

# Safe Measles, Mumps and Rubella Vaccine Administration in Atopic Children with High Levels of Egg White-Specific IgE Antibody

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## Abstract:

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**Key words:** atopic dermatitis; egg white-specific IgE antibody; measles; mumps and rubella vaccine.

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**Aim:** To present our clinical experience vaccinating egg allergic patients with a regular triple viral vaccine.

**Material and Methods:** Twenty seven children with atopic dermatitis and high levels of egg whitespecific IgE antibody were recruited. The patients were selected in two groups: group without history of allergic reaction to egg consumption and group with convincing history of egg allergic reaction. In children aged less than 13 months open food challenge test was performed.

**Results:** Thirteen children without history of allergic reaction to egg received ambulatory MMR immunization with no reaction. Fourteen children with convincing history of egg allergy, aged under 13 months had not been vaccinated, and they underwent open food challenge test in the hospital. They had increased IgE specific antibodies to egg white allergen and six of them had increased specific IgE to yolk. Nine children had history of mild to moderate allergic reaction while five had severe allergic reaction. Open food challenge test was performed. Eleven children with negative food challenge test were immunized in hospital; none had an adverse reaction. Three of them had positive food challenge test and due to anxiety of the parents the immunization was dallied at age of 2 years. One of them had worsening of the eczema; the two other had no adverse reaction.

**Conclusion:** The measles, mumps and rubella vaccine can be safely administered ambulatory to children with atopic dermatitis allergic to eggs.

## Introduction

Immunization with measles, mumps and rubella (MMR) vaccine protect the population of those important infections which can result with serious complications in measles, high risk of theratogenic effects in rubella infections in pregnancy and serious sequels as sterilities among adults because of mumps infection. Any delay in MMR immunization is a risk for possible measles, mumps and rubella epidemics. That why it is important that >95% of children are protected with MMR vaccine [1].

Concern exists over the use of MMR vaccine in eggallergic children. Egg allergy is the most common food allergy in children with atopic dermatitis. There is worry about potential anaphylaxis to MMR vaccine, since the live attenuated virus used in vaccine is grown in cultured chick-embryo fibroblasts. However, MMR vaccine contains less than the minimum amount of egg antigen required to elicit an allergic reaction. Many studies have demonstrated the safety of MMR immunization in eggallergic children, even those with

severe egg allergy. Immediate, anaphylactic reactions to MMR are extremely rare and are result of an allergy to gelatin [1].

The aim of this paper is to present our clinical experience of vaccinating patients with atopic dermatitis, allergic to egg with a regular triple viral vaccine.

## Material and Methods

Twenty seven children ranged from 12 to 63 months in age (mean age, 18 months) with atopic dermatitis (AD) and high levels of egg white-specific IgE antibody referred to our Clinic from 2006 through 2010 were recruited for the study. The egg allergy was confirmed by measuring specific IgE antibodies of yolk and egg white ( $> 0.35$  KU/l) (CAP System Pharmacia FEIA). SCORAD index was calculated according the Consensus report of the European Task Force on Atopic Dermatitis for assessing the severity of AD [2].

A history was taken and based on it they were divided in two groups: one without allergic reaction to egg consumption and the other with allergic reaction. The severity of their allergic reaction was categorized as mild, moderate or severe based of the children's histories for urticaria, gastrointestinal symptoms, wheezing, and laryngeal edema after the ingestion of egg protein.

Children with allergic reactions to egg underwent open challenge test with a portion of a food containing egg. Reactions were considered positive when there were objective cutaneous, respiratory, or gastrointestinal symptoms within two hours after the food challenge.

All children were given MMR vaccine in one 0.5 ml subcutaneous injection, and observed 24 hours in hospital.

## Results

We recruited 27 children with atopic dermatitis (AD) (mean age, 18 months) and high levels of egg white-specific IgE antibody. Half of them, 13 children, with negative history of allergic reaction to egg consumption, have received MMR immunization ambulatory, without reaction. The clinical characteristics of two groups of children with AD are shown at Table 1.

Fourteen children (50%) aged under 13 months had allergic reaction to egg. Nine had mild to moderate and five had severe allergic reactions to egg. All 14 children with allergic reaction to egg had increased IgE

**Table 1: Clinical characteristics of children with atopic dermatitis and high levels of egg white-specific IgE antibody.**

	Without egg allergy	With egg allergy
n	13	14
Sex (m/f)	7/5	11/3
Median age of diagnosis of allergy (months)	35	6.5
SCORAD index	33.63	45.50
Evidence of egg allergy + History	0	14
• Mild to moderate		9
• Severe		5
Positive IgE antibody to yolk	4	6
Positive IgE antibody to egg white	13	14
Polisensitisation	7	4
Positive food challenge test	No performed	3
Reaction to MMR	0	1 (itching, worsening of eczema)

n, number of patients; SCORAD index, for clinical evaluation the severity of atopic dermatitis.

specific antibodies to egg white allergen and 6 of them had increased IgE antibodies to yolk. Specific level of IgE is shown at Table 2.

