The ECG: It's Not as Hard as You Think!

Dr Rita Singh BSc BVMS DipVetClinStud FANZCVS DipACVIM

Registered Specialist in Veterinary Cardiology

waves

Veterinary CARDIAC REFERRALS

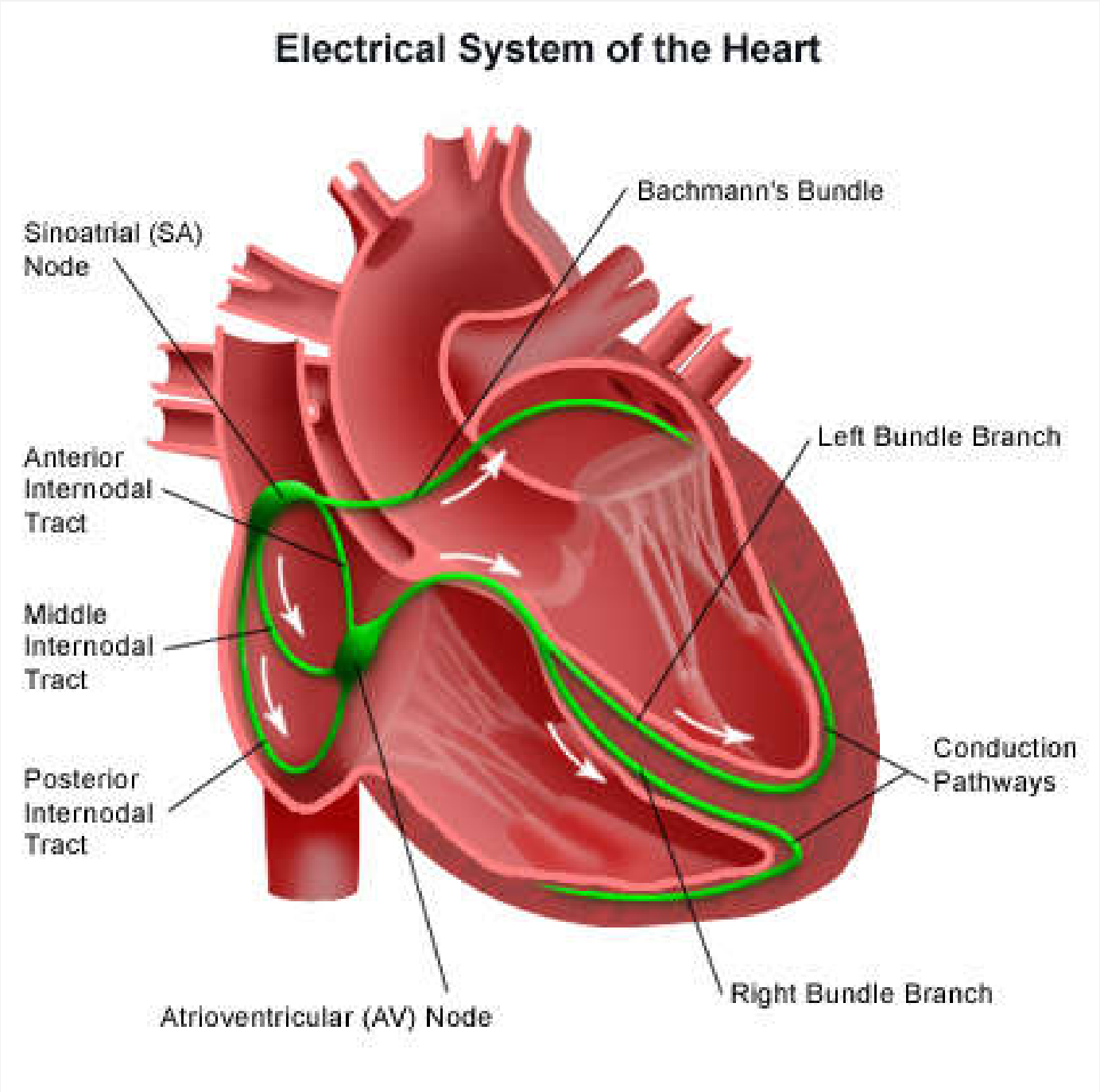
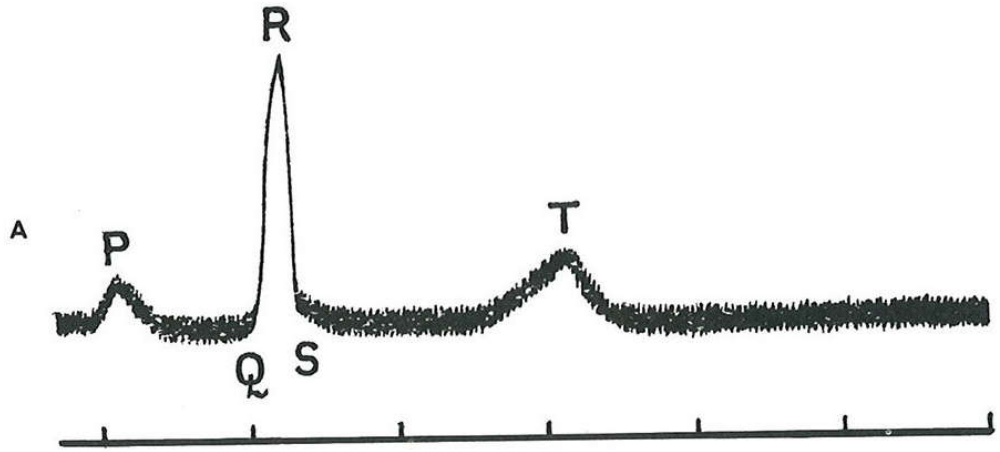
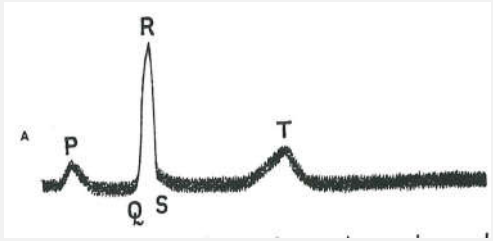
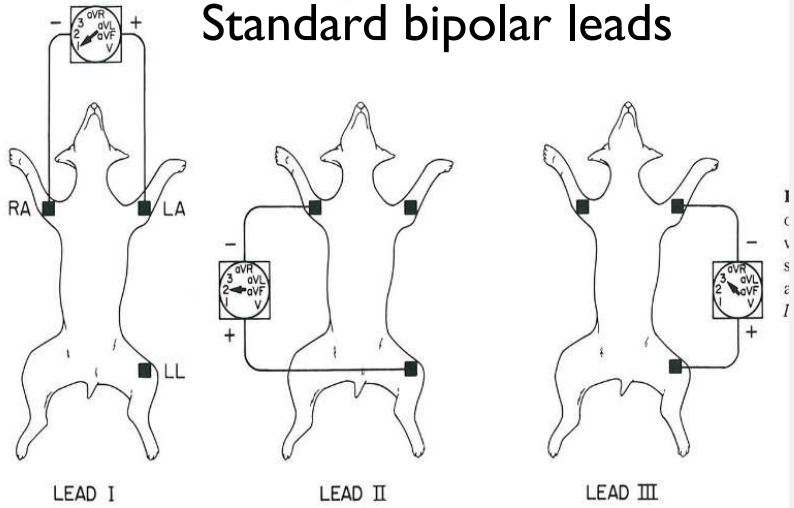

Electrical System of the Heart
Bachmann's Bundle
Sinoatrial (SA) Node
Left Bundle Branch
Anterior Internodal Tract
Middle Internodal Tract
Conduction Pathways
Posterior Internodal Tract
Right Bundle Branch
Atrioventricular (AV) Node

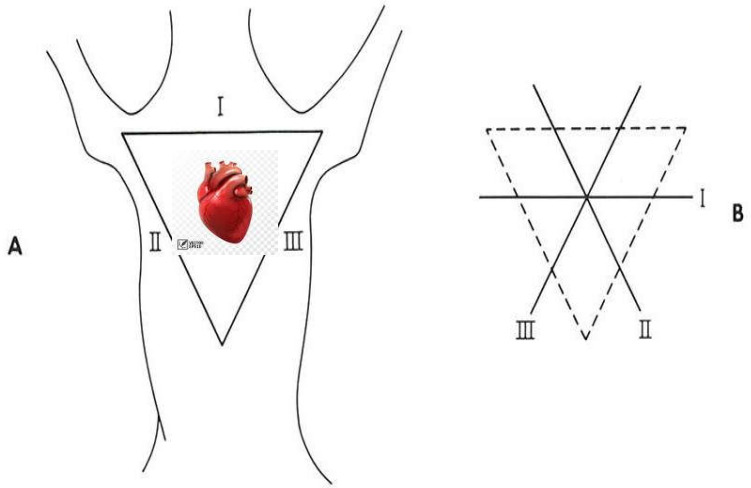
Fig. 1-3. A, One of Waller's original electrocardiograms of the dog, using Einthoven's galvanometer. Einthoven experimented with the capillary electrometer and improved the instrument by making alterations in circuitry and resistance levels. **B,** The method of recording the electrocardiogram in a dog with the capillary electrometer is shown on the right. The Bulldog is Jimmie, shown with Waller in Fig. 1-1. (**A** from Waller, A. D.: Lancet **1:**1448, 1909; **B** from Waller, A. D.: Physiology, the servant of medicine, London, 1910, University of London Press; reprinted with permission of Hodder & Stoughton, Ltd., Sevenoaks, Kent, England.)



