**How to Safely Anesthetize a Horse for Sixty Minutes or More in the Field**

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1. **Introduction**

Most equine veterinarians perform short-duration anesthesia frequently, but only 10% anesthetize horses for greater than 30 minutes weekly. Approximately 50% of equine veterinarians anesthetizing horses for greater than 30 minutes use inhalants for maintenance of anesthesia, with the balance using repeated injections of induction drugs or guaifenesin recipes. Almost all equine veterinarians (87%) anesthetizing horses for greater than 30 minutes use an assistant to monitor the depth of anesthesia and administer additional anesthetic drugs as required. This report will provide recommendations on how to safely anesthetize a horse for 60 minutes or more in the field with the use of injectable agents.

2. **Background Information**

The risks of morbidity and mortality increase with increasing duration of anesthesia. The increase in risk associated with longer anesthetic durations is probably heightened in larger horses such as warmbloods or drafts because of the difficulty of assisting in recovery in a field situation. Foals less than 1 month of age appear to be at increased risk for anesthetic complications. Fortunately, most foals respond to sedation and thus many procedures can be accomplished with the use of small doses of sedatives, such as xylazine, and physical restraint combined with local anesthesia. The topic of anesthesia of the foal in the field has been addressed previously.

Successful management of equine anesthesia beyond short, single-administration techniques requires careful evaluation of the patient and adept planning of the procedure to keep the duration of anesthesia to a minimum. An intravenous (IV) catheter should be placed because constant-rate or intermittent administration of anesthetic drugs is required to maintain an anesthetic plane. The site of anesthesia and surgery should be chosen on the basis of avoiding hard surfaces, the availability of padding (especially for the head), and the quality of footing (nonslip), anticipating concerns during the recovery phase. Padding, if available, should be placed under the points of the shoulder and the hip. For horses in lateral recumbency, the lower front leg is traditionally pulled forward with the goal of reducing pressure on the radial nerve.

Much of the success of equine field anesthesia is predicated on the maintenance of light levels of anesthesia. The need to administer additional anesthetic agents to deepen the level of anesthesia is determined on the basis of changes in respiration,
increases in muscle tone, or movement. Heart rate and ocular signs are less reliable indicators of anesthetic depth when a ketamine-based technique is used. Limiting movement while administering additional anesthetic drugs is important; thus, most practitioners combine restraint with ropes with the anesthetic techniques.5

No single IV bolus injection of a drug or drug combination safely produces 60 minutes of anesthesia in the horse. Anesthesia should be induced with the use of techniques described for short-term equine field anesthesia.6–10 The induction techniques usually produce approximately 15 to 25 minutes of anesthesia. During this period, the horse should be positioned for surgery and the halter removed or loosened to prevent facial paralysis as a result of compression of the facial nerve.

The use of intravenous infusions is preferred, but intermittent boluses of the induction drugs can be used. Xylazine and ketamine can be given at the rate of 30% to 50% of the initial dose (xylazine 0.5 mg/kg and ketamine 1.1 mg/kg) combined in the same syringe.11 The administration of a second dose of the combination extends the anesthetic period approximately 10 minutes. Subsequent boluses in response to movement appear to be less effective, perhaps because sympathetic activation is or may be associated with the variations in anesthetic depth. Co-infusions of xylazine and ketamine have been used to extend short-term IV anesthesia.12 Induction is accomplished through the use of standard techniques, and an infusion of xylazine (2.1 mg/kg per hour) and ketamine (5–7 mg/kg per hour) is begun. The technique has been used for durations of 70 minutes.

Guaifenesin recipes (combinations) are widely used to extend anesthesia beyond 20 minutes in the horse. Guaifenesin (5%) solution is combined with xylazine and ketamine to produce a solution commonly referred to as “triple drip,” or “GKX.”13 “Triple drip” is formulated by adding 1000 to 2000 mg of guaifenesin supplemented with detomidine (0.04 mg/mL) and ketamine (4 mg/mL), given to effect. The required rate of infusion approximates 0.6 to 0.8 mL/kg per hour (approximately one half of the “triple drip” rate). Recoveries are generally longer than after inhalant anesthesia but have been judged good to excellent. Midazolam has been substituted for guaifenesin in recipes with ketamine and xylazine to produce IV anesthesia.16 Midazolam (50 mg), ketamine (1000 mg), and xylazine (500 mg) are added to 1 liter of isotonic fluids and administered at a rate of 2.2 mL/kg per hour. The combination is infused at a rate equivalent to “triple drip” (2.2 mL/kg per hour) and is similarly effective, in the author’s experience. The concentration of ketamine in the recipes has been varied, with increased concentrations (2 mg/mL) recommended when particularly painful procedures are contemplated.3

The assumption of lateral recumbency at induction is associated with ventilation/perfusion mismatches that can cause hypoxemia. Horses positioned in dorsal recumbency have further deterioration of pulmonary function. Oxygen supplementation through insufflation or the use of a demand valve4 is recommended, particularly when anesthesia is extended beyond 60 minutes.17,18 Persons performing IV anesthesia routinely should consider the purchase of an oxygen tank and regulator to facilitate emergency oxygenation and ventilation of the patient.19 Placement of an orotracheal tube helps to ensure a patent airway and facilitates the administration of oxygen or the delivery of assisted ventilation. Orotracheal intubation should be considered if there is risk of respiratory obstruction or regurgitation or if the horse is to be positioned with the neck in an abnormal position. Horses can be ventilated by adapting a nasogastric tube onto a pressure-reducing valve attached to an oxygen tank. The tube is inserted into one nostril and the nasal openings are momentarily occluded. The nostrils are released when the chest wall rises to a normal inspiratory level. The process is repeated until spontaneous ventilation resumes. The techniques described usually produce tolerable levels of cardiovascular depression, but, as anesthesia is extended, the importance of monitoring increases.

3. Recommendations

Equine anesthesia should not be undertaken lightly. The risk of morbidity or mortality in equine anesthesia is greater than that in the other commonly anesthetized domestic species.2,16,17 A history must be obtained, a physical examination must be performed, and the results must be documented. The horse’s body weight is estimated, and the amount of drug to administer is based on that weight. If significant fluid deficits are present, they should be corrected before anesthetic induction and supplemented during the anesthetic procedure. All drugs administered with the route and time of administration are recorded in the medical record. Indices of cardiac and respiratory function are recorded at least every 10 minutes during the anesthetic period, and results are recorded. The horse should be monitored until it returns to a standing position.

The assumption of lateral recumbency is associated with the development of ventilation-perfusion
mismatches and the shunting of blood through the lungs resulting in less than optimal oxygenation. This level of oxygenation is well tolerated for short periods, but oxygen supplementation should be considered if anesthetic periods greater than 30 minutes are anticipated. Induce anesthesia using drugs and techniques that are familiar to you. The intravenous combination of diazepam or midazolam and ketamine administered to horses fully sedated with xylazine or detomidine is useful. Once the horse is positioned for surgery (approximately 10 minutes after induction), an infusion of guaifenesin in combination with xylazine and ketamine at a rate of 2.2 mL/kg per hour is begun. The horse’s respiratory rate, heart rate, and muscle tone are monitored, and the rate of infusion is adjusted up or down on the basis of the operator’s assessment of anesthetic depth. The infusion is discontinued as the surgery is completed. The horse is rolled to lateral recumbency for recovery. The halter and attached lead rope are replaced.

References and Footnote


*Equine demand valve, JD Medical Distributing Co, Inc, Phoenix, AZ 85029–4914.