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Taking the bite out of food allergies

By Susan Simmons, PhD, RN, APRN-BC

TWO NEW PEDIATRIC patients are being evaluated in the allergy clinic for environmental and food allergies. Both sets of parents wonder if their child is allergic to milk. KD, age 7, says that when she has milk or cheese, she has abdominal pain and diarrhea. The other patient is EW, age 5. Her parents say that the last time she drank milk, she broke out in hives and had difficulty swallowing. Obviously, each patient has issues with milk, but are they both *allergic* to milk? From these signs and symptoms, likely not. Although EW may have a food allergy, KD probably has a food intolerance.

This article discusses the difference between food allergy and food intolerance, with a focus on food allergy. Because food allergies can be life-threatening, this article also addresses the nurse's role in responding to anaphylactic reactions.

Intolerance or allergy?

What distinguishes food intolerance from food allergy? *Intolerance* affects the digestive system, whereas an *allergy* activates the immune system. Food intolerances occur most often when the enzymes needed to digest food are lacking. Intolerances may also occur due to food sensitivities, which are minor, nonallergic reactions to food additives or naturally occurring chemicals in food.¹

In contrast, food allergies occur when the body identifies a food as a foreign substance, or antigen, and begins to develop antibodies against it. (See *Understanding type I, IgE-mediated hypersensitivity reactions*.) Unlike food intolerances, food allergies can lead to anaphylaxis and death.¹ When patients are exposed to the food responsible for their allergy, they can experience anaphylaxis. This severe immunoglobulin

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E (IgE)-mediated allergic reaction involves release of mediators from mast cells and basophils into the systemic circulation.² IgE is involved in allergic reactions and active release of substances from mast cells and basophils

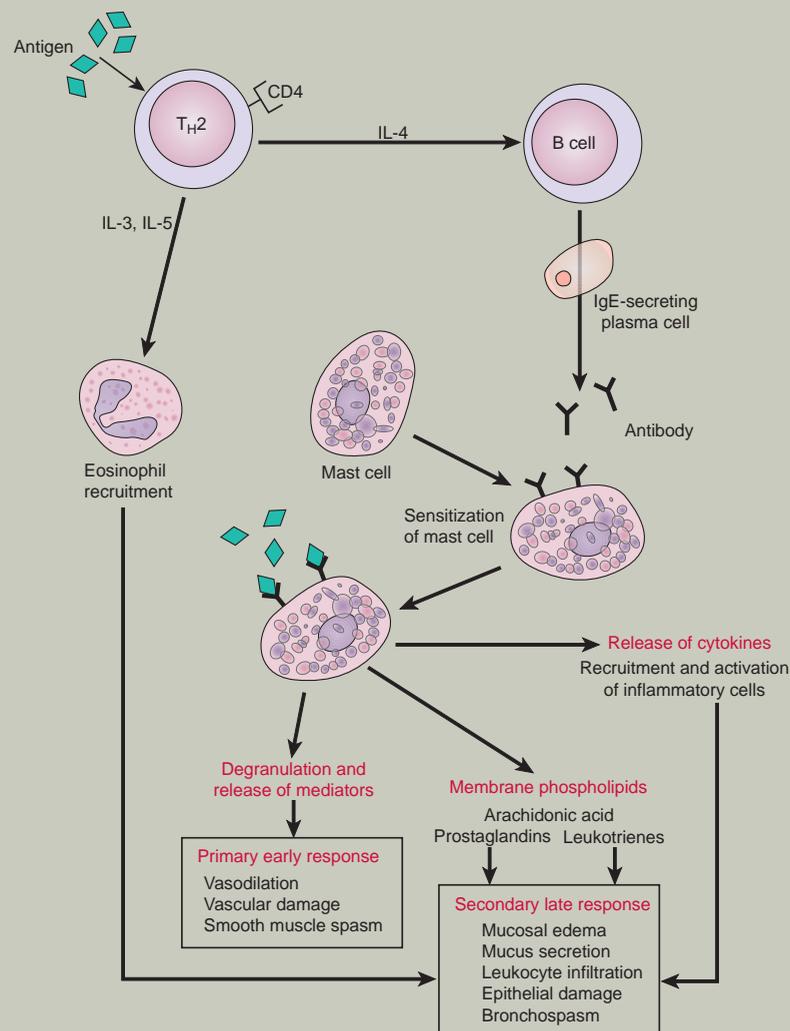
that lead to vasodilation and vascular damage, which may result in signs and symptoms such as urticaria, mucosal edema, or difficulty breathing.³