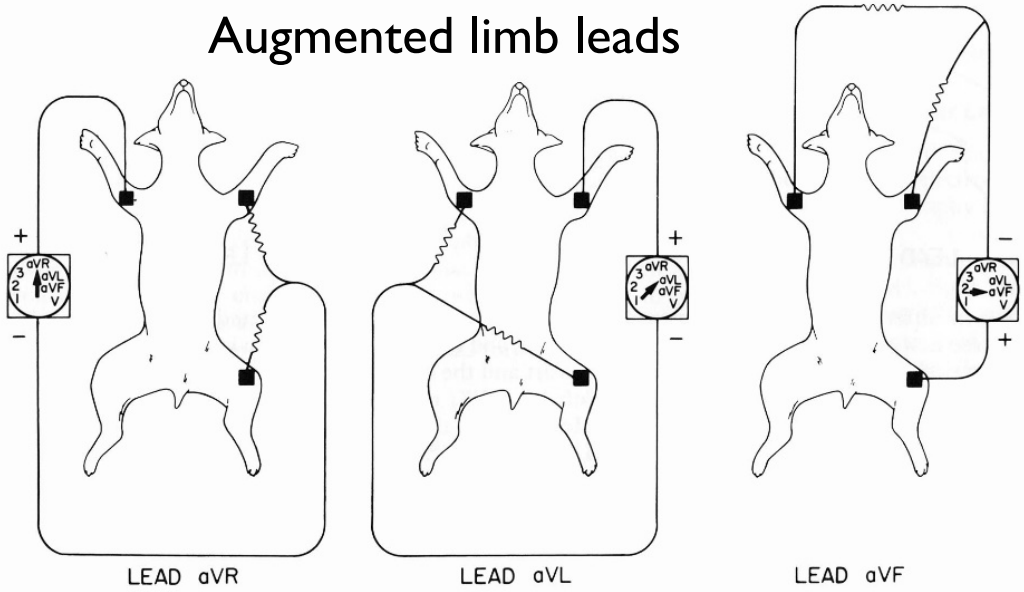


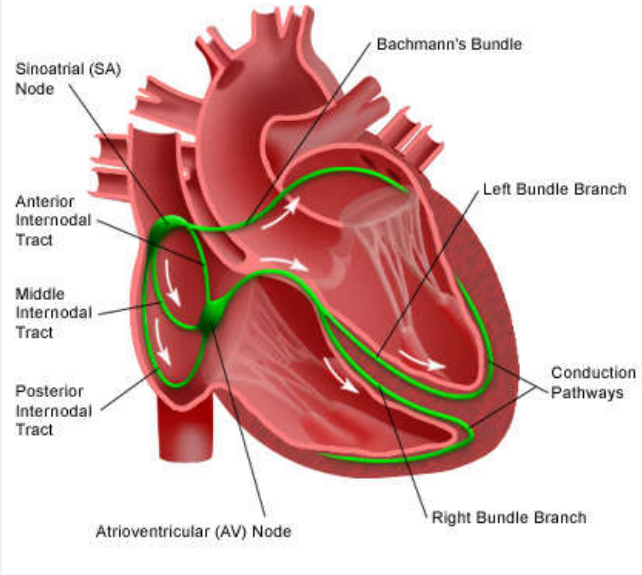
Standard bipolar leads





Augmented limb leads





INDICATIONS FOR THE ECG

Tachycardia
Bradycardia
Arrhythmia
Acute Dyspnea
Shock
Fainting/ seizures
During surgery
Preoperatively

Heart murmurs
Cardiomegaly
Cyanosis
Cardiac drugs
Pericardiocentesis
Systemic disease
Electrolyte disturbances

waves

Veterinary CARDIAC REFERRALS

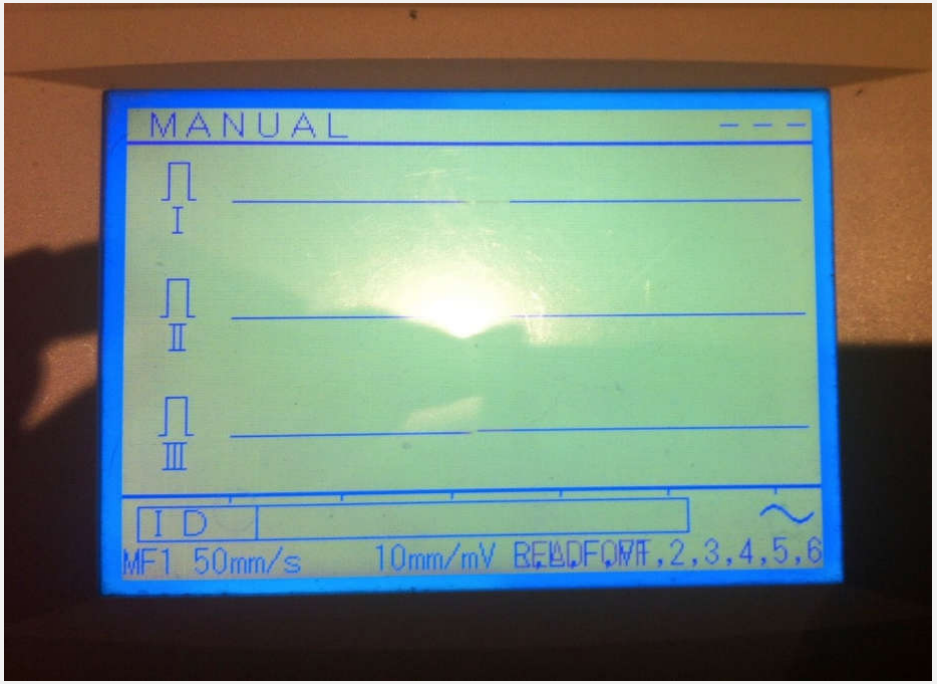
LIMITATIONS OF THE ECG

- Interpret with the clinical picture
- Tells nothing about function of heart
- May not tell prognosis
- Only gives information on the myocardium
- Division between normal and abnormal is broad
- Wide variation in dogs
- Record properly!!!

waves

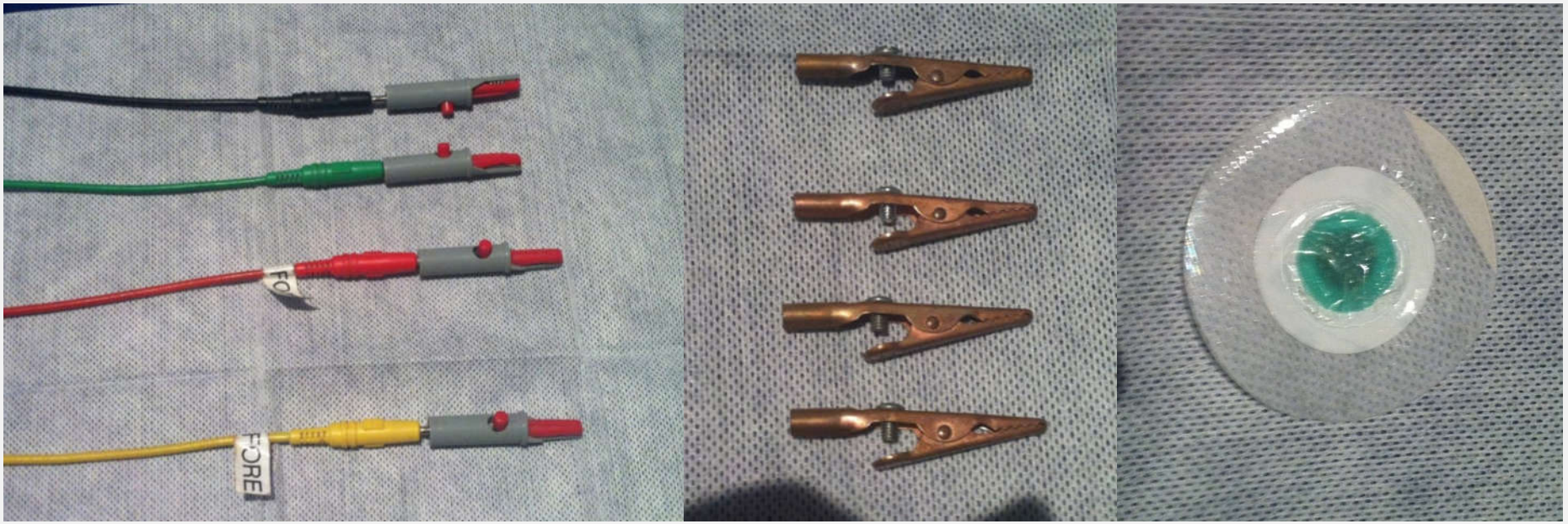
Veterinary CARDIAC REFERRALS

THE ECG MACHINE



waves

Veterinary CARDIAC REFERRALS



waves

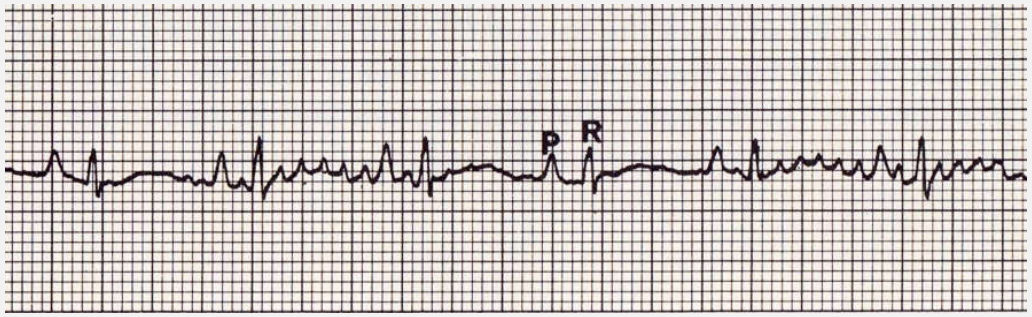
Veterinary
CARDIAC
REFERRALS

PLACING THE ECG

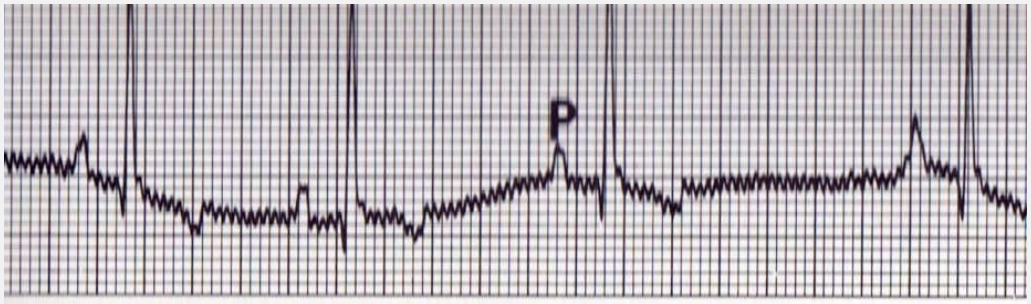
waves

Veterinary CARDIAC REFERRALS

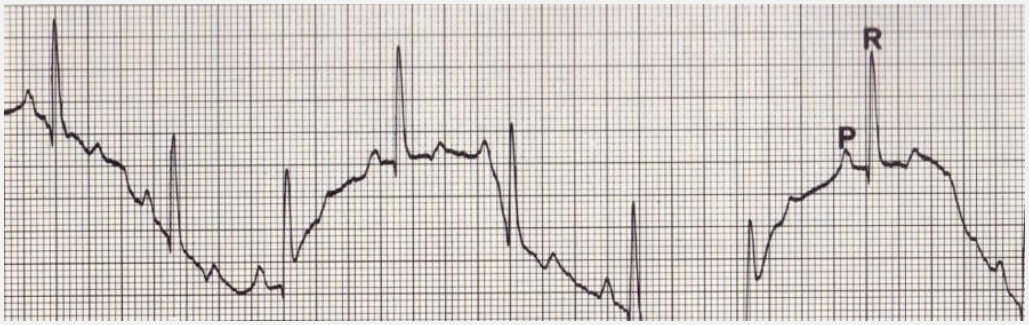

50mm/hr 1mV
ULTIMATE
To Order
Ph: 1 300 793 755
Fax: 1 300 793 018
Fax: 1 300 793 018
ULTIMATE
To Order
Ph: 1 300 793 755
LEAD II
50mm/hr 1mV
6/7/14
ULTIMATE
To Order
Ph: 1 300 793 755
Fax: 1 300 793 018



Purring artifact



Panting artifact



Wandering baseline

INTERPRETING THE ECG

waves

Veterinary CARDIAC REFERRALS

MY APPROACH TO THE ECG

- What is the heart rate?
- Is the rhythm regular or irregular?
- Are there p waves for each QRS complex and vice versa?
- Are all QRS complexes narrow and upright in leads I, II, III and aVF or it there a variation on this? If so, characterize this further.
- Any pauses/ wide bizarre complexes?

