Anaphylaxis & Food Allergy

Schuman Tam, M.D., FACP, FAAAAI
Clinical Professor, UCSF
Asthma & Allergy Clinic of Marin & S.F., Inc.

Anaphylaxis: Definition

- Severe, sudden, life-threatening symptoms
- Classically: IgE mediated
- Mechanism may be unknown
- Median time from onset of symptoms to shock or respiratory arrest ranges from 5 minutes with medication to up to 30 minutes for foods

Epidemiology of Anaphylaxis

- 1% to 15% of US population (3.3 to 41 million people) may be at risk[1]
- Incidence of anaphylaxis is increasing[2]
- Community setting > health care setting

1. Neugut et al. *Arch Int Med.* 2001.
2. Sheikh et al. *BMJ.* 2006.

Most Frequent Signs and Symptoms of Anaphylaxis[1]

Manifestation	Percent
Urticaria/angioedema	87
Dyspnea/wheeze	46
Flush	50
Hypotension	30
Gastrointestinal	30

1. Lieberman P. *Immunol Allergy Clin North Am.* 2001.

Case 1

- History
  - 19 yo female student athlete; soccer player; routine soccer practice
  - 30 min: developed pruritus of neck and sob
  - 45 min: has to stop exercising
  - 50 min: Benadryl was given
  - 90 min: in ER; dizzy

Case 1 (cont'd)

- PMH
  - Asthma since childhood
  - Allergic rhinitis (grass allergy)
  - 2003: similar symptoms after exercising requiring hosp and intubation/resp support
  - 2006/2007: similar symptoms improved with epinephrine treatments

Case 1 (cont'd)

- Food allergy history
  - None per patient
  - 0 to -2 hours: cheese, wheat, beef, broccoli
- Medication
  - Oral contraceptive
  - -2 hours: Motrin
  - EpiPen (did not carry)

Case 1 (cont'd)

- Adverse drug reaction: morphine
- Social history:
  - Soccer team at school
  - Psychology major
  - Soccer scholarship
  - Exercises qd except summer prior to current semester: 2x per week
  - Negative for smoking

Case 1 (cont'd)

Acute treatment

1. Benadryl 50 mg IM, Pepcid 20 mg IV, Epinephrine SQ, then steroid IV
2. Epinephrine 0.3 mg SQ, Benadryl IM, Pepcid IV, then steroid IV
3. Epinephrine 0.3 mg IM, Benadryl 50 mg IM, Pepcid 20 mg IV, then steroid IV
4. Epinephrine 0.3 mg IV, Benadryl 50 mg IV, Pepcid 20 mg IV, then steroid IV

Epinephrine: evidence?

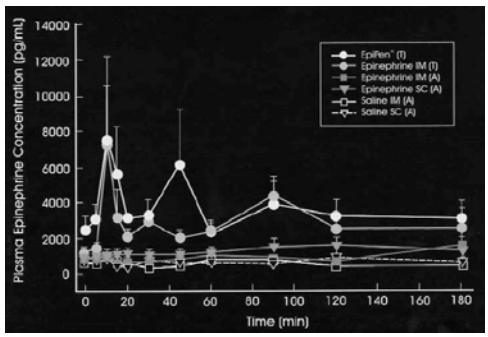
- Both alpha and beta adrenergic actions
- Maintain airway:
  - Bronchodilation (beta 2)
  - Decrease mucosal edema (alpha)
- Support blood pressure
  - Vascular smooth muscle contraction (alpha)
  - Increase cardiac output (beta 1)
- Inhibit mediator release
- Controlled trial not ethical

Epinephrine: retrospective study

- UK from 1992 to 1998[1] (123 cases)
  - Mean minutes to arrest: <30 minutes
    - Iatrogenic: 5 minutes
    - Food: 30 minutes
    - Venom: 15 minutes
  - Adrenalin prescribed in 64% of the fatal cases with prior anaphylaxis
  - Adrenalin was given only 14% before cardiac arrest
  - 3 cases: adrenalin overdose (3mgIV; 2.5mgIV; repeated epinephrine)

