Food Allergies & Asthma

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Disclosures

• None

Objectives

1. Define food allergy and describe current prevalence and burden of food allergies
2. Describe clinical symptoms of food allergic reactions
3. Discuss clinical and epidemiologic overlaps between food allergies and asthma
4. Understand how food allergy is currently diagnosed and treated as well as recent landmark changes to food allergy management

Public perception

• ¼ households in US have dietary modifications in place due to perceived food reaction
AAAAl definition of food allergy

- “Adverse health effect arising from a specific immune response that occurs reproducibly on exposure to a given food.”
  - Not limited to IgE-mediated reactions
  - Describes the induction of clinical signs and symptoms
  - This contrasts with sensitization, which indicates the presence of IgE antibodies to a food, often in the absence of clinical symptomatology.

IgE-mediated food allergy

Prevalence

- 1-2% of the population, estimated to affect 15 million people
- 7-8% of all children in first 3 years of life, up to 5% of adults
  - Infants with moderate to severe atopic dermatitis at highest risk
- National surveys suggest that the prevalence of peanut allergy has tripled since the 1990s
**Allergens**

- Over 170 foods have been described as triggers of food related reactions
- 8+1 foods account for 90% of food allergies
  - peanut, tree nuts, fish, shellfish, milk, egg, wheat, soy, and seeds (particularly sesame)

**Characteristics of food allergens**

- Must be able to survive digestion and elicit an immunological response when exposed to the mucosal immune system
- Such characteristics are thought to include
  - water solubility
  - glycosylation residues
  - relatively low molecular weight
  - resistance to digestion by heat and proteases
  - abundance within the food source
Symptoms

- Skin: most common
  - hives, swelling, itch, warmth, redness, rash
- Respiratory
  - wheezing, shortness of breath, throat tightness, cough, hoarse voice, chest pain/tightness, trouble swallowing, itchy mouth/throat, nasal stuffiness/congestion
- GI
  - nausea, pain/cramps, vomiting, diarrhea
- Circulatory
  - pale/blue color, low pulse, dizziness, lightheadedness/passing out, low blood pressure, shock, loss of consciousness
- Misc
  - anxiety, feeling of impending doom, itchy/red/watery eyes, headache, cramping of the uterus

Characteristics of IgE mediated food reaction

- Rapid onset after ingestion (e.g., within minutes to 2 hours)
- Small amount of allergen ingested can cause serious reaction
- Reproducible

History

- Time from ingestion to symptoms
- Which symptoms?
  - Do they sound IgE mediated?
- Number of occasions
- Quantity required
- Most recent/length of time since reaction
- Other factors: exercise, medication

So what about processing foods?

- Thermal treatments (i.e., baking) can reduce the allergenicity of certain foods, like egg or milk
- This can allow for reintroduction of problem foods earlier than otherwise possible
- Some cooking practices, particularly roasting compared with boiling, may potentiate the allergenic activity of peanuts
Near fatal/fatal anaphylaxis

- Most commonly associated foods:
  - Peanut (most common)
  - Tree nut
  - Shellfish
  - Fish
- Related to several factors including
  - Adolescence
  - Underlying respiratory disease (asthma)
  - Concomitant use of beta blockers
  - Non cutaneous reactions
  - Delayed epinephrine

Food Allergy and Asthma

- Children with both food allergies and asthma are at increased risk for severe anaphylaxis, particularly if asthma is uncontrolled
- There is a close association between food allergy and asthma
  - Unclear if these just coexist in children predisposed to atopic conditions (i.e., atopic march) or whether a causal relationship exists.
  - High rate of food allergies in asthmatic children

Food Allergy and Asthma

- Both are increasing in prevalence
- Food allergies often affect young children
  - Can precede the development of asthma
  - Are considered a risk factor for persistent, problematic asthma in young children
- Children with asthma and concurrent food allergies tend to have worse asthma morbidity than those with asthma alone

