Influence of sedation on onset and quality of euthanasia in sheep

Michele Barletta a,⁎, Erik H. Hofmeister b, John F. Peroni a, Merrilee Thoresen a, Alexandra M. Scharf a, Jane E. Quandt a

a Department of Large Animal Medicine, College of Veterinary Medicine, University of Georgia, Athens, GA 30602, USA
b Department of Small Animal Medicine & Surgery, College of Veterinary Medicine, University of Georgia, Athens, GA 30602, USA

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ABSTRACT

The purpose of this study was to determine if dexmedetomidine administered IV prior to euthanasia in sheep affected the speed or quality of euthanasia. Twenty clinically healthy Dorset-cross adult ewes between 1 and 3 years of age were enrolled in a randomized blinded experimental trial. The subjects were randomly assigned to receive dexmedetomidine 5 μg/kg IV or an equivalent volume of saline. Five minutes later, euthanasia was accomplished with a pentobarbital/phenytoin overdose given IV. The time to apnea, asystole, cessation of audible heartbeat, and absence of corneal reflex were recorded by two blinded investigators. If any muscle spasms, contractions, vocalization, and/or dysrhythmias were noted, the time was recorded and type of ECG abnormality was described. An overall score of the euthanasia event was assigned using a numeric rating scale (NRS) after the animal was declared dead. The time to loss of corneal reflex was significantly longer in sheep given dexmedetomidine compared with those who received saline (P = 0.03). Although vocalization was observed only in some animals premedicated with dexmedetomidine, no significance was found for this event and no other significant differences between groups were noted. Dexmedetomidine at 5 μg/kg IV 5 min prior to injection of pentobarbital/phenytoin for euthanasia did not substantially affect the progress of euthanasia. Dexmedetomidine may be given to sedate sheep prior to euthanasia without concern for it adversely affecting the progress of euthanasia, however vocalization may occur.

1. Introduction

Euthanasia means “good death” and has to be carried out by the veterinarian with maximum level of respect towards the animal's life that is to be taken. When the decision is made, the euthanasia process has to be humane and with no or minimal distress for the animal. Sedation prior to euthanasia may help minimize any distress and it is recommended by the American Veterinary Medical Association (AVMA) Guidelines for euthanasia, which is to occur in the presence of a client (Leary et al., 2013). Those same guidelines state that sedative drugs may influence the cardiovascular system, which may prolong the onset of death after injection of a euthanasia solution. Approximately 85% and 100% of animal shelters in Canada premedicated dogs and cats when euthanasia was performed by a veterinarian and a non-veterinarian, respectively (Caffrey et al., 2011). All the surveyed establishments used pre-medications prior to euthanasia of other species (Caffrey et al., 2011). Sedation prior to euthanasia may allow for less physical restraint, reducing stress on the animals (Ramsay and Wetzel, 1998). In horses given detomidine 0.01 mg/kg IV 5–10 min prior to euthanasia, time to collapse was significantly longer than in unsedated horses, but time to asystole was significantly shorter (Buhl et al., 2013).

The AVMA Guidelines for the Euthanasia of Animals mention that unconsciousness should be rapid and should be followed by cardiac arrest or respiratory arrest and, ultimately, by loss of brain function (Leary et al., 2013). Animals in deep narcosis may recover after injection of euthanasia solutions and death should be confirmed by loss of vital signs. It is important to consider the type of drugs used and animal species when assessing death (Leary et al., 2013). In people asystole is considered a marker of death, however in veterinary medicine clinical signs such as respiratory arrest, lack of pulse and heartbeat, and absence of corneal reflex are used to confirm death (Leary et al., 2013). In dogs (Evans et al., 1993) and horses (Buhl et al., 2013) asystole occurred after clinical confirmation of death and the authors concluded that before declaration of death cardiac function should be assessed.

Injectable alpha-2 agonists, such as dexmedetomidine, have been used clinically to facilitate sedation prior to euthanasia. However, it is unknown if this use affects the speed or quality of euthanasia in sheep. Achieving a smooth, rapid euthanasia reduces the stress on the patient as well as the client and research personnel working with these animals. The purpose of this study was to determine if dexmedetomidine...
administered IV prior to euthanasia in sheep affected the speed and quality of euthanasia. The hypothesis for this study was that the time to death would be longer and the quality of euthanasia would be better when dexmedetomidine was used for sedation prior to the administration of euthanasia solution, compared to animals who did not receive dexmedetomidine.

