Allergy Testing and Practical Mitigation Measures

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Overview of Allergies and Mitigation

• The human component
• The environmental component
• Mitigation of the components

Types of Allergic Reactions

• Type I – IgE-mediated immediate hypersensitivity
• Type II – antibody-dependent cytotoxicity
• Type III – immune complex mediated
• Type IV – cell-mediated/delayed hypersensitivity
Types of Allergic Reactions

- **Type I** – IgE-mediated immediate hypersensitivity
- Type II – antibody-dependent cytotoxicity
- Type III – immune complex mediated
- Type IV – cell-mediated/delayed hypersensitivity

Immunology of IgE-mediated reactions

Skin Testing

For a skin test to be positive: allergen and allergen-specific IgE are required.

Skin testing for allergen-specific IgE
Blood Testing (Unicap, Rast)

Serum is run through a filter coated with allergen

If IgE “recognizes” allergen, it sticks

An anti-IgE marker is run through the filter, the amount of this that stick is quantitated

Pitfalls for Blood Testing

Allergen is destroyed in processing

IgE is present, but doesn’t stick well

IgE is present, but in very low quantities

*Sensitivity of blood testing is estimated at 89%*

Skin and Blood Testing Negative, History Positive?

Believe the patient –

IgE class switching and synthesis may occur in peripheral tissue (nasal mucosa and lungs)

The gold standard for testing is direct challenge to the tissue
Pros/Cons of Different IgE Testing

<table>
<thead>
<tr>
<th></th>
<th>Pro</th>
<th>Con</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Skin Prick</strong></td>
<td>quick – 15 min, cheaper $5-$10 ea</td>
<td>can’t do if pt on antihistamines</td>
</tr>
<tr>
<td></td>
<td>more sensitive (95%)</td>
<td>can have systemic reaction</td>
</tr>
<tr>
<td></td>
<td>can determine “potency”</td>
<td>of the allergen</td>
</tr>
<tr>
<td><strong>Blood/Sera</strong></td>
<td>only one poke</td>
<td>if IgE high (&gt;5000), false positives</td>
</tr>
<tr>
<td></td>
<td>diverse allergens available</td>
<td>medications don’t effect results</td>
</tr>
<tr>
<td></td>
<td>primary care can do testing</td>
<td>can get panels which are less expensive per IgE</td>
</tr>
</tbody>
</table>

How to Interpret IgG Testing?

IgG is another immune system protein that is classically involved in Type II (cytotoxic) and Type III (immune complex) reactions.

IgG can act through both activating (+) and inhibitory (-) pathways:

- (-) IgG elevation with shots correlates with tolerance to allergen
- (+) IgG in autoimmune disease appears to play a role in inflammation
- (-) Excess IgG shuts down the immune response after an infection
- (+) Vaccination increases pathogen specific IgG – activates “army”

I, unfortunately, can’t tell you how to interpret IgG results.

Overview of Allergies and Mitigation

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Types of Allergens

Outdoor

Indoor

When is the level allergen sufficient to cause a reaction?

Resources to Determine Outdoor Allergen Levels

Indoor Allergen Levels

- History, History, History
  - Animals and birds present in the home
  - Feather pillows/comforters
  - Trees, grasses and weeds adjacent to the home
  - Humidifier or swamp cooler present?
  - Mold present in bathrooms/basement

- Quantitation of indoor allergens is performed in research protocols, generally not available to the public

Indoor allergen concentration

<table>
<thead>
<tr>
<th>Location</th>
<th>Surface</th>
<th>Der p1 (mcg/gm)</th>
<th>Fel d1 (mcg/gm)</th>
<th>Bla g2 (U/gm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virginia</td>
<td>Floor</td>
<td>&lt;0.2</td>
<td>472</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>Virginia</td>
<td>Carpet</td>
<td>26.5</td>
<td>20.6</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>Virginia</td>
<td>Carpet</td>
<td>0.6</td>
<td>&lt;0.2</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>Ohio</td>
<td>Bedding</td>
<td>1.7</td>
<td>&lt;0.2</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>California</td>
<td>Carpet</td>
<td>1.9</td>
<td>2.2</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>California</td>
<td>Bedding</td>
<td>20.3</td>
<td>6.7</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>Delaware</td>
<td>Kitchen</td>
<td>0.43</td>
<td>&lt;0.2</td>
<td>298</td>
</tr>
<tr>
<td>Atlanta</td>
<td>Mixed</td>
<td>0.7</td>
<td>&lt;0.2</td>
<td>219</td>
</tr>
</tbody>
</table>

Overview of Allergies and Mitigation

- The human component
- The environmental component
- Mitigation of human reactivity
- Allergen mitigation
Can Allergies & Asthma be Prevented?

