Other Cardiac Conditions and the ECG

Fast & Easy ECGs – A Self-Paced Learning Program
Other Cardiac Conditions

• Many conditions cause changes to the ECG
  – Electrolyte abnormality
  – Ischemia
  – Infarction
  – Inflammation
  – Medications
Pericarditis

- Inflammation of pericardium

Effects of pericarditis on the heart

Enlarged view

Normal pericardium

Inflamed pericardium
ECG Changes in Pericarditis

- T wave initially upright and elevated but then during recovery phase it inverts
- ST segment elevated and usually flat or concave
Pericardial Effusion

- Can occur with pericarditis
- Can cause low-voltage QRS complexes in all leads and electrical alternans
Electrical Alternans

- QRS complexes change in height with each successive beat
Pulmonary Embolism

• Acute blockage of one of the pulmonary arteries
• Leads to obstruction of blood flow to the lung segment supplied by the artery
• Produces large S wave in lead I, deep Q wave in lead III, inverted T wave in lead III
  – Called the S1 Q3 T3 pattern
Pulmonary Embolism

- Large S wave in lead I
- Large Q wave in lead III with T wave inversion
- ST segment depression in lead II
- Right bundle branch block in leads V1-V4
- T wave inversion in leads V1-V4
Pacemakers

• Implanted pacemakers regulate heart rate
• Patients often have:
  – A condition which causes the heart rate to occasionally slow down
  – A complete heart block where the ventricular escape rate is too low
• Artificial devices produce an impulse and convey it to the myocardium
Pacemakers

• Firing of a pacemaker produces one or two small spikes on the ECG
Electrolyte Imbalances

- Increases or decreases in potassium and calcium serum levels can have a profound effect on the ECG
Hyperkalemia

- Key characteristics include:
  - T wave peaking
  - Flattened P waves
  - 1st-degree AV heart block
  - Widened QRS complexes
  - Deepened S waves
  - Merging of S and T waves
Hyperkalemia

Normal

Sodium-potassium pump

Cell membrane

Cell interior

– Charge

+ Charge

With hyperkalemia

Sodium-potassium pump

Increased serum potassium levels

As serum potassium levels increase more

With excessive serum potassium levels

Widened QRS complexes and peaked T waves become almost indistinguishable, forming what are described as a "sine-wave pattern"

Peaked, narrow T waves in all leads

T wave peaking increases, P waves flatten and QRS complexes widen

Widened QRS complexes and peaked T waves become almost indistinguishable, forming what are described as a "sine-wave pattern"
Hypokalemia

• Key ECG characteristics include:
  – ST segment depression
  – Flattening of the T wave
  – Appearance of U waves
Hypokalemia
Hypocalcemia

- QT interval slightly prolonged
Digoxin

- Slows influx of sodium while allowing a greater influx of calcium
- Increases myocardial contractility and improves the heart’s pumping ability
- Slows heart rate and AV conduction
- Useful in the treatment of fast atrial dysrhythmias
Digoxin

- Gradual downward curve of the ST segment
Digoxin

- Very narrow therapeutic margin
- Excreted from the body slowly
- Excessive levels can cause slower heart rates, faster heart rates and PVCs
Practice Makes Perfect

- Determine the type of condition

Identify if pulmonary embolism, low-amplitude waveforms, electrical alternans, pacemaker, electrolyte imbalance, or digitalis use are present.
Practice Makes Perfect

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Identify if pulmonary embolism, low-amplitude waveforms, electrical alternans, pacemaker, electrolyte imbalance, or digitalis use are present.
Summary

• Pericarditis is an inflammation of the pericardium.

• In pericarditis the T wave is initially upright and elevated but then during the recovery phase it inverts. The ST segment is elevated and usually flat or concave.

• Substantial pericardial effusion can occur with pericarditis and produce ECG changes which include low voltage QRS complexes in all leads and electrical alternans.
Summary

• A pulmonary embolism is an acute blockage of one of the pulmonary arteries.

• Characteristic ECG changes seen with massive pulmonary embolus include a large S wave in lead I, a deep Q wave in lead III and an inverted T wave in lead III.
Summary

• A pacemaker is an artificial device that produces an impulse and conveys it to the myocardium.

• The firing of a pacemaker produces one or two small spikes on the ECG.

• Increases or decreases in the potassium and calcium serum levels can have a profound effect on the ECG.

• Key characteristics of hyperkalemia include T wave peaking, flattened P waves, 1\textsuperscript{st}-degree AV heart block, widened QRS complexes, deepened S waves and merging of S and T waves.
Summary

- Key ECG characteristics of hypokalemia include ST segment depression, flattening of the T wave and appearance of U waves.

- In hypocalcemia the QT interval is slightly prolonged.

- Digoxin slows the influx of sodium while allowing a greater influx of calcium.

- A characteristic gradual downward curve of the ST segment is seen with digoxin.