Pediatric Burns

- I have no financial relationships to disclose

Statistics

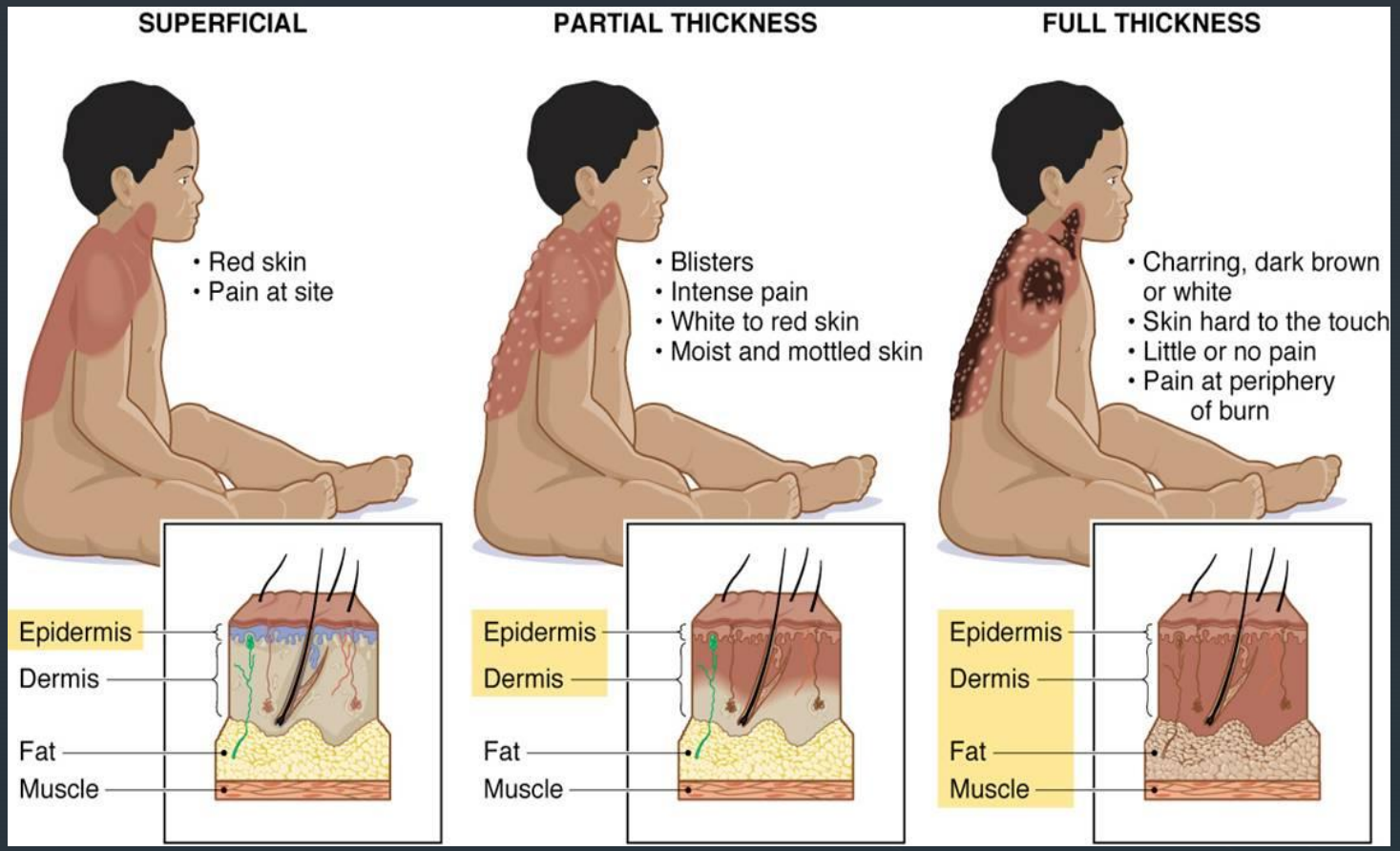
- Burns in the pediatric population have different prevalence, according to ages. From birth to 19.9 years old (2009-2018, US Data)[1]: Scald injury (49.8%): most common in all children less than 16 years old
- Fire/flame (22.6%): most common in children between 16 and 20 years old
- Hot Object Contact (15.8%): decreases with increasing age, highest in children less than 1 year old
- Electrical (2.0%): increases with increasing age, highest in children between 16 and 20 years old
- Chemical (1.9%): prevalence varies across ages
- Radiation (0.2%): very rare in the pediatric population

- Leading causes of accidental injury at home are burns, drowning, suffocation, choking, poisonings, falls, and firearms.
- Burns and fires are the fifth most common cause of accidental death in children and adults, and account for an estimated 3,500 adult and child deaths per year.
- Nearly 75% of all scalding burns in children are preventable.
- Toddlers and children are more often burned by a scalding or flames.
- Most children ages 4 and under who are hospitalized for burn-related injuries suffer from scald burn (65%) or contact burns (20%).
- Hot tap water burns cause more deaths and hospitalizations than burns from any other hot liquids.

