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Advanced Emergency Trauma Course

Burns

Presenter: Carl Seger, MD

Ghana Emergency Medicine Collaborative

Patrick Carter, MD • Daniel Wachter, MD • Rockefeller Oteng, MD • Carl Seger, MD

Epidemiology of Burns

- 1-1.5% of population sees MD for burns/ year in US
- 1.25-2.5 million burns each year
- 500,000 ED visits, 50,000 admits,5,000 deaths
- Most burns cover less than 5-10% of body surface area

Types of Burns

- Thermal
- Chemical
- Electrical

Thermal Burns

- Contact
- Flame
- Heat
- Scalding

Medscape

Chemical Burns

- Both acids and bases can be defined as caustics, which cause significant tissue damage on contact.
- ACIDS produce a coagulation necrosis by denaturing proteins, forming a coagulum (eg. eschar) that limits the penetration of the acid.
- BASES typically produce a more severe injury known as liquefaction necrosis

Chemical Burns

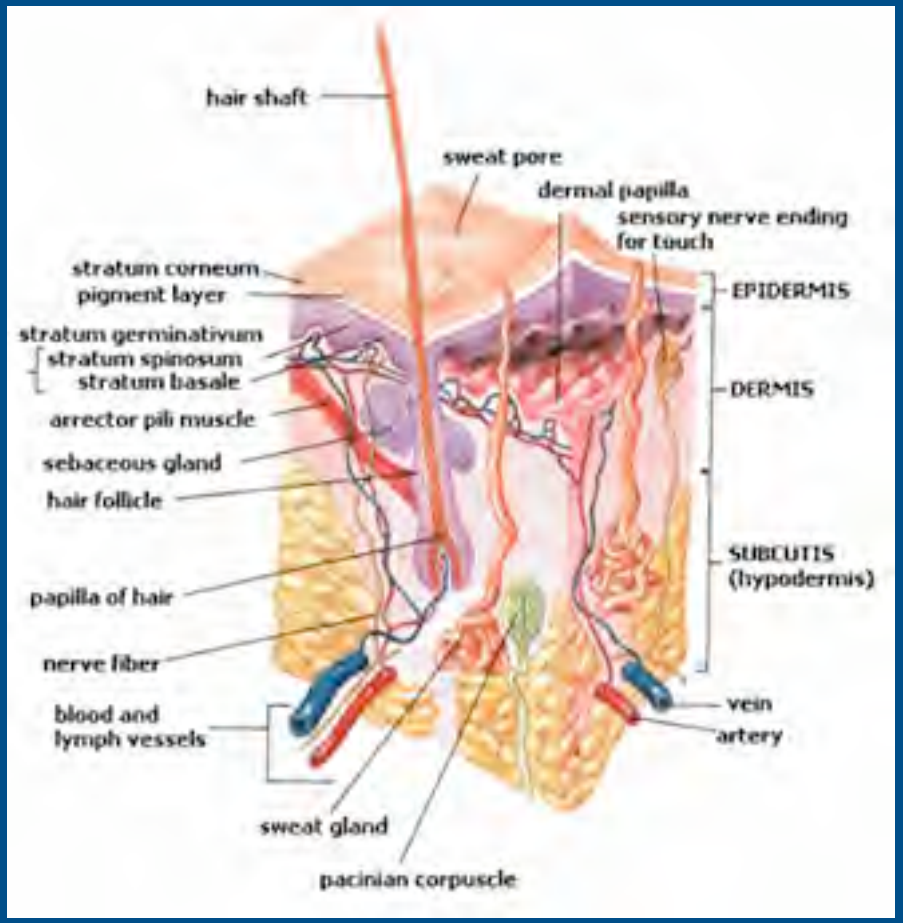
- Acids
  - Toilet bowl cleaners, drain cleaners, metal cleaners, automobile battery fluid, fertilizer manufacturing, rust removers, tire cleaners, tile cleaners, glass etching, dental work, refrigerant, and hair wave neutralizers
- Bases
  - Drain cleaners, bleach, oven cleaners, mortar, plaster, and cement

Electrical Burns

- LOW-VOLTAGE
  - Electric burns almost exclusively involve either the hands or oral cavity.
- HIGH-VOLTAGE
  - In burns from an electric arc, the current courses external to the body from the contact point to the ground
  - Electric current that passes between the power source and the anatomic point of contact (entrance wound), and between the patient (exit wound) and the grounding mechanism, causing hidden destruction of deeper tissues

