You're the Flight Surgeon

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You are attending sick call on a usual Wednesday morning when a 24-yr-old U.S. Air Force active duty male pilot presents complaining that he must have the flu. He states that he started to feel bad halfway through his sortie yesterday. "I don't feel well, doc. My upper body aches and I have been up all night coughing." He denies fever, chills, nausea, vomiting, and shortness of breath, but states that he can't stop coughing. If he takes a deep breath, it triggers an aggressive coughing episode. As you are interviewing your patient, your colleague pops in to see who is coughing so much.

Further questioning reveals he is learning fighter tactics in the F-15. He is highly motivated to get treatment for his flu symptoms and return to training. He is resolute on making his afternoon brief time and inquires what he can take to stop his cough so he can fly. He denies taking any medication for the cough, but reports that he took 600 mg of Motrin last night for his upper body aches.

1. At this time, your differential diagnosis includes which of the following?

A. Influenza with cough.
B. Allergic rhinitis with postnasal drip and cough.
C. Pneumonia.
D. Pneumothorax.
E. All of the above.

ANSWER/DISCUSSION

1. E. This early in the evaluation, consideration can be given to all of the diagnoses listed. The art now is to tweeze out specific clues in the history, keeping in mind the threats present in the aviation environment.

The pilot goes on to tell you that he was in his usual state of excellent health until yesterday when he was flying his first basic fighter maneuvers sortie. Halfway through the sortie, after he completed his second pass, he started to feel "achy" in his shoulders and upper chest. He pressed on and completed the sortie without further incidence. During debrief, he continued to feel achy and started coughing. At first it was a slight abrupt cough, but progressed throughout the evening into a hacking cough. At no time did he feel in distress or short of breath. As he returned to his dorm room and the excitement of the day wore off, he reports that his aches began to coalesce in his right shoulder.

Review of his medical record reveals no significant past medical history. He denies smoking tobacco, but enjoys chewing tobacco, 1–2 cans per week. He drinks alcohol socially, but screens negative upon CAGE questioning. He denies any prescription drugs or over-the-counter medications on a regular basis, but reports taking ibuprofen as needed for aches and pains. He denies previous similar events. Family and surgical histories are noncontributory. He is not aware of any close contact, classmate, or crewmate illness.

2. What is the next step in your assessment of this individual?

A. Pulmonary function studies.
B. Physical exam.
C. Chest X-ray.
D. Computed tomography (CT) of the chest.

ANSWER/DISCUSSION

2. B. Physical exam with concentration on the upper and lower respiratory tract of this stable-appearing airman is appropriate at this time. His vital signs are as follows: temperature 98.6°F, heart rate 76, respiratory rate 15, blood pressure 110/72, oxygen saturation 96% on room air, pain 3/10. He is 73″ tall and weighs 185 lb. He is in no acute distress but coughs frequently. He is able to speak in full sentences. Head, eyes, ears, nose, and throat exam is normal with a clear oropharynx, no jugular vein distention is appreciated, and his trachea is midline. There is no crepitus of the neck or supraclavicular notch. The heart is in regular rate and rhythm with no murmur, gallop, click, or rub. Examination of the chest and lungs reveals a symmetrical chest wall with no wheeze, rales, or rhonchi. There is no egophony, tactile fremitus, whispering pectoriloquy, or hyperresonance on percussion. Breath sounds are noted throughout all fields, but slightly less prominent in the right apex. He coughs with each deep breath, making examination difficult to confirm the disparity. The remainder of his exam is completely normal.

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3. What concerns would you consider in formulating your diagnosis of this individual?

A. An abrupt onset of a cough without previous "cold" symptoms.
B. Physical exam findings.
C. The persistence of the cough.
D. The exposure to altitude and the rigors of flight the day prior.
E. The fact that the pilot was concerned enough to present to your clinic despite his motivation to continue flying.
F. All of the above.