Of children and adolescents up to age 18, about 8% have a food

allergy. Of children under age 2, 6% have food allergies. More than 30% of these children have multiple food allergies. Children are more susceptible to anaphylaxis than adults.² (See *Zeroing in on food allergy* by Lippincott Williams & Wilkins.)

Understanding type I, IgE-mediated hypersensitivity reactions

The stimulation of B-cell differentiation by an antigen-stimulated type 2 helper T (T_H2) cell leads to plasma cell production of IgE and mast cell sensitization. Subsequent binding of the antigen produces degranulation of the sensitized mast cell with release of preformed mediators that leads to a primary, or early-phase, response. T_H2 T-cell recruitment of eosinophils, along with the release of cytokines and membrane phospholipids from the mast cell, leads to a secondary, or late-phase, response. Key: IL = interleukin; CD4 = helper T lymphocytes that express cluster determinant 4.



Source: Porth CM. *Essentials of Pathophysiology: Concepts of Altered Health States*. 3rd ed. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams and Wilkins; 2011.

Bringing guidelines to the table

What would make one 6-month-old allergic to a food and another 6-month-old not? How can those at risk for food allergies be identified? How are those with food allergies treated and how is anaphylaxis prevented? How is safety in schools, homes, and the community ensured?

In 2010, the National Institute of Allergy and Infectious Diseases, in conjunction with 34 other organizations, published the first guidelines for the diagnosis and management of food allergy, recognizing that many of these questions haven't been definitively answered.² The committee concentrated on five main areas:

- definitions, prevalence, and epidemiology
- natural history of food allergies and associated disorders
- diagnosis of food allergy
- management of food-induced non-acute allergic reactions and prevention
- diagnosis and management of acute and anaphylactic food-induced reactions.²

An explanation of these guidelines follows.

Serving up the facts

Foods can be defined as any ingested substance intended for human consumption that isn't a drug, including food additives, drinks, chewing gum, and dietary supplements. In susceptible individuals, most foods can cause a reaction whether they're eaten raw or cooked; however, some fruits and vegetables cause allergic reactions only when eaten raw.²

Foods similar to each other such as those in the same food group

(for example, tree nuts) can cause *cross-reactivity*.²

Allergic reactions, which involve the immune system, can be IgE-mediated or non-IgE-mediated.² IgE-mediated reactions result in immediate local cutaneous signs and symptoms such as urticaria and pruritus, or more severe systemic signs and symptoms of anaphylaxis such as dyspnea and hypotension, which can be fatal if not recognized and managed early. Many reactions to food proteins aren't IgE-mediated; instead, they cause enteropathy and eosinophilic gastrointestinal disorders, such as eosinophilic gastritis, eosinophilic enteritis, eosinophilic colitis, or eosinophilic gastroenteritis.² Because EW, the child in this case study, is allergic to milk, she's allergic to the milk protein.

A nonimmune-related food issue, food intolerance occurs when someone lacks an enzyme to adequately digest the food.² KD, the other child in this case study, suffers from milk intolerance from an inability to digest lactose, the sugar in milk.² Many reactions to food additives and artificial colors are intolerances rather than allergies.²

About 2% to 4% of patients with food allergies have allergy-related comorbidities, including allergic rhinitis, atopic dermatitis, and/or asthma.² Other comorbidities include eosinophilic esophagitis and exercise-induced anaphylaxis, which may be a result of or worsened by food allergy.

How do food allergies evolve?

