

Food Allergies

Rebecca Scherzer, MD
Associate Professor of Pediatrics
Allergy and Immunology
Nationwide Children's Hospital
The Ohio State University Wexner Medical Center

Food Allergy (hypersensitivity)

- Definition:**

- **An adverse health effect arising from a specific immune response that occurs reproducibly on exposure to a given food**

Food Adverse Reactions

- **Intolerance**
 - Lactose intolerance, galactosemia
- **Pharmacologic**
 - Caffeine, tyramine in aged cheeses
- **Toxins**
 - Food poisoning
- **Food Allergy**
 - IgE mediated
 - Mixed IgE mediated and non-IgE mediated
 - Non-IgE mediated

Food Adverse Reactions

- **Intolerance**
 - Lactose intolerance, galactosemia
- **Pharmacologic**
 - Caffeine, tyramine in aged cheeses
- **Toxins**
 - Food poisoning
- **Food Allergy**
 - IgE mediated
 - Mixed IgE mediated and non-IgE mediated
 - Non-IgE mediated

Food Adverse Reactions

- **Intolerance**
 - **Lactose intolerance, galactosemia**
- **Pharmacologic**
 - **Caffeine, tyramine in aged cheeses**
- **Toxins**
 - **Food poisoning**
- **Food Allergy**
 - **IgE mediated**
 - **Mixed IgE mediated and non-IgE mediated**
 - **Non-IgE mediated**

Food Adverse Reactions

- **Intolerance**
 - **Lactose intolerance, galactosemia**
- **Pharmacologic**
 - **Caffeine, tyramine in aged cheeses**
- **Toxins**
 - **Food poisoning**
- **Food Allergy**
 - **IgE mediated**
 - **Mixed IgE mediated and non-IgE mediated**
 - **Non-IgE mediated**

Food Hypersensitivity Disorders

IgE mediated	
Gastrointestinal	Oral allergy syndrome, gastrointestinal anaphylaxis
Cutaneous	Urticaria, angioedema, morbilliform rashes and flushing
Respiratory	Acute rhinoconjunctivitis, bronchospasm (wheezing)
Generalized	Anaphylactic shock

J Allergy Clin Immunol May 2004, 113:805-19

Food Hypersensitivity Disorders

Mixed IgE and cell mediated	
Gastrointestinal	Eosinophilic esophagitis/ Gastroenteropathy
Cutaneous	Atopic dermatitis
Respiratory	Asthma

J Allergy Clin Immunol May 2004, 113:805-19

Food Hypersensitivity Disorders

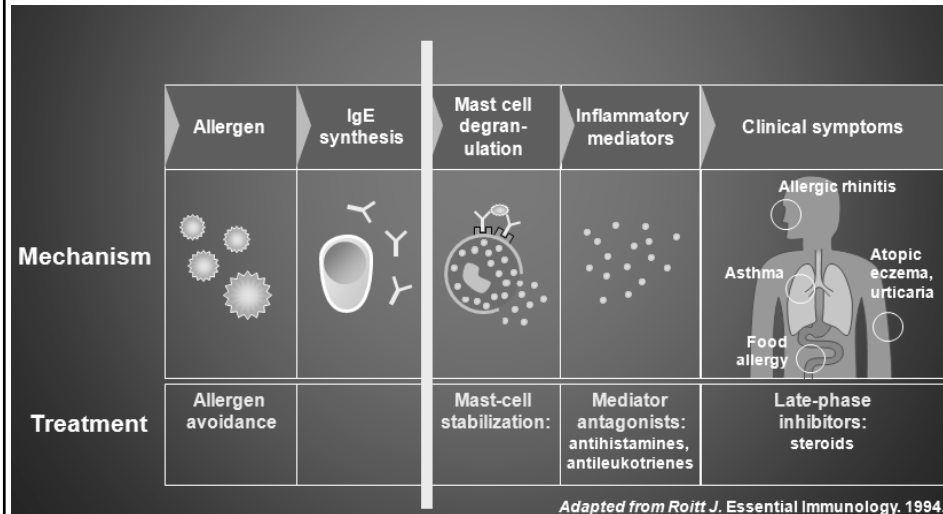
Cell mediated	
Gastrointestinal	Food protein -- induced enterocolitis Syndrome (FPIES) Food protein – induced proctocolitis (allergic colitis) Food protein – induced enteropathy syndromes Celiac disease
Cutaneous	Contact dermatitis, Dermatitis herpetiformis
Respiratory	Food-induced pulmonary hemosiderosis (Heiner syndrome)