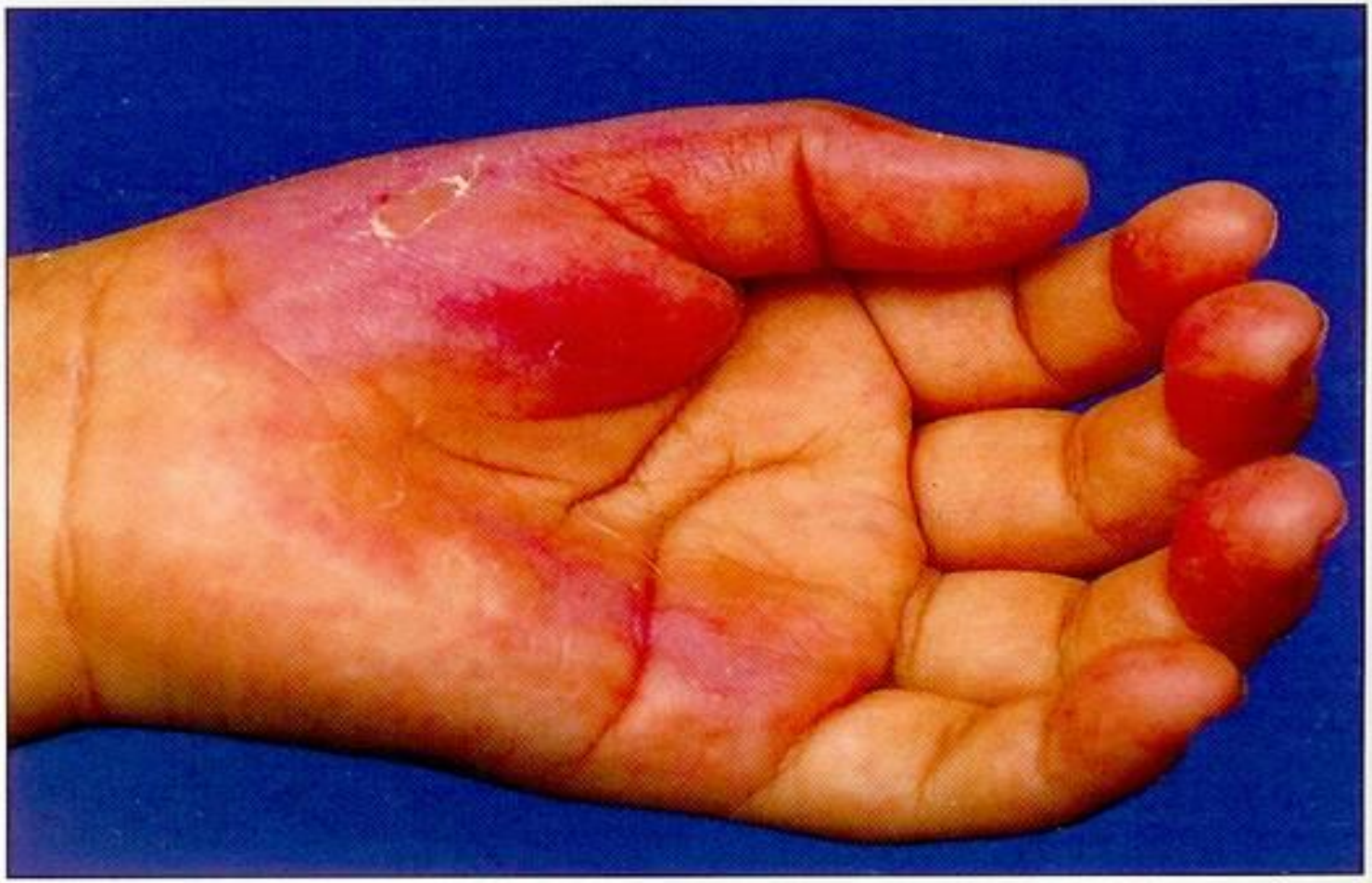
Burn Depths

- Superficial
- Superficial Partial Thickness
- Deep Partial Thickness
- Full Thickness
- Involving Other Tissues- “Fourth Degree”

