“What’s got you so hot and bothered anyway?””

Discussion of allergic reactions, burns and heat emergencies with an emphasis on:

- differentiating mild, moderate & severe allergic reaction including risk factors & treatment priorities.
- predisposing factors associated w/ heat disorders & contrast the body’s compensatory process for heat exhaustion or stroke.
- identifying differences b/t emergent & urgent presentations.
- treatment & intervention priorities for dehydration w/ heat disorders.
- physiologic response to injury which contributes to the development of burn shock.

Allergic reactions

- How common are food allergies?
  ~15 M people in US have food allergies
  More common with children (1:13)
- What areas of the body are most often affected?
  – Skin, GI tract, respiratory or cardiovascular system

Food Allergy Research & Education

According to FARE, 8 foods are responsible for 90% of food allergies:
- Cow’s milk
- Eggs
- Peanuts
- Fish
- Shellfish
- Tree nuts
- Wheat
- Soy

Is there anything really new about such an old illness?

“The EMS Praxis for Anaphylaxis”
Jeffrey M. Goodloe, MD, NREMT-P, FACEP
Medical Director for Metropolitan OK City & Tulsa
U of OK School of Medicine

He asked this very question...answer:
While there may not be a huge change for EMS, there is a practice issue for both pre-hospital and in the emergency department!
Common food allergies in children

- Egg
- Milk
- Peanut
- Tree nuts such as walnuts
- Soy (primarily in infants)
- Wheat

Common food allergies in adults

- Shellfish such as shrimp, crayfish, lobster, and crab
- Peanut
- Tree nuts
- Fish such as salmon

Food is only one of many things that causes an allergic or anaphylactic reaction

What other things might be considered?
- Animal dander
- Bee stings or other insects
- Plants
- Pollens

Severity of a reaction is affected by:

- the quantity of the antigen;
- route & rapidity of absorption
  (↑ risk = parenteral; ↓ risk = topical; oral = somewhere between the two)
- a PMH of asthma or cardiac disease; and/or
- patients taking beta blocker drugs.

Iatrogenic things... what?

induced inadvertently by a physician or surgeon or by medical treatment or diagnostic procedures
- Such as?

What if the allergen is unknown?

SOP does not dictate that treatment is based on allergen but rather on symptoms

For long term risk, it is preferable to determine etiology but not imperative for short term treatment
What are common symptoms of any allergic reaction?

- Pass out cards.

What is it?

- Edematous reddened patches or welts on the skin
- May be itchy!
- Can appear anywhere on the body

What causes them?

- Histamine
- Antibody release & attach to mast cells

What else happens?

- Wheezing, mucus and mayhem!
  - Skin becomes flushed, rash and itching
  - Vasodilation of blood vessels
  - Eyes & nose water, itch, productive cough
  - Increased mucus production
  - Lungs begin to wheeze
  - Bronchoconstriction

What other system is often affected but overlooked with assessment?

Gotta go!

- The GI tract
  - Histamine is contained in almost all body tissues, including the GI tract

Patients complain of:

- Abdominal cramps
- Diarrhea
- N/V

1. A conscious A & O adult presents w/ urticaria & pruritus on chest & arms following yard work. They also c/o itchy, watery eyes, sneezing, & a scratchy throat. There is no facial or airway edema or respiratory distress.

   BP 124/72; P 86; RR 16; SpO2 99%; BS = clear.

Which of these is indicated first?

   A. Epinephrine 1:1,000 IM
   B. Epinephrine 1:10,000 IVP
   C. Diphenhydramine IM or slow IVP
   D. Albuterol & ipratropium via HHN
Diphenhydramine (Benadryl)

Classification: antihistamine (H1 blocker)
Why is that beneficial?
What is the dosage in accordance with SOP?
Diphenhydramine 1 mg/kg (max 50 mg) IM or IVP (IV desired in moderate to severe reactions)

Asthma?

Localized reaction
Treatment with cold pack for comfort

How serious is this?

Type of reaction?
Pt c/o hives to hand and forearm only from grabbing a handful of pretzels (PB inside)
Denies any other complaints
VS: BP 118/74, P 84, R 18, pulse ox 96% RA

Anaphylaxis Guidelines

“How likely when any one of the following three criteria is fulfilled…”

1. Sudden onset of illness
“Can occur within minutes to hours
Involving the skin, mucosal tissue or both AND
– At least one of these:
  • Sudden respiratory symptoms
  • Sudden reduced blood pressure or signs of end organ failure.”

