VETERINARY CARDIOLOGY SPECIALISTS

OPTIMIZING YOUR ECG

OPTIMIZING YOUR ECG ACQUISITION

An electrocardiogram (ECG) can be a critical tool in diagnosing and managing heart disease in dogs and cats. However, interpreting an ECG can be challenging even with the best recording. Have a poor recording, forget about it. So here are 4 quick tips for optimizing your ECG acquisition.

1) Proper Patient Positioning and Restraint
2) Conventional Lead Placement
3) Optimal ECG Settings: paper speed and gain (scale)
4) Benefits of a 6 lead vs single lead II ECG

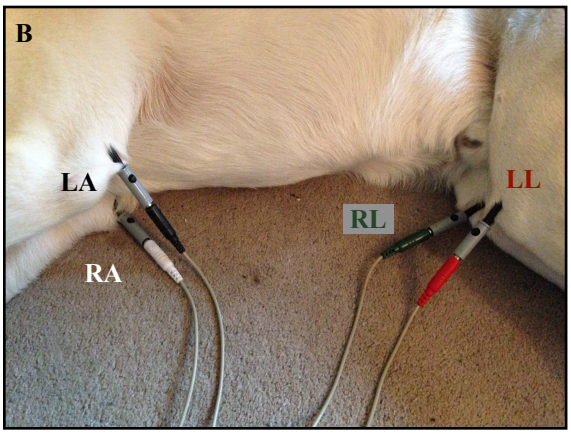
1) Proper patient positioning and restraint is a must. Refer to photo "A" to the right.

- right lateral recumbancy
- head flat, in line with body
- legs perpendicular to body, parallel to one another
- patient must be still: no panting or purring, no moving
- minimize contact with patient: no petting

Improper positioning and patient movement can lead to artifact and difficult interpretation (see ECG "F" below).

A. Proper Patient Positioning and Restraint

2) Lead placement must be consistent and according to convention as all the normal values (amplitude and duration measurements) are based on standardized lead placement. Note that most leads are colored coded as noted , but not all, so check the labels on the leads.



B. Conventional Lead Placement

Lead	Placement	Typical Color
Right Arm (RA)	Right Elbow	White
Right Leg (RL)	Right Knee	Green
Left Arm (LA)	**Left Elbow**	**Black**
Left Leg (LL)	Left Knee	Red

Hints
Front Arms: Black and White (read newspaper with arms)
Back Legs: Red and Green (Christmas - end of year)
Right side down (green grass / white snow on ground)

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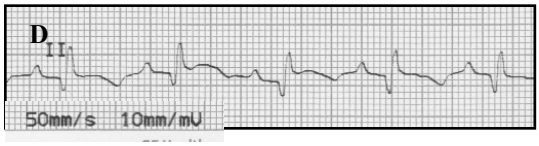
3) Proper ECG Settings: paper speed (mm/sec) and gain (scale in mm/mV), will make it easier to interpret your ECG data. Standard gain setting is 10 mm/mV, but can be adjusted as needed for best interpretation. Two paper speeds should be acquired.

- **A short strip at 25 mm/sec.** This is where your amplitude and duration measurements are meant to be acquired (ECG "C"), but this speed is not always best for rhythm analysis.

- **A longer 3 to 5 minute recording at 50 mm/sec.** This spreads out the wave forms for rhythm analysis with better assessment and identification of P, QRS and T waves, particularly in patients with high heart rates (ECG "D").

ECG "C". Heart rate 160 bpm, recorded at 25 mm/sec. Note how the T waves coalesce into the P waves of the next complex making it hard to clearly identify each wave form.

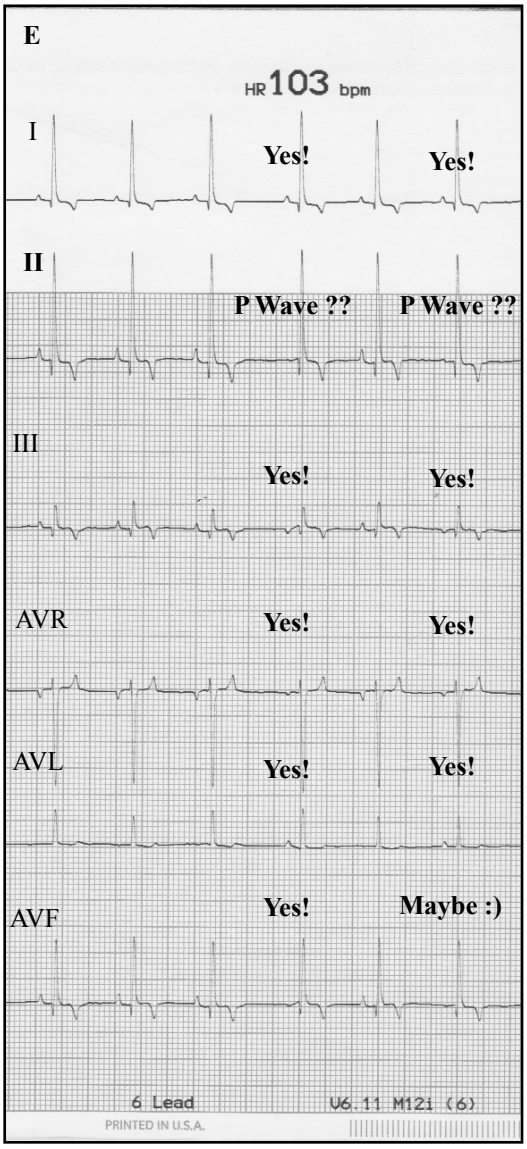


ECG "D". Heart rate also 160 bpm. but recorded at 50 mm/sec. Note how the P waves can now be clearly distiquished from the T waves making it easy to call this a sinus rhythm.

4) Benefits of a 6 lead vs single lead II ECG

- **A 6 lead ECG can help verify your findings as not all wave forms are always equally identified in all leads**

Look at the 6 lead ECG labeled "E" to the right. The 6 leads are noted, I, II, III, AVR, AVL, AVF. If only a lead II ECG had been performed, there would be question regarding the presence of a P wave on the 4th and 6th complexes from the left. Having only a lead II to interpret, junctional escape beats may have been suspected. However, when looking at the other leads, a P wave is clearly present (inverted in leads III and AVF) and an accurate diagnosis of a sinus arrhythmia with a wandering pacemaker can be confirmed.



- **A 6 lead ECG can help confirm and interpret around motion artifact***

Look at the 6 lead ECG labeled "F" to the right. There is tremendous motion artifact noted in all leads except lead III. This was created by movement in the right forelimb during the ECG acquisition. If only a lead II ECG strip had been obtained, this would have been an uninterpretable ECG. But, we can see from lead III that this is a normal sinus rhythm. * avoiding artifact is best.

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