You're the Flight Surgeon

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You are the flight surgeon at a small expeditionary base at a remote and austere location. You are deployed with a fighter squadron and have a tent-based clinic on the flight line. There is a Navy hospital about 1000 yd away from your location that is staffed by an emergency physician, a family practitioner, a surgeon, and an anesthesiologist.

While you're working out at the gym, you get a frantic call from your medical technician. She tells you that a 25-yr-old female fighter pilot has presented to the clinic with complaints of faintness, shortness of breath, and palpitations. Your technician says, "Doc, she doesn't look good, her color's off," and reports that her vital signs show an oral temperature of 99.0, a heart rate of 195, a blood pressure of 90/62, a respiratory rate of 22, and a peripheral oxygen saturation of 99%.

1. You abandon your workout to attend to the patient, but it will take you about 10 min to get back to clinic. Your technician asks for instructions. What should you tell her?

A. Obtain an electrocardiogram (EKG).
B. Administer ice water to the face.
C. Attach the monitor/defibrillator pads to the patient and start an antecubital intravenous (IV) line. You will call 911 and dispatch an ambulance.
D. Walk the patient out to the commander's pickup truck and drive her immediately to the hospital. You will meet her there.

ANSWER/DISCUSSION

1. C. Attach the monitor/defibrillator pads to the patient and start an antecubital IV. You will call 911 and dispatch an ambulance. This patient has an uncharacterized tachyarrhythmia and may deteriorate. The monitor will likely reveal the underlying rhythm and, if she becomes unstable, cardioversion or defibrillation could be lifesaving. Starting an IV is also a good idea, as parenteral fluids and/or medicines are likely to be required in any patient with an acute cardiopulmonary presentation and/or hypotension.

Obtaining an EKG is important, but is not the first priority, as it is a diagnostic rather than therapeutic measure, and there is no one present to interpret it. Ice water to the face is a vagal maneuver that might be indicated, but should not take precedence over attaching resuscitative equipment.

Bundling the patient into the nearest vehicle to rush her to the hospital is a temptation that should be resisted, as it would remove the safety net of the monitor/defibrillator. Even if the equipment was portable, running a code in a pickup truck is far from ideal. Just as pilots first aviate, then navigate, and lastly communicate, medical treatment takes priority over moving the patient or making phone calls. By calling for an ambulance yourself, you decompress the task-saturated technician and refocus her efforts on applying lifesaving equipment.

You call 911 and a fully equipped ambulance with two Navy corpsmen is now en route. You arrive at your clinic first and find your patient lying on the gurney with the monitor/defibrillator pads in place and an 18-gauge IV in the right antecubital fossa. She looks sweaty, slightly pale, but manages a nervous smile and is interactive. As you speak with her, you note her radial pulse is rapid, regular, but weak. She tells you that she was in her usual state of excellent health when she suddenly began to feel her heart race about 10 min ago. This was swiftly followed by a slight faintness and mild shortness of breath. She was able to walk over to the clinic with a friend.

Her past medical history is unremarkable, she takes no medicines, and has no allergies. She has not flown in several days, denies any exposures to smoke or chemicals, and her review of systems is negative for cough, fever, chest pain, and leg swelling. The monitor shows a narrow-complex regular tachycardia with a rate of 188 and no discernable P waves.

2. The ambulance will arrive any minute. What is your tentative diagnosis and what should you do next?

A. Ventricular tachycardia. Because the patient is unstable, she should be defibrillated immediately.
B. Supraventricular tachycardia. Perform a focused physical exam, hang a bag of normal saline, and escort her in the ambulance to the hospital. Call your Navy colleagues to let them know you're coming.
C. Atrial fibrillation with rapid ventricular response. Control her heart rate with an IV calcium channel blocker.
D. Sinus tachycardia from dehydration. Have her drink some oral fluids and cool her with a fan.

ANSWER/DISCUSSION

2. B. Supraventricular tachycardia. Perform a focused physical exam, hang a bag of normal saline, and escort her in the ambulance to the hospital. The

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elevated heart rate, lack of P waves, and relative stability all support the diagnosis of supraventricular tachycardia (SVT).[1,5] The patient is in mild distress, but is stable. Hanging a bag of fluids will keep her IV patent and may benefit her blood pressure by supporting preload. A quick cardiopulmonary exam would help reinforce the diagnosis, as there should be no cardiac murmurs or pulmonary findings. Riding with her in the ambulance will enable your continuous care, and calling ahead will alert the Navy physicians and allow them to ready a resuscitation bed.

Ventricular tachycardia is a wide complex dysrhythmia. While immediate shock delivery would be indicated for an unstable patient, your pilot is awake, talking, and without chest pain.[6] It is possible that this is atrial fibrillation with a rapid ventricular response, but that rhythm is usually irregularly irregular. Because a definite diagnosis would require an EKG, rate control should be withheld until one is obtained. While the narrow complex QRS makes underlying atrial fibrillation with aberrant conduction unlikely (as in Wolff-Parkinson-White syndrome), atrioventricular (AV) nodal blocking agents given in this setting can lead to the acceleration of impulses through the aberrant conduction pathway, which can degenerate into a rapidly lethal nonperfusing rhythm.[4]

Sinus tachycardia with a heart rate approaching 200 is unlikely in this patient and the absent P waves favor SVT. Extreme sinus tachycardia can be seen in hypovolemia, thyroid storm, pheochromocytoma, drug intoxication, and other rare syndromes that seem unlikely in this healthy young woman with sudden onset symptoms.[13] Oral hydration is contraindicated in this patient, as she may require procedural sedation for cardioversion.

