THE INJECTOR

DOI: 10.5281/zenodo.10498457
The Injector 2023;2(3):157-162

Original Article

Experience of measles-mumps-rubella vaccine among children with egg allergy

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Abstract

Objective: Patients with egg allergy have had hesitations about measles-mumps-rubella (MMR) vaccination for a long time due to the egg protein contained in the vaccine. In this study, we aimed to share our clinical experience on this subject.

Methods: This descriptive study included all 179 patients with egg allergies who received MMR in our clinic between 2015 and 2022. The patients' age, sex, clinical findings, allergy tests, total IgE, eosinophil values, and postvaccine reaction status were evaluated retrospectively.

Results: The median age of those vaccinated in our clinic was 13.0 months (9.0-84.0). The median value for the calendar delay in the vaccine dose was 1.0 months (minimum: 0, maximum: 72.0). The median absolute eosinophil value of the patients was 360.0 10^3/uL (10.0-2220.0), the median eosinophil value (%) was 3.4% (0.1-20.0%), and the median total IgE value was 53.5 IU/mL (1.0-2500.0). The most common clinical findings were atopic dermatitis and urticaria (54.7% and 44.1%, respectively). No patient had developed a previous anaphylaxis. A postvaccine reaction developed in one out of 179 children who received the MMR vaccine. This patient presented with urticaria. No serious reaction was observed in any of the other patients.

Conclusion: Children with egg allergy should be evaluated by pediatric allergy clinics; however, this should not cause a delay in the MMR vaccination schedule.

Keywords: Anaphylaxis, children, egg allergy, measles-mumps-rubella vaccine.

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Received: 11 August 2023 **Revised:** 15 August 2023 **Accepted:** 13 September 2023 **Published:** 20 September 2023

INTRODUCTION

The prevalence of food allergies is increasing worldwide. Food allergies in Western societies affect 5% of the adult population and 8% of children (1). The quality of life of patients with food allergies and their relatives may be adversely affected (2).

Egg allergy can be defined as an adverse immune reaction mediated by egg-specific IgE caused by proteins in egg white, usually induced by ovalbumin (Gal d 2) and/or ovomucoid (Gal d 1) (3). It usually occurs in early childhood after the first egg is retrieved (4). The prevalence of egg allegy was reported as 0.9%-1.3% in children (5). According to the EuroPrevall birth cohort, the prevalence of egg allergy in 2-year-olds across Europe was approximately 1% and 2% in the United Kingdom (6, 7). The prevalence of egg allergy in adults was lower, with approximately 0.1% (8). Egg allergy can cause skin findings like urticaria and atopic dermatitis, respiratory symptoms like cough and wheezing, gastrointestinal symptoms like vomiting and diarrhea, and anaphylaxis (9).

Measles and mumps components in MMR (Measles, Rubella, Mumps) vaccines are grown in fibroblast cultures obtained from chick embryos (10). Due to the egg protein contained in the vaccine, patients with egg allergy have had hesitations about MMR vaccination for a long time (10). The latest guidelines of British Society of Allergy and Clinical Immunology (BSACI) recommends that all children with egg allergy should receive their childhood routine vaccinations in primary care, including the MMR vaccine, without the need for extra precautions (3). Research indicates that children with egg allergies have no increased risk of severe allergic reactions against the MMR vaccine (11, 12). In addition, latest guide of the European Academy of Allergy and Clinical Immunology (EAACI) reports that MMR vaccines can be administered under standard conditions for patients with egg allergy (13). However, anaphylaxis cases develop after receiving the MMR vaccine in patients with egg allergies (14). This leads to different approaches in practice.

Because there are different experiences with MMR vaccination in children with egg allergy according to the literature, we aimed to share our clinical experience on this subject. Sociodemographic characteristics, clinical findings and postvaccine reaction status of patients with egg allergy and MMR vaccine in our clinic were evaluated within the scope of the study.

