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Twenty-four hour Holter monitoring in finishing cattle housed outdoors

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Abstract *Introduction:* Atrial premature complexes have been reported to be the most common arrhythmia in cattle and is suspected to be secondary to systemic disease, especially gastrointestinal disease. In order to properly identify pathologic arrhythmia in cattle, the normal rhythm and arrhythmia prevalence should be defined. The objective of this study was to determine the normal heart rate, rhythm, number of ventricular premature complexes (VPCs), and atrial premature complexes (APCs) in unrestrained Angus steers.
Animals: Twenty-seven client owned steers with unremarkable physical examinations and serum biochemical analyses were used.
Materials and methods: Twenty-four hour Holter monitors, attached by a custom-made harness, were retrospectively evaluated. Three lead electrocardiographic registrations of good quality and normal sinus rhythm were obtained from all steers in the study.
Results: The mean heart rate was 66.8 bpm ± 16.4 bpm. Ventricular premature complexes were rare (noted in 14.8% of steers), and APCs were common (noted

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in 85% of the steers). Simple second degree AV block was observed in 18.5% of the steers.

Conclusion: In summary, healthy steers have rare single VPCs, although it is possible for an individual animal to have apparent more frequent VPCs. Mean heart rate varies with a diurnal pattern similar to other species. Atrial premature complexes are the most prevalent abnormality observed in feedlot steers.

Introduction

Ambulatory electrocardiogram monitoring, in the form of Holter monitoring, has been used in human and veterinary medicine for decades as an aide in the diagnosis and determination of appropriate therapy of heart rhythm disturbances. Within veterinary medicine, Holter monitors have been primarily used in companion animal species, yet little attention has been given to food animal species. Moreover, the heart rhythm in clinically normal cattle fed high concentrate diets and housed outdoors in confined dry-lot facilities has not been previously reported. In order to properly identify pathologic arrhythmias in cattle, the normal rhythm and arrhythmia prevalence in healthy cattle should be defined. Most prior reports of arrhythmia in cattle have been recordings of relatively shorter duration and in animals that were hospitalized or being handled for various reasons [1—3]. Therefore, we set out to document the normal Holter monitor registrations of this class of cattle.

Materials and methods

All animal handling and animal care practices were reviewed and approved by the Kansas State University Institutional Animal Care and Use Committee (# 3250). Twenty-seven healthy 15- to 17-month-old Angus steer cattle were used. Clinical examination, complete blood count, and serum biochemical analysis were performed. Cattle were determined to be disease free based on normal physical examinations and normal laboratory data (complete blood count and serum chemistries). In addition, tissue histopathology was determined to be normal following euthanasia (27 d after Holter recordings). A lightweight Holter monitor was used in an outdoor environment. The steers (506 kg $\pm$ 5.5 kg) were received from a commercial feeding facility in southwest Kansas. Steers were selected from a larger group based on weight uniformity and condition. Steers were adapted to a standard commercial finishing diet prior to shipment. Upon arrival, steers were weighed, identification recorded, placed in a pen with ad libitum access to grass hay/fresh water, and provided 3.7 kg finish diet per head. Steers were reacclimated to the finish diet over 10 d. After 10 d, steers were placed into six dirt floor pens with feed bunks containing an individual animal feeding system.[f] Steers were stratified by weight and randomly assigned to one of six pens. Pens were divided into two blocks of three pens with study day was separated by 5 calendar days between the two blocks. Pens were approximately 18 m $\times$ 3.6 m and each contained five gated feed bunk gates. Approximately 2.5 m^2 of shade was provided per animal. Steers were provided water ad libitum from a tank located at the rear of the pen. Steers were individually fed twice daily with the first delivery beginning at 07:00 h and the second delivery between 09:00 and 10:00 h. Blood samples for serum chemistry and CBC were collected on all study animals on days -11 and -16 for blocks 1 and 2, respectively. Blood was immediately transferred through the rubber stopper into three 10-ml serum collection tubes followed by 6-ml EDTA tubes.[g] All samples were processed within 3 h of sampling. Serum was separated immediately after centrifugation and stored overnight at 4—6 °C. Serum was submitted to Kansas State University Veterinary Diagnostic Laboratory for analysis of serum chemistry panel.[h] Complete blood counts were analyzed using a hematology analyzer.[i]

Holter registrations of each monitor were digital. Sample frequency was 180 samples per second. Each registration had recorded three leads.[j] Silver/silver chloride electrodes[k] were applied to

[f] Calan Broadbent Feeding system, American Calan, Inc. Northwood, NH, USA.
[g] Greiner Bio One, Monroe, NC, USA.
[h] Cobas c501, Roche Diagnostics, Indianapolis, IN, USA.
[i] ProCyte Dx, IDEXX Laboratories, Westbrook, ME, USA.
[j] DR200/HE, NorthEast Monitoring, Inc. Maynard, MA, USA.
[k] Invivo Quadtrode CV, Philips Medical Systems, Orlando, FL, USA.

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