3. You arrive at the hospital and are met by two Navy physician colleagues. The patient is connected to their equipment and her condition is unchanged. An EKG is obtained and you all agree that the patient has SVT. How should you control this arrhythmia?

A. Synchronized cardioversion with procedural sedation.
B. Vagal maneuvers. If they fail, adenosine.
C. Administer a beta-blocker.
D. Arrange for aeromedical evacuation—this patient needs a cardiologist.

ANSWER/DISCUSSION

3. B. Vagal maneuvers. If they fail, adenosine. Vagal maneuvers, such as ice water to the face, carotid sinus massage, and Valsalva, are designed to stimulate the vagus nerve and cause an increase in parasympathetic tone to the heart.[7] This can slow SVT enough to break it; one study found a success rate of 19.4%.[11] Especially in a young patient with no comorbidities, there is little down side to attempting vagal maneuvers first. If they fail to break the arrhythmia, then adenosine is the drug of choice.[1] It can be administered with a starting dose of 6 mg IV push. Adenosine induces a transient slowing of conduction through the AV node. Therapeutically, this may terminate SVT by allowing the heart to resume normal pacing and conduction in up to 93.4% of cases.[2]

If the arrhythmia does not terminate, adenosine is often diagnostically useful, as the resultant AV block can reveal important clues on the EKG, such as P waves that were previously fused with T waves due to tachycardia. For this reason, a continuous 12-lead rhythm strip should ideally be obtained during the administration of adenosine. While procedural sedation is not required, adenosine administration and its resultant 3-5 s of asystole can feel very uncomfortable, so you should warn the patient.[9] While adverse outcomes are rare, having pacing, cardioversion, and defibrillation equipment immediately available is prudent.

Note that because of its very short half-life, to deliver enough drug to the heart, adenosine must be administered via rapid IV push. One technique is to place the syringe of adenosine in the same line as another syringe containing a 20-cc saline flush.[5] Immediately after pushing the adenosine, the flush is rapidly administered to help carry the drug through the line and into the central venous circulation. Proximal and large bore IVs help facilitate this.

Synchronized cardioversion with sedation is not preferred over pharmacological rhythm control.[9] If you were in a remote facility that did not have adenosine available, this could be considered after vagal maneuvers failed. Electrical therapy in a stable patient should be accompanied by procedural sedation and/or analgesia if possible and within your skill set. Administering a beta-blocker might break the SVT, but is not the drug of first choice.[9]

Finally, leaving the patient in SVT and arranging for evacuation is the worst option. Not even the young and healthy can tolerate tachycardias indefinitely. Because her condition could deteriorate while awaiting transport, her arrhythmia must be addressed locally and expeditiously.

You have the patient Valsalva, but there is no rhythm change. You also attempt carotid sinus massage and have her splash ice water on her face. While these maneuvers transiently slow her SVT, they do not convert it. You then administer adenosine 6 mg IV push. After a prolonged sinus pause, P waves are seen on the rhythm strip followed by a narrow QRS complex. A repeat EKG demonstrates sinus rhythm with a rate of 88, with a normal axis and intervals. Basic screening labs reveal no unusual findings on complete blood count, and there are no electrolyte abnormalities. The patient's urinalysis is normal and her pregnancy test is negative. She is allowed to return to her quarters with a battle buddy and is flown back to home station for cardiology evaluation.

4. What is the patient's disposition?

A. Return to flying status without restriction.
B. Permanent disqualification.
C. Return to flying status with waiver or special issuance after appropriate therapy.
D. Medical retirement.

ANSWER/DISCUSSION

4. C. Return to flying status with waiver or special issuance after appropriate therapy. In the U.S. Air Force, before aeromedical disposition can be determined for SVT, a medical evaluation board for service retention is required.* Because she remained asymptomatic and desired a waiver, this trained asset was retained.

* U.S. Air Force. Section H: heart and vascular USAF medical standards, H8. In: Medical standards directory. Washington (DC): Department of the Air Force; 2015:24. [Accessed 9 Nov. 2015]. Available to those with access from https://kx2.afms.mil/kj/kx4/Flight-Medicine/Documents/Medical%20Standards%20Directory%20(MSD)/MSD%20Jul%202015%20(final).pdf.

The patient was seen by the on-base cardiologist, who suspected the most common subtype of SVT, AV nodal reentrant tachycardia.[9] This diagnosis was confirmed by an off-base electrophysiologist, who successfully interrupted her accessory pathway using radiofrequency catheter ablation. After an appropriate follow-up period of 4 mo, her case was reviewed at the U.S. Air Force's Aeromedical Consultation Service and she was returned to flying duties with no restrictions.[10]

The U.S. Navy and Army have similar guidelines for retention, grounding, and waiver process.[8,12] Similarly, the Federal Aviation Administration will grant a special issuance for SVT after successful ablation.[3]

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