Case Reports and Reviews

Case Report

Allergy to Egg Yolk - Case Report and Literature Review

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Abstract

Egg is one of the most commonly eaten foods worldwide and egg allergy is the second most common food allergy. We report an adult patient who was previously healthy and tolerating eggs through out, then developed allergic reactions to egg yolk confirmed by positive skin prick test with commercially available extracts for egg yolk and negative for egg white.

Introduction

Egg is very common food used globally because it contains a lot of nutrients. Food allergies in general are increasing in prevalence in both children and adults, and the estimated prevalence of egg allergy in particular varies depending on definition, the method of data collection or both. However, hen's egg allergy (HEA) is very common worldwide and remains the second most common food allergy after cow's milk, that affects up to 9% of children and about 3% of adults in average [1-3]. Cohort studies from Sweden and German, showed prevalence of egg allergy in children ranging between 5% to 6%, [4,5] while the prevalence in large adults USA population (more than 4400) showed prevalence of egg allergy ranging between 2.1% to 3.9% [6].

The egg white mainly water and proteins; albumen, but egg yolk is a rich source of lipids, vitamins, and minerals, but also contains some proteins. While hen's eggs are a versatile ingredient for use in many foods and a variety of manufactured products, it may be hard to avoid eggs [7].

The clinical manifestations of egg yolk allergy after ingestion of egg yolk, regardless of the method of preparation usually include gastrointestinal symptoms (vomiting, abdominal pain), and skin symptoms (localized or generalized urticaria, erythema, facial angioedema), but may manifest respiratory symptoms including cough, shortness of beath, chest tightness or rhinitis [8-11].

The IgE-mediated reactions are the most common type of allergic reactions to egg. The allergic children usually develop skin rash, urticaria or angioedema as acute onset within minutes to hours after ingestion. Although skin manifestations are the most common, but other systemic reactions involving gastrointestinal or respiratory tracts could develop and the severity of the reactions can be unpredictable, which potentially can be life threatening [12-16]. Ingestion of raw or undercooked egg may trigger more severe reactions than well-cooked egg, but it is important to keep in mind that some reactions are due to heat-resistant substance [17]. In children the tolerance of egg allergy may develop within few years of life, usually before the age of 6 years in about 73% or more of children, however, some of them may continue to be allergic lifelong [18].

It is rarely, where a patient may tolerate egg yolk ingestion for years, then start to develop allergic symptoms to egg yolk later in life, but if happens it may indicate egg yolk allergy and subsequent reactions could potentially predicate more serious reactions that worth to refer patient for assessment by allergist/ immunologist [19].

Case report

We describe 35-years old patient who was previously healthy and tolerating egg ingestion throughout her life. However, 6-months prior to her presentation, she started to develop progressive and severe itchy generalized urticarial rash immediately after eating grilled eggs. She was managed each time with oral anti-histamine, that usually relive her symptoms, but because the progression and severity of her symptoms, she was referred for allergy assessment. The patient underwent skin prick test (SPT) with standard commercially available (stallergenes allergens) extracts on the patient forearm, then after fifteen minutes

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of the procedure, they were measured in millimeter (mm) in diameter.

The results showed that histamine (positive control) was 6x5 mm; negative control was 0x0 mm; egg white was 0x0 mm and egg yolk was 4x4 mm (in diameter). The specific immunoglobulin E for egg white and egg yolk were measured using radioallergosorbent test (RAST) that turned to be negative for both egg white and egg yolk (less than 0.35 ku/ml).

The diagnosis of allergy to egg yolk was made based on clear history of ingesting grilled eggs immediately before each allergic episodes and positive skin prick test with specific standard commercially available allergen extract for egg yolk. The anaphylaxis action plan was undertaken, including strict avoidance of eggs and all its products, and to use epinephrine (Epi-pen autoinjector, dose 0.3mg) intramuscularly as lifesaving medication for accidental exposure.

