

Basic ECG Interpretation

Meg M. Sleeper VMD, DACVIM (Cardiology)

Professor of Cardiology; University of Florida School of Veterinary Medicine

Electrical properties of the heart

Keeping the basic electrical properties of the heart in mind while reviewing electrocardiograms greatly simplifies the interpretation process. Knowing the principles of cardiac cell behavior makes interpreting a complex ECG a process like solving a puzzle. These principles are:

- A. **Automaticity**-only pacemaker cells are capable of beating spontaneously
- B. **Excitability**- all resting myocytes maintain a transmembrane electrical potential and are capable of responding to an effective stimulus by generating an all or nothing action potential.
- C. **Refractoriness**- all cardiac myocytes undergo a period of recovery following excitation when cells are incapable of responding to stimuli of any magnitude. Excitability is gradually restored. This period makes it impossible to tetanize cardiac muscle.
- D. **Conductivity**- low impedance junctions (intercalated discs) located in the ends of muscle fibers at the intercellular junctions give the atria and ventricles the property of a functional syncytium. Therefore, if propagation cannot be expedited along the preferential conducting pathway, depolarization can be spread directly (although more slowly) from one cell to the next. Thus, one of the primary causes of widened QRS complexes is ventricular ectopy.
 - 1. Rate of conduction is dependent on cell size
 - 2. Conduction is slower at the AV node, which is normally the only electrical continuity between the atria and the ventricles. This slowing allows mechanical atrial systole to catch up with the electrical discharge (and the ventricles to fill before ventricular systole occurs).
- E. **Contractility**- Peak tension that can be developed from a specific resting fiber length. The ECG gives no information about contractile function of the heart.

Pacemaker cells are situated along the conduction pathway and are governed by the hierarchy of dominance. This hierarchy is: Sinus node>>internodal atrial tracks>>>AV node>>Bundle of His>>Bundle branches>>Purkinje fibers; all undergo gradual diastolic depolarization during phase 4 (automaticity). Non-pacemaker cells do not normally exhibit automaticity.

Mechanisms of cardiac arrhythmias

Arrhythmias result from abnormalities of impulse generation that alter rate, regularity or origin of excitation and/or change the sequence of atrial and ventricular depolarization due to interference with conduction of the impulse. Below are some example ECGs which will be discussed during this session.

