

**think ANAESTHESIA WEBINAR**

**Vet Nurse Anaesthetic Monitoring Series**

**Episode 4: Understanding ECGs**  
with Courtney Scales, DipVN, NCert (Anaesth), PgCertVAA, RVN

This course is approved for CPD points under the AVNAT Registration Scheme  
www.avnat.org.au  
Established by the VNCA

The Australian Veterinary Nurse and Technician (AVNAT) Regulatory Council has allocated 1 AVNAT CPD points to this continuing education activity.

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**think ANAESTHESIA**

- The electrical pathway
- What is an ECG
- ECGs and anaesthesia
- Common traces

- Normal ECGs
- AV Blocks
- Ventricular Abnormalities
- Fibrillation

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**Cardiac Cells**

1. Cardiomyocytes – 99%  
= stretch and contract, conduct
2. Cardiac pacemaker cells (nodal) – 1%  
= initiate and conduct – intrinsically

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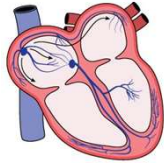
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### The Electrical Pathway

1. Impulse starts at SA node
2. Moves across both atria
3. Once at AV node, briefly slows
4. Moves down bundle of His
5. L and R branches
6. Fine Purkinje fibres from apex



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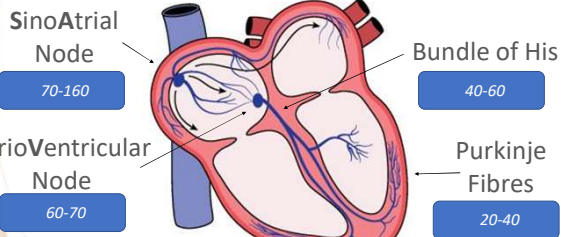
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### Pacemakers Electrical Pathway



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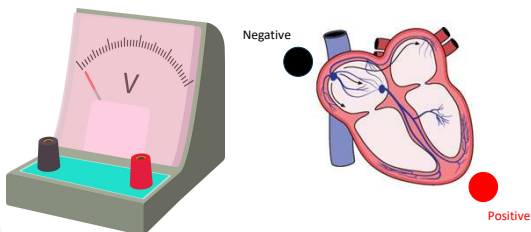
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### What is an ECG? ElectroCardioGraph



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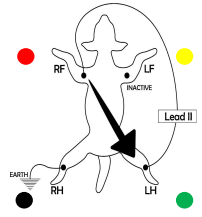
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### ECG Placement – Lead II

- 1. Red – Right Fore
  - 2. Yellow – Left Fore
  - 3. Green – Left Hind
  - 4. Black – Right Hind
- 1. White – Right Fore
  - 2. Black – Left Fore
  - 3. Red – Left Hind
  - 4. Green – Right Hind



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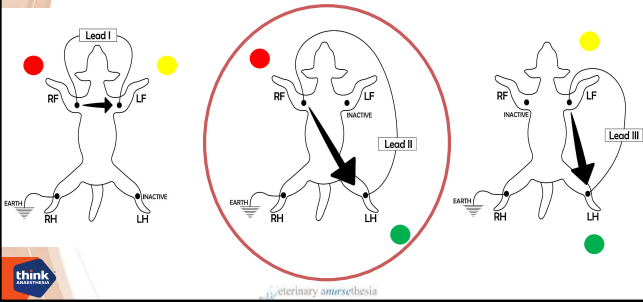
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### ECG Leads I - III



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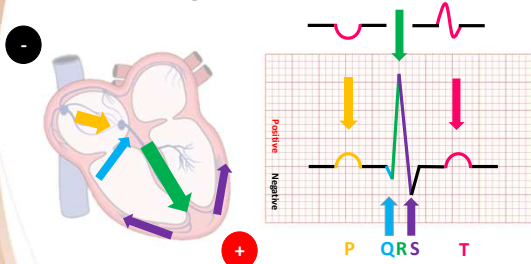
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### Monitoring – ECG: Lead II



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### Monitoring – ECG: Lead II

**P = Atria**  
**QRS = Ventricles**

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### ECGs and Anaesthesia

**Guidelines for Safer Anaesthesia**

“Additional monitoring such as ECG may be required in some cases”

**2020 AAHA Anesthesia and Monitoring Guidelines for Dogs and Cats\***

Use ECG to “mitigate risk during anaesthesia”

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### ECGs and Anaesthesia

- Put an ECG on every patient
- Arrhythmias due to drugs given
- Non-cardiac disease:
  - Electrolyte disturbances
  - Myocardial hypoxia
  - Manipulation of body systems

