Interpretation of Abnormal EKGs

Learning to interpret EKGs accurately will take time and practice. Using a systematic approach will help in this process, but it is never an exact process. Review the steps and associated questions before moving on to practice analyzing a few abnormal EKG tracings.

Basics
- Does the patient’s name and DOB match the information on the EKG?
- What is the patient’s age and sex?
- Does the EKG have good technical quality—lead placement, skin prep, calibration, no artifacts?
- How does the EKG compare to any prior EKGs from this patient?

Rhythm
- Is the rhythm regular or irregular?
- Can you see atrial activity?
- Is there a P-QRS relationship?

Rate
- Calculate the heart rate using sequencing or 6-second strip method.
- Is the rate normal, 60–100 bpm?
- Is the rate bradycardic, < 60 bpm?
- Is the rate tachycardic, > 100 bpm?

P-wave
- Is the P-wave upright in lead II?
- Is the P-wave negative in lead V1?

PR, QRS, QT Intervals
- Is the PR interval 0.12–0.20 seconds? If not, is it prolonged or shortened?
- Is the QRS complex ≤ 0.10 seconds, or is it wider?
- Is the corrected QT interval normal?

QRS, ST-T Changes
- Is a Q-wave present?
- Is the Q-wave normal (< 0.04 seconds wide and < 1/3 the height of the QRS complex)?
- If abnormal (pathologic) Q-waves are present, in which anatomic distribution?
- Is the QRS complex amplitude normal or increased?
- Do you see evidence of left ventricular hypertrophy?
- Is the ST segment elevated, depressed, or isoelectric? Does the ST segment indicate ischemia or injury?
- Is the T-wave upright or inverted?

Abnormal Patterns
- Do you see any evidence of arrhythmias?
- Do you see any evidence of ischemia or myocardial infarction?
- Do you see any evidence of conduction disturbances?

Remember to use every opportunity to practice interpreting EKGs. Skill comes with repetition. Learn from those around you with more experience and greater skill.
This image is an abnormal EKG tracing. Apply each step by asking the questions and calculating the intervals.

**Basics**
This image does not include data about the patient, so there is nothing to verify in that respect. The image does not show any evidence of technical issues such as lead placement, skin prep, calibration, or artifacts.

**Rhythm**
The rhythm is consistent and regular. P-waves are visible. Every P-wave is followed by a QRS complex and every QRS complex is preceded by a P-wave.

**Rate**
The heart rate is approximately 60 bpm, which is barely within the normal range.

**P-wave**
Upright P-waves are visible in lead II and biphasic in V1 (normal variant).

**Intervals**
The PR-interval is 0.24 seconds, which is prolonged but constant. This is indicative of a 1st degree AV block. The QRS complex is 0.08 seconds and is normal, as is the QT interval.

**Changes**
No evidence of left ventricular hypertrophy exists. The ST segment is isoelectric and the T-wave is upright. The QRS complex, though, has poor R-wave progression across the precordium. Normal QRS progression across the precordium is demonstrated by a negative QRS in V1, a mostly isoelectric QRS (half the QRS is positive and half is negative) in V3, and a completely positive QRS in V6. This tracing is mostly negative QRS complexes until V6, thus poor R-wave progression. It is a normal finding, typically in female patients.

**Patterns**
No abnormal patterns of arrhythmia, ischemia, or myocardial infarction appear.

**Interpretation**
NSR, 1st degree AV block, poor R-wave progression
Here is another abnormal EKG to analyze. Compare your interpretation to the table below.

<table>
<thead>
<tr>
<th>Basics</th>
<th>This image also includes no data about the patient, so there is nothing to verify in that respect. The image does not show any evidence of technical issues such as lead placement, skin prep, calibration, or artifacts.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhythm</td>
<td>The rhythm is consistent and regular. No P-waves are visible.</td>
</tr>
<tr>
<td>Rate</td>
<td>The heart rate is approximately 160–170 bpm, which is far outside the normal range and indicates tachycardia.</td>
</tr>
<tr>
<td>P-wave</td>
<td>Since P-waves are not visible, there is nothing to record.</td>
</tr>
<tr>
<td>Intervals</td>
<td>Since P-waves are not visible, the PR interval isn’t measureable. The QRS complex is wide and bizarrely shaped.</td>
</tr>
<tr>
<td>Changes</td>
<td>ST segments and T-waves are not visible because of the fast rate. The T-waves are likely hidden in the QRS complexes.</td>
</tr>
<tr>
<td>Patterns</td>
<td>Ventricular tachycardia is the presenting pattern.</td>
</tr>
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<td>Interpretation</td>
<td>Ventricular tachycardia</td>
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### Basics
This image also does not include data about the patient, so there is nothing to verify in that respect. The image shows no evidence of technical issues such as lead placement, skin prep, calibration, or artifacts.

### Rhythm
The rhythm is irregular with no discernible P-waves.

### Rate
The heart rate is approximately 100 bpm, which is just outside the normal range and indicates tachycardia.

### P-wave
Since P-waves are not visible, there is nothing to record.

### Intervals
Since P-waves are not visible, the PR interval isn’t measureable. The QRS complex is 0.16 seconds, which is wider than normal, with an RsR’ pattern (rabbit ears) anteriorly with S-waves laterally. This is indicative of a right bundle branch block (RBBB). QT interval appears normal.

### Changes
You cannot really analyze ST segments in the case of bundle branch blocks. T-waves have nonspecific changes called a strain pattern, which is typical in bundle branch blocks.

### Patterns
Atrial fibrillation is presented in this tracing.

### Interpretation
Atrial fibrillation and RBBB
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![EKG Image](image)

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<td>Rate</td>
<td>Unable to accurately determine the rate.</td>
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<td>P-wave</td>
<td>Since P-waves are not visible, there is nothing to record.</td>
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<td>Intervals</td>
<td>Since P-waves are not visible, the PR interval isn’t measureable. The QRS complex is also not measureable, but is wider than normal with a bizarre shape. No QT-interval is discernible.</td>
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<td>Changes</td>
<td>You cannot really analyze ST segments or T-waves in this tracing.</td>
</tr>
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<td>Patterns</td>
<td>Ventricular fibrillation is presented in this tracing.</td>
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<td>Interpretation</td>
<td>This tracing shows ventricular fibrillation. Urgent defibrillation is required to attempt to shock the heart back into a normal rhythm.</td>
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<td>Changes</td>
<td>ST segments and T-waves appear normal.</td>
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<td>No abnormal patterns of arrhythmia, ischemia, myocardial infarction, or conduction disturbances appear.</td>
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<td>Interpretation</td>
<td>This tracing shows a dual-chamber pacemaker. The atria and ventricles are both paced. In a paced EKG, conduction delays such as AV blocks or signs of ischemia (ST or T changes) cannot be determined.</td>
</tr>
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