Administration of Intravenous Anesthetics to Horses Immediately After Maximal Exercise

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Horses can be safely anesthetized immediately after maximal exercise with standard doses of intravenous anesthetic drugs if full sedation is achieved before drug administration. Two anesthetic drug regimens (diazepam and ketamine; tiletamine and zolazepam) produced a good quality of anesthesia. Authors’ address: Dept. of Veterinary Clinical Sciences, The College of Veterinary Medicine, The Ohio State University, 601 Tharp St., Columbus, OH 43210. © 1998 AAEP.

1. Introduction
A critical factor in treating horses immediately after injuries is the difficulty in managing an excited, stressed, and exhausted horse. Occasionally, anesthesia must be induced immediately to prevent exacerbation of the injury or to allow for a complete examination. Intravenous anesthesia in unstressed horses is associated with cardiovascular depression and imbalances of ventilation and perfusion that can produce tissue hypoxia and ischemia.1–5 Intravenous anesthesia in exhausted horses may be more difficult because of the excitement and metabolic derangements that occur after exercise. Another concern is the potential for exacerbation of the delayed return to pre-exercise physical status that occurs when movement is restricted or sedatives are administered.6,7 To our knowledge, neither the effectiveness nor the cardiorespiratory effects of intravenous anesthetic agents in horses recuperating from maximal exercise have been reported.

We have shown that sedation can be attained in horses after maximal exercise by the intravenous administration of twice the standard dose of sedatives.7 This project was designed to determine the effectiveness of four commonly used intravenous anesthetic techniques in horses sedated with a combination of xylazine and acepromazine immediately after maximal exercise.

2. Materials and Methods
Six Thoroughbred horses were used. The horses were entered into an exercise program on a treadmill designed to establish and maintain a level of fitness similar to that maintained in Thoroughbred horses in race training. At the end of 6 weeks the horses were tested to establish their individual maximum oxygen utilization (VO₂ max). The treadmill speed that caused the horse to exercise at 120% of its VO₂ max was used during simulated races. At 14-day intervals, the horses were instrumented for the collection of arterial and venous blood gases and the measurement of cardiopulmonary and metabolic indices. The horses were exercised at 120% of their VO₂ max until fatigued or for a maximum of 2 min.
Fatigue was defined as the inability to maintain position on the treadmill despite vigorous oral encouragement. Measurements were made prior to exercise and 1, 10, 20, 30, 45, 60, and 90 min after exercise. Xylazine (2.2 mg/kg IV) and acepromazine (0.04 mg/kg IV) were administered 2 min after the end of exercise. Five minutes after the end of exercise, one of four intravenous anesthetic protocols was administered: (1) ketamine (2.2 mg/kg), (2) diazepam (0.1 mg/kg) and ketamine (2.2 mg/kg), (3) premixed tiletamine and zolazepam (1 mg/kg), and (4) guaifenesin (50 mg/kg) and thiopental (5 mg/kg). Each horse received each of the drug combinations and the order was randomized. Time to lateral recumbency, time to the return to sternal recumbency, time to standing, and the number of attempts to stand were recorded. The quality of sedation, induction, anesthesia (10, 20, and 30 min), and recovery were scored by three independent observers using visual analog scales. Data were analyzed by using a two-way analysis of variance with appropriate posttests. The level of significance was set at p < 0.05.

3. Results

Times (in seconds) from the beginning of drug administration to lateral recumbency were as follows: ketamine, 83.7 ± 8.7; ketamine–diazepam, 61.2 ± 4.1; tiletamine–zolazepam, 55.7 ± 4.0; and guaifenesin–thiopental, 72.3 ± 4.8. Times (in minutes) to the resumption of sternal recumbency were as follows: ketamine, 25.2 ± 6.3; ketamine–diazepam, 40.4 ± 6.3; tiletamine–zolazepam, 50.4 ± 6.2; and guaifenesin–thiopental, 63.4 ± 8.6. Times (in minutes) to standing were as follows: ketamine, 29.2 ± 8.4; ketamine–diazepam, 46.2 ± 7.9; tiletamine–zolazepam, 53.1 ± 6.8; and guaifenesin–thiopental, 67.8 ± 7.8. The quality of induction and the quality of anesthesia were inadequate with ketamine alone but good to excellent with the other techniques. The quality of recovery was best with ketamine–diazepam, followed by guaifenesin–thiopental, tiletamine–zolazepam, and ketamine. The percentage of horses standing on the first attempt were as follows: ketamine, 50%; ketamine–diazepam, 83%; tiletamine–zolazepam, 50%; and guaifenesin–thiopental, 66%. Cardiorespiratory changes were similar for all techniques, with the exception of arterial blood pressures, which were significantly lower in the guaifenesin–thiopental group.

4. Discussion

Anesthesia was successfully induced in horses sedated with xylazine–acepromazine immediately after maximal exercise. Based on the ease of administration, quality of anesthesia, and degree of cardiorespiratory depression, ketamine–diazepam and tiletamine–zolazepam appear to be the most suitable drug combinations. The quality and duration of anesthesia were not good when ketamine was used alone. Guaifenesin–thiopental was cumbersome to administer and produced more cardiovascualr depression.

Although increased doses of sedative drugs are required during the recuperative period from maximal exercise, only standard doses of intravenous anesthetic agents were required to induce anesthesia in this study. The differences in dose requirements are probably the result of the decreases in neuroexcitatory substances and cardiac output produced by prior sedative administration. The amount of cardiovascular and respiratory depression produced in these horses was similar to that in previous reports of resting horses.

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References