Most children who develop food allergies will do so within the first 2 years of life, but many of them will eventually become tolerant, or no longer reactive, to the offensive food. Most children with milk, egg, soy, or wheat allergy will eventually “out-grow” the allergy or begin to tolerate the food protein in small amounts. Tolerance to peanuts and tree nuts

can occur but is rare and recurrence may also develop.²

Shellfish allergy, which more commonly develops during adulthood, is also less likely to resolve.² Any food allergy that begins in adulthood is likely to persist.²

Clinical manifestations

Signs and symptoms of food allergies are variable, depending on the amount of IgE produced as well as comorbidities such as asthma, atopic dermatitis, and allergic rhinitis. Eosinophilic esophagitis and exercise-induced anaphylaxis may be caused or worsened by food allergies. Gender differences can depend on the offending food; for instance, women are more likely to be allergic to shellfish.² Food variables include the amount ingested and the form: raw, cooked, processed, and/or mixed with other foods or additives.

Previous exposures determine the amount of IgE produced, which influences the severity of the reaction: the more times a person has been exposed to the antigen, the greater the reaction.² An exception to this rule is exposure to peanuts, which can cause anaphylaxis on the first exposure. If the first exposure to peanuts is near-fatal, more than 70% of future exposures are likely to be life-threatening.²

Signs and symptoms of food allergy, which can affect multiple organ systems, can be immediate or delayed. Immediate signs and symptoms that develop within minutes to a few hours are associated with IgE activity. Those that develop several hours to a few days after exposure are linked to cellular activity, especially mast cells and basophils.² (See *Be alert for signs and symptoms of food allergy*.)

Identifying food allergy

Consider food allergy in patients presenting with the following:

- anaphylaxis within minutes to hours after food ingestion

Zeroing in on food allergy culprits²

- Over 170 foods and food substances have been identified as causing food allergy.
- The foods most commonly causing allergies in the United States include peanuts, milk, eggs, wheat, soy, and shellfish.
- Worldwide, in order of prevalence, the most common are milk, eggs, peanuts, tree nuts, fish, shellfish, wheat, and soy.
- In young children, the most common culprits are milk, eggs, and peanuts.

- any combination of signs and symptoms from the list on page 48 within minutes to a few hours
- comorbid conditions in infants and children with an increased risk of food allergy, including moderate-to-severe atopic dermatitis, eczema, eosinophilic esophagitis, enterocolitis, enteropathy, and allergic proctocolitis
- eosinophilic esophagitis in adults due to increased risk of food allergy.²

Obtain a patient and family history of food allergy as well as of atopic dermatitis, asthma, and gastrointestinal conditions. Questions to consider about food allergies include:

- Has the patient ever had a reaction to a certain food in the past, and if so, what was the food?
- In what form was the food ingested; for instance, was it raw or cooked?
- Was the food ingested in its original form or mixed with other foods?
- Did the patient ingest the food on an empty stomach, after exercise, or with alcohol?
- If the patient had a reaction to a certain food in the past, are the current signs and symptoms similar or worse?
- How were prior reactions treated?²

Next, a comprehensive physical examination that includes all affected organ systems should be performed.

Be alert for signs and symptoms of food allergy²

	Immediate onset: minutes to hours	Delayed onset: hours to days
Cutaneous	<ul style="list-style-type: none"> • Erythema • Pruritus • Urticaria • Morbilliform eruption • Angioedema 	<ul style="list-style-type: none"> • Same as immediate • Eczema
Ocular	<ul style="list-style-type: none"> • Pruritus • Tearing • Conjunctival erythema • Periorbital edema 	<ul style="list-style-type: none"> • Same as immediate
Upper respiratory	<ul style="list-style-type: none"> • Nasal congestion • Rhinorrhea • Sneezing • Pruritus • Laryngeal edema • Hoarseness • Dry staccato cough 	<ul style="list-style-type: none"> • None
Lower respiratory	<ul style="list-style-type: none"> • Cough • Dyspnea • Wheezing • Chest tightness • Accessory muscle use/ intercostal retractions 	<ul style="list-style-type: none"> • Cough • Dyspnea • Wheezing
Gastrointestinal (oral)	<ul style="list-style-type: none"> • Angioedema—lips, tongue, palate • Pruritus • Tongue swelling 	<ul style="list-style-type: none"> • None
Gastrointestinal (lower)	<ul style="list-style-type: none"> • Nausea • Abdominal pain • Reflux • Vomiting • Diarrhea 	<ul style="list-style-type: none"> • Same as immediate • Hematochezia • In young children: irritability, food refusal, and weight loss
Cardiovascular	<ul style="list-style-type: none"> • Tachycardia • Bradycardia possible in anaphylaxis • Hypotension • Dizziness • Syncope • Loss of consciousness 	<ul style="list-style-type: none"> • None
Miscellaneous	<ul style="list-style-type: none"> • Uterine contractions • Sense of impending doom 	<ul style="list-style-type: none"> • None

