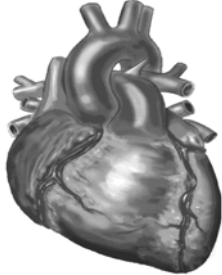
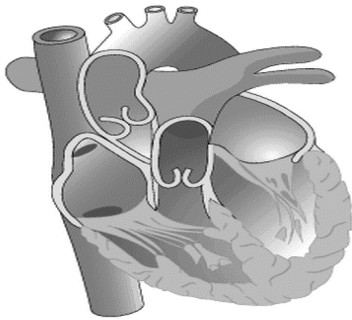


Anatomy and Electrophysiology of the Heart

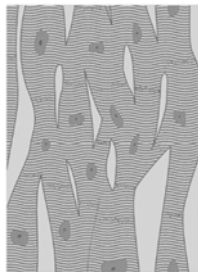


Basic Anatomy of the Heart chambers and vessels



Properties of Cardiac Cells two basic types

- **Mycardial Cells** (working)
 1. contain contractile filaments
 2. contract when electrically stimulated.
 3. form the muscular layers.
- **Pacemaker Cells** (conduction)
 1. Cannot contract
 2. Spontaneously generates and conducts electrical impulses.

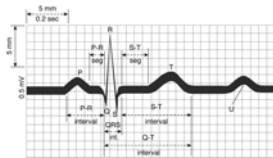


Key Terms

- **Depolarization**- movement of ions (Na⁺ K⁺ Ca⁺) across cell membrane causing inside of cell to become more positive; an electrical event which is expected to result in a contraction (mechanical event)
- A difference between electrical charges must exist for electrical current to be generated. This electrical activity appears on an ECG as waveforms.
- **Repolarization**- movement of ions across cell membrane in which the inside of cell is restored to its negative charge.

Key Terms (con't) see syllabi for definitions

- Baseline
- Waveform
- Segment
- Interval
- Complex- used instead of contraction since ECG depicts electrical activity, not mechanical function of the heart.
- Dysrhythmia/Arrhythmia - used interchangeably



Cardiac Cells four primary characteristics

1. Excitability (irritability)
ability of muscle cells to respond to outside stimulus, ionic imbalance.
2. Automaticity- ability of pacemaker cells to spontaneously initiate an electrical impulse, SA node, AV junction, and Purkinje fibers.



Primary Characteristics (con't)

- 3. Conductivity- ability to receive an electrical stimulus and conduct that impulse to adjacent cells- all cardiac cells possess this.
- 4. Contractility- cardiac cells shorten, causing muscular contraction in response to an electrical stimulus.



The Conduction System Sinoatrial (SA) Node

- Sinoatrial Node- cluster of cells located in upper portion of right atrium at junction of superior vena cava and right atrium.
- Impulse spreads from cell to cell in wavelike form across atrial muscle, resulting in contraction.
- Normally paces heart because it depolarizes more rapidly than any other part (60-100 bpm)
- Impulse now spreads to the atrioventricular node.



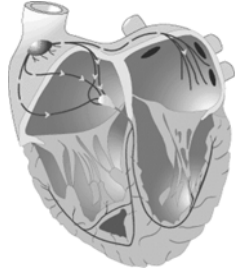
The Atrioventricular (AV) Node

- Specialized cells located in lower portion of right atrium above tricuspid valve.
- Doesn't possess pacemaker cells
- **Has two functions:**
 1. to delay impulse to allow atria to contract and complete filling of ventricles.
 2. to receive an impulse and conduct it to ventricles.



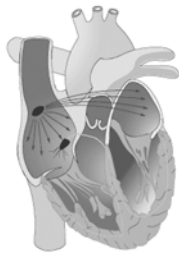
Bundle of His

- After passing through AV node, impulse enters bundle of His, (common bundle).
- Located in the upper portion of interventricular septum.
- Connects AV node with the two bundle branches.
- Has pacemaker cells that can discharge at 40-60bpm.
- AV node and bundle of His referred to AV junction.



R and L Bundle Branches and Purkinje Fibers

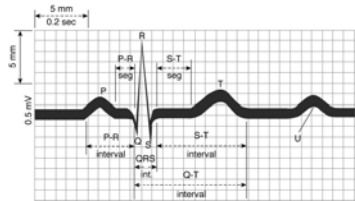
- R bundle branch innervates R ventricle.
- The left bundle branch divides into two bundles to supply the thicker, more muscular left ventricle.
- The R and L bundle branches divide into smaller branches called the Purkinje fibers.
- Purkinje fibers penetrate 1/3 of the way into ventricular muscle and become continuous with it.
- Can pace the heart at 20-40 bpm.



