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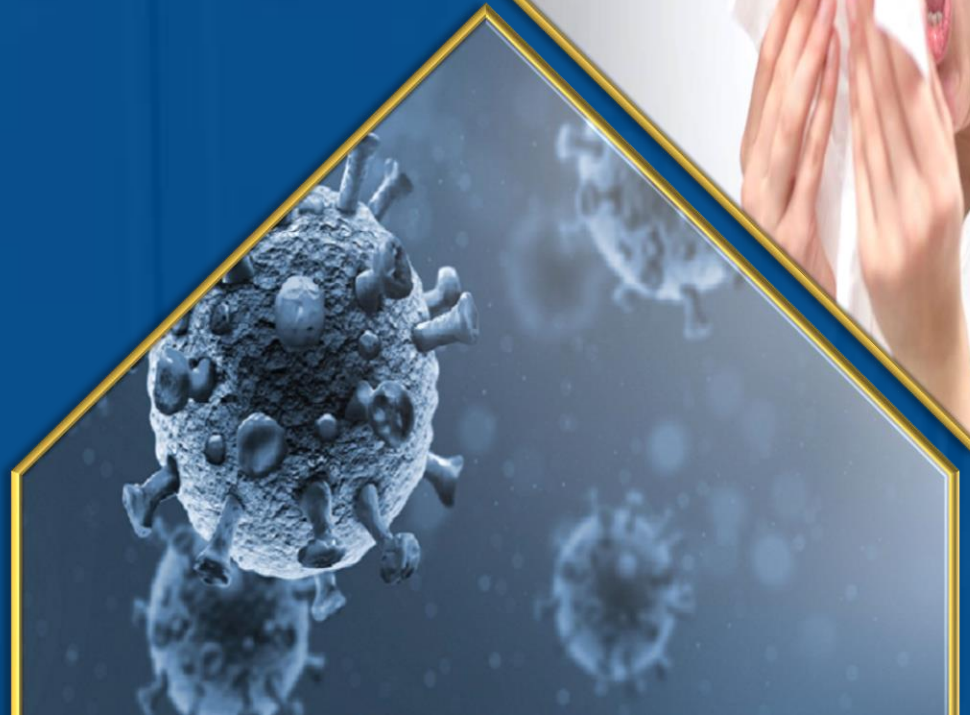
Allergies and Anaphylaxis