J Allergy Clin Immunol May 2004, 113:805-19

Food Hypersensitivity Reactions

- **The most studied type of food reaction is Type 1 -- IgE mediated:**
 - **Occurs when there is a failure to develop or with a breakdown in oral tolerance**
 - **This results in production of food-specific IgE antibodies**

IgE Mediated Responses



Food Allergy

- **Food Allergy appears to be the leading cause of anaphylaxis outside of hospitals**
- **Accounts for 30,000 cases of anaphylaxis treated in Emergency Departments each year**

Sampson, HA Update on Food allergy. J allergy Clin Immunol 2004;113:805-819

Prevalance of Food Allergy

- **Affects 4-8% of children** *NCHS Data Brief. No 10; October 2008*
- **Affects 3-4% of adults**
AAAAI. Allergy Statistics. <http://www.aaaai.org/about-the-aaaai/newsroom/allergy-statistics.aspx>
- **73% caused by Milk, Egg, and Peanut in Peds**
Journal of Pediatrics 1990;4:561-567
- **Up to 95% of reactions in children are caused by: Milk, Eggs, Peanut, Tree Nut, Soy, Wheat and Fish**
- **In Adults, peanut, tree nuts, and seafoods most common**

Prevalence of Food Allergy in the United States

J Allergy Clin Immunol 2004;113:805-19

Food	Young Children	Adults
Milk	2.5%	0.3%
Egg	1.3%	0.2%
Peanut	0.8%*	0.6%
Tree Nuts	0.2%	0.5%
Fish	0.1%	0.4%
Shellfish	0.1%	2%
OVERALL	6%	3.7%

Food Allergies

Peter Mustillo, MD

Associate Professor of Pediatrics & Internal Medicine

Allergy and Immunology

Nationwide Children's Hospital

The Ohio State University Wexner Medical Center

Case 1

- **A 9 year old girl with hives on her arms.**



...Case 1

- 5 minutes earlier had just eaten a cookie.
- She has a medical ID bracelet indicating a known peanut allergy. She also has asthma.



Courtesy of Allermates™

...Case 1

- She is able to converse with you, and complains that the hives are “itchy,” but denies any other symptoms at this time.
- Has Benadryl (PO), Albuterol and an Epinephrine auto injector available
- Her food allergy action plan is not available.

...Case 1: Question #1
Which medication would you give to her at this time?

- A. Benadryl (diphenhydramine)**
- B. Epinephrine auto injector**
- C. Albuterol**
- D. No medication, just watch and wait**

...Case 1: Question #1
Which medication would you give to her at this time?

- A. Benadryl (diphenhydramine)**
- B. Epinephrine auto injector**
- C. Albuterol**
- D. No medication, just watch and wait**

...Case 1

- **As you are about to reach for the Benadryl, she begins to cough and clear her throat.**
- **She is able to talk, but is beginning to have a mild wheeze and mild shortness of breath.**

...Case 1: Question #2
At this time which medication would you administer?

- A. Benadryl (diphenhydramine)**
- B. Albuterol**
- C. Epinephrine Auto injector**
- D. Both A and B**

...Case 1: Question #2
At this time which medication would you administer?

- A. Benadryl (diphenhydramine)**
- B. Albuterol**
- C. Epinephrine Auto injector**
- D. Both A and B**

ANAPHYLAXIS: Manifestations

• RESPIRATORY

- Dyspnea
- Chest tightness
- Wheezing
- Cough
- Stridor

• CUTANEOUS

- Urticaria (diffuse)
- Angioedema
- Generalized pruritis
- Flushing

• NEUROLOGIC

- impending doom
- fussiness (infants)

• CARDIOVASCULAR

- Lightheaded/Syncope
- Hypotension
- Tachycardia / Chest discomfort

• GASTROINTESTINAL

- Abd. Pain / Cramping
- Nausea/Vomiting/Diarrhea

• NASO-OCULAR

- Rhinorrhea/Conjunctivitis
- Congestion
- Sneezing (repetitive)

ANAPHYLAXIS: Defined

- **An acute, serious and potentially life-threatening systemic reaction with varied mechanisms, clinical presentations, and severity, resulting from the sudden systemic release of mediators from mast cells and basophils.**

ANAPHYLAXIS: treat early

- **If precious minutes are lost early in the course of a systemic allergic reaction, subsequent management can become more difficult.**
- **Most fatalities related to food allergies are due to delaying administration of epinephrine**
- ****ADMINISTER EPINEPHRINE EARLY in the course of anaphylaxis!**

Food Allergy Action Plan

Name: _____ D.O.B.: ____/____/____

Allergy to: _____

Weight: _____ lbs. Asthma: ☐ Yes (higher risk for a severe reaction) ☐ No

Place
Student's
Picture
Here

Extremely reactive to the following foods: _____

THEREFORE:
☐ If checked, give epinephrine immediately for ANY symptoms if the allergen was likely eaten.
☐ If checked, give epinephrine immediately if the allergen was *definitely* eaten, even if no symptoms are noted.

