ECG's: The Basics

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Basic Conduction:
ECG: Electrocardiogram- Studies the electrical activity generated by the heart. The heart has two components, a mechanical pump, for blood flow, and an electrical generator to push the pump.

Depolarization/Repolarization
Depolarization- Electrical current transfer across cardiac cell membranes causing contraction. Ca++/K+ ions move into cell.

Repolarization- Movement of ions back out of cells, relaxing of muscles. K+/Na+ move out-K+(quickly to establish negative gradient)

This process allows the muscle cells to contract in sequence, allowing a synchronized contraction of many, many muscle cells, allowing the heart to pump blood to the lungs and body.

Normal Conduction Pathway:
ALL POSSESS AUTOMATICITY (or the ability to discharge without outside stimulus)

SA Node
- Initiates electrical signal-Under normal physiologic conditions
- Is in right atrium
- Firing of SA node sends contraction signals through the right atrium

AV Node
- Directs electrical signal towards the ventricles
- Is just above the right ventricle
- Failsafe- Can fire on its own (automaticity)-If the SA node stops working

Bundle of His
- Large bundle of electrical fibers directing the signal towards the Bundle Branches

Right/Left Bundle Branches
- Separate groups of electrical fibers powering the right and left ventricles

Purkinjie Fibers
- Terminal fibers at the end of the conduction sequence
- Can fire on their own (automaticity)

Cellular Electrical Potentials:

Resting
- Cardiac cell is polarized (relative negative inside as opposed to outside cell)
- Na+/Cl- Highly Extracellular
- K+-Mainly Intracellular

Depolarization
- Stimulus applied
- Na+/Cl- rush into cell causing a net positive effect intracellularly
- Ca2+- also shifts inside

Magnitude of electrical activity is proportional to the length and diameter of the muscle
Dilitation- Lengthening and Hypertrophy-Thickening can see an increase in electrical activity on ECG

Repolarization

K+ begins to leave cell as permeability increases
The Sodium-Potassium Pump removes intracellular sodium

Normal ECG:

The Waves

P-wave

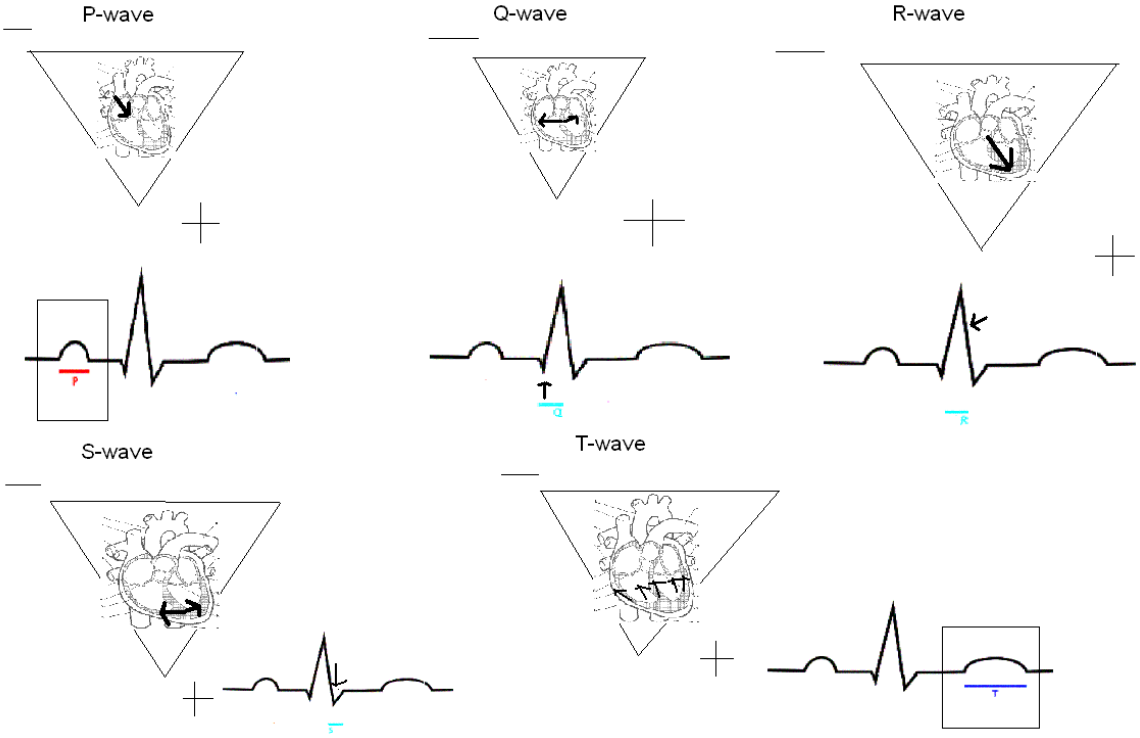
First component of normal ECG and is produced by depolarization of the atria.
Width indicates time for contraction
Height indicates amount of current generated
Positive in Lead II