General Skin Anatomy and Physiology

- Skin Layers
  - Epidermis
  - Dermis
- Skin Function
  - Protection
    - Pathogens
    - Water loss
  - Temp regulation
  - Sensation
  - Vitamin D Synthesis

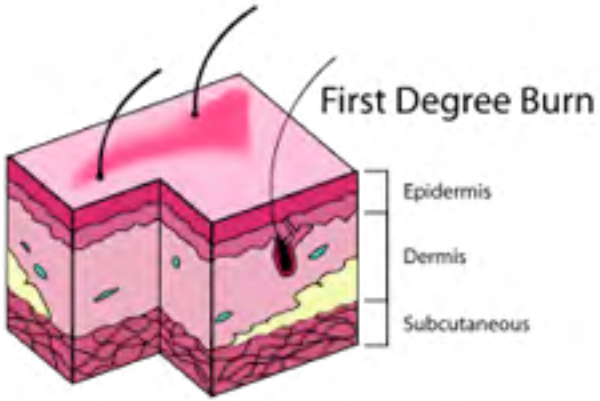


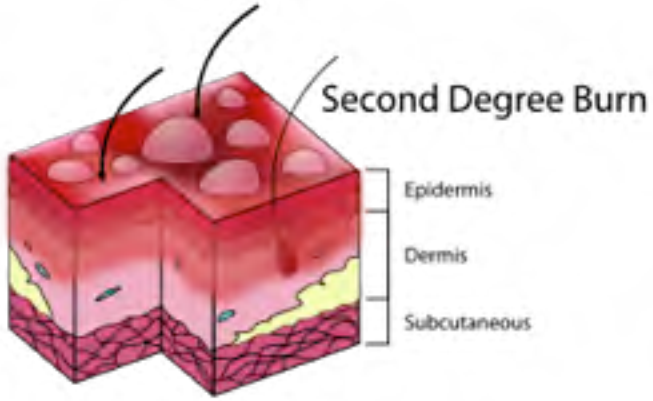
PD-GOV National Cancer Institute, SEER

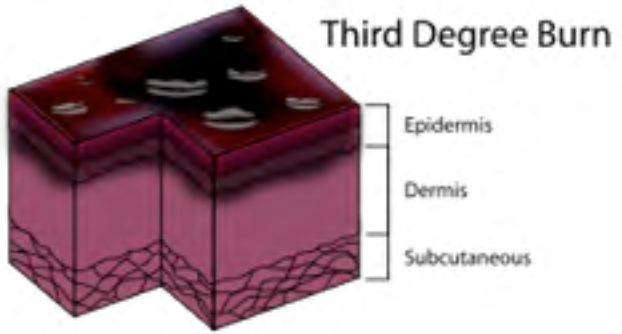
Classification

- Traditional Classification
  - 1st degree
  - 2nd degree
  - 3rd degree
- Current Classification
  - Superficial partial thickness
  - Deep partial thickness
  - Full Thickness

Burn Classification







K. Aainsqatsi, Wikipedia

1st Degree

- Redness
- Dry skin
- Painful to touch
- Pain lasts 48 to 72hrs
- Peeling skin

PD-INEL Source Undetermined

2nd Degree; Partial Thickness

- Involves the top layers of skin.
- The skin is red and blistered.
- Usually painful.
- Takes up to 3-4 weeks to heal.
- May scar.

PD-INEL Source Undetermined

3rd degree; Full thickness burns

- Destroys all lays of skin and underlying structures.
- May look brown or black and tissue underneath may be white.
- Usually not painful.