MATERIALS AND METHODS

Ethics

The Ethics Committee of University of Health Sciences Ümraniye Training and Research Hospital granted approval for the study (date: 09.29.2022, number: 309). Permission for the study was obtained from the clinic where the study was conducted. The study was carried out in accordance with the Declaration of Helsinki Principles. No personal information that could reveal the private lives and/or identities of the participants was collected and the security of the data was ensured.

Study design, population and sample

In this descriptive study, the patients followed in the Pediatric Allergy and Immunology outpatient clinic, diagnosed with egg allergy and administered MMR vaccine were determined retrospectively from patient files. Clinical and laboratory data and allergy tests of these patients were evaluated. The study employed 179 patients with egg allergies who received MMR vaccines in our clinic between 2015 and 2022.

Measurements

The diagnosis of egg allergy was made after history, physical examination, and laboratory tests (egg-specific IgE). As a result, the diagnosis was confirmed by an oral provocation test in cases where an egg allergy could not be clearly demonstrated. In this study, the age, sex, clinical findings, allergy test results, total IgE, eosinophil values, and postvaccine reaction status of patients diagnosed with egg allergy were evaluated retrospectively.

The blood eosinophil counts were measured from hemogram parameters. Total IgE values were measured by nephelometric method with a machine from Siemens Healthcare Diagnostics Products, Marburg, Germany. Allergen-specific IgE levels were determined with the Immuno-CAP system (UniCAP; Uppsala, Sweden). Specific IgE levels ≥ 0.35 kIU/l were accepted as positive results (15,16).

Statistical analysis

Statistical evaluation was performed using IBM SPSS Version 25.0 (IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp, Chicago/USA). Median, minimum and maximum values, number (n) and percentages (%) were used for descriptive data.

RESULTS

The study included a total of 179 patients with egg allergies who were vaccinated against MMR between 2015 and 2022. Of the patients, 64.8% (n=116) were male and 35.2% (n=63) were female. The median age of those vaccinated in our clinic was 13.0 months (minimum: 9.0, maximum 84.0). The median value for the calendar delay in the vaccine dose is 1.0 months (minimum: 0, maximum: 72.0).

When the clinical findings related to egg allergy were evaluated, atopic dermatitis was observed in 54.7% (n=98) and urticaria was observed in 44.1% (n=79) of the patients. Other clinical findings were gastrointestinal system (GIS) findings (19.6%) and reactive airway findings (5.6%). Allergic rhinitis symptoms were observed as clinical findings in only two patients (1.1%). No patient developed anaphylaxis (Table 1).

Table 1. Clinical features of the patients

Clinical features	n	%
Atopic dermatitis	98	54.7
Urticaria	79	44.1
Allergic rhinitis	2	1.1
Gastrointestinal findings	35	19.6
Reactive airway	10	5.6
Anaphylaxis	0	0

Concerning the laboratory findings of the patients, the median absolute eosinophil value was 360.0 103/µL (10.0-2220.0), the median eosinophil value (%) was 3.4% (0.1-20.0%) and the median total IgE value was 53.5 IU/mL (1.0-2500.0). The median of the specific IgE (egg) value is 0.97 kIU/l (minimum: 0.0, maximum 100.0). Specific IgE (egg) values were positive in 69.8% (n=125) of the patients. Specific IgE (cow's milk) values were positive in 15.6% (n=28) of them (Table 2).

Table 2. Laboratory features of the patients

Laboratory features	Median	Minimum	Maximum
Eosinophil (absolute) (10^3/uL)	360.0	10.0	2220.0
Eosinophil (%)	3.4	0.1	20.0
Total IgE (IU/mL)	53.5	1.0	2500.0
Specific IgE (egg) (kIU/l)	0.97	0.0	100.0
Specific IgE positivity		**n**	**%**
Specific IgE (egg)		125	69.8
Specific IgE (cow's milk)		28	15.6

Nearly half of the patients (n=90; 50.3%) had a specific IgE (egg) value of <1.0 kIU/l. Of the patients, 39.1% (n=70) had specific IgE (egg) values between 1.0 and 20.0 kIU/l, and 8.9% (n=16) of them had specific IgE (egg) values between 20.0 and 50.0 kIU/l. Three patients had a specific IgE (egg) value of 100.0 kIU/l.