Primary Care Paramedicine

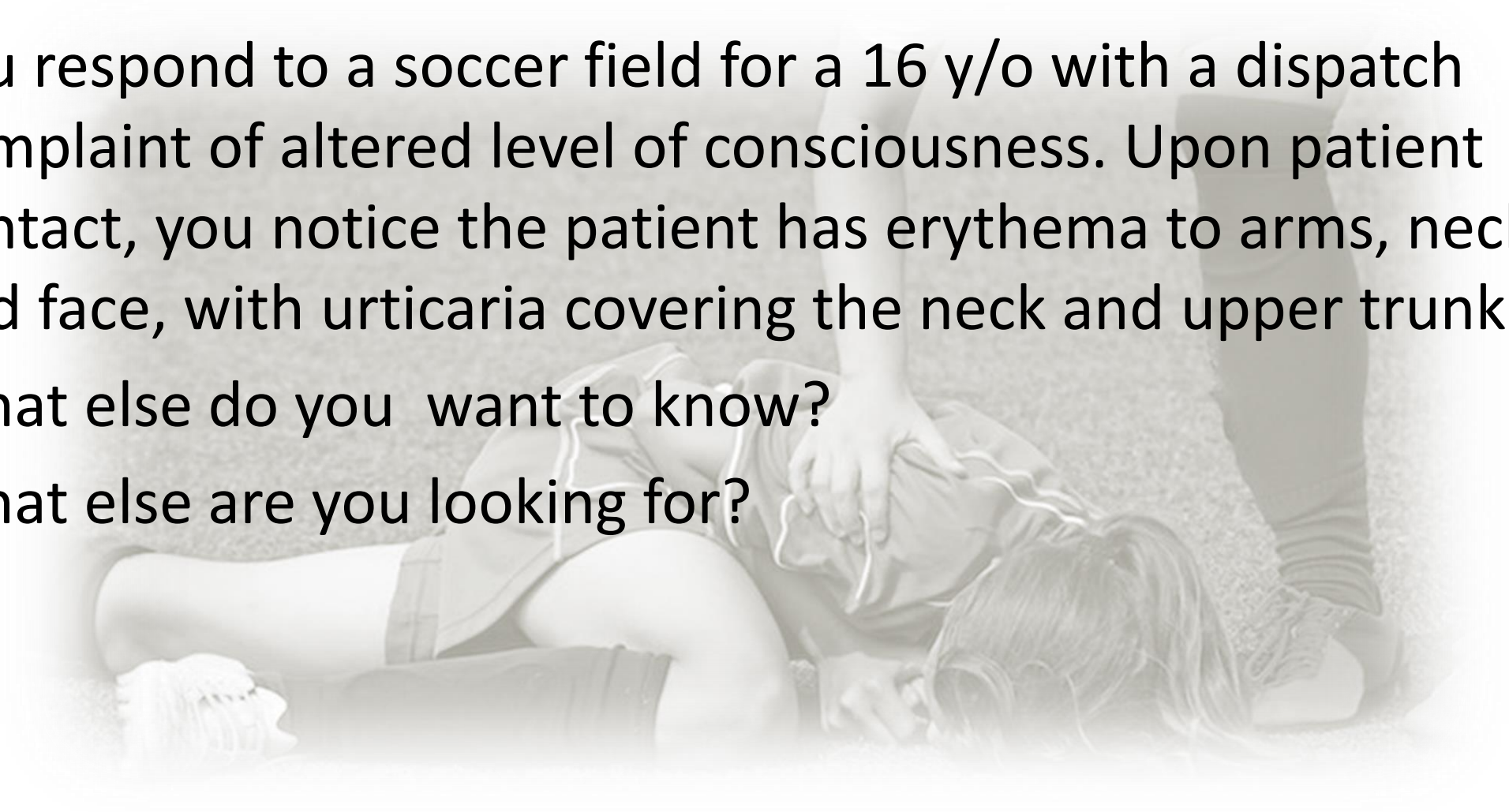


Module: 16

Section: 03

Case Study 01

- You respond to a soccer field for a 16 y/o with a dispatch complaint of altered level of consciousness. Upon patient contact, you notice the patient has erythema to arms, neck, and face, with urticaria covering the neck and upper trunk
- What else do you want to know?
- What else are you looking for?



Case Study 01

- The patient denies any allergies but does admit to being stung once before.
  - A - You ask the patient to open his mouth and find the following
  - B – Expiratory wheezes throughout on auscultation
  - C – Thready pulse, BP 96/40

Case Study 02

- You respond to a residence for a patient who was working in the yard for the past 2 days with erythema and hives to both arms and upper trunk. The patient has no other complaints. You find nothing significant. Vitals are stable
- Differences in treatment?

Lecture Outline

- Introduction
- Pathophysiology
- Assessment
- Management

Defining the Problem

- Allergic (hypersensitivity) reaction
  - An exaggerated response by the immune system to a foreign substance
- Anaphylaxis
  - An unusual or exaggerated systemic allergic reaction
  - A life-threatening emergency