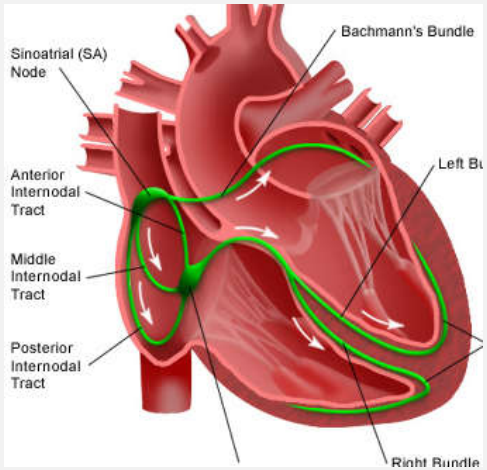
25mm/s. HR 200 bpm

SOME ECGS

waves

Veterinary CARDIAC REFERRALS

SINUS ARRHYTHMIA



waves

Veterinary CARDIAC REFERRALS

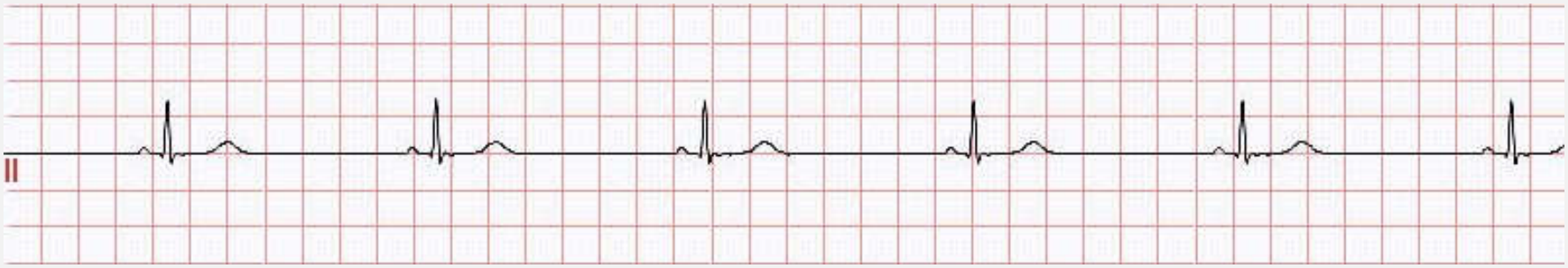
BRADYCARDIA

- < 60 bpm dog, < 140bpm cat
- Sinus bradycardia
- SA block/ SA arrest
- Sick sinus syndrome
- Atrial standstill
- AV block:
  - 1st degree
  - 2nd degree
  - 3rd degree

waves

Veterinary CARDIAC REFERRALS

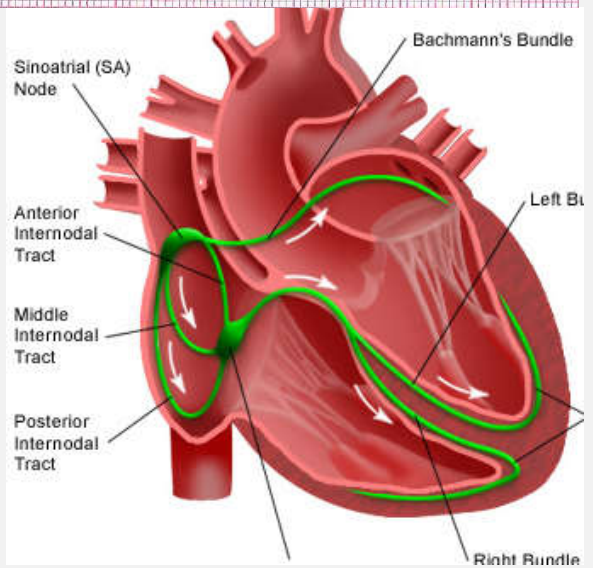
SINUS BRADYCARDIA



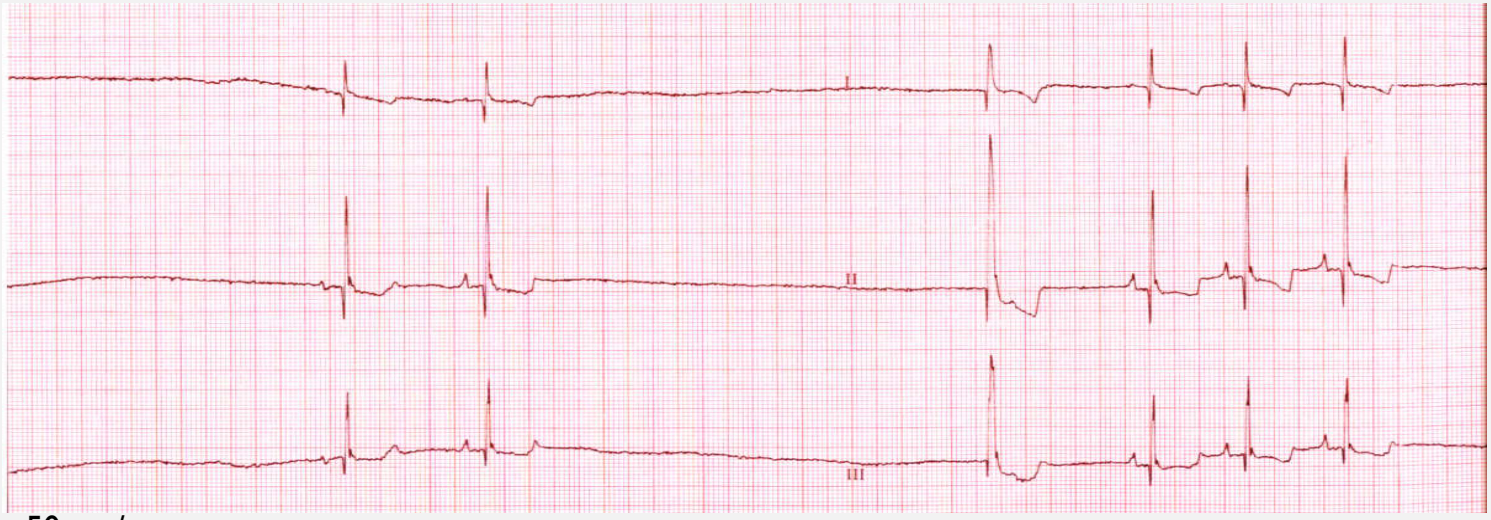
- HR < 60 bpm dog, < 140 bpm cat (in hospital)
- Increased parasympathetic tone (ocular, GI, chronic respiratory, systemic, CNS disease)
- Athletic animal
- GA overdose, impending cardiac arrest
- Hypothermia
- Severe hypothyroidism
- Sick sinus syndrome
- Drugs (digoxin, beta blockers, Ca++ blockers)
- Hyperkalaemia

SINOATRIAL BLOCK/ARREST

- Increased parasympathetic tone
- Sinus node dysfunction

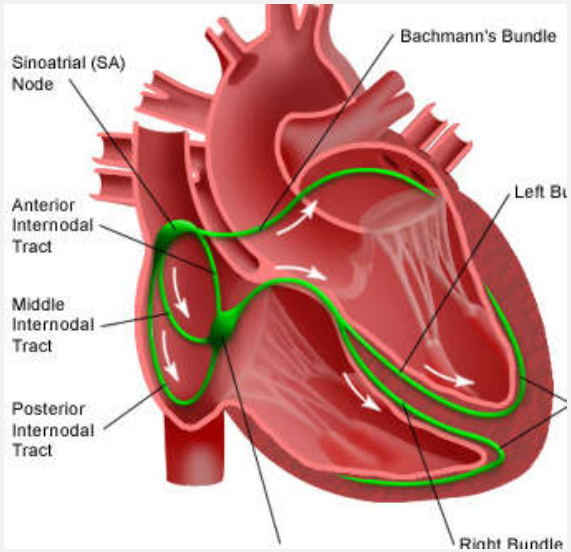


SICK SINUS SYNDROME



50mm/s

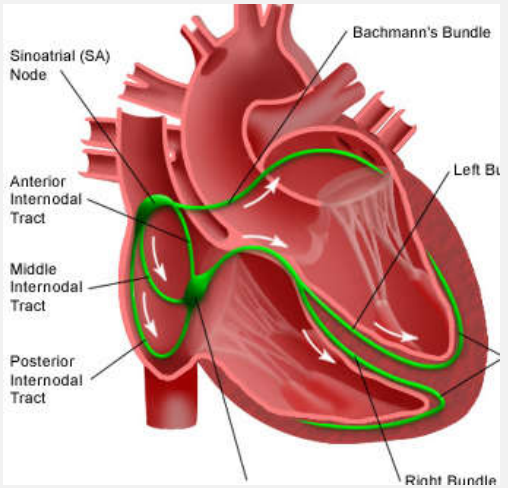
- Sinoatrial node diseased
- Bradycardia +/- SVT, SA block, SA arrest,
- Miniature schnauzers, WHWT, Cocker Spaniels



1ST DEGREE AV BLOCK

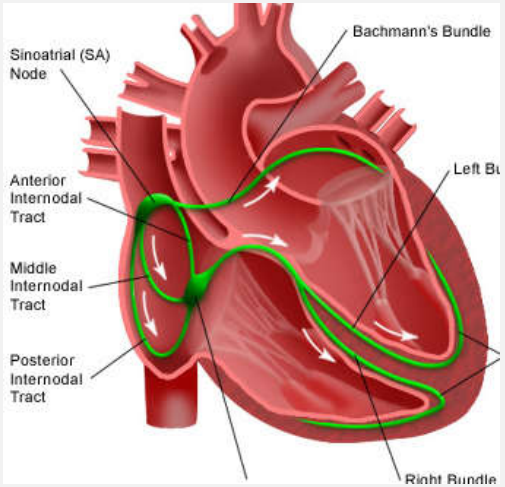
25mm/s

- P-R interval > 0.13s(dog), > 0.09s (cat)
- P-R = 6 boxes = 0.24s
- Disease of conduction system
- Increased vagal tone
- Hyperkalemia
- Drugs