P. 13 SOP Severe / Systemic Reaction
Life threatening:
...respiratory failure, cardiovascular collapse...
2. **Two or more** of the following occurs after exposure to a likely trigger:

*Sudden*
- skin or mucosal;
- respiratory;
- reduced BP (or end-organ dysfunction);
- or gastrointestinal symptoms.

**SOP:** The difference between *mild* and *moderate* reaction?

2. An adult presents with dyspnea, anxiety, facial swelling, watery eyes, and sneezing following exposure to a cat. VS: BP 110/70; P 100; R 24; RA SpO2 94%; lung sounds: diffuse wheezing. Which of these is indicated first?

A. Diphenhydramine IM
B. Epinephrine 1:1,000 IM
C. Epinephrine 1:10,000 IVP
D. Albuterol & ipratropium via HHN

**Quiz Q #2**

Why should epinephrine 1:1,000 IM be given?
- Moderate systemic reaction

Why first?
- Start the process immediately

Why should this not be categorized as a mild systemic reaction?
- Both mucus production causing sneezing, watery eyes and respiratory symptoms with dyspnea

Why not severe?
- BP ok

**Moderate Reaction**

What is given after epi?
- Diphenhydramine
- Albuterol 2.5 mg
  - beta-2 agonist to help relieve bronchospasm by relaxing smooth muscles
  - helps potassium to return to the cells by activating the Na/K pump

**Epinephrine**

What is the rationale for giving epi 1:1,000 IM?
- Beta-2 effects
  - Bronchodilation!
3. What causes patients with anaphylaxis to experience shock and a relative hypovolemia?

A. Massive vasodilation
B. Pump failure and osmotic diuresis
C. Loss of sympathetic nervous system function
D. Endotoxin release that opens AV shunts around the capillaries

4. What is the desired action of epinephrine when given in the prescribed dose to a pt in anaphylactic shock?

A. H1 & H2 blocker to reverse the immune response
B. Anticholinergic agent to dry secretions and vasoconstrict the patient
C. Alpha & beta stimulant to bronchodilate & vasoconstrict the pt
D. Stabilize cell membranes to reduce inflammation and decrease airway hyper-reactivity

Myth: Anaphylaxis always presents w/ cutaneous S&S

Reality
10%-20% of anaphylaxis cases have NO hives or other skin signs
80% of food-induced fatal anaphylaxis cases had no cutaneous S or S
3. Reduced BP

Infants/children: age specific or > 30% drop

Adults: <90 mmHg systolic or 30% drop from baseline

Treatment Plan

GET A LINE!

This is important
While an IV is started?
IM epi...IVP to follow
IVFs
Dopamine
Diphenhydramine
Albuterol 2.5 mg & ipratropium
0.5 mg / HHN

What is the rationale for giving epi 1:10,000 IV?

Beta-1 effects

vasoconstriction

Epinephrine

If a patient in anaphylaxis does not respond to IV fluid challenges & epi & the BP remains < 90, what drug is indicated next?

A. Albuterol 2.5 mg/HHN
B. Glucagon 1-2 mg IVP slowly
C. Dopamine 10 mcg/kg/min IVPB
D. Diphenhydramine 50 mg slow IVP

Do patients even take their health seriously?

Study from 02-08’
12, 000 total pts
25% with h/o anaphylaxis
Non-compliance with carrying epi pen or reg appts with allergist

S. Clark, MD et. al
Weill Cornell Medical College
NYC

Smaller study regarding the proper use of epiPen
91% stated they had good knowledge
Majority could not identify injection side of the autoinjector!
Did not know to rub site after injection

R. Chaudhry, MD
U of Medicine & Dentistry
New Jersey

We have a huge opportunity here

...but do we take it?
A 13 yo presents w/ acute dyspnea
Mother reports nl. activity this am before school
~ 2 hrs later, school called; a rash w/ generalized flushing shortly developed after eating a chocolate chip cookie brought in from another student. During exam + N/V with SOB.

