NORMAL SINUS RHYTHM

- **P wave**: atrial depolarization
  - $\leq 0.11$ sec
- **P-R interval**: AV conduction time
  - $0.12 - 0.20$ sec (3-5 boxes)
- **QRS complex**: ventricular depolarization, atrial repolarization
  - $\leq 0.10$ sec (2.5 boxes)
- **T wave**: ventricular repolarization

WAYS TO COUNT HEART RATE

1. **Count from R to R in a 4 sec strip**
   - Multiply by 10
   - Must have regular rhythm
   - Example: 8 R waves $\times 10 = 80$ bpm

2. **Count # of small squares between 2 R waves**
   - Divide 1500 by that #
   - Example: $1500 / 22$ squares $= 68$ bpm

3. **Count # of large squares between 2 R waves**
   - Divide 300 by that #
   - This is an approximation
   - Example: $300 / 4$ squares $= 75$ bpm

4. **Quick count method**
   - Find an R wave that occurs on a dark line
   - Count down 300, 150, 100, 75, 60, 50, 43
   - Must have regular rhythm
   - R wave in between 100 & 75, with 5 boxes in between
   - $100 - 75 = 25$
   - $25 / 5$ boxes $= 5$ per box
   - R wave is 1 box before 75
   - $75 + 1(5) = 80$ bpm
**RHYTHM INTERPRETATION**

**SINUS BRADYCARDIA**
- Heart Rate: < 40 bpm
- Rhythm: Regular
- P wave: Before each QRS, identical
- PR interval: < .12 - .20 sec
- QRS: < .12 sec
- Clinical Implications:
  - Caused by lack of sympathetic input, medication, or physical training

**SINUS TACHYCARDIA**
- Heart Rate: > 100 bpm
- Rhythm: Regular
- P wave: Before each QRS, identical
- PR interval: < .12 - .20 sec
- QRS: < .12 sec
- Clinical Implications:
  - Caused by a demand for cardiac output

**ATRIAL FLUTTER**
- Heart Rate: A [220 - 430 bpm], V [< 300 bpm]
- Rhythm: Regular or variable
- P wave: Sawtoothed appearance
- PR interval: N/A
- QRS: < .12 sec
- Clinical Implications:
  - Causes: Age, cardiac conditions, digoxin toxicity, renal failure
  - Serious rhythm, although stable
  - Potential for developing emboli
  - Anticoagulant therapy

- Sawtoothed P wave is the classic sign of atrial flutter

**ATRIAL FIBRILLATION**
- Heart Rate: A [350 - 650 bpm], V [Slow - Rapid]
- Rhythm: Irregular
- P wave: Fibrillatory (Fine to coarse)
- PR interval: N/A
- QRS: < .12 sec
- Clinical Implications: Same as atrial flutter

- R waves are consistently inconsistent (multiple ectopic foci firing)
**Ventricular Tachycardia**

Heart Rate: < 100 bpm
Rhythm: Regular
P wave: Absent or not related
PR interval: N/A
QRS: > 0.12

Clinical Implications:
- Causes: Ischemia, acute MI, CAD, hypertensive heart disease, medicine toxicity
- Symptoms: Lightheadedness, syncope, weak and thready pulse
- Emergency Situation: \\& CO \\& PR
- May progress to v-fib \\& death
- Tx: meds, cardioversion, defibrillation

*Stimulation is not from the SA node, so no P wave*

**Ventricular Fibrillation**

Heart Rate: 300 - 600 bpm
Rhythm: Extremely irregular
P wave: Absent
PR interval: N/A
QRS: Fibrillating baseline

Clinical Implications:

**Atrial Fibrillation**

**1st Degree AV Block**

Heart Rate: 60 - 100 bpm
Rhythm: Regular
P wave: Before QRS, identical
PR interval: > 0.20
QRS: > 0.12
PREMATURE ATRIAL CONTRACTIONS

- Heart Rate: irregular
- Rhythm: regular
- P wave: present but looks abnormal
- L may be buried in preceding T wave

Clinical Implications:
- Causes: emotional stresses, infection, caffeine, nicotine, alcohol, hypokalemia, myocardial ischemia, rheumatic heart disease, atrial damage

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PREMATURE VENTRICULAR CONTRACTIONS:
- Impulse in myocardium of one of the ventricles

**PVC: Couplet**

**PVC: Triplet**

**PVC: Bigeminus**
- Abnormal wave - every other one

**PVC: Trigeminus**
- Abnormal wave - every 3rd wave

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- Heart Rate: irregular
- Rhythm: 2:1
- P wave: absent
- PR interval: 2:1
- QRS: wide & bizarre

Clinical Implications:
- Skipped beat can be palpated when checking pulse
- Causes: caffeine/nicotine, stress/overexertion, electrolyte imbalance/acid-base imbalance, cardiac diseases, irritation of myocardium, pharmacological toxicity, ischemia
- Most common ventricular conduction abnormality
- Benign/dangerous
- Concerning if ventricular ectopy increases w/activity
  - ↑ activity = ↑ irritability
  - 3 or more PVCs in a row = ventricular tachycardia