Food Allergy and Asthma

- Food allergy generally does not present with chronic or isolated respiratory symptoms
  - Food allergic reactions can trigger lower respiratory symptoms as a component of overall reaction
- A concurrent diagnosis of asthma appears to worsen the general prognosis for food allergy
  - The food allergy(ies) tend to persist
  - Asthma, especially uncontrolled asthma, is a risk factor for fatal or near-fatal anaphylaxis
Food Allergy and Asthma

- Food allergy should be considered in children with acute life-threatening asthma exacerbations with no identifiable triggers, and in highly atopic children with severe persistent asthma resistant to medical management.
- In patients with concomitant food allergy and asthma, educate about heightened risks, and manage both well.

Diagnosis

- Isolated ingestion of potential allergen on several occasions leading to a reaction PLUS positive skin prick test (SPT) or ImmunoCAP assay.

Skin prick testing

- Highly sensitive ~85%
- Less specific ~40-80%
  - Well suited for foods for which you have high suspicion
- Positive Predictive Value (PPV) < 50% (presence of IgE antibody but no hypersensitivity)
- No intradermal testing to foods
  - Higher rate of false positives
  - Can elicit systemic reactions

Specific IgE: Immunocap

- Fluorescence anti-IgE
- Serum IgE
- Allergens
- Sedimentation
ImmunoCAP

- Previously known as RAST
- Also highly sensitive but not specific. Low PPV (high rate of false positives)
- Trend outgrowth of the allergy
- “Consequently, panels of food allergy tests should not be performed without consideration of the history because one may be faced with numerous irrelevant positive results (particularly in disorders with high total IgE antibody).”

Common foods

Common foods by age

<table>
<thead>
<tr>
<th>Infants</th>
<th>Children</th>
<th>Older children/adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow’s milk</td>
<td>Cow’s milk</td>
<td>Peanut</td>
</tr>
<tr>
<td>Eggs</td>
<td>Eggs</td>
<td>Tree nuts</td>
</tr>
<tr>
<td>Peanut</td>
<td>Peanut</td>
<td>Fish</td>
</tr>
<tr>
<td>Soy</td>
<td>Soy</td>
<td>Shellfish</td>
</tr>
<tr>
<td>Wheat</td>
<td>Tree nuts (walnut, cashew, etc)</td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td>Shellfish</td>
<td></td>
</tr>
</tbody>
</table>

Cow’s milk

- 2.5% of infants, 0.2% adults
- Most achieve tolerance (approximately 85%) by the age of 3 to 5 years
- Can usually tolerate extensively hydrolyzed formulas based on cow’s milk protein (approximately 98%) or soy (approximately 85%)
- IgE antibodies to casein and whey (beta-lactoglobulin and alpha-lactalbumin) proteins most commonly
- Cow’s milk cross reacts with other mammalian milk (i.e. goat (90%))
  - Not mare or human
Egg

- Approximately 1.3-2.5% of infants and young children, 0.2% adults
- Major allergenic proteins are in egg white (ovalbumin, ovomucoid (heat-stable), ovatransferrin)
- Egg allergic children sometimes tolerate egg in baked products or have contact urticaria from egg interaction, but eat it without symptoms
- OK to give seasonal flu vaccine to egg allergic children without any precautions needed

Peanut

- Approximately 0.8% children, 0.6% adults
- Most common food in fatal food-induced anaphylactic reactions
- Approximately 20% of children with a peanut allergy established under the age of 2 years will outgrow it
- Recurrence of resolved peanut allergy has been observed
  - Thought to be affected by not complying with recommended diet
- Peanut allergic patients tolerate other legumes (95%), including soy
- Highly refined peanut oil usually tolerated (can eat at Chik-Fil-A)
### Tree nuts
- Almond, walnut, cashew, brazil nut, pistachio, hazelnut, pecan, macadamia
- 0.2% of children, 0.5% adults
- 25-40% of peanut allergic patients are also allergic to at least one tree nut
- Allergens in tree nuts are highly homologous and can crossreact
  - pistachio and cashew
  - pecan and walnut

