

Help! I Holtered My Dog and I Don't Know What This Means!

by Nancy Hopkins, celestialbz@mac.com

We have a Holter Rental Program! Yay! So you decide to Holter a dog or two. You pay the fee, fill out the forms and, “Yippee!” the Holter monitor and all the equipment comes in the mail. After a bit of a struggle and wondering what you have gotten yourself into (never fear, we have people to help you out!), you manage to get the Holter monitor on your first dog and the vest safely secured. Now you watch the dog like a hawk to keep him from chewing

on the equipment and after that 24-hour vigil you do it all over again with your other dog. After another successful Holter test, you take the sim cards, put them in the reader one by one and download the data to your computer. At the ALBA website, you click on “Transmit Holter” in the upper left hand of the page. On the transmit page, you diligently read the instructions, click the link to go to the drop box and enter your information:

Full Name: Barbara Borzoi Breeder
 E-mail Address: BBBBorzoi@Email.email
 Phone Number: 555-555-5555
 Dog's Name: Boris Vorenoff
 Dog's Age: 4 years
 Dog's Breed: Borzoi
 “Please include the Full Disclosure”

And before you know it, there is a message from ALBA Medical in your inbox! Hot Dog! You are so excited. Now you will have so much information to add to what you know about your dogs! Hooray!

You open your e-mail and see this (Figure A):

CANINE HOLTER MONITORING REPORT										
HOLTER MONITOR REPORT										
Patient Name:	McCartin, Khavi	Interp. Physician:								
Date of Birth:		Scan Number: mielikiborzoi@gmail								
ID :	KAU	Date Recorded: 12/14/2017 @ 19:24								
Age:	8 Months	Date Processed: 12/21/2017								
Sex:	F	Recorder Num: 025144								
Analyst:		HookupTech:								
Physician:										
Indications:	Borzoi	Medications:								
<p>The patient was monitored for a total of 23:46 hours. The total time analyzed was 21:04 hours. Start time was 7:24pm1. There was a total of 118758 beats. There were 0 Ventricular beats, there were 0 Supraventricular beats, and patient is not paced.</p> <table> <tr> <td>Mean Heart Rate: 94</td> <td>Total Beats: 118758</td> </tr> <tr> <td>Maximum Heart Rate: 240 @ 5:55am2</td> <td>Tachycardia beats: 1432 (>=160 BPM) 1%</td> </tr> <tr> <td>Minimum Heart Rate: 40 @ 5:13am2</td> <td>Bradycardia beats: 246 (<= 60 BPM) 0%</td> </tr> <tr> <td>Pauses: 0 (>5 sec.)</td> <td>Longest RR at: 2.3 seconds at 5:37am2</td> </tr> </table> <p>Ventricular - Not Present Supraventricular - Not Present RR Variability SDNN: 213.34 ms pNN50: 51.973 % RMSSD: 242.68 ms SDSD: 242.68 ms</p> <p>COMMENTS: PVC Summary : Total VE's = 0</p>			Mean Heart Rate: 94	Total Beats: 118758	Maximum Heart Rate: 240 @ 5:55am2	Tachycardia beats: 1432 (>=160 BPM) 1%	Minimum Heart Rate: 40 @ 5:13am2	Bradycardia beats: 246 (<= 60 BPM) 0%	Pauses: 0 (>5 sec.)	Longest RR at: 2.3 seconds at 5:37am2
Mean Heart Rate: 94	Total Beats: 118758									
Maximum Heart Rate: 240 @ 5:55am2	Tachycardia beats: 1432 (>=160 BPM) 1%									
Minimum Heart Rate: 40 @ 5:13am2	Bradycardia beats: 246 (<= 60 BPM) 0%									
Pauses: 0 (>5 sec.)	Longest RR at: 2.3 seconds at 5:37am2									
Physician's Signature:	_____	Date								

What???? The first page provides information in English, at least, but what does it mean? All the other pages (20 to 30+) are filled with varying amounts of squiggles that can be really alarming looking. What do THEY mean?

Suddenly your head is swirling. You just paid \$40 to rent the Holter, approximately \$45 to mail the Holter back, and \$30 for ALBA Medical to send you the report and what is all this? Do you need to get a cardiologist interpretation? Should you breed your dog? Should you take him to a cardiologist? Just, what does all this mean?

