

Aerospace Medicine Clinic

This article was prepared by Shana Hirschert, M.D., MPH, and Monica Pierce-Wysong, M.D., MPH.

You are the flight surgeon in clinic when a 35-yr-old fighter pilot presents for follow-up after an in-flight emergency (IFE) the night prior. He reported symptoms of vertigo and shortness of breath during ascent, at which time he declared an emergency and landed without incident. His symptoms resolved upon landing. He notes that he has had two unexplained physiological events while flying over the past 2–3 yr. He has no history of lung disease but is a social smoker. He exercises regularly and runs 4–5 mi for 3–4 d each week without difficulty. He reports seasonal allergy symptoms, including sinus congestion and difficulty clearing his ears, since moving to his current location. The night of the IFE, he was evaluated by an experienced physician, and other than serous otitis, his exam was unremarkable, including oxygen saturation of 98% on room air and normal lung auscultation.

You refer the patient to otorhinolaryngology, allergy, and pulmonology. His pulmonary function testing (PFT) with pre- and postbronchodilator spirometry shows fixed obstructive lung disease. At this time, he is started on a long-acting bronchodilator (LABA) and inhaled corticosteroid (ICS). Over the next 6 mo he has improvement in his spirometry values, including reversing of his obstruction with positive bronchodilator response. His forced expiratory volume in 1 s (FEV₁) is 65% of predicted.

1. Which of the following would not be consistent with a diagnosis of asthma?
 - A. Asymptomatic.
 - B. Reversible obstructive lung disease on PFT.
 - C. Suspected hypoxic events in the past.
 - D. Normal PFT and methacholine challenge testing.

ANSWER/DISCUSSION

1. D. Normal PFT and methacholine challenge testing are not consistent with a diagnosis of asthma. Asthma is a disease of chronic respiratory inflammation with typical symptoms that include cough, shortness of breath, and wheezing. However,

asthma can be asymptomatic, particularly in elite athletes.¹ The diagnostic criteria for asthma are an FEV₁/forced vital capacity (FVC) less than normal for one's age and gender and an increase from their baseline of greater than 200 mL or greater than 12% in FEV₁ with bronchodilator.² This pilot's initial presentation of fixed obstruction is consistent with severe asthma. Because asthma can be asymptomatic, you should consider PFT with all physiological IFEs, especially if there is a concern for hypoxia. Frequently, very fit asthmatics will not present with "typical" symptoms and may only experience symptoms in the flying environment under extreme physiological stressors and environmental triggers.

Your patient has had two IFEs involving perceived hypoxia without a documented/confirmed equipment failure. He tells you that he has a history of seasonal allergies but has never been diagnosed with asthma.

2. What testing would be recommended?
 - A. Allergen skin testing.
 - B. PFT.
 - C. Complete blood count to evaluate for eosinophilia.
 - D. No further testing is indicated.

ANSWER/DISCUSSION

2. B. PFT is indicated. A history of seasonal allergies is commonly associated with the diagnosis of asthma. Eczema is also a condition associated with asthma, often in childhood, and some patients outgrow this condition as they get older. Healthy athletic patients often have poor insight into their asthma symptoms.¹ In addition, because the patient is flying in high-performance aircraft, baseline lung function will allow monitoring for worsening with stressors of flight.

Your pilot has noted that he frequently coughs after flying but is hesitant to get further testing. You ask further questions about

possible asthma and discuss that flying exposes a pilot to many respiratory stressors that can trigger asthma exacerbations.

3. He asks you what exposures in the flying environment are potential asthma triggers and you tell him all of the following except:
 - A. Smoke and jet fumes.
 - B. Hypobaric/hypoxic environment.
 - C. Pressure breathing and anti-G straining maneuver.
 - D. Emotional and physical stressors.

ANSWER/DISCUSSION

3. C. Pressure breathing and anti-G straining maneuver are not direct triggers of bronchospasm but can lead to barotrauma, which can further worsen lung function of high-performance pilots.³ An aviator with unknown underlying asthma is at high risk of an exacerbation in the high-performance/high-G aviation environment. High-performance pilots encounter additional occupational-related respiratory stressors during flight, including hypobaric and hypoxic conditions, anti-G straining maneuvers, and positive pressure breathing, which can cause barotrauma. Additionally, breathing dry or cold air, frequent occupational exposure to fumes, dust, and smoke, high particulate levels/poor air quality, and repetitive physical or emotional stressors may cause inflammation of airway tissues. Just one of these factors can trigger bronchospasm, leading to a life-threatening breathing emergency in flight.^{4,5}

After treatment with an ICS, your patient has new PFTs that show a reversible obstructive defect. This has confirmed the diagnosis of asthma and the patient is now willing to comply with his medications. He would like to know what will be required for him to return to flying status with a waiver.

4. What do you tell him?
 - A. He will need to be seen by the Aeromedical Consultation Service (ACS) but does not need any further testing.
 - B. He will be enrolled in your local high-performance asthma group for intermittent follow-up but does not need any further testing.
 - C. He needs to have spirometry with greater than 80% predicted of FEV₁, negative methacholine challenge, and must be seen by the ACS.
 - D. He must be switched to an ICS-LABA with 6 wk stability prior to waiver submission.

