

ECG MONITORING

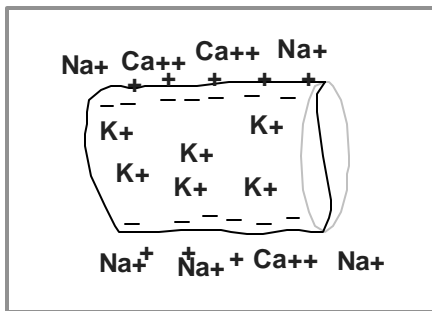
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Learning Objectives

- △ Describe myocardial tissue electrical activity
- △ Trace electrical conduction through the heart.
- △ Identify electrode locations for common ECG leads.
- △ Analyze the components of a normal ECG.
- △ Identify common dysrhythmias on an ECG monitor.

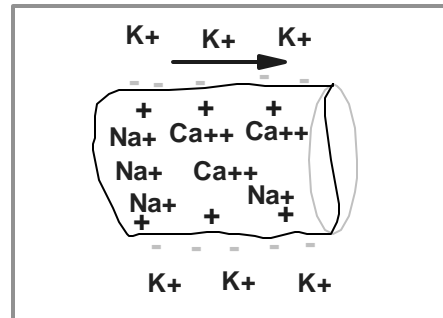
Chemical Basis for Electrical Activity

Resting potential- cell interior negative, in relation to exterior



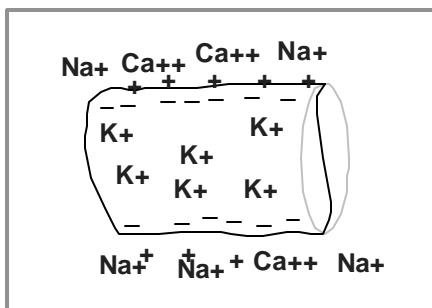
Electrochemical Basis For ECG

Na+, Ca++ channels open ==> influx of +
==> negative charge external cell ==>
current ==> conduction & contraction

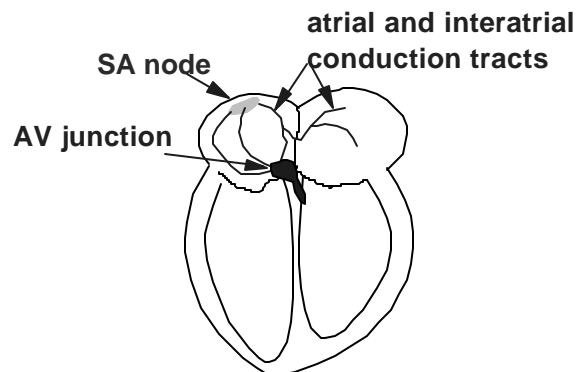


Electrochemical Basis For ECG

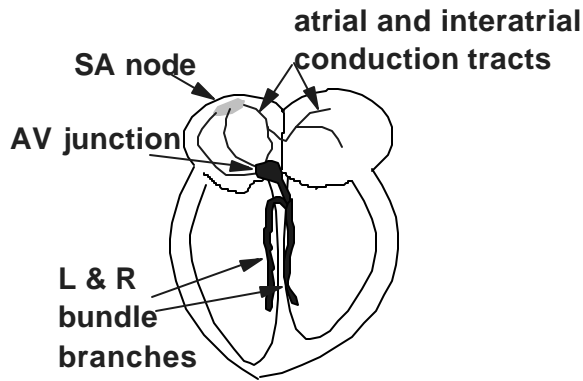
Refractory period- K+ enters cell & restores action potential



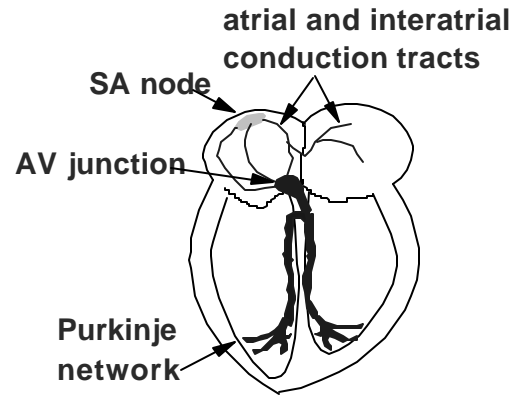
Conduction Pathway



Conduction Pathway



Conduction Pathway



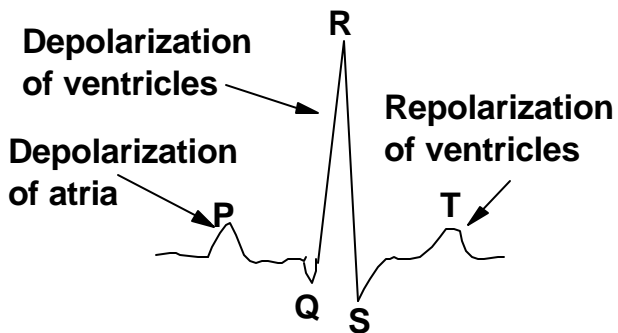
Pacemaker Cells

- ▲ Automatic rates for different sites
- ▶ SA node = 60-100 / min
- ▶ AV node = 40-60 / min
- ▶ Bundle branches = 30-40 / min