VS: BP 72/50, P 134, R 28; pulse ox 94% RA

...EMS is called

Symptoms can occur minutes to hours after exposure

Acute onset involving:
- The skin and / or mucosal tissue
- Respiratory compromise and / or ↓ BP
- Persistent gastrointestinal symptoms

Epinephrine: 1st line drug for anaphylaxis
Used if 1+ body systems involved, airway compromise or signs of hypoperfusion

Sooner epi is given = ↑ outcome

Lesson for EMS: Risk factors for severe or fatal anaphylaxis include a h/o asthma, nut allergies, & age.

Symptoms can also resolve, & then hrs later recur; term: biphasic anaphylaxis.

EMS Pearl: The earlier epinephrine is administered in the course of anaphylaxis, the better the chance of a favorable outcome.
Take home points:

• Most fatalities occur in first 60 min of onset
• Airway obstruction & cardiovascular collapse are most common causes of death
• Many pts who died from anaphylaxis only had *minor previous reactions*
• Risk factors include sensitivity to peanuts, history of asthma & beta blocker use
• Hypotensive pts should remain supine due to the risk of complications from massive volume depletion due to fluid shifts.

Heat Emergencies

Defined...
A medical condition caused or exacerbated by environmental factors

Severity
Based on skin parameter/ signs and symptoms

- Cramps
- Exhaustion
- Stroke

Thermoregulatory Mechanisms

The body's desire to maintain its core temp balanced

Starts in the brain (hypothalamus)

Body responds to environmental factors

Internal heat production affected by age, health, nutritional status

It is 88° F outside with 70% humidity. An awake and alert 26 y/o mail carrier is complaining of severe pain in their thighs, legs, and abdomen with nausea. The patient stated they have been late in their rounds and last drank a cup of ice water about two hours ago. BP: 120/82; P 120; R 32; SpO₂ 99%; EtCO₂ 33; T 99° F.

A paramedic should suspect heat

A. tetany.  
B. stroke. 
C. cramps. 
D. exhaustion.

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A. tetany.  
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D. exhaustion.
Heat Production

Loss

Convection

Evaporation

Environmental

Radiation

Conduction

Compensatory Response

Vasodilation:

↑ blood flow thus cooling body through convection & radiation

Sweating:

Utilizes convection & evaporation to cool

SOP:

Cramps or tetany

Pt starts to become dehydrated and c/o muscle cramps often in the legs

Due to significant water loss, electrolyte imbalances can occur causing discomfort

Progression of Symptoms

SOP:

Cramps

Treatment:

No immediate need for IVF replacement

Remove from warm environment

Do NOT massage cramped muscles

Symptoms based on temp

Predisposing Factors

Which patients would most likely be predisposed to a heat illness?
It is 92°F outside. A 70 y/o was found supine under a tree. Pt is awake, answers questions accurately, but c/o extreme dizziness, weakness, thirst, nausea & has vomited X 2. Skin is flushed & diaphoretic. Denies CP or SOB & has a PMH of DM & HTN. Meds: propranolol. The pt became ill over past 30 minutes after golfing for the past 2 hours.

VS: BP 84/60; P 118 & thready; RR 24; SpO₂ 97%; T 99°F. Glucose 120.

A paramedic should suspect heat

A. tetany.
B. stroke.
C. cramps.
D. exhaustion.

What intervention should be initiated for the above patient with heat exhaustion per SOP?

A. Midazolam 2 mg IVP
B. Massage arms & legs to remove lactic acid
C. IV NS fluid challenge in consecutive 200 mL increments to maintain SBP ≥ 90
D. Initiate rapid cooling: Cold packs to cheeks, palms and soles of feet
What 2 assessment findings differentiate this scenario from heat stroke?

Heat stroke defined...
When the body can no longer shed heat effectively & temp rises above the body’s set point, hyperthermia occurs. Failure of thermoregulatory mechanisms...