Any SEVERE SYMPTOMS after suspected or known ingestion:

One or more of the following:

LUNG: Short of breath, wheeze, repetitive cough

HEART: Pale, blue, faint, weak pulse, dizzy, confused

THROAT: Tight, hoarse, trouble breathing/swallowing

MOUTH: Obstructive swelling (tongue and/or lips)

SKIN: Many hives over body

Or combination of symptoms from different body areas:

SKIN: Hives, itchy rashes, swelling (e.g., eyes, lips)

GUT: Vomiting, crampy pain

➔

1. INJECT EPINEPHRINE IMMEDIATELY

2. Call 911

3. Begin monitoring (see box below)

4. Give additional medications:*
-Antihistamine
-inhaler (bronchodilator) if asthma

*Antihistamines & inhalers/bronchodilators are not to be depended upon to treat a severe reaction (anaphylaxis). USE EPINEPHRINE.

MILD SYMPTOMS ONLY:

MOUTH: Itchy mouth

SKIN: A few hives around mouth/face, mild itch

GUT: Mild nausea/discomfort

➔

1. GIVE ANTHISTAMINE

2. Stay with student, alert healthcare professionals and parent

3. If symptoms progress (see above), USE EPINEPHRINE

4. Begin monitoring (see box below)

Medications/Doses

Epinephrine (brand and dose): _____

Antihistamine (brand and dose): _____

Other (e.g., inhaler-bronchodilator if asthmatic): _____

Monitoring

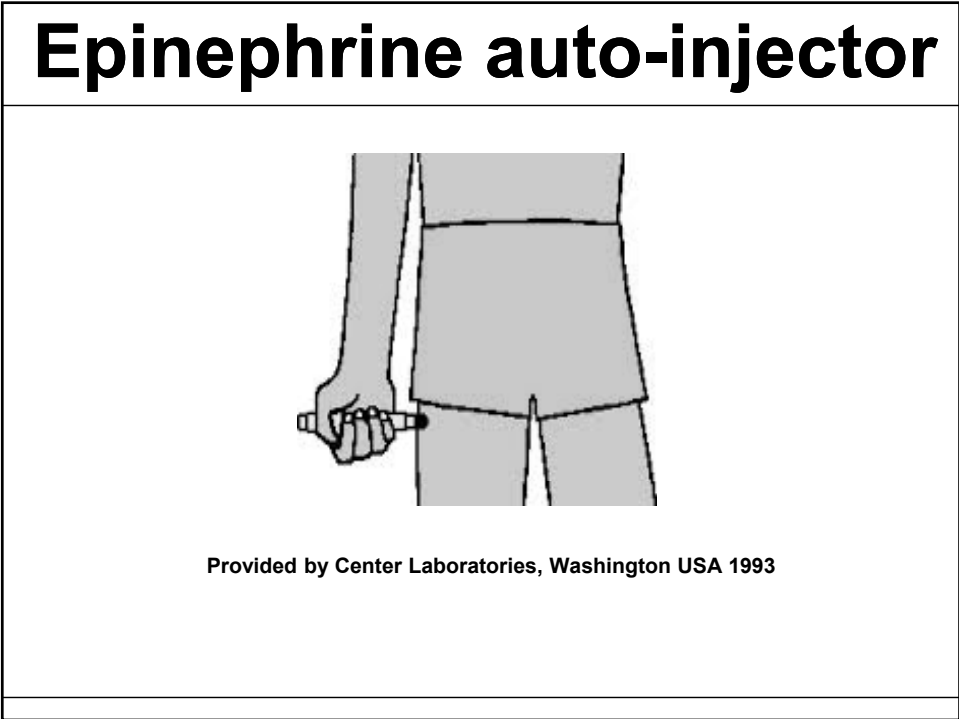
Stay with student; alert healthcare professionals and parent. Tell rescue squad epinephrine was given; request an ambulance with epinephrine. Note time when epinephrine was administered. A second dose of epinephrine can be given 5 minutes or more after the first if symptoms persist or recur. For a severe reaction, consider keeping student lying on back with legs raised. Treat student even if parents cannot be reached. See back/attached for auto-injection technique.