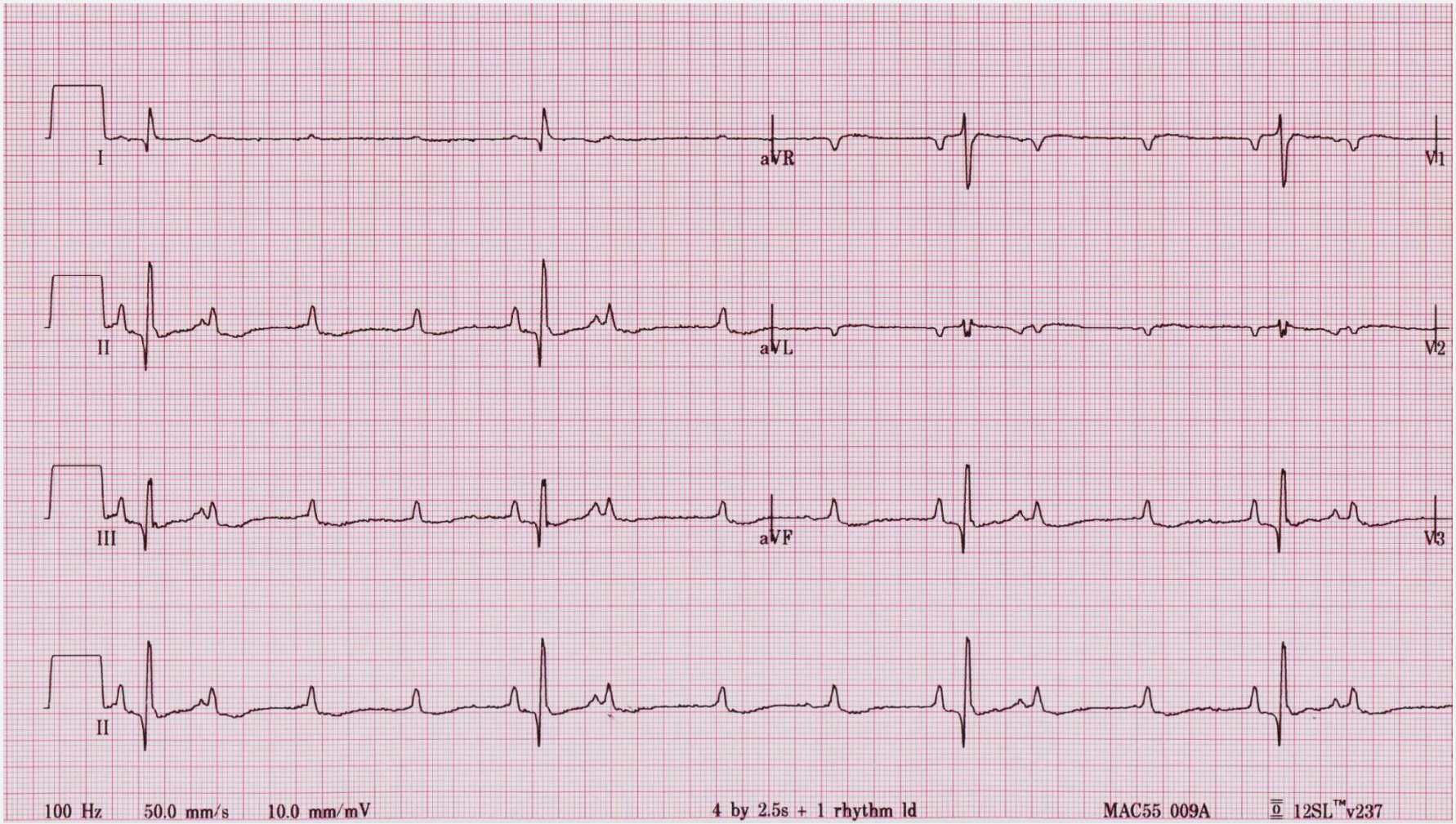


2ND DEGREE AV BLOCK

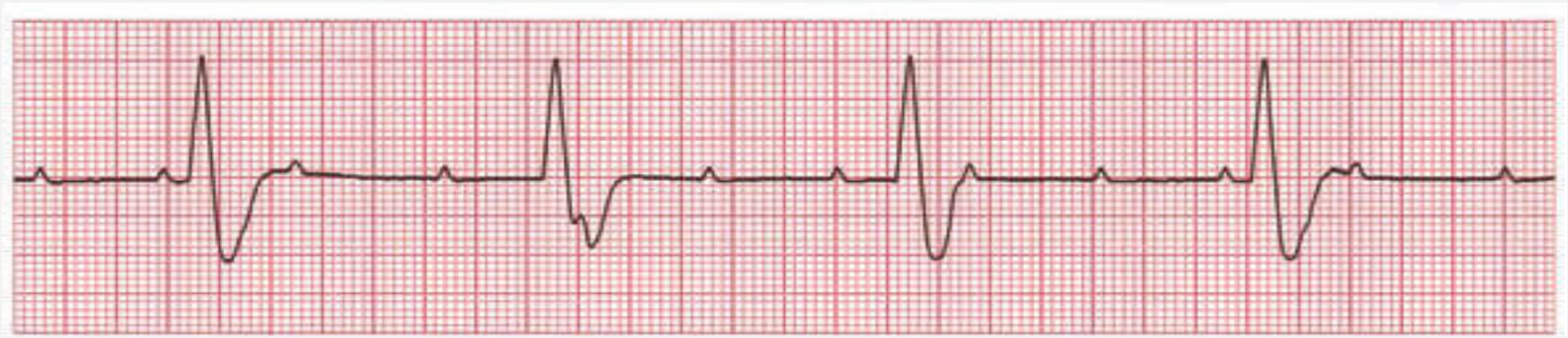
- Mobitz type I (Wenkebach), Mobitz type II and High grade
- Increased vagal tone esp young dogs (type I)
- Conduction system disease: degeneration, fibrosis, inflammation, ischemia
- Hereditary stenosis of bundle of His (pugs)



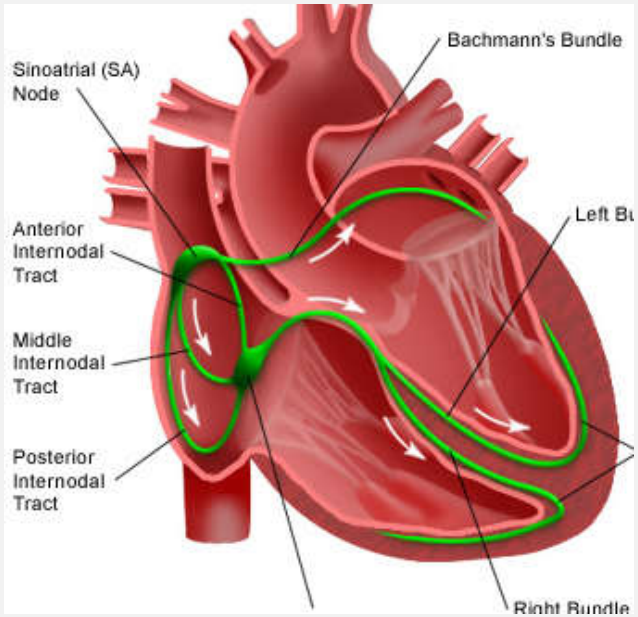
HIGH GRADE 2ND DEGREE AV BLOCK



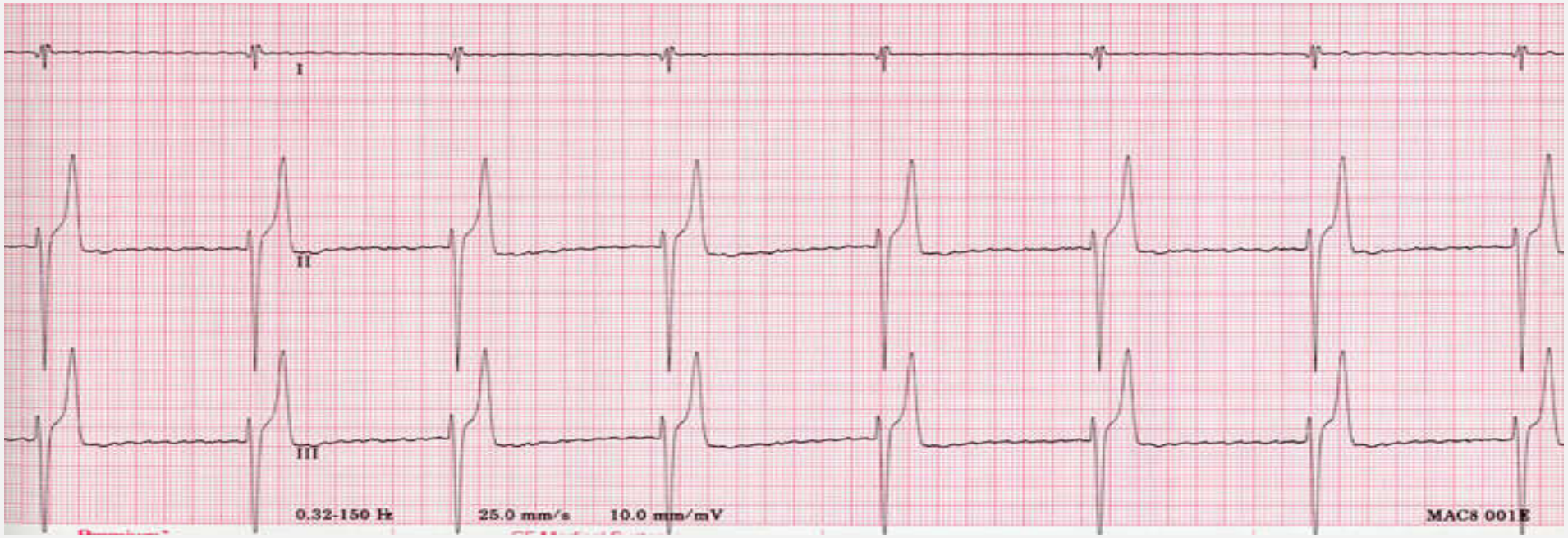
3RD DEGREE AV BLOCK



- Disease of AV node:
  - Degeneration
  - Mineralization
  - Inflammation
  - Fibrosis
  - Hereditary
- Toxin?

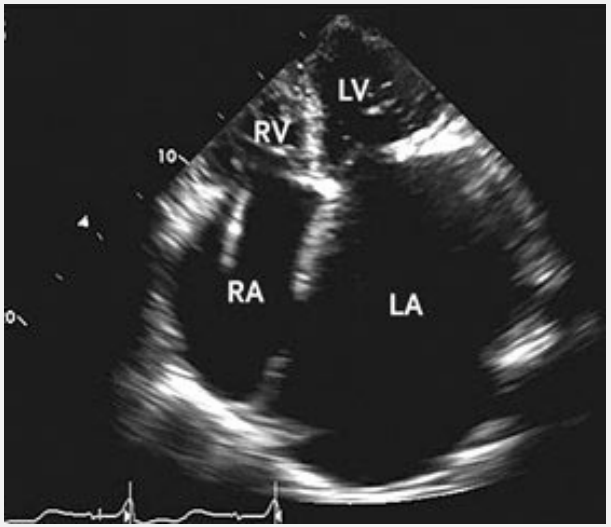


ATRIAL STANDSTILL



HR 40 bpm

- Cardiomyopathy of atrial myocardium eg English Springer Spaniel
- Digoxin toxicity
- Hyperkalemia



SOME CASES

waves

Veterinary CARDIAC REFERRALS

CASE 1: BELLE

- 7yr FS Border Collie
- 2 weeks of weakness and falling
- Remained conscious
- 1-2 secs
- No assoc with exercise
- Up to 6 x day
- No pre or post ictal signs

