ECG Interpretation

Part 1

Interpretation

First
- patient’s condition must be evaluated
- all dysrhythmias must be interpreted and evaluated with respect to the patient’s clinical presentation
- signs & symptoms that may be associated with dysrhythmias

- chest pain
- dyspnea
- palpations
- nausea
- hypotension

- fine crackles in bases
- pale, cool, clammy skin
- dizziness or syncope
- sense of impending doom
- altered LOC
Levels of Interpretation

- 1st level
  - identify the ventricular response
  - contraction of ventricles creates majority of CO and perfusion of blood to tissues
  - evaluated by QRS complex and resulting pulse strength

- 2nd level
  - place dysrhythmia into appropriate category based on origin of the electrical impulse
  - 
  - 
  - 
Levels of Interpretation

- 3rd level
  - evaluate the pathway of the conduction disturbance
    - ectopic beats or rhythms
    - escape beats or rhythms
    - AV blocks
    - bundle branch blocks
  - To make sure all components are covered, you must adopt a systematic approach
    - avoid assumptions

Step 1

- Identify the heart rate
  - most monitors display rate
  - always take patient’s pulse to make sure monitor is correct
  - on strip
    - 300 ÷ no. of large boxes between QRS

  - more than ________ large boxes between = ______________
  - ________
  - less than ________ large boxes between = ______________
Step 2

- Evaluate the rhythm
  - classified as either ______________ or ______________
  - establish the pattern of QRS complexes
    - measure ventricular rhythm by measuring interval between R-R waves
    - then measure atrial rhythm by measuring interval between P-P waves
  - if intervals > 0.06 seconds = ______________
• Irregularity can occur randomly or in patterns
• Irregular rhythms may indicate the following
  • ectopic beats
  • escape beats
  • 2° heart AV blocks
  • atrial fibrillation
  • sinus dysrhythmias

Step 3

• Note the presence of ________ waves
• Generally ________________ (depending on lead)
• Rounded shape
• < 0.12 seconds wide & < 2.5 small boxes tall
  • Odd-shaped P waves may indicate ________________ enlargement
• Normal rhythms
  • 1 P wave preceding each _____________
  • every P wave __________________
• If looks like >1 P per QRS -->
  • atrial flutter, atrial fibrillation, 2° AV block, 3° AV block
Step 4

- Measure the ____________________
- Normal = 0.12 - 0.2 seconds (3-5 small boxes)
- Wider than 0.2 seconds = delay in conduction through the ____________________

PR interval = 0.16 seconds (4 x 0.04)

PR interval = 0.24 seconds (6 x 0.04)
Step 5

- Measure the width of _________________
- Normal width = < 0.12 seconds (3 small boxes)

QRS width = 0.04 seconds (1 x 0.04)

- > 0.12 seconds = _________________ in origin
  - bundle branch blocks
  - ectopic beats originating in the ventricles (PVC)
  - ventricular dysrhythmias (v-tach, idioventricular rhythms)
  - 3° AV blocks

QRS width = 0.32 seconds (8 x 0.04)

QRS width = 0.4 seconds (10 x 0.04)
Step 6

- Inspect the ____________________ in all leads
- ST elevation = ____________________
- ST depression = ____________________
- Area of ischemia or injury can be determined by which leads are abnormal
Step 7

- Identify the

```
Lead V2
```

```

11-25AB-1990 17:05
```
Step 8

- Assess the ____________________
  - some QRS complexes have additional deflections
  - if there is a 2nd R or S deflection = R' or S'

Step 9

- Evaluate the ____________________
  - a Q wave is considered normal if it is less than 0.04 seconds (1 small box) wide and less than 1/3 the height of the R wave
  - Q waves that are >0.04 seconds and higher than 1/3 height of R wave = pathologic
    - ____________________
    - ____________________
Step 10

- Look for signs of ____________________

- high-voltage R waves in precordial leads = _________________

- large or abnormally-shaped P waves = _________________

Left Ventricular Hypertrophy
Right Ventricular Hypertrophy

Left Atrial Enlargement
Organized Approach

- Use algorithm
- Questions and answers that lead way to interpretation
- Confusing at first
- Rhythms
  - sinus
  - atrial
  - junctional
  - ventricular
  - blocks

Main Algorithm

- regular, regular but interrupted, irregular?
  - compare P-P and R-R intervals
- ventricular and atrial rates?
  - <60, 60-100, >100?
- present?
  - normal shape?
  - same shape or varied?
  - relationship to QRS?
    - 1 per QRS? same place to each QRS? QRS without P?
Main Algorithm

- ______________________
  - normal? (0.12-0.20 seconds)
  - constant?
- ______________________
  - normal? (0.06 to 0.12 seconds)
  - same size and shape?
  - a QRS complex after each P wave?
- Evaluate any other ________________
  - ectopics?
  - aberrantly conducted beats?
  - any other abnormalities?