1. Clinical & Experimental Allergy 2000; 30: 1144-1150

Mean Plasma Epinephrine Concentration vs. Time



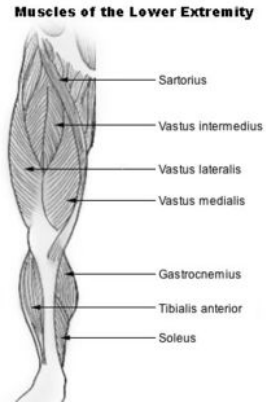
Simons, FER et. al. JACI 2001; 108: 871-873

Mean maximum plasma epi conc

Injection route	EpiPen IM	Epinephrine IM	Epinephrine IM	Epinephrine SC	Saline IM	Saline SC
Injection site	Thigh	Thigh	Arm	Arm	Arm	Arm
Cmax: mean ± SEM (pg/mL)	12,222* ± 3,829	9,722* ± 4,801	1,821 ± 426	2,877 ± 567	1,458† ± 444	1,495† ± 524

**P* < .01 from all arm values. †Endogenous epinephrine

Simons, FER et. al. JACI 2001; 108: 871-873



Epinephrine: Side Effects

- About 40% (IM>SC)
- Mild and transient
- Pallor
- Tremor
- Heart pounding
- Headache
- Shivering

Simons, FER et. al. JACI 2001; 108: 871-873

Anaphylaxis: acute treatment

- Intramuscular injection in lateral thigh produces most rapid rise in blood level
  - 0.01 mg/kg in children, 0.3-0.5 mg in adults
- Avoid IV administration unless cardiac arrest
- Benadryl 50 mg or 1 mg/kg PO/IM/IV
- Zantac 50 mg IV
- Solumedrol 1.5 mg/kg or 80 mg IV or Prednisone 1mg/kg or 50 mg po
- IVF; oxygen

1. Korenblat et al. *Allergy Asthma Proc.* 1999.

Case 1 (cont'd)

Acute treatment

1. Benadryl 50 mg IM, Pepcid 20 mg IV, Epinephrine SQ, then steroid IV
2. Epinephrine 0.3 mg SQ, Benadryl IM, Pepcid IV, then steroid IV
3. ***Epinephrine 0.3 mg IM, Benadryl 50 mg IM, Pepcid 20 mg IV, then steroid IV***
4. Epinephrine 0.3 mg IV, Benadryl 50 mg IV, Pepcid 20 mg IV, then steroid IV

Anaphylaxis: long term risk reduction

- Death can occur despite appropriate acute treatment[1]
- Etiology: appropriate avoidance
- Self-injectable epinephrine
  - EpiPen 0.3 mg or Twinject 0.3 mg
  - EpiPen Jr. 0.15 mg or Twinject 0.15 mg
- PO antihistamine like benadryl 50 mg
- Emergency action plan
- Medic alert bracelet
- Assess/treat comorbidities: asthma; beta blocker usage
- Immunomodulation: desensitization

1. Clinical & Experimental Allergy 2000; 30: 1144-1150

Food-Associated, Exercised-Induced Anaphylaxis

- Symptoms are triggered only when ingestion of a causal food is followed by exercise
- Association with a specific food
- Association with any foods (less common)
- Common allergens: wheat and celery

Case 1 (Cont'd): long term risk reduction

- Etiology: exercise induced anaphylaxis
- Heat exposure: ok
- Diagnosis: based on history
- First described in 1980
- Presentation: hives, angioedema, sob, hypotension
- May be food specific/non-specific dependent

Case 1 (Cont'd): long term risk reduction

- Always exercise with a friend/friends
- Availability of EpiPen or Twinject
- Medic alert bracelet
- Avoid ingesting foods within 2 hours before exercise
- Stop exercising if there is any symptoms of allergy including pruritus
- Premedication: ? H1 and ? H2 blocker

Food Allergy & Anaphylaxis

- Anaphylaxis in the United States:
  - Food (33%), insect sting (14%), medications (13%)
- Anaphylaxis in Australia
  - Food (61%), insect sting (20%), medications (8%)
- Fatality (cases per year in US)
  - Food (200 deaths), asthma (5000 deaths)

Triggers of Anaphylaxis: Food

- **Peanuts***
- **Shellfish***
- **Tree nuts* (eg, walnuts, pecans)**
- **Fish***
- **Milk**
- **Eggs**
- **Soy**
- **Wheat**

*common in adults

Prevalence: food allergy

- Milk allergy: 2.5% of newborn infants
- Egg allergy: 1.6% of young children
- Peanut allergy: 0.5% of children
- Peanut allergy: increasing and doubled from 1980's to 1990's
- Peanut and nut allergies: 1.1% of adults
- Shellfish allergy: 0.5% of adults

Indications for Carrying Self-Injectable Adrenalin in Food Allergic Patients

- Prior food induced anaphylaxis
- Food allergy (mild or anaphylaxis) + Asthma
- Allergy to foods that commonly cause severe reactions (nuts and seafood's)

Question 1

A patient in which of the following groups is at the highest risk for having a fatal food-induced anaphylactic reactions?

