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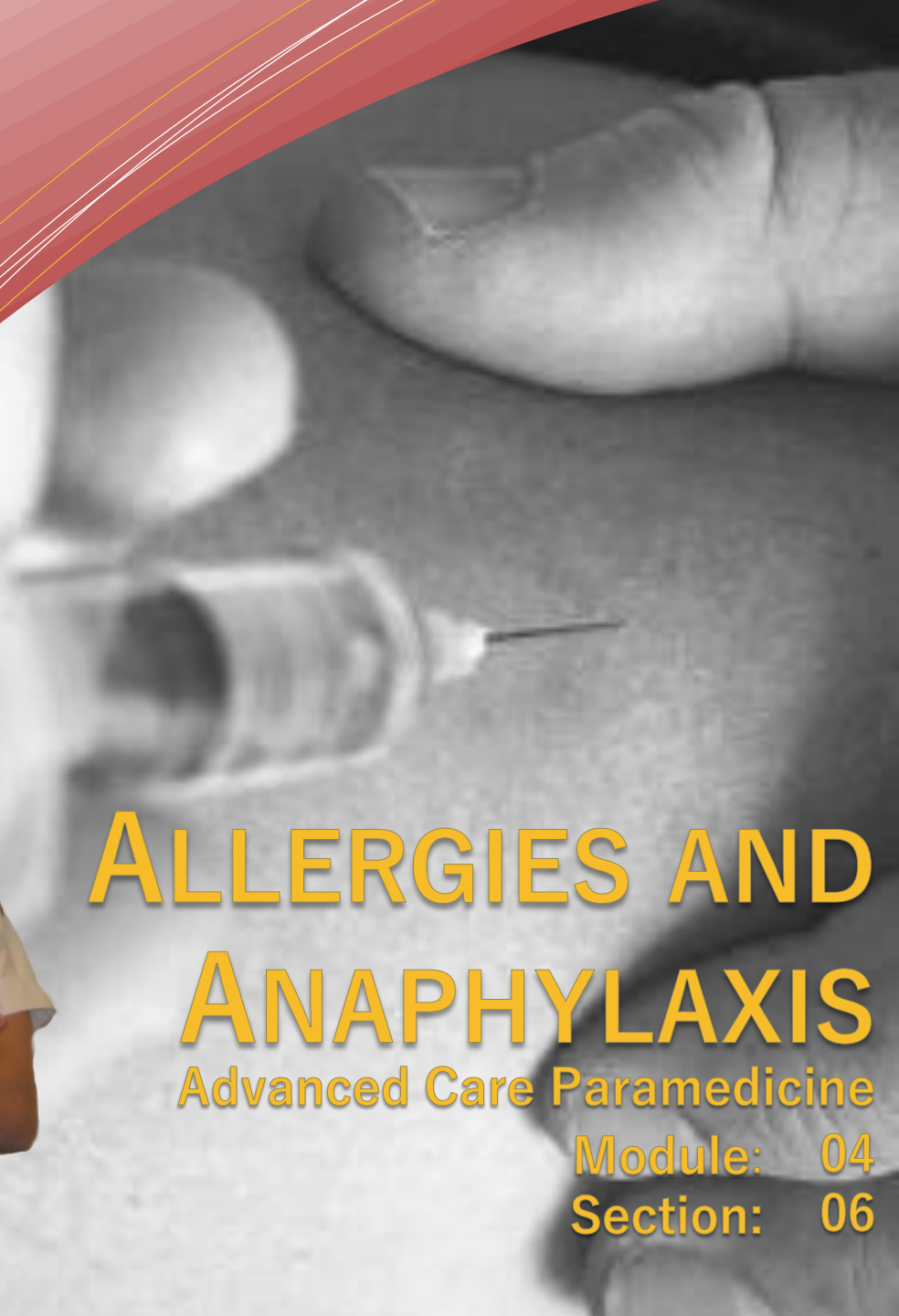


Allergies and Anaphylaxis

Advanced Care Paramedicine

Module: 04

Section: 06

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

Antigens

- A substance that induces the formation of antibodies
  - Antigens can enter the body by injection, ingestion, inhalation, or absorption
  - Examples:
    - Drugs (penicillin, aspirin)
    - Envenomation (wasp stings)
    - Foods (seafood, nuts)
    - Pollens

Antibodies

- Protective protein substances developed by the body in response to antigens
  - Bind to the antigen that produced them
  - Facilitate antigen neutralization and removal from the body
- This normal antigen-antibody reaction protects the body from disease by activating the immune response