Sinus Rhythms

- Normal Sinus Rhythm
- Sinus Bradycardia
- Sinus Tachycardia
- Sinus Arrhythmia
# Sinus Rhythms

<table>
<thead>
<tr>
<th>RHYTHM</th>
<th>REGULARITY</th>
<th>RATE</th>
<th>P WAVES</th>
<th>PRI</th>
<th>QRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Sinus</td>
<td>Regular</td>
<td>60-100</td>
<td>upright, uniform, 1:1</td>
<td>0.12-0.20</td>
<td>&lt;0.12 seconds</td>
</tr>
<tr>
<td>Sinus Brady</td>
<td>Regular</td>
<td>&lt;60</td>
<td>upright, uniform, 1:1</td>
<td>0.12-0.20</td>
<td>&lt;0.12 seconds</td>
</tr>
<tr>
<td>Sinus Tach</td>
<td>Regular</td>
<td>&gt;100</td>
<td>upright, uniform, 1:1</td>
<td>0.12-0.20</td>
<td>&lt;0.12 seconds</td>
</tr>
<tr>
<td>Sinus Arrhythmia</td>
<td>Regular</td>
<td>Depends</td>
<td>upright, uniform, 1:1</td>
<td>0.12-0.20</td>
<td>&lt;0.12 seconds</td>
</tr>
</tbody>
</table>

## Normal Sinus Rhythm

![EKG Chart](image)

- REGULAR -
- RATE -
- P WAVES -
- PRI -
- QRS -
Sinus Bradycardia

- Causes
  - increased vagal stimulation
  - damage to SA node (MI)
  - hypothyroidism
  - hypothermia
  - hyperkalemia
  - drugs
- Treatment
  - ________________________
  - atropine
  - pacing
  - treat cause

REGULAR -
RATE -
P WAVES -
PRI -
QRS -
Sinus Tachycardia

- Causes
  - sympathetic nervous system stimulation
  - fever, hypoxemia, hypovolemia, sepsis, heart failure
  - drugs, caffeine, alcohol
- Treatment
  - ____________
  - observation
  - fluid (IV) if hypotension, hypoperfusion present
  - beta-blockers -
    - propranolol (Inderal)
    - metoprolol (Lopressor, Toprol XL)
    - carvedilol (Coreg)
    - atenolol (Tenormin)
Sinus Dysrhythmia

REGULAR -
RATE -
P WAVES -
PRI -
QRS -

Atrial Rhythms

Atrial Flutter
Atrial Fibrillation
Atrial Tachycardia
Premature Atrial Contraction
# Atrial Rhythms

<table>
<thead>
<tr>
<th>RHYTHM</th>
<th>REGULARITY</th>
<th>RATE</th>
<th>P WAVES</th>
<th>PRI</th>
<th>QRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrial Flutter</td>
<td>Regular or irregular</td>
<td>atrial rate 250-350 vent rate varies</td>
<td>flutter waves present sawtooth pattern</td>
<td>usually constant</td>
<td>&lt;0.12 seconds</td>
</tr>
<tr>
<td>Atrial Tach</td>
<td>Regular</td>
<td>150-250</td>
<td>differs from other P waves, may be buried in T wave</td>
<td>&lt;0.12 generally, can vary</td>
<td>&lt;0.12 seconds</td>
</tr>
<tr>
<td>Atrial Fib</td>
<td>Irregularly regular</td>
<td>atrial rate 350-750 vent rate varies</td>
<td>none</td>
<td>none</td>
<td>&lt;0.12 seconds</td>
</tr>
</tbody>
</table>

## Atrial Flutter

Atrial Flutter is characterized by:
- **Regular** rhythm
- **Rate** between 250-350 bpm
- **P Waves** present, sawtooth pattern
- **PRI** usually constant
- **QRS** <0.12 seconds
Atrial Flutter

- Caused by
  - post-cardiac surgery, MI, myocarditis, pericarditis, cardiomyopathy
- Results in
  - decreased atrial filling time --
  - areas of diminished blood flow near atrial walls --> "mural thrombi" along atrial walls --> break off -->
  - Short-lived - rapidly deteriorates into atrial fibrillation or spontaneously returns to patient’s previous rhythm
- Symptoms - palpitations, rapid heart rate, chest pain, shortness of breath, light headedness, fatigue, and low blood pressure

