Mary is a 31-year-old nulliparous female who presents at the ED with complaint of "racing heartbeat" which "comes and goes." Mary has no significant medical history beyond a recent case of COVID-19, one month prior, for which she was not hospitalized and received no treatment. She is currently negative for COVID-19 and fully vaccinated. She states that she does not take medications, does not use substances, and is not overly stressed or anxious. She is afebrile with no other signs of infection.

Mary reports that she has had palpitations "for years" but that the episodes have become "much more frequent" since being ill with COVID-19.

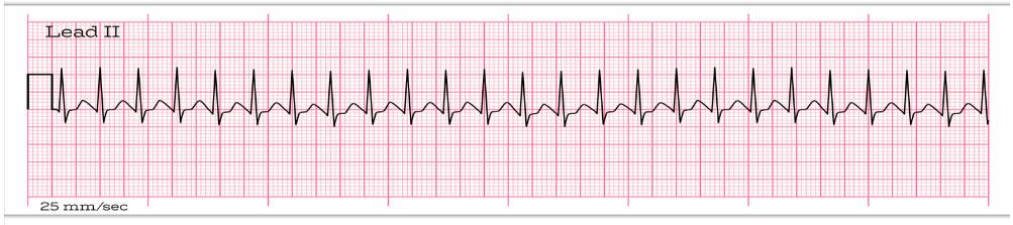
A 12-lead ECG is performed which shows normal sinus rhythm (NSR) with a rate of 80. There are no signs of pre-excitation markers, such as P-R interval and delta waves, which would suggest Wolff-Parkinson-White syndrome. (Page et al., 2016)

Mary is placed on continuous cardiac telemetry, blood pressure (BP) monitoring, and pulse oximetry. Telemetry shows NSR with heart rate in the 80s and the last BP is105/70. Respiratory rate is 17. The oxygen saturation on room air is 100%.

The nurse leaves the room to get supplies for blood testing and when she is walking back, she hears Mary's cardiac monitor alarm beep, very briefly. Mary tells the nurse that she had another "episode" which lasted about 4 seconds.

The telemetry monitor has recorded a 4 second strip which is as follows:

- *Heart rate 182*
- *Rhythm Regular*
- *P-waves not discernable*
- *QRS < 1.2 (narrow-complex QRS)*



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Correct Answers are circled in red:

1. Which of the following rhythms is indicated by the above:

    a. Atrial fibrillation
        i. This is unlikely as the rhyme is irregular in atrial fibrillation. This rhythm could possibly be atrial flutter, but the rate needs to be slowed to be able to distinguish flutter waves.

    b. Sinus tachycardia
        i. Sinus tachycardia is a sinus rhythm above 100 BPM. This is not the best answer as there are no discernable P waves. It is possible that the P waves are hidden in the previous T waves, but the rate needs to be slowed to determine where the electrical impulse originates. Furthermore, sinus tachycardia tends to remain between 100 and 150 BPM. (Supraventricular tachycardia (SVT) | ACLS-Algorithms.com. 2022).

    c. Supraventricular tachycardia
        i. Supraventricular tachycardia (SVT) is defined as any arrhythmia that originates above or at the bundle of His, ***excluding*** atrial fibrillation. SVT is characterized by a narrow QRS complex, a rate greater than 150 BPM, and non-discernable P waves. There are several different types of SVT. However, it is difficult or impossible to diagnose the type unless the rhythm can be slowed, as the rapid rate obscures distinguishing diagnostic features. (Supraventricular tachycardia (SVT) | ACLS-Algorithms.com. 2022).

    d. Ventricular tachycardia
        i. While ventricular tachycardia has a rate above 180 and lacks P waves, the rhythm generally has a wide QRS complex, as the impulse is generated from the ventricles. (Pulseless ventricular tachycardia | ACLS-Algorithms.com. 2022).

e. Ventricular fibrillation
    i. Ventricular fibrillation is a lethal rhythm signifying cardiac arrest and characterized by irregular waves of varying amplitude; a lack of identifiable P waves, QRS complexes, or T waves; and a rate of 150 to 500 BPM. (Buttner, 2022)

The nurse inserts an 18-guage intravenous catheter into the left antecubital vein, and then draws the following labs from the new line: a complete blood count, basic metabolic panel, troponin test, thyroid function test, and blood hCG test.

After drawing the blood, the nurse labels the specimens and prepares to send for testing. However, before the nurse is able to leave the room, the alarm rings again and the nurse looks at the monitor. The heartrate shoots up to the 190s and the rhythm is regular with narrow QRS and non-discernible P waves.

This time, the rhythm does not convert back to SR spontaneously and the BP starts to fall. The HR is sustained around 190 and the BP is now 90/50. Mary becomes tachypneic and anxious. The nurse calls a rapid response and sends the certified nurse assistant to get the crash cart.