ANSWER/DISCUSSION

4. C. Meeting the spirometry criteria, a negative methacholine challenge, and evaluation by the ACS are required before this patient will be able to return to flying status. This individual may appear to be ready for an asthma waiver, but he will need to continue his treatment, verify his spirometry is

normal, and demonstrate a negative methacholine challenge test on aircrew-approved medication. These tests will be performed as part of his evaluation by the ACS to ensure accuracy and consistency of techniques. He also likely will be enrolled in the high-performance management group and followed on a routine basis by the ACS.⁶

After several months of treatment, your fighter pilot has improvement in his PFT. He is compliant and continues his ICS-LABA treatment daily and is feeling well. He denies any asthma symptoms or use of a rescue inhaler. He has not required any oral steroids. He is excited for the potential to return to flying status. He attended his required evaluation at the ACS, where he underwent a repeat PFT that showed normal spirometry with his FEV₁ at 85% of predicted value. He also had a methacholine challenge, which was negative for responsiveness. This is deemed his new best baseline and he was granted a waiver. As his flight surgeon, you will continue to monitor him for symptoms in addition to his pulmonologist. At his annual periodic health assessment, along with PFTs, you will continue asthma education, including discussion of asthma triggers present within his operational environment.

5. Your patient is considering separating from the military and becoming a commercial pilot. Which of the following statements is accurate regarding issuance of a Federal Aviation Administration (FAA) first-class medical certificate in airmen diagnosed with asthma?
 - A. He will require a special issuance by the FAA.
 - B. He will need to have an evaluation by pulmonology prior to certificate issuance.
 - C. He meets the criteria for the Conditions an AME [aviation medical examiner] Can Issue (CACI) asthma worksheet.
 - D. He cannot fly as a commercial pilot with asthma.

ANSWER/DISCUSSION

5. C. To meet CACI criteria, the airman cannot use oral steroids more than two times in 1 yr or have more than 2 d of asthma symptoms per week.⁷ In the past year, the airman can have no hospitalizations and no more than two outpatient visits for asthma exacerbations.⁷ PFT must show at least 80% of predicted value for FEV₁ on approved medications, which does not include monoclonal antibodies.⁷ CACI worksheets are available online for this condition at www.faa.gov/ame_guide.

Finally, asthma is a disqualifying diagnosis for all Army and Navy aviators as well.^{8,9} Waivers are considered on a case-by-case basis for all untrained servicemembers.^{8,9} Trained aviators in the three services can seek a waiver for stable asthma.^{6,8,9} Army aviators require stable disease with no restrictions, hospitalizations, or use of oral steroids.⁸ Navy aviators can seek waivers with stable asthma with no use of oral steroids.⁹

Hirchert S, Pierce-Wysong M. *Aerospace medicine clinic: asthma*. *Aerosp Med Hum Perform*. 2024; 95(11):877–879.

ACKNOWLEDGMENTS

The authors would like to thank Dr. Dara Regn, USAF (retired), for her contributions and professional review of this article. The views expressed are those of the authors and do not reflect the official guidance or position of the U.S. Government, the Department of Defense (DoD), the U.S. Air Force, or the U.S. Space Force. Mention of trade names, commercial products, or organizations does not imply endorsement by the U.S. Government. The appearance of external hyperlinks does not constitute endorsement by the DoD of the linked websites, or the information, products, or services contained therein. The DoD does not exercise any editorial, security, or other control over the information you may find at these locations.

REFERENCES

1. Price OJ, Ansley L, Menzies-Gow A, Cullinan P, Hull JH. Airway dysfunction in elite athletes—an occupational lung disease? *Allergy*. 2013; 68(11): 1343–1352.
2. Global Initiative for Asthma. Global strategy for asthma management and prevention. 2023. [Accessed March 12, 2024]. Available from <https://ginasthma.org/2023-gina-main-report/>.
3. Ioannidis G, Lazaridis G, Baka S, Mpoukovinas I, Karavasilis V, et al. Barotrauma and pneumothorax. *J Thorac Dis*. 2015; 7(Suppl. 1):S38–S43.
4. Carter D, Pokroy R, Azaria B, Barenboim E, Swartz Y, Goldstein L. Asthma in military aviators: safe flying is possible. *Aviat Space Environ Med*. 2006; 77(8):838–841.
5. Anderson DM, Ondrasik NR, Rawlins FA, Lospinoso JA, Zanders TB, Morris MJ. Screening spirometry in military personnel correlates poorly with exercise tolerance and asthma history. *Mil Med*. 2018; 183(9–10): e562–e569.
6. Young A, Menner L, Lee M, Vu P. Asthma. In: *Aerospace medicine waiver guide*. Wright-Patterson AFB (OH): U.S. Air Force School of Aerospace Medicine; 2023. [Accessed March 12, 2024]. Available from <https://www.afrl.af.mil/711HPW/USAFSAM/>.
7. Federal Aviation Administration. CACI – asthma worksheet. In: *Guide for aviation medical examiners*. 2024. [Accessed March 12, 2024]. Available from https://www.faa.gov/ame_guide/media/C-CACIAsthma.pdf.
8. U.S. Army Aeromedical Activity. Asthma. In: *Flight surgeon's aeromedical checklists*. Aeromedical policy letters [mobile app]. 2021:254–255. [Accessed March 12, 2024]. Available from <https://play.google.com/store/search?q=med%20standards&c=apps>.
9. Naval Aerospace Medical Institute. 15.1. Asthma. In: *U.S. Navy aeromedical reference and waiver guide*. Pensacola (FL): Naval Aerospace Medical Institute; 2022. [Accessed March 12, 2024]. Available from <https://www.med.navy.mil/Navy-Medicine-Operational-Training-Command/Naval-Aerospace-Medical-Institute/Aeromedical-Reference-and-Waiver-Guide/>.