IV Epinephrine
Avoiding Therapeutic Errors
High Risk Emergency Medicine 2017
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Mastering Emergency Medicine

- Secure the ABC’s
- Consider or give NGT
- Five Causes
  - Five Steps
  - Five Reasons for almost everything

Five Causes of Dyspnea
- Cardiac (AMI, ACS, CHF, Cardiomyopathy)
- Pulmonary (Bronchospasm, PE, Pneumonia)
- CNS (Anxiety, Metabolic Acidosis)
- Neuromuscular (Rib Fractures, Myasthenia)
- Abnormal Blood
  - Hypoxia
  - Hemoglobin (sickle cell, CO)
  - Profound Anemia (acute blood loss or chronic disease)

The Five Causes of Wheezing
- Reactive Airway Disease
- Congestive Heart Failure
- Pulmonary Embolus
- Pneumothorax
- Mass
  - foreign body, tumor, infectious

True Definition of Anaphylaxis
- Reduced BP after exposure to known allergen
- Acute onset of skin or mouth symptoms plus wheezing or hypotension/tachycardia
- Involvement of 2 or more systems:
  - Skin
  - Mucous membranes
  - Respiratory
  - Cardiovascular
  - Gastrointestinal

All that wheezes is NOT Asthma
### Anaphylaxis

- Laryngeal edema
- Bronchospasm and bronchorrhea
- Vasodilation, myocardial depression
- Nausea and vomiting
- Skin erythema and urticaria

### Symptoms of Anaphylaxis

*Angioedema or Urticaria (87%)
- Shortness of breath – Wheezing (59%)
- Diarrhea or Abdominal Cramps (29%)
- Throat Tightness (21%)
- Nausea or Vomiting (20%)

*Any skin manifestation including flushing > 90%*

### Anaphylactic Reactions

#### 5 Major Causes

- Food Allergies
- Hymenoptera stings
- Drugs
- Contrast dye
- Transfusions

### Anaphylaxis

#### 5 Major ED Causes

- Food (Nuts and Shellfish)
- Hymenoptera Stings (bees, wasps, hornets, fire ants)
- Medication (ASA, NSAIDS, Pen, Sulfa)
- Exercise/mixed causes
- Unknown

### Anaphylaxis: a review of 601 cases

- 25 year retrospective study
- Food (22%), Meds (11%) and Exercise (5%)
- Only 41% of cases had etiology determined

### Anaphylactic Reactions

- Average age 2.4 years old
- Most cases were first time events
- Food causative agent in 85%
- Peanuts or Cashews (40%) Milk or Eggs (20%)
- Be suspicious in new wheezing/respiratory distress

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*Allergy. 2008;62:1071-1076*
Initial Approach to all Patients with Wheezing

Secure the ABC’s 
(The Opening Gambit)

- O₂
- O₂ saturation monitor
- IV access as indicated
- ECG monitor
- Consider 12-lead ECG

If Histamine is the main mediator of anaphylaxis, then what is the main therapy? EPI!!!

2012 Update: World Allergy Organization Guidelines for the assessment and management of anaphylaxis

- Epinephrine is the drug of choice
  - 0.01mg/kg IM
  - 0.3mg IM max dose in children
  - 0.5mg IM max dose in adults

Where is the best location to administer Epi?
Is SQ or IM better?

- 6 way crossover study SQ vs. IM
- Levels 4-6 times higher for IM in thigh vs. arm
- Levels 2 times higher IM vs. SQ in arm

Epinephrine is the Drug of Choice
- Use it earlier, not later
- Know the dose
- Say “1 mg in 1 ml” (vs. 1:1000)
- Used in less than 50% of cases
- Most current guidelines
- Epinephrine is underused in anaphylaxis

No ODs with IM epi
- 13% toxicity with IV epi

Epinephrine Anaphylaxis Dosing

0.3 cc 1:1000 IM

0.1 cc/10 kg in children (0.01 cc/kg).
Up to 0.5 cc in giant people.

To avoid confusion better to now say:

epi
Benedryl
H-2 Blocker
Steroids
Volume
Epinephrine is the drug of choice

The #1 cause of death in anaphylaxis is the failure to give epi in a timely manner

Less than ¼ of cardiac arrests due to anaphylaxis received epi before arrest

How often is epinephrine given to pediatric patients with true anaphylaxis

- 205 allergic reactions, 98 had anaphylaxis
- Epinephrine given to only 54% (53/98) pts with anaphylaxis

Is epinephrine safe in older patients with anaphylaxis?

- 2,995 allergy-related visits; 492 with anaphylaxis
- 24.8% (122 pts) were ≥ 50 yo
- 2 urban academic British Columbia teaching hospitals
- BC Ambulance service
- Looked at IV and IM epi use

Results

- Equal # of older and younger pts | BP < 90 mm
- Older pts more likely to get IV epi (5/122 vs 2/370)
- 5 pts had complications
- 4/5 patients were over age 50
When is Epi Dangerous?