Parent/Guardian Signature _____ Date _____

Physician/Healthcare Provider Signature _____ Date _____

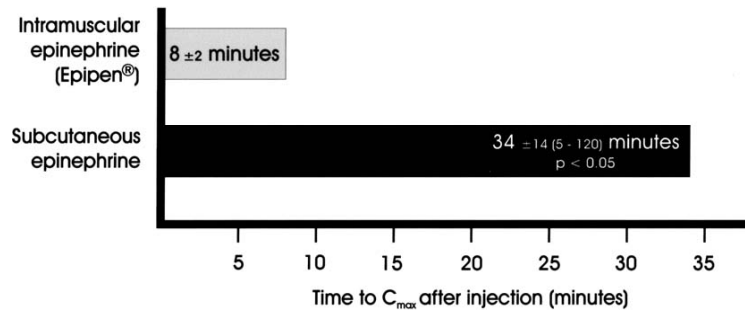
TURN FORM OVER

Form provided courtesy of FAAN (www.foodallergy.org) 7/2010



Epinephrine Administration

- Intramuscular preferred over subcutaneous
 - Mid-anterolateral thigh



Simons. *JACI*. 2004;113:837-44.

Epinephrine Auto injectors



Spectrum / Severity of Food Allergies Varies Greatly

Eczema ↔ Anaphylaxis

Eczema and Food Allergy

30% of infants / young children with moderate to severe eczema have an associated food allergy



Image Copyright DermNet.com DermNet.com is developed & maintained by Alan N. Binnick & Thomas P. Habif, Dartmouth Medical School, New Hampshire.

Food Allergies

Rebecca Scherzer, MD

Associate Professor of Pediatrics

Allergy and Immunology

Nationwide Children's Hospital

The Ohio State University Wexner Medical Center

Diagnosing Food Allergies

- **History**
 - What food had been eaten?
 - Time course of reaction
 - Symptoms and treatment of reaction
 - Previous exposure?
 - Other food allergies?
 - Other atopic (allergic) disease?
- **Diagnostic Studies**
 - Allergy Skin testing +/- food specific IgE tests
 - Age requirements?
 - Patch testing?

Diagnosis

- **Skin Prick Testing**

- Simple and safe procedure to perform in office
 - Relatively inexpensive
- Results in 20 minutes
 - Do not have to wait for lab testing/results
 - Can discuss the results while the patient still in clinic
 - Necessary teaching occurs during appt
- Good negative predictive value (IgE-mediated)
- Lower positive predictive

Diagnosis

- **Skin Prick testing**

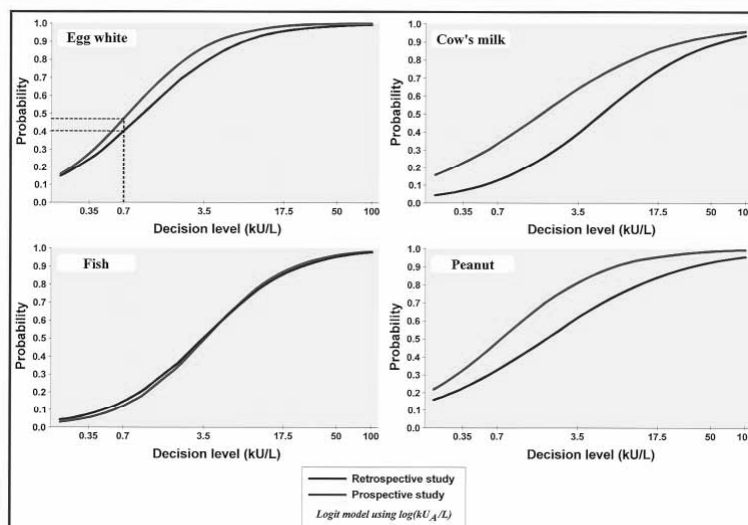
- Confirms sensitization but does not always confirm clinical diagnosis
- Examples when cannot be performed: severe eczema, dermatographism/urticaria, patient cannot stop antihistamines, small surface area

Diagnosis

- **Serum Food-Specific IgE levels**
 - Best interpreted by healthcare provider
 - Studies have shown reactions in patients with levels below detectable limits and positive values may represent sensitization and not clinical reactivity
 - Avoid testing with Panels
 - Not economical
 - Leads to irrelevant positive tests
 - Positive results may not have clinical significance
 - Positive results may be secondary to cross reactivity between related foods

Lieberman JA et al. Diagnosis of Food Allergy: Epicutaneous Skin Tests, In Vitro Tests, and Oral Food Challenge. *Cin Allergy Asthma Rep*(2011). 11:58-64

WHAT DOES FOOD-SPECIFIC IGE LEVEL *REALLY* MEAN?



