

Evaluation of systemic allergy in a jet aviator

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ABSTRACT

Cholinergic urticaria and exercise-induced anaphylaxis (EIA) are related conditions. Cholinergic urticaria is caused by a rise in body core temperature and usually results in pruritus, skin lesions and, rarely, in serious respiratory and cardiovascular compromise. EIA can result in a cardiovascular compromise and syncope. Ingestion of certain foods may be associated with EIA. A 41-year-old jet pilot complained of 3-month onset of pruritus and urticaria during treadmill exercise. On one occasion, after a routine exercise bout, albeit with pruritus and urticaria, he experienced two short episodes of syncope. Treatment with a nonsedating H₁-receptor antagonist was started. He underwent a unique challenge test that we designed. This included passive warming as well as exercising in a hot (temperature of 40°C at 40% humidity) environment. After passing this test uneventfully, the pilot was returned to jet flight with a copilot and, subsequently, to full active duty.

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Cholinergic urticaria is characterized by flushing with distinctive, punctuate 2- to 4-mm pruritic wheals surrounded by a red flare. Other symptoms include lacrimation, salivation, abdominal colic, and diarrhea. It is usually caused by a rise in the body core temperature due to exercise. Usually, no signs of cardiovascular compromise or pulmonary insufficiency are seen and prognosis is excellent.^{1,2} Treatment with H₁-receptor antagonist and avoidance of precipitating causes usually has good results.

Exercise-induced anaphylaxis (EIA) is a distinct entity caused by exercise but not by core temperature rise. A few minutes after exercise onset, symptoms of pruritus, generalized weakness, and erythema occur, followed by cardiovascular compromise and syncope.³ Acute cases need emergency treatment with fluids, adrenaline, corticosteroids, and antihistamine. Avoidance of exercise under very hot conditions,⁴ avoidance of certain foods,⁵ H₁-receptor antagonists treatment, and a personal epinephrine kit usually are necessary. A published report on⁶ four pilots suffering from cholinergic urticaria and EIA concluded that this condition limits pilot ability to fly high-performance aircraft. We describe our evaluation of a pilot with severe systemic allergy.

CASE REPORT

A 41-year-old high-performance jet pilot was evaluated at our institute. He was previously healthy and was not taking medications. A few months before his

evaluation, he began regular treadmill exercise in an air-conditioned gymnasium. Since then, he noticed pruritus and rash a few minutes after treadmill exercise. The rash consisted of small (2–3 mm) punctuate lesions surrounded by large flares all over his body. The pruritus and rash disappeared with cessation of exercise and cooling. He denied previous episodes as well as symptoms associated with exposure to warm weather, hot baths, emotional stress, and flying. He often ate small quantities of various fruits about 1 hour before exercising.

On one occasion, after a regular session of treadmill exercise albeit with pruritus and rash, he had two short syncopal episodes. He was admitted to a hospital for 24 hours where the attending physician assessed him as stable and recommended ambulatory allergic investigation. Twelve-lead electrocardiogram, 24-hour rhythm recording, and echocardiography were normal. No evidence of orthostatic hypotension was found. Blood count was normal, with no evidence of eosinophilia. Skin-prick tests for food allergy (cow milk, eggs, peanuts, soy, and various fruits) were negative. Our allergy specialist recommended initiating nonsedating H₁-receptor antagonist treatment.

Heat and Exercise Challenge Test

Jet cockpit temperature of 42°C with humidity of 40% was measured on a hot summer day, after standing in direct sunlight for a few hours. To mimic these climatic conditions and to evaluate the influence of exercise, we designed the following test. The test began with 20 minutes of rest at a room temperature of 42°C and humidity of 40%. With continual core temperature measurement, after having no symptoms, a treadmill exercise test was conducted under these hot conditions. At a speed of 8 km/hour, core temperature increased by 1°C with no sign of allergy or hemodynamic

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compromise. The pilot then ceased exercise and rested at a room temperature of 7°C for 15 minutes. The pilot showed no allergic or hemodynamic reaction and the test was considered negative.

Even though our pilot ceased his H₁-receptor antagonist treatment before the challenge test, he remained symptom free. He returned to fly as a copilot. No further episodes of rash, pruritus, or syncope occurred during exercise. He stopped eating before exercise. After being free of symptoms for 6 months, the pilot was granted medical status for full aviation duties. A personal epinephrine injection kit is carried by the pilot during flight. He remains healthy and free of allergic symptoms.

DISCUSSION

This case emphasizes the difficulties in establishing a specific diagnosis. The nature of the rash, the possible connection to food, and the good response to H₁-receptor antagonist treatment support the diagnosis of cholinergic urticaria. The syncope events and the fact that passive warming did not cause rash or pruritus support the diagnosis of EIA. Variant type of EIA is another possible diagnosis. This type of allergy is characterized by the development of punctuate urticaria with exercise that proceeds vascular collapse. This variant is precipitated by exercise and not by passive warming.

Extreme heat and physical activity are part of the jet pilot's work conditions. In our case, temperatures as high as 42°C were measured in the cockpit before takeoff. Both cholinergic urticaria and EIA can cause symptoms that interfere with a jet pilots functioning. Continuation of exercise or an exposure to excessive temperature can lead to total incapacitation due to syncope and anaphylaxis.¹ There are few descriptions of aviators suffering from the foregoing conditions. To our knowledge, all the reported cases were disqualified from flying because of the possibility of sudden incapacitation and the side effects of the drug therapy (drowsiness due to H₁-receptor antagonist).⁶

Pharmacologic therapy, such as H₁-receptor antagonists,^{1,7} and avoidance of suspected food before exercise usually control the symptoms. Although drowsiness was a frequent side effect of the older H₁-receptor antagonists, the newer antagonists are nonsedating and flight safe. Personal self-injectable epinephrine kits are recommended as a precaution in case of severe anaphylactic reaction. Corticosteroids and β -agonists are used rarely.^{1,4,6}

In this case, we tried to simulate the environment that caused the pilot's symptoms. We assessed the pilot's response to heat and cold exposure, because exposure to extreme conditions can induce cholinergic urticaria. We are aware of the low reproducibility of symptoms during an exercise test. We tried to enhance the test's negative predictive value by performing it in a hot and dry environment as well as cold exposure. Beginning with passive warming testing gave us confidence to safely advance to high temperature exposure. Normal response to our test and resolution of exercise-related symptoms enabled us to return the pilot to his aviation duties, first as a copilot and, subsequently, to full operative duties. To the best of our knowledge, this is the first description of a military aviator who was returned to full aviation duties after an allergic reaction with hemodynamic alteration.

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