QRS Complex

Second Component comprised of 3 separate waves in the ECG
Represents ventricular depolarization
Q-wave- First negative wave following the p-wave
R-wave- First positive wave after the p-wave
S-wave- Second negative wave after the p-wave

T-wave

Final positive wave after the QRS Complex
Represents Ventricular Repolarization (atrial repolarization hidden in QRS Complex)



Basics of Arrythmias:

Questions to ask when interpreting ECG's:

-Is the heart rate normal or abnormal?

-Is the rhythm regular or irregular?
-Can I identify P waves and QRS-T complexes?
-Is there a P-wave for every QRS and a QRS for every P-wave?
-Do all the complexes look roughly the same length/shape/size?

Slow rhythms:

Sinus Bradycardia

Abnormal rate
Regular rhythm
Yes PQRST
Yes P for QRS and QRS for P
Complexes look the same-Complexes look "sinus" Or Normal QRS

First Degree AV Block

Heart rate abnormal
Irregular
There are p-wave and QRS Complexes
Yes P for every QRS or QRS for every P
Complexes do not look the same, elongated P-R interval

Third Degree AV Block

Heart rate abnormal (slow)
Irregular rhythm
There are p-waves and QRS Complexes
Not a p for every QRS or QRS for every P
Complexes do not look the same (VPC's interspersed)
There is no relation between P-waves and QRS complexes

Fast rhythms

Sinus Tachycardia

Abnormal rate
Regular rhythm
Yes PQRST
Yes P for QRS and QRS for P
Complexes look the same-QRS is Sinus

Ventricular Tachycardia

Abnormal rate
Appears Regular
No P waves QRS Complexes wide and abnormal
No P for QRS or QRS for P
Complexes may look the same or different depending on where in the ventricle the electrical signal has originated from

Ventricular Fibrillation

Unable to determine rate
Not regular
No P waves/QRS Complexes
No P for QRS or QRS for P
There are no identifiable complexes
THIS IS A RHYTHM OF CARDIAC ARREST!

Atrial Fibrillation

Atrial rate-Very fast
Ventricular rate-Slow to fast
Irregular rhythm
No stable P-waves present, appear as fibrillation
Not a regular PQRST configuration
QRS Complexes sometimes normal morphology

Supraventricular Tachycardia

Atrial/Ventricular rate very fast, sometimes 300+ BPM
Irregular (may speed up and/or slow down-Paroxysmal)
P-waves may or may not be present
Appears to be a QRS for every P wave
QRS Complexes are regular to thin

Rhythm's with Premature Beats

APC's

Premature firing from an atrial focus
Heart rate usually normal to slow
Irregular rhythm (premature beat present)
P-wave may or may not be present
QRS for every P of non premature beats
QRS of normal morphology because atrium initiated contraction

VPC's

Heart rate normal to slow or fast
Irregular rhythm (Premature beats present)
P-wave not present with premature beats
QRS for every P with normal Sinus beats
QRS of wide and bizarre morphology of premature beats
Premature firing of the ventricles-Can occur at multiple foci-Multi-focal