Probability of reacting to a food at a given IgE level.

Sampson HA. *J Allergy and Clin Immunol* 2001;107:891-6

slgE Allergy Profiles

Food Allergy Profile

- Total IgE
- Milk (cow)
- Soybean
- Egg white
- Peanut, Walnut
- Wheat
- Codfish
- Shrimp, Scallop, Clam
- Corn
- PRICE \$\$\$

Childhood Allergen Profile

- Total IgE
- Dust mite (farinae)
- Cat dander, Dog dander
- Cockroach
- Alternaria mold
- Milk (cow)
- Soybean
- Egg white
- Peanut, Wheat, Codfish
- PRICE \$\$\$

Food slgE testing:

- Has limited sensitivity and specificity
- ***Does not distinguish between sensitization and (clinical) allergy**
- Does not determine reaction “severity”
- Does not identify non-IgE mediated allergies that may be causing symptoms
- Does not determine significance of cross-reactivity

Sicherer S: Medscape Education 2012

Food Allergy Diagnostic Pearls

- **History determines pretest probability**
- **Nothing will substitute for a detailed history taken by an expert**
- **Tests are not designed for screening**
(values are difficult to interpret without a supportive history)
- **Ordering panels is not recommended**
- **(+) Test results in absence of history should be interpreted cautiously**

Sicherer S: Medscape Education 2012

Food Challenges

- **Gold Standard to diagnose food allergy**
 - **Open**
 - **Single-Blinded**
 - **Double-Blinded**

Does Maternal / Infant diet affect atopy risk?

Based on lack of evidence to support earlier position, AAP withdrew recommendations for at risk infants to:

- 1. Avoid egg until age 2 years**
- 2. Avoid peanut, tree nuts and seafood until age 3 years**
- 3. Mothers avoid peanuts during pregnancy and while breast feeding**

Maternal / Infant diet: AAP Updated Position Statement:

“current evidence does not support a major role for maternal dietary restrictions during pregnancy or lactation.... There is also little evidence that delaying timing of the introduction of complementary foods beyond 4-6 months of age prevents the occurrence of atopic disease.”

Will they outgrow their food allergies?

Peanut--20% will develop clinical tolerance

	Age 4	Age 8	Age 12	Age 16
Cow's milk	5%	21%	37%	55%
Egg	4%	26%	48%	68%

Treatment

- **The only way to avoid future reactions is complete avoidance of known food allergens**
 - Education is critical
 - Consider dietary involvement
- **Even with teaching 50% of patients had accidental ingestions over a 5 year time period**

Sicherer SH et al. Clinical features of acute allergic reactions to peanuts and tree nuts in children. Pediatrics 1998;102(1):e6

Treatment

- **The only way to avoid future reactions is complete avoidance of known food allergens**
 - Education is critical
 - Consider dietary involvement
- **Even with teaching 50% of patients had accidental ingestions over a 5 year time period**

Sicherer SH et al. Clinical features of acute allergic reactions to peanuts and tree nuts in children. *Pediatrics* 1998;102(1):e6

Treatment

- **Current treatment in avoidance**
- **Very good education for family and all care givers crucial**
- **Teaching on the use of self-injectable epinephrine is very important!**
 - All people taking care of the child
 - Clear instruction on when to use the medication
- **Consult nutrition if there are one or more major food groups involved**

Food Allergies

Peter Mustillo, MD

Associate Professor of Pediatrics & Internal Medicine

Allergy and Immunology

Nationwide Children's Hospital

The Ohio State University Wexner Medical Center

Case 2

A 19 y/o male is seen in your office for complaints of discomfort in his upper chest during meals, and more recently gagging during eating. Other than some seasonal allergic rhinitis, he has been previously healthy. Physical exam is unremarkable.

You start him on a proton pump inhibitor bid, recommend he avoids caffeine, and suggest a follow-up in 4 weeks.