Atrial Flutter

- Treatment
  - control of the ventricular rate (drugs that block AV node)
  - calcium channel blockers (eg, verapamil, diltiazem) or beta-blockers, adenosine, digoxin
  - restoration of sinus rhythm
    - radiofrequency ablation, electrical cardioversion, chemical cardioversion
  - prevention of thromboembolic complications
    - Coumadin
Atrial Fibrillation

- Caused by
  - same causes as atrial flutter
  - hyperthyroidism
  - pulmonary disease
  - congenital heart disease

- Results in
  - no help with ventricular filling
  - areas of diminished blood flow near atrial walls → "mural thrombi" along atrial walls → break off → PTE
Atrial Fibrillation

- Treatment
  - _______________
  - anticoagulation - aspirin, Coumadin
  - rate control - calcium channel blockers (eg, verapamil, Cardizem) or beta-blockers, adenosine, digoxin
  - antiarrhythmic meds (quinidine, procainamide, amiodarone)
  - ablation
  - device implants - atrial pacers
  - _________________________________*****

Atrial Tachycardia

- REGULAR -
  - RATE -
  - P WAVES -
  - PRI -
  - QRS -
Atrial Tachycardia

- Occurs when an ectopic focus in the atrium over-rides the SA node and paces the heart → _________________
- Comes and goes spontaneously & abruptly
- Causes
  - emotional stress, mitral valve disease, rheumatic heart disease, digitalis toxicity, alcohol, caffeine, nicotine
- Result
  - increases myocardial oxygen demand
  - reduces ventricular filling time
- Symptoms
  - light-headedness
  - palpitations
  - syncope

Treatment

- __________________________
- __________________________
- chemical ___________________ (adenosine)
- ca channel blocker drugs (Verapamil), digitalis
- electric _____________________
- ablation
- __________________________
Premature Atrial Contraction

Causes
- CHF, ischemia and ___________________
- Can lead to more serious atrial dysrhythmias
- May feel palpitation
- Are common
- Almost always ___________________
- No special treatment needed
- Can be exacerbated by certain substances (e.g., alcohol, decongestants, caffeine, nicotine)
# Heart Blocks

1° Heart Block
2° Heart Block Type I (Wenckebach)
2° Heart Block Type II (Mobitz II)
3° Heart Block

<table>
<thead>
<tr>
<th>RHYTHM</th>
<th>REGULARITY</th>
<th>RATE</th>
<th>P WAVES</th>
<th>PRI</th>
<th>QRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1°</td>
<td>Usually regular</td>
<td>Depends on underlying rhythm</td>
<td>uniform, upright, 1:1</td>
<td>&gt;0.20 sec</td>
<td>&lt;0.12 sec</td>
</tr>
<tr>
<td>2° Type I Wenckebach</td>
<td>Irregular</td>
<td>Normal to slow</td>
<td>uniform, upright, &gt;1:1</td>
<td>increases until a QRS is dropped</td>
<td>&lt;0.12 sec</td>
</tr>
<tr>
<td>2° Type II Mobitz</td>
<td>Regular or irregular</td>
<td>Usually bradycardic</td>
<td>uniform, upright, &gt;1:1</td>
<td>constant for conducted beats</td>
<td>normal or widened</td>
</tr>
<tr>
<td>3°</td>
<td>Regular</td>
<td>Usually bradycardic</td>
<td>uniform, upright, &gt;1:1, no relation to QRS</td>
<td>no relationship</td>
<td>&lt;0.12 seconds if junctional pacemaker, &gt;0.20 if ventricular</td>
</tr>
</tbody>
</table>
1° Heart Block

- Caused by
  - conduction delay through the AV node but all electrical signals reach the ventricles
  - digitalis can slow conduction of the impulse from the atria to the ventricles
  - hyperkalemia
  - well-trained athletes may have it
  - rarely causes any problems

- treatment _____________________
2° Heart Block Type I (Wenckebach)

REGULAR -
RATE -
P WAVES -
PRI -
QRS -

- May or may not compromised cardiac output
- Can cause ___________________
- Same causes as 1° heart block
- No specific treatment
2° Heart Block Type II (Mobitz)

- Rarer, but more serious than Wenckebach
- Causes
  - damage to AV node (MI)
  - degenerative disease
- Symptoms
  - light-headedness
  - dizziness
  - syncope
- Treat promptly - can lead to complete heart block
  - ______________________
3° Heart Block (Complete)

None of the P waves are being conducted to ventricles, ventricles doing their own thing (not very well) - complete AV dissociation

Block occurs at the level of the AV node (20%), the bundle of His (60%), or the bundle-branch Purkinje system (20%)

Cause
- acquired
  - overdose AV-nodal, beta-adrenergic, and calcium channel blocking agents
  - anterior wall MI, cardiomyopathy, severe hyperkalemia
- congenital

Treatment
- _____________________