Eosinophilic Esophagitis (EoE)

- Eosinophilic esophagitis represents a chronic, immune/antigen mediated, esophageal disease characterized clinically by symptoms related to esophageal dysfunction and histologically by eosinophil-predominant inflammation.
- Diagnosed is based on clinical-pathologic findings on biopsy with greater than 15 eosinophils/HPF
  - Exclude other causes of esophageal eosinophilia
    - GERD, Celiac, IBD, Allergic Rhinitis
  - EoE is a lifelong chronic condition

Gastrointestinal Eosinophils

Normal values, per 400x microscopic field:
- Esophagus (0)
- Gastric antrum (2-20)
- Duodenum (2-20)
- Colon (10-50)

Other Causes of Eosinophilia

- GERD
- Celiac
- IBD
- Fungal Infection
- Allergic Rhinitis
- Drug Allergy
The role of Atopy in EoE

Pharmacologic Therapy
Systemic Steroids – effective at improving symptoms and histology of EoE in 95% of pts
- Upon discontinuation, 90% had recurrence of symptoms
- (Long term use) Side effects: bone abnormalities, poor growth, adrenal suppression
- May be needed short term for extreme cases

Topical/swallowed Steroids – less toxic to pt while still 50-85% effective
- A mainstay of EoE treatment in adults and children.
- Upon discontinuation almost all patients have a recurrence of symptoms
- Often, large doses needed
- Side effects: esophageal candidiasis

Food Avoidance Therapy

Link Between Food Allergy and EoE
- Dobbins (1977): 51 yo with GERD, food allergy and esophageal eosinophilia
- Kelly and Sampson (1995)
  - 10 patients (5 yr range: 8 mo-12.5 yr)
  - Given amino-acid based formula (> 6 weeks)
    - Neocate® or Neocate 1+®
    - 6 prior Nissen fundoplication
    - Endoscopy pre- & post-trial

Kelly, 1995
Results

Treatment Options

Elimination diet
Combination Elimination diet & Trinity Diet
Elemental diet
Combination of Diet and Steroids
Steroids: Topical or Systemic
**Dietary Management**

**Amino Acid-Based Formula**

- 172 patients (128 nasogastric tubes, 32 oral, 4 failed, 8 noncompliant)
- Patients evaluated 4-6 weeks after starting diet

Liacouras et al., Clin. Gastroenterol Hepatol 2005

<table>
<thead>
<tr>
<th>Pre-Diet</th>
<th>Post-Diet</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eosinophils/HPF</td>
<td>30.7 ± 10.3</td>
<td>1.1 ± 0.6</td>
</tr>
<tr>
<td>Dysphagia</td>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>GERD Symptoms</td>
<td>134</td>
<td>3</td>
</tr>
</tbody>
</table>

**Oral Immunotherapy induces EoE**

- Seen after egg, milk and peanut OIT
- Incidence about 5-20%
- Indicates foods causes EoE and it is not TH2 mechanism

Ridolo et al., Annals of Asthma Allergy Immunology 2011: Abstracts 85, 87, 91, 94, 103

**Selective Diet: Guess**

- 60 children
  - 35 children on elimination diet of milk, soy, wheat, egg, peanut and seafood
  - 25 children on elemental diet
- Repeat endoscopy 6 weeks later
- 74% of six-food diet had < 10 eos/hpf
- 88% of elemental diet had <10 eos/hpf


**Most Common Foods in EoE**

<table>
<thead>
<tr>
<th>Food</th>
<th>EoE by Rx</th>
<th>IgE Reactions</th>
<th>EoE by Symptoms</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>168</td>
<td>25</td>
<td>145</td>
<td>356</td>
</tr>
<tr>
<td>Egg</td>
<td>43</td>
<td>44</td>
<td>81</td>
<td>168</td>
</tr>
<tr>
<td>Soy</td>
<td>41</td>
<td>10</td>
<td>74</td>
<td>155</td>
</tr>
<tr>
<td>Wheat</td>
<td>55</td>
<td>2</td>
<td>64</td>
<td>111</td>
</tr>
<tr>
<td>Peanuts</td>
<td>16</td>
<td>44</td>
<td>42</td>
<td>102</td>
</tr>
<tr>
<td>Beef</td>
<td>27</td>
<td>0</td>
<td>61</td>
<td>88</td>
</tr>
<tr>
<td>Corn</td>
<td>31</td>
<td>0</td>
<td>51</td>
<td>82</td>
</tr>
<tr>
<td>Chicken</td>
<td>25</td>
<td>1</td>
<td>51</td>
<td>72</td>
</tr>
<tr>
<td>Potato</td>
<td>19</td>
<td>0</td>
<td>33</td>
<td>52</td>
</tr>
<tr>
<td>Pork</td>
<td>16</td>
<td>0</td>
<td>30</td>
<td>46</td>
</tr>
</tbody>
</table>