**If arrhythmia is heard prior to anaesthesia – investigate!**

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## Normal ECG – Sinus

- Normal conduction starting at SAN
  - Normal, brady, tachy, respiratory



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AV Blocks

Ventricular

Fibrillation

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## Normal ECG – Sinus



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Ventricular

Fibrillation

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## Normal ECG – Sinus Bradycardia

- Long R-R interval
- Monitor blood pressure



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Ventricular

Fibrillation

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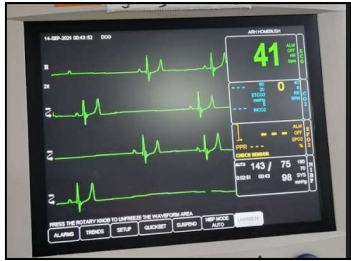
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## Normal ECG – Sinus Bradycardia



AV Blocks

Ventricular

Fibrillation

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## Normal ECG – Sinus Tachycardia

- Short R-R interval
- Analgesia? Hypovolemia? Vasodilation?



P Wave

QRS

Morphology

P to QRS

relationship

Rhythm

AV Blocks

Ventricular

Fibrillation

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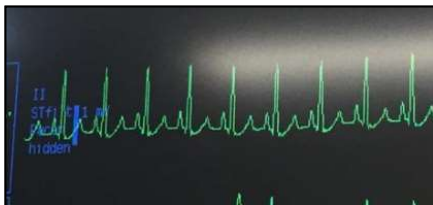
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## Normal ECG – Sinus Tachycardia



AV Blocks

Ventricular

Fibrillation

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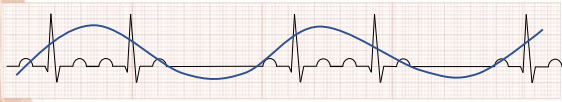
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## Normal ECG – Sinus Arrhythmia

- Autonomically mediated by vagus nerve
- No treatment



AV Blocks

Ventricular

Fibrillation



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## Normal ECG – Sinus Arrhythmia



AV Blocks

Ventricular

Fibrillation



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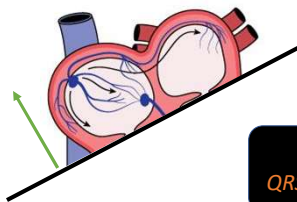
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## AV Blocks



Normal

Ventricular

Fibrillation



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### AV Block – Second Degree

- Intermittent AV node failure
- Hypoxaemia, hypothermia, electrolytes
- Drugs - medetomidine
- *Often don't require treatment, BP?*

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Normal

Ventricular

Fibrillation

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### AV Block – Second Degree

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Normal

Ventricular

Fibrillation

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### AV Block – Third Degree

- Complete failure of AV node conduction
  - Independent pacemakers in atria and ventricle
- *Needs pacemaker implanted*

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Normal

Ventricular

Fibrillation

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## AV Block – Third Degree



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Normal  
Ventricular  
Fibrillation

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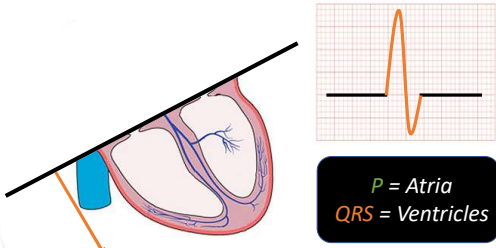
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## Ventricular



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Normal  
AV Blocks  
Fibrillation

P = Atria  
QRS = Ventricles

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## Ventricular – VPC

- Premature, before expected sinus
- Isolated, wide and bizarre
  - Long refractory period
- *No treatment? Clinical assessment.*



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Normal  
AV Blocks  
Fibrillation

P Wave    QRS Morphology    P to QRS relationship    Rhythm

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### Ventricular – VPC

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Normal  
AV Blocks  
Fibrillation

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### Ventricular – VPC cont.

- Couplets or triplets
  - 4+ is ventricular tachycardia
- Consider treatment

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Normal  
AV Blocks  
Fibrillation

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### Ventricular – VPC cont.

