

Oral food challenges in children with food allergies

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The prevalence of food allergies among children in the US is steadily increasing. The number of children with food allergies rose 50% between 1997 and 2011.¹ The reason for this increase is not fully understood but is likely multifactorial.² The total number of children with at least one documented food allergy is estimated to be

■ Diagnosis

Because of the growing public health concern about increasing prevalence of pediatric food allergies, it is essential for providers to correctly diagnose children who have food allergies. Food allergies can be diagnosed at various stages of life. Some experience symptoms of anaphylaxis as infants after their first ingestion of an allergen, whereas others may be older before they experience allergic symptoms from a food that was previously tolerated. The

If an NP suspects a food allergy for a pediatric patient, a referral to a pediatric allergist is advisable. Further testing is often performed by an allergist and may include skin prick testing (SPT) or serial monitoring of the serum IgE levels. There is no test for an IgE-mediated allergy that is completely and independently diagnostic. Some individuals with elevated IgE or reactive SPT results may tolerate a food without any reaction, and conversely, some individuals with negative serum IgE levels and/or negative SPT results may develop anaphylaxis following exposure to a particular food.⁸

Additionally, it is important to recognize that up to 26.6% of children with a previously identified food allergy may develop a tolerance to that food over time.⁹ If tolerance is suspected or if an allergy cannot be confirmed or refuted despite careful history and lab evaluation, an OFC is a useful diagnostic tool.^{8,10}

OFC involves the child ingesting a small amount of the allergen and monitoring the child for an allergic or anaphylactic reaction.

6 million, or 8% of all children in the US.¹ The eight most common food allergies among children are milk, egg, wheat, soy, peanut, tree nut, shellfish, and fish.³ Together, these account for approximately 90% of food allergies in children.³

Pediatric healthcare providers and allergists play an essential role in identifying and properly managing food allergies. Food allergy management over time is dynamic and generally includes serial lab testing, continued education regarding avoidance and anaphylaxis management, and may also involve testing using an oral food challenge.

first step in evaluating a child with a suspected food allergy is to take a detailed history of allergic events, including foods ingested, symptoms experienced, and interventions required to alleviate symptoms.

Serum immunoglobulin E (IgE) testing should be used discerningly. The American Academy of Allergy, Asthma & Immunology (AAAAI) recommends avoiding food allergy IgE panels and instead favors specific food IgE levels based on clinical history.^{4,5} Elevated IgE does not necessarily correlate with a clinical allergy in up to 50% of children, and therefore, testing may lead to overdiagnosis of food allergy.^{6,7}

■ Oral food challenges

An OFC is a procedure in which a patient ingests a potential or known allergen to determine if a patient has an allergy to a given food. The allergist will determine where the OFC will be done. Some might be done at home while most are best done under medical supervision. An OFC can be done for any child regard-

less of age.¹¹ Challenges completed in a controlled healthcare environment must be equipped to intervene if anaphylaxis occurs after ingestion. The double-blind, placebo-controlled OFC approach, in which neither the provider nor the family or child are aware if the child is given an allergen or a placebo to ingest, is both expensive and time-consuming (although it is the gold standard).^{2,12} Therefore, the most common and clinically feasible OFC approach involves open communication regarding the type and amount of the ingested allergen.

The decision to proceed with OFC may be influenced by many factors, including the patient's medical history, age, past adverse food reactions, SPT results, food-specific serum IgE trends, and concomitant food allergies.⁸ Nutrition needs and family preference are also taken into consideration.⁸ (See *OFC testing*.) In general, children with an estimated 50% or less likelihood of reacting to a food are considered optimal candidates for OFCs.¹³ The primary benefit of a successful OFC is the ability to liberalize the child's diet to include previous allergens. Interestingly, parents report improved quality of their own lives after their child participates in an OFC, regardless of whether the child passed the OFC and can introduce the food into his or her diet.¹⁴

OFC involves the child ingesting a small amount of the offending allergen and monitoring the child for any signs or symptoms of allergic or anaphylactic reaction. Prior to OFC, families are told their child must

be free from illness and fever on the day of the test. If the child has underlying asthma, eczema, or allergies, the symptoms of these conditions must be well controlled before starting an OFC. It is important to ensure that there are no symptoms present that might be difficult to differentiate from allergic reactions.^{8,11} The child should also be given N.P.O. for 4 hours prior to the start of the challenge, as this helps ensure the child will be hungry enough to ingest the allergen. Antihistamines generally should not be used for 3 to 5 days prior to OFC to avoid masking the presentation of symptoms of an allergic reaction.⁸ However, it is recommended that some antihistamines (such as cetirizine) should not be used for 5 to 7 days prior to OFC.⁸ Other medication (such as leukotriene receptor antagonists) avoidance is recommended on a case-by-case basis⁸

The total amount of allergen ingested is often based on the amount of food protein, and age-appropriate serving sizes should also be considered. The AAAAI recommends a dose of 8 to 10 g for a dry food, 16 to 20 g for meat or fish, and 100 mL of a liquid food.⁸ A child undergoing an OFC to evaluate for a peanut allergy, for example, will need to gradually ingest approximately 2 tablespoons of peanut butter in order to complete the challenge. The food is ingested using a graduated dosing schedule.

