



Equine Sedation, Anesthesia and Analgesia

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The need for equine field anesthesia and sedation do not always present as ideal situations. Both equine standing chemical restraint and general anesthesia in the field are challenging due to a wide variety of temperaments and challenging situations that cannot always be adequately controlled. In no other domestic species is the availability of safe and dependable protocols more important. Fortunately, effective injectable drug protocols for standing restraint and short-term anesthesia in horses have been well established for field work. Virtually all protocols utilize an alpha-2 agonist (xylazine, detomidine, romfidine) with or without an opioid (butorphanol, buprenorphine, morphine) or acepromazine for standing restraint. Standing restraint may be prolonged and controlled with constant rate infusion (CRI) using detomidine or butorphanol. The use of local or regional analgesia techniques, when applicable, will further improve the quality of the chemical restraint. Ketamine alone or in combination with a benzodiazepine (diazepam or midazolam) or with guaifenesin (5 or 10%) provide the basis for short-duration anesthesia. A combination of guaifenesin, an alpha-2 agonist, and ketamine provides an effective method for maintenance of anesthesia in the field.

While situations cannot always be controlled, the following suggestions will help minimize the risk of complications and inadequate depth and/or duration of anesthesia. Preparation and planning (always having a plan B!) are critical to successful outcome.

- Perform a thorough physical examination with emphasis on the cardiovascular and respiratory system.
- Preanesthetic bloodwork is not always feasible and studies have not clearly demonstrated a benefit in regards to anesthetic outcome; however in some high-risk groups (foals at risk for lung disease, geriatric horses), bloodwork may be justified.
- Be aware of the environment. Select a safe and shaded area free of obstacles to assure a safe recovery.
- Assess the quality and quantity of assistance that you have available. This will influence your protocol and preparation.
- Placement of an intravenous catheter is always beneficial though not always essential. Situations where a catheter is indicated includes the known need for extended anesthesia, a patient with underlying dehydration to facilitate fluid administration, and lack of adequate assistance to facilitate additional intravenous dosing.

- If there is any doubt regarding length / difficulty of the procedure, refer the patient to a surgical facility.

Adverse reactions associated with agents used for standing restraint are uncommon in horses. If complications develop or if duration of effect is prolonged beyond the desired length of time, α_2 agonists may be reversed with atipamezole (0.1-0.4 mg/kg), tolazoline (0.5-2 mg/kg) or yohimbine (0.1 mg/kg).

The combination of xylazine and ketamine provides safe, reliable, short-term (10-20 minutes) anesthesia. For intractable animals, the xylazine may be given intramuscularly at twice the intravenous (IV) dose to facilitate IV induction with ketamine. Also, detomidine gel may be used 40 minutes prior to induction. Donkeys, mules, ponies and very excitable horses often fail to respond favorably to xylazine-ketamine resulting in a rough induction, inadequate immobilization and/or inadequate duration of effect. **Several options may improve the quality of anesthesia in these patients; outcome is rarely effective to complete the procedure without adequate sedation prior to induction.**

- Addition of acepromazine (0.005 mg/kg) or butorphanol (0.01 mg/kg) if xylazine sedation appears inadequate may provide adequate sedation for a smooth induction.
- Detomidine (0.02-0.04 mg/kg) is more potent and has a longer duration of effect compared to xylazine. In very excitable horses, detomidine may provide better sedation and a longer duration of effect when combined with ketamine. Reports suggest that recoveries may be rougher when detomidine is used.
- The use of diazepam or midazolam in combination with ketamine, following xylazine sedation, will smooth induction and lengthen the duration of anesthesia.
- Guaifenesin may be administered prior to ketamine injection to improve the quality of induction and anesthetic duration. However, the use of guaifenesin as an adjunct, while quite effective, is a less convenient option as it requires an IV catheter and takes several minutes and additional assistance to deliver the necessary volume
- Telazol (zolazepam-tiletamine) may be used in place of the ketamine. The same dosage of xylazine is used followed by telazol at 1.1 mg/kg. This combination has been reported to provide a smooth induction and 20-25 minutes of anesthesia; however, recoveries are rougher compared to xylazine-ketamine.

As a general rule, field anesthesia should not exceed 60 minutes. Horses do not oxygenate effectively when recumbent and hypoxemia does develop and becomes more severe with time. If a prolonged duration of anesthesia is anticipated and is unavoidable, oxygen should be delivered via a nasal tube at a rate of 10-15 L/minute for an adult horse. Options to extend anesthesia are available and effective, including repeated dosages (one-third to one-half the original dose) of xylazine-ketamine or administration of "triple drip", the combination of 5% guaifenesin with xylazine (0.5 mg/ml) and ketamine (1 mg/ml). However, injectable agents are cumulative and will lengthen recovery time and quality significantly. Patient monitoring is critical during field anesthesia, especially if a prolonged period of anesthetic maintenance with triple drip is anticipated. One individual dedicated to patient monitoring and, ideally, a

monitoring device such as pulse oximetry, is optimal. Finally, keeping an anesthetic record is important, not only as a legal document but to have a record of dosages used and vital signs during the anesthetic period. This information provides valuable information when future anesthetic periods are needed.

