

Acute Myocardial Infarction following Food-dependent Exercise-induced Anaphylaxis

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Abstract

A 70-year-old man with a history of food-dependent exercise-induced anaphylaxis (FDEIA) since age 50 was admitted to the emergency department with chest pain and urticaria caused by FDEIA. Coronary angiography revealed total occlusion of the proximal left anterior descending coronary artery. After thrombus aspiration, a bare metal stent was placed into the culprit lesion, resulting in no residual stenosis. Urticaria disappeared on the second hospital day. This is the first reported case, to our knowledge, in which acute myocardial infarction followed FDEIA. Physicians should be aware of acute myocardial infarction as a rare but potential complication of FDEIA.

Key words: urticaria, allergy, acute myocardial infarction

(Intern Med 50: 451-454, 2011)

(DOI: 10.2169/internalmedicine.50.4467)

Introduction

Food-dependent exercise-induced anaphylaxis (FDEIA) is a distinct form of allergy to common foods characteristically induced by a combination of causative food ingestion and physical exercise. It was first recognized in 1979 (20). Although acute myocardial infarction complicating anaphylaxis induced by drugs, other chemicals, or insect bites has been reported (26), no cases of acute myocardial infarction following FDEIA have been reported to date. We herein present a case of FDEIA associated with acute myocardial infarction.

Case Report

A 70-year-old man was admitted to the emergency department with chest pain and urticaria. Since age 50, he had experienced several episodes of anaphylaxis in association with exercise at around 2 hours after ingestion of wheat-containing foods. Exercise by itself or after foods not containing wheat did not trigger any symptoms. He had eaten udon (Japanese noodles containing wheat) at noon on the day of hospitalization. Approximately 2 hours later, while

walking on a treadmill at the gym, he developed urticaria on the flank, back, and femoral region. Although he usually stopped exercise when urticaria developed, on this occasion he continued exercising for a further 15 minutes. He developed chest pain approximately 1 hour after stopping exercise and consulted our hospital.

The patient had been diagnosed with FDEIA after episodes of generalized urticaria in association with exercise after ingestion of foods containing wheat since age 50. He reported having had cerebral infarctions at age 64 and 65, from which he had recovered without sequelae. The onsets of these infarctions were not related to exercise. At age 64, he was diagnosed with hypertension, diabetes mellitus, and hypertriglyceridemia and was accordingly commenced on medication including aspirin. He had smoked 30 cigarettes per day from the age of 37 and consumed approximately two standard alcohol per day from the age of 20. He had no history of ischemic heart disease. The family history revealed that both his second son and the son of his second son had urticaria of unknown cause.

On admission, his height was 165 cm and body weight 68 kg. Blood pressure was 124/45 mmHg and heart rate was 51 beats/min, with a regular pulse. Oxygen saturation was 99% on room air. Examination of the heart and lungs was nor-



Figure 1. Urticaria is present in the bilateral femoral regions.

mal. He had an erythematous rash involving the abdomen, back, and lower extremities (Fig. 1). Neurological examination was normal. A chest x-ray in the supine position showed mild cardiomegaly. Electrocardiography demonstrated sinus bradycardia and ST elevation in leads I, aV_L , and V_1 - V_5 and ST depression in leads II, III, and aV_F , compatible with acute anteroseptal myocardial infarction (Fig. 2).

Laboratory results on admission showed an elevated leukocyte count of 12,700/ μ L (normal, 4,500-9,000/ μ L), but serum levels of creatine phosphokinase (CPK), CPK-MB, alanine aminotransferase, C-reactive protein, and low-density lipoprotein cholesterol were normal. Serum levels of the following were elevated: hemoglobin A1c (6.3%, normal <5.8%), triglyceride (235 mg/dL, normal <150 mg/dL), IgE antibody (1,174 international units (IU)/mL, normal <400 IU/mL), and 50% hemolytic complement activity (49 units/mL, normal, 30-45 units/mL).

Coronary angiography, performed on the day of hospitalization, revealed total occlusion of the proximal left anterior descending coronary artery (Fig. 3), and the patient therefore underwent primary percutaneous coronary intervention. Because there was a residual stenosis at the culprit lesion after thrombus aspiration, a 3-mm bare metal stent was placed in the culprit lesion. This resulted in no residual stenosis and Thrombolysis in Myocardial Infarction grade 3 flow into the distal vessel. Urticaria disappeared on the second hospital day. Peak CPK was 4,759 U/L. A treadmill exercise test on the 16th hospital day was negative. The patient was advised not to consume foods containing wheat before exercise, and was discharged on the 20th hospital day.