The standard starting amount for a medically supervised OFC is typically 1% of the total volume and gradually increases every 15 to 30 minutes over 5 to 7 doses until the total amount is

OFC testing

- Although OFC is generally safe when done by trained medical providers, anaphylaxis can still occur. OFC protocols have been designed to identify an allergic reaction early.
- Blood work (IgE) is helpful to guide when or if an OFC should take place, but it is not predictive of a pass or fail result.
- Families are an important part of the OFC process and bring expertise specific to their child and his or her allergy journey.
- Quality of life is shown to improve after an OFC, regardless of the outcome.

ingested.^{8,11} Many children have multiple food allergies, and therefore, it is important to ensure the OFC food protein has not been cross-contaminated with other allergens. Throughout the OFC and following the final dose of the allergen, the child is monitored for signs of allergic reaction. Typically, the child will be monitored in the clinic or hospital for 1 to 2 hours after the last dose of food protein was ingested. A typical length of stay when the child has passed the OFC is 3 to 4 hours. If no signs of allergic reaction occur, the allergist will then instruct the family on food allergen reintroduction guidelines.¹¹

If the child develops signs of allergic reaction, this confirms the allergy, and avoidance is continued. Anaphylaxis, although rare, is the most serious risk for children during OFC and must be managed quickly with epinephrine.¹⁵ More commonly, OFC failures are mild, and if a single organ system is involved, reactions may be treated with antihistamines and carefully

monitored for progression or resolution.¹⁵ Containment of a mild reaction is ideal; however, the progression to anaphylaxis can be unpredictable. Early intervention is crucial, and epinephrine is considered the first-line treatment for anaphylaxis for best outcomes.^{12,15} Early signs of allergic reaction may include integumentary symptoms of rash, pruritus, or angioedema; respiratory

during OFC is associated with IgE levels, meaning that if an IgE level is higher, the child may be more likely to experience anaphylaxis.¹⁶ Numerous factors, including comorbid conditions, age, and the specific food allergen type, may increase the likelihood for an allergic reaction to occur during the OFC. Previous studies demonstrate that between 14% and 33% of

day of the OFC, and intensivists are in house at all times should any emergencies arise. Since its inception, the authors' program has gradually grown to accommodate around 500 patient encounters per year, with over 75% of those successfully passing OFC without reaction. Although OFCs can be safely performed in a variety of inpatient and outpatient settings, the availability of emergency medications and personnel as well as the comfort level of support staff must all be considered.^{8,11}

APRNs must recognize that OFCs may be stressful for both parents and children. Children and parents may experience anxiety during OFCs for a variety of reasons, including memories of prior allergic reactions or even textural and taste issues with the OFC protein. Although children should be encouraged to finish the recommended food protein volume, they should never be forced to finish the food. Showing empathy is important to create pleasant and successful ingestion of the entire food protein.

■ Conclusion

OFC testing is an essential diagnostic tool for children with known or suspected food allergies. Performing OFCs can raise some logistical difficulties. However, collaboration between allergists, APRNs, and pediatricians as well as continued and ongoing research in this field can lead to improved identification, management, and treatment of childhood food allergy. 

All children who participate in OFCs should have an epinephrine pen and anaphylaxis action plan at the time of discharge.

symptoms of congestion, rhinorrhea, sneezing, or wheezing; and abdominal complaints of nausea, pain, or diarrhea.^{11,12}

All staff caring for the patient must demonstrate competence in recognizing the early signs and symptoms of anaphylaxis and must be able to intervene quickly with appropriate treatment.¹¹ The observation period after anaphylaxis should take into consideration biphasic reactions. Observation in the hospital setting after an OFC reaction should be at least 4 to 8 hours.¹⁵ Although anaphylaxis after discharge following the OFC procedure is unlikely, parents should be advised that delayed reactions may occur. All children who participate in OFCs should have an epinephrine pen and anaphylaxis action plan at the time of discharge.¹¹

■ OFC outcomes

Parents often inquire about the risk of an allergic reaction during an OFC. There is some precedent that the risk of anaphylaxis

patients undergoing an OFC develop an allergic reaction during the OFC, and of those, between 2% and 19% meet the criteria for anaphylaxis.^{17,18} One death from an OFC has been reported. Details surrounding the death of a 3-year-old during a baked dairy OFC challenge in 2017 are unclear, but this event reinforced that OFCs should only occur within environments capable of responding to anaphylaxis.¹⁹ Further study is needed to better identify predictors of OFC failure and reaction severity.

■ Opportunities

Advanced practice registered nurses (APRNs) have a unique opportunity to help meet the increased need for OFCs. APRNs at Children's Hospital of Minnesota in Minneapolis, Minn., run an OFC program in collaboration with local allergists. The allergists refer patients, recommend protocols, and are available by phone for questions. APRNs carry out the procedure on the

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