www.jcimcr.org

JCIMCR OPEN ACCESS Journal of Clinical Images and Medical Case Reports

ISSN 2766-7820

Case Report

Open Access, Volume 4

Anaphylaxis to egg, through breast milk or airborn allergen? A case study

Mohammad Hassan Bemanian; Mina Ahmadi*; Mohamad Nabavi; Sima Shokri; Morteza Fallahpour; Saba Arshi; Samaneasefi

Allergy and Clinical Immunology Department, Rasool Akram Medical Complex, Iran University of Medical Sciences, Tehran, Iran.

***Corresponding Author: Mina Ahmadi**

Iran University of Medical Science, Teran, Iran.

Email: mina.ahmadi65@yahoo.com

Received: Jan 28, 2023

Accepted: Feb 17, 2023

Published: Feb 24, 2023

Archived: www.jcimcr.org

DOI: www.doi.org/10.52768/2766-7820/2300

Abstract

Hens egg allergy is common food allergy in infant, there are various clinical presentations which anaphylaxis is the most serious reaction, it could be life threatening event and need to manage urgently. Major rout of allergenes delivery in food allergy is oral rout although it could be occured by skin or respiratory system. There are 5 important egg allergens, ovomucoid (Gal d 1), ovalbumin (Gal d 2), ovotransferrin (Gal d 3), c- type lysosyme (Gal d 4) α-livetin (Gal d 5) which Gl d 1 is major allergen in egg white, it is highly heat resistant. Here in we present a rare case of egg allergy who exposed to egg allergenes not per os and may be an uncommon egg allerges play as culprit in this patient. In general, the examination of the studied child showed that the egg allergy was due to inhalation and not through breast milk. No positive serum was reported for any of the white epitopes, including ovum, ovalbumin, ovotransferrin, lysozyme, and albumin, and negative tests were also reported for Gal d and 5 Gal d-yolk.

Keywords: Anaphylaxis; Food allergy; Egg.

Introduction

Egg allergy is one of the most common pediatric food allergies affecting 0.5%–10% of children and infants [1]. Allergic reactions occur when antigen-specific Immunoglobulin E (IgE) binds to its high-affinity receptors on granulocytes, activating their effector functions and release of inflammatory mediators [2,3]. Several egg-white proteins contribute to IgE sensitization, of which Ovomucoid (OVM) is considered a major allergen, designated as Gal d 1 (WHO-IUIS). Ovomucoid is resistant to heat and digestive enzymes, and IgE recognition of the OVM protein is indicative of a more persistent allergic phenotype [4]. Additionally, IgE recognition of a greater number of sequential epitopes is shown to be associated with greater severity of allergic reactions [4].

There are two types of food allergy reactions; immediate and delayed. A baby can have either or both Immediate reactions are also called IgE-mediated alllergies. This is because the baby's immune system creates specific IgE antibodies to a certain food. If a baby is given the specific food, they are allergic to; the IgE antibodies will recognise it and cause the rapid release of chemicals, including histamine, that trigger inflammation and allergic symptoms. Symptoms appear within minutes, or up to 2 hours after eating the food responsible [5-8]. Delayed reactions are called non-IgE mediated allergies because they are not controlled by IgE. Instead, it is believed such reactions are regulated by immune cells. Symptoms appear 4-72 hours after eating the food [5-8]. Over the past few years, various groups have shown that induction of other antibody isotypes, such as IgA, IgG1, IgG4, and IgD, can improve IgE-mediated reactions [4].

In particular, several clinical trials of egg oral immunotherapy reported increases of serum antigen-specific IgG4, IgG1, and IgA in patients who responded to treatment [4].

Interestingly, the ability of the antibodies to block IgE-mediated responses could be largely dependent on their antigen specificity rather than isotype [4].

However, recent research in food allergy has mainly focused on understanding epitope-specific repertoire of IgE and IgG4, with only a limited number of studies addressing epitope specificity of IgG1, IgA, and IgD [4].