- HR 48 bpm
- All else WLN
- Thoracic radiographs, blood work and UA unremarkable
- Referred

waves

Veterinary CARDIAC REFERRALS

- BAR, pink mm, RR-24, T-38.3
- **HR 48 bpm, regular**
- No murmur
- Pulses strong, synchronous
- Basic neuro exam WLN
- Abdominal palpation WNL

waves

Veterinary CARDIAC REFERRALS

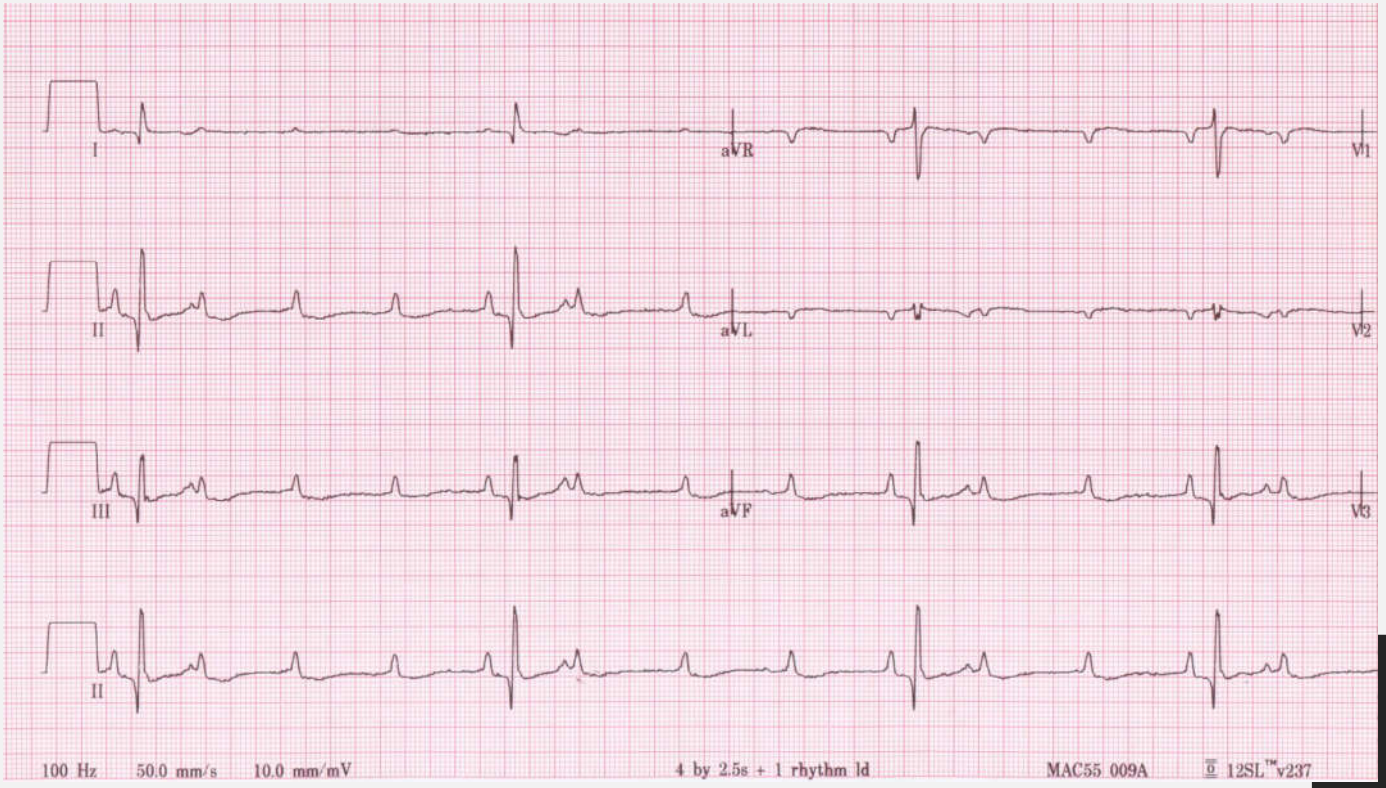
BRADYCARDIA

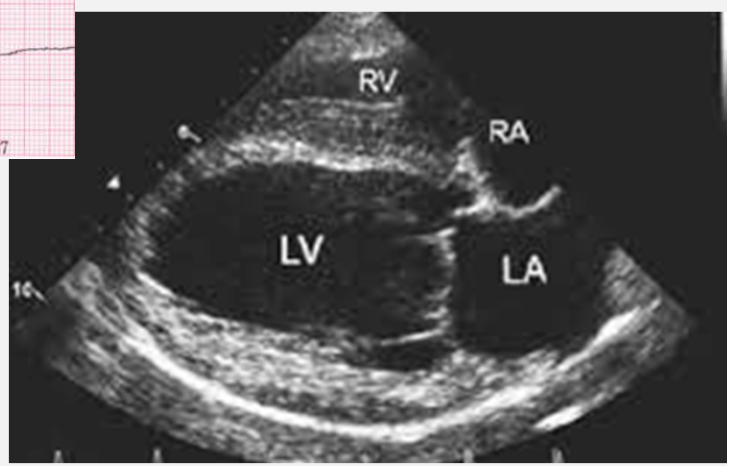
- Sinus bradycardia
- SA block/ SA arrest
- Sick sinus syndrome
- Atrial standstill
- AV block:
  - 1st degree
  - 2nd degree
  - 3rd degree

waves

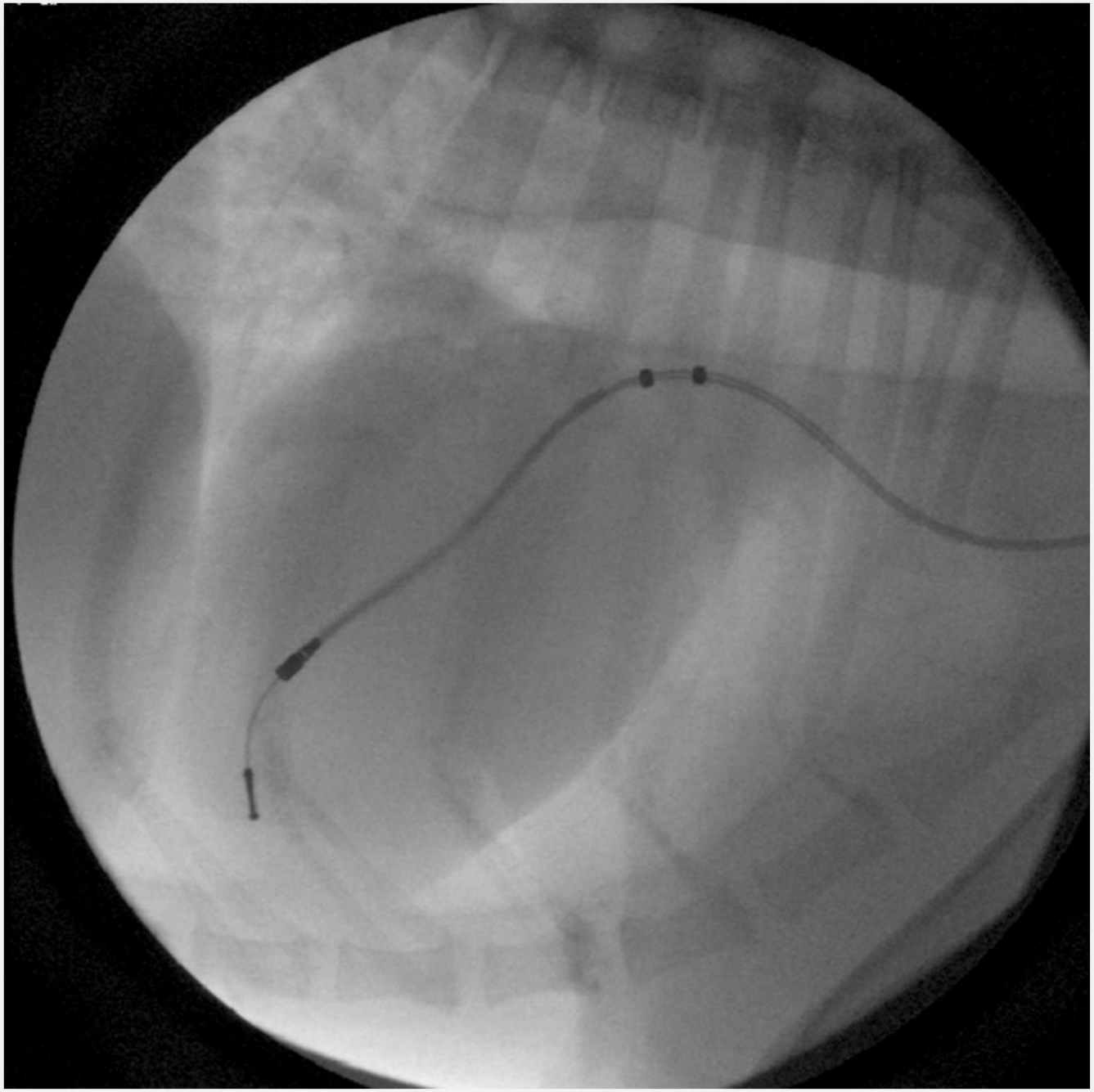
Veterinary CARDIAC REFERRALS

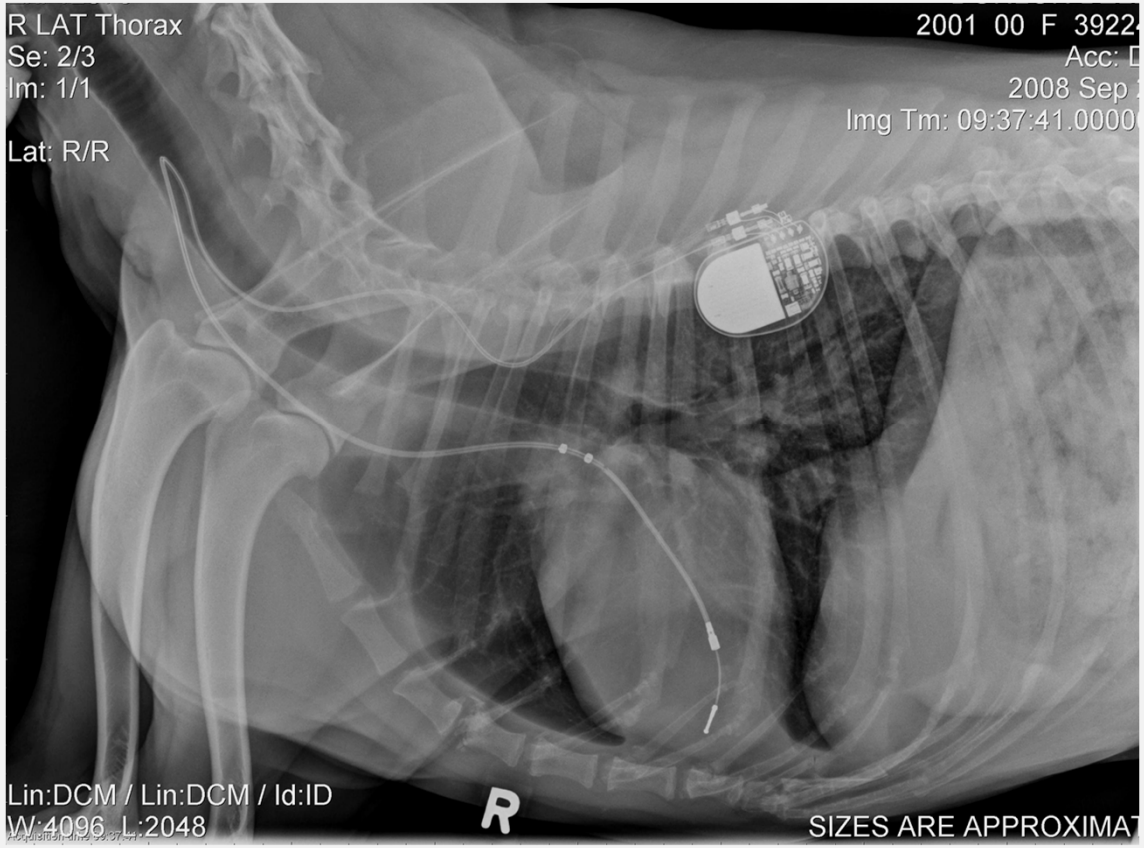
HIGH GRADE 2ND DEGREE AV BLOCK





PACEMAKER




R LAT Thorax
Se: 2/3
Im: 1/1
Lat: R/R
2001 00 F 3922
Acc: D
2008 Sep
Img Tm: 09:37:41.0000
Lin:DCM / Lin:DCM / Id:ID
W:4096 L:2048
R
SIZES ARE APPROXIMAT