Discussion

Acute myocardial infarction accompanying allergic reaction is defined in the literature as allergic myocardial infarction or Kounis syndrome (13, 26). The occurrence of acute myocardial infarction with anaphylactic or anaphylactoid reactions is increasingly encountered in clinical practice and there are several reports of acute myocardial infarction

following anaphylaxis induced by antibiotics (2, 7, 9, 27), nonsteroidal anti-inflammatory agent (4, 6), other drugs (1, 8, 10), insect bites (15, 16, 22, 28), and foods (17, 29).

FDEIA is an IgE-mediated hypersensitivity reaction to foods that is induced by exercise. Several mechanisms by which exercise induces this reaction are postulated: 1) exercise enhances the degranulation of mast cells and increases the serum concentration of chemical mediators, such as histamine (24, 25), and 2) exercise enhances the absorption of incompletely digested or undigested allergen proteins from the gastrointestinal tract (19). Although various foods, such as shellfish, hazelnuts, celery, and corn, are reported in association with FDEIA, wheat is the most frequent provoking food in Japan (12). The typical symptoms of FDEIA include skin manifestations, such as urticaria and angioedema, respiratory symptoms, abdominal pain, fatigue, and loss of consciousness (21). However, this is the first reported case, to our knowledge, in which acute myocardial infarction followed FDEIA.

What percent of the anaphylactic patients suffer from acute myocardial infarction remains unknown. However, in a diagnostic sting challenge study performed by pushing a single ant (jack jumper ant, *Myrmecia pilosula*) against the ventral forearm of 21 healthy volunteers, allowing it to sting for 60 seconds, two subjects (9.5%) developed chest pain with electrocardiographic changes suggesting acute myocardial ischemia (3). Laxenaire and Mertes reported that cardiovascular symptoms were the most common (73.6%) clinical features in anaphylaxis during anesthesia (14).

Coronary artery spasm and/or atheromatous plaque erosion or rupture induced by inflammatory mediators, such as histamine, tryptase, chymase, arachidonic acid products, platelet activating factor, and a variety of cytokines, released through mast cell activation of the coronary arterial wall during anaphylaxis are proposed as the main underlying mechanism of allergic myocardial infarction (13).

In the present case, the angiographic findings suggest that a thrombotic vascular occlusion on organic coronary stenosis was the main causative mechanism of acute myocardial infarction. Although we believe that anaphylaxis triggered the development of thrombogenic stimuli, such as plaque erosion and/or rupture, in the culprit lesion in this case on the basis of the clinical course and previous reports, the contribution of mechanical, chemical, and infectious stimuli as triggering factors of thrombogenic stimuli (18) cannot be disregarded.

Coagulation and fibrinolytic activities modify thrombus growth leading to coronary arterial occlusion. Since we did not measure both activities before various therapeutic interventions, whether or not increased coagulation and reduced fibrinolytic activities might modify thrombus growth in the culprit lesion in the present case remains unknown.

On the day of the present patient's acute myocardial infarction, he continued exercising after urticaria appeared, although he had not previously done this. Pals et al (23) re-