2. Materials and methods

Twenty clinically healthy Dorset-cross adult ewes between 1 and 3 years of age and weighing between 30 and 87 kg were used for this study. The sheep were also enrolled in another study investigating tracking of mesenchymal stem cell migration in a defect of the deep digital flexor tendon. The sheep were housed in groups of 2 or 3 in an animal housing facility at the University of Georgia, College of Veterinary Medicine. The study was approved by the University of Georgia Institutional Animal Care and Use Committee.

After the study was concluded, a minimum of 7 days was allowed where no drugs were administered to the sheep. Before the experiment began, 1 mL of 2% lidocaine (Lidocaine HCl; Hospira, IL, USA) was administered subcutaneously on the right side of the neck to facilitate the placement of an 18-gauge, 57 mm (2.25 inch) catheter in the jugular vein, which was secured with skin sutures. After catheter placement, 10 min were allowed before any drug was administered and the sheep were allowed to move freely during this time. The subjects were assigned by a random number generator to receive dexmedetomidine (Dexdomitor; Zoetis, Kalamazoo, MI, USA) 5 µg/kg IV (Dex) or an equivalent volume of saline (0.01 mL/kg IV) (Sal). Five minutes after the injection of dexmedetomidine or saline, an overdose of pentobarbital/phenytoin (Beuthanasia-D Special; Merck, Madison, NJ, USA) was administered IV at 0.22 mL/kg (85.8 mg/kg of pentobarbital and 11 mg/kg of phenytoin) over 10 s. The time to apnea, cessation of audible heart beat, and no corneal reflex, and declaration of death were recorded by two blinded investigators. The first observer (MB) monitored the respiration by visual detection of chest movements and heart rate by auscultation with a stethoscope. The second investigator (JQ) monitored the cardiac rhythm via electrocardiogram (ECG), which was placed prior to the injection of euthanasia solution. If any muscle spasms, contractions, vocalization, and/or dysrhythmias were noted, the time was recorded. Declaration of death occurred when both clinical and cardiac death were noted. Clinical death was determined on the basis of apnea, no audible heartbeat, and no corneal reflex. Cardiac death was defined as asystole, flat baseline on ECG. Time between clinical and cardiac death was calculated. An overall score of the euthanasia event was assigned (QJ) using a numeric rating scale (NRS) after the animal was declared dead. The NRS used was a simple 10 cm straight line with the extreme left, 0 cm, representing the best and smoothest euthanasia event, and the extreme right representing the worst euthanasia with struggling and vocalization. Whole numbers were assigned along this continuum.

Data were analyzed for normality using the D’Agostino-Pearson method. Normally distributed data were compared using a 2-way t-test and non-normally distributed data were compared using a Mann-Whitney U test. Categorical data were compared using a Fisher’s Exact Test. Significance was set at α < 0.05.

3. Results

No complications were recorded during jugular catheter placement and all euthanasia events were successful. Signs of sedation in animals premedicated with dexmedetomidine included head drop, reduced movement of the head and ears, ataxia, and sternal recumbency. In the Dex group, the first dysrhythmia seen after euthanasia solution administration was increased sinus rate (n = 4), ventricular tachycardia (n = 3), idioventricular rhythm (n = 1), ventricular escape complexes (n = 1), and no arrhythmias before asystole (n = 1). In the Sal group, the first arrhythmia seen was idioventricular rhythm (n = 8), ventricular tachycardia (n = 1), increased sinus rate (n = 1), and no arrhythmias before asystole (n = 1). Events associated with euthanasia are presented in Table 1. The time to loss of corneal reflex was significantly longer in sheep given dexmedetomidine compared to those who received saline (P = 0.03). Although vocalization was observed only in some animals in the Dex group, the frequency of vocalization was not significantly different between groups. No other significant differences between groups were noted. Apnea was the first event in all of the sheep, absence of an audible heart beat occurred concurrently in 3 sheep (n = 1 in Dex and n = 2 in Sal) and after apnea in 17 sheep, asystole occurred before loss of corneal reflex in 10 sheep (n = 6 in Dex and n = 4 in Sal) and loss of corneal reflex in 9 sheep (n = 4 in Dex and n = 5 in Sal). For the remaining sheep in the Sal group, asystole and loss of corneal reflex occurred at the same time. Clinical death occurred prior to cardiac death in 4 sheep in the Dex group and in 5 sheep in the Sal group. The two events occurred simultaneously only in one animal and it was in the Sal group. For all other subjects clinical death was noted after cardiac death.
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