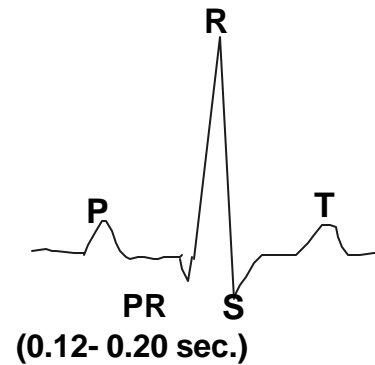
Pacemakers

- ▲ Beats that originate outside the SA node are 'ectopic'
- ▲ Escape beats originate from alternate sites when higher ones are depressed.

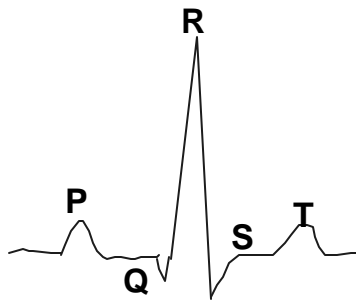
ECG Waves



ECG Wave Intervals

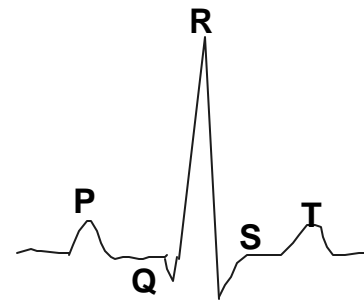


ECG Wave Intervals



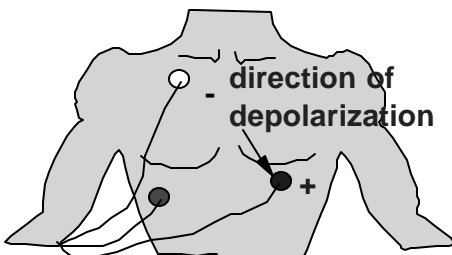
QRS
(< 0.12 sec.)

