

# Holter Monitor

What is it, and what do the results mean for my dog's health.

by Samantha J. Hendricks

---



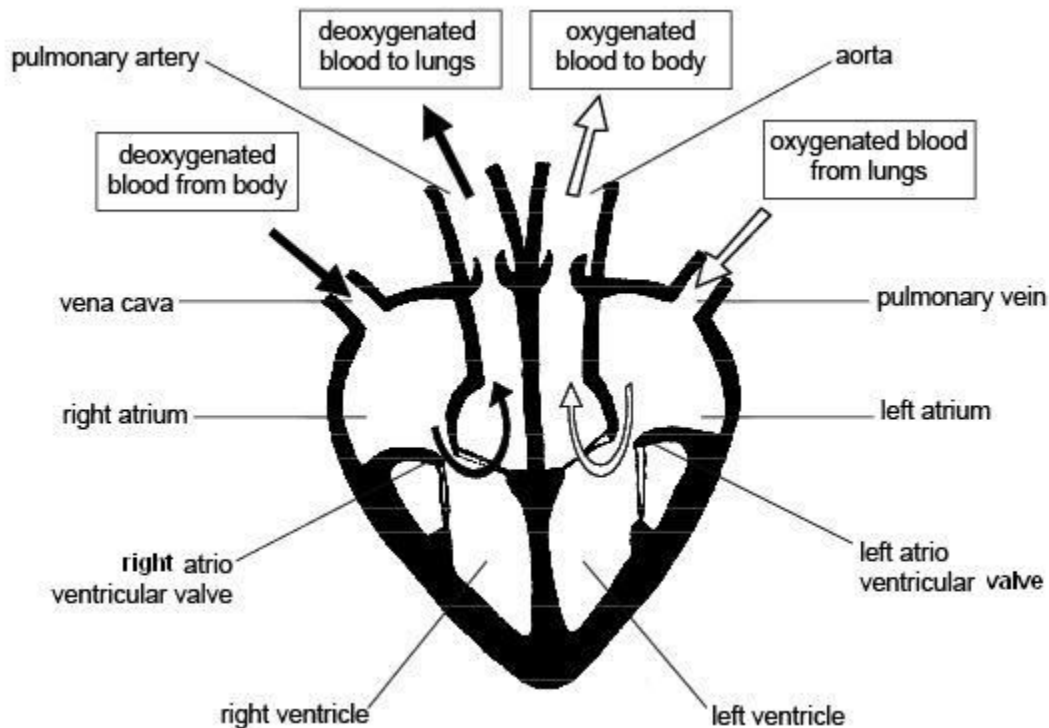
## History and Background

The Holter monitor is a portable device for continuously monitoring heart activity over an extended period of time, typically 24 hours. The monitor records electrical signals from the heart that are sent via a series of electrodes attached to the chest. The data is then analyzed for different sorts of heart beats and rhythms. It was invented in the 1940s by American biophysicist, Norman “Jeff” Holter, as a way to study the heart’s electrical activity during human’s normal daily activities. Up until the invention of the Holter monitor, electrocardiograms (ECGs) could only be performed on patients who were lying still.

## Understanding the Holter’s Function

Mammalian hearts (humans and dogs), consist of 4 chambers. 2 at the top of the heart called Atria. These are the filling chambers, and act as reservoirs for blood returning to the heart from

the lungs and body. The other 2 chambers at the bottom of the heart, are called Ventricles. These are the pumping chambers, and are responsible for pumping blood to the lungs and around the body.



Heart beats are generated by electrical signals, which drive the heart muscle of the ventricles to contract and pump blood into the body. These electrical signals originate in special areas of the heart called nodes. The Sinoatrial node (or SA node for short), controls all normal heart beats, heart rate, and normal sinus rhythm, and is found in the top chambers of the heart (Atria). Heart beats that originate from outside the SA node, are considered abnormal, or ectopic beats. Ectopic beats can be caused by a wide range of things, from physical disease of the heart, to emotional or physical stress, or even certain medications or foods (consider palpitations in people who drink caffeine). There are 2 types of ectopic beats: those originating in the atria which are called atrial ectopics, or supraventricular ectopics (SVE), and those originating in the ventricles which are called ventricular ectopics (VE) or premature ventricular contractions (PVCs). Individually, ectopic beats are not dangerous to the health of a dog, but can indicate some underlying conditions. Groups of ectopics are a different story, and can become life threatening in some cases. Groups of PVCs in particular are of great concern. Since the abnormal heart beats originate outside of the normal electrical channels, they can create an erratic pumping motion of the ventricles which affects the heart's ability to pump blood into the body effectively. As the amount of blood the ventricles pump into the body decreases due to the

erratic beating, the dog can suffer from loss of oxygen flow to the brain and other critical organs, causing fainting, loss of consciousness, and eventually death.

Other rhythms besides sinus rhythm that may be detected by the Holter monitor, include:

- Sinus arrhythmia – this rhythm also originates from the SA node, but unlike sinus rhythm (which has a regular rhythm), this is an irregular rhythm. It is considered normal in dogs and children.
- Atrial Fibrillation/Flutter (AF) – this rhythm originates in the atrial chambers of the heart, and is an often irregular, fast heart rhythm which causes the atrial chambers to ‘flutter’. This ‘fluttering’ can cause blood to pool and form blood clots, which increases the risk of a stroke or embolism. If the heart rate is too high, it may also cause fainting and lack of exercise tolerance.
- AV block – this rhythm is a sign of a conduction delay of the electrical signal from the atrial chambers to the ventricles. It can cause slow heart rates. Fainting, and loss of consciousness may be seen if the heart rate becomes too low.

