

Anaphylaxis

- Anaphylaxis – rapid and generalized immunologically mediated events involving an antigen-specific IgE-mediated mechanism that occur after exposure to foreign substances in previously sensitized persons
- Anaphylactoid reaction – “not” mediated by way of the IgE antibody and prior exposure is not necessary

Intraoperative Allergic Reactions

- 1:5,000 - 1:25,000 anesthetics
- >90% evoked by IV drugs occurs within 5 minutes
- Anaphylaxis is the most feared and presents with circulatory collapse
- ~3.4% mortality

Anaphylactic Reactions

(IgE-mediated pathophysiology)

- Reaction initiated by antigen binding to IgE
- Prior exposure to the antigen (or substance of similar structure) is required for sensitization
- Allergic history may be unknown
- On re-exposure, antigen binds to and bridges two immunospecific IgE Abs located on the surface of mast cells of basophils
- Liberation of stored mediators
 1. Histamine
 2. Tryptase
 3. Chemotactic factors

Recognition Of Anaphylaxis

Systems	Symptoms	Signs
Respiratory	Dyspnea Chest discomfort	Coughing Wheezing Sneezing Laryngeal edema Decreased pulmonary compliance Fulminant pulmonary edema Acute respiratory failure
Cardiovascular	Dizziness Malaise Retrosternal oppression	Disorientation Diaphoresis Loss of consciousness Hypotension Tachycardia Dysrhythmias Decreased systemic vascular resistance Cardiac arrest Pulmonary hypertension
Cutaneous	Itching Burning Tingling	Urticaria Flushing Periorbital edema Perioral edema

Management

Initial Therapy

1. Stop administration of antigen
2. Maintain airway and administer 100% O₂
3. Discontinue all anesthetic agents
4. Start intravascular volume expansion (2 – 4 l of crystalloid/ colloid with hypotension)
5. Give epinephrine (5 – 10 μg iv bolus with hypotension, titrate as needed; 0.1 – 1.0 mg iv with cardiovascular collapse)

Secondary Therapy

1. Antihistamines (0.5 – 1 mg · kg⁻¹ diphenhydramine)
2. Catecholamine infusions (starting doses: epinephrine, 4 – 8 $\mu\text{g} \cdot \text{min}^{-1}$; norepinephrine, 4 – 8 $\mu\text{g} \cdot \text{min}^{-1}$; or isoproterenol, 0.5 – 1 $\mu\text{g} \cdot \text{min}^{-1}$ as a drip; titrated to desired effects)
3. Aminophylline (5 – 6 mg · kg⁻¹ over 20 min with persistent bronchospasm)
4. Corticosteroids (0.25 – 1 g hydrocortisone; alternatively, 1 – 2 g methylprednisolone)
5. Sodium bicarbonate (0.5 – 1 mEq · kg⁻¹ with persistent hypotension or acidosis)
6. Airway evaluation (before extubation)

Initial Therapy

- **Stop further antigen administration!**
- Maintain airway & administer 100% O₂
 - Profound V/Q mismatch can accompany anaphylaxis
 - ABGs may be useful to follow

Initial Therapy

- D/C all anesthetic drugs
 1. Inhalational anesthetics are not the bronchodilator of choice for anaphylaxis
 2. Worsen hypotension
 3. Interfere with body's compensatory response to CV collapse

Initial Therapy

- **Volume expansion**

1. Hypovolemia (up to 40% loss of intravascular fluid into interstitial space)
2. 2-4 L crystalloid / colloid initially (an additional 25-50 ml/kg may be necessary)
3. Refractory hypotension → additional monitoring
 - TEE can assess intravascular volume, ventricular function, and any other occult cause of CV dysfunction
 - Useful to guide therapy
4. Fulminant non-cardiogenic pulmonary edema
 - Require intravascular volume repletion with careful hemodynamic monitoring until capillary dysfunction improves

Initial Therapy

- **Epinephrine**

- Drug of choice

- α - adrenergic combats hypotension

- β_2 - causes bronchodilation & inhibits mediator release by \uparrow cAMP in mast cells & basophils

- 50-100 μ g bolus

- Titrated to restore BP along with additional volume

- Complete CV collapse (0.1-1 mg)

Secondary Therapy

- **Antihistamine**

- 0.5-1.0 mg/kg Diphenhydramine (H_1)
- Does not inhibit the reaction or release of histamine
- Competes for receptor sites
- H_2 antagonists remain unclear

Secondary Therapy

- **Epinephrine infusions** for persistent hypotension or bronchospasm
 - 0.05-0.1 $\mu\text{g}/\text{kg}/\text{min}$ (5-10 $\mu\text{g}/\text{min}$) & titrate to correct BP
- **Norepinephrine** may also be useful in refractory hypotension 2^o decreased SVR
 - 0.05-0.1 $\mu\text{g}/\text{kg}/\text{min}$ (5-10 $\mu\text{g}/\text{min}$)

Secondary Therapy

- **Aminophylline**

- Nonspecific phosphodiesterase inhibitor
- Bronchodilates & ↓ histamine release from mast cells and basophils by ↑ cAMP
- ↑ contractility & ↓ pulmonary vascular resistance
- Persistent bronchospasm & hemodynamic stability
 - IV loading dose 5-6 mg/kg over 20 min
 - 0.5-0.9 mg/kg/hr

Secondary Therapy

- **Corticosteroids**

- Anti-inflammatory
- 12-24h for effect
- May attenuate late-phase reactions

Secondary Therapy

- **Bicarbonate**

- Acidosis develops quickly and can diminish effect of Epinephrine
- Refractory hypotension & acidosis
- 0.5-1 mEq/kg q5min
- Follow ABGs

Secondary Therapy

- **“Airway Evaluation”**
 1. Laryngeal edema may occur
 - Suggested by facial edema
 2. Leave intubated until edema subsides
 3. Air leak useful for patency
 4. Consider direct laryngoscopy

Triggering Agents

CAUSES OF ANAPHYLAXIS AND ANAPHYLACTOID REACTIONS DURING ANESTHESIA

<u>Causes</u>	<u>Rate of Reaction (%)</u>
1. Muscle relaxants	61.6%
2. Latex	16.6%
3. Antibiotics	8.3%
4. Hypnotics	5.1%
5. Colloids	3.1%
6. Opioids	2.7%
7. Other (Aprotinin, Ethylene oxide, and Local anesthetics)	2.6%