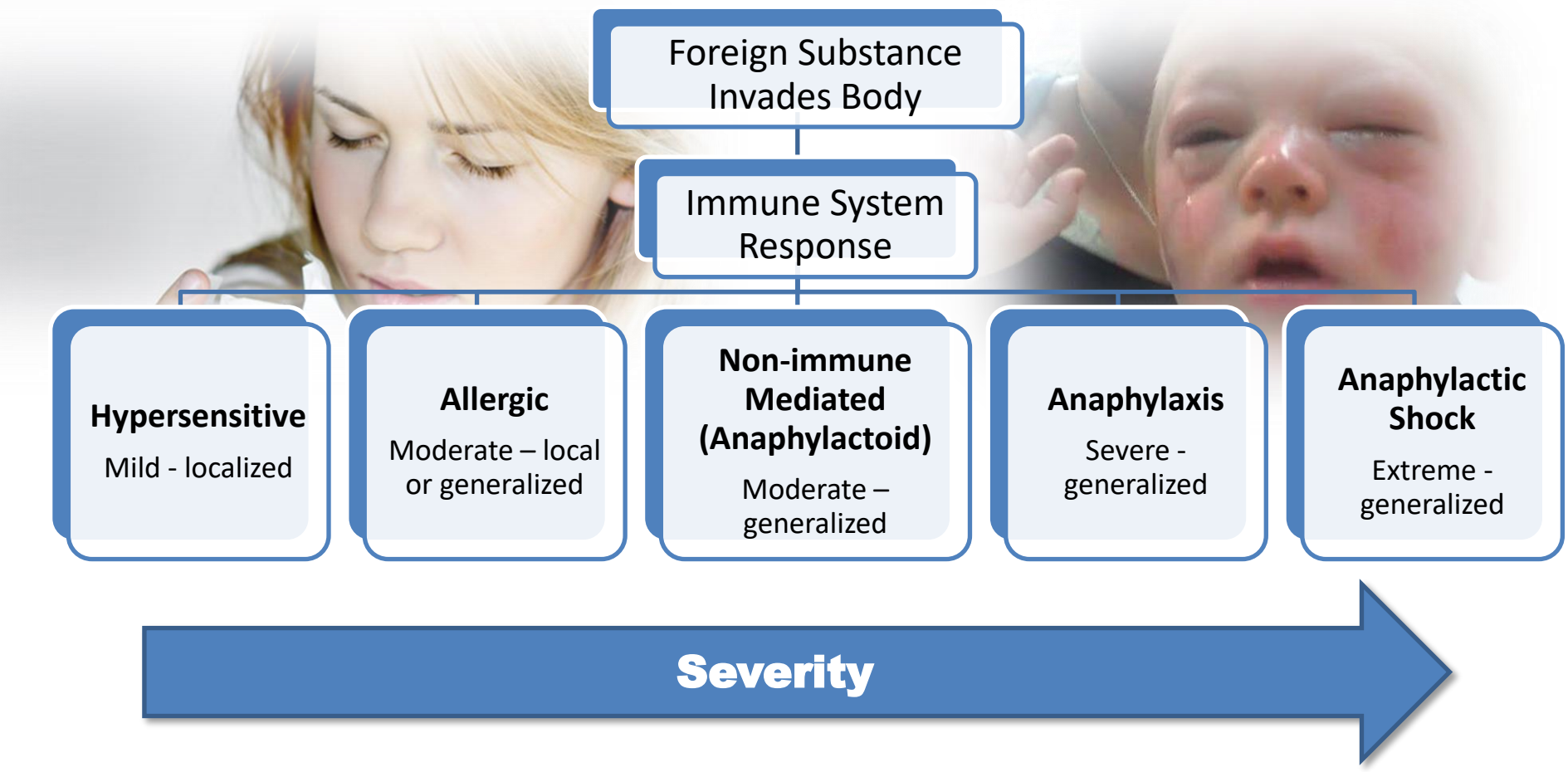
Allergy Types (Allergens)

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



Allergies and Anaphylaxis

PATHOPHYSIOLOGY

Immune Response

- Immune responses are normally protective
- They can become oversensitive or be directed toward harmless antigens to which we are often exposed
  - This response is termed “allergic”
  - The antigen or substance causing the allergic response is called an “allergen”

