NOTES
PREMATURE CONTRACTION

GENERALLY, WHAT IS IT?

PATHOLOGY & CAUSES

- Depolarizing potential from anywhere in heart other than sinoatrial (SA) node → contraction earlier than normal in cardiac cycle
- Triggered activity
  - Cells triggered by preceding action potential after repolarization
  - *Cause:* reperfusion therapy after myocardial infarction/digoxin toxicity
- Ectopic focus
  - Cells irritated by electrolyte imbalances, drugs, ischemic damage → increased sympathetic activity → enhanced automaticity → early depolarization
- Reentrant loop
  - Tissue unable to depolarize (e.g. scar tissue, amyloid) → no signal conduction → depolarizing wave obstructed → depolarizing wave circles tissue → abnormal electrical circuit

CAUSES

- Often idiopathic
- Electrolyte imbalances (hypokalemia, hypercalcemia, hypomagnesemia)
- Recreational/prescription drugs (methamphetamines, cocaine, digoxin intoxication)
- Alcohol use
- *Heart dilation:* cardiomyopathies, cor pulmonale
- *Heart scarring:* after myocardial infarction, myocarditis

COMPLICATIONS
- Rarely atrial/ventricular fibrillation

SIGNS & SYMPTOMS

- Usually asymptomatic
- *In case of frequent premature contractions:* lightheadedness, palpitations

DIAGNOSIS

OTHER DIAGNOSTICS
- ECG
- Holter monitor
- ZIO patch

TREATMENT

- See individual disorders

PREMATURE ATRIAL CONTRACTION (PAC)

osms.it/premature-atrial-contraction

PATHOLOGY & CAUSES

- Contraction of atria earlier than normal in cardiac cycle
- *Atrial bigeminy:* premature atrial contraction consistently occurs after each normal cardiac cycle
- *Atrial trigeminy:* premature atrial contraction consistently occurs after every two normal cardiac cycles

CAUSES
- Heart structural disorders, intoxication, electrolyte imbalances

COMPLICATIONS
- Atrial fibrillation

SIGNS & SYMPTOMS

- Usually asymptomatic
- In case of frequent premature contractions: lightheadedness, palpitations

DIAGNOSIS

OTHER DIAGNOSTICS

ECG
- Early, abnormal P wave
  - Ectopic focus in bottom of atria → negative P wave
  - Ectopic focus closer to atrioventricular (AV) node → PR interval shorter
  - P wave, T wave overlap

- Noncompensatory pause
  - Premature impulse enters sinoatrial (SA) node → shortens cycle
  - Distinct from compensatory pause: premature ventricular contraction → premature impulse does not reach SA node → if AV node still refractory, pauses → lengthens cycle
- Normal QRS
  - Premature impulse reaches AV node in refractory → blocked premature atrial contraction → QRS nonexistent
- Ashman phenomenon
  - R-R interval prolongs → increases refractory period of right bundle branch → abnormal conduction of subsequent impulse → right bundle branch block on ECG
- Holter monitor
  - 24h, detect premature contractions

TREATMENT

- Typically requires no treatment

MEDICATIONS
- *If symptomatic:* beta blockers/calcium channel blockers
- Electrolyte replacement

SURGERY
- *If triggering atrial fibrillation:* radiofrequency catheter ablation
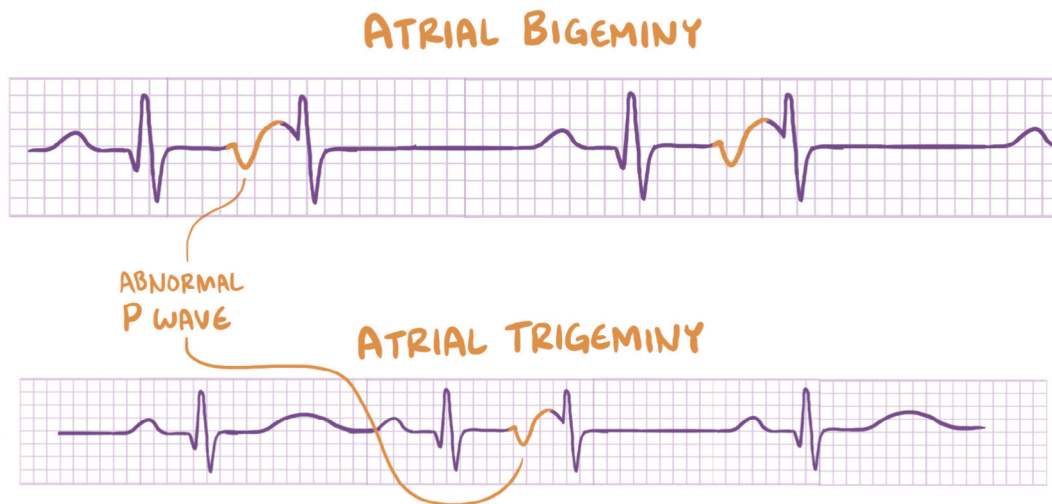
ATRIAL BIGEMINY