Thorax
1/3
1/1
R/R
2001 00 F 3922
Acc: D
2008 Sep
Img Tm: 09:37:04.0000

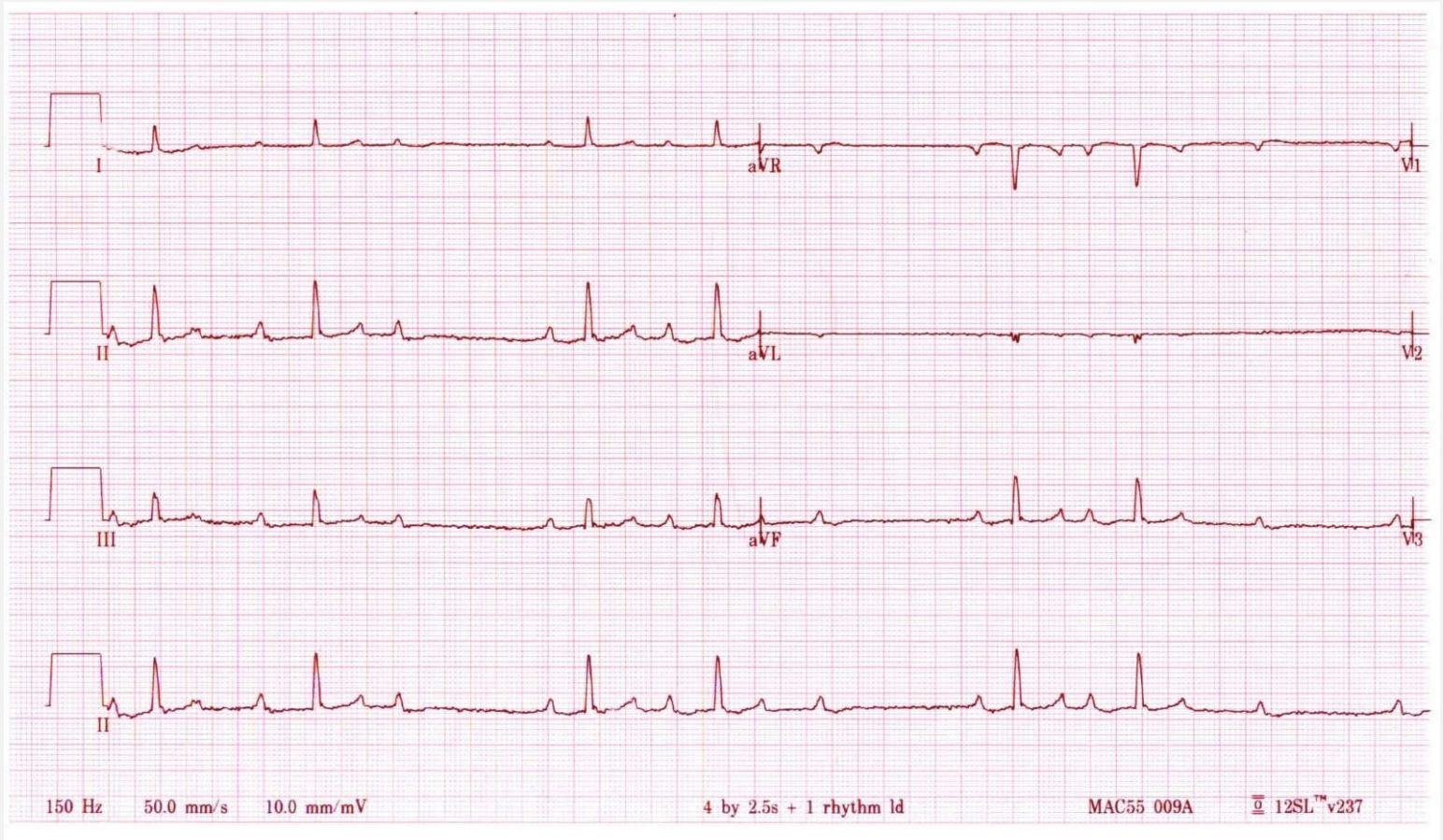
CASE 2: POPPY

- 5 yo FS Chow
- 4 week history of lethargy
- Stopping on walks
- Ref vet: HR 60 bpm, irregular
- Blood work unremarkable
- Referred

waves

Veterinary CARDIAC REFERRALS

2ND DEGREE AVB (MOBITZ TYPE 1



50 mm/s. Average HR 70 bpm (range 60-80bpm)

ATROPINE RESPONSE TEST

25mm/s. HR 200 bpm

CAUSES OF HIGH VAGAL TONE

- Neurologic disease
- Respiratory disease
- Gastrointestinal disease
- Ocular disease

- Physical exam unremarkable
- Thoracic radiographs unremarkable
- Echocardiogram unremarkable
- Abdominal ultrasound unremarkable
- Repeat blood and urinalysis unremarkable

TREATMENT

- Propantheline Bromide
- Oral anticholinergic
- Similar effects to atropine
- Monitored for years
- Signs never progressed

TACHYCARDIA

waves

Veterinary CARDIAC REFERRALS

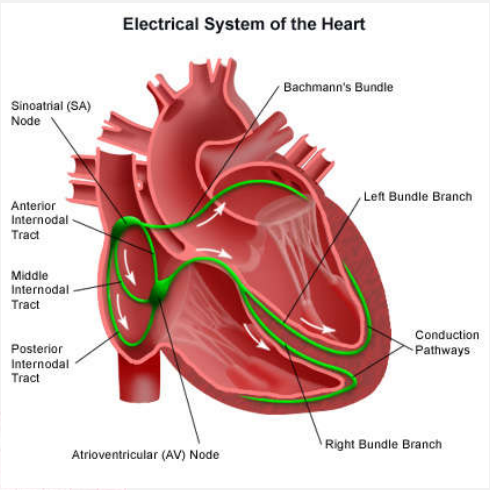
TACHYCARDIA

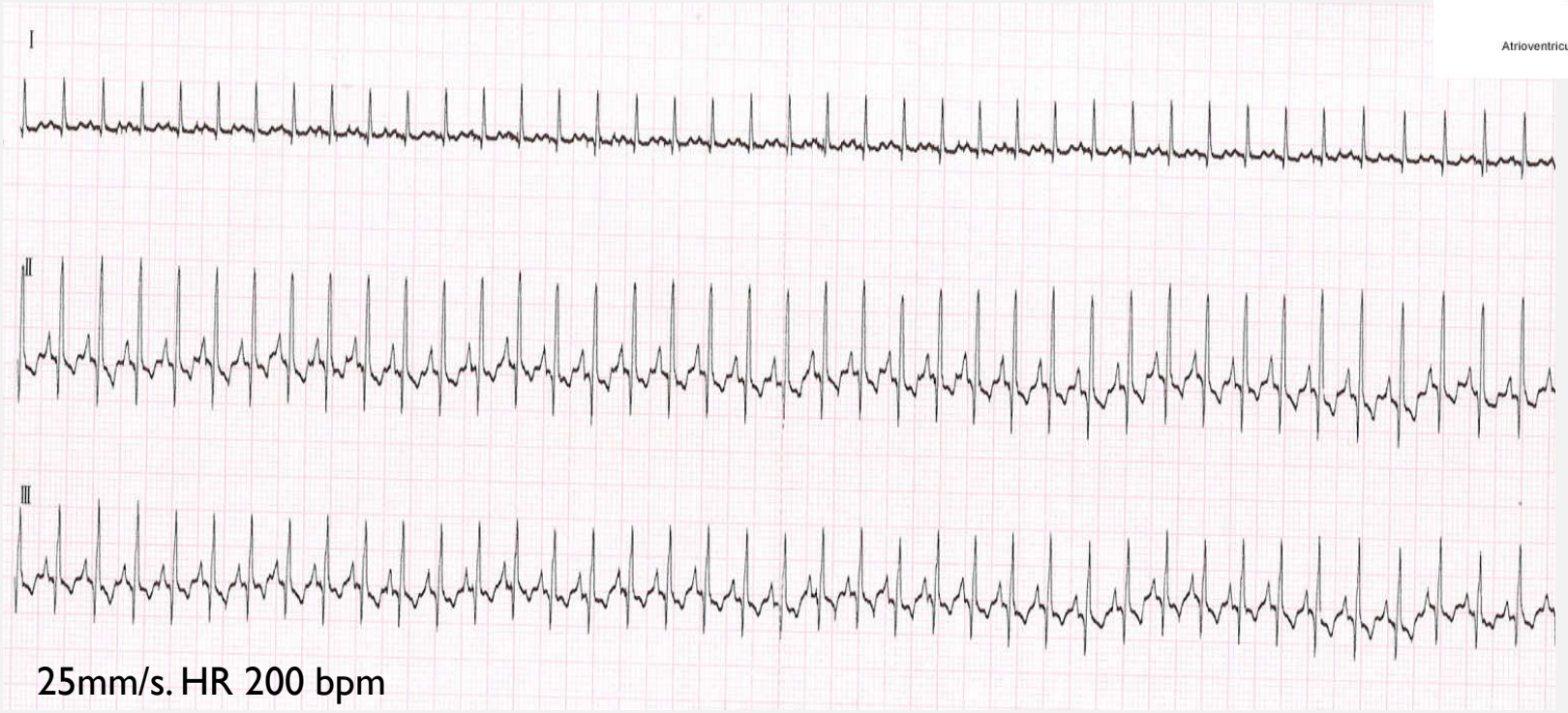
- >150 bpm dog, > 240 bpm cat
- Sinus tachycardia
- Supraventricular tachycardia
- Atrial flutter
- Atrial fibrillation
- Ventricular tachycardia