PD-INEL Source Undetermined

Pathophysiology of Burns

- Cellular damage at >45° C
- Dependent on temperature and duration
  - Singer et al. Acad Emerg Med 2000;7:1
- Three zones of injury –
  - Central zone of necrosis
  - Zone of stasis (at risk of necrosis)
  - Zone of hyperemia
    - Jackson Br J Surg 1953;40:588 Burn Pathophysiology

Pathophysiology of Burns

- Thermal injury triggers intense inflammatory response
  - Initial release of histamine, bradykinin
  - Increased capillary permeability with third spacing
  - Progressive vascular occlusion by PMN, RBCs
  - Release of free radicals, proteases

Clinical Evaluation

- History
  - History of events – closed space, toxic fumes
  - Evaluate for inconsistencies or patterns suggesting child abuse (immersion injuries)
  - PMH: AMPLE, Tetanus immunization status

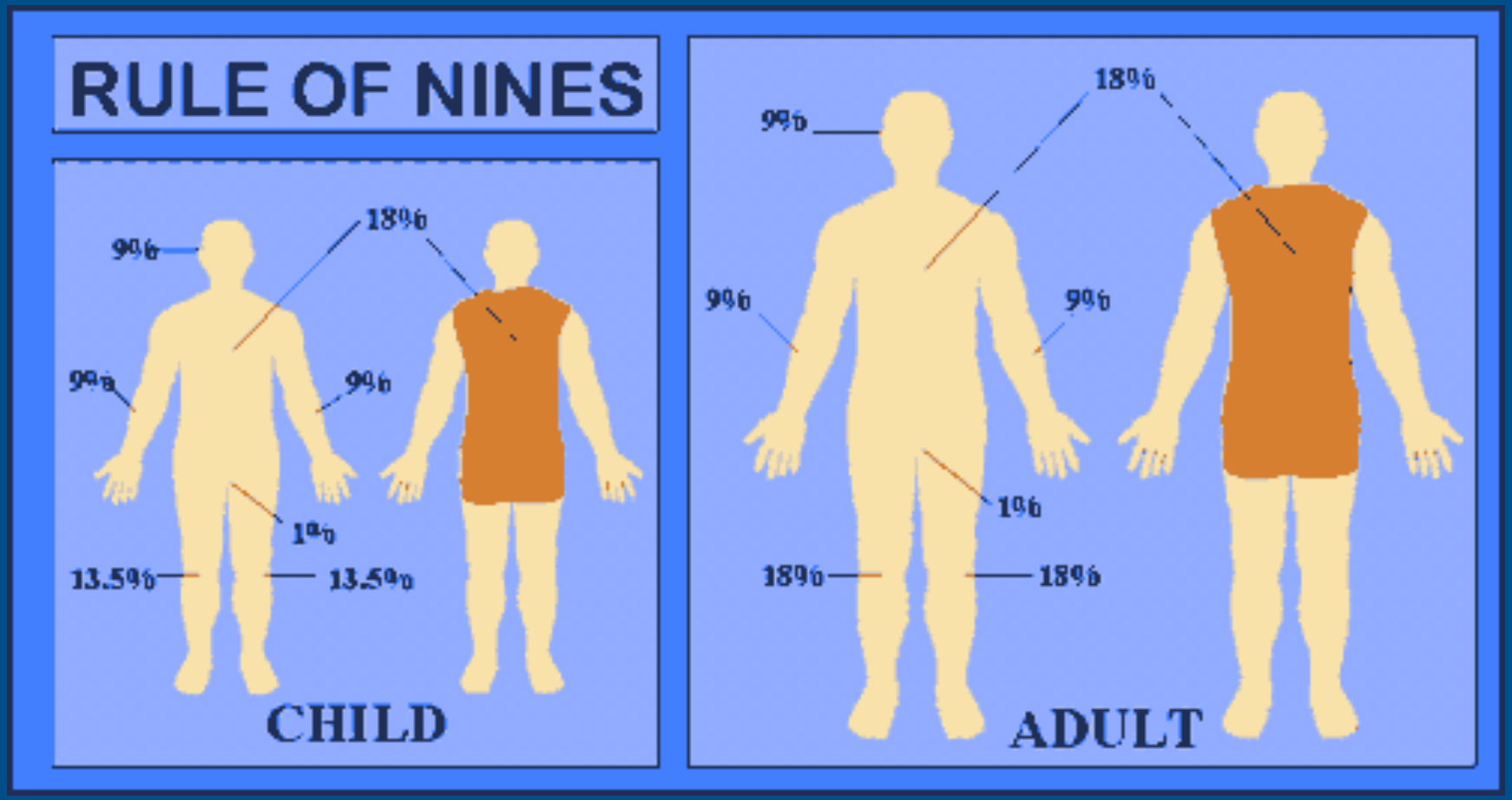
Clinical Evaluation

- Physical Exam
  - Assess for inhalation injury
    - Signs not always present
    - Singed nasal hair
    - Carbonaceous sputum
    - Cough
    - Hoarseness
    - Dyspnea
    - AMS
- Assess Severity of Injury