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

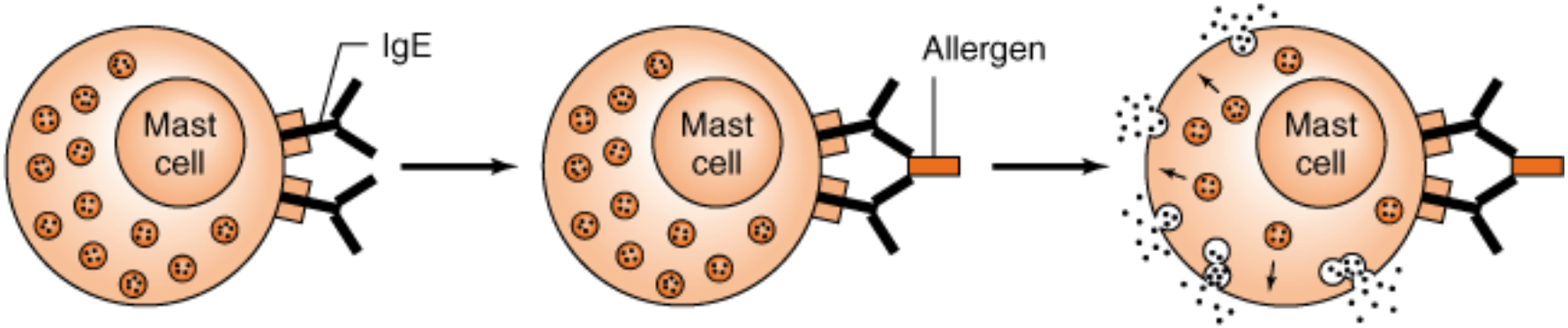
Immune System Response

- 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

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

Other Factors

- Histamine infusion alone is sufficient to produce most of the symptoms of anaphylaxis
  - H1
    - Stimulate endothelial cells to produce nitric oxide
    - Extravascular smooth muscle contraction (eg, bronchial tree, gastrointestinal tract)
    - Mediate glandular hypersecretion.
  - H2
    - Vascular smooth muscle
    - Cardiac effects
    - Mediate glandular hypersecretion.

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

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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

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: System Based

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

Assessment: System 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.

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

- Scene Safety
- Establish baseline assessment findings
- Pharmacology
  - Oxygenation
  - Epinephrine (1:1,000 or 1:10,000)
  - Diphenhydramine
  - Ventolin
  - Glucagon
  - H2 blockers
- Reassessment, be on the look out for rapid changes.

Management of Severe Allergy / Anaphylaxis

- 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

Management: Severe Allergy / Anaphylaxis

- 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.
    - Place a second IV line if indicated.

Management: Severe allergic / Anaphylaxis

- Consider IV fluid administration
- Medications
  - Oxygenation
  - Epinephrine (1:1,000 or 1:10,000)
  - Diphenhydramine
  - Ventolin
  - Glucagon
  - H2 blockers

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

Management: Epinephrine 1:1000

- Class: Adrenergic, Sympathomimetic
- Mechanism of Action:
  - Natural occurring catecholamine
  - Stimulates sympathetic receptors
    - Relaxes smooth muscles - bronchodilation
    - Histamine antagonist
- Indication
  - Moderate to severe allergic reaction
  - Anaphylactic shock

Epinephrine 1:1000

- Dose
  - Adult
    - 0.3-0.5 mg of 1:1000 Epi
    - Repeat q 5-20 min PRN
  - Pediatric
    - 0.01 mg/kg (0.01ml/kg)
    - Max 0.3 mg
    - Repeat q 5-20 min PRN
- Route
  - IM
- Supplied
  - 1 mg / 1 ml ampoule (1:1000 concentration)
- Adverse Effects
  - Arrhythmia
  - Palpitations
  - Tachycardia
  - N&V
  - Tremors

Diphenhydramine (Benadryl)

- Class: Antihistamine, Anticholinergic, Antiemetic
- Mechanism Of Action:
  - Competes with free histamine for binding and blocks H_1 histamine receptors
  - Antagonizes the effects of histamine on HA-receptors, leading to a reduction of the negative symptoms brought on by histamine HA-receptor binding
  - CNS Depressant
- Indication:
  - Allergic reaction involving
    - Respiratory distress
    - Airway swelling
    - Edema
    - Itching
    - Urticaria / hives

Diphenhydramine (Benadryl)

- Dose
  - Adult
    - 25-50 mg given once
    - 25 mg if Pt > 60 y/o
  - Pediatric
    - 1 mg/kg (Max 25 mg) given once
- Route
  - IV
  - IM
- CI:
  - Hypersensitivity
  - Precaution should be used in Acute asthma as it may thicken secretions
- Adverse Effects
  - Drowsiness
  - Decrease BP
  - Reflex tachycardia

Salbutamol (Ventolin)

- Class: Bronchodilator, Sympathomimetic, β-2 Agonist
- Mechanism Of Action:
  - Selective β-2 stimulation allows for smooth muscle relaxation of the bronchioles and peripheral vasodilatation of the vasculature by stimulation of the alpha receptors. Also has some β-1 affects causing increases in HR.
- Indication:
  - Wheezes

Salbutamol (Ventolin)

- CI:
  - Hypersensitivity
  - Ischemic CP
- Dose:
  - Adult
    - 5.0 mg Aerosol
    - 4 – 6 puffs via MDI (0.1 mg/puff)
  - Ped
    - 2.5 mg Aerosol
    - 2 – 3 puffs via MDI
  - Infant
    - 1.25 mg via Aerosol

Salbutamol (Ventolin)

- SE:
  - Hypertension
  - Tachycardia
  - Muscle cramps
  - Dry nose and throat
  - Headache
- Precautions:
  - Pt's with pulmonary edema (cardiac wheeze)

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

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

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.