Be alert for life-threatening signs and symptoms such as tongue swelling, facial angioedema, difficulty swallowing, shortness of breath, and/or wheezing or decreased air movement on auscultation.²

Food allergies can be identified by using elimination diets, food challenges, or allergy testing.

- To use an elimination diet, the patient eliminates the suspected offending food from the diet while keeping a diary of signs and symptoms.²

Drawbacks to an elimination diet include the possibility of nutrient and calorie deficiency.

- Double-blind food challenges that use both the food allergen and a control are the gold standard for determining food allergies.^{2,4} A food challenge is the most specific test; however, it can be expensive, carries the most risk due to the potential for anaphylaxis, and requires the patient to stop using antihistamines before testing. (Oral antihistamines can be an important part of treatment.) Initially, the patient uses a diary to keep track of signs and symptoms during a 2- to 8-week elimination diet. Next, under medical supervision, a dose of the suspected food is given in an amount likely to induce signs and symptoms but not anaphylaxis. The dose is gradually increased and both dose and reaction are recorded by the healthcare professionals until what would be a standard dose of the food has been ingested. The disadvantages of food challenges are that their performance and interpretation aren't standardized.²

- Allergy testing uses either a skin prick test or allergen-specific serum IgE. (Intradermal testing is associated with an increased potential of anaphylaxis, and atopy patch tests lack sensitivity for food allergy, so neither is recommended when testing for food allergies.²)

The skin prick test, which carries little risk, can help to identify an IgE-mediated food allergy. It's considered positive when a wheal with a

diameter of 3 mm or larger develops within 30 minutes when compared with the control. The larger the wheal, the more likely it's due to a food allergy.² Because it isn't very accurate, skin prick testing results in overdiagnosis and has a low predictive value. The skin prick test, although not as predictive or reliable as oral antigen testing, won't result in anaphylaxis as oral antigen testing can. Skin prick testing shows the reaction of cutaneous mast cells with the antigen.^{2,5}

- The recommended test for food allergy identification, due to its low risk, is allergen-specific serum IgE. In this test, levels of IgE generated against specific food products are measured. This testing carries no risk for anaphylaxis or calorie/nutrient deficiency, and testing can be performed even if a patient is taking antihistamines.²

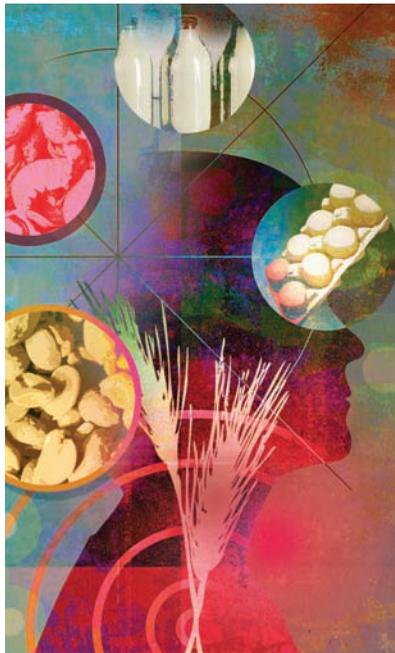
The radioallergosorbent test, an earlier serum test, has been replaced by a more sensitive test called fluorescence enzyme-labeled assay (FELA). As with the skin prick test, FELA testing products and the labs that run the tests aren't standardized. False negatives have been reported.²