1. Preschool students
2. Elementary school students
3. High school students
4. Young children at home with babysitters

Age group at highest risk of fatal food anaphylaxis

- Adolescents
- Young adults
- 61% always carrying epinephrine
- 54% purposefully ingested unsafe foods
- ? Peer pressure
- ? Denial
- ? Risk taking behaviors

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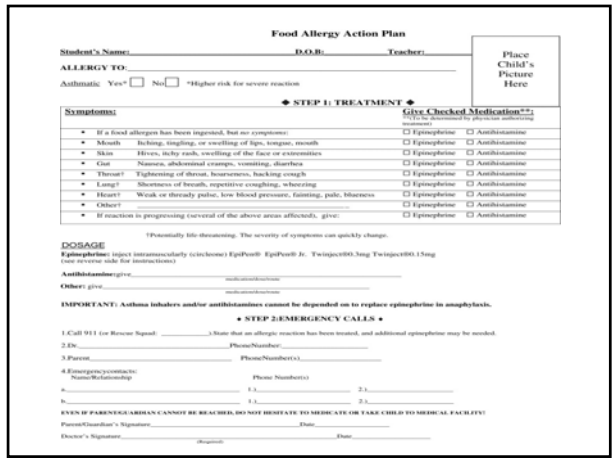
Deficiencies in food anaphylaxis care in schools and childcare

- Inadequate food allergy management plan
  - Not available in school or not given by MD
  - Management plan not followed
  - Inadequate staff training
- Inadequacy in recognizing and treating anaphylaxis
  - Anaphylactic symptoms not recognized
  - Medications not available
  - Personnel not trained to administer epinephrine



Food Allergy Action Plan

Student's Name: _____ **D.O.B:** _____ **Teacher:** _____

Place Child's Picture Here

ALLERGY TO: _____

Asthmatic Yes* ☐ No ☐ *Higher risk for severe reaction

◆ STEP 1: TREATMENT ◆

Symptoms:		Give Checked Medication**: (To be determined by physician authorizing treatment)
• If a food allergen has been ingested, but *no* symptoms:		☐ Epinephrine ☐ Antihistamine
• Mouth	Itching, tingling, or swelling of lips, tongue, mouth	☐ Epinephrine ☐ Antihistamine
• Skin	Hives, itchy rash, swelling of the face or extremities	☐ Epinephrine ☐ Antihistamine
• Gut	Nausea, abdominal cramps, vomiting, diarrhea	☐ Epinephrine ☐ Antihistamine
• Throat†	Tightening of throat, hoarseness, hacking cough	☐ Epinephrine ☐ Antihistamine
• Lung†	Shortness of breath, repetitive coughing, wheezing	☐ Epinephrine ☐ Antihistamine
• Heart†	Weak or thready pulse, low blood pressure, fainting, pale, blueness	☐ Epinephrine ☐ Antihistamine
• Other†	_____	☐ Epinephrine ☐ Antihistamine
• If reaction is progressing (several of the above areas affected), give:		☐ Epinephrine ☐ Antihistamine

†Potentially life-threatening. The severity of symptoms can quickly change.

DOSAGE

Epinephrine: inject intramuscularly (circleone) EpiPen® EpiPen® Jr. Twinject®0.3mg Twinject®0.15mg (see reverse side for instructions)

Antihistamine:give_____ medication/dose/route

Other: give_____ medication/dose/route

IMPORTANT: Asthma inhalers and/or antihistamines cannot be depended on to replace epinephrine in anaphylaxis.

◆ STEP 2:EMERGENCY CALLS ◆

1.Call 911 (or Rescue Squad: _____),State that an allergic reaction has been treated, and additional epinephrine may be needed.