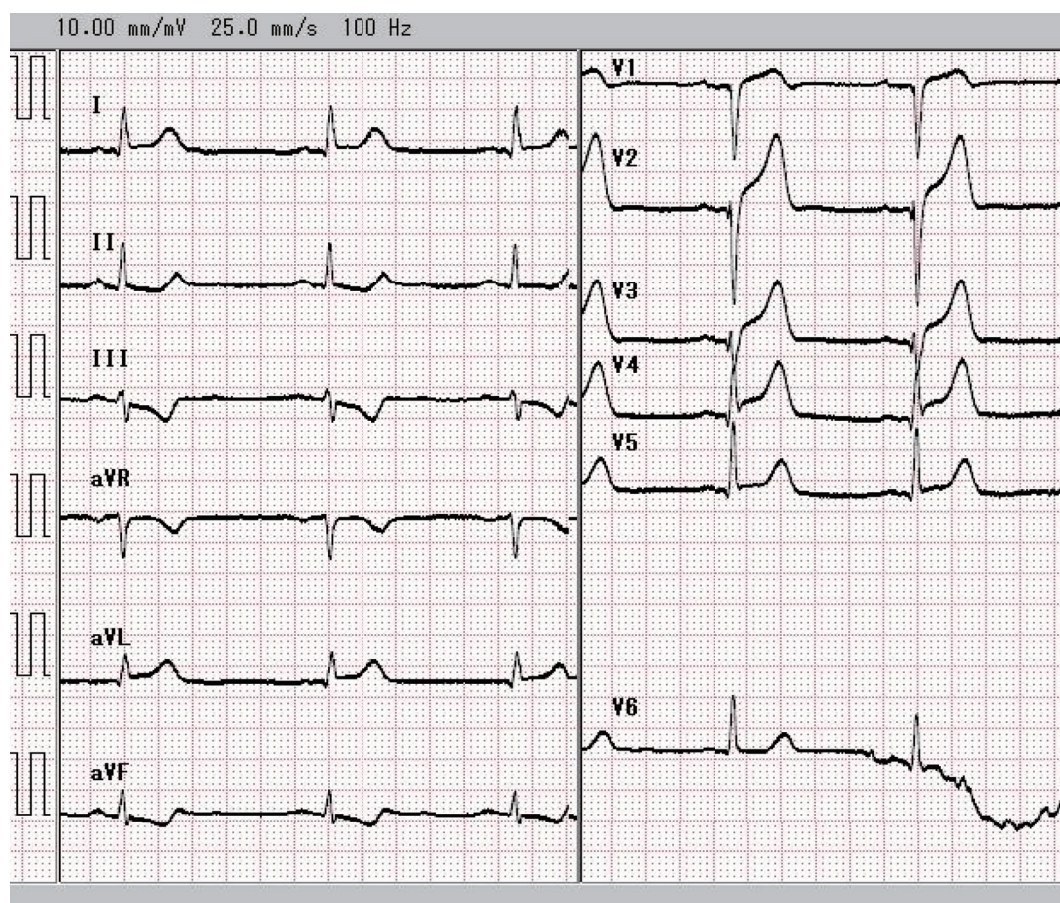


Figure 2. Twelve-lead electrocardiogram recorded during chest pain shows ST segment elevation in leads I, a_{VL} , and V_1 - V_5 and ST segment depression in leads II, III, and a_{VF} .

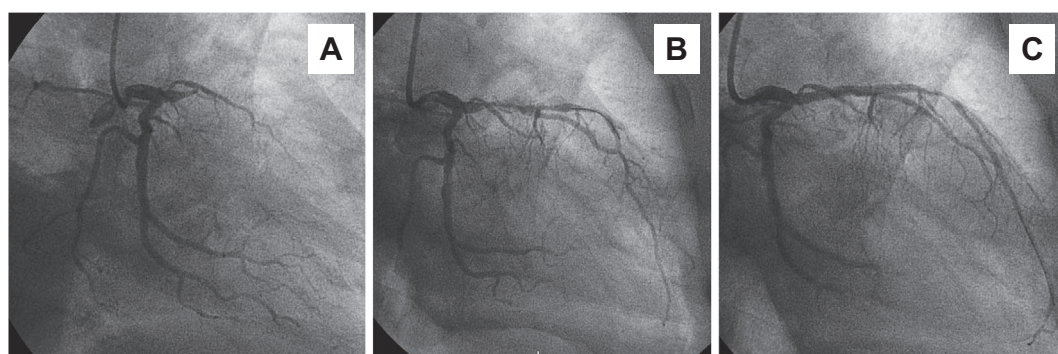


Figure 3. A: Left coronary angiogram before percutaneous coronary intervention shows total occlusion of the proximal left anterior descending coronary artery. B: After thrombus aspiration, a residual stenosis remains at the culprit lesion. C: After bare metal stent implantation, no significant stenosis remains at the culprit lesion.

ported that small intestinal permeability is increased after high-intensity running but not after low-intensity running. Therefore, the more intense exercise than usual in the present case may have contributed to the onset of acute myocardial infarction via the increase of absorption of wheat-related allergens from the gastrointestinal tract.

Aspirin can promote anaphylaxis in FDEIA patients (11). Possible mechanisms are: 1) aspirin may increase antigen uptake across the intestinal epithelium; or 2) aspirin itself may activate mast cells in combination with IgE cross-

linking through an unknown mechanism (21). The patient had been taking aspirin since developing cerebral infarction at age 64. The question as to whether the aspirin tended to prevent myocardial infarction or to induce it by promoting FDEIA remains unknown in this case.

Cerebral infarction has been reported following anaphylaxis induced by wasp sting (5). The onset of the present patient's cerebral infarction was not related to exercise, and whether FDEIA contributed to the onset of the previous cerebral infarctions remains unknown.

Why did the present patient experience myocardial infarction at this time but not during several previous FDEIA episodes? At least three factors contribute to the onset of acute myocardial infarction: 1) thrombogenic stimuli derived from plaque erosion or rupture, 2) thrombogenic potential of blood, and 3) blood stasis, which can have several causes. It is possible that acute myocardial infarction occurred after this particular FDEIA episode because the thrombogenicity induced by the combination of these three factors is high enough to create occlusive coronary thrombus, whereas this had not been the case on previous occasions. Physicians treating patients with FDEIA should be mindful of thrombotic cardiovascular events such as myocardial infarction as rare but potential complications of FDEIA.

The authors state that they have no Conflict of Interest (COI).

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