Clinical Evaluation

- Determine Severity of Injury
  - Size
  - Depth/Degree
  - Location-
    - Hands, face, genitals, feet, circumfrential
  - Rule of 9's

Rule of 9's



PD-INEL Burnsurgery.org

Initial Burn Management

- ABCs
- Identify and treat associated injuries
- Remove source, protect rescue
- Initial cooling with cool water (not cold)
- Cover with dressing, leave blisters intact
- Brush off any metal other material
- Irrigation for chemical burns

Acute Management

- Airway Management
  - Secure airway early
  - Signs of impending airway obstruction
    - Hoarseness, Stridor, Facial edema
  - Endotracheal intubation or surgical airway if ET not possible
  - Give 100% O2 for suspected smoke inhalation

Chemical Burns

- Brush off dry material first
- Take off any clothing that can easily be removed
- Flush with water for at least 20-30 minutes

Acute Management

- Fluid Resuscitation
  - Parkland Formula
  - Urine Output
  - Pediatric Considerations

Parkland Formula

- 4 x (% body surface burned) x wt in Kg
- This equals the amount of fluid (in ml) to replace in a 24hr period
- The first half in the first 8hrs
- The rest in the next 16hrs

Acute management

- General Wound Care Principles
  - Biological Dressing
  - Wound Debridement

Acute management

- Topical Agents
  - Silvadine cream
  - Covering the wound with clean linens
- Analgesia
  - Often very painful and require large amount of pain medication

