

Beer anaphylaxis

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Beer is an alcoholic drink consumed worldwide. Its basic ingredient is malted barley, although other cereals can be added. Barley is malted by soaking and germinating the grains. Hops add a bitter flavor, and yeast is essential for fermentation. Despite its high consumption, allergy to beer is infrequently reported. In 1980, Van Ketel¹ described 2 patients with acute reactions after drinking beer. The results of scratch testing were positive to malt. Keller and Schwanitz² reported a patient with urticaria after drinking beer or eating bread, with positive skin test responses to beer and flours. Gutgesell and Fuchs³ described a case of contact urticaria from beer. Vidal and Gonzalez-Quintela⁴ reported a case of cereal-induced asthma caused by inhalation and ingestion of barley and beer ingestion. Recently, 3 cases of urticaria and angioedema from beer were described by Santucci et al.⁵ We report 3 cases of acute allergic reactions to beer documented by allergy testing and double-blind placebo-controlled food challenge or a convincing history of anaphylaxis.

CASE HISTORIES

Case 1

A 34-year-old woman had a tingling sensation in her face, lip angioedema, chest tightness, dyspnea, and rhinoconjunctivitis immediately after drinking beer on 3 occasions. She had a history of allergic asthma, with sensitizations to dust mites and grass pollens.

Case 2

A 20-year-old man experienced a "lump in the throat," tongue angioedema, cough, wheezing, generalized urticaria, and fainting 30 minutes after drinking beer. The patient was evaluated in the

Abbreviation used

PVDF: Polyvinylidene difluoride

emergency department of our hospital and treated with subcutaneous epinephrine and methyl-prednisolone. He had previous perennial rhinitis and asthma, with hypersensitivity to olive and grass pollens and cat dander.

Case 3

A 22-year-old woman reported generalized urticaria immediately after drinking beer. She had an oral allergy syndrome after eating peaches and previous allergic rhinitis and asthma, with sensitizations to grass pollens, dust mites, and cat.

LABORATORY INVESTIGATION

An extract was prepared from barley-made beer. Beer proteins were extracted by stirring 5 g of freeze-dried beer overnight at 4°C in 25 mL of 0.15 mol/L PBS (pH 7.4). Particulate material was removed by centrifugation at 30,000 g for 30 minutes. The supernatant was dialyzed against distilled water, sterilized by 0.22 µm filtration (Millipore Corp, Bedford, Mass), and lyophilized. Skin prick testing was performed with beer extract (1 mg/mL), a commercial barley extract (ALK-Abelló, Spain), and appropriate negative and positive controls.

Patient 1 had a 5-mm wheal and 23-mm flare to beer extract. Barley extract produced an 11-mm wheal and 36-mm flare. Patient 2 had a 5-mm wheal and 7-mm flare to beer extract and a 14-mm wheal and 33-mm flare to barley extract. Patient 3 had a 4-mm wheal and 12-mm flare to barley extract and a negative response to the beer extract. Skin prick test responses to beer and barley extracts were negative in 20 control consumers of beer. Barley-specific IgE levels (CAP-FEIA System Pharmacia Diagnostic) were 20.2, 6.05, and 0 kU_A/L in patients 1, 2, and 3, respectively.

Double-blind placebo-controlled food challenges were performed in patients 1 and 3 with barley and freeze-dried beer. Increasing doses of barley and freeze-dried beer (3 g is equivalent to 100 mL of beer) were adminis-