ECG Wave Intervals

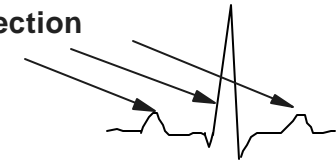


ST segment
should be flat

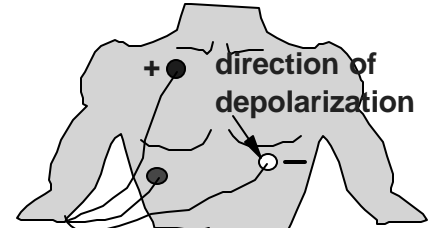
ECG Leads and Waves



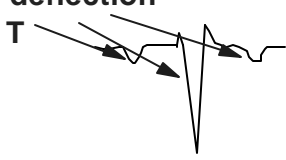
upward deflection
of P, QRS, T



ECG Leads and Waves

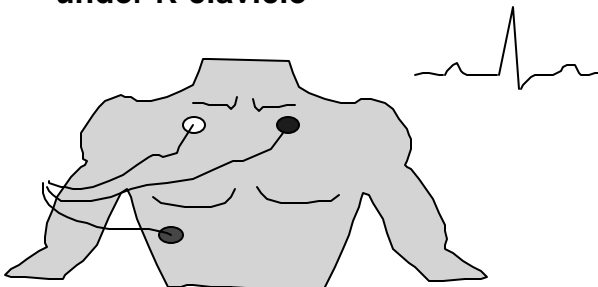


downward deflection
of P, QRS, T



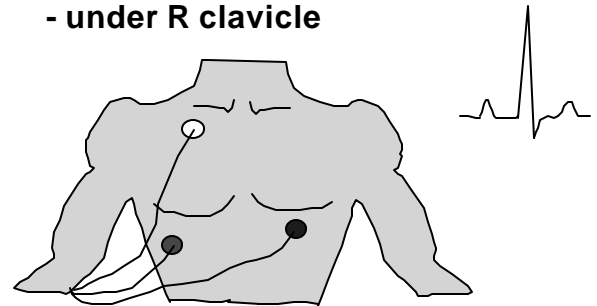
ECG Electrode Placement

- Lead 1
 - + under L clavicle
 - under R clavicle



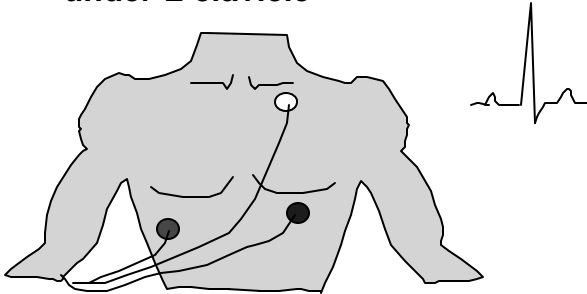
ECG Electrode Placement

- Lead 2
 - + under L pectoral
 - under R clavicle



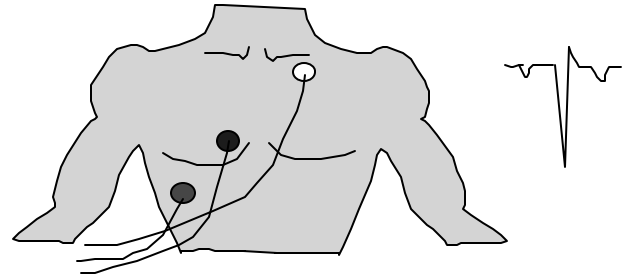
ECG Electrode Placement

- ▶ **Lead 3**
 - + under L pectoral
 - under L clavicle



ECG Electrode Placement

- ▶ **MCL**
 - + R sternum, 4th intercostal
 - under L clavicle



Rhythm Analysis

ECG Analysis Steps

- ▲ **Lead**
 - ◆ usually lead II or III
- ▲ **Rate**- five large boxes = 1.0 sec
 - ◆ six second tracing & multiply R waves by ten
 - ◆ count large squares between R waves and divide into 300
- ▲ **Regularity**- compare distances between QRS complexes

ECG Analysis Steps

- ▲ **P wave**
 - ◆ absent ==> beats are ectopic or rate is excessive
 - ◆ tall or wide ==> atrial enlargement

ECG Analysis Steps

- ▲ **PR interval**
 - ◆ short (<0.12 sec) ==> Wolf-Parkinson White (WPW) syndrome
 - ◆ prolonged (>0.2 sec) ==> AV block

ECG Analysis Steps

△ PR relationship

- ◆ more P than QRS ==>
 - ▶ AV block
 - ▶ atrial flutter with block
- ◆ absent P wave ==>
 - ▶ hidden by QRS complex
 - ▶ ectopic rhythm

ECG Analysis Steps

△ QRS complex

- ◆ interval >0.12 ==>
 - ▶ bundle branch block
 - ▶ ectopic beat
- ▶ electrolyte imbalance

ECG Analysis Steps

△ ST segment- should be flat

- ◆ elevation ==> ischemia
- ◆ depression ==> ischemia

ECG Analysis Steps

△ T wave- should be same direction as QRS

- ◆ inversion ==> evolving infarction
- ◆ tall ==> electrolyte imbalance

ECG Analysis Steps

△ Interpret, with consideration to:

- ◆ medical history
- ◆ general clinical status
- ◆ electrolyte balance
- ◆ artifacts
- ◆ equipment calibration and adjustment

Dysrhythmias

Sinus Dysrhythmias

△ Sinus bradycardia

- ◆ beats originate in SA node
- ◆ normal wave configurations
- ◆ rate < 60/min

Sinus Dysrhythmias

△ Sinus tachycardia

- ◆ beats originate in SA node
- ◆ normal wave configurations
- ◆ rate > 100/min

Sinus Dysrhythmias

△ Sinus dysrhythmia

- ◆ beats originate in SA node
- ◆ normal wave configurations
- ◆ irregular rhythm

Atrial Dysrhythmias

△ Paroxysmal atrial tachycardia (PAT)- ectopic atrial focus initiates beats

- ◆ type of paroxysmal supraventricular tachycardia (PSVT)
- ◆ sudden onset
- ◆ spontaneous termination
- ◆ rate > 150/min

Atrial Dysrhythmias

△ Atrial flutter

- ◆ sawtooth atrial waves
- ◆ associated with pulmonary disease
- ◆ promotes thrombus formation
- ◆ atrial rate 180-300/min
- ◆ usually four atrial waves per QRS

Atrial Dysrhythmias

△ Atrial fibrillation

- ◆ non-discernible P waves
- ◆ promotes thrombus formation

Atrial Dysrhythmias

- ▲ **Premature atrial complex (PAC)**
 - ◆ normal beat inserted between other beats
 - ◆ normal waves and configurations