Pathophysiology
Failure of body reserves in face of heat stress
Fluid & electrolyte depletion
Anaerobic metabolism
Significant CV stress
Peripheral vascular shutdown

Pathophysiology
Sweating ceases
Cardiac decompensation
Redistribution of blood from core to periphery adds to hypotension
As cooling occurs, fluid shifts back to core and BP improves
Avoid huge IVF loads to prevent pulmonary edema

Presentation
↑ temp to 105°F
↑ P & RR
AMS
Dilated pupils
Hyperventilation
Hypotension
DRY hot skin
Delayed cap refill
↓ skin turgor
Electrolyte imbalance
LETHARGY

Example?
While it is often a presumed scenario of the heat stroke pt as a marathon runner (or more often the weekend warrior) who goes out and becomes dehydrated after significant exertion, more often EMS is called for the nonexertional heat stroke.
Help me please!

Treatment includes:
- move to cool place & remove clothing
- assess temp
- **RAPID** cooling measures
- assess for hypoglycemia
- place supine for ↑ ICP
- IVFs to maintain SBP of 90
- apply CCP to neck, lateral chest, groin, axillae, temples & behind knees
- treat w/ midazolam if convulsive activity presents

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**Remember...**

- Monitor volume status
- IVFs for dehydration
- Seizure precautions
- Treat with midazolam
- Observe for ↑ ICP
- Consider other dx.

**PT SAFETY!**

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**Injury** to the largest body organ caused from extreme temperatures

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**From a variety of energy sources**
- Thermal
- Radiant
- Electrical
- Nuclear
- Chemical

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**Epidemiology**

- 1.25 M persons burned/ year
- Incidence down by 50% in US since 1971 from 10 to 4.2/10,000 persons

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Thanks to Connie Mattera for burn slide materials!
Who is at greatest risk?

- Children
- Elderly
- Debilitated
- Mass casualty

...and would have risk for greatest severity

### Children

- 2nd leading cause of accidental death
- 34% of all burns
- 10,000 experience severe permanent disability
- ↑ risk for inhalation with airways more difficult to secure

### Elderly risks

- Cooking, house fires, unattended cigarettes
- Scalds

Scalds 18 mos – 3 yrs
History difficult
Greater BSA/kg = larger evaporative surface,
↓ ability to conserve heat
↑ risk for hypothermia
Higher fluid needs, less metabolic reserves –
↑ incidence of hypoglycemia

↑ risk for home fires

↑ risk for inhalation with airways more difficult to secure
**Determining depth of injury**

- **Superficial**
  - Partial thickness
  - Full thickness

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**Epidermis**

- Outermost & thinnest; subdivided into 5 layers
- No blood vessels, totally dependent on dermis

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**Partial thickness**

- Deeper in dermis - greater destruction
- Skin contact
- Hot liquids
- Explosions producing burns
- Hot grease

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**Full thickness burns**

- Destroys epidermis + dermis including area that produces new skin cells

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**How to identify?**

- Edema
- Hairs intact
- Red, cap refill intact
- Moist, often blisters
- Extreme pain
- Risk of infection
- Can convert to FT
- Heals w/o grafting
- Scar or changed appearance

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- IAFF/ABA, 2007
Full Thickness Burns

4th degree

Immediate assessment & management

↑priorities include:

Airway
(MOI include inhalation?)
Breathing (listen for noises)
Circulation
(damaged cells cause ↑fluid leak)
Disability
(Frequent reassessment for deterioration-think hidden trauma/HI)

Identify TBSA
(↑concern w/ injury over joints)
Pain Relief (including dressings)

A conscious and confused patient has been rescued from a smoky fire. He presents with severe ventilatory distress, singed nasal hairs and eyebrows, hoarseness, productive cough of carbonaceous sputum, stridor and diffuse wheezes in all lung fields. VS: BP 150/84, P 92, R 40 and labored; SpO₂ 95%; EtCO₂ 20 with sharkfin waveform. What should a paramedic do first?

A. Administer 15L oxygen and prepare for DAI
B. Start an IV and administer 3 amps of sodium bicarbonate
C. Give epinephrine 0.1 mg IVP; withhold O₂ due to SpO₂ reading
D. Start an IV NS wide open and give sequential albuterol treatments

Sensation & cap refill absent
small vessels & nerve endings destroyed
May still have pain due to PT burns
surrounding FT

White

Brown/leathery
Which of these should take FIRST priority for transport due to the urgency of their injury?

A. 18% deep partial thickness leg burns
B. 2% partial thickness burns to both palms
C. Upper airway burn with suspected smoke inhalation
D. 9% deep partial thickness arm burn with a fractured radius and ulna

How is TBSA burned usually calculated?

