Based on the Federal Aviation Administration Guide for Aviation Medical Examiners, the Federal Aviation Administration would consider any neurological condition disqualifying if that condition, based on the case history and the medical judgment of the Aviation Medical Examiner, makes the person unable to safely perform his/her duties.³ All of these cases would have to be deferred by the initiating Aviation Medical Examiner to the Federal Air Surgeon for final aeromedical disposition.

Although it is assumed that the visiting country will fly under the host country's aeromedical standards, this is not always the case. This particular case is a good example of where pre-established relationships with the allied country's flight surgeons and a better understanding of the visiting country's aeromedical waiver system would have assisted the expediency of the work-up in the case of an "untrained asset."

Tontz RC. You're the flight surgeon: complex regional pain syndrome. Aerosp Med Hum Perform. 2015; 86(6):574–577.

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This article was prepared by E. Hugh Mulagha, M.D., M.P.H.

You are the flight surgeon at a joint base that has active duty, Guard, and Reserve members. Your first patient in the afternoon is an urgent care visit, a 41-yr-old African-American female Air Force aeromedical evacuation nurse currently on active duty status who complains of lower chest pain. Her symptoms began after she ate breakfast. She describes the pain as a sudden onset of pain increasing in intensity initially for 15 min and then continuously for several hours. She states it feels like someone is pushing a fist under her sternum and she is having vague discomfort around her right shoulder as well. She'd had similar, though less severe, symptoms the day before, but thought it was heartburn from stress, as she was to take her physical training test later that day. She took Maalox, but her symptoms persisted for another 3 h after the dose. Later that afternoon she passed her physical training test with her best recorded run time. This morning, however, she reports that her symptoms are more intense and are associated with nausea. She took Maalox without benefit and noted that her pain was radiating to her back. She reports no history of similar symptoms prior to this episode.

In her review of systems, she denies dyspnea, lightheadedness, headache, weakness, diarrhea, constipation, or dark stools. She just finished her menstrual cycle 2 d ago. During a recent deployment to Southwest Asia she lost 12 lb, which she attributes to exercise and diet. She had been under stress during her deployment because she had to leave her small children behind and her father had a transient ischemic attack during her deployment. She has no other family history. She takes no medications besides the Maalox noted above and does not use tobacco or illicit drugs. She does not take

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any supplements or use performing-enhancing drugs. She will drink alcohol with her unit during social occasions, but never more than three drinks at one time. She is married and had her second child 1 yr ago.

She appears mildly uncomfortable on exam. She is 65" tall and weighs 145 lb with a calculated body mass index of 24.8. She is afebrile with a blood pressure of 115/70. She has a heart rate of 82 bpm, respiratory rate of 20 breaths/min, and a pulse oximeter reading of 100% on room air. Head, eyes, ears, nose, and throat exam are within normal limits. Her heart and lung examination is normal to auscultation, and she denies pain on deep inspiration. She is tender over the right upper abdomen. She has no hepatosplenomegaly and her liver span is 9 cm. Bowel sounds are normal and no abdominal bruits are appreciated. She has no rebound or guarding. Her extremities have no tenderness, clubbing, cyanosis, or edema. An electrocardiogram (EKG) shows normal sinus rhythm with flattened T-waves in lead III. Her printed medical record is at her Reserve unit, so your medic is currently trying to retrieve it to get an old EKG for comparison.

1. What medical problem does this airman most likely have?

- A. Biliary colic.
- B. Acute coronary syndrome.
- C. Pulmonary embolism.
- D. Esophagitis.

ANSWER/DISCUSSION

1. A. Biliary colic is in the spectrum of biliary tract disease. This spectrum ranges from asymptomatic gallstones to biliary colic, cholecystitis, choledocholithiasis, and cholangitis. Cholelithiasis is the presence of one or more calculi (gallstones) in the gallbladder. Cholelithiasis is often asymptomatic, but can cause biliary colic, manifesting as colicky or constant pain in the right upper or middle upper abdomen. This pain may radiate to the back or shoulder blade and may be associated with nausea and vomiting. Principal risk factors include age, female sex, and obesity. Lesser risk factors include multiparity, abstinence from alcohol, some medications, and rapid weight loss.