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Normal  
AV Blocks  
Fibrillation

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### Ventricular – V. Tachycardia

- Fast ventricular rate (4+ VPCs) >180bpm
  - Paroxysmal, intermittent or sustained
- Can lead to ventricular fibrillation
- Haemodynamically unstable = lidocaine*



P Wave    QRS Morphology    P to QRS relationship    Rhythm

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Normal

AV Blocks

Fibrillation

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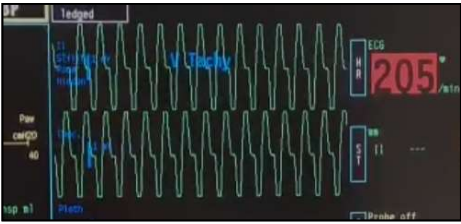
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### Ventricular – V. Tachycardia



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Normal

AV Blocks

Fibrillation

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### Ventricular – Escape

- Wide and bizarre
- After sinus pause/arrest
  - Dogs 30-40bpm, cats 70-90bpm
- Treat the bradycardia!*



P Wave    QRS Morphology    P to QRS relationship    Rhythm

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Normal

AV Blocks

Fibrillation

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### Ventricular – Escape

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Normal

AV Blocks

Fibrillation

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### Ventricular – AIVR

- Wide and bizarre complex
- Regular rate
- *Self-limiting - Doesn't require treatment*

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Normal

AV Blocks

Fibrillation

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### Ventricular – AIVR

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Normal

AV Blocks

Fibrillation

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### Fibrillation – Atrial

- Random electrical activity in atria
  - Occasionally foci reaches the AV node
- Normal QRS, but irregular rhythm
- Seen with atrial dilation (large breeds)
- *Treatment is heart failure focused*



Normal

AV Blocks

Ventricular

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### Fibrillation – Atrial



Normal

AV Blocks

Ventricular

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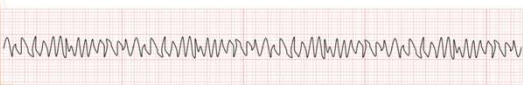
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### Fibrillation – Ventricular

- Quivering electrical activity
- No cardiac output
- Arrest rhythm
- *Defibrillate*



Normal

AV Blocks

Ventricular

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## Fibrillation – Ventricular

Normal

AV Blocks

Ventricular

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## Take-Home Message

- Put an ECG on every patient
- Understand P-QRS relationship
- Electrical activity does not mean pulses!

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## Case Base Discussion:

- 4yo French Bulldog having a FB removal

P Wave

Yes

QRS Morphology

Tall and narrow

P to QRS QRS to P

P for every QRS, no QRS for every P

Identify

**2<sup>nd</sup> degree AV block**

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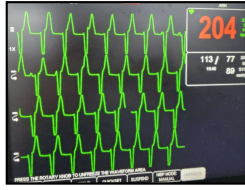
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### Case Base Discussion:

- 10yo GSD undergoing a splenectomy



- P Wave: *No*
- QRS Morphology: *Wide, regular*
- P to QRS QRS to P: *No P wave*
- Identify: **Accelerated idioventricular rhythm**



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### Case Base Discussion:

- Healthy 4yo Jack Russell having a lump removal



- P Wave: *Yes*
- QRS Morphology: *Tall and narrow*
- P to QRS QRS to P: *P for every QRS, QRS for every P*
- Identify: **Normal Sinus Rhythm**



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### Case Base Discussion:

- 6yo Dachshund for grass seed removal with medetomidine sedation



- P Wave: *No*
- QRS Morphology: *Wide and abnormal*
- P to QRS QRS to P: *No P for every QRS*
- Identify: **Bradycardia with Escape Complex**



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### Case Base Discussion:

- 5yo ME Labrador inguinal wound stitch up



- P Wave: Yes
- QRS Morphology: Tall and narrow
- P to QRS QRS to P: P for every QRS, QRS for every P
- Identify: Sinus Arrhythmia



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### Case Base Discussion:

- 5yo FS Great Dane presenting with polytrauma



- P Wave: No
- QRS Morphology: Wide and bizarre
- P to QRS QRS to P: No P wave, ventricular complexes
- Identify: Ventricular Tachycardia



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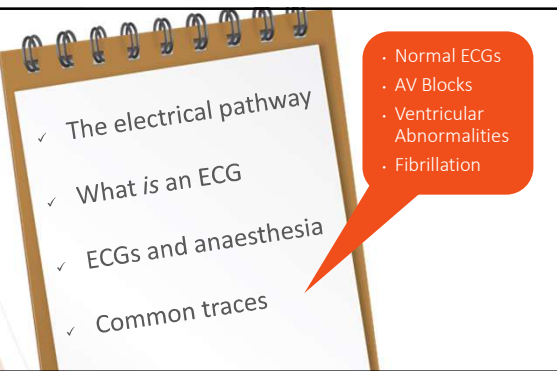
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- ✓ The electrical pathway
- ✓ What is an ECG
- ✓ ECGs and anaesthesia
- ✓ Common traces

• Normal ECGs  
• AV Blocks  
• Ventricular Abnormalities  
• Fibrillation



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