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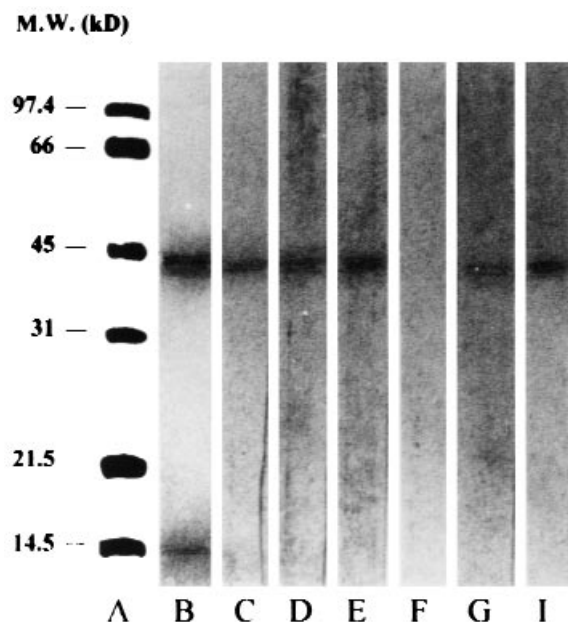


FIG 1. IgE antibody reactivity to barley-made beer allergens by immunoblotting. Proteins in beer were resolved by means of SDS-PAGE and transferred to PVDF. Five-millimeter strips from each blot were tested for reactivities to serum IgE from patients with beer anaphylaxis. *Lane A*, Molecular weight markers; *lane B*, staining for proteins by amido black; *lanes C* through *E*, sera from patients 1, 2, and 3, respectively; *lanes F* through *I*, IgE inhibition experiments performed with barley extract. A serum pool from patients 1, 2, and 3 was preincubated with 1000 µg/mL, 500 µg/mL, and 10 µg/mL of barley extract (*lanes F*, *G*, and *I*). PVDF-blotted beer proteins were incubated with this solution, and immunoblotting was performed.

tered in opaque capsules at 30-minute intervals. Dextrose was used as a placebo. Both patients had positive responses to barley and freeze-dried beer. Cumulative doses of 10.5 g of barley elicited clinical responses in both patients. Patient 1 reacted with generalized pruritus and eyelid angioedema to a cumulative dose of 1.1 g, and patient 3 reacted with pruritic wheals on the back to 0.35 g of freeze-dried beer (equivalent to 36.3 mL and 11.5 mL of beer, respectively). No challenges were performed in patient 2 because severe objective symptoms and signs were elicited after isolated ingestion of beer and documented in the emergency department. All patients have tolerated ingestion of wheat bread, other alcoholic beverages, and sulphite-containing food and drink.

SDS-PAGE was performed with a 12% polyacrylamide separating gel and a stacking gel of 4%. Fifteen micrograms of beer extract was applied to each well, and electrophoresis was performed at 170 V for 1 hour. Proteins were electrophoretically transferred onto a polyvinylidene difluoride (PVDF) membrane, which was saturated with 0.1 mol/L tris-buffered saline and 5% fat-free milk powder and incubated overnight with the patients' sera after washing. Bound specific IgE was detected by alkaline phosphatase-conjugated goat anti-human IgE (1:2000 vol/vol). The blot was developed with staining solution for 15 minutes. Immunoblots were scanned in the Desk Top Densitometer and analyzed with Diversity One software (PDI Inc, New York, NY). Staining with amido black on membrane showed 2 bands at 14.6 and 44.1 kD (Fig 1, *lane B*). Immunoblot analysis performed with the patient's individual sera showed a signal at 44.1 kD (Fig 1, *lanes C*, *D*, and *E*). A serum pool was used to demonstrate inhibition of serum IgE by barley extract. The serum pool was diluted 1:2 and mixed with beer (homologous inhibition), ovalbumin (inhibition control), or barley extract at concentrations of 1000, 500, and 10 µg/mL (Fig 1, *lanes F*, *G*, and *I*). Assays similar to the previously described immunoblotting were performed. Complete inhibition was achieved with beer and barley extract.

DISCUSSION

These patients illustrate the potential for life-threatening IgE-mediated reactions to trace components of barley in beer. Despite its wide consumption, allergic reactions to beer have been rarely reported; perhaps they are infrequent or underrecognized. However, barley-made beer should be considered as a potential culprit of severe anaphylaxis, and barley-sensitive patients should be questioned about beer tolerance.

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