ANSWER/DISCUSSION

3. F. All the factors listed are important in formulating a diagnosis. An abrupt cough without prior cold symptoms, right shoulder pain and lack of fever on physical exam, and the level of concern in a highly motivated individual (i.e., enough to come in and interrupt a busy schedule) all point to a significant problem. Understanding the threats of the aviation environment is important when considering the differential diagnosis. Ensuring a diagnosis is a critical step in making an appropriate aeromedical disposition.

Getting caught up in the motivation of a flyer to not miss a sortie needs to be acknowledged. Avoiding such allure and ensuring that the patient can safely continue to fly is explained to the pilot and a chest X-ray is requested. He understandingly accepts the recommendation. Results of the chest X-ray show a 20% pneumothorax of the right lung with no subcutaneous gas. Review of the film with the patient proves beneficial to his appreciation of the gravity of his condition.

The pilot is sent to the local hospital for further evaluation and treatment. CT scan confirmed the pneumothorax between 20–30% and a surgical consultation was obtained. He underwent a small tube thoracentesis with good results. After discussion regarding risk of recurrence, the pilot decided to have a surgical procedure with mechanical pleurodesis.

4. What gas law explains the most dangerous threat of flying with a pneumothorax?

A. Charles' law.
B. Henry's law.
C. Guy Lussac's law.
D. Boyle's law.
E. None of the above.

ANSWER/DISCUSSION

4. D. Boyle's law states that the volume of a gas is inversely proportional to the pressure surrounding the gas. As one ascends to lower atmospheric pressures, the greater the volume of the gas becomes. When the gas is trapped inside the chest wall, the volume of the pneumothorax will increase at the expense of the functioning lung space, which, if large enough, can cause hypoxia and is potential for a life-threatening tension pneumothorax. In this case, the pilot was not in respiratory distress with a 20% pneumothorax under normal activity. Given the probable increase of the pneumothorax and the increased respiratory demand of flying basic fighter maneuvers, the harrowing potential scenario that could have developed in this case gave the physician and the pilot great pause.

An important lesson learned from this case was lowering of one's threshold to obtain a chest X-ray. In everyday civilian practice, it would be less likely for an individual like the one described above to present than in a practice where the majority of individuals are regularly exposed to the environmental threats of aviation. As a flight surgeon, it is essential to keep in mind the additional threats of the flight environment when determining the cause of symptoms in an aviator and, if not satisfied, ensure that the etiology is not one that can cause more harm.

Harrison's Principles of Internal Medicine defines spontaneous pneumothorax as the presence of gas in the pleural space that occurs without antecedent trauma. It goes on to further define a primary spontaneous pneumothorax as occurring in the absence of underlying lung disease, whereas a secondary pneumothorax occurs in its presence.[7] The classic symptoms of a patient with spontaneous pneumothorax are dyspnea and pleuritic chest pain. The chest pain may radiate to the shoulder, neck, and into the back. Tachycardia, tachypnea, hyperresonance to percussion, diminished breath sounds, and asymmetrical chest wall expansion may be present on physical exam.[10] The main risk factors for spontaneous pneumothorax are male gender between 15–34 yr or greater than 55 yr, tall, and slender body type. Smoking is the most important modifiable risk factor of spontaneous pneumothorax.[1] This fact gives providers greater reason to encourage tobacco cessation among aviators.

Environmental threats of high-performance aviation—reduced barometric pressure at high altitude, rapid decompression, hypoxia, positive pressure breathing, increased gravitational forces, and chest restriction due to aircrew equipment—are also of concern and have not changed since this topic was addressed in this journal in the late 1960s and again in 1994.[5,11] What has changed is the resolution of the imaging studies that are now available. High-resolution imagery has advanced such that patients with no history of pulmonary disease or evidence on chest X-ray are being recognized with lung abnormalities such as blebs and bullae. The distinction between primary and secondary spontaneous pneumothoraxes is diminishing.[1]

Recurrence is an important concern of spontaneous pneumothorax and a major determinant of its treatment. Current indications for more invasive treatment to prevent recurrence are a second pneumothorax in the same lung, bilateral pneumothorax, and professions at risk (e.g., divers and pilots).[8] Pleurodesis is the main treatment to prevent recurrence of pneumothorax. The two main methods are chemical and surgical. Video-assisted thoracopic surgery and open thoracotomy have gained favor over chemical treatment due to their higher efficacy and less side effects.[1] Video-assisted thoracopic surgery has been shown to carry a higher patient satisfaction rate and higher return to activity over thoracotomy.[4]