A postvaccine reaction developed in one out of 179 children who received the MMR vaccine. Urticaria was observed in this patient and developed within 30 minutes after MMR vaccine administration. Immediately, the patient received intravenous antihistaminic drug and steroid treatment. Urticaria regressed within 30 minutes after

treatment. The patient was discharged with recommendations, as the urticarial lesions completely disappeared after six hours of observation. The patient did not experience any related clinical problems after discharge. Table 3 shows the clinical and laboratory characteristics of the patient.

Table 3. Clinical and laboratory characteristics of the patient who had a reaction after MMR vaccine

Features	
Age	12 months
Sex	Male
Clinical finding	Atopic dermatitis
Eosinophil (absolute) (10^3/uL)	180.0
Eosinophil (%)	2.0
Total IgE (IU/mL)	2280.0
Specific IgE (egg) (kIU/l)	100.0
Specific IgE (cow's milk)	-
Reaction	Urticaria

DISCUSSION

Hesitations about childhood vaccinations and vaccine safety may cause delays in vaccine schedules. In this case, it is extremely important to know in which situations vaccination can be performed safely in children with allergies and to follow the studies in the literature and current recommendations of vaccination guidelines. Experiencing delays in vaccinations can create an important public health concern. In this context, we evaluated the MMR vaccination of children with egg allergy in our clinic.

Out of 179 children with egg allergy evaluated within the scope of our study, a patient developed urticaria after MMR vaccination. No serious side effects were observed in this patient or others in our study. In many studies, the safety of the MMR vaccine has been demonstrated in children with or without egg allergy (17-21). Other similar studies have reported that nearly all children, including those with severe egg allergies, tolerate the MMR vaccine (12, 22). A study conducted in Turkey evaluated 44 children who were followed up due to egg allergy and received the MMR vaccine. Of the children, 4 (9.1%) showed reaction. The reactions observed in these patients were vomiting, rash and wheezing. No serious reaction was observed in any of the patients (23). A study with a larger sample evaluated MMR vaccination of 145 children with egg allergy and only three patients developed reactions, including urticaria and rash. No serious reactions were observed in any of the vaccinated children, including those with a history of anaphylaxis (24).

Studies have reported that children with egg allergies are often referred to higher-level health care centers for MMR vaccines by their family physicians (20, 25). This may cause delays in the vaccination schedule. A study states that there was an average of 2.4 months delay in MMR vaccination of children with egg allergy as per the vaccination schedule (26). In another study, more than 81% of children experienced a delay of more than 1 month in MMR dose (25). In our study, the median delay in vaccination of children with egg allergy was one month. To avoid these delays, there is a need to address concerns about MMR vaccination in primary care and to inform primary care workers about the true contraindications of the MMR vaccine.

Limitations:

In our study, skin prick tests against eggs and other preservatives that may cause a postvaccine reaction were not applied before MMR vaccination. Although this is not considered necessary according to the literature (27), the application of skin prick tests would have provided a broader perspective in the evaluation of our results. This can be considered a limitation of our study. Another limitation is that our cases with egg allergy are mild and moderate cases. Although we did not have any patients who developed a severe allergic reaction like

anaphylaxis, it is noteworthy that the study included a large number of patients with mild to moderate egg allergy. The MMR vaccination experience of 179 patients with egg allergy has a larger sample than many similar studies in the literature. This is the strength of our study.