...Case 2

On follow-up, he tells you he is no better on the antacid, and twice in the past 2 weeks was unable to swallow meat, until it was washed down with an extra beer.

You subsequently refer him to GI, who performs an upper endoscopy.



Endoscopic photo gallery from North American Society for Pediatric Gastroenterology, Hepatology and Nutrition.

...Case #2

Which of the following would be the most likely diagnosis?

- A) Candida esophagitis**
- B) Vocal cord dysfunction**
- C) Severe gastroesophageal reflux disease**
- D) Eosinophilic esophagitis**

...Case #2

Which of the following would be the most likely diagnosis?

- A) Candida esophagitis**
- B) Vocal cord dysfunction**
- C) Severe gastroesophageal reflux disease**
- D) Eosinophilic esophagitis**

Eosinophilic Esophagitis

- **An immune reaction due to an IgE mediated, non-IgE mediated or combined response**
- **Characterized by infiltration of the esophagus with eosinophils ($\geq 15/\text{hpf}$)**
- **Seen most often during infancy through adolescence**

Eosinophilic Esophagitis: Clinical Signs and Symptoms

- **Failure to thrive / Poor weight gain**
- **Recurrent vomiting**
- **Abdominal pain**
- **Heartburn**
- **Difficultly swallowing**
- **Food impaction**

























































Eosinophilic Esophagitis (EoE) Clinical Features in INFANTS

Symptoms may be more vague

- **Feeding refusal**
- **Early satiety**
- **Failure to thrive**
- **Poor weight gain**
- **Pyloric stenosis with outlet obstruction and postprandial projectile emesis**

Eosinophilic Esophagitis

- **Commonly, but not always attributed to food allergy (68% (+) Skin test +/- RAST).**
J Allergy Clin Immunol 2002; 109:363-8.
- **Treatment options**
 - **Food elimination or hypoallergenic formula**
 - **Swallowed topical steroid treatment**
- **Long term prognosis unclear**
 - **Strictures in some**

If Allergic to:	Risk of Reaction to at Least One:	Risk:	<p>Approximate rate of clinical reactivity to at least 1 other related food.</p> <p><i>J Allergy Clin Immunol Volume 108, Number 6</i></p>
A legume* peanut 	Other legumes peas  lentils  beans 	5% 	
A tree nut walnut 	Other tree nuts brazil  cashew  hazelnut 	37% 	
A fish* salmon 	Other fish swordfish  sole 	50% 	
A shellfish shrimp 	Other shellfish crab  lobster 	75% 	
A grain* wheat 	Other grains barley  rye 	20% 	
Cow's milk* 	Beef hamburger 	10% 	
Cow's milk* 	Goat's milk goat 	92% 	
Cow's milk* 	Mare's milk horse 	4% 	
Pollen birch  ragweed 	Fruits/vegetables apple  peach  honeydew 	55% 	
Peach* 	Other Rosaceae plum  pear  cherry 	55% 	
Melon* cantaloupe 	Other fruits watermelon  banana  avocado 	92% 	
Latex* latex glove 	Fruits kiwi  banana  avocado 	35% 	
Fruits kiwi  avocado 	Latex latex glove 	11% 	

Case 3

You order a renal angiogram on a 68 y/o female patient. Which of the following is NOT relevant to the study:

- A) The indication for testing
- B) She has a shellfish allergy
- C) Her creatinine is 1.3
- D) She takes warfarin
- E) All of the above are important

Case 3

- A) The indication for testing**
- B) She has a shellfish allergy**
- C) Her creatinine is 1.3**
- D) She takes warfarin**
- E) All of the above are important**

...Case 3: The Shellfish Allergy and Radio-contrast Misconception

- Shellfish allergy is related to tropomyosin**
- Adverse reactions to radiocontrast are generally due to hypertonicity (known to augment basophil and mast cell histamine release)**
- Patients with allergies/adverse reactions to shellfish tolerate topical and oral iodine**
- There is no association linking shellfish and radiocontrast media adverse reactions**

Vaccinations & Egg Allergy

What vaccines should be avoided?

- 1) Influenza – obtain detailed history**
 - if tolerates any egg in food, ok to give
 - if anaphylaxis to egg, consult expert
 - avoid Flumist if egg allergic!
 - FluBlock OK (approved in 2013 age \geq 18y)
 - 2) Yellow Fever (evaluate and test 1st)**
 - 3) Rabies (Imovax not contraindicated)**
- **MMR is NOT contraindicated!****