First, it is important to remember that the Holter test is a screening tool intended to give you information that will better inform your breeding decisions. Like almost everything else to do with breeding, there are few clear-cut answers. However, you will gain more information than you had before you tested and you will be contributing to the effort to make the Holter a more definitive tool for you to use in the future through the Borzoi Arrhythmia Project investigation.

So, never fear! Read on and you will feel much more comfortable the first time you get a Holter report in your inbox.

Figure A is the summary page. This provides a breakdown of the findings from ALBA Medical. The benefit of using ALBA Medical is that experienced technicians (humans) review the data from the Holter information you send. This is better than a machine read. However, it is important to remember that a veterinary cardiologist is not the one doing this initial

Continued on page 22

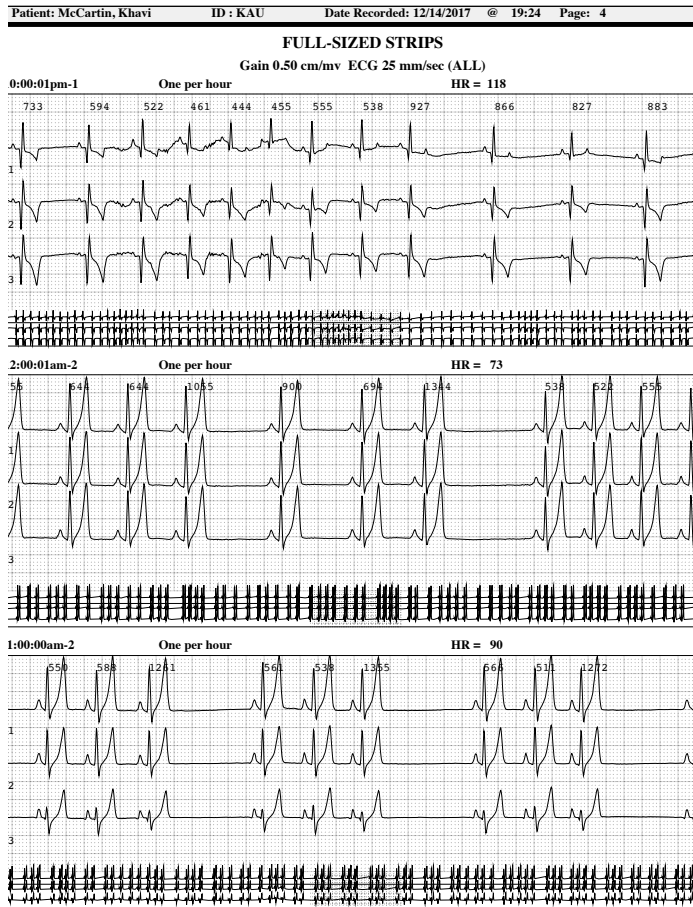


Figure B

reading, so one should consider the information on this summary page as a screening. If everything is good, then nothing more needs to be done. If there are some areas of possible concern, then you will need to take the next step to get more information. Bottom line, no dog should ever be removed from a breeding program based only on the information on this summary page!

Figure B is the event page. This page shows highlights from the 24-hour recording. These pages show complete information from all channels for short periods of time. These will have meaning only to people with the training to interpret ECG strips. They are interesting to look at, but don't let them alarm you.

Figure C is a page from the Full Disclosure part of the report. You will not get this portion of the Holter recording unless you specifically request it. If you are participating in the Borzoi Arrhythmia Project by sharing your dog's heart information with our researchers, Dr. Meurs and Dr. Gelzer, you will need to request the Full Disclosure. You will also need this if you plan to provide the

Holter data to a veterinary cardiologist for evaluation. This section of the report uses a lot of data space, so if you have an e-mail account with limited data usage, request that ALBA Medical send you the shortened version of the report and a copy with the Full