The higher the level of IgE, the more likely the patient is to have a food allergy. The history and physical examination must be used with the results of FELA to determine the presence or absence of a food allergy.²

- Patients with non-IgE-mediated food reactions, such as those found with gastrointestinal diseases, need to be diagnosed through endoscopic biopsy. IgE testing may also be performed to help rule in or out IgE-mediated issues.²

Day-to-day management

Patients manage food allergy by avoiding the food allergen. Care must be taken during food preparation to avoid cross-contamination. In certain cases, cross-sensitivity should also be considered; for instance, patients with a peanut allergy may also have a general tree nut allergy.²



Most children who develop food allergies will do so within the first 2 years of life.

Food allergen avoidance may lead to a nutritional or caloric deficiency, sometimes resulting in malnutrition. To combat these issues, patients should participate in nutritional counseling, and growth and development in children should be followed closely.² Food allergy can also affect the patient's psychological well-being.²

Patient education includes how to read and interpret ingredients on food labels. In 2004, Congress passed the Food Allergen Labeling and Consumer Protection Act (FALCPA). It requires manufacturers to reveal on their labels any of eight major food allergens contained in the food; these allergens are responsible for 90% of food allergies. These eight potential food allergens are milk, eggs, peanuts, tree nuts, soybeans, wheat, fish, and crustacean shellfish. Besides fresh fruits and vegetables, other exceptions to FALCPA labeling are

well-refined oils made from one of the eight major food allergens and anything made from this oil.⁶ Patients may see statements on food labels, such as "This product may contain traces of..." or "This product does not contain ... but was prepared in a facility that makes products containing ...". These warnings, which aren't regulated by FALCPA, may leave the consumer with fewer food choices.²

Patients with a food allergy should be reevaluated by their healthcare provider regularly for improved or worsened signs and symptoms. Annual testing for the most common allergens that can be outgrown, including eggs, milk, soy, and wheat, can be performed using food challenge testing. Allergies to peanuts, tree nuts, fish, and crustacean shellfish are probably best tested only every 2 to 3 years due to the risk of a life-threatening reaction with each test as well as the lower chance of allergy resolution.^{2,4} Currently, no evidence supports this or another algorithm for testing.²

Oral antihistamines used for maintenance or an acute exposure can reduce reactions to food allergens. Immunotherapy, as for environmental allergies, isn't currently recommended for IgE-mediated food allergy due to the increased potential for life-threatening reactions and the lack of evidence that the treatment cures the allergy.²

Responding to anaphylaxis

The incidence of food-related anaphylaxis is increasing in industrialized countries, including the United States.² Anaphylaxis is highly likely if one of the following three criteria has been met:

- Acute onset of signs and symptoms over minutes to hours that involve the skin, mucosal tissue (generalized urticaria, pruritus, erythema, or swelling of the lips, tongue, or uvula) along with at least one of the following:

- respiratory compromise
- hypotension or signs and symptoms of associated end-organ dysfunction, such as hypotonia, syncope, or incontinence.
- Two or more of the following that occur within minutes to hours after exposure to the food allergen:
 - involvement of the skin-mucosal tissue with resultant generalized urticaria, pruritus, erythema, or swelling of the lips, tongue, or uvula
 - respiratory compromise
 - hypotension or signs and symptoms of associated end-organ dysfunction such as hypotonia, syncope, or incontinence
 - persistent gastrointestinal signs and symptoms such as crampy abdominal pain or vomiting.
- Hypotension within a few minutes to hours of exposure to an allergen.

Hypotension is defined as:

- in adults, a systolic BP less than 90 mm Hg or a 30% or greater drop in systolic BP from baseline
- in infants and children, greater than 30% decrease from expected age-specific systolic BP or a systolic <70 mm Hg when <1 year of age; <70 mm Hg + 2 x age in children ages 1 to 10 years; <90 mm Hg in ages 11 to 17 years.

