Use of ambulatory electrocardiography for detection of ventricular premature complexes in healthy dogs

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Objective—To evaluate the use of 24-hour ambulatory electrocardiography (AECG) for the detection of ventricular premature complexes (VPC) in healthy dogs.

Design—Case series.

Animals—50 healthy mature dogs.

Procedure—A 24-hour AECG was performed on each dog and evaluated for the presence of VPC.

Results—Fifty dogs weighing between 18.2 to 40.9 kg (40 and 90 lb) representing 13 breeds were evaluated; there were 4 sexually intact females, 21 spayed females, 4 sexually intact males, and 21 castrated males. Ages ranged from 1 to 12 years. Thirty-four dogs had no VPC; 16 dogs had between 1 and 24 VPC. The grade of arrhythmia ranged from 1 to 4, with 4 dogs having an arrhythmia with a grade > 1. Significant differences were not detected between the group of dogs with VPC and those without VPC with regard to sex, age, and minimum, maximum, or mean heart rate.

Conclusions and Clinical Relevance—We conclude that healthy mature dogs have infrequent VPC, as detected by use of 24-hour AECG. The presence of numerous or sequential VPC may be suggestive of cardiac or systemic disease and may indicate the need for thorough clinical evaluation. (J Am Vet Med Assoc 2001;218:1291–1292)

The 24-hour ambulatory electrocardiogram (AECG) is often used to evaluate dogs for the presence of ventricular premature complexes (VPC) associated with occult dilated cardiomyopathy, familial cardiovascular disease, or syncope. The significance of the identification and number of VPC on an AECG is controversial in healthy mature dogs because of a paucity of information regarding this technique and its use for long-term (24 hour) ECG recording. Previous studies have demonstrated that occasional VPC appear to be a normal finding in some species (humans, cats); however, this information is not available in dogs. To our knowledge, only 2 studies have been performed in dogs that evaluate the finding of VPC on the AECG. In 1 of these studies, only 1 breed of dog (Beagle) was evaluated. In the second study, only 12 dogs were evaluated for > 22 hours. Two of those 12 dogs were Boxers, a breed that is predisposed to the development of VPC associated with cardiac disease. The limitations of these studies would appear to justify additional evaluation of the AECG in dogs. The purpose of the study reported here was to evaluate healthy mature dogs for the presence of VPC by use of AECG.

Materials and Methods

Healthy mature dogs (> 1 year of age) representing both sexes and weighing between 40 and 90 lb (18.2 to 40.9 kg) were recruited from within the veterinary school community for evaluation. Dogs were screened by history and physical examination findings and excluded from the study if any evidence of cardiac disease was evident (eg, murmur, gallop). Doberman Pinschers and Boxers were also excluded from evaluation because of the predisposition for cardiac disease in these breeds.

An AECG was obtained with a 3-channel Holter monitoring recorder. Holter recordings were initiated at the veterinary hospital; dogs were sent home to allow for monitoring of the dog’s electrical activity in its own environment. Owners were encouraged to maintain the dog’s normal activity level. The Holter monitor was removed after 25 hours. The Holter tapes were analyzed by a technician under the guidance of a veterinary cardiologist, using a Holter analysis system. Any tapes without at least 20 hours of readable data were excluded. The total number of VPC and maximum and minimum heart rate were tabulated, and ventricular arrhythmia, if present, was graded as follows: 1 = single VPC; 2 = bigeminy, trigeminy; 3 = couplets, triplets; 4 = R on T or ventricular tachycardia (4 or more consecutive VPC).

Statistical analyses—Data were not normally distributed; therefore, a nonparametric Mann-Whitney Rank Sum test was performed to evaluate whether significant differences existed between the group of dogs with VPC and the group without VPC with regard to sex, age, and maximum, minimum, or mean heart rate.

Results

Fifty dogs weighing between 40 and 90 lb (18.2 to 40.9 kg) and representing 13 breeds (including mixed-breed) were evaluated (Table 1). Ages ranged between 1 and 12 years (mean, 5 years). Four sexually intact females, 21 spayed females, 4 sexually intact males, and 21 castrated males were evaluated. The median number of VPC in the total population in a 24-hour period was 0, with a range of 0 to 24.

Thirty-four dogs (68%) had no VPC; the age of these dogs ranged from 1 to 11 years (mean, 4 years). Minimum heart rate in this group of dogs ranged from 29 to 52 beats/min (mean, 39 beats/min), maximum heart rate ranged from 130 to 240 beats/min (mean, 171 beats/min), and mean heart rate ranged from 52 to 86 beats/min (mean, 66 beats/min).

Sixteen dogs (32%) had between 1 and 24 VPC; the age of these dogs ranged from 1 to 12 years (mean,
Discussion

We evaluated 50 large-breed healthy mature dogs by use of AECG for at least 20 hours, and only infrequent VPC were documented. In an attempt to mimic normal daily activity level, all dogs were allowed to return to their home environment while wearing the Holter monitor. We specifically excluded Doberman Pinschers and Boxers, because these breeds are predisposed to the development of cardiomyopathy. Ventricular arrhythmias may be observed before the development of obvious clinical signs in these breeds, and the inclusion of dogs with occult cardiac disease could have biased the results.2,4 We specifically selected dogs that were between 40 and 90 lb to evaluate dogs that were of similar size to that of breeds more commonly screened for cardiomyopathy or familial arrhythmias.1,4

Of all dogs evaluated, only 8% (4 of 50) had an arrhythmia with a grade > 1. This suggests that the observation of 2 or more sequential VPC in mature dogs may be an indicator of cardiac or systemic disease. Although it is possible that certain breeds of dogs may normally have a higher number of VPC, this would seem unlikely, because 13 breeds of dogs were evaluated in the present study, and none of the dogs in any of the breeds had > 24 VPC (Table 1).

The AECG is being used more commonly in veterinary medicine for evaluation of syncpe and screening for cardiac arrhythmias, particularly ventricular arrhythmias associated with cardiomyopathies and other inherited cardiovascular diseases.5,6 Unfortunately, use of the AECG for screening and diagnostic purposes in dogs is controversial, because the frequency of VPC in normal dogs is unknown. The presence of VPC is considered a normal finding in some species, including humans, cynomolgus monkeys, and cats.5,7,8 However, in other species, including horses, VPC are rarely observed.9 Some authors have suggested that a small number of VPC may be normal in dogs, particularly in older dogs.9,10 In 2 previous studies, attempts were made to evaluate the AECG in clinically normal apparently healthy dogs, but both studies had limitations.9,10 In 1 study,9 AECG was performed on 228 Beagles. Ventricular premature complexes were documented in approximately 20% of the dogs. The total number of VPC per day was ≤ 9 in all but 4 dogs. Although a large number of dogs were evaluated in that study, the results were limited by evaluation of only a single breed. That study also was performed in a closed research environment. The dogs lived in a controlled confined environment, making it difficult to compare them with dogs with more variable daily activity patterns. In another study,10 12 dogs representing 8 breeds were evaluated by use of AECG for 22 to 24 hours. These dogs had a mean of 7 (range, 0 to 52) VPC. Unfortunately, the study population was small and included 2 Boxers, a breed known to be predisposed to ventricular arrhythmias.8 If these Boxers are excluded from the results, the mean number of VPC per day was only 2.

We conclude that healthy mature dogs have infrequent VPC in a 24-hour period, as evaluated by use of AECG. The presence of numerous or sequential VPC may be suggestive of cardiac or systemic disease and may indicate the need for thorough clinical evaluation.

References