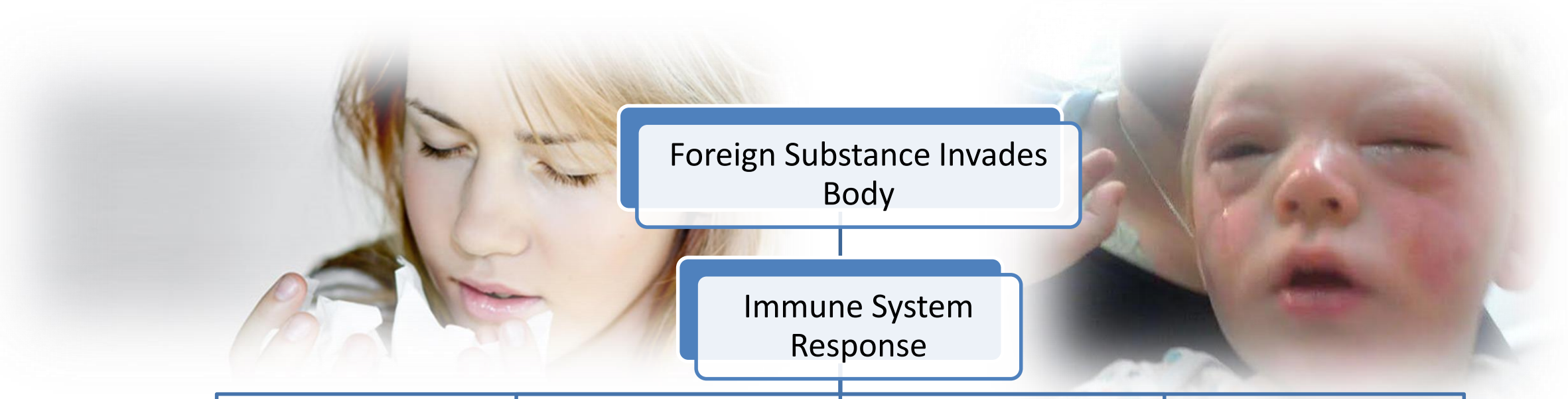
Allergy Types (Allergens)

Type	Example
Environmental	Mold, dust
Food	Peanuts, shell fish, milk
Seasonal	Pollen, hay fever
Insect stings	Bee, wasp, hornet
Medication	Penicillin, aspirin
Latex	Gloves, IV tubing
Animal	Dog, cat dander

Epidemiology

- 1-2% of Canadians live at risk for anaphylaxis
- 1% (n=171 000) of ED visits in Canada are for allergic reactions
- Breakdown of types of reactions:
  - Unspecified 69%
  - Insect stings 15%
  - Food related 11%
  - Drug related 5%

The Spectrum of Allergic Response



Foreign Substance Invades Body

Immune System Response

Hypersensitive
Mild - localized

Allergic
Moderate – local or generalized

Non-immune Mediated (Anaphylactoid)
Moderate – generalized

Anaphylaxis
Severe - generalized

Anaphylactic Shock
Extreme - generalized

Severity

Allergies and Anaphylaxis

PATHOPHYSIOLOGY

The Immune Systems Role

- Complex cascade of events
  - Activated by an invading pathogen
- Goals
  - Destruction or inactivation of the pathogen
- Mechanisms
  - Cellular immunity
  - Humoral immunity