**Table 2: Specific IgE levels in children with atopic dermatitis and high levels of egg white-specific IgE antibody.**

Results	Children without egg allergy		Children with egg allergy	
	Median value	From to	Median value	From to
Eosinophiles	471	104-890	1228	198-2686
Total IgE antibody (KU/l)	446	20-2213	234.6	12-1406
IgE antibody to yolk (KU/l)	1.85	0.8-3.23	3.72	0.43-10.6
IgE antibody to white (KU/l)	3.39	0.46-11	13.93	0.77-91.1

All of them underwent open food challenge test. Nine children had convincing histories of mild allergic reaction after the ingestion of eggs in infancy, and all of them had negative food challenge test. They were immunized; none had an immediate or delayed adverse reaction. Two children with severe allergic reaction to egg in infancy had negative food challenge test and they were immunized also, without adverse reaction. 3 children with convincing history of severe symptoms after ingestion of egg, had positive food-challenge test. Symptoms that appeared during the challenge test involved the skin (urticaria, itching and erythema), the gastrointestinal tract (vomiting), and the respiratory tract (wheezing). Due to anxiety of parents, the immunization was delayed at age of 2 years. One of them had worsening of the eczema with itching after the immunization and two of them had no adverse reaction.

## Discussion

It is important that  $>95\%$  of children are immunized to protect the population from measles, mumps and rubella epidemic. In Macedonia, the

vaccination schedule includes two MMR doses in all children (first one at the age of 13 months and a second dose at the age of seven years), except those in whom there is contraindication. Since the vaccine components in MMR are grown in cultures of fibroblast from chick embryos, for a long time there have been concerns about the presence of egg protein in the vaccine and the recommendations given to egg allergic patients.

Egg allergy is very common, affecting 1% to 2% of children and it's the most common food allergy in children with atopic dermatitis. It is generally thought that the majority of children with egg allergy develop tolerance in early childhood. Self-reported prevalence values of egg allergy of up to 7% have been demonstrated, while challenge-confirmed egg allergy has shown lower estimates, up to 1.7% [3].

Anaphylactic reactions to egg are not commonly reported, even in children. However, the reaction severity has been associated with asthma, suggesting that asthma care should be a critical target for supervision of children with food allergy [4]. In rare cases, egg has caused fatal reactions because of anaphylaxis [5]. The combined rate for anaphylaxis, anafilactoid and allergic reaction to MMR is rare and it is 1.8 per 100 000 administered doses [6].

Ingestion of cooked or baked egg can be tolerated by some children who react to raw egg, whereas other children react both to raw as well as heated egg [4]. It should be emphasized that if a child tolerates egg in the diet on a regular basis without any immediate reaction, then this child is not egg allergic, even if high levels of egg white-specific IgE antibody are detected in serum. In our study we found egg allergy to be present in about 50% of children with atopic dermatitis. None of them had anaphylactic reaction to egg.

Kamin *et al* in 1965 reported the safe administration of measles vaccine to 22 children with egg allergy confirmed by food challenges [7]. During the 1980s, Miller *et al.* and Greenberg and Birx administered the MMR vaccine to a total of 19 children who were allergic to eggs without any reported reaction [8, 9]. By 1995, of 40 reported cases of anaphylaxis to MMR vaccine given as a single dose, only two involved children with egg allergy (the same two reported by Herman [10].

A review of 17 studies from 1963 to 1995 showed only (the same) two of 1227 patients who were allergic to eggs and had been given the vaccine had developed any symptoms suggestive of allergy [11]. Kemp *et al.* [12] successfully immunized 32 children who were allergic

to eggs, without any adverse reactions. Lavi *et al.* safely immunized 90 such children using one dose MMR vaccine. The investigators from Italy administered the measles vaccine safely to 23 children with severe egg allergy confirmed by positive open food challenges. Subsequently, the same group has safely immunized an additional 60 children with allergy to eggs [13].

Aicken *et al* carried out skin prick testing on 410 children allergic to eggs with the vaccine and subsequently vaccinated them with a standard single dose [14]. Cerecedo *et al.* found negative results found in SPT support the absence of clinical reaction against the components and Immunological studies point that there is no detectable amount of egg protein in this vaccine to produce an IgE mediated reaction [15]. Skin testing for reactions to the vaccine lacks specificity and sensitivity [11, 16]. Kelso *et al.* in 1993 first suggested that some anaphylactic reactions to MMR may be the result of an allergic reaction to gelatin [17]. Different studies have focused on determining the amount of egg proteins in MMR vaccines, finding from any proteins, picograms valuation or between 0.5-1 nanograms of ovalbumin per 0.5 ml dose [18]. It is too small to provoke allergic reaction. Children allergic to egg receive MMR without adverse reaction, while allergic reaction is shown in children who don't have egg allergy. 93% of children with allergic reaction have IgE specific to gelatin [1].

Our clinical experience agrees with the previous studies. We didn't observe any allergic reaction in 27 vaccinated patients with high levels of egg white-specific IgE antibody (with and without convincing history of egg allergy). Only in one of our patient it was observed itching and transitory worsening of eczema.

With this study and the previous clinical experience reported in the literature, we can conclude that MMR can be safely administrated in children allergic to egg. Children with anaphylaxis to egg, and children with egg allergy and severe asthma should be evaluated in immunologic department according the recommended guidelines and proceed MMR immunization in hospital setting [19]. Egg allergy is incorrectly considered to constitute a contraindication to MMR in the community, despite a long history of its safe administration to egg allergic children. Unnecessary hospital referral for MMR vaccination is an extra burden on hospital resources.

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