CONCLUSION

Although it is recommended in the latest guidelines, the MMR vaccine, like other vaccines, should be administered in primary care in children with egg allergies. However, in Turkey, these children are referred to allergy clinics. Serious reactions that develop after MMR vaccination in children with egg allergy can also influence this. In our study, which has the highest number of patients in Turkey, we observed a mild reaction in only one patient with the administration of the MMR vaccine among children with mild and moderate egg allergies. The results obtained in our study also show that MMR vaccine administration is not contraindicated in cases of a history of egg allergy. Although it is stated in the guidelines that the MMR vaccine can be administered under normal conditions in all children with egg allergy, regardless of severity, it may be more appropriate for severe cases to be evaluated by allergy departments in Turkey. Children with severe egg allergy can be evaluated by pediatric allergy clinics, but this should not cause a delay in the MMR vaccination schedule. Before the vaccine is administered, the prospectus of all vaccines should also be carefully read. It should also be considered that some MMR vaccines are contraindicated in those allergic to cow's milk protein, egg and neomycin.

Conflicts of interest: The authors declare that there are no conflicts of interest.
Ethics committee approval: The Ethics Committee of University of Health Sciences Ümraniye Training and Research Hospital granted approval for the study (date: 29.09.2022, number: 309).
Financial disclosure: The authors declared that they received no financial support for this study.
Peer-review: Externally peer-reviewed
Author contributions: Study design; UA, AÇ, ZMA, EA, MYÖ, MD - Supervision; MYÖ, MD - Data collection and/or processing; UA, AÇ, MYÖ - Data analysis; UA, ZMA - Literature review; UA, AÇ, ZMA, EA, MYÖ, MD - Written by; UA, AÇ, ZMA, EA, MYÖ, MD - Critical review; UA, AÇ, ZMA, EA, MYÖ, MD

References

1. Sicherer SH, Sampson HA. Food allergy: epidemiology, pathogenesis, diagnosis, and treatment. J Allergy Clin Immunol. 2014;133:291-307.
2. Patel N, Herbert L, Green TD. The emotional, social, and financial burden of food allergies on children and their families. Allergy Asthma Proc. 2017; 1;38:88-91.
3. Leech SC, Ewan PW, Skypala IJ, Brathwaite N, Erlewyn-Lajeunesse M, Heath S, et al. BSACI 2021 guideline for the management of egg allergy. Clin Exp Allergy. 2021;51:1262-78.
4. Caffarelli C, Giannetti A, Rossi A, Ricci G. Egg Allergy in Children and Weaning Diet. Nutrients. 2022;14:1540.
5. Samady W, Warren C, Wang J, Das R, Gupta RS. Egg Allergy in US Children. J Allergy Clin Immunol Pract. 2020;8:3066-3073.e6.
6. Keil T, McBride D, Grimshaw K, Niggemann B, Xepapadaki P, Zannikos K, et al. The multinational birth cohort of EuroPrevall: background, aims and methods. Allergy. 2010;65:482-90.
7. Xepapadaki P, Fiocchi A, Grabenhenrich L, Roberts G, Grimshaw K, Fiandor A et al. Incidence and natural history of hen's egg allergy in the first 2 years of life—the EuroPrevall birth cohort study. Allergy. 2016;71:350-7.
8. Tedner SG, Asarnoj A, Thulin H, Westman M, Konradsen JR, Nilsson C. Food allergy and hypersensitivity reactions in children and adults-A review. J Intern Med. 2022;291:283-302.
9. Magistà S, Albanesi M, Chaoul N, Di Bona D, Di Leo E, Nettis E et al. Safety of measles, mumps, and rubella vaccine in egg allergy: in vivo and in vitro management. Clin Mol Allergy. 2020;18:1-5.
10. Cerecedo Carballo I, Dieguez Pastor MC, Bartolomé Zavala B, Sánchez Cano M, de la Hoz Caballer B. Safety of measles-mumps-rubella vaccine (MMR) in patients allergic to eggs. Allergol Immunopathol (Madr). 2007;35:105-9.
11. Çöğürlü MT, Şimşek IE, Aydoğan M. Is MMR vaccination safe in the children with egg allergy? Klinik Tıp Pediatri Dergisi. 2018;10:38-41.
12. Keleş Ş, Filiz S. Yumurta alerjisi olan çocuklarda kızamık-kızamıkçık-kabakulak aşılaması sonrası reaksiyon durumunun değerlendirilmesi. Pam Tıp Derg. 2020;13:687-693.
13. Nilsson L, Brockow K, Alm J, Cardona V, Caubet JC, Gomes E, et al. Vaccination and allergy: EAACI position paper, practical aspects. Pediatr Allergy Immunol. 2017;28:628-40.