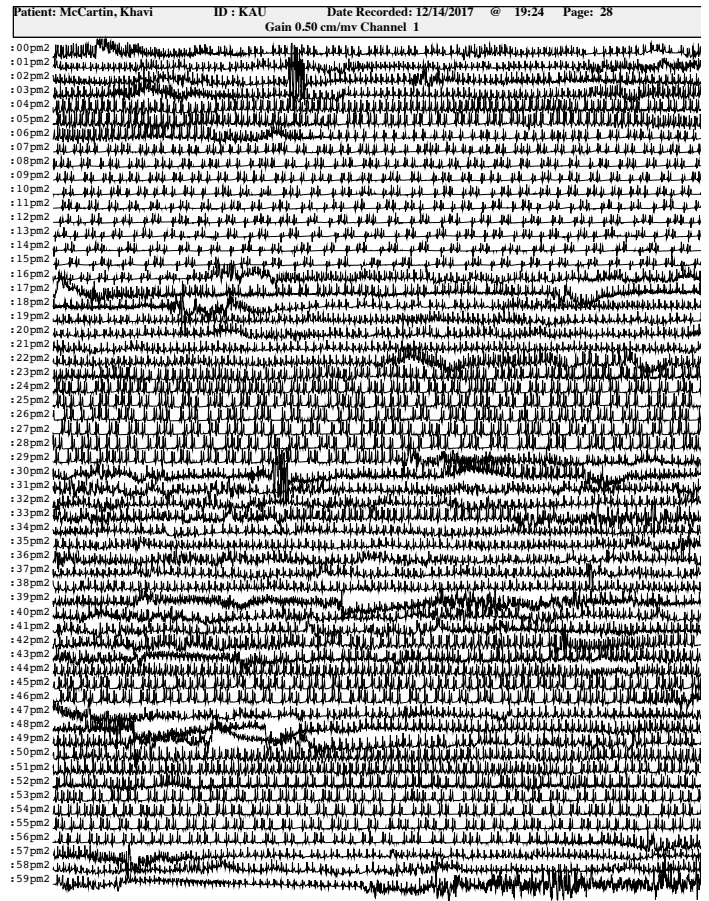


Figure C

Disclosure to either Nancy Hopkins (if participating in the Borzoi Arrhythmia Project) or your dog's cardiologist. So what does the report in Figure A mean? This particular dog (an 8-month-old puppy) had a heart rate of about 94 beats per minute (bpm). During the recording period her heart beat 118758 times. She had a maximum heart rate of 240 bpm at 5:55 am and a minimum heart rate of 40 bpm at 5:13 am.

For the purposes of this report "Tachycardia" is defined as a heart rate faster than 160 bpm. This is found in every report and is not a specific indication of pathologically fast heart rate. It is merely an indication of the number of heartbeats with a rate faster than 160 bpm.

The same is true for the Bradycardia beats section. Just as tachycardia means a fast heart rate, bradycardia is a term that means slow heart rate. For the purposes of the Holter report bradycardia is considered to be any heart beats occurring at rates of less than 60 bpm.

It is normal for a dog (or person) to have periods of slower and faster heart beats. This is just a sign of the heart doing its job.

The RR (as in the “Longest RR” and “RR Variability”) is the measure of the variation in the cardiac cycle length (or the beat to beat interval). This is information for cardiologists.

The 8-month-old dog who provided the information for the report shown in Figure A had no ventricular or supraventricular ectopic beats (misplaced beats or arrhythmias). Ventricular refers to the heart’s ventricles. They are the 2 large muscular chambers; one pumps the blood to the lungs, the other pumps the blood to the body. Supraventricular refers to the part of the heart above the ventricles. This includes the two atria and the AV node. The atria are the 2 smaller chambers of the heart. One atrium is the chamber that first accepts the blood as it returns to the heart from the body, the other accepts the blood as it returns to the heart from the lungs. The AV node (also known as the atrioventricular node) is a major part of the heart’s electrical conduction system.

If you get a report with this information, be glad. Your dog did not have arrhythmias of any kind during the period of time your dog was tested. You can still get a cardiologist’s interpretation, but there is no real urgency unless your dog is showing symptoms. If there is a direct family history of arrhythmias or sudden death you may still want a cardiologist’s interpretation to make sure there is nothing hidden in the Full Disclosure that is of concern. While getting a report such as the one in Figure A is wonderful, there is a chance, especially when testing older dogs, that arrhythmias will be found.

Before we go further, let us look at the types of arrhythmias a report might enumerate. Arrhythmias can occur in the ventricles of the heart as well as the atria. For the purposes of this article we will focus on ventricular arrhythmias. Ventricular arrhythmias can occur as single misplaced beats (single ectopics), as two misplaced beats spaced very close together (pairs/couplets), or 3 or more misplaced beats paired close together (3 = triplet and 4 or more = a run). It is when these ectopic beats begin to occur in rapid sequence in the ventricles that the risk for sudden death increases. Another type of concerning ectopic is the R on T phenomenon which can lead to sustained ventricular tachyarrhythmias leading to sudden death.

