A 20-year-old female college student presents to the college health service with complaints of an irregular heart rate. She does not have any known cardiac disease but has noted palpitation in the past. However, the palpitations have lasted for only 1 to 2 hours and have been infrequent. She has never seen a physician for these palpitations. However, she has never noted her heartbeat to be irregular.

The rhythm in ECG A is irregular, and there is no pattern to the irregularity. Therefore, the rhythm is irregularly irregular. There are only 3 supraventricular rhythms that are irregularly irregular: sinus arrhythmia (1 P-wave morphology and stable PR interval); wandering atrial pacemaker (or multifocal atrial rhythm), which has a rate <100 bpm, or multifocal atrial tachycardia, which has a rate >100 bpm (≥3 different P-wave morphologies without any 1 dominant P wave); or atrial fibrillation (no organized atrial activity). There are no organized P waves noted before any of the QRS complex; hence, this is atrial fibrillation. Two different QRS complex morphologies are noted. The narrow complexes (complexes 6, 12, and 14; +) have a normal duration and morphology. The wide QRS complexes (duration, 0.16 second; *) have a tall R wave in lead V1, but the morphology is not typical for a right bundle-branch block nor do they resemble a left bundle branch block. Therefore, they do not have a morphology typical for aberration due to a bundle branch block. In addition, there is positive concordance across the precordium (ie, tall R wave in V1-V6). These features are seen with direct myocardial activation (ie, QRS complex that is ventricular, paced or due to Wolff-Parkinson-White). The QRS complexes are very irregular and are therefore not likely ventricular in origin. There are no pacing stimuli seen. More important, there is no relationship between QRS complex width (duration) and rate (or RR interval). It can be seen that there are narrow complexes associated with fast rates (short RR intervals) (? ) and wide QRS complexes at slow rates (long RR intervals; ↔). This is not seen with typical rate-related aberration but is associated with an accessory pathway or pre-excitation, specifically Wolff-Parkinson-White syndrome.

ECG B is her baseline ECG, which was obtained after sinus rhythm was restored. The rhythm is regular at a rate of 60 bpm. There is a P wave before each QRS complex (+), and there is a stable but short PR interval (0.12 second). The P wave is positive in leads I, II, aVF, and V4 through V6. Hence, this is a normal sinus rhythm with a short PR interval. The QRS complex morphology is identical to what was seen in ECG A. The widened QRS complex is due to a “slurred” upstroke (↑), known as a delta wave. The delta wave is due to initial activation that is directly through the ventricular myocardium and thus slow; there is then fusion with later activation through the normal conduction system. The short PR interval and the delta wave are characteristic of a Wolff-Parkinson-White pattern. The presence of a Q wave in leads I and aVL (▲), and the positive delta wave in lead V1, are seen with a left lateral bypass tract. The QT/QTc intervals are slightly prolonged (480/480 milliseconds) but are normal when the prolonged QRS complex duration is considered (420/420 milliseconds). Because the QT interval includes the QRS complex, ST segment, and T wave, prolongation of the QRS complex duration needs to be considered when establishing the QTc interval. The amount of widening of the QRS complex that is above the normal width needs to be subtracted from the QT interval measurement before the QT is corrected for heart rate.

Please go to the journal’s Facebook page for more ECG Challenges: http://goo.gl/cm4K7. Challenges are posted on Tuesdays and Responses on Wednesdays.