Depth Evaluation

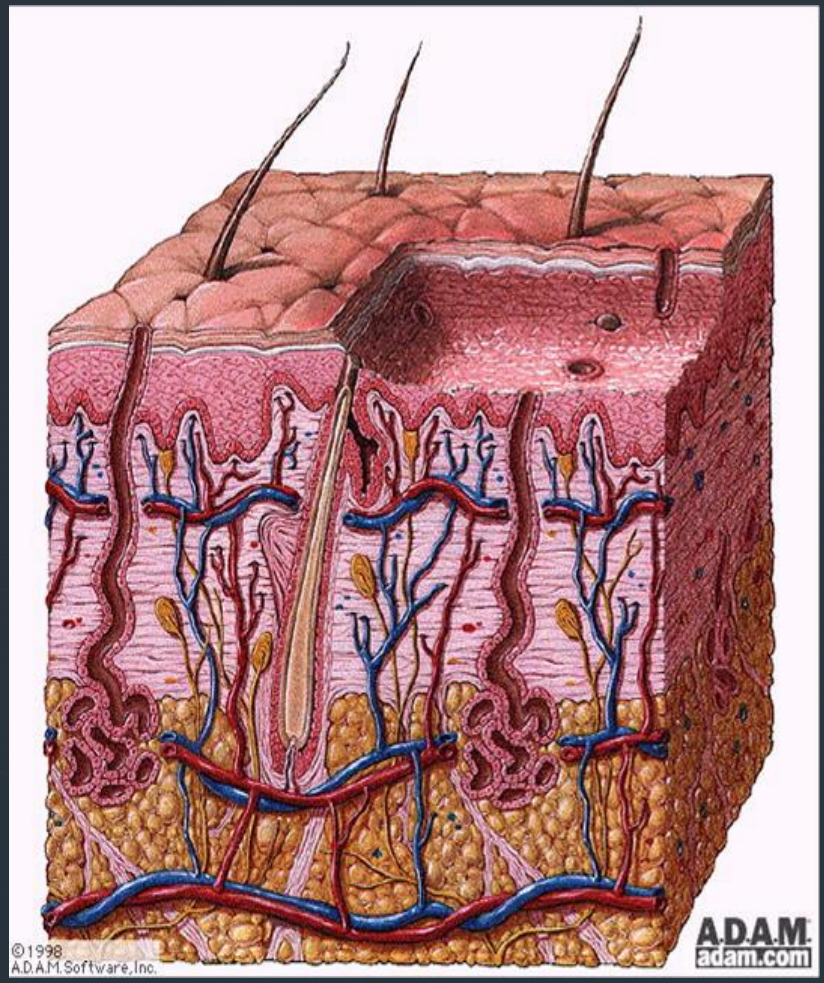


Superficial Burn



Superficial Burns

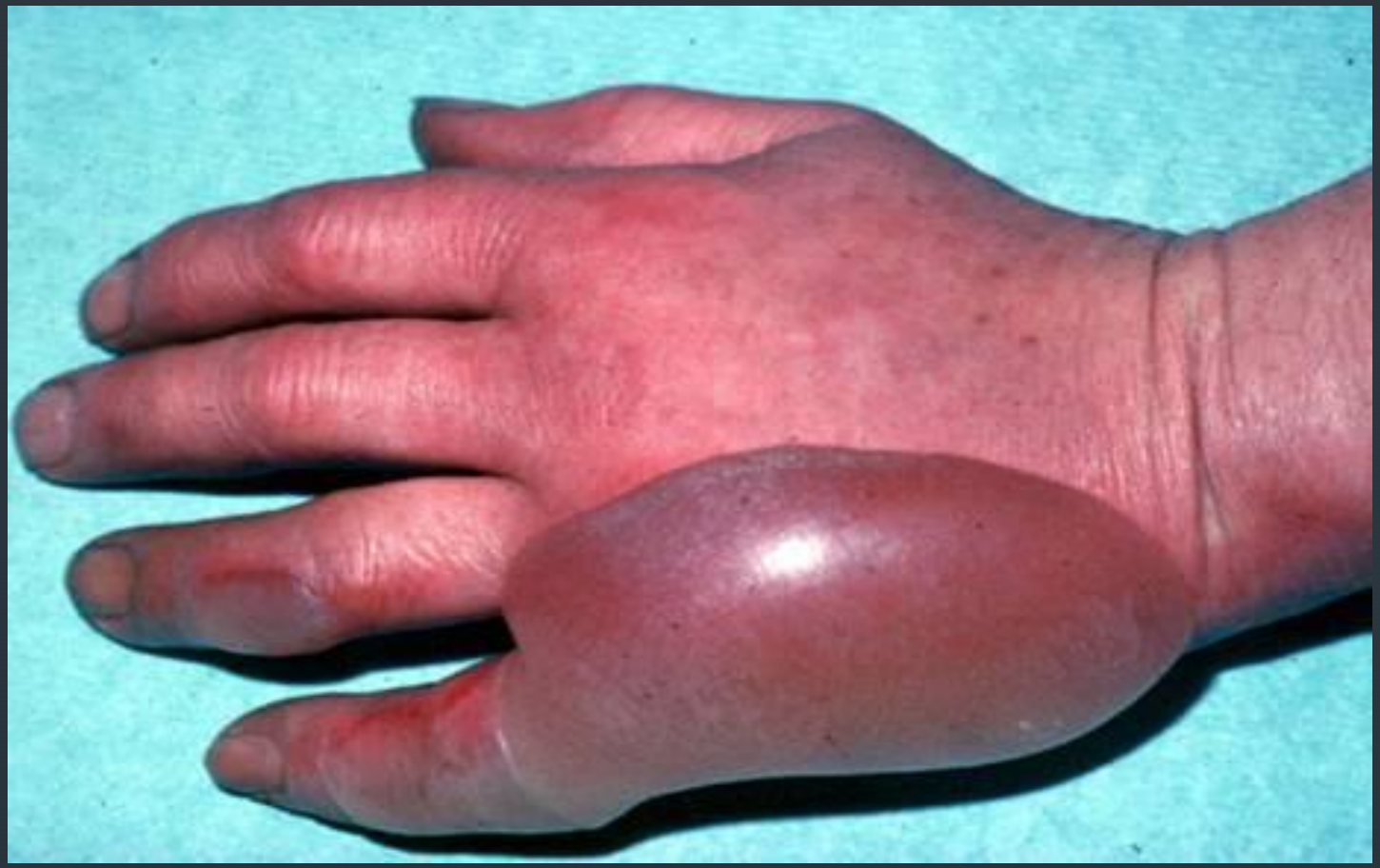
- Involves only the epidermis



Superficial Burns

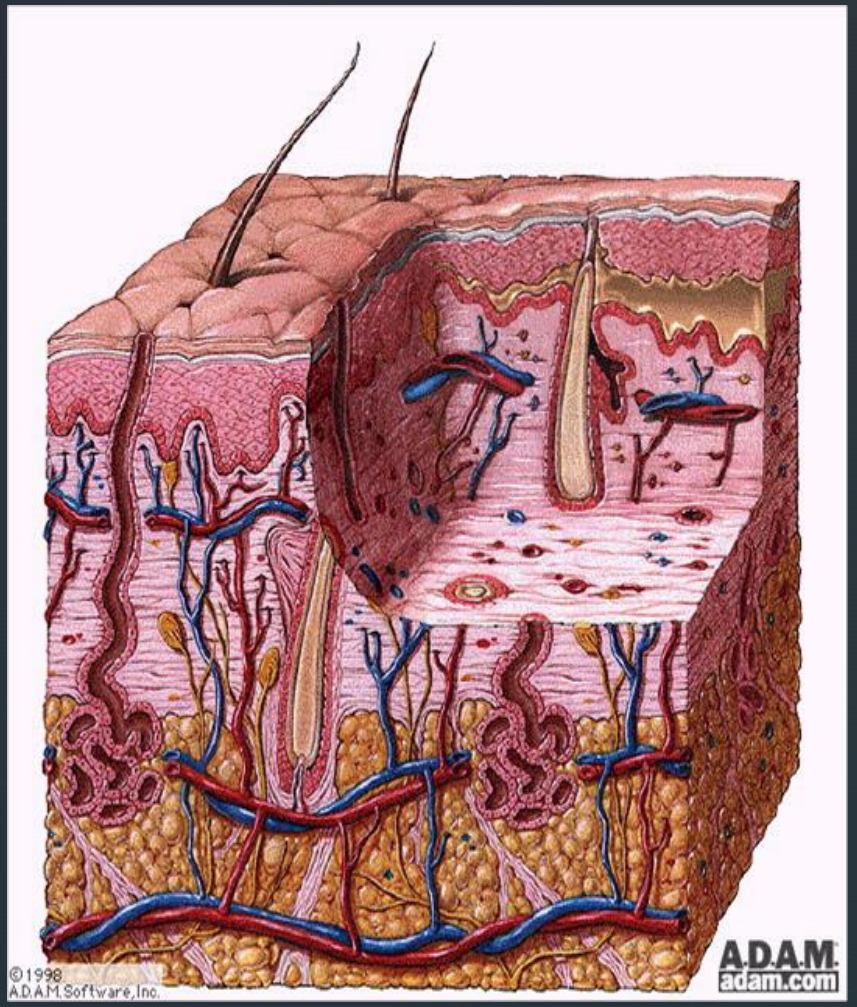