Table 1. DOSAGES FOR EQUINE STANDING RESTRAINT

<u>DRUGS</u>	<u>mg/kg</u>	<u>mg/lb</u>	<u>ml/1100#</u>
Acepromazine	0.02-0.06	0.01-0.03	1-3
Xylazine	0.44-1.0	0.2-0.5	2-5
Detomidine	0.01-0.04	0.005-0.02	0.5-2
Romifidine	0.05-0.1	0.02-0.05	1-3
Acepromazine/ Xylazine	0.02-0.04 0.44	0.01-0.02 0.2	1-2 2
Xylazine/ Butorphanol	0.22-0.44 0.02-0.04	0.1-0.2 0.01-0.02	1-2 1-2
Xylazine/ Morphine	0.44-0.66 0.1	0.2-0.3 0.005	2-3 3 (15 mg/ml)
Acepromazine/ Xylazine/ Butorphanol	0.02-0.04 0.44 0.02-0.04	0.01-0.02 0.2 0.01-0.02	2-3 2 1-2
Detomidine/ Butorphanol	0.01-0.02 0.02-0.04	0.005-0.01 0.01-0.02	0.5-1 1-2

Table 2. Constant Rate Infusion (CRI) Protocols for Standing Chemical Restraint; Epidural Analgesia Protocols

<u>Drug/Protocol</u>	<u>Route</u>	<u>Dosage</u>
<i>CRI Protocols for Standing Chemical Restraint</i>		
Detomidine	CRI	6-9 ug/kg <i>bolus</i> ; 0.6 ug/kg/min (decrease by 50% every 15 min of infusion)
Butorphanol	CRI	50 mg added to 5 L isotonic fluids; Administer at 1 L/hr/450 kg
<i>Epidural Agent Dosages</i>		
Morphine	epidural	0.1 mg/kg qs saline to 1 ml/50kg
Morphine/ Detomidine	epidural	M: 0.1 mg/kg D: 30-60 µg/kg
Ketamine	epidural	1 mg/kg qs saline to 1 ml/50kg
Xylazine	epidural	0.17 mg/kg qs saline to 1 ml/50kg
Tramadol	epidural	1 mg/kg qs saline to 1-2 ml/50kg
Lidocaine	epidural	0.26-0.35 mg/kg
Bupivacaine	epidural	3 ml (0.5%)/450 kg

Table 3. PROTOCOLS FOR EQUINE INJECTABLE ANESTHESIA

*Xylazine/Diazepam/Ketamine	<p>1.1 mg/kg IV xylazine followed in 5 minutes by 2.2 mg/kg IV ketamine. (Provides smooth induction and 12-20 minutes of anesthesia).</p> <p>Methods for increasing or improving anesthesia time and/or quality:</p> <ol style="list-style-type: none">1. Administer 30-50% of the original doses of both drugs (mixed) at 12-20 minute intervals.2. Administer butorphanol (0.04 mg/kg IV) prior to ketamine3. Administer diazepam or midazolam (0.05-0.1 mg/kg IV) with ketamine following xylazine sedation.4. Maintain anesthesia with a mixture of GG, xylazine, and ketamine (GKX**)
Xylazine/Telazol	<p>1.1 mg/kg IV xylazine followed in 3-5 minutes by 1.1 mg/kg IV Telazol. [Provides smooth induction and 20-25 minutes of anesthesia. Recoveries may be rough compared to xylazine and ketamine. May extend anesthesia time slightly by adding butorphanol (0.04 mg/kg IV) to protocol.]</p>
**GKX (“triple drip”)	<p>1 Liter of 5% guaifenesin + 1000 mg ketamine + 500 mg xylazine Maintenance is “to effect”: 2 ml/kg/hour</p>
*GKD	<p>1 Liter of 10% guaifenesin + 4000 mg ketamine + 40 mg/ml detomidine Rate: 0.28-0.67 ml/kg</p>

*Mules, donkeys, ponies and high-strung warm-blooded horses do not respond predictably to xylazine/ketamine: the animal may not become recumbent or may recover more quickly than usual. Using butorphanol, GG or diazepam with the protocol or using telazol instead of ketamine may improve induction and anesthesia time.