Most reactions to egg are mild. Commonly infants refuse the egg-containing food, develop redness and sometimes swelling around the mouth and may vomit after eating. Stomach ache or diarrhoea may also occur. Symptoms nearly always occur immediately or within 2 hours of eating the food [9,10]. The more the egg is cooked or processed the less likely it is to cause a reaction [11]. Rarely, some children also develop a more severe reaction with cough, difficulty breathing, an asthma-type wheeze or even anaphylaxis [12]. Further reactions do not, as a rule, become increasingly severe unless a greater amount or a less well-cooked form of egg is eaten. Accidental skin contact usually only causes a rash but no generalized or dangerous symptoms. Egg allergy may also be responsible for worsening of eczema, but this is usually more difficult to diagnose given the slower time to onset of symptoms [12].

The diagnosis of egg allergy is based on the history of previous reactions, and can be confirmed by Skin Tests (SPTs) or blood tests (IgE/RAST) [13].

Allergic reactions to egg can be mild, moderate or severe (anaphylaxis) [9,10]. There are certain things that affect how severe an allergic reaction may be, including the amount of egg eaten, and how well the egg was cooked. Egg does not have to be eaten to cause an allergic reaction, coming into contact with egg shells or touching (raw) egg can cause allergic symptoms usually affecting the skin in highly sensitive individuals [9,10].

Small amounts of egg protein may be passed through mother's milk during breastfeeding. If the infant has no symptoms the mother can continue eating egg. However, if the infant has any gut or skin symptoms such as eczema, they may benefit from the mother trialling excluding egg from her diet. If there is no improvement in symptoms after two weeks, eggs can be reintroduced back into the mother's diet [14].

In eggs, two proteins, ovomucoid and ovalbumin, have been found to be responsible for egg allergies [15]. Egg whites are more allergenic than the yolk, but if child has an egg allergy it is better for him/her to avoid the entire egg for a couple of reasons. First, the egg yolk still contains allergenic proteins. Also, it is impossible to completely separate the egg yolks from the whites [16].

The most common exposure that causes reactions to egg is ingestion. However, there is a potential for airborne reactions. It is important to remember that airborne reactions can occur if eggs are cooked on a stove top near an egg-allergic child. This is because while the egg is being cooked, egg protein is released into the air. This protein can then cause a reaction in your child.

Therefore, our aim in this present study is to examine anaphylaxis to egg, through breast milk or airborn allergen. In this study, we intend to present a case of a child with anaphylaxis whose mother ate eggs.

Patient

The patient's mother stated that for the first time at the age of 9 months, after eating a whole egg and breastfeeding, 45 minutes later, the child suffered severe restlessness, hives, wheezing and vomiting for 20 minutes. According to the history, a prick test was performed for the patient, in which the yolk and egg white of wheat, soy and tree almonds were positive. In order to solve the mystery of whether the secretion of egg allergens in breast milk caused anaphylaxis or aero-allergens, the patient was challenged, so that first the mother and the child were separated and kept in two separate rooms, and then Eggs were fed to the mother and due to the fact that one to three hours later, allergens are secreted in breast milk, the child was fed milk on two occasions at 1 and 3 o'clock, and no symptoms were recorded from the child. Two months after this challenge, the child again suffered anaphylaxis in the arms of his older sister who had eaten an egg. According to the mother, he had eaten an egg almost 10 minutes before hugging the child. With all the findings, it was proved that egg aerosols cause anaphylaxis.

But in response to the next question, which egg epitope can cause anaphylaxis with its aerosol? For this reason, CRD was requested for the patient.

In tested of WHOLE EXTACT, KUA/L of egg white is equivalent to 1.5.

KUA/L was shown to be <0.01 for yolk, while for none of the white epitopes including ovumucoid, ovalbumin, ovotransferrin, lysozyme and serum albumin, positive 5 was not reported. Also, about the yolk Gal d and 5 Gal d-yolk, it was negative.

Discussion

In general, the examination of the studied child showed that the egg allergy was due to inhalation and not through breast milk. No positive serum was reported for any of the white epitopes, including ovum, ovalbumin, ovotransferrin, lysozyme, and albumin, and negative tests were also reported for Gal d and 5 Gal d-yolk.

It has been shown that understanding the molecular mechanism of allergic sensitization may help to improve diagnostic, prognostic and therapeutic approaches in food allergy.

