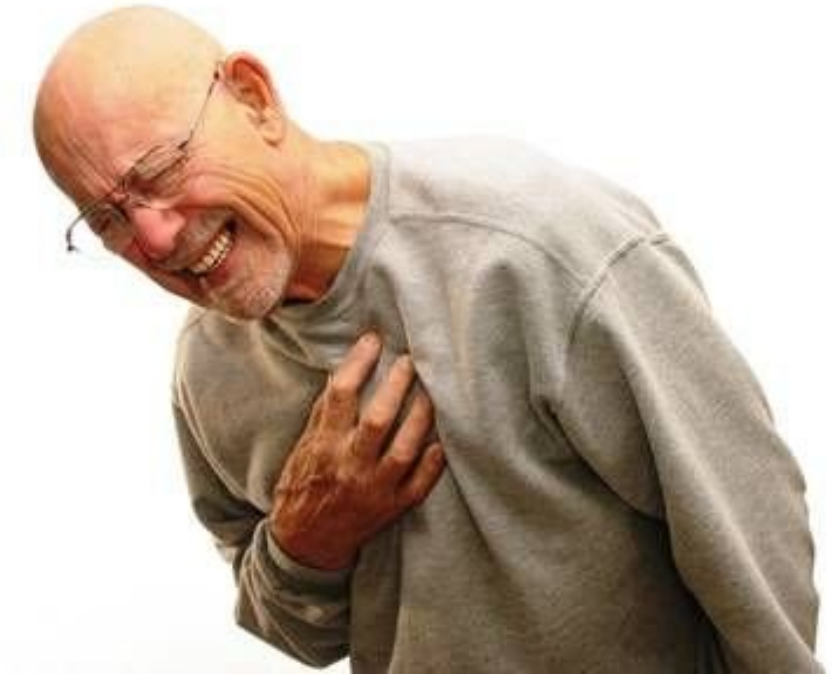
Arrhythmia and its Mitochondrial Causes

What is Arrhythmia?

- Latin name: no rhythm
- Arrhythmia – mistiming of heartbeat
- Types:
  - Bradycardias – Slow beat
  - Tachycardias – Fast beat
  - Fibrilation – Rapid, chaotic impulses

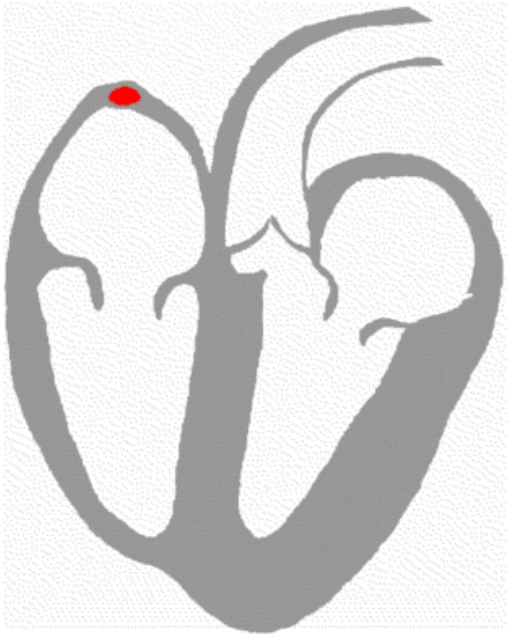
Causes

- Heart attack
  - Heart scarring
- Cardiomyopathy – heart muscle damage
- Coronary artery disease – clogged heart arteries
- Genetic factors



Biological Properties

- One cause: hypoxia – low oxygen
- Heart beat managed by electrical signals
  - Signals generated by electrical potential
    - Potential created by concentration gradient of ions
    - Hypoxia causes channels to open – depolarization
    - Disruption of electrical signal disrupts heart beat



Mitochondrial Involvement

- sarcKATP channels – maintain potassium ion gradient
  - Opened by presence of ADP
  - Failure in mitochondria prevents ATP regeneration, leads to sarcKATP channel opening

Metabolic Properties

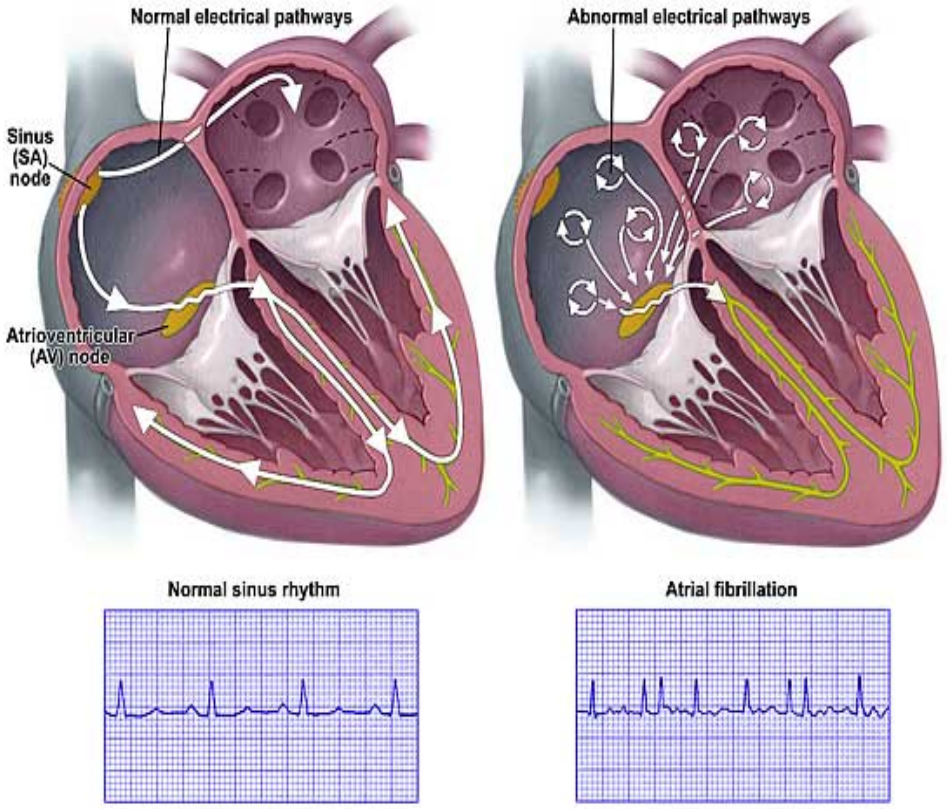
- Hypoxia causes release of free fatty acids (FFA)
  - Increases oxygen demand
  - Hemolysis (rupture) of red blood cells
  - Detergent effects – breaks lipid membranes
    - Causes ion concentration gradient to leak

Symptoms

- Minor: Unusual heart beat
  - Slow beat
  - Irregular beat
  - Pauses between beats
- Minor cases – not life-threatening
- Serious: Low blood supply
  - Dizziness
  - Fainting
  - Short Breath
  - Chest Pains
- Anemia-like symptoms

Mitochondrial Involvement

- Ion concentration gradient within mitochondria
  - Concentration gradient necessary for electrical signals
  - Ions gated by channels
    - Opening of channels – loss of potential
    - Arrhythmia treated by inhibiting channels



Heartbeat is controlled by electrical signals; arrhythmia is a disruption to these signals that affect the timing of the heartbeat.

Treatments

- Medication
  - Beta blockers
  - Channel blockers
- Medical Procedure
  - Pacemaker implant
- Surgery
  - Maze surgery
    - Cuts, burns in heart to limit path of electric signals

Sources cited

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