Note: in infants and children, hypovolemic shock may occur in the absence of hypotension, but patients are likely to experience tachycardia.²

In most patients, cutaneous (80% to 90%) and respiratory (70%) signs and symptoms are most common. Worrisome signs and symptoms can include angioedema, hoarseness, wheezes, dyspnea, hypotension, lethargy, confusion, and seizures.²

Anaphylaxis begins over several minutes to hours, and without intervention, death can occur within 30 to 120 minutes from exposure to the allergen. Anaphylaxis may also be fatal due to delayed or improper dosing of epinephrine.^{2,4} The course of anaphylaxis can be uniphasic, biphasic, or protracted.²



Signs and symptoms of food allergy, which can affect multiple organ systems, can be immediate or delayed.

- A *uniphasic reaction* occurs immediately upon exposure to the offending food and resolves within a few minutes to hours, with or without treatment.
- In a *biphasic reaction*, which may occur in 20% of those having an anaphylactic reaction, signs and symptoms recur after anaphylactic signs and symptoms initially resolve. In biphasic reactions, signs and symptoms usually return in about 8 hours, although they may be delayed up to 3 days.

If an anaphylactic reaction lasts several hours to several days without resolution, it's called a *protracted reaction*. Concurrent medications such as alpha- and beta-adrenergic antagonists, angiotensin-converting enzyme inhibitors, or angiotensin II receptor blockers can interfere with the body's compensatory mechanisms and interfere with resolution.²

First-line and second-line treatment of anaphylaxis is epinephrine.

Epinephrine should be administered as soon as possible once anaphylaxis is recognized. It's given as an I.M. injection in the anterior-lateral thigh, or, for persistent hypotension, as a continuous I.V. infusion. Epinephrine has both alpha- and beta-adrenergic activity to reverse anaphylaxis. Alpha activity causes vasoconstriction and increases peripheral vascular resistance, which supports BP. Mucosal edema is also decreased. Beta-adrenergic actions increase myocardial contractility (positive inotropy) and heart rate (positive chronotropy) and decrease bronchoconstriction. Beta activity also decreases the release of chemical mediators associated with inflammation.²

After the patient arrives at the healthcare facility such as the ED, place the patient recumbent with the legs elevated to improve venous return to the right side of the heart, administer supplemental oxygen, and start an I.V. infusion of 0.9% sodium chloride solution for fluid resuscitation. A patient who's dyspneic or vomiting should be placed semirecumbent with lower extremities elevated.⁷ Adjunct medications may be needed.²

After the ABCs are assessed and epinephrine has been given, epinephrine is repeated in 5 to 15 minutes if recurrence or insufficient resolution of signs and symptoms is noted. Adverse reactions to epinephrine, which are usually mild and transient, include headache, anxiety, fear, dizziness, palpitations, and tremor.²

The patient will be discharged with a prescription for two doses of an epinephrine autoinjector. Other discharge medications include 2 to 3 days of a histamine₁ (H₁)-receptor antagonist such as diphenhydramine, a histamine₂ (H₂)-receptor antagonist such as ranitidine, and a corticosteroid.²

Discharge education includes how to use the epinephrine autoinjector. Education also includes allergen avoidance, recognition of food allergy

signs and symptoms, and an emergency action plan. (See *Food allergy anaphylaxis emergency kit*.) Encourage patients to obtain a medical-alert bracelet, necklace, or wallet card. Schedule a follow-up appointment.²

Tackling associated issues

The presence of food allergies can impact a patient's life and general physical and mental well-being. Fear of allergic reactions occurring in school caused 10% of affected households to decide to home school.²

Mealtime and the meals themselves are affected in a family with a member with a food allergy. Not only does the person with the allergy need to avoid the offending food, but usually the rest of the family avoids it as well.²

Vaccinations that contain egg protein are a concern for patients with egg allergies. Vaccines with egg protein include MMR (measles, mumps, and rubella), MMRV (measles, mumps, rubella, and varicella), influenza, yellow fever, and rabies. However, the amount of egg protein found in MMR, MMRV, and one rabies vaccine (Imovax) is so low that it can be given safely to those allergic to egg.² These vaccines contain egg protein because they're grown in chick embryos or chick embryonic tissue. The amount of egg protein can vary greatly among vaccines. One of the egg proteins in vaccines, ovalbumin, is often used as a measure of potential vaccine protein concentration. Although this value may be listed on the final vaccine lot, it may be higher than reported and is only one of the potential egg proteins that cause food allergy. In the instance of MMR, MMRV, and Imovax, the ovalbumin level is so negligible it's considered almost nonexistent.²

Can food allergy be prevented?