waves

Veterinary CARDIAC REFERRALS

SINUS TACHYCARDIA



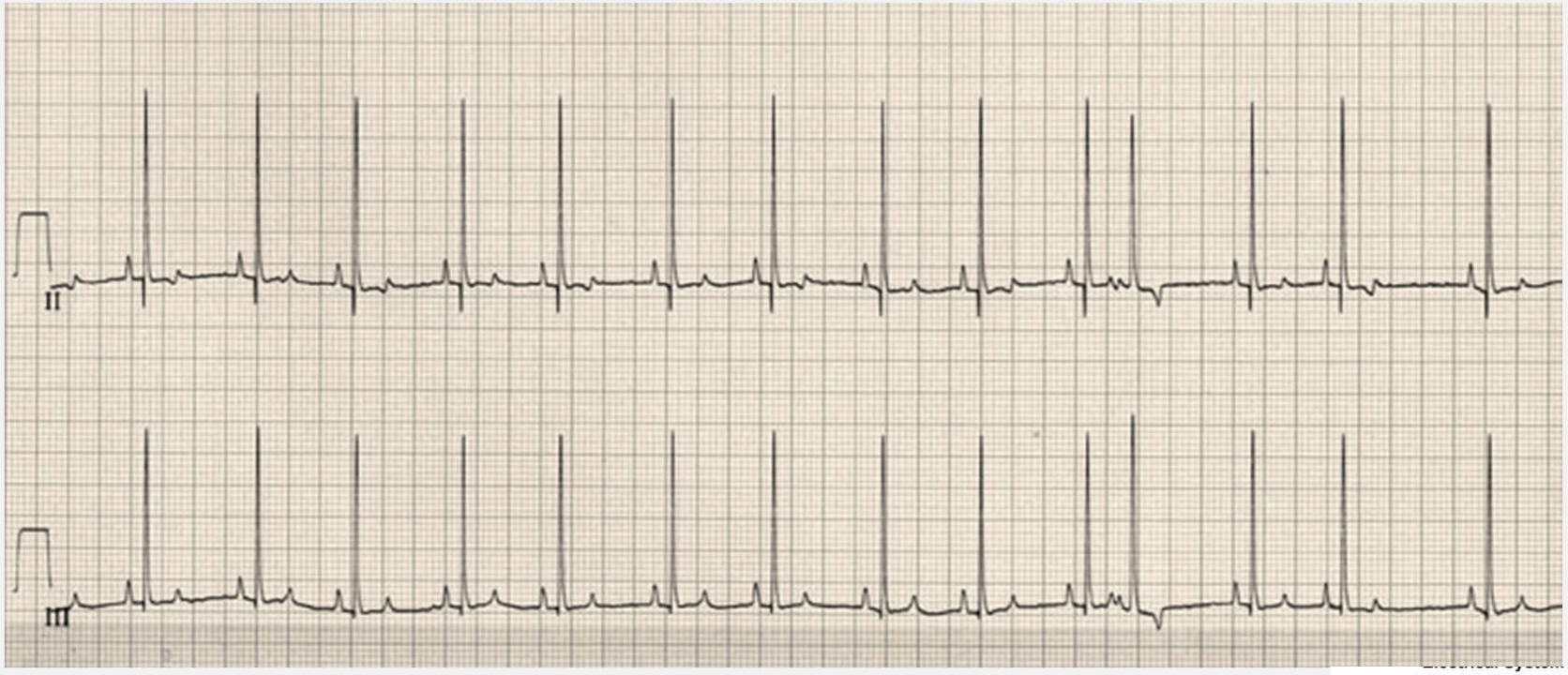


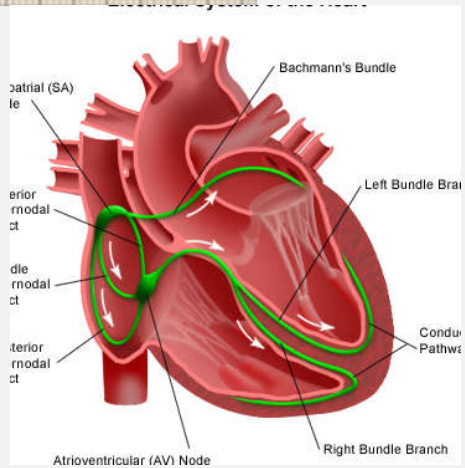
25mm/s. HR 200 bpm

waves

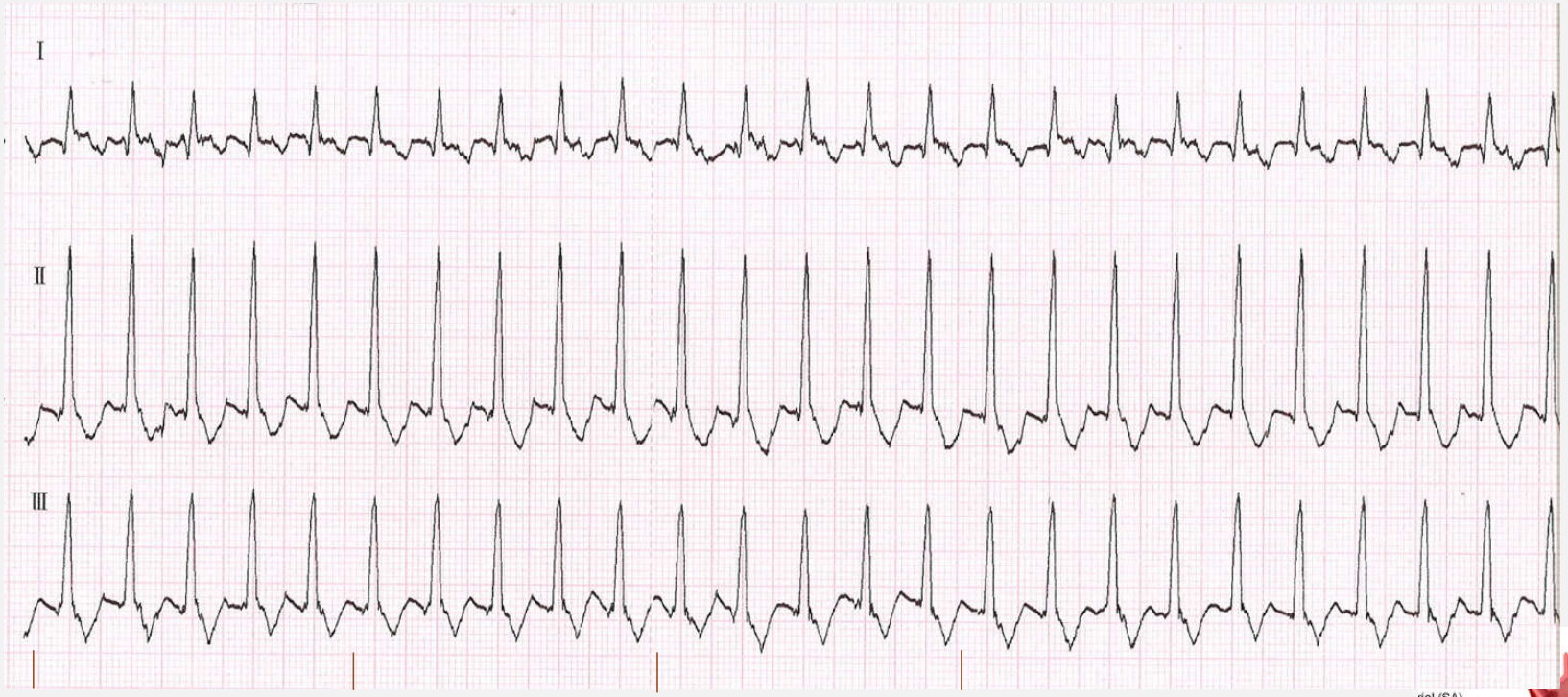
Veterinary CARDIAC REFERRALS

ATRIAL PREMATURE CONTRACTIONS



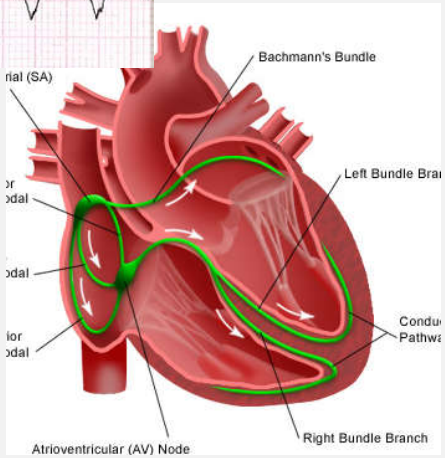


SUPRAVENTRICULAR TACHYCARDIA

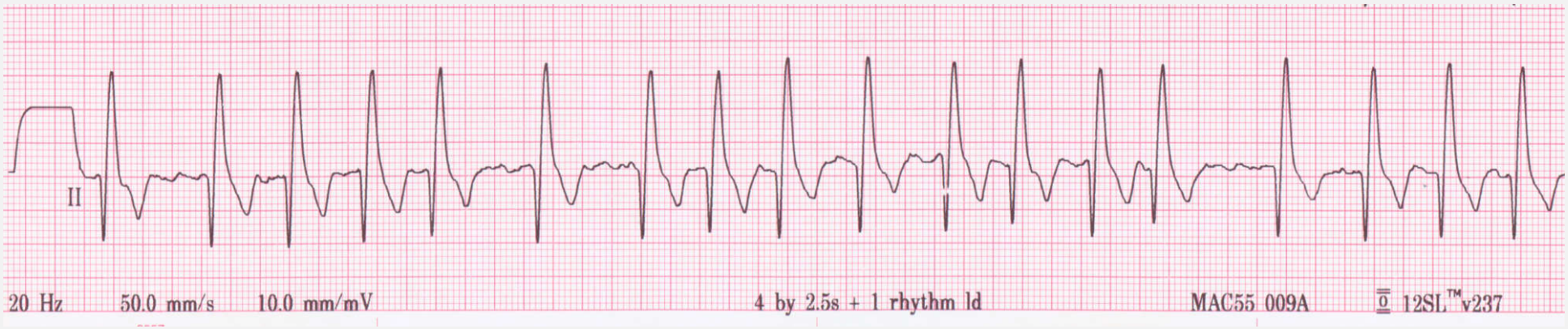


50mm/s. HR 300 bpm

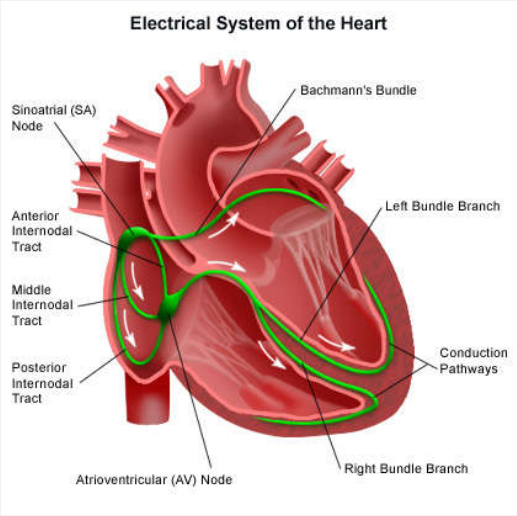
Rx:
Vagal maneuvers
Verapamil/ Diltiazem
Esmolol/ Atenolol