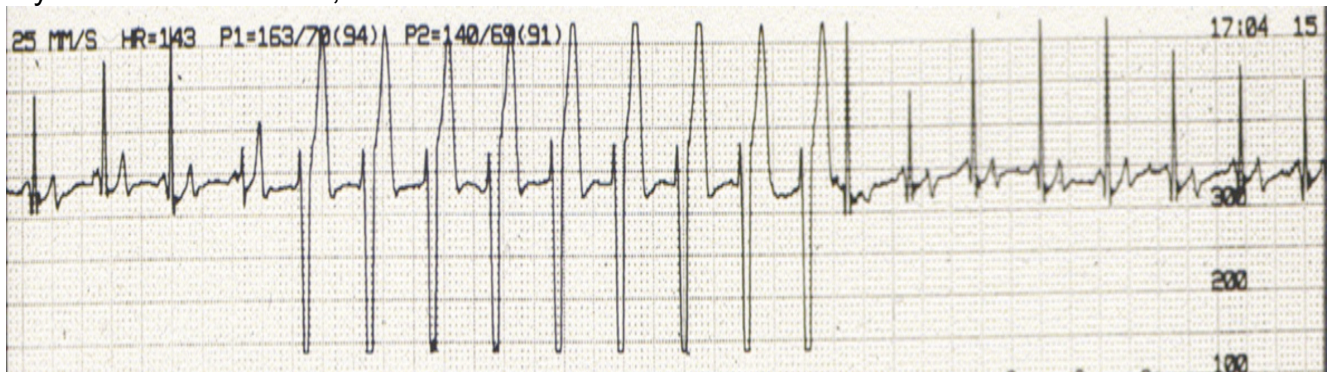
ECG example #1

7 year old Jack Russell; asymptomatic



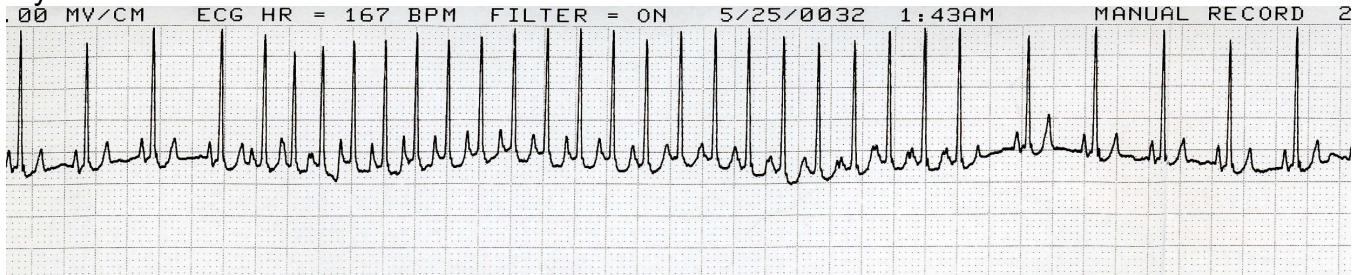
ECG example #2

3 year old mixed breed; automobile accident



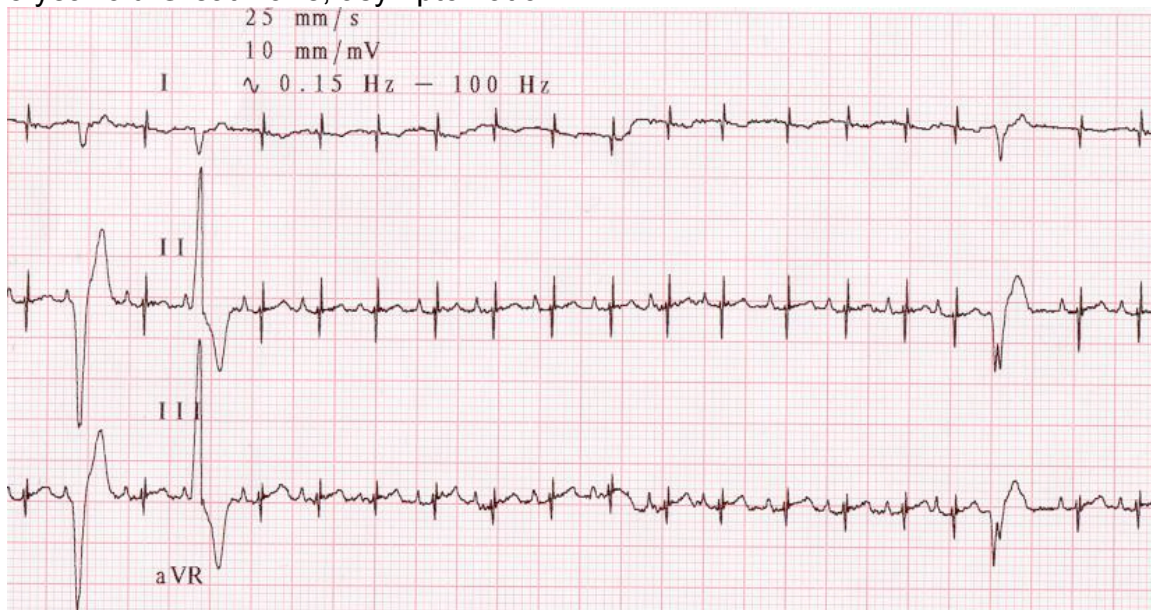
ECG example #3

3 year old Labrador retriever



ECG example #4

5 year old Great Dane; asymptomatic



ECG example #5

5 year old Boxer; syncope