14. Yavuz ST, Şahiner UM, Sekerel BE, Tuncer A, Kalaycı O, Sackesen C. Anaphylactic reactions to measles–mumps–rubella vaccine in three children with allergies to hen's egg and cow's milk. Acta Paediatr. 2011;100:e94-e6.

15. Buczyńska A, Grzybowska-Chlebowczyk U, Pawlicki K. IgE-Dependent Food Sensitisation and Its Role in Clinical and Laboratory Presentation of Paediatric Inflammatory Bowel Disease. Nutrients. 2023;15:1804.

16. Çiçek F, Köle MT. Evaluation of the Impact of Serum Vitamin D Levels on the Scoring Atopic Dermatitis Index in Pediatric Atopic Dermatitis. Children. 2023;10:1522.

17. Çapanoğlu M, Giniş T, Büyüktiryaki AB, Toyran M, Vezir E, Kocabaş CN, et al. The evaluation of allergic reaction in patients with egg allergy after measles-mumps-rubella vaccination. Asthma Allergy Immunol. 2015;13:71-75.

18. Can C, Kural B. Reassessing the risks of MMR vaccination for egg-allergic patients referred by healthcare workers; a clinical paradigm. Iran Red Crescent Med J. 2019;21: e90300.

19. Bahçeci S, Nacaroğlu HT, Arı HF, Karaman S, Karkıner CŞ, Toprak Kanık E, et al. Measles-rubella-mumps vaccination in cases with egg allergy:Is skin prick test necessary? Can vaccination be done safely? İzmir Dr. Behçet Uz Çocuk Hast Dergisi. 2017;7:129-132.

20. Barış HE, Boran P, Kıykım A, Barış S, Özen A, Aydıner Karakoç E. Immunization practices in children with a history of allergies. Turk Arch Pediatr. 2020;55:244.

21. Tsai M-H, Chiu C-Y. Allergic reactions to vaccines in children: from constituents to specific vaccines. Biomedicines. 2023;11:620.

22. Fox A, Swan K, Perkin M, du Toit G, Lack G. The changing pattern of measles, mumps and rubella vaccine uptake in egg-allergic children. Clin Exp Allergy. 2014;44:999-1002.

23. Sayar EH. Yumurta alerjisi olan süt çocuklarında kızamık kızamıkçık kabakulak aşılama deneyimi. Acta Medica Alanya. 2019;3:283-6.

24. Kara Elitok G, Çelikboya E, Bülbül L, Kaya A, Toraman T, Bülbül A, et al. Does food allergy require any change in measles-mumps-rubella vaccination? Indian J Pediatr. 2019;86:915-20.

25. Ainsworth E, Debenham P, Carrol ED, Riordan FAI. Referrals for MMR immunisation in hospital. Arch Dis Child. 2010;95:639-41.

26. Cunha L, Almeida D, dos Santos FR, Falcão H. Measles, mumps, and rubella vaccination in children with egg allergy. Nascer E Crescer-Birth And Growth Medical Journal. 2022;31:25-30.

27. Khakoo G, Lack G. Recommendations for using MMR vaccine in children allergic to eggs. BMJ. 2000;320:929-32.