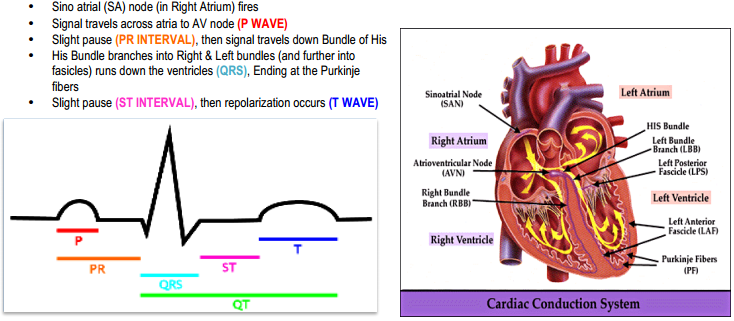
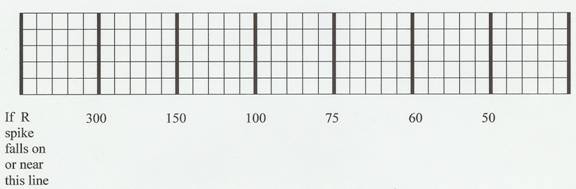
**ELECTROCARDIOGRAM REVEIW**



**When reading an EKG, it is vital to have a systematic approach!**

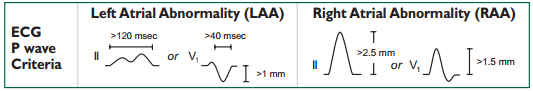
1. **Determine Cardiac Rhythm**
   1. Is the rhythm regular or irregular?
   2. Identify atrial activity
   3. Determine P-QRS relationship
2. **Measure heart rate** 
   1. Is the rate normal? (60-100 bpm) bradycardia (<60bpm)? Or tachycardia (>100 bpm)?

How to determine heart rate: count the number of small squares (0.04 secs) between two QRS complexes

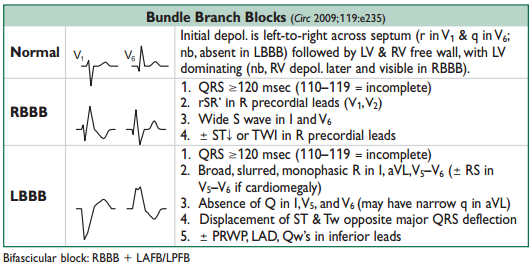


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| 5 small boxes between the 2 QRS complexes | 300 bpm |
| 10 small boxes | 150 bpm |
| 15 small boxes | 100 bpm |
| 20 small boxes | 75 bpm |
| 25 small boxes | 60 bpm |
| 30 small boxes | 50 bpm |
| 35 small boxes | 43 bpm |
| 40 small boxes | 37 bpm |

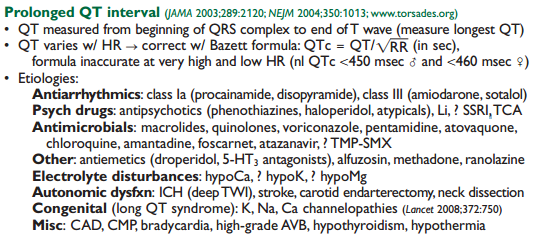
1. **Evaluate P wave morphology** 
   1. Inspect P waves in lead II and VI for right and left atrial enlargement
      1. What is the amplitude? Duration? Direction?



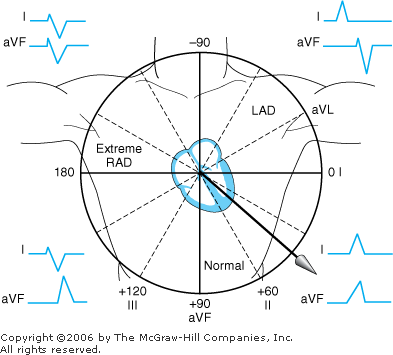
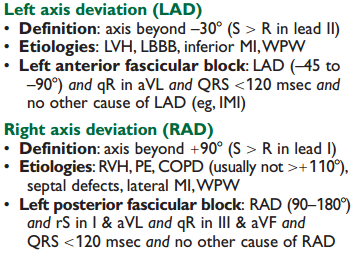
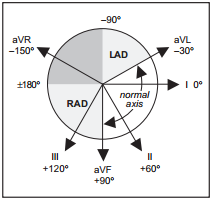
1. **Assess PR, QRS, and QT interval**
   1. PR interval- normal is 0.12-0.20 seconds. Is it short or prolonged?
      1. Short PR intervals (less than 0.12 second) indicate that the impulse originated somewhere other than the SA node. This variation is associated with junctional arrhythmias and preexcitation syndromes.
      2. Prolonged PR intervals (greater than 0.20 second) may represent a conduction delay through the atria or AV junction due to digitalis toxicity or heart block – slowing related to ischemia or conduction tissue disease.
   2. QRS interval- normal is (less than or equal to 0.10 seconds.
      1. Make sure to check for a bundle branch block!