- Clinically see redness, tenderness, and pain
- No blisters present
- 2 point discrimination intact
- Healing takes place over 3-5 days without scarring
- Not considered in total Body Surface Area
- Consider if greater than 25-30% TBSA involved
- Painful
- Not a big infection risk
- Not a big scarring risk

Partial Thickness Burns



Partial Thickness Burns

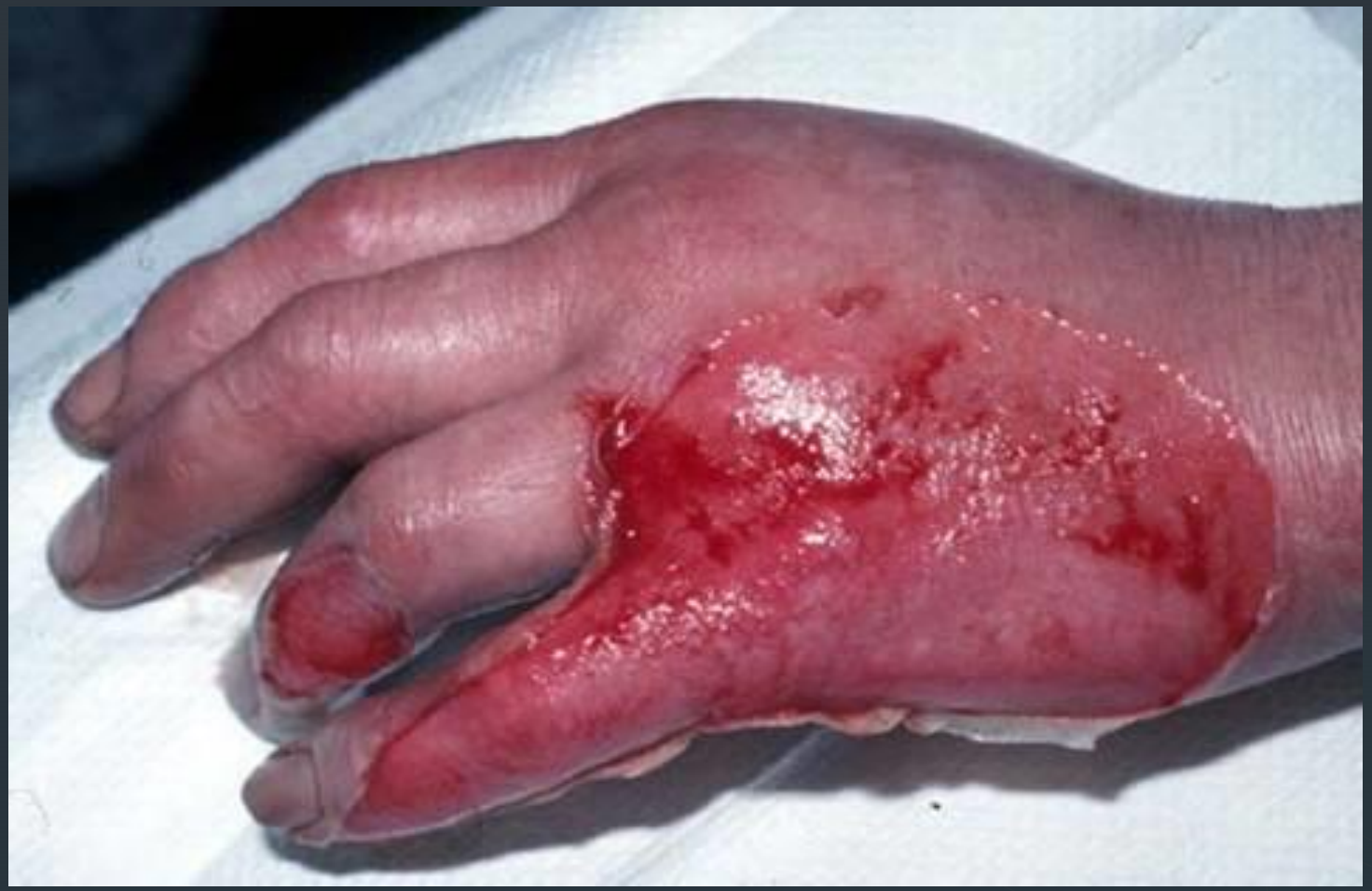
Involves the epidermis as well as the dermis