Acute coronary syndrome is possible, as women show atypical signs of coronary artery disease. In this case, though, normal vital signs, an EKG not indicative of acute disease, and the fact her run yesterday did not elicit symptoms make this diagnosis less likely. However, it is still prudent to find an old EKG for comparison. Pulmonary embolism is unlikely, as she does not describe pleuritic chest pain and denies shortness of breath, and her vital signs, including pulse oximetry, all are normal. Esophagitis is in the differential. However, because Maalox did not help alleviate her symptoms and given her risk factors for gallstone formation, biliary colic is more likely.

Intramuscular ketorolac is given to the patient for pain control. Her old EKG shows that the flattened T-waves are a pre-existing finding. Complete blood count, urinalysis, and renal and electrolyte panels are normal. Pregnancy test is negative. Amylase, lipase, and liver function tests are normal except for a slight elevation in bilirubin, 1.3 mg \cdot dl⁻¹

 $(< 1.2 \text{ mg} \cdot \text{dl}^{-1})$. In your clinic you have X-ray and ultrasound available. You have the availability to get a computed tomography (CT) scan and nuclear imaging if you send the patient to a community hospital, which is only 10 min away.

2. What is the ideal procedure in this setting to confirm your diagnosis?

- A. Abdominal X-ray.
- B. Abdominal ultrasound.
- C. Abdominal/pelvic CT scan with oral and intravenous contrast.
- D. Hepatobiliary iminodiacetic acid (HIDA) scan.

ANSWER/DISCUSSION

2. B. Ultrasonography is the diagnostic test of choice for identifying gallstones. Current high-resolution, real-time ultrasonography can identify gallstones as small as 2 mm, with sensitivity greater than 95%.³ An abdominal X-ray is not a good test for gallstones because only about 15–20% of gallstones contain enough calcium to make them sufficiently radio-opaque to be visible on a plain radiograph.¹ The sensitivity of a CT scan for gallstones has been reported to be approximately 75%.¹ A HIDA scan is used to diagnose acute cholecystitis. Even if acute cholecystitis is suspected, a HIDA scan is usually not done before an ultrasound or another diagnostic image confirms gallstones.

The ultrasound reveals two 2.0-mm gallstones at the neck of the gallbladder. The gallbladder is not enlarged or thickened. The cystic duct and intrahepatic ducts are normal in diameter. The patient's pain subsided with intramuscular ketorolac and you make a presumptive diagnosis of biliary colic due to cholelithiasis. You disqualify her from flying and instruct her to avoid fatty foods, give her a prescription for Percocet to take for pain as needed, and give her a consult to see the general surgeon. She is reluctant about having surgery, as she had some complications with her last C-section, and asks about nonsurgical options. She says her mother in-law had extracorporeal shock wave lithotripsy (ESWL) for a gallstone and avoided the need for surgery about 10 yr ago. She would like to get back on flying status as soon as possible.

3. Which of the below statements is true?

- A. ESWL and bile salt therapy are viable options in her case and will get her back on flying status sooner, since she will avoid surgery and not need a waiver.
- B. If she remains asymptomatic and does not require pain medications for 72 h, you can place her back on flying status and she will not need a waiver.
- C. Surgery is the only way she will get back on flying status, as this the only way to prevent recurrence of a stone formation.
- D. Laparoscopic cholecystectomy is a safe and effective choice for her if she wants to get back on flying status. She would not need a waiver when she recovers.

ANSWER/DISCUSSION

3. D. The diagnosis of symptomatic cholelithiasis is disqualifying for all aviation classes in the U.S. Air Force. Patients who need surgical treatment are grounded until cleared by the surgeon to resume unrestricted activities, at which time they can be returned to flying duties without a waiver. A history of cholelithiasis treated surgically, or asymptomatic gallstones seen on imaging, no longer require a waiver to resume flying duties. Until her gallstones have been cleared on ultrasound, they are categorized as symptomatic, as they caused what appear to be two bouts of biliary colic. If she chooses not to have a procedure but remains asymptomatic, she will still require a waiver. In the U.S. Air Force, flyers who have undergone ESWL will need to apply for a waiver.

In the U.S. Navy, aviators with symptoms should be grounded until the stones are removed. Waivers are recommended for aviators and applicants with incidentally noted asymptomatic stones. Aviators who have undergone ESWL may apply for a waiver after a 6-mo period free of biliary colic.⁵ A history of cholecystectomy, either open or laparoscopic, is not considered disqualifying in all aviation personnel.