Previous studies have already reported that milk-BBEA and peanut-BBEA have excellent reliability and sensitivity in detecting allergenic epitopes, providing further insight into the role of IgE and IgG4 pools in disease phenotypes and outcome prognosis. They offer milk oral immunotherapy [17].

In a similar study, an assay called egg-BBEA was developed to measure the levels of five antibody isotypes, i.e., IgE, IgG4, IgG1, IgA, and IgD, to peptides covering the entire sequence of a major egg white allergen—ovomucoid. In this study, it is shown that egg-BBEA, similar to other high-performance technologies, has screen effects that can be identified and eliminated. And is a reliable assay with high agreement and low variability among technical replicates [4].

It has been shown in the study of Suprun et al, that IgE directed at sequential peptides associated with egg allergy, constituting immunogenic IgE epitopes previously identified by other groups and demonstrating sensitivity of egg-BBEA for epitope detection [4].

Also found that EA children had variable but on average higher esIgD, while AC showed greater levels of esIgA and esIgG1 antibodies [4].

Furthermore, found that esIgE was highly correlated with esIgD in AC but not EA patients, which may indicate that while

atopic patients have low levels of IgE, it is produced by plasma cells coming from a direct isotype switch from IgD+ B cells, resulting in lower-affinity IgE antibodies. Different antibody isotypes may inhibit IgE-mediated allergic reactions, given they have similar specificity to an antigen, and in this cohort, EA patients had high egg sensitization with median egg sIgE of 49.9 kUA/L, which might have rendered antibody repertoire profiles different from patients with lower sIgE levels. However, these results provide basis for further studies that should include broader allergic population and a larger number of control participants [17,18].

There are sparse epidemiological data on the frequency of reaction to food particle inhalation in children with food allergy. An Internet-based survey showed that in 51 responders, median age of 7 years, with anaphylactic reactions to foods, most reactions (78%) occurred after ingestion, eight (16%) reactions occurred after exclusive skin contact, and three (5.9%) reactions occurred after exposure to aerosolized food. Airborne food allergens are generated when the food is cooked, particularly boiled or steamed, or manipulated, especially cutting or cleaning [19].

Sometimes a food can be eaten with no problem, but issues arise only when small particles of it are inhaled. This is referred to as hypersensitivity to foods by inhalation. This phenomenon can occur with peanuts, cow's milk, fish, shellfish, seeds, soybeans, cereal grains, legumes, hen's egg, coffee, and flour. In fact, there have been several reports of steam allergy to legumes. Typical symptoms of an airborne allergy to food particles often include runny, watery eyes, coughing, wheezing, and asthma. An anaphylactic reaction is serious and less common but can occur [20].

It is worth noting that systemic anaphylaxis to food allergens is very rare, yet striking examples have been reported. One report described an 11-year-old boy who had anaphylaxis while his mother was cooking rice. He was able to consume rice without any symptoms, but bronchial challenge with rice induced anaphylaxis [21]. Another report described anaphylaxis in an 8-year-old girl while white potatoes were being boiled at home [22]. IgE-mediated allergy to potato was evidenced in her by positive skin prick, specific IgE, basophil histamine release, and passive transfer testing [22]. A 6-year-old boy with multiple food allergies had anaphylaxis from being merely in the vicinity of fried fish and urticaria while in the vicinity of uncooked fish or egg. Skin prick testing and specific IgE were strongly positive to egg, fish, shrimp, and crab. Fatal anaphylaxis occurred in a woman after walking through a milk storage room in a barn. Her serum specific IgE was known to be positive to casein [23]. A 33-year-old male on a milk-free diet due to milk allergy in childhood complained of shortness of breath with loss of consciousness while he was milking sheep. He had positive skin prick and specific IgE tests to casein, lactoglobulin, and whole milk. He later discovered that wearing a gas mask while milking prevented further attack [24].

Conclusion

The findings obtained in the present study showed that the food allergy in the baby was caused by egg inhalation. However, the examination of egg epitopes has also indicated that they are negative.

Finally, after reviewing the findings of the current study and reviewing similar studies, the authors of this study raised three questions about the necessity of continuing more extensive studies in this field.

1. Are the epitopes known as the most common epitopes of egg white, such as "ovum, ovalbumin, ovotransferrin, lysozyme, and albumin" in the Iranian race, also considered as major allergies?