ABNORMAL
P WAVE

ATRIAL TRIGEMINY

Figure 17.1 Illustration depecting abnormal P wave in atrial bigeminy and trigeminy.

PREMATURE ATRIAL CONTRACTION

ATRIA CONTRACT **EARLY**
└ from ECTOPIC FOCUS

* **NORMAL** CONDUCTION
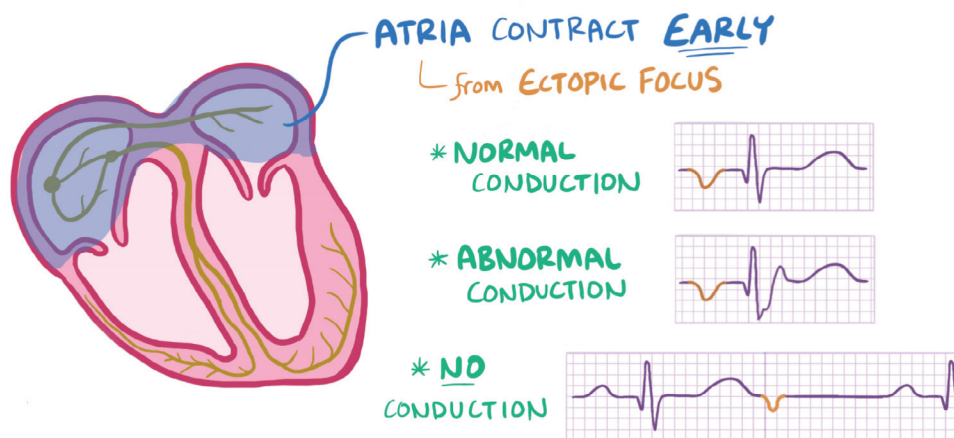
* **ABNORMAL** CONDUCTION

* **NO** CONDUCTION

Figure 17.2 Illustration comparing normal ECG tracing vs ECG tracing with premature atrial contraction.

PREMATURE VENTRICULAR CONTRACTION (PVC)

osms.it/premature-ventricular-contraction

PATHOLOGY & CAUSES

- Contraction of ventricles earlier than normal in cardiac cycle
- Ectopic focus
  - *Latent pacemakers:* AV node, bundle of His/Purkinje fibers take over SA node's function of pacemaker
  - Irritated cardiac muscle cells → early depolarization
- Triggered activity
  - Ventricular repolarization → ventricle cells triggered by preceding action potential
  - *Cause:* reperfusion therapy after myocardial infarction/digoxin toxicity
- Reentrant loop
  - Tissue unable to depolarize (e.g. scar tissue, amyloid) → no signal conduction → depolarizing wave obstructed → depolarizing wave circles tissue → abnormal electrical circuit
- *Ventricular bigeminy:* premature ventricular contraction consistently comes after each normal cardiac cycle
- *Ventricular trigeminy:* premature ventricular contraction consistently comes after every two normal cardiac cycles

CAUSES

- Heart structural disorders, intoxication, electrolyte imbalances

RISK FACTORS

- Hypertension, smoking, exercise, stress, people of African descent (+30% risk), biological male

COMPLICATIONS

- Ventricular tachycardia, ventricular fibrillation, increased risk for sudden cardiac death

SIGNS & SYMPTOMS

- Can be asymptomatic
- Lightheadedness, palpitations

DIAGNOSIS

OTHER DIAGNOSTICS

ECG
- *Wide, bizarre QRS:* signal goes through ventricular muscle, not normal conduction pathway → conduction is slower than normal
- Ectopic impulse in right ventricle
  - Left bundle branch block pattern of QRS complex
  - *V1:* large negative complex, dominating S wave
- Ectopic impulse in left ventricle
  - Right bundle branch block pattern of QRS complex
  - *V1:* large positive complex, dominating R wave