Until the Borzoi Arrhythmia Project investigation is complete, we do not know what is normal and what is not normal for Borzoi. In her 2005 report to the American Boxer Club, Dr. Kate Meurs stated that, “it was not common for a normal dog to have more than 100 ventricular premature contractions (VPCs) [ventricular ectopic beats] in 24 hours, or to have couplets, triplets, or runs. Normal large-breed dogs have an average of 2 VPCs per day.” In Boxers, more than 500 VPCs per 24-hour period indicates an affected dog and between 100-500 VPCs is suspicious for

Arrhythmogenic Right Ventricular Cardiomyopathy (a type of cardiomyopathy specific to Boxers). Unlike Boxers, Rhodesian Ridgebacks with more than a handful of ventricular ectopic beats are considered to be suspicious for Rhodesian Ridgeback Inherited Arrhythmia. So you can see that what is deemed normal and abnormal can be breed dependent.

Based on this information it is safe to say that the breeder/owner of any Borzoi who has more than a handful of singles and/or any number of pairs, triplets, or runs should seek a cardiologist’s interpretation and/or get an echo at the next available opportunity or recheck with another Holter test in 6 months. Remember that the results of a Holter test can pick up on arrhythmias that are caused either by a problem in the way the heart produces the electrical signal that stimulates its beats (such as in Rhodesian Ridgeback Inherited Arrhythmia) or by early stage cardiomyopathy (as seen in Doberman Pinscher DCM). Currently, Dr. Gelzer is graciously

CANINE HOLTER MONITORING REPORT																																																											
HOLTER MONITOR REPORT																																																											
Patient Name:	Hopkins, Drakon	Interp. Physician:																																																									
Date of Birth:		Scan Number:	celestialbz@mac.com																																																								
ID :	0 4753231	Date Recorded:	9/9/2017 @ 19:42																																																								
Age:	3 Years	Date Processed:	9/12/2017																																																								
Sex:	M	Recorder Num:	025144																																																								
Analyst:		HookupTech:																																																									
Physician:		Medications:																																																									
Indications:	Borzoi																																																										
The patient was monitored for a total of 23:45 hours. The total time analyzed was 22:29 hours. Start time was 7:42pm1. There was a total of 110321 beats. Less than 1% were Ventricular beats, there were 0 Supraventricular beats, and patient is not paced.																																																											
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Mean Heart Rate: 82</td> <td style="width: 50%;">Total Beats: 110321</td> </tr> <tr> <td>Maximum Heart Rate: 251 @ 7:21am2</td> <td>Tachycardia beats: 8212 (>=160 BPM) 7%</td> </tr> <tr> <td>Minimum Heart Rate: 42 @ 2:17am2</td> <td>Bradycardia beats: 6733 (<= 60 BPM) 6%</td> </tr> <tr> <td>Pauses: 0 (> 5 sec.)</td> <td>Longest RR at: 4.672 seconds at 5:10am2</td> </tr> </table>				Mean Heart Rate: 82	Total Beats: 110321	Maximum Heart Rate: 251 @ 7:21am2	Tachycardia beats: 8212 (>=160 BPM) 7%	Minimum Heart Rate: 42 @ 2:17am2	Bradycardia beats: 6733 (<= 60 BPM) 6%	Pauses: 0 (> 5 sec.)	Longest RR at: 4.672 seconds at 5:10am2																																																
Mean Heart Rate: 82	Total Beats: 110321																																																										
Maximum Heart Rate: 251 @ 7:21am2	Tachycardia beats: 8212 (>=160 BPM) 7%																																																										
Minimum Heart Rate: 42 @ 2:17am2	Bradycardia beats: 6733 (<= 60 BPM) 6%																																																										
Pauses: 0 (> 5 sec.)	Longest RR at: 4.672 seconds at 5:10am2																																																										
<table style="width: 100%; border: none;"> <tr> <td colspan="2">Ventricular Ectopy</td> <td colspan="2">Supraventricular - Not Present</td> </tr> <tr> <td colspan="4">Total: 21</td> </tr> <tr> <td colspan="4">Singles: 19</td> </tr> <tr> <td colspan="4">Pairs: 1</td> </tr> <tr> <td colspan="4">Total Runs: 0</td> </tr> <tr> <td colspan="4">Beats in Runs: 0</td> </tr> <tr> <td colspan="4">Longest Run: 0 @ 7:42pm1 (0 BPM)</td> </tr> <tr> <td colspan="4">Fastest Run: 0 @ 7:42pm1 (0 BPM)</td> </tr> <tr> <td colspan="4">RonT: 0</td> </tr> <tr> <td colspan="4">RR Variability</td> </tr> <tr> <td colspan="4">SDNN: 406.90 ms</td> </tr> <tr> <td colspan="4">pNN50: 52.328 %</td> </tr> <tr> <td colspan="4">RMSSD: 411.26 ms</td> </tr> <tr> <td colspan="4">SDSD: 411.26 ms</td> </tr> </table>				Ventricular Ectopy		Supraventricular - Not Present		Total: 21				Singles: 19				Pairs: 1				Total Runs: 0				Beats in Runs: 0				Longest Run: 0 @ 7:42pm1 (0 BPM)				Fastest Run: 0 @ 7:42pm1 (0 BPM)				RonT: 0				RR Variability				SDNN: 406.90 ms				pNN50: 52.328 %				RMSSD: 411.26 ms				SDSD: 411.26 ms			
Ventricular Ectopy		Supraventricular - Not Present																																																									
Total: 21																																																											
Singles: 19																																																											
Pairs: 1																																																											
Total Runs: 0																																																											
Beats in Runs: 0																																																											
Longest Run: 0 @ 7:42pm1 (0 BPM)																																																											
Fastest Run: 0 @ 7:42pm1 (0 BPM)																																																											
RonT: 0																																																											
RR Variability																																																											
SDNN: 406.90 ms																																																											
pNN50: 52.328 %																																																											
RMSSD: 411.26 ms																																																											
SDSD: 411.26 ms																																																											
COMMENTS: PVC Summary : 19 singles, 1 pair and 0 runs.																																																											
Physician's Signature: _____		Date _____																																																									