Partial Thickness Burns

- Involves epidermis and superficial dermis
- Often results in thin fluid-filled blisters
- Appear pink, moist, soft; extremely tender, blanchable; hair intact
- Heal in 2-3 weeks without scarring
- High risk for infection
- Without proper treatment, can progress to full thickness
- May require surgery

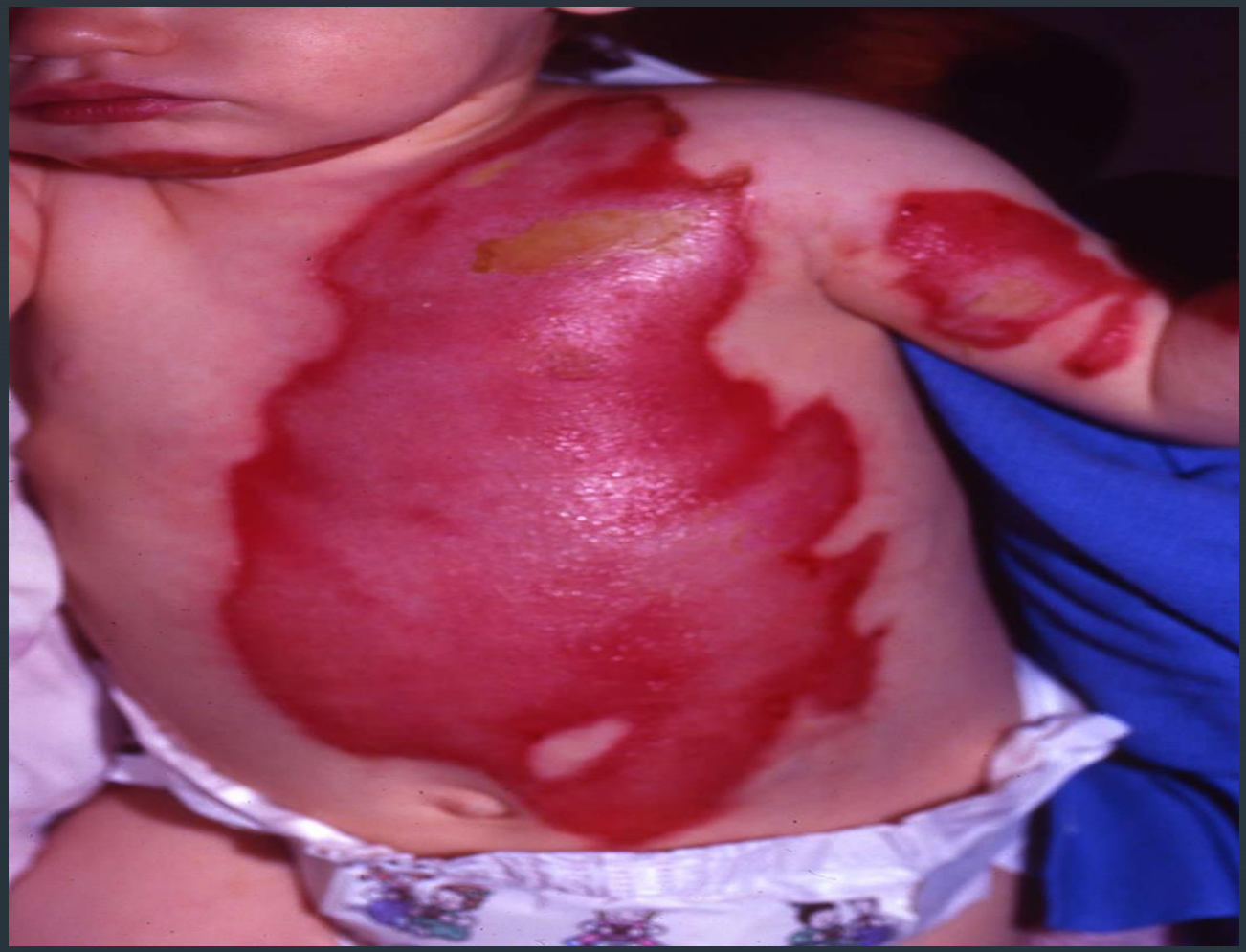
Partial Thickness Burn, Debrided



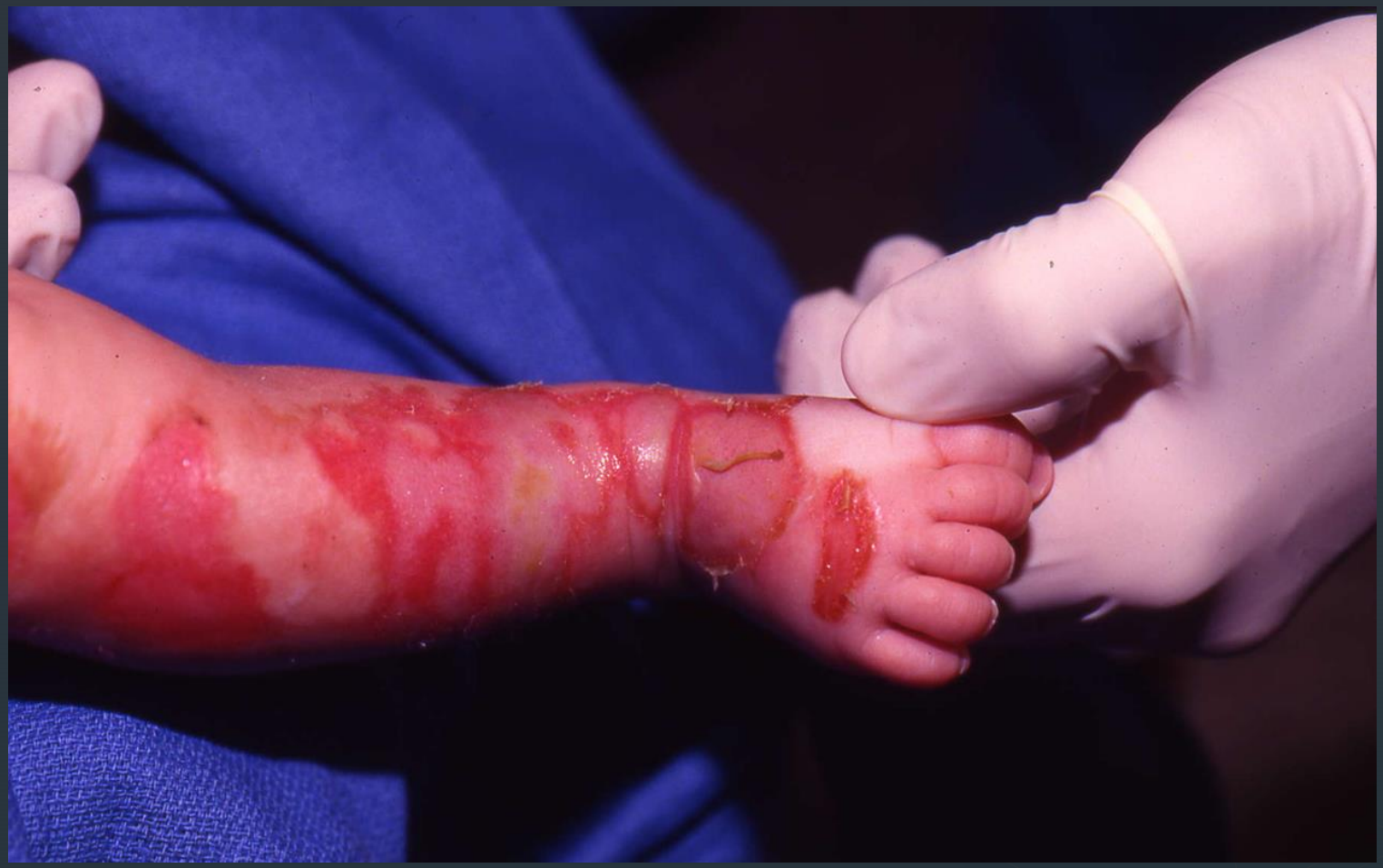
Partial Thickness Burn

- Debridement
  - Removes dead tissues and fluid that contains inflammatory mediators
  - Allows for antimicrobial topicals to come in contact with the wound
  - Allows for appropriate evaluation of burn depth