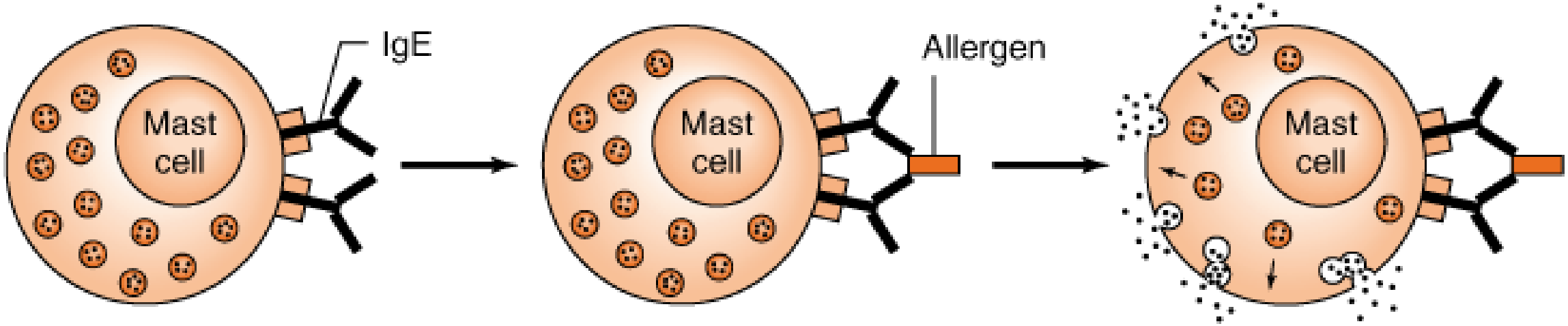
Immune System Response

- Cellular immunity
  - Direct attack on foreign substance by specialized cells
- Humoral immunity
  - More complicated
  - Chemical response
  - Principle chemical agents are antibodies
    - Immunoglobulins (IgA, IgD, IgE, IgG, IgM)

Humoral Immune Response

- Exposure of body to antigen
- Antibodies released
- Primary response
  - Generalized (IgG, IgM)
  - Develops memory
- Secondary response
  - Second exposure
  - Specific antibody response

Mast Cell Degranulation



Mast cell with IgE bound to surface

Allergen cross-links IgE on mast cell surface

Mediators (e.g., histamine) released from mast cells

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By Products of Degranulation

Chemical Mediator	Actions	Effects
Histamine	• Systemic vasodilation • Permeability of blood vessels • Bronchoconstriction	• Hives • Swelling • Decreased BP • Wheezing / SOB
Prostaglandins	• Smooth muscle contraction	• Wheezing / SOB
Leukotrienes (AKA SRS-A)	• Permeability of blood vessels • Bronchoconstriction • Decrease cardiac contraction • Arrhythmias	• Hives • Swelling • Decreased BP • Wheezing / SOB
Serotonin	• Pulmonary Vasoconstrictor • Bronchoconstrictor	• Reduced blood flow to lungs • Wheezes / SOB

By Products of Degranulation

Chemical Mediator	Actions	Effects
Bradykinin	• Trigger inflammatory pathways • Permeability of blood vessels • Vasodilation • Smooth muscle contraction	• Increase S/S of allergic reaction • Hives • Swelling • Decreased BP • Wheezing / SOB
Platelet Activating Factor	• Increases inflammatory response • Increases histamine release	• Hives • Swelling • Decreased BP • Wheezing / SOB • Nasal congestion

Allergies

- Sensitization
  - Initial exposure to an antigen
- Hypersensitivity
  - Unexpected exaggerated reaction to a particular antigen
  - Commonly results in a skin rash (urticaria)
  - May be immediate or delayed

Allergens

- Substance capable of inducing an allergic reaction
- Almost all are proteins

- Most commonly:
  - Drugs
  - Foods and food additives
  - Animals
  - Insects and insect parts
  - Fungi and molds
  - Radiology contrast materials

Allergies and Anaphylaxis

HISTORY AND PHYSICAL ASSESSMENT

Assessment

- Mild – Affecting a local area
- Moderate – Mild signs throughout the body
- Severe – Anaphylactic reaction, generalized with ABC compromise

Table 31-1 Agents That May Cause Anaphylaxis

Antibiotics and other drugs
Foreign proteins (e.g., horse serum. Streptokinase)
Foods (nuts, eggs, shrimp)
Allergen extracts (allergy shots)
Hymenoptera stings (bees, wasps)
Hormones (Insulin)
Blood Products
Aspirin
Non-steroidal anti-inflammatory drugs (NSAIDs)
Preservatives (sulfiting agents)
X-ray contrast media
Dextran

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Anaphylaxis Criterion

Anaphylaxis is highly likely when any 1 of the following 3 criteria is fulfilled following exposure to an allergen:

1	**Acute onset of an illness** (minutes to several hours) **with involvement of the skin, mucosal tissue, or both** (e.g. generalized hives, pruritis or flushing, swollen lips-tongue-uvula) **and at least 1 of the following:** **a.** Respiratory compromise (e.g. dyspnea, wheeze-bronchospasm, stridor, reduced PEF†, hypoxemia) **b.** Reduced BP‡ or associated symptoms of end-organ dysfunction (e.g. hypotonia [collapse], syncope, incontinence)
2	**2 or more of the following that occur rapidly after exposure to a likely allergen for that patient** (minutes to several hours): **a.** Involvement of the skin-mucosal tissue (e.g. generalized hives, itch-flush, swollen lips-tongue-uvula) **b.** Respiratory compromise (e.g. dyspnea, wheeze-bronchospasm, stridor, reduced PEF, hypoxemia) **c.** Reduced BP or associated symptoms (e.g. hypotonia [collapse], syncope, incontinence) **d.** Persistent gastrointestinal symptoms (e.g. painful abdominal cramps, vomiting)
3	**Reduced BP after exposure to a known allergen for that patient** (minutes to several hours): **a.** Infants and children: Low systolic BP (age-specific) or greater than 30% decrease in systolic BP§ **b.** Adults: Systolic BP of less than 90mmHg or greater than 30% from that person's baseline

Differential Diagnosis

- Anxiety attack
- Epiglottitis
- Hereditary angioedema
- Bradykinin induced angioedema
- Foreign body airway obstruction
- Mastocytosis
- Vocal cord dysfunction
- Non–IgE-mediated drug reactions

Assessment: Key Factors

- Signs and symptoms begin within 30-60 seconds
- Onset may be delayed up to 1 hr
- Severity often related to speed of onset
- Presentations vary significantly
- Early detection and management are critical to patient survival

Assessment: Systems Based

- Respiratory
  - Angioedema may involve laryngeal edema
    - Airway obstruction
  - Bronchoconstriction
- Circulatory
  - Vasodilation and increased vessel permeability
  - Life threatening reduction in circulating volume

Assessment: Systems Based

- Skin
  - Urticaria
    - Not by itself an indicator of anaphylaxis
  - Angioedema
- Gastrointestinal
  - Increased motility
  - Nausea, vomiting, diarrhea

Urticaria vs Angioedema

- Urticaria (Hives) are swollen, pale red, bumps, patches or welts that appear on the skin that often accompany an allergic reaction

- Angioedema is similar but the swelling occurs beneath the skin instead of on the surface.

Bradykinin Induced Angioedema

- Caused by angiotensin converting enzyme (ACE) inhibitor medications
  - Very common anti-hypertensive medication
- Occurs in up to 1% of patients taking these medications
- Not only do ACE inhibitors prevent RAAS mechanism, they also prevent bradykinin from being broken down
- Not treated same way as anaphylaxis
  - Angioedema, not pruritus and urticaria are the hallmark
- Monitor and manage airway
- Inform receiving facility

Source: K.J. Knoop, L.B. Stack, A.B. Storrow, R.J. Thurman:
The Atlas of Emergency Medicine, 4th Edition,
www.accessemergencymedicine

Table 31-2 Signs and Symptoms of Allergic and Anaphylactic Reactions

Mild Allergic Reaction	Severe Allergic Reaction or Anaphylaxis
Onset: Gradual	*Onset:* Sudden (30-60 seconds but can be more than an hour after exposure)
Skin/Vascular system: Mild flushing, rash, or hives	*Skin/vascular system:* Severe flushing, rash, or hives; angioneurotic edema to the face and neck
Respiration: Mild bronchoconstriction	*Respiration:* Severe bronchoconstriction (wheezing), laryngospasm (stridor), breathing difficulty
GI system: Mild cramps, diarrhea	*GI system:* Severe cramps, abdominal rumbling, diarrhea, vomiting
Vital signs: Normal to slightly abnormal	*Vital signs:* Increased pulse early, may fall in late/severe case; increased respiratory rate early, falling respiratory rate late; falling blood pressure late
Mental status: Normal	*Mental status:* Anxiety, sense of impending doom, may decrease to confusion and to unconsciousness
	Other Clues: Symptoms occur shortly after exposure to parenteral penicillin, *Hymenoptera* sting (fire ant, wasp, yellow-jacket, hornet, bee), or ingestion of foods to which patient is allergic such as nuts or shellfish
	Ominous signs: Respiratory distress, signs of shock, falling respiratory rate, falling pulse rate, falling blood pressure

Note: Not all signs and symptoms will be present in every case.

