EKG

EKG Basics

1. Remember to look at the name, date, and time on EKG
2. Find an old EKG for comparison
3. Follow a systematic approach
    a. Rate
    b. Rhythm
    c. Axis
    d. Intervals
    e. PQRSTU
        i. Morphology of the P waves
        ii. Morphology of the Q waves
        iii. Look at R wave progression
        iv. Evaluation the ST segments
        v. Morphology of the T waves
        vi. Look for U waves
4. Summary interpretation: Arrhythmias, Blocks, Drug effects, Electrolyte disturbances, Hypertrophy, Infarction, Ischemia, etc

Rate

- Each little box represents 0.04 seconds, each big box represents 0.2 seconds
- If the rate is irregular or slow, count the number of QRS complexes between 20 big boxes and multiply by 10 to get the heart rate

Rhythm

- Questions to ask yourself to help determine the rhythm:
    - Is it tachy (> 100) or brady (< 60)
    - Is there a P before every QRS? If not, suggests a rhythm other than sinus
    - Is there a QRS after every P? In not, suggests a block (2^{nd} or 3^{rd} degree)
    - Is the QRS regular? If not, suggests A-fib, PVCs, sinus arrhythmia, etc
    - Is the QRS narrow? If not, suggests conduction delay (LBBB, RBBB, etc), or the QRS originates in the ventricle (V tach, ventricle paced)
- Important Rhythms to Know
    - Sinus rhythm: P waves are seen (upright in II and III), QRS follows every P wave
    - Junctional: narrow QRS, P waves are absent or P can be retrograde, before, after, or buried in the QRS

    - Atrial fibrillation: no P waves seen, irregularly irregular QRS
    - Atrial flutter: regular QRS, saw-tooth pattern
    - Ventricular tachycardia: wide QRS, if P waves are seen they are dissociated with the QRS complex
    - Ventricular fibrillation: no discernable P waves or QRS complexes, “chaotic,” look in more than one lead
    - Examples
        - Sinus bradycardia
        - Junctional
        - A Fib
        - A flutter
        - V tach
        - V Fib

Axis

- Normal axis is -30° to +90°
- If I is (+) and II is (+) then axis is normal
- If I is (+) and II is (-) then axis is LAD (left axis deviation)
- If I is (-) and II is (+) then axis is RAD (right axis deviation)

Intervals

- PR interval: beginning of P wavee to beginning of QRS.
    - Normal is <0.2, or 1 big box
    - Short (< 0.12 sec): WPW, Atrial ectopic beats, Junctional
    - Long
        - First degree AV block
        - Second degree AV block
            - Type I or Wenckebach: PR progressively lengthens and a QRS is eventually dropped (P-R varies, R-R varies)
            - Type II: PR is constant but not every P leads to a QRS (P-R prolonged but constant, R-R varies)
        - Third degree block: P and QRS are not associated with each other and each have their own rate (P-R varies, R-R constant)
- QRS interval: beginning of the Q or R wave to the end of the S wave (normal is less than 0.12 sec)
    - Wide: beat that starts in the ventricle, impariemnt of conduction system (LBBB, RBBB, WPW) or the ventricle is paced

        - RBBB: Is there a terminating R wave (an R wave is the last wave of the QRS complex; may be rSR, qR, or just R); If so, this R represents the delayed RV depolarization and diagnosis, therefore, is RBBB
            - Then keep going through QRS axis and Q analysis and then stop at that point
        - LBBB: is there no terminating R but rather a predominantly negative wave (Q or S) in V1? If so, look for mid-QRS notches usually best seen in those leads with tall R waves
            - If present, diagnosis is LBBB; Stop QRS analysis at this point
            - If not, diagnosis is Nonspecific Intraventricular Conduction Defect (IVCD) and continue QRS analysis
- QT interval: Beginning of QRS to the end of the T wave
    - Use the QTc = QT/square root of the RR interval (corrects for rate)
        - Normal QTc is <0.43 sec
    - Long: Drugs (anti-arrhythmics, tricyclics, idiopathic, hypothermia, electrolyte abnormalities)

Electrolyte disturbances

- Hypokalemia: T wave flattens, U waves, ST depression, shortening of QRS
- Hyperkalemia: in typical sequence: Tall and peaked T waves, ST depression, decreased R amplitude, prolonged PR, widening of QRS, elongation of QT interval with sine wave pattern, asystole

Ischemia and Infarction

- ST elevation: Acute MI
    - Elevations are usually > 1mm and have reciprocal changes (ST depression in anatomically opposite leads)
    - Be mindful of J point elevation: up-sloping and concave and is benign
- ST depression: ischemia
    - Remember, think infarct if ST elevation and reciprocal ST depression
- Myocardial Infarction evolution: Acute vs. Chronic
    - This is why it is important to repeat EKG often in the setting of ischemic symptoms to rule out an evolving MI
    - Acute
        - Fist sign is hyperacute T waves (due to local hyperkalemia)
        - J pt elevation and ST segments remain concave
        - ST segment elevations become more pronounced
        - Q waves develop and can have a loss of R waves
    - Chronic
        - Deep Q waves are seen (> 1mm) and are broad (> 0.04 sec)

LVH

- Many definitions of LVH:
    - R in AVL > 11
    - Sum of S in V1 and R in V5 or 6 > 35
- Can also see a QRS > 0.10 sec, strain pattern with down sloping ST segments and T wave inversions, especially in V5 and 6, or LAD