Deep Partial Thickness Burns



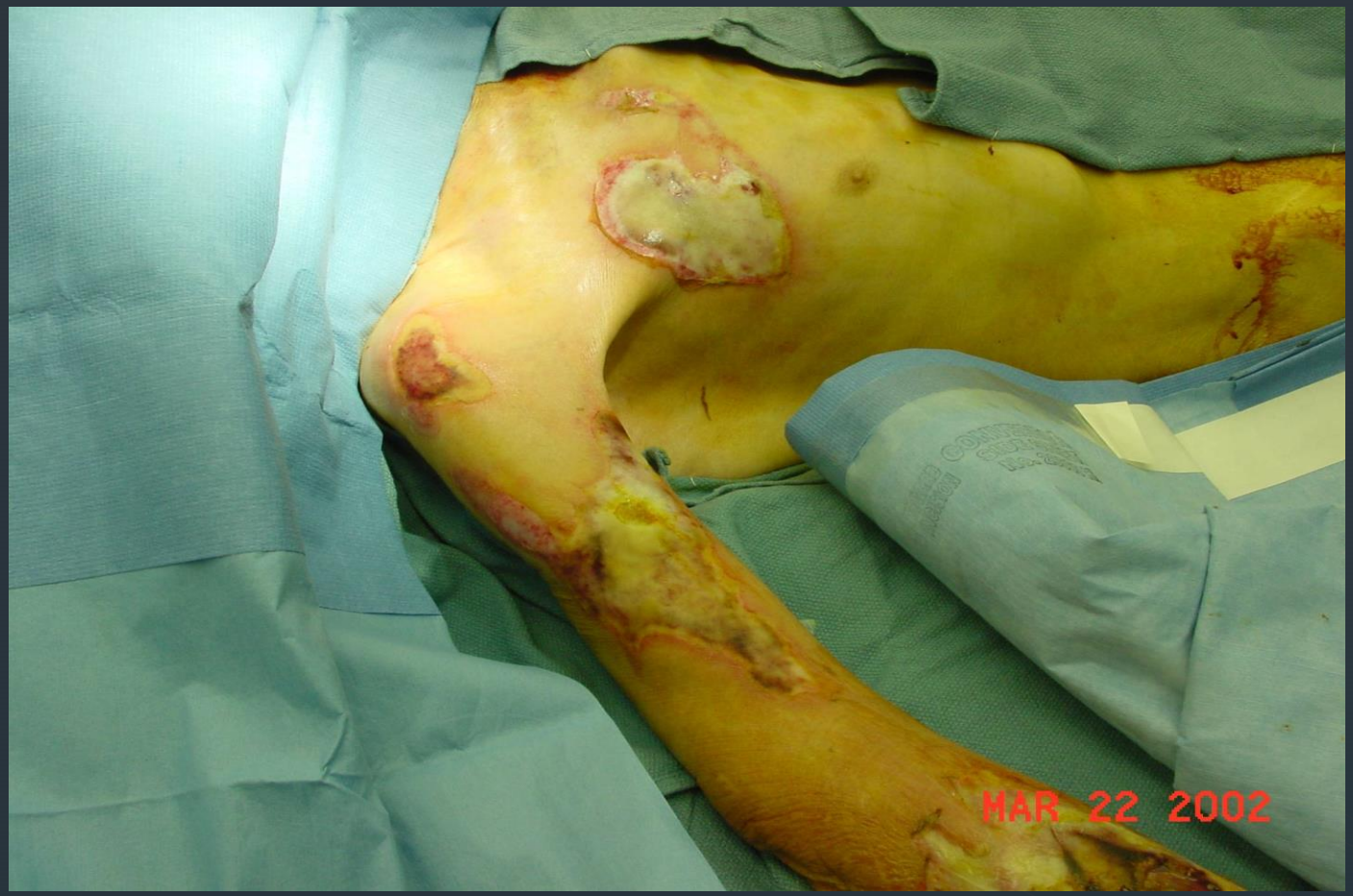
Deep Partial and Full Thickness



Deep Partial and Full Thickness

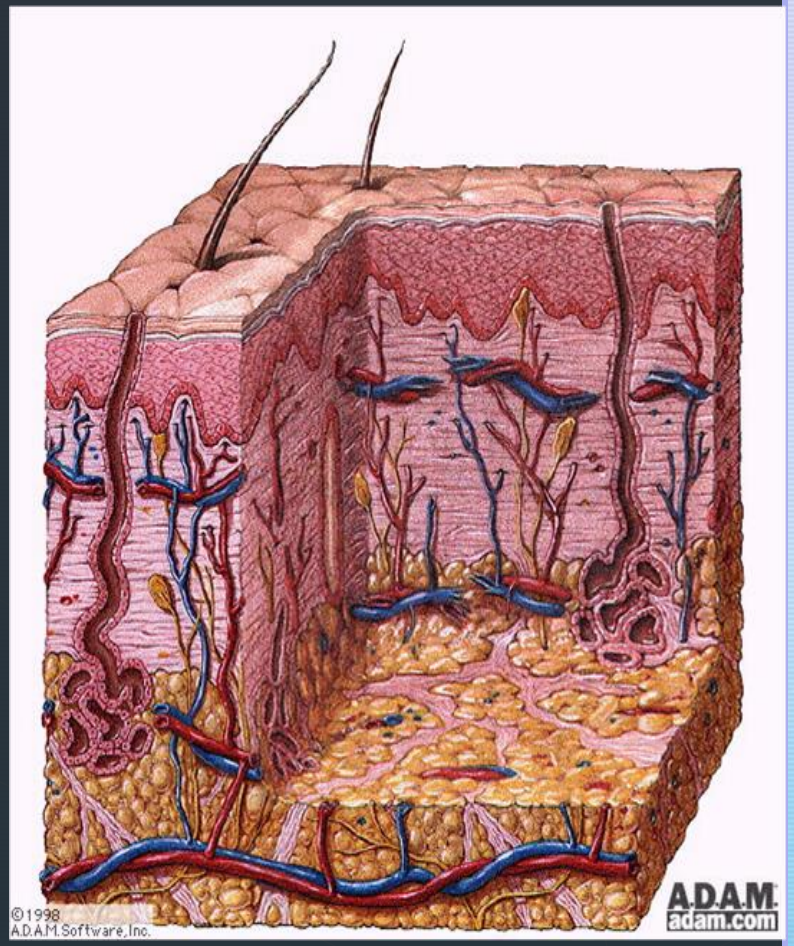
- Extend into the reticular dermis (deep dermal layer)
- Often intermixed with areas of third-degree burns
- Appears as a mixture of red (nonblanchable) and
- blanched white, can be dry or moist
- Hairs come out more easily
- Blisters thick, commonly ruptured
- May or may not be painful (if painful, then pain is
- extreme)
- May have decreased two point discrimination but pressure sensation intact
- Heals within 3-6 weeks
- Has increased potential for forming scars, e.g. contraction across joints is common

