ECG Puzzler

Scenario: At 35 years old, all commercial pilots are required by the Federal Aviation Administration to have an annual exam. Specifically, pilots must have a baseline electrocardiogram (ECG) at 35 and then an annual ECG after 40 years of age. You are scheduled on a flight to Reno, Nevada and this is your 52-year-old male pilot’s resting 12-lead ECG. Are you worried?

Interpretation Questions:

1. Is the ECG properly calibrated (10 mm) and are leads properly placed? ❑ Yes ❑ No ❑ NA
   If no, interpret cautiously.
2. Is this a sinus rhythm (one P wave preceding every QRS complex)? ❑ Yes ❑ No ❑ NA
   If no, check for number of P waves in relation to QRS complexes.
3. Is the heart rate (R-R interval) normal (60-100/min)? ❑ Yes ❑ No ❑ NA
   If no, check for supra-ventricular or ventricular arrhythmias.
4. Is the QRS complex narrow (duration < 110 milliseconds [ms] in V1)? ❑ Yes ❑ No ❑ NA
   If no, check for bundle branch blocks (BBBs), pacing, or ventricular arrhythmia.
5. Is the ST segment deviated (> 2 mm in V2-V3, or > 1 mm in other leads)? ❑ Yes ❑ No ❑ NA
   If yes, check for similar deviations in contiguous cardiac territories.
6. Is the T wave inverted in relation to the QRS (> 0.5 mV)? ❑ Yes ❑ No ❑ NA
   If yes, check for ST deviation or conduction abnormalities.
7. Is the QT interval lengthened (> 450 ms [women] or > 470 ms [men])? ❑ Yes ❑ No ❑ NA
   If yes, check for ventricular arrhythmias or left ventricular hypertrophy.
8. Is R or S wave amplitude enlarged (S wave V1 + R wave V5 > 35 mm)? ❑ Yes ❑ No ❑ NA
   If yes, check for axis deviation or other chamber hypertrophy criteria.

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Interpretation

This 12-lead ECG shows normal sinus bradycardia at 55/min. There are many ways to approach the interpretation of an ECG including the following 10 considerations:

- PR interval should be 120 to 200 milliseconds or 3 to 5 little squares
- The width of the QRS complex should not exceed 110 milliseconds, less than 3 little squares
- The QRS complex should be dominantly upright in leads I and II
- QRS and T waves tend to have the same general direction in the limb leads
- All waves are negative in lead aVR
- The R wave in the precordial leads must grow from V₁ to at least V₄ and the S wave in the precordial leads must grow from V₁ to at least V₃ and disappear in V₆
- The ST segment should start isoelectric except in V₁ and V₂ where it may be elevated
- The P waves should be upright in leads I, II, and V₂ to V₆
- There should be no or only small (40 ms in width) Q wave in leads I, II, V₂ to V₆
- The T wave must be upright in leads I, II, V₂ to V₆.

Rationale

Widespread ECG screening of asymptomatic adults for inherited and acquired disease remains controversial because, although the ECG is a sensitive test and its negative predictive value is high, the low prevalence of disease makes screening on a population-wide basis plagued with problems. These problems include high false-positive rates, additional testing costs, potentially unnecessary interventions/therapies, and unwarranted anxiety. However among some populations, which include airline pilots, there is consensus that ECG screening should be routinely performed because the benefits outweigh the risks.

Nursing Actions

You should not be concerned about your pilot flying you to Reno because he is clear for takeoff.

Answers:

1. Proper calibration, note calibration mark on the left side of ECG
2. Sinus rhythm with 1:1 P to QRS ratio
3. Heart rate is regular, 55/min
4. QRS duration is narrow (< 11 ms)
5. No ST segment deviation
6. No T wave inversion
7. QT interval is < 470 seconds
8. No signs of left ventricular hypertrophy
ECG Screening of Special Populations
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