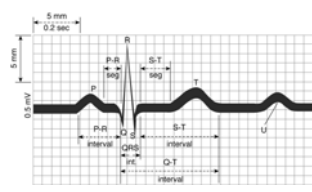
ECG Paper

- Graph paper made up of small and larger, heavy lined squares.
- Records at constant speed of 25mm/sec.
- Horizontal lines measure time.
- Vertical lines measure voltage or amplitude.
- The width of each small square represents 0.04 sec.
- The width of each large square represents .20 sec.
- Five large boxes represent one second.
- Thirty large boxes represent six seconds.
- All practice strips in class will be six second strips.

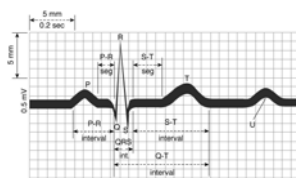
The P Wave - the first wave in the cardiac cycle or depolarization of the right and left atria.
The beginning of the P wave - recognized as the first deviation from the baseline.
The end of the P wave - is the point at which the waveform returns to the baseline.



• Normal Characteristics of the P Wave
Smooth and rounded
No more than 0.11 seconds in duration
Upright (positive) in leads I and II
An abnormal P wave in leads I or II means the S/A node didn't initiate it, but the atrium did.



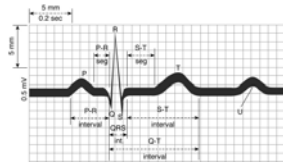
• The PR Segment
Part of the PR interval, area from the end of the P wave to the beginning of the QRS complex.
Normally it is an isoelectric (flat) line



The PR Interval

The entire P wave + PR segment = PR interval.

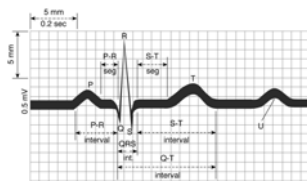
Reflects depolarization of the R and L atria (P wave) + spread of impulse through AV node, bundle of His, R and L bundle branches, and Purkinje fibers (PR segment).



Normal Characteristics of the PR Interval

Begins with the onset of the P wave and ends with the onset of the QRS complex.

Normally measures 0.12 to 0.20 seconds



• **The QRS Complex**

Ventricular depolarization produces the Q wave, the R wave and the S wave.

Atrial repolarization usually takes place, but QRS complex overshadows it.

The Q wave is the first negative/downward deflection following the P wave. Represents depolarization of interventricular septum.

Not shown in this complex. Q waves usually indicate dead muscle

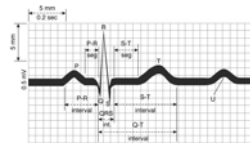


R and S Waves

The R wave is the first positive/upward deflection following the P wave.

The S wave is the first negative wave following the R wave.

The R and S waves represent depolarization of the R and L vents.

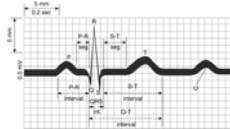


QRS Characteristics

The beginning of the QRS is measured from the point where the first wave of the complex begins to deviate from the baseline.

The end of the QRS is marked by the point in which the last wave of the complex begins to level out. Could be above or below baseline.

The normal QRS duration is 0.10 or less.



The ST Segment - The portion between the QRS complex and T wave
Early part of repolarization of R& L ventricles (Not in syllabi, handout)

Measured at a point 0.04 seconds (one small box) after end of QRS

This point is referred to as the J point

Measured from J point and ends with onset of T wave.

It is usually isoelectric, can be elevated 1mm (one small box) normally in Lead I, II, or III.

If elevated more called ischemia, toombstone T, call nurse immediately (MI)

See page 36 in syllabi.

Depression of more than .5mm is abnormal

See handout, not in syllabi.

The T Wave - Represents ventricular repolarization
Identified as the point where the slope of the ST segment appears to become abruptly or gradually steeper.

Ends when it returns to baseline.

Often difficult to determine onset and end of T wave.

Rate measurement six second method

- To determine ventricular and atrial rate.
- Thirty large boxes represents 6 seconds.
- Six second strips are also represented between two long lines on bottom of EKG paper.
- May be used for regular/irregular rhythms
- Simplest, quickest, and most commonly used.

- To determine rate = count the number of complete QRS complexes or P waves within 6 seconds and multiply X 10.
- Practice strips are all in six second intervals.

Analyzing a Rhythm Strip

- See pg. 21- 22 in syllabi
- A note about P waves
 - Are there more atrial beats than QRS complexes?
- Step # 9 is to interpret the rhythm.
- We will not be concerned with QT intervals in this class.
- Neither will we cover the U wave.



Practice drawing waveforms, segments,
and intervals on graph paper

- 1. Waveform .08, segment .16
- 2. Waveform .04, segment .12
- 3. Waveform .12, segment .06
- 4. Waveform .06, segment .10
- 5. Isoelectric line .12, waveform .08, segment .10, next wave .12, next segment .04, next wave .06
- 6. Circle all the intervals in 1-5
- Homework- pgs. 25-29