Full Thickness Burns



Full Thickness Burn

Involves the epidermis, the dermis and the underlying tissues including fat, fascia, and muscle



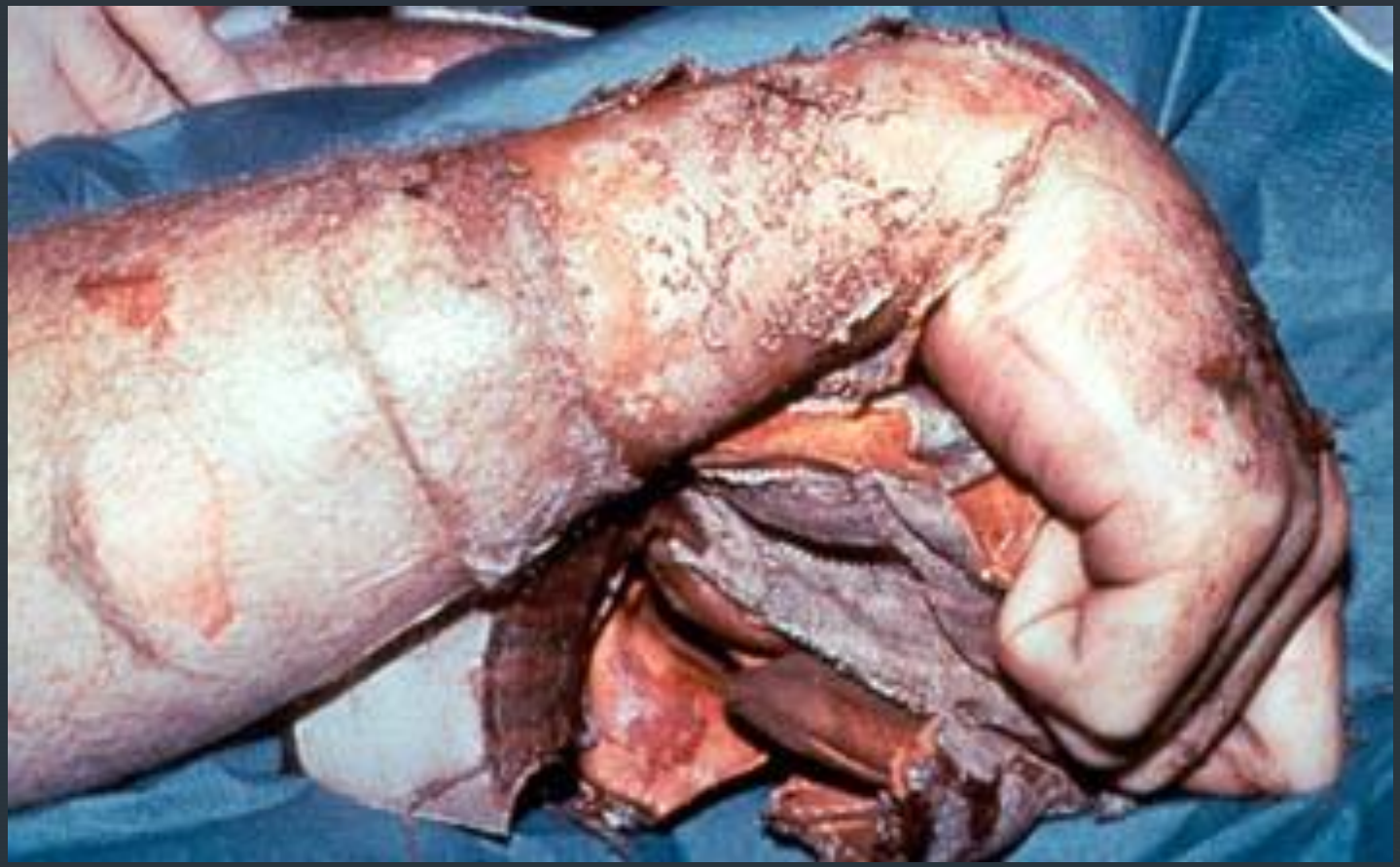
Full Thickness Burn

- Dermis capillary network totally destroyed (including sweat glands and hair follicles)
- Appear dry, white or leathery
- Tissue has no sensation
- Skin grafting always necessary to resurface the injured area (unless <1.0 cm in diameter – heals by contraction)