Junctional (Nodal) Dysrhythmias

- ▲ **Junctional rhythms**
 - ◆ slow rhythm- due to suppression of SA node
 - ◆ junctional tachycardia- type of PSVT

Junctional (Nodal) Dysrhythmias

- ▲ **Premature junctional complexes**
 - ◆ beat originates in AV node
 - ◆ P wave may be inverted
 - ◆ P wave may appear after QRS

Ventricular Dysrhythmias

- ▲ **Premature ventricular complexes (PVC)**
 - ◆ beat originates in ventricle
 - ◆ P wave is absent
 - ◆ wide QRS complex
 - ◆ compensatory pause before next regular beat

Ventricular Dysrhythmias

- ▲ **Premature ventricular complexes (PVC)**
 - ◆ unifocal- similar configurations ==> one damaged area
 - ◆ multifocal- variable configurations ==> more than one damaged area

Ventricular Dysrhythmias

- ▲ **Premature ventricular complexes (PVC)**
 - ◆ frequency
 - ▶ isolated
 - ▶ every third- trigeminy
 - ▶ every other- bigeminy
 - ▶ couplet = two, triplet = three
 - ▶ every- ventricular tachycardia

Ventricular Dysrhythmias

- △ Premature ventricular complexes (PVC)
 - ◆ increased frequency ==> increased risk for R on T and ventricular tachycardia (VT)

Ventricular Dysrhythmias

- △ Ventricular tachycardia
 - ◆ all beats originate in ventricle
 - ◆ wide QRS complexes
 - ◆ P waves are absent
 - ◆ torsades des pointes- type of VT caused by hypomagnesemia

Ventricular Dysrhythmias

- △ Ventricular fibrillation (VF)
 - ◆ rapid, irregular rhythm
 - ◆ coarse to fine complexes

Heart Block

- △ Blockage of conduction between atria and ventricles at:
 - ◆ lower atrial tissue
 - ◆ AV node
 - ◆ Bundle of His
 - ◆ Bundle branches

Heart Block

- △ First degree block
 - ◆ benign
 - ◆ PR interval > 0.20 sec.

Heart Block

- △ Second degree block- Mobitz type one
 - ◆ progressive lengthening of PR, then dropped beat

Heart Block

- △ Second degree block- Mobitz type two
 - ◆ constant PR intervals
 - ◆ beats dropped at fixed ratio
 - ◆ often occurs with bundle branch block

Heart Block

- △ Third degree (complete) block
 - ◆ slow ventricular rate
 - ◆ no consistent association between P wave and QRS complex
 - ◆ associated with bundle branch block

Heart Block

- △ Bundle branch block
 - ◆ slow ventricular rate
 - ◆ wide, notched QRS complex

Artificial Pacemakers

- △ Pacemaker create spikes in waves
 - ◆ atrial pacemaker
 - ◆ ventricular pacemaker
 - ◆ failure to pace

Artifact

- △ Patient movement causes abnormal waves

Review & Summary

- △ ECG trace is result of electrical conduction through heart.
- △ ECG comprised of waves and intervals between waves.
- △ Sinus dysrhythmias
 - ◆ bradycardia
 - ◆ tachycardia
 - ◆ dysrhythmia

Review & Summary

- ▲ Atrial dysrhythmias
 - ◆ PAT, PSVT
 - ◆ atrial flutter
 - ◆ atrial fibrillation
 - ◆ premature atrial contractions
- ▲ Junctional (nodal) dysrhythmias
 - ◆ premature junctional complex
 - ◆ junctional rhythms

Review & Summary

- ▲ Ventricular dysrhythmias
 - ◆ premature ventricular contractions
 - ◆ ventricular tachycardia
 - ◆ ventricular fibrillation
- ▲ Heart block
 - ◆ first degree
 - ◆ second degree, Mobitz I
 - ◆ second degree, Mobitz II
 - ◆ third degree (complete)
 - ◆ bundle branch

Review & Summary

- ▲ Pacemaker beats
 - ◆ atrial
 - ◆ ventricular
- ▲ Artifact

References

- ▲ Brown KR, Jacobson S. Mastering dysrhythmias 1988: FA Davis; Phila.
- ▲ Wilkins RL, Krider SJ, Sheldon RL. Clinical assessment in respiratory care, 3rd ed. 1995 Mosby-Yearbook; St. Louis.
- ▲ Elstun LR. Electrocardiography and cardiac monitoring, Chap 7 in Chang DW, Elstun LR, Jones AP. The multiskilled respiratory therapist: A competency-based approach 2000: FA Davis; Phila.