Discussion

Egg allergy can be defined as immune mediated reaction induced by egg proteins [20], that includes IgE antibody-mediated allergy and non-IgE antibody-mediated allergic response such as atopic dermatitis and eosinophilic esophagitis, which are mixed IgE- and cell-mediated immune disorders. IgE-mediated allergic reaction is well known as type I mediated allergic reaction, that is responsible for majority of food-induced allergic reactions mediated through allergen-specific IgE antibodies [21].

In general the immunological response and the allergenicity of proteins to stimulate a specific immune response depends on their resistance to heat and digestive enzymes [22,23]. The allergenic substance with its specific epitope (sequential or conformational) stimulate immune response that binds specifically with membrane receptors on T or B cells. The conformational epitopes can be destroyed with heating or partial hydrolysis using digestive enzymes, which alters the tertiary structure of the protein, whereas sequential epitopes can resist heating and digestive enzymes. Particularly for egg allergy, it is unlike IgE antibodies against conformational epitopes, those patients with IgE antibodies reacting against sequential epitopes tend to have persistent allergy [24].

Worldwide, allergy to eggs is one of the most difficult of all food allergies to deal with, because eggs are a supremely versatile ingredient, that are used in large number of foods; a startling number of soups, processed meats, frozen dinners, crackers, bread, egg noodles, pancakes, waffles, cakes, French toast, tea-boiled egg [25]. Egg yolk is commonly used in products like salad dressing, sauces, confectionery, creams, noodles, baking goods, and mayonnaise [26].

The egg yolk has been reported to possess two clinically important allergens, which are Gal d 5 (alpha-livetin/chicken serum albumin), a heat-labile protein, and Gal d 6 or YGP42 (a lipoprotein), a heat-resistant protein. Moreover, Gal d 5 has been claimed as a major allergen present in egg yolk [27–30].

Egg yolk has been reported to be primarily comprised of carbohydrates (1%), lipids (31 to 35%), proteins (15 to 17%), and water (50%). Low-density lipoproteins (17%), phosvitin (8%), livetins (38%), and lipovitellins (36%) are the proteins present in egg yolk. The yellow color of the yolk has been found to be imparted by the presence of carotenoids (1%) [31,32]. During the cooking process, egg proteins are claimed to undergo significant conformational modifications (based on heating temperature and cooking time), leading to protein denaturation. This process of protein denaturation may lead to the inactivation of antinutritional factors like antiprotease from egg-white and other highly resistant proteins in eggs [33].

Egg white allergy (EWA) and egg yolk allergy (EYA) are both part of human egg allergy (HEA). Egg yolk allergy (EYA) has been gaining more and more attention over recent years. In a recent study, the diagnosis of egg yolk allergy in children clearly confirmed the allergens and serum albumin (Gal d 5) and YGP42 (Gal d 6) were the main allergens in egg yolk [34,35]. Huang Lunhuia,b et al reported that the major allergen of egg yolk was Gal d 6, and it could remains stable after cooking or other heat treatment, and it resists the digestion of protease [36]. Identification of individuals with IgE-mediated egg allergy is important because these patients are at risk for severe reactions. As with other forms of food allergy, the severity of symptoms in given patient with egg allergy may vary considerably between reactions. In addition, the severity of an initial reaction does not predict the severity of subsequent reactions [37].

Skin prick testing (SPT) is minimally invasive, inexpensive, reproducible, and immediately revile the results to confirm the diagnosis in allergy clinic for IgE-mediated allergic disease in patients with suspected food, anaphylaxis, drug allergy and atopic diseases [38]. It may be necessary to discriminate between EY and EW allergy during diagnosis, but in practice there is no perfect way to separate egg yolk from egg white, therefore, the potential risk for allergic reactions egg ingestion coexists if an individual is allergic to one of them [39].

Conclusion

There is no perfect way to separate egg yolk from white without leaving traces amount of one on the other. Therefore, diagnosing egg yolk allergy doesn't justify allowing patient to eat egg white because of potential risk of development of allergic reaction. Therefore, avoidance of egg ingestion and all of its products and education regarding the treatment of allergic reactions are the cornerstones of egg allergy management and anaphylaxis action plan should be undertaken in all cases of egg allergy.

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