- 3 of 4 older patients with complications received intravenous epi
- Toxicity in the above 3 IV pts were:
  - 3 min VT resolved spontaneously D/C’d (150 ugm IV)
  - CP with AFib RVR; D/C’d (300 ugm IV)
  - Transient ST depression on prolonged IV drip (300ugm IV)
- The fourth had mild CP and was discharged

The number one cause of death is in anaphylaxis is the failure to give epi in a timely manner

Epi Use in Confirmed Anaphylaxis
Older vs Younger

Take Homes on Epi in the Elderly
- Very, very safe
- Don’t use IV epi routinely in older pts!
- Don’t use IV epi routinely in younger pts!
- IV epi is for profound shock only
How effective is diphenhydramine or other more selective antihistamines in anaphylaxis?

There are no controlled studies to prove the efficacy of antihistamines in anaphylaxis or to make effective dosing recommendations.

- Added H₂ Blocker to Benedryl
- Significant decrease in Urticaria with H₂ Blocker
- Decreased Urticaria from 46% to 14% (p=0.03)
- Improves Symptoms by OR of 4.7
- No toxicity, cheap, lasts 8-12 hours

Steroids

- IV, IM, PO
- Take hours (2-6 hrs)
- All patients with systemic symptoms
- 80-125 mg SoluMedrol or 60-80 Prednisone
- Three days of therapy
Volume

- Give 500-1000 cc (or 20 cc/kg)
- May require more
- Keep patients flat longer

5 Causes of EMD-PEA

- Hypoxia
- Tension Pneumothorax
- Hypovolemia
- Tamponade
- Toxic - Metabolic

A patient is eating Pad Thai and suddenly slumps in his noodles. BP is nonpalpable, pt is profoundly diaphoretic and med alert bracelet says allergic to peanuts. You cannot feel a pulse, but he is breathing and wheezing.

Rx?

IV Epinephrine Infusion

- Only for true shock
- Life Saving, but potentially Toxic
- Start at 1-2 micrograms/minute
- Titrate to Effect

The starting dose epinephrine by IV infusion is

1-2 micrograms/minute

Minipush Epi

“Just give 1 cc of cardiac epi”

- 10 cc = 1 mg = 1000 micrograms
- 1 cc = 0.1 mg = 100 micrograms
- Don’t do it!
Physicians, nurses and paramedics make dosing mistakes in using IM and IV epinephrine, especially when dealing with severe anaphylaxis and asthma.

The starting dose epinephrine by IV infusion is 1-2 micrograms/minute.

**The “1” Rule for IV Epi:**

- 1 amp
  - or
- 1 mg
  - in
- 1 liter
  - at
- 1 cc/min
  - adjust
- Q 1 minute

**IV Epinephrine at 1 mcg/min**

- 1 mg of Epinephrine in 1000 cc
  - 1 cc of 1:1,000
    - or
    - 10 cc of 1:10,000

- Start at 1 cc/min.
- Piggy back into high flow IV
- Titrate to Effect Q 1 minute
- Follow HR and monitor
• Inject 1mg Epi into 1000 cc
• Run IV at 1 cc/min.
  ~ piggy back into high flow IV
• Titrate to Effect
  ~ Adjust rate as needed

The number one cause of death in anaphylaxis is the failure of patients, family, EMS, RN or Doc to give epinephrine in a timely fashion.

The “1” Rule for IV Epi:
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Safely Giving IV Epinephrine

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Consider Glucagon in Epinephrine-Refractory Anaphylaxis

You or someone must be sure your patient knows how and when to use the Epi Pen

Autoinjector Errors

- Up to 84% misuse rate
- Misuse also documented in fatal cases
- Often not held for 10 seconds
- No injection due to suboptimal force
- Finger injections > 10%

Only 25% of docs (EM, FP, Peds) know how to teach correct epi pen use

Be sure your patient can obtain the Epi Pens

- Only 54% filled Rx within 1 year
- Only 50% of patients carry the Epi Pen
- Parents often unclear on indications and use
- Less than 50% acute care docs use when indicated
Covered by Insurance?

$730?
$300?
$100?

• Do not write “Epi Pen”
• Write Epi Pen generic
• Give second Rx:
• “Generic Epinephrine AutoInjector” (formerly called Adrenoclick)

5 EMS Therapies for Asthma

- O₂
- Inhaled Beta Agonist
- Inhaled Anticholinergic
- Magnesium
- IM EPI

5 ED Therapies for Asthma

- O₂
- Inhaled Beta Agonist
- Inhaled Anticholinergic
- Steroids
- Magnesium

Avoiding intubation in a worsening asthmatic despite aggressive care

- Give IM epi
- Consider CPAP or BiPAP Trial
- Slowly infuse IV epinephrine

While you wait for a more concentrated epinephrine drip to be mixed by nursing or pharmacy – begin the 1 mg in 1 liter infusion
In Summary

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Differential Diagnosis of Anaphylaxis

• Anaphylaxis: HR, BP, wheeze, red, known allergy
• HF/Pulmonary Edema: older, hx of HF, more gradual
• PE: usually no wheeze, but hypoxic + ↑RR
• Hypovolemic shock: clear lungs, bleeding, trauma
• Angioedema: oral symptoms only, no wheeze

ED Therapy of Anaphylaxis

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