Pregnant women shouldn't avoid potentially allergenic foods to prevent food allergy.^{2,4} Food antigens may be

Food allergy anaphylaxis emergency kit²	
Medications	
Two epinephrine autoinjectors	Check expiration dates frequently.
H ₁ -receptor antagonist	Diphenhydramine
H ₂ -receptor antagonist	Ranitidine or cimetidine
Bronchodilator	Albuterol
Miscellaneous	
Medic Alert	<ul style="list-style-type: none"> • Bracelet • Necklace • Wallet card
Information sheet	<ul style="list-style-type: none"> • Copy of medical insurance card • Information about emergency contact • Contact information for primary care provider and allergist • Contact information for primary hospital • Contact information for pharmacy • List of current medications, allergies, and comorbid medical conditions.

passed through breast milk, but evidence about whether this exposure increases the likelihood of food allergy development is conflicting. The expert panel of the food allergy guideline recommends breastfeeding exclusively for 4 to 6 months. Evidence shows that breastfeeding may decrease development of atopic dermatitis, cow's milk allergy, and wheezing during early childhood.²

If an infant can't be breast-fed, to decrease the incidence of milk allergy, hydrolyzed infant formula should be used instead of cow's milk formulas for at-risk infants. The use of hydrolyzed formula may also decrease the development of atopic dermatitis. Some drawbacks to using these formulas are that they're less readily available and more costly. They may not be available through infant food programs, such as The Special Supplemental Nutrition Program for Women, Infants, and Children.² This federally funded program is often called the WIC program.

Infants should be introduced to solid foods, including potentially allergenic foods, by age 6 months because delaying their introduction hasn't proven beneficial in food allergy reduction. A delay may also be harmful because it reduces nutrients and calories.²

Nursing considerations

Taking care of a patient with a food allergy can be frightening for nurses, who must put all of their observation and critical thinking skills to use while intervening swiftly and accurately. All the while, they're aware that the patient may enter a biphasic reaction or, worse, a protracted reaction. Nurses need to know the most common food offenders that may lead to anaphylaxis and be familiar with the warning signs and symptoms. Nurses must realize that although most patients exhibit cutaneous signs and symptoms first, some patients don't experience these signs and symptoms at all. Nurses' top priority, besides

monitoring and protecting the ABCs, is to administer epinephrine immediately and be prepared to repeat the dose in 5 to 15 minutes. The patient and family are likely to be very anxious, and nurses' rapid work may make them even more anxious. Nurses should take a moment to talk to them, hold their hand, and show that they care and that they're there to help their loved one.²

Whether nurses work in the hospital or in the clinic, a big part of the job is patient education. In the hospital, they provide the patient and family with information about food allergy and anaphylaxis and teach them how to build an anaphylaxis emergency kit. Because epinephrine is their lifeline, be sure that patients and families understand how to use the autoinjector and help dispel any fears about self-injection. Remind patients to check the expiration date. They should also check the injector for changes in fluid color or other changes.²

Teach your patient how to read labels to check for potential sources of food allergen. Sources that may help nurses and their patients include the American Academy of Allergy, Asthma and Immunology at <http://www.aaaai.org> and the American College of Allergy, Asthma and Immunology at <http://www.acaai.org>.²

Getting a handle on food allergy

The incidence of food allergy is on the rise. Up-to-date guidelines can increase nurses' awareness of this potentially fatal condition and can help them to identify affected patients and intervene more efficiently and effectively.² ■

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INSTRUCTIONS

Taking the bite out of food allergies

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