- *Abnormal ST segments*: deviation from isoelectric baseline in opposite direction from QRS complex
- Inverted T waves in leads, QRS complex predominantly positive
- *Nonexistent P wave*: covered by wide QRS complex
  - QRS followed by compensatory pause
- *Ventricular fusion beat*: premature QRS complex occurs during PR segment, combines with normal depolarization wave
- *R-on-T phenomenon*: premature QRS complex occurs at/near T wave apex
- Holter monitor

TREATMENT

- Typically requires no treatment

MEDICATIONS
- *If symptomatic*: venodilators, calcium channel blockers, administer beta blockers with caution

SURGERY
- *If triggering ventricular arrhythmias*: radiofrequency catheter ablation to destroy ectopic focus/replacement if necessary

OTHER INTERVENTIONS
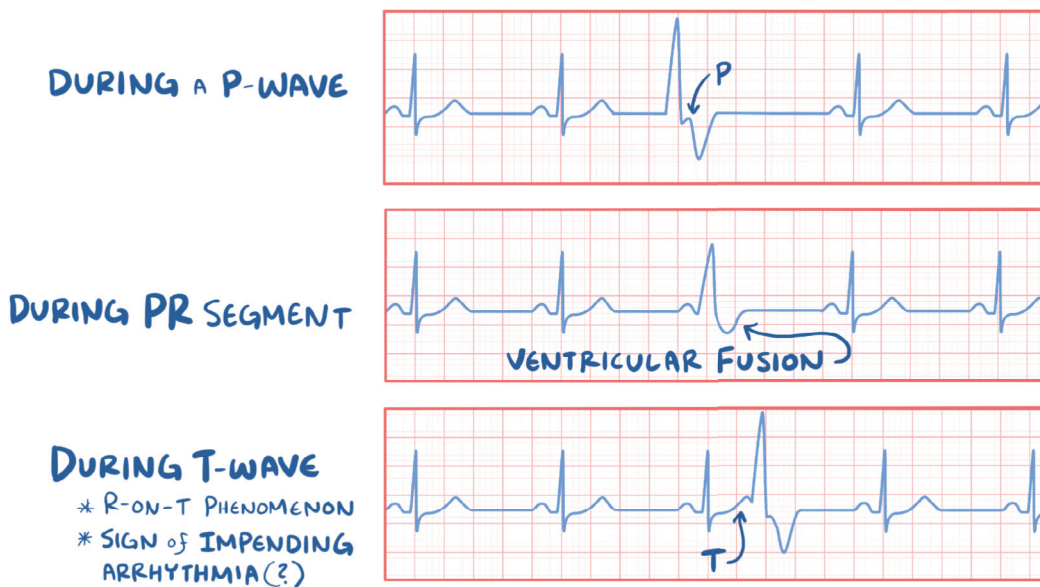- If mild, no exercise restrictions; if severe, reduced physical activity

DURING A P-WAVE

DURING PR SEGMENT
VENTRICULAR FUSION

DURING T-WAVE
* R-ON-T PHENOMENON
* SIGN of IMPENDING ARRHYTHMIA(?)
T

Figure 17.3 Illustration comparing premature ventricular contractions that occur during a P wave, during a PR segment, and during a T wave.

VENTRICULAR BIGEMINY
* PVC AFTER EACH CARDIAC CYCLE

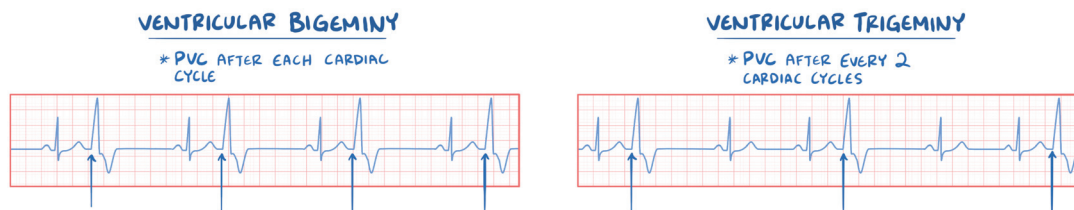VENTRICULAR TRIGEMINY
* PVC AFTER EVERY 2 CARDIAC CYCLES

Figure 17.4 Illustration comparing ventricular bigeminy and trigeminy.