- Perinatal dog exposure in the home appears to decrease development of allergic disease (cat – not so much)  

- Increased diversity of the GI microbiome is associated with a decreased risk of developing allergic disease  
  2012 AAAAI Conference (multiple sources)

- Acetaminophen use during pregnancy appears to increase multi-trigger wheeze by 2 fold in pre-schoolers  
  Acta Pediatrscia 2011;100:1567-1571

Mitigation of human reactivity

- Saline nasal irrigations

- Allergen Immunotherapy
  - Subcutaneous (shots)
  - Sublingual (oral)

Allergen Immunotherapy (IT) Decreases Allergic Sensitivity

Both sublingual & subcutaneous IT appear to be effective in decreasing sensitivity. Sublingual is not approved for use in the US. European data suggests it will be safer.
Overview of Allergies and Mitigation

• The human component
• The environmental component
• Mitigation of human reactivity
• Allergen mitigation

Myth #1

• Patients or parents of an allergic child will get rid of animals in the home to decrease allergen levels
• They are more likely to get rid of the doctor who advises it

Myth #2

• You can now obtain a cat and dog that have had the allergens bred out of them Annals Allergy 108 (2012): 74-76
  A cat without Fel d1 (>50% of allergic individuals are sensitized) = $7,000+
  A dog without Can f1 (>50% of allergic individuals are sensitized) = $8,000+

However, most people are sensitized to multiple different allergens on the animal

Allergen mitigation measures:
1. Switching to hardwood floors
2. Hepa filter
3. Keeping the animal out of sleeping area
4. Washing animal bedding
5. Washing the animal 2 x weekly
   - Vacuuming had minimal effect
Dust Mite Mitigation

- Dust mites are 8 legged relatives of spiders and ticks that live in carpets, bedding, stuffed toys, furniture; anywhere they are able to feed off dead skin. They do not bite.
- They only survive if the humidity is > 45%
  - USFS data for Western MT - humidity ranges from 70% in the early morning to 20-30% in the afternoon
- A study done in Denver CO (Weber et al.), showed that dust mites were only present in homes with humidifiers and/or swamp coolers
- As part of the Healthy Homes project, RN Josy (Peterson) has been vacuuming mattresses and assessing for dust mite allergen. She has not yet had a positive in 40 houses screened (indoor Biotech kit)

Dust Mite Mitigation

**Recommendations:**

1. If a humidifier is present, maintain humidity at < 40%
2. Consider allergy covers for the mattress/pillows particularly if imported from a humid climate
3. Stay in Montana where the humidity is naturally low

Pollen Mitigation

A comparison of 1976 and 2006 peak pollen seasons and sampling methods in Missoula, Montana

**Major Pollen Groups**

1. Populus
2. Pinus
3. Poacea
4. Amaranthus/Chenopod
5. Artemisia

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**Table:**

<table>
<thead>
<tr>
<th>Month</th>
<th>Populus</th>
<th>Pinus</th>
<th>Poacea</th>
<th>Amaranthus/Chenopod</th>
<th>Artemisia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>Jun</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>Jul</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>Aug</td>
<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>Sep</td>
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<td>0.00</td>
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<tr>
<td>Oct</td>
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<td>Nov</td>
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<tr>
<td>Dec</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
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Pollen Mitigation

**Major Pollen Groups**

1. Populus  
2. Pinus  
3. Poacea  
4. Amaranthus/Chenopod  
5. Artemisa

**Peak season**

1. Populus  April  
2. Pinus  May - August  
3. Poacea  June - August  
4. Amaranthus/Chenopod  July - September  
5. Artemisa  August - September

*Grana. 2010 June; 49(2): 128-133.*
### Pollen Mitigation

<table>
<thead>
<tr>
<th>Major Pollen Groups</th>
<th>Peak season</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Populus</td>
<td>April</td>
</tr>
<tr>
<td>2. Pinus</td>
<td>May - August</td>
</tr>
<tr>
<td>3. Poacea</td>
<td>June - August</td>
</tr>
<tr>
<td>4. Amaranthus/Chenopod</td>
<td>July - September</td>
</tr>
<tr>
<td>5. Artemisa</td>
<td>August - September</td>
</tr>
</tbody>
</table>

#### Mitigation Measures:
- Avoid planting allergenic plants near your home
- Ornamental grasses do pollenate (don’t plant near ventilation intake or under windows)
- Close windows during high pollen season

![Amaranthus/Chenopod Pigweed](image1)

![Amaranthus/Chenopod Pigweed](image2)

![Amaranthus/Chenopod Pigweed](image3)
Molds

<table>
<thead>
<tr>
<th>Outdoor Molds</th>
<th>Indoor Molds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillium</td>
<td>Alternaria</td>
</tr>
<tr>
<td>Aspergillus</td>
<td>Cladosporium</td>
</tr>
</tbody>
</table>

The exact mechanism of *S. chartarum* pathogenesis has not yet been defined. Moreover, a causality-effect relation is not yet established.

Mold Mitigation

- **Find and fix the source of excess moisture**
  - Molds associated with extensive water damage include: *Aspergillus, Chaetomium, Ulocladium, and Stachybotrys*
  - Heavily damaged porous materials that can not be dried should be discarded and replaced
  - Non-porous surfaces should be cleaned using soap or detergent; disinfection can be done with a diluted bleach solution (10%)

Summary

- The individual must be sensitized to be affected (determined by skin test, blood test or “challenge”)
- The level of the allergen must be present in sufficient quantities to cause a reaction
  - Threshold of reactivity varies between individuals
- Mitigation can be accomplished by:
  - Increasing tolerance to the allergen (immunotherapy)
  - Decreasing the level of allergen exposure
Extra Credit
Pollens may cross-sensitize to foods
Cross-reactivity patterns in pollen-food allergy syndrome

Oral allergy syndrome
1. oral itching/blisters
2. throat swelling
3. anaphylaxis

Other cross reactive groups

Other cross reactive groups

UpToDate.com
UpToDate.com
UpToDate.com
Questions?