2. Given that specific IgE does not play a role in allergic reactions to eggs, what is the role of other IgA, IgG1, IgG4 antibodies in the development of this allergy?

3. Is there an epitope in the egg that has not been discovered that causes anaphylaxis?

References

1. Allen Clare Wendy, Campbell Dianne Elizabeth, KEMP Andrew Stewart. Egg allergy: Are all childhood food allergies the same?. Journal of paediatrics and child health. 2007; 43: 214-218.
2. Mitre Edward, Norwood Stephanie, NUTMAN, Thomas B. Saturation of Immunoglobulin E (IgE) binding sites by polyclonal IgE does not explain the protective effect of helminth infections against atopy. Infection and Immunity. 2005; 73: 4106-4111.
3. Galli Stephen J, Tsai Mindy. IgE and mast cells in allergic disease. Nature medicine. 2012; 18: 693-704.
4. Suprun, Maria, et al. Ovomucoid epitope-specific repertoire of IgE, IgG4, IgG1, IgA1, and IgD antibodies in egg-allergic children. Allergy. 2020; 75: 2633-2643.
5. Valenta, Rudolf, et al. Food allergies: The basics. Gastroenterology. 2015; 148: 1120-1131. e4.
6. Han Youngshin, Kim Jihyun, Ahn Kangmo. Food allergy. Korean journal of pediatrics. 2012; 55: 153.
7. Urisu Atsuo, Kondo Y, Tsuge I. Hen's egg allergy. Food allergy: Molecular basis and clinical practice. 2015; 101: 124-130.
8. Seth, Divya, et al. Food allergy: A review. Pediatric annals. 2020; 49: e50-e58.
9. Tan John W, Joshi Preeti. Egg allergy: An update. Journal of paediatrics and child health. 2014; 50: 11-15.
10. Samady, Waheeda, et al. Egg allergy in US children. The Journal of allergy and clinical immunology: In Practice. 2020; 8: 3066-3073. e6.
11. Benedé, Sara, et al. Egg proteins as allergens and the effects of the food matrix and processing. Food & function. 2015; 6: 694-713.
12. Clark AT, et al. British Society for Allergy and Clinical Immunology guidelines for the management of egg allergy. Clinical & Experimental Allergy. 2010; 40: 1116-1129.
13. Ansotegui, Ignacio J, et al. IgE allergy diagnostics and other relevant tests in allergy, a World Allergy Organization position paper. World allergy organization journal. 2020; 13: 100080.
14. Bernard, Herve, et al. Peanut allergens are rapidly transferred in human breast milk and can prevent sensitization in mice. Allergy. 2014; 69: 888-897.
15. Caubet, Jean-Christoph, Wang, Julie. Current understanding of egg allergy. Pediatric Clinics. 2011; 58: 427-443.
16. Anet J, et al. Allergens in the white and yolk of hen's egg. International Archives of Allergy and Immunology. 1985; 77: 364-371.
17. Mine Yoshinori, Zhang, Jie Wei. Identification and fine mapping

of IgG and IgE epitopes in ovomucoid. Biochemical and biophysical research communications. 2002; 292: 1070-1074.

18. Dodev TS, et al. Inhibition of allergen-dependent IgE activity by antibodies of the same specificity but different class. Allergy. 2015; 70: 720-724.

19. Fleischer, David M, et al. Allergic reactions to foods in preschool-aged children in a prospective observational food allergy study. Pediatrics. 2012; 130: e25-e32.

20. Ramirez, Daniel A, Bahna, Sami L. Food hypersensitivity by inhalation. Clinical and Molecular Allergy, 2009; 7: 1-6.

21. Fiocchi, Alessandro, et al. Exercise-induced anaphylaxis after food contaminant ingestion in double-blinded, placebo-controlled, food-exercise challenge. Journal of allergy and clinical immunology. 1997; 100: 424-425.

22. Castells MC, et al. Allergy to white potato. Journal of allergy and clinical immunology. 1986; 78: 1110-1114.

23. Bahna SL. Exquisite food allergy without eating. Allergy. 1994; 49: 129-130.

24. Vargiu A, et al. Hypersensitivity reactions from inhalation of milk proteins. Allergy. 1994; 49: 386-387.