In the Army, cholelithiasis is considered disqualifying, in accordance with Army Regulation 40-501.⁹ Asymptomatic gallstones found incidentally and with no evidence of cholecystitis on ultrasound examination are routinely granted a waiver in rated aviation personnel. Aviators with symptoms are grounded until the stones are removed. A history of cholecystectomy, if uncomplicated, does not require a waiver and is filed for information only.

The Federal Aviation Administration will allow a pilot and controllers to perform duty with gallstones that are not causing any symptoms. If surgery is required, the pilot may return to flying once healing is complete and the surgeon has released him/her to full activity. The surgery is then reported at the time of the next airman medical examination. If the gallstones are symptomatic, but do not require surgery, the pilot should not fly until the symptoms subside. When biliary colic is chronic in nature, the pilot should not fly until definitive treatment is complete.

Cholecystectomy is a definitive prophylactic therapy to prevent future attacks of biliary colic and the preferred method to prevent the complications of gallstone disease.^{2,8,10} Cholecystectomy is recommended for the majority of symptomatic cholelithiasis patients, but medical dissolution therapy may be appropriate for patients who are poor surgical candidates or are averse to having surgery.

ESWL is a procedure that consists of a patient sitting in a tub of water and getting high-energy, focused ultrasound shockwaves directed through the abdominal wall toward the gallstone. Shockwaves travel through the tissues and break up the stones. The intent is to create stone fragments that are small enough to pass through the bile duct and into the small intestine. Gallstone disease may be treated successfully and without serious adverse effects by extracorporeally generated shock waves in selected patients.⁷ It works best with solitary calcified stones less than 2 cm. Gallstone recurrence rates post-lithotripsy have been described to vary from 11 to 26% for a 24-mo period using actuarial analysis.⁴

ESWL is widely used for kidney stones, but has fallen out of favor for the treatment of gallbladder stones, in part because of recurrence

of gallstone formation and the evidence-based success of laparoscopic cholystectomy. Only a few centers worldwide continue to offer ESWL, and it is generally used in conjunction with oral dissolution therapy to help dissolve the fragmented pieces of the original gallstone, mainly for those who cannot undergo cholecystectomy. The principal noninvasive, nonsurgical medical treatment for cholesterol gallstones is the use of orally ingested bile acids (ursodeoxycholic acid) for stone dissolution. This treatment eliminates the gallstones while preserving the gallbladder and is effective in about two-thirds of people who take it.⁶ Medical dissolution of gallstones requires a waiver.

The patient did follow up with a general surgeon, who saw her a week later and felt surgery was not absolutely necessary at that point. Her rapid weight loss in conjunction with the low carb-high protein-high fat diet she was on during her deployment most likely led to the gallstones. A month later, prior to getting off active duty orders, she was seen in the office. She denied having any more symptoms. She was offered an ultrasound to see if the gallstones had cleared. She said it did not matter to her since she planned to switch to a nonflying position in another unit. A year later she was seen for her physical health assessment and denied ever having any symptoms of biliary colic during the year.

Mulagha EH. You're the flight surgeon: cholelithiasis. Aerosp Med Hum Perform. 2015; 86(6):577–580.

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Erratum

Du C-F, Liu X-Y, Wang L-Z, Liu S-Y, Fan Y-B. Restraint harness performance during flight maneuvers: a parametric study. Aerosp Med Hum Perform. 2015; 86(5):466–471.

The authors of this article recently notified us of some errors that were not caught earlier. These errors are as follows:

- 1. On p. 468, top of the right-hand column, first sentence under 'Data Analysis' reads "The displacements of the upper torso of the mannequin...". It should read "The displacements of the lower torso of the mannequin...".
- 2. The second sentence in that same paragraph should be deleted.
- 3. On p. 468, in the second paragraph of the Results section, the first sentence currently reads "The resultant displacements of the upper torso and lower torso...". It should read "The resultant displacements of the lower torso...".
- 4. On p. 469, first full paragraph in the left-hand column, the second sentence should be deleted.
- 5. In that same paragraph, the fourth sentence says: "For the impact in the $-G_x$ direction, the motion of both the upper torso and lower torso...". It should read "For the impact in the $-G_x$ direction, the motion of the lower torso decreased...".
- 6. On p. 470, in the caption for Fig. 4, the words "upper torso and" should be deleted from the first sentence and the word 'the' should be inserted. It should read "Displacement of the lower torso of the mannequin..."

We apologize for these errors and any inconvenience.