Assessment Findings: Anaphylaxis

- Focused History & Physical Exam
  - Focused History
    - SAMPLE & OPQRST History
      - Rapid onset, usually 30 – 60 seconds following exposure.
      - Speed of reaction is indicative of severity.
      - Previous allergies and reactions.
  - Physical Exam
    - Presence of severe respiratory difficulty is key to differentiating anaphylaxis from allergic reaction.

Assessment Findings: Anaphylaxis

- Physical Exam
  - Facial or laryngeal edema
  - Abnormal breath sounds
  - Hives and urticaria
  - Hyperactive bowel sounds
  - Vital sign deterioration as the reaction progresses

Assessment Findings: Allergic Reactions

- Assessment
  - Much less sever than anaphylaxis
  - More gradual onset and do not usually present with respiratory distress
  - Itching, rash and urticaria

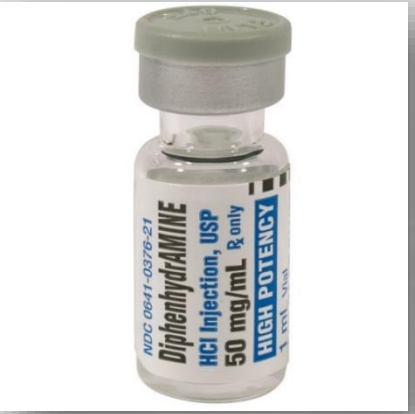
Allergies and Anaphylaxis

TREATMENT

Mild to Moderate Allergic Reactions

Management

- Scene Safety
- Establish baseline assessment findings
- Oxygenation
- Epinephrine 1:1000 IM
- Diphenhydramine IM
- Reassessment, be on the look out for rapid changes.



Severe Allergy / Anaphylaxis

Management

- Scene Safety
  - Consider the possibility of trauma.
- Protect the Airway.
  - Use airway adjuncts with care.
  - Extraglottic airways such as the King LTS-D may not be effective.
  - Be prepared to notify ACP for back up

Severe Allergy / Anaphylaxis

Management

- Support Breathing
  - High-flow oxygen
  - Assisted ventilation if indicated.
- Establish IV Access
  - Patient may be volume-depleted due to “third spacing” of fluid.
    - Administer crystalloid solution at appropriate rate.
    - 2nd IV line if indicated.
- Consider IV fluid administration
- Medications
  - Oxygen
  - Epinephrine
  - Benadryl

Epinephrine

- Primary drug for treatment of allergic reactions and anaphylaxis
- Sympathetic agonist
  - Increased heart rate, contractility
  - Peripheral vasoconstriction
  - Bronchodilation

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Patient Self Management

Epinephrine 1:1000

Classification

- Adrenergic, Sympathomimetic

Mechanism of Action

- Natural occurring catecholamine
- Stimulates sympathetic receptors
  - Relaxes smooth muscles - bronchodilation
  - Histamine antagonist

Indications

- Moderate to severe allergic reaction
- Anaphylactic shock

Epinephrine 1:1000

Contraindications

- Hypersensitivity
- No indications

Dosage

- Adult
  - Asthma/Anaphylaxis: 0.3-0.5 mg IM; Repeat q 5-20 min PRN
  - Stridor: 5.0 mg (5 ml) of 1:1,000 nebulized
- Pediatric
  - Asthma/Anaphylaxis: 0.01 mg/kg (0.01ml/kg) IM/SQ; max 0.5 mg; Repeat q 5-20 min PRN
  - Croup/Stridor: 0.5 mg/kg of 1:1,000 nebulized to max 5.0 mg mixed with NaCl 0.9% to make 5.0 ml of solution