2.Dr._____PhoneNumber:_____

3.Parent_____ PhoneNumber(s)_____

4.Emergencycontacts: Name/Relationship Phone Number(s)

a._____ 1.)_____ 2.)_____

b._____ 1.)_____ 2.)_____

EVEN IF PARENT/GUARDIAN CANNOT BE REACHED, DO NOT HESITATE TO MEDICATE OR TAKE CHILD TO MEDICAL FACILITY!

Parent/Guardian's Signature_____Date_____

Doctor's Signature_____Date_____ (Required)

Inhalation of food allergens life-threatening?

- Can occur when patients are near foods being cooked[1]
- Peanut/peanut butter at room temperature
  - Distinctive aroma
  - No significant vapor phase peanut protein[2]
- Inhalation of Peanut/peanut butter in room temperature does not cause allergic reaction[3]

1. Golder. Allergy 2002; 57: 713-7

2. Perry. JACI 2004; 113:973-6. Maga. J. Agric Food Chem 1973; 21:22-30

3. Simonte. JACI 2003; 112: 180-2 (double blinded placebo controlled trial of 30 subjects)

Will skin contact with allergenic foods cause anaphylaxis

- Skin contact with peanut butter x 1 min
- Subjects (30 children) allergic to peanut
- Double blind placebo controlled
- Only mild contact symptoms
- No systemic reactions
- Simonte. JACI 2003; 112: 180-2

Cleaning hands/table surface

- Peanut protein is relatively easy to clean with conventional cleaning methods
  - Soap
  - Liquid soap
  - Commercial wipes
  - Not by alcohol based hand sanitizer
- Perry. JACI 2004; 113: 973-6

To ban or not to ban peanut in school

- No studies to date that examine the benefit of banning peanut in school
- Decision may be based on:
  - Students' ages
  - Understanding the concept of cross contamination
  - Ability of teaching staffs to monitor students
- "Allergen-safe" tables as option

Conclusion

- Food induced anaphylaxis is caused by ingestion
- Skin contact with allergenic foods usually does not cause anaphylaxis unless transfer of allergen from skin to mouth
- Peanut aroma does not cause anaphylaxis
- Inhalation induced anaphylaxis uncommon at normal temperature (exception: cooking)

Question 2

Where do the majority of school-releated anaphylactic food reactions occur?

1. Cafeteria
2. School bus
3. Classroom
4. Gym class

US peanut and tree nut registry

- Classroom: 79%
  - During craft projects
  - ? Cooking
- Cafeteria: 12%
- Sicherer. J Pediatric 2001; 138: 560-5

Question 2

Where do the majority of school-related anaphylactic food reactions occur?

1. Cafeteria
2. School bus
3. Classroom
4. Gym class

Anaphylaxis: Treatment

- Epinephrine:
  - Adult: 1:1000 dilution. 0.3 to 0.5cc IM
  - Children: 0.01 mg/kg to maximum of 0.3 mg
- Diphenhydamine
  - Adult: 50 mg po or IM or IV
  - Children: 1mg per kg
- Ranitidine
  - 50 mg in adults; 1mg/kg in children
- Emergency transport

Self-Injectable Epinephrine

- <10Kg: 1:1000 epinephrine ; 0.01 mg/kg
- 10-30Kg: Epipen Jr. or Twinject-0.15
- >30Kg: Epipen or Twinject-0.3
- IM: anterolateral thigh area
- To emergency facility in case of delayed reaction

Question 3

According to the US peanut and tree nut registry, approximately what proportion of school anaphylaxis occurs in patient without prior diagnosis?

1. 10%
2. 25%
3. 33%
4. 50%

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1. 10%
2. 25%
3. 33%
4. 50%

Final Remarks

- Prevalence of children with food allergy is rising
- Food-induced anaphylaxis almost exclusively results from ingestion and oral/mucosal contact and not from exposure to skin or inhalation
- Primarily risk of fatal food anaphylaxis: failure or delay in administration of epinephrine

Final Remarks (Cont'd)

- Prevention: avoiding allergens
- Conventional cleaning techniques are effective in removal of allergens
- Unclear benefit: peanut free school
- Deficiency: Food allergy management plan
- Deficiency:
  - Recognition of anaphylaxis
  - Prompt treatment with epinephrine