2. What action would be appropriate to take next?
    a) The patient should be instructed to bear down, as if having a bowel movement, for 10 seconds.
        i) Bearing down stimulates the vagus nerve, which in turn, stimulates parasympathetic fibers in the heart muscle. Vagal maneuvers such as bearing down stimulate baroreceptors in the aortic arch and carotid bodies. Stimulating the baroreceptors causes bradycardia at the AV node and interrupts the reentry phenomenon that is causing the SVT. This is the first-line method to decrease the rate in SVT. (ACLS.com,2022)

    b) The patient should be given adenosine IV push.

i) This is not the first step in ACLS protocol for slowing SVT. (Page et al., 2016)

c) The patient should be told that the team needs to perform an immediate synchronized cardioversion.
   i) Synchronized cardioversion is indicated for unstable SVT when vagal maneuvers and adenosine are ineffective. Unstable SVT is present when the rapid heart rate reduces cardiac output to a degree that causes the patient to experience continuous chest pain and/or loss of consciousness. (Page et al., 2016)

d) As long as the patient is stable, it is ok to take a wait and see approach.
   i) Symptoms of stable SVT include shortness of breath, chest palpitations, dizziness, tachypnea, and numbness and tingling, while unstable SVT occurs when the patient experiences ongoing chest pain and/or loses consciousness. However, even when the patient is stable, in sustained SVT, attempts should be made to reduce the heart rate to prevent subsequent hemodynamic collapse. (Supraventricular tachycardia (SVT) | ACLS-Algorithms.com. 2022).

e) The patient should be prepared for electrical defibrillation.
   i) Defibrillation is not appropriate for converting SVT. (Supraventricular tachycardia (SVT) | ACLS-Algorithms.com. 2022).

The physician instructs the patient to bear down as if having a bowel movement, and then has her blow into an occluded straw for 15 seconds.

Neither of these vagal maneuvers are effective at converting the tachyarrhythmia to SR, and the patient complains of lightheadedness, and appears increasingly anxious. The oxygen saturation has dropped to 92%.

The nurse places 2 liters of O2 by nasal cannula on the patient, and the pulse oximeter now reads 98%. The physician orders a normal saline bolus of 500 ml, and 6 mg adenosine to see if this will convert the tachyarrhythmia. One nurse hangs and starts the normal saline bolus, and the primary nurse retrieves a syringe, prefilled with 6 mg adenosine from the crash cart. The pacing pads are attached to the defibrillator.

3. Select all that are correct:
    a. The adenosine should be pushed slowly so as to avoid a sudden drop in BP.
        i. Adenosine has a half-life of less than 10 seconds so slow IV push will not be effective as the medicine will be metabolized before it reaches the heart (Gartley, 2020).

    b. A central line should be placed as adenosine should only be delivered via central line.
        i. It is safer to give adenosine through a peripheral, rather than central line, because it has such a rapid effect that it can precipitate atrial fibrillation, ventricular fibrillation, or prolonged asystole (ACLS and Adenosine | ACLS-Algorithms.com, 2018).

    c. A stopcock should be placed at the IV port closest to the patient. The adenosine syringe is attached to one port on the stopcock, and a 10-ml normal saline flush is attached to a second port.
        i. Adenosine slows conduction through the AV node and interrupts reentry pathways, thus slowing the rhythm. However, with a half-life of less than 10 seconds, the medicine should be pushed over 2-3 seconds, and followed immediately with a rapid IV flush of 10 ml of normal saline. Adenosine has an extremely short half-life of less than ten seconds(Gartley,2020). Best practice is to have two people administer adenosine, with one pushing the medication and flush, and the other person quickly switching the stopcock (*Adenosine Indications for ACLS,* nd).

    d. The adenosine can be injected into a 50 ml NS piggy-back bag and delivered via quick infusion over 5 minutes.
        i. Adenosine delivered in this method would be degraded before it even reaches the heart, due to its very short half-life (Gartley, 2020).

    e. Adenosine may be helpful in diagnosing the type of SVT and to distinguish the rhythm from atrial fibrillation and atrial flutter.

i. There are several different types of SVT. However, it is often difficult to diagnose which type because of the rapid rate. For example, slowing the rate can allow one to see the P waves and to determine if this is a focal or multifocal atrial tachycardia. Adenosine will not convert atrial fibrillation or atrial flutter but may slow the rate enough so that these arrhythmias can be diagnosed (Page et al., 2016).

f. To diagnose SVT and to convert to SR, a first dose of adenosine is given at 6 mg/2ml, and if ineffective, a second dose of 12 mg/4 ml can be given. A second dose of 12 mg adenosine may be given if the first dose is ineffective. If the second dose of adenosine is ineffective and the patient complains of chest pain or loses consciousness, she should be treated with synchronized cardioversion.
    i. Unstable SVT is present when the rapid heart rate reduces cardiac output to a degree that causes the patient to experience continuous chest pain and/or loss of consciousness. Unstable SVT is treated with synchronized cardioversion at a voltage of 50-100 J. (Page et al., 2016)

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