.

If chemical restraint or light anesthesia is planned, the airway should be controlled via intubation and oxygen provided. Many emergency patients present with a full stomach and are at high risk for aspiration if they vomit or regurgitate during their procedure, therefore airway protection is crucial. Intravenous access, oxygen supplementation, airway control, and cardiorespiratory monitoring should be performed routinely in sedated or chemically restrained patients.

**Sedatives**

- Diazepam: 0.2-0.5 mg/kg IV bolus
- Midazolam: 0.2-0.5 mg/kg IV, IM or SQ
- Acepromazine: 0.01-0.02 mg/kg IV, IM or SQ (avoid if hypotensive)
- Dexmedetomidine: 2-5 mcg/kg IM or SQ (avoid if hypotensive)
- Xylazine: 0.2-0.5 mg/kg IM or SQ (avoid if hypotensive)
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<tr>
<th>Anticholinergics</th>
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<tbody>
<tr>
<td>• Atropine</td>
<td>0.01-0.02 mg/kg IM, SQ, or IV (IV dosing may cause tachycardia)</td>
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<tr>
<td>• Glycopyrrolate</td>
<td>0.005-0.01 mg/kg IM, SQ, or IV</td>
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<th>General anesthetics</th>
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<tr>
<td>• Propofol</td>
<td>1 mg/kg boluses slowly to effect (watch for apnea and hypotension)</td>
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<tr>
<td>• Ketamine</td>
<td>2 mg/kg boluses IV to effect; 4-6 mg/kg IM</td>
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<tr>
<td>• Etomidate</td>
<td>0.2 mg/kg boluses IV to effect; Dilute 50:50 in saline in cats or renal disease</td>
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<tr>
<td>• Thiopental</td>
<td>2-4 mg/kg boluses IV to effect</td>
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<tr>
<td>• Telazol</td>
<td>2-6 mg/kg IM</td>
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<th>Opioids</th>
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<tr>
<td>• Fentanyl</td>
<td>2-5 mcg/kg IV bolus</td>
</tr>
<tr>
<td>• Morphine</td>
<td>0.2-1 mg/kg IM or SQ (use low dose in cats)</td>
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<tr>
<td>• Hydromorphone</td>
<td>0.025-0.2 mg/kg IV, IM, SQ (most common range in cats: 0.025-0.05 mg/kg)</td>
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<tr>
<td>• Oxymorphone</td>
<td>0.05-0.1 mg/kg IV, IM, or SQ</td>
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<tr>
<td>• Butorphanol</td>
<td>0.2-0.4 mg/kg IV, IM, or SQ</td>
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<tr>
<td>• Buprenorphine</td>
<td>6-10 mcg/kg IV, IM, or SQ; can be given on buccal membrane surface in cats</td>
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<tr>
<td>• Methadone</td>
<td>0.1-0.5 mg/kg IV, IM, or SQ</td>
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<th>Reversal drugs</th>
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<tr>
<td>• Naloxone</td>
<td>0.01-0.02 mg/kg IV, IM, or SQ; 0.25 mcg/kg IV for partial reversal of opioids</td>
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<tr>
<td>• Nalbuphine</td>
<td>0.1 mg/kg for partial reversal of opioids</td>
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<tr>
<td>• Flumazenil</td>
<td>0.01-0.02 mg/kg IV, IM, or SQ (very expensive)</td>
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<tr>
<td>• Atipamezole</td>
<td>Same volume as dexmedetomidine given</td>
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<th>Combination examples</th>
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<tr>
<td>1. 0.2 mg/kg Butorphanol + 0.2 mg/kg Midazolam IM or IV (good for cats, respiratory distress animals)</td>
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<tr>
<td>2. 0.05-0.1 mg/kg Hydromorphone + 0.25 mg/kg DIAzepam IV (good for dog minor laceration if local anesth used)</td>
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<tr>
<td>3. 0.2 mg/kg Butorphanol + 0.02 mg/kg Acepromazine IV or IM (good for minor sedation), can repeat if necessary</td>
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<tr>
<td>4. 0.05 mg/kg Hydromorphone + 0.005-0.01 mg/kg Dexmedetomidine IM (good restraint, animal needs to be stable)</td>
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