Epinephrine 1:1000

Side Effects

- Arrhythmia
- Palpitations
- Tachycardia
- N&V
- Tremors

Weight (kg)	Epinephrine 1:1,000 (ml)	NaCL 0.9% (ml)
1	0.5	4.5
2	1.0	4.0
3	1.5	3.5
4	2.0	3.0
5	2.5	2.5
6	3.0	2.0
7	3.5	1.5
8	4.0	1.0
9	4.5	0.5
10	5.0	0.0

Diphenhydramine (Benadryl)

Classification

- Antihistamine

Mechanism of Action

- Blocks histamine receptor sites reducing
  - Bronchoconstriction, Vasodilation, Edema

Indications

- Allergic reaction involving
  - Respiratory distress
  - Airway swelling
  - Edema
  - Itching
  - Urticaria / hives

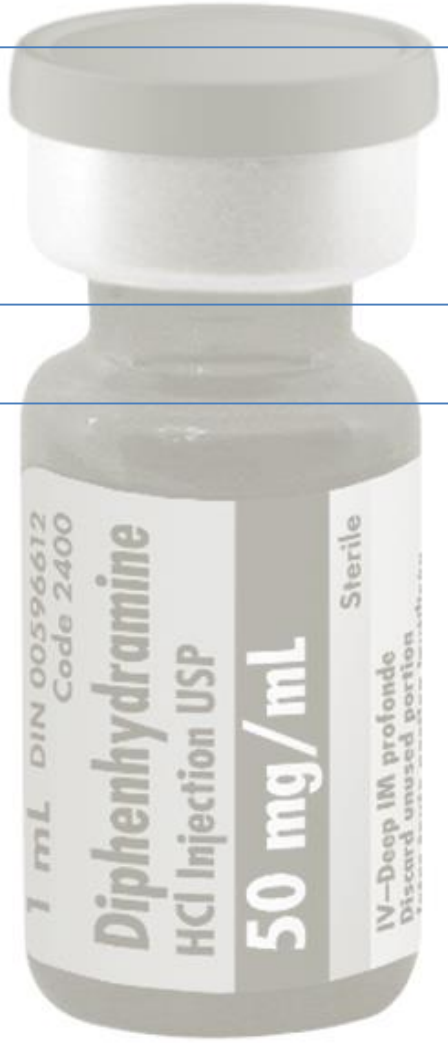
Diphenhydramine (Benadryl)

Contraindications

- Hypersensitivity

Dosage

- Adult
  - 25 - 50 mg IV/IM given once
  - 25 mg if Pt > 60 y/o
- Pediatric
  - 1 mg/kg (Max 50 mg) IV/IM given once



Other Medications

- Antihistamines
  - Second line treatment given after epinephrine
- Corticosteroids
  - Important in treatment and prevention
  - Little benefit initially
- Vasopressors
  - Support blood pressure in prolonged cases
- Beta agonists
  - Help reverse some of the bronchospasm
- Glucagon
  - Acts as chronotropic and dromotropic agent in patients who take beta–blockers and blunt the effects of epinephrine

Documentation

- When charting the call remember to document:
  - Time of allergen exposure
  - Initial patient presentation
  - Treatment provided before and after EMS arrival
  - Time/dose/route of epinephrine before and after EMS arrival
  - Post intervention vital signs
  - Reassessment findings

Patient Education

- Prevention of Reactions
- Recognition of signs/symptoms
  - Patient-initiated treatment
    - Epinephrine auto-injectors
- Desensitization

- SAFE
  - **S**eek Help
  - **A**llergy ID
  - **F**ollow up with specialist
  - **E**pi for emergencies

Conclusion: Always Remember

- Allergic reactions can be immediate or delayed; high risk for non-transports
- Important to differentiate between adverse effects due to medications vs. medication allergy
- Symptoms can progress rapidly and become life threatening; Reassess frequently
- An accurate Hx, assessment and frequent reassessment will help differentiate between an acute allergic reaction and other etiologies.

Summary

- Pathophysiology
- Assessment findings in allergic reactions anaphylaxis
- Management of allergic reactions anaphylaxis
- Patient education