Options for Field Anesthesia in the Horse

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Xylazine-ketamine anesthesia can be improved with the addition of diazepam to the regimen. Longer periods of anesthesia can be produced by inducing anesthesia with xylazine-diazepam-ketamine and infusing guaifenesin-xylazine-ketamine (triple drip) to maintain anesthesia. Author’s address: Dept. of Veterinary Clinical Sciences, College of Veterinary Medicine, Ohio State University, 601 Tharp Street, Columbus, OH 43210. © 1999 AAEP.

NOTES

1. Introduction
A number of anesthetic agents have been used to produce field anesthesia in the horse with varying success. Following the publication of a paper describing the use of a new technique for short term anesthesia in the horse in 1977, a new era of safe anesthesia in horses began. The technique described utilized the α-2 adrenoreceptor, xylazine, and the dissociogenic agent, ketamine, to produce short-term intravenous anesthesia. As the popularity of this technique grew, the safety and humanity of short-term equine anesthesia increased dramatically. Safety increased because the technique produced lateral recumbency with maintenance of reasonable cardiovascular function and acceptable respiratory depression. Recovery from anesthesia was generally smooth, with the horse rising to its feet 25 to 30 min after induction. The humanity of equine anesthesia increased because the institution of xylazine-ketamine anesthesia led to a dramatic reduction in the use of succinylcholine for equine restraint.

Xylazine produces dose-dependent sedation and analgesia that result in the horse assuming a head down posture. In addition, significant muscle relaxation and ataxia occur. This relaxation results in a horse that may knuckle on one or more legs or assume a sawhorse stance. Heart rate and cardiac output decrease while arterial blood pressure transiently increases followed by a sustained decrease. Respiration is depressed and the horse may “snore” as a result of relaxation of the muscles of the upper airway. Ketamine produces a dissociated state where the cortex is seemingly “dissociated” from the rest of the body. Animals are indifferent to peripheral pain stimuli and have increases in muscle tone. Characteristically, an apneustic or breath-holding respiratory pattern occurs. Xylazine-ketamine anesthesia has been administered to many horses during the past 20 years with relatively good results. Modifications of the xylazine-ketamine technique have been made as practitioners have encountered problems and have sought to improve the quality of the anesthetic protocol. The major problems associated with xylazine-ketamine anesthesia are related to (1) inadequate xylazine sedation prior to ketamine administration producing induction failure; (2) inadequate muscle relaxation during recumbency; or (3) too short a duration of anesthesia.

2. Methods and Results
The shortcomings of xylazine-ketamine anesthesia can be addressed by adding additional drugs to the
combination. The addition of diazepam to the xylazine-ketamine combination produces improved sedation and muscle relaxation at minimal cardiovascular cost.1,2 Diazepam, a sedative and centrally-acting skeletal muscle relaxant, augments xylazine-induced sedation and improves the quality of surgery by producing muscle relaxation. Diazepam is given at a dose of 0.05 to 0.1 mg/kg IV immediately before or in combination with the standard dose of ketamine (2.2 mg/kg IV). The addition of diazepam produces improved quality of anesthesia with minimal additional cardiopulmonary compromise. The addition of diazepam increases the duration of anesthesia from 20 to 25 min. The addition of diazepam to the xylazine-ketamine technique costs approximately $3.00 for a 500-kg horse.

If anesthesia needs to be extended because of unforeseeable circumstances, such as encountering a hernia while castrating a stallion, an additional dose of xylazine-ketamine can be administered. The drugs are 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.3 The administration of a second dose of the combination extends the anesthetic period approximately 10 min. The administration of additional doses beyond the single redosing is discouraged because the quality of the anesthetic state and the recovery from anesthesia worsen dramatically in the experience of the author. Seizure activity can occur if the combination is administered repeatedly.

Intravenous anesthesia of longer duration can be accomplished in a variety of ways. One of the most popular methods of producing IV anesthesia for up to 60 min is to induce anesthesia with the aforementioned xylazine-diazepam-ketamine technique and then extend anesthesia using a guaifenesin recipe (combination). Guaifenesin (5%) solution can be combined with xylazine and ketamine to produce a solution that is called “Triple Drip.”4 “Triple Drip” is formulated by taking a liter of 5% guaifenesin and adding 1000 to 2000 mg of ketamine and 500 mg of xylazine. The combination is administered to effect up to a rate of 1 ml/kg body wt/h. The combination produces excellent muscle relaxation and suitable analgesia. The degree of muscle relaxation and lack of movement are the best indicators of the depth of anesthesia. The quality of recovery is generally good if the anesthetic period is kept less than 1 h. “Triple Drip” should not be used for anesthetics longer than 1 h in duration unless oxygen supplementation and respiratory support are provided.

Alternatively, the combination of xylazine and tiletamine and zolazepam (Telazol) can be used to produce good quality anesthesia for 30 to 40 min.5 Xylazine (1.1 mg/kg) is administered IV in order to produce profound sedation and relaxation. Telazol (1.1 mg/kg) is given following the onset of full sedation. The quality of anesthesia is similar to that with xylazine-diazepam-ketamine in that muscle relaxation is excellent. Respiration is depressed but remains adequate for the period of recumbency. Recoveries are not as crisp as those seen with the xylazine-ketamine combination because of the greater degree of muscle relaxation.

3. Discussion

Xylazine and ketamine have been successfully used to produce short-term IV anesthesia in horses for more than 20 years. The addition of diazepam extends the period of anesthesia and augments the quality of the anesthetic period by producing improved muscle relaxation. Longer periods of anesthesia can be produced by administering additional doses of xylazine and ketamine, but guaifenesin recipes incorporating xylazine and ketamine produce improved results.

Equine anesthesia should not be undertaken lightly. 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. The suboptimal oxygenation is well-tolerated for short periods, but oxygen supplementation should be considered if anesthetic periods longer than 60 min are anticipated. Respiratory function should be monitored closely. If respiratory function becomes excessively depressed, the administration of the anesthetic agent should be stopped and respiration assisted. Persons performing IV anesthesia routinely should consider the purchase of an oxygen tank and regulator in order to facilitate emergency oxygenation and ventilation of the patient. Horses can be ventilated by adapting a nasogastric tube onto a pressure reducing valve attached to an oxygen tank. The tube is slid up one nostril and the nasal openings are occluded. The nostrils are released when the chest wall rises to a normal inspiratory level. The process is repeated until spontaneous ventilation resumes. In addition to respiratory depression, anesthesia is associated with decreases in cardiac output and arterial blood pressures. The techniques described usually produce tolerable levels of cardiovascular depression but as anesthesia is extended, the importance of monitoring increases.

References