Beer Anaphylaxis

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Beer is a popular beverage that has been consumed for hundreds of years all over the world. Although beer is drunk by millions of people, allergic reactions are seldom seen. In this report we describe a case of anaphylaxis to beer and discuss the pertinent literature.

PATIENT DESCRIPTION

A 21 year old man presented to the allergy department owing to a severe reaction to beer. Two weeks previously he had drunk a glass of beer and within minutes suffered a generalized reaction consisting of urticaria, dyspnea, angiodema of face, and vomiting. He was promptly transferred to the emergency department where he was given the standard treatment for such cases. He rarely drank beer before but had no problem drinking other alcoholic beverages. He denied suffering from rhinitis, asthma or any other allergic disease. He also denied any other food-related allergic reaction. He was otherwise healthy.

Skin prick tests with commercial reagents (Alk-Abello, USA) were performed to test for reactions to different kinds of foods and environmental allergens. Tests were performed using beer taken straight from the original container and tested "as is." The beers tested were Goldstar, Maccabi, Efes Pilsener (contains also rice), Miler (contains also wheat) and malt beer. A test was considered positive if the wheal was ≥ 5 mm and the erythema ≤ 7 mm in the presence of a negative control and a positive histamine test.

Prick tests with all the above mentioned beers were clearly positive. Food tests were positive to oats and barley and mildly positive to almonds and peas. Tests to house dust mites, plants, moulds, animals and yeast (*Saccharomyces cerevisiae*) were all negative. Specific immunoglobulin E (Immulite 2000, 3 g, Allergy™, Siemens Medical Solutions Diagnostics, USA) was highly positive to apples and mildly positive to rice, tomato, peanut and peach. He was advised to refrain from drinking all types of beer.

COMMENT

We present a case of anaphylaxis to beer but without reaction to other alcoholic beverages. The diagnosis of beer allergy was suspected following the clinical presentation and confirmed by positive skin tests. Since the patient was able to eat the various foods that were found by skin or blood tests to be positive, these results were deemed clinically non-relevant.

Beer is produced by the fermentation of sugar derived from a starch-based material, the most common being barley, although in some cases rice, corn or wheat are used, usually in conjunction with barley. This multistep process starts with the malting of the cereal, mainly barley as mentioned earlier. The grain is malted by soaking it in water, allowing it to germinate, then drying the partially germinated grain in a kiln. Different roasting times and temperatures are used to produce different colors of malt from the same grain. Darker malts will produce darker beers. The next step involves mixing water and malt at a high temperature for a period, which induces the alpha and beta amylases present in barley to transform the long chain dextrins to simpler fermentable sugars such as glucose. Next, the fermentable liquid, known as wort, is filtered and separated from the grain. This wort is boiled, which serves several purposes: boiling sterilizes it, increases its concentration of sugars and destroys any remaining enzymes. During the boiling, hops (the dried flower cones of the hop vine *Humulus lupulus*) are added, conferring to beer its bitter taste as well as preservative properties. Finally, different species of yeast are added (*S. cerivisiae* or *S. uvarum*) and during a period that lasts weeks to months they ferment the sugars, producing alcohol. Thus, wort is transformed to beer. Malt beer is produced in the same way but with a shorter fermentation process, reaching a maximum alcohol content of 0.50%.

Although allergy to various alcoholic beverages has been described [1], allergic reactions to beer are rare. In 1980 Van Ketel [2] reported two patients with urticaria and angioedema after drinking beer; their skin tests were positive to malt. Since then other reports [3,4] have described similar reactions.

Allergy to beer can be caused by several possible allergens. It can be part of a wider reactivity to ethanol, which can be excluded in our case since the patient reacted only when drinking beer. Another possibility is yeasts, but this was excluded by a negative skin test. As described above, hops are added to beer and although we were not able to test for this plant, a positive barley skin test identified it as the cause of his reaction, which is usually the case in beer allergy.

Allergy to barley-containing food products can be caused by inhalation, as in baker's asthma, by eating products made of barley flour, or by drinking barley-containing beverages. An

decreased IL-10 and IFNγ synthesis and a concurrent loss of regulatory function. This suggests that TLR-9 could be used to monitor and potentially modulate the function of 1α,25VitD3-induced IL-10-secreting Tregs *in vivo*, and that this has implications in cancer therapy and vaccine design [17].

It is noteworthy that in addition to its systemic effect, topical vitamin D analogs such as calcipotrol were found to affect cutaneous immune responses. In this respect it was demonstrated that exposure of the skin to calcipotriol before transcutaneous immunization with OVA protein and CpG adjuvant prevents Ag-specific CD8+ T cell priming coincident with Langerhans cell depletion in the skin. Immunization through calcipotriol-treated skin induces CD4+CD25+ Treg cells that prevent subsequent Ag-specific CD8+ T cell proliferation and IFNγ production. In addition, it is suggested that ultraviolet B-induced tolerance is induced via a vitamin D receptor-dependent mechanism since vitamin D receptor knockout mice failed to increase FoxP3+ Tregs in their peripheral draining lymph node following irradiation [18].

In conclusion, the impact of the vitamin D pathway on immune function, including its therapeutic effects on IL-10, Tregs, and toll-like receptors with respect to its influence on both autoimmune diseases and cancer should be further elucidated.

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IFNγ = interferon-gamma
TLR = toll-like receptor
OVA = ovalbumin