Holters also record the overall maximum heart rate and overall minimum heart rate, the percentage of ectopic beats, and can detect any pauses that may occur between heart beats. A clinician can utilize all of this information to assess if the overall electrical function of the heart is normal.

## The Holter’s Role in DCM Screening

Since DCM in the Doberman has a strong association with ventricular arrhythmias, annual Holter monitoring is still considered a gold standard test for DCM. It can detect the presence of PVCs which can indicate early onset of DCM. The European Society of Veterinary Cardiology screening guidelines for DCM in Dobermans, recommends yearly Holter monitor testing beginning at three years of age. Based on these guidelines, more than 300 PVCs in one single 24hr Holter monitor, or two recordings within 1 year showing between 50 and 300 PVCs, is considered a positive indication for DCM.

In 25-50% of affected dogs, there is a risk of sudden cardiac death as a result of groupings of multiple PVCs called Ventricular Arrhythmias or Ventricular Tachycardia, without other signs of DCM. The Holter monitor test is key for detecting these arrhythmias.

# Interpretation of results.

<b>HOLTER MONITOR REPORT</b>	
<b>Patient Name:</b>	<b>Interp. Physician:</b>
<b>Date of Birth:</b>	<b>Scan Number:</b>
<b>ID :</b>	<b>Date Recorded:</b>
<b>Age:</b>	<b>Date Processed:</b>
<b>Sex:</b>	<b>Recorder Num:</b>
<b>Analyst:</b>	<b>HookupTech:</b>
<b>Physician:</b>	<b>Medications:</b>
<b>Indications:</b>	

The patient was monitored for a total of 23:59 hours. The total time analyzed was 21:29 hours. Start time was 10:43am1. There was a total of 90310 beats. There were 0 Ventricular beats, there were 0 Supraventricular beats, and patient is not paced.

Mean Heart Rate: 70	Total Beats: 90310
Maximum Heart Rate:220 @ 5:58pm1	Tachycardia beats: 565 (>=160 BPM) 1%
Minimum Heart Rate: 31 @ 4:59am2	Bradycardia beats: 13457 (<= 60 BPM) 15%
Pauses: 0 (> 5.0 sec.)	Longest RR at: 3.461 seconds at 5:10am2

**Ventricular Ectopy**

Total: 0  
Single: 0  
Pairs: 0  
Total Runs: 0  
Beats in Runs: 0  
Longest Run: 0 @10:43am1 ( 0 BPM)  
Fastest Run: 0 @10:43am1 ( 0 BPM)  
RonT: 0

**Supraventricular - Not Present**

**RR Variability**

SDNN: 343.37 ms  
pNN50: 63.818 %  
RMSSD: 347.63 ms  
SDSD: 347.63 ms

COMMENTS:

**PVC Summary : Total VE's = 0**

The above image is an example of the first page of an Alba Medical Holter report that you will receive after hiring The Dobermann Club of NSW's Holter Monitor. Information on how long your dog was monitored for, how many total heart beats, and how many ectopic beats were recorded can be found in the first paragraph. When setting up the monitor, you will be asked if

your dog has a pacemaker, which is an implanted electronic device that helps maintains the heart’s rhythm. The section below the first paragraph is a break-down of the information contained in the first paragraph, including:

1. Maximum and minimum heart rate recorded.
2. The average (or mean) heart rate.
3. The number of pauses between heart beats that lasted for more than 5 seconds.
4. The percentage of time that the heart rate was over 160 beats per minute (tachycardia).
5. The percentage of time that the heart rate was under 60 beats per minute (bradycardia).
6. And the longest period of time recorded between 2 consecutive heart beats (Longest R-R).

There is also a section that includes more information about any ectopic beats recorded.

RR variability refers to heart rate variability, and is the measurement of time between heart beats. A certain amount of variability in heart rate is normal, and this section can be utilised by trained professionals to assess for the presence of certain arrhythmias, as well as to assess the efficacy of certain medications if a dog is being medicated for any heart disease. While RR variability can hold some importance to clinicians in specialised cases, it does not provide any significant information on the health of majority of dogs.

The “Comments” section at the end is a summary of all the information held within the Holter report. The information up until this point is largely computer generated. The “Comments” are the human technician’s interpretation of the Holter recording.

Normal parameters for large adult dogs are listed in the table below.

<b>Mean Heart Rate</b>	70 – 120 bpm
<b>Maximum Heart Rate</b>	180 – 240 bpm
<b>Minimum Heart Rate</b>	33 – 45 bpm
<b>Pauses</b>	Anything under 5 seconds is acceptable
<b>Ventricular Ectopy</b>	<50 in a 24hr period

## Citations:

G. Wess, O. Domenech, J. Dukes-McEwan, J. Häggström, S. Gordon. European Society of Veterinary Cardiology screening guidelines for dilated cardiomyopathy in Doberman Pinschers. *Journal of Veterinary Cardiology*. Volume 19, Issue 5, 2017. Pages 405-415. ISSN 1760-2734. <https://doi.org/10.1016/j.jvc.2017.08.006> (<https://www.sciencedirect.com/science/article/pii/S1760273417300619>)

National Museum of American History. At the Heart of the Invention: The development of the Holter Monitor. 2011. <https://americanhistory.si.edu/blog/2011/11/at-the-heart-of-the-invention-the-development-of-the-holter-monitor-1.html>