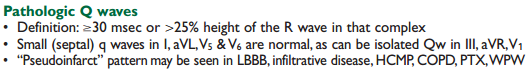


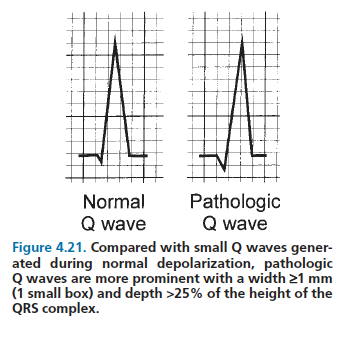
* 1. QT interval- what is the duration? Normal QT is less than or equal to one-half of the R-R interval (if HR is normal)



1. **Determine Mean QRS Axis**
   1. Normal is between +90 degrees and -30 degrees
   2. Is there left or right axis deviation?
      1. Check leads I and aVF!

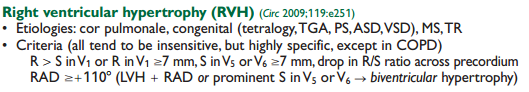


1. **Evaluate QRS Complex, ST and T wave Morphologies**
   1. Is a Q wave present? If it is, what is the distribution?
      1. Q waves are normal at a width of <0.04 seconds and height of <1/3 of the QRS complex

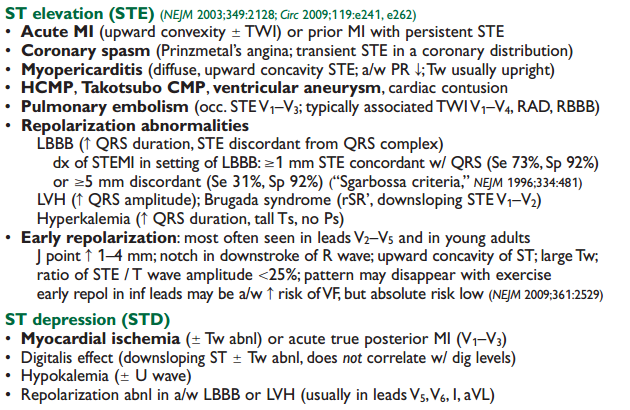


* 1. Is the QRS amplitude normal? Increased? Or decreased?
     1. Check for left or right ventricular hypertrophy!

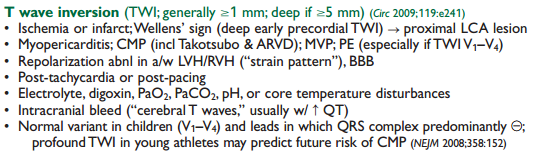
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* 1. Is the ST segment elevated, depressed, or isoelectric?
     1. Check for ischemia, infarction, pericarditis, metabolic/chemical abnormalities!

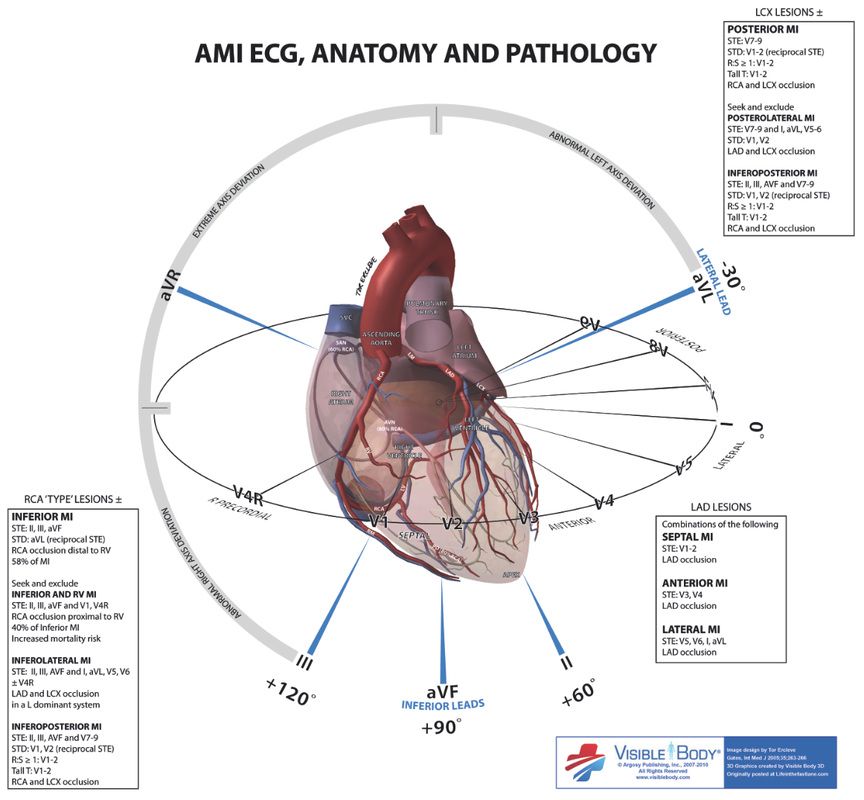


* 1. Is the T wave upright or inverted?



* 1. Is the amplitude increased or diminished?

1. **Identify Abnormal ECG Pattern** 
   1. Myocardial ischemia and infarction
   2. Cardiac chamber enlargement and hypertrophy
   3. Arrhythmias and conduction disturbances
   4. Miscellaneous patterns (e.g., pericarditis, WPW syndrome, electrolyte imbalances, drug effects)



References:   
Pocket Medicine: The Massachusetts General Hospital Handbook of Internal Medicine  
Clinical Cardiology Made Ridiculously Simple (Edition 4)  
Rutgers PANCE/PANRE Review Course  
http://www.medskills.eu/index.php/wiki/en/cellular/chest%20pain/heart%20and%20blood%20vessels/ecg%20presentation/  
<http://www.teaems.com/ekg-review.htm>  
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