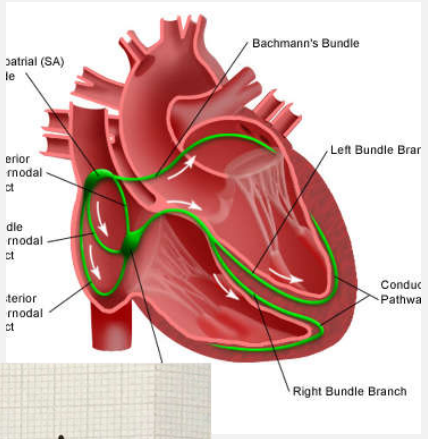
ATRIAL FIBRILLATION

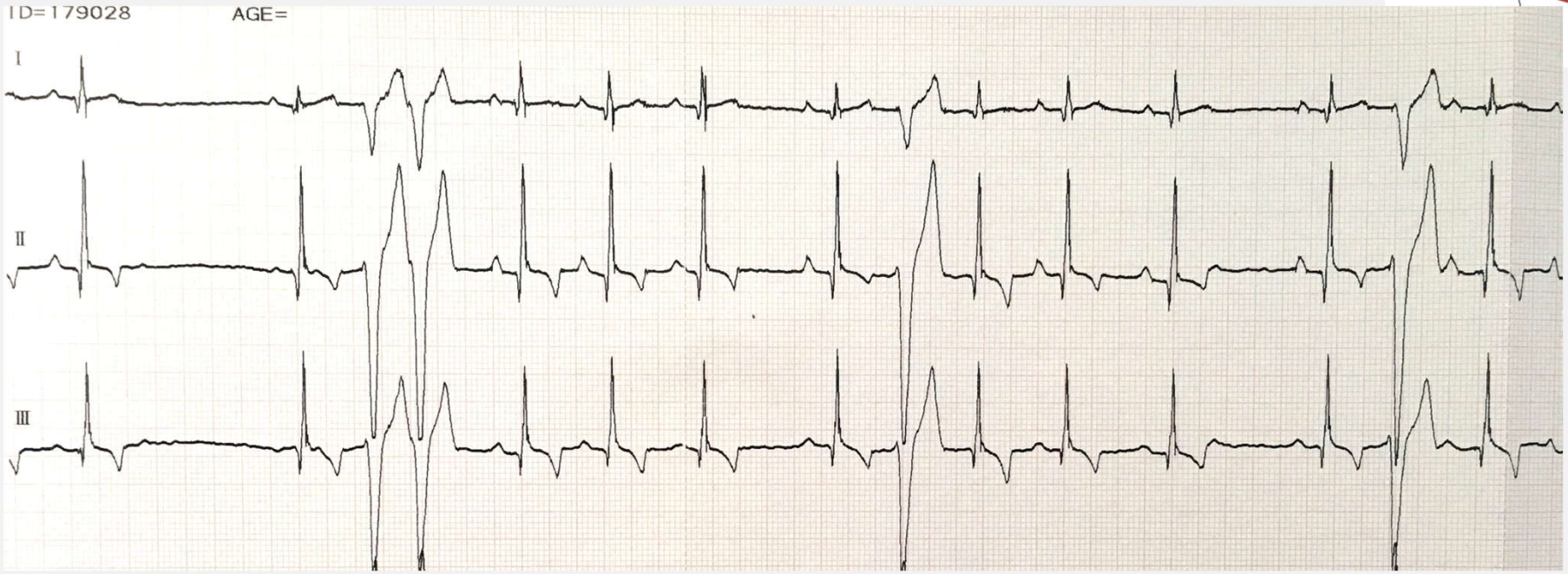


- HR 220 bpm, QRS 0.08s
- Irregularly irregular rhythm – only rule that stands
- Absent p waves?
- Rapid rhythm?



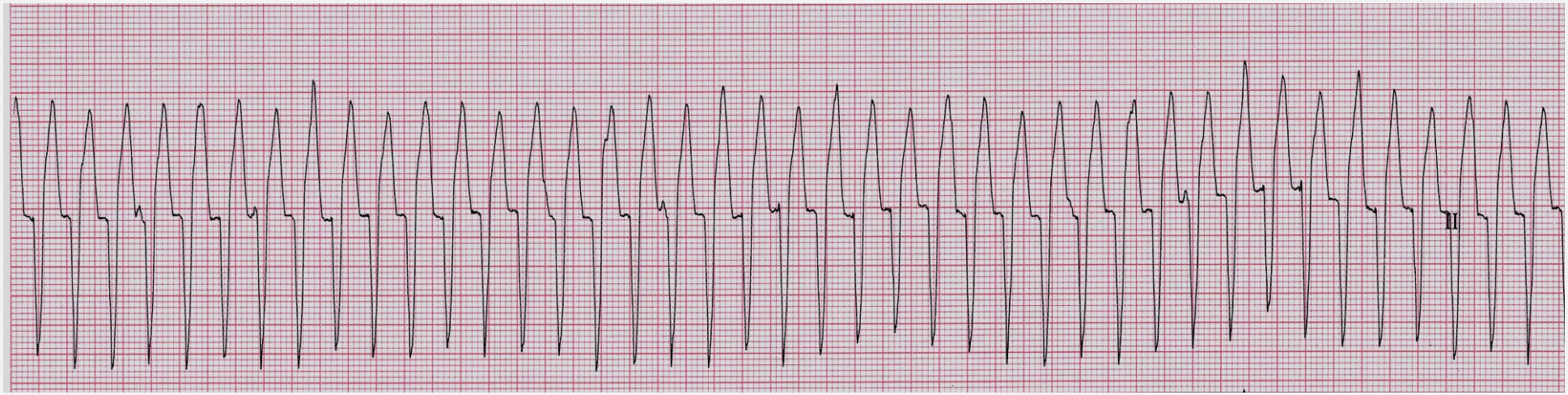
VENTRICULAR PREMATURE CONTRACTIONS





- Myocardial disease
- CHF
- Neoplasia (intra or extra cardiac)
- Myocardial infarction
- Pericardial disease
- Systemic disease – hypoxia, uraemia, anaemia, GDV, pancreatic disease, splenic disease
- Excitement, stress, drugs

VENTRICULAR TACHYCARDIA



25mm/s. HR 240 bpm

waves

Veterinary CARDIAC REFERRALS

SUSTAINED VT

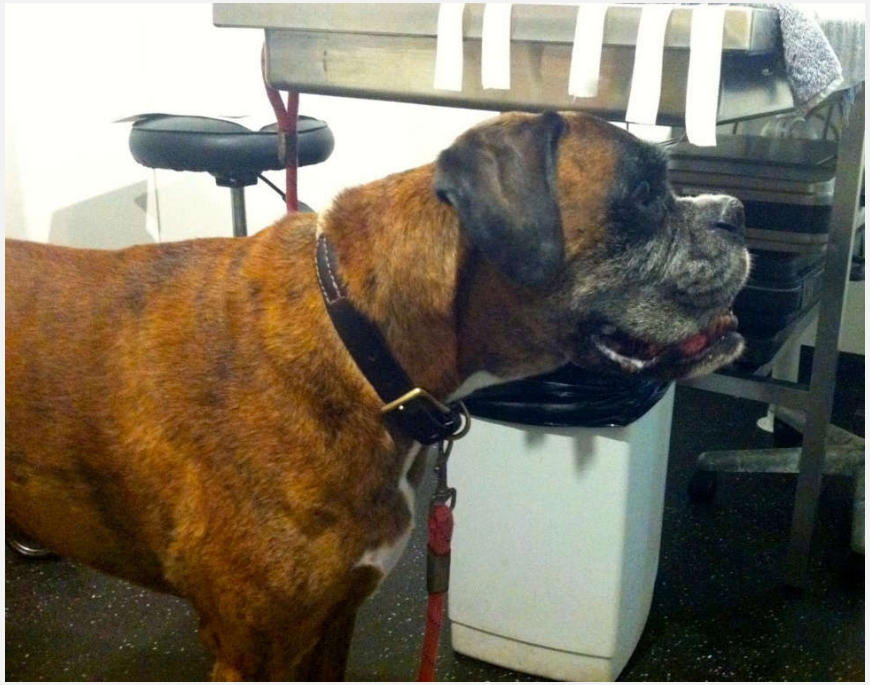
- Lignocaine bolus. 4mg/kg
- Lignocaine CRI. 75ug/min
- Mg bolus IV. ½ g for a small dog, 1 g medium dog, 1.5g large dog.
- If the above has not worked, the next step is a BB. Check echo first
- Esmolol IV or Sotalol PO.
- Amiodarone
- Electrical cardioversion

waves

Veterinary CARDIAC REFERRALS

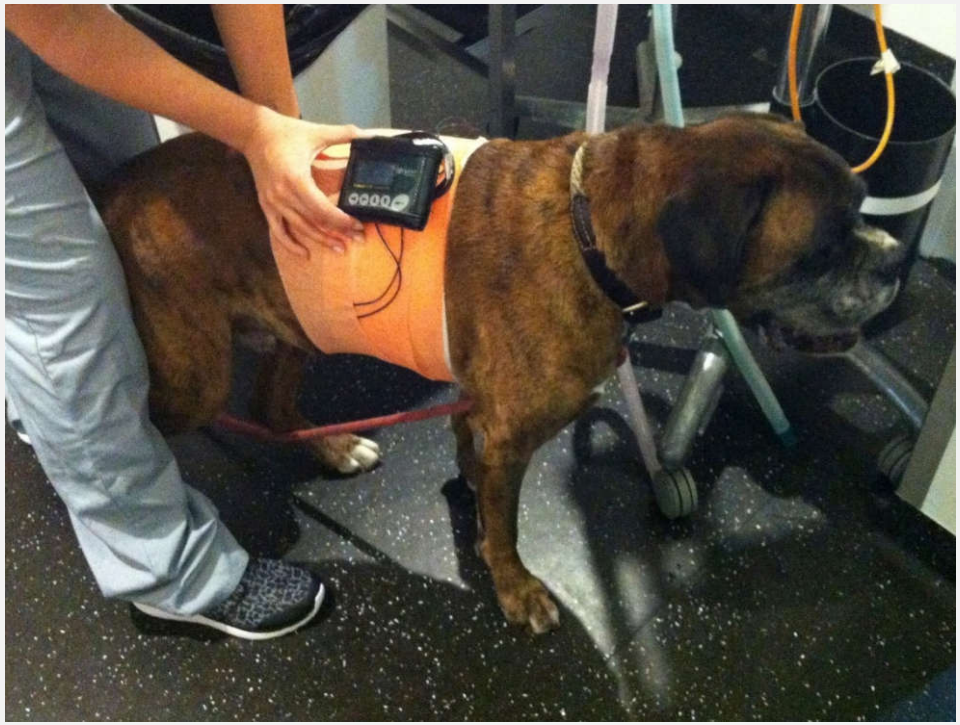
CASE 3: BIFF

- 10yo MC Boxer
- Multiple fainting episodes/day
- HR 300 bpm at ref vet
- IV Ligocaine
- Referred



waves

Veterinary
CARDIAC
REFERRALS



waves

Veterinary CARDIAC REFERRALS


VT 270 bpm
11:57:02
101 BPM

ECG TAKE HOME MESSAGES!

- Get a clear ECG, clean baseline
- In an emergency, heart rate is all that really matters
- HR > 50 bpm - < 200 bpm, not an emergency
- HR < 50bpm or > 200 bpm – ASAP
- HR < 40bpm, > 280 bpm – **RIGHT NOW!**

waves

Veterinary CARDIAC REFERRALS

THANK YOU!

rsingh@vetcardioreferrals.com
www.vetcardioreferrals.com

YouTube videos to watch:

- Living Arrhythmias
- Diagnosis Wenckebach

waves

Veterinary CARDIAC REFERRALS