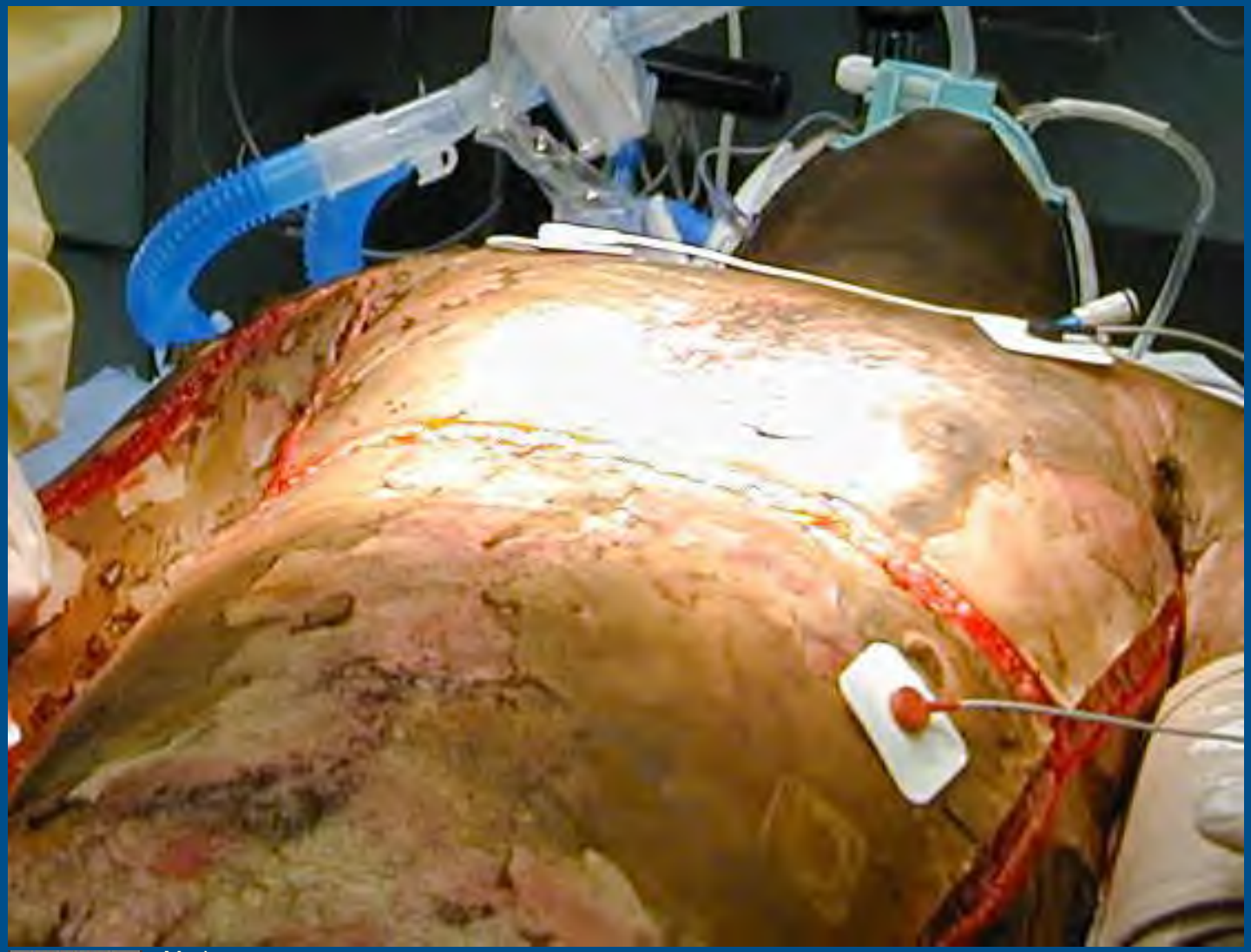
Do's and Don'ts of Burn Care

- Do's
  - Brush off dry chemical while in a protective suit
  - Flush with cool water
  - Cover wound with dry dressing
  - Keep victim comfortable
- Don'ts
  - Apply ice
  - Touch the burn
  - Remove pieces of cloth from burned area
  - Clean severe burns
  - Break blisters
  - Use ointment on severe burns

Acute management

- Escharotomy
  - Deep circumferential burns over neck, chest limbs
  - Compromised ABC's
  - May be life or limb threatening
  - Incision of eschar to sub Q fat
  - Avoid major vessels and nerves
  - Anesthetics usually not required

Escharotomy



PD-INEL Medscape

Acute management

- Inhalational Injuries
  - General Evaluation and Management
  - Carbon Monoxide

Inhalational Injuries

- Responsible for most deaths
- Evolution may require several days
- Exposure of airways and lungs to toxic chemicals
- Tracheobronchitis
- Airway obstruction
- Pulmonary edema within 2-3 days

Inhalation Injury

- Carbon Monoxide
  - Has higher affinity for hemoglobin than O2.
  - CO poisoning can lead to AMS, myocardial ischemia, and severe long term neurologic sequelae
  - O2 in higher concentrations accelerates CO elimination
  - Can also treat with amyl nitrate, sodium nitrite, sodium thiosulfate

Complications of Burn Care

- Infection
- Airway Considerations
- Circumferential Burns

Indications for Admission

- Adults > 15% 2° Degree Burns
- Children > 10% 2° Degree Burns
- 3° burns > 2%
- Face, hands, feet, perineum
- Serious underlying diseases
- Social considerations

When does Cold Injury Occur?

- The Factors that contribute to Cold Injury
  - Temperature
  - Duration of exposure
  - Immobilization
  - Moisture
  - Vascular disease
  - Open wounds

Recognize local cold injuries

- Frostnip- Mild form, does not result in tissue destruction, very painful
- Frostbite- intracellular ice crystals, can get reperfusion injury, Classified based off of depth

PD-INEL Medscape

Frostbite

PD-INEL Medscape

PD-INEL Medscape

Treating cold injuries

- Do not delay
- Remove clothing
- Warmed blankets
- Rewarm frozen part
- Preserve damaged tissue
- Prevent infection
- Elevated exposed part
- Analgesics, tetanus, and antibiotics

Recognize hypothermia

- Rapid or slow drop in core temperature to < 35 degrees C
- Elderly and children at greater risk
- Low-range thermometer required

Hypothermia clinical signs

- Temperature <35 degrees C
- Depressed Level of consciousness
- Gray, cyanotic
- Variable vital signs
- Absence of cardiorespiratory activity

Treating Hypothermia

- ABCDE's
- Rewarm
- Assess for associated disorders
- Blood analyses, including K+ and C++

Treating hypothermia

- Passive external rewarming: Warm enviroment, blankets, IV fluids
- Active core rewarming:surgical rewarming techniques
- Not dead until warm and dead

Questions?

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