Kagalwalla et al. JPN 2011

**How to Select the foods?**

- 60 children
  - 35 children on elimination diet of milk, soy, wheat, egg, peanut and seafood
  - 25 children on elemental diet
- Repeat endoscopy 6 weeks later
- 74% of six-food diet had <10 eos/hpf
- 88% of elemental diet had <10 eos/hpf


**SFED follow-up**

- Single Food Reintroduction in 36 children
  - 74% to milk
  - 26% to wheat
  - 17% to egg
  - 10% to soy
  - 6% to peanut
  - Single food in 72%, 2 foods in 8% and 3 foods in 8%

Kagalwalla et al. JPN 2011
Food Allergy Testing: Skin Test

Finn Chambers® Used in Patch Testing

Food Testing in EoE

- 74% Atopic (asthma, ARC, or AD)
- 1/3 have negative skin tests
- Most common foods were
  - Egg, soy, milk, peanuts, beef, chicken, wheat, corn, peas, and potato
- 1/4 have negative APT
  - 1/8 have both negative SPT and APT
  - Wheat, corn, soy, milk, beef, rice, chicken, egg, rye, oat, and potato

Predictive Values: Combination of SPT and APT

<table>
<thead>
<tr>
<th>Food</th>
<th>PPV</th>
<th>Combined SPT and APT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk (n=99)</td>
<td>93.0%</td>
<td>Sensitivity</td>
</tr>
<tr>
<td>Egg (n=38)</td>
<td>65.5%</td>
<td>NPV</td>
</tr>
<tr>
<td>Wheat (n=37)</td>
<td>73.7%</td>
<td>Specificity</td>
</tr>
<tr>
<td>Soy (n=25)</td>
<td>43.2%</td>
<td></td>
</tr>
<tr>
<td>Beef (n=21)</td>
<td>48.4%</td>
<td></td>
</tr>
<tr>
<td>Chicken (n=20)</td>
<td>46.3%</td>
<td></td>
</tr>
<tr>
<td>Corn (n=17)</td>
<td>92.8%</td>
<td></td>
</tr>
<tr>
<td>Potato (n=12)</td>
<td>47.4%</td>
<td></td>
</tr>
<tr>
<td>Rice (n=11)</td>
<td>22.2%</td>
<td></td>
</tr>
<tr>
<td>Pork (n=11)</td>
<td>38.5%</td>
<td></td>
</tr>
</tbody>
</table>

Spergel et al, JACI 2007 and unpublished data

Specific IgE

- 53 adult patients
- 84% had positive sIgE to food or aeroallergens
- sIgE was most sensitive

Erwin et al, J Allergy Clin Immunol 2010
**What method is best?**

<table>
<thead>
<tr>
<th>Method</th>
<th>SPT//apt</th>
<th>MILK</th>
<th>Milk, Egg, Wheat</th>
<th>SFED</th>
<th>SPT/apt + Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of Resolution</td>
<td>57%</td>
<td>30%</td>
<td>43%</td>
<td>60%</td>
<td>77%</td>
</tr>
</tbody>
</table>

- Retrospectively examined all patients with defined food identified
- Excluded patients on ICS or anti-IL5
- Examined which diet method lead to normalization of histology

**Nutrition Therapy**

**Common Challenge - Diet Adherence**

**Nutritional Balance**

<table>
<thead>
<tr>
<th>Nutrition Therapy</th>
<th>Challenges/Barriers</th>
</tr>
</thead>
</table>
| 6 Food Elimination | • May remove unnecessary foods  
• Increases risk of nutritional deficiencies  
• Potential growth problems  
• Symptoms may persist  
• Diet compliance  
• QOL  
• Cost |
| Tailored Elimination | • Increased risk of nutritional deficiencies  
• Potential growth problems  
• Lack of reliable allergen tests  
• Extensive allergy testing done on pt  
• Diet compliance  
• QOL  
• Cost |
| Elemental | • Diet compliance  
• QOL  
• Psychosocial developmental  
• Volume – NG or PEG tubes often needed  
• Cost |

**Summary: Treatment in EoE**

- Pharmacologic therapy has been shown effective but long term use and possible side effects must be considered.
- Elimination diet is effective - keeping in mind nutrient deficiencies may occur.
- Elemental diet is the most effective nutrition therapy. Compliance/cost may be an issue for some patients.

- Combination of diet and steroids for difficult to treat patients
- Combination of elimination diet with elemental supplementation may be the best fit for patients and families dealing with EoE.

*"Dietary therapy should be considered as an effective therapy in all children diagnosed with EoE."*

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**What have we learned in 28 years?**

Katz, Flores, Twarog SPR 1983

- Positive on Skin tests; highly atopic
- Response to Diet and Steroids
- pH probe negative
- Basal cell hyperplasia

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**Furuta et al, Gastroenterology 2007**

- Combination of diet and steroids for difficult to treat patient
- Combination of elimination diet with elemental supplementation may be the best fit for patients and families dealing with EoE.