Rule of 9s modified for infant

4% taken from each leg
(along w/ 1% from perineum)
Given to head

For Infants

Larger Children

Rule of Palms

Palm surface w/ fingers = 1%
Irregularly shaped burns up to 10% BSA
Fluid infusion (ABA, SOP)
Warm NS
0-5 yrs: 125 mL/hr
5-14 yrs: 250 mL/hr
≥15: 500 mL/hr

Parkland formula:
4 mL X % TBSA X kg; ½ in first 8 hrs

SOP p. 41 ITC Special Considerations

Standard dosing until max dose given
Monitor VS carefully
Evaluate response

An awake and alert adult spilled hot coffee on his left hand and forearm (TBSA 3%) sustaining a deep partial thickness burn. The patient is c/o severe pain (10/10).
VS: BP 160/90, P 96, R 16. Attempts at IV access are unsuccessful. Which of these is indicated to treat the pain?
A. Midazolam IM
B. Fentanyl IN
C. Spray burn with Benzocaine
D. Transport with arm covered with crushed ice

Wound care
No topical ointments, creams, or anti-microbials in field
If PT> 15% and/or FT> 5%: dry dressings
Smaller burns/eyelids moist dressings
Wound care

↓ Air movement to ↓ pain
Reduce fluid loss
Prevent hypothermia
Prevent bacterial contamination

Let’s calculate some burns...

1. Depth of injury
2. TBSA
3. Type of dressing

Wrap digits individually or place gauze between burned skin areas

Leave blisters intact
Immediate transport

All FT and PT burns > 5%
Burns to face, hands, feet, genitalia, or over major joints
Toxic gas, smoke, steam, or flame inhalation
Geriatric, peds, or otherwise ill patient
Chemical, electrical, lightning burns
**Criteria for burn center referral**

- PT > 10% in ages
- Full thickness any age group
- Face, hands, feet, perineum, or major joints
- Inhalation injury
- Chemical burns; electrical/lightning burns
- Children; Suspected child abuse
- Pre-existing disorders that could complicate mgt, prolong recovery
- Concomitant trauma; burn poses greatest risk
- Pts require special social, emotion or rehab intervention

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**Danger of Eschar**

- May tighten over wound like a tourniquet
- Restricts blood flow
- Increases pressure in compartment

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**S&S impaired circulation**

- Cyanosis
- Impaired cap refill
- Progressive neuro deficits: paresthesias, deep tissue pain
- May need Doppler to obtain pulses
An adult has been rescued from a smoky fire. He is conscious, but very confused & disoriented, & is c/o a bad headache w/ nausea. Airway open & gag reflex intact. VS: BP 117/78; P 72; R 19; SpO₂ 98%; EtCO₂ 32; BS clear bilaterally; skin flushed & diaphoretic; pupils are dilated bilaterally & reactive to light. Pt opens eyes to pain & closes them again, answers questions slowly & doesn't remember address; & moves all extremities on command. If any hospital can be reached in 30 minutes by ground, where should this patient be transported? You do not note any thermal skin burns.

A. Nearest trauma center
B. Lutheran General Hospital

Research is ongoing, not proven yet by any published studies...but intriguing

For a long time, standard treatment for burns was skin grafting. Healthy skin from pt is harvested & used to cover damaged area. Another common is known as cultured epithelial autograft (CEA).

When a child receives either tx, skin may not always grow or grow correctly with the child. This often means repeated surgeries until the child has finished growing.

With ReCell, skin can grow & stretch as nl, allowing the pt to avoid multiple, painful procedures.
Having been used successfully on thousands of patients in Canada, the UK, France, Germany, and Australia, it still needs FDA approval in US.

Now Avita Medical is taking wound & burn treatment to a whole new level with a new technology called ReCell.

**ReCell**

Now Avita Medical is taking wound & burn treatment to a whole new level with a new technology called StrataGraft.

**StrataGraft**

Proprietary human skin cell line
When properly cultured, forms a fully stratified multilayered human tissue with physical strength and biological characteristics of intact human skin.

**Silverlon dressings**

Manufactured by Argentum of Geneva, IL
Long-acting silver-impregnated nylon bandage.
Psychological aspects

Questions