Returning people to commercial passenger flying is a topic of debate among expert societies. Existing data provide varying recommendations. The majority of experts and limited data suggest that a 14-d period from the time of pneumothorax resolution documented by radiographic imagery is most appropriate. Other authorities note that a 7-d waiting period is appropriate for spontaneous pneumothorax, whereas the longer 2-wk period is correct for the traumatic type.[2,8] One society notes up to a 3-wk waiting period after successful therapy and radiographic resolution of the pneumothorax.[2]

AEROMEDICAL DISPOSITION

As of July 2016, Air Force policy regarding spontaneous pneumothorax has been significantly revised, effectively making spontaneous pneumothorax disqualifying for all initial and trained aviation duties. Aeromedical waiver for spontaneous pneumothorax may be considered only if inspiratory and expiratory chest radiograph and CT chest scan show full expansion of the lung and no demonstrable pathology that would predispose to recurrence, such as blebs or bullae, or after definitive surgery to prevent recurrence if CT demonstrates residual blebs. Any form of definitive surgical pleurodesis is acceptable for waiver. Chemical pleurodesis is generally not acceptable for waiver. If chemical pleurodesis has been completed prior to entry into military service or an aviation career field, a waiver may be considered on a case-by-case basis after review by the Aeromedical Consultation Service. U.S. Air Force analysis of patients exposed to chamber flight before return to flying duties revealed that no episodes were eliminated and there was no value in predicting later recurrence. Altitude chamber runs are not required for waiver consideration.[6]

Review of the Aeromedical Information Management Waiver Tracking System in August 2016 revealed 111 aircrew members with an aeromedical summary and the diagnosis of spontaneous pneumothorax (traumatic and iatrogenic cases were excluded). There were 29 flying class (FC) I/IA cases, 40 FC II cases, and 42 FC III cases. Of the 22 disqualified (5 FC I/IA, 4 FC II, and 13 FC III), 3 were due to the aviator's voluntary decision not to pursue definitive treatment to become eligible for a waiver; 8 of the disqualified individuals had no other disqualifying conditions.[6]

In the U.S. Navy, primary spontaneous pneumothorax is considered disqualifying. All applicants must first be granted a waiver for commissioning before an aviation waiver can be considered. The applicant may be considered for waiver 1 yr after the resolution of the pneumothorax if treated solely with chest tube reinflation or 6 mo following resolution if treated surgically or chemically. High-resolution CT scan must prove no pathology (blebs or underlying parenchymal disease) and pulmonary function tests must be within normal limits. For designated personnel, a waiver request may be submitted 3 mo after resolution of the condition. Any subsequent pneumothorax must undergo chemical or surgical pleurodesis prior to waiver consideration. An altitude chamber run is not required for disposition and/or waiver recommendation.[9]

Previous history of a spontaneous pneumothorax is disqualifying for U.S. Army initial flight applicants. Exception to policy is not recommended. A single instance of spontaneous pneumothorax requires no waiver, but the aviator must be grounded locally for at least 2 mo or until recovery is complete, pulmonary function tests are normal, and no underlying pathology is present. Waiver may be possible for patients with recurrent spontaneous pneumothorax after surgical pleurodesis and a satisfactory period of postoperative observation of 6 mo. Chemical pleurodesis is not an acceptable treatment. Chamber flight before return to flying duties is no longer required.[12]

The Federal Aviation Administration requires deferral to Civil Aerospace Medical Institute (Oklahoma City, OK) personnel for decision in aviators with a history of spontaneous pneumothorax. A history of a single pneumothorax is considered disqualifying until X-ray evidence of resolution and until it can be determined that no condition likely to cause recurrence is present or surgical interventions are carried out to correct the underlying problem. A 3-mo period is recommended prior to resumption of flying if surgical intervention is required.[3]

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