### Soybean
- Prevalence not widely studied, thought to be 0.3% to 0.4%
  - typically transient
- Soybean oil & soy lecithin usually okay
- Oral food challenges have demonstrated low clinical cross-reactivity with other legumes in soy allergic children; typically transitory
  - peanut, soybean, lima beans, pea, garbanzo bean, green bean

### Fish
- 0.1% children, 0.4% adults
- Potentially severe
- Common to have reactions to multiple fish
- Typically long lived allergy
- Common in areas of the world where fish is a major source of protein

### Fish
- Dominant allergen in finned fish is parvalbumin
  - Both fresh and salt water fish
- Patients with fish allergy should avoid all finned fish as this protein is found in all fish
**Shellfish**

- 0.2% children, 0.5-2% adults
- High risk of cross-reactivity between crustaceans
  - Less well defined between mollusks and crustaceans
- Potentially severe
- No cross-reactivity between fish and shellfish
- No documented relationship between reactions to radiocontrast media (RCM) and allergy to fish, crustacean shellfish, or iodine
  - RCM reactions are non-IgE mediated

**Management: IgE-mediated Food Allergy**

- Avoidance
- Reading labels, Caution when eating out
  - A great resource is the FARE website, www.foodallergy.org
- Injectable Epinephrine carried at ALL times
- Serial testing, usually trending ImmunoCAP numbers
- Oral food challenge as gold standard

**Alpha gal**

- Newly described delayed systemic reaction to red meat
- Due to the production of IgE to galactose-α-1,3-galactose (which is an alpha linked glycan) in susceptible subjects, secondary to a tick bite.
- Alpha-gal specific IgE will recognize epitopes present in all mammals, and thus all of these meats should be eliminated from the diet.
- Think of this in patients with urticaria, angioedema, and/or anaphylaxis occurring 3 to 6 hours after eating beef, pork, lamb, and venison
The Future Is Now

LEAP trial

- The authors had shown in previous studies that the risk of the development of peanut allergy was 10x higher in Jewish children in the UK as compared to Israeli children
- They noted that in the UK, peanut is not introduced until after 1 year of age, whereas in Israel, babies consume peanut based foods starting around 7 months of age
- Does early introduction of peanut offer protection from the development of peanut allergy?
LEAP trial

- Randomized, open label, controlled trial at 1 UK site
- To be eligible, infants had to be at least 4 months and less than 11 months of age and had to have severe eczema, egg allergy, or both.
- 640 infants were stratified into two study cohorts on the basis of the results of a peanut skin prick test (SPT)
  - No measurable wheal versus wheal measuring 1 to 4 mm
- Then each cohort was randomized to 2 groups
  - Consumption of peanut versus avoidance of peanut
  - If randomized to consumption, they underwent a baseline peanut oral challenge
  - If they reacted, they crossed over to the avoidance group

Primary outcome:

- Peanut allergy at 60 months of age:
  - In the SPT negative group, 13.7% of the avoidance group and 1.9% of the consumption group
  - 86.1% relative reduction in the prevalence of peanut allergy
  - In the SPT positive group, 35.3% of the avoidance group and 10.6% of the consumption group
  - 70.0% relative reduction in the prevalence of peanut allergy

2017 NIH Addendum Guidelines for the Prevention of Peanut Allergy in the United States

- Published January 2017
- Addendum to 2010 Guidelines for Diagnosis and Management of Food Allergy
- Based mainly off findings of LEAP and other studies

NIH Peanut Allergy Prevention Guidelines

![Summary of Addendum Guidelines](image)
NIH Peanut Allergy Prevention Guidelines

Thank You!

Vanderbilt Pediatric Allergy Clinic

Bibliography

Bibliography (cont’d)