Figure D

Continued on page 26

offering Borzoi owners Holter interpretations for the low price of \$50. I have paid \$100 for this same service in Texas and I have seen a price of \$150 at a southern university vet cardiology department, so Dr. Gelzer is offering Borzoi owners a significant discount.

Figure D (on previous page) provides an example of a Borzoi's Holter report demonstrating why using the Rhodesian Ridgeback model is wise until we determine what number of arrhythmias is normal for Borzoi.

This dog fell into the normal range for Boxers but the abnormal range

for Rhodesian Ridgebacks, with 21 total ventricular ectopic beats (or VPCs). He had no arrhythmias based in his atria or his AV node (supraventricular). Of those 21 ventricular ectopics, 19 were singles and 1 was a pair. The owner sent the

Holter report with Full Disclosure to her veterinary cardiologist for evaluation. Based on the information in the Full Disclosure, the cardiologist recommended a Doppler echocardiogram. Through that test, this dog was determined to have dilated cardiomyopathy (DCM). His illness was discovered before he had begun showing any symptoms and before changes in the heart could have been picked up using X-rays. His disease was caught before he was bred. This dog was placed on medications and is currently on continued evaluation and care by that cardiologist which includes periodic echos and Holter tests to monitor the effectiveness of his treatment.

To date, with the support of the dedicated breeders and owners who are participating in the Borzoi Arrhythmia Project investiga-

tion, Dr. Meurs and Dr. Gelzer have narrowed their focus and are asking for people with dogs from families with a history of sudden death to Holter test puppies. In both German Shepherd Dogs and

Rhodesian Ridgebacks young dogs are at greatest risk for sudden death due to inherited arrhythmias. Holter testing can pick up arrhythmias in young dogs but may be missed in older dogs in these two breeds. Initial findings in Borzoi suggest that something similar may be occurring. We need breeders willing to Holter test puppies prior to 1 year of age. I commend the breeder of the dog depicted in Figure A for her willingness to Holter an 8-month-old puppy! If you are willing to help us gain more information about arrhythmias in Borzoi, please contact either Nancy Hopkins celestialbz@mac.com or Leslie Walenta (see contact information below).

To help you sort out any questions about the Holter results or to assist you in determining whether to request a veterinary cardiologist's interpretation and how quickly it should be done, BCOA member Danielle Steenkamp, DVM has offered to assist you. You may contact her at sataraBorzoi@gmail.com with your Holter report-related questions.

For help with putting the Holter on, taking it off, keeping your dog from eating the equipment, sending the information to ALBA Medical, or other questions regarding the Holter equipment you can contact Leslie Walenta at BorzoiGirls2006@aol.com.

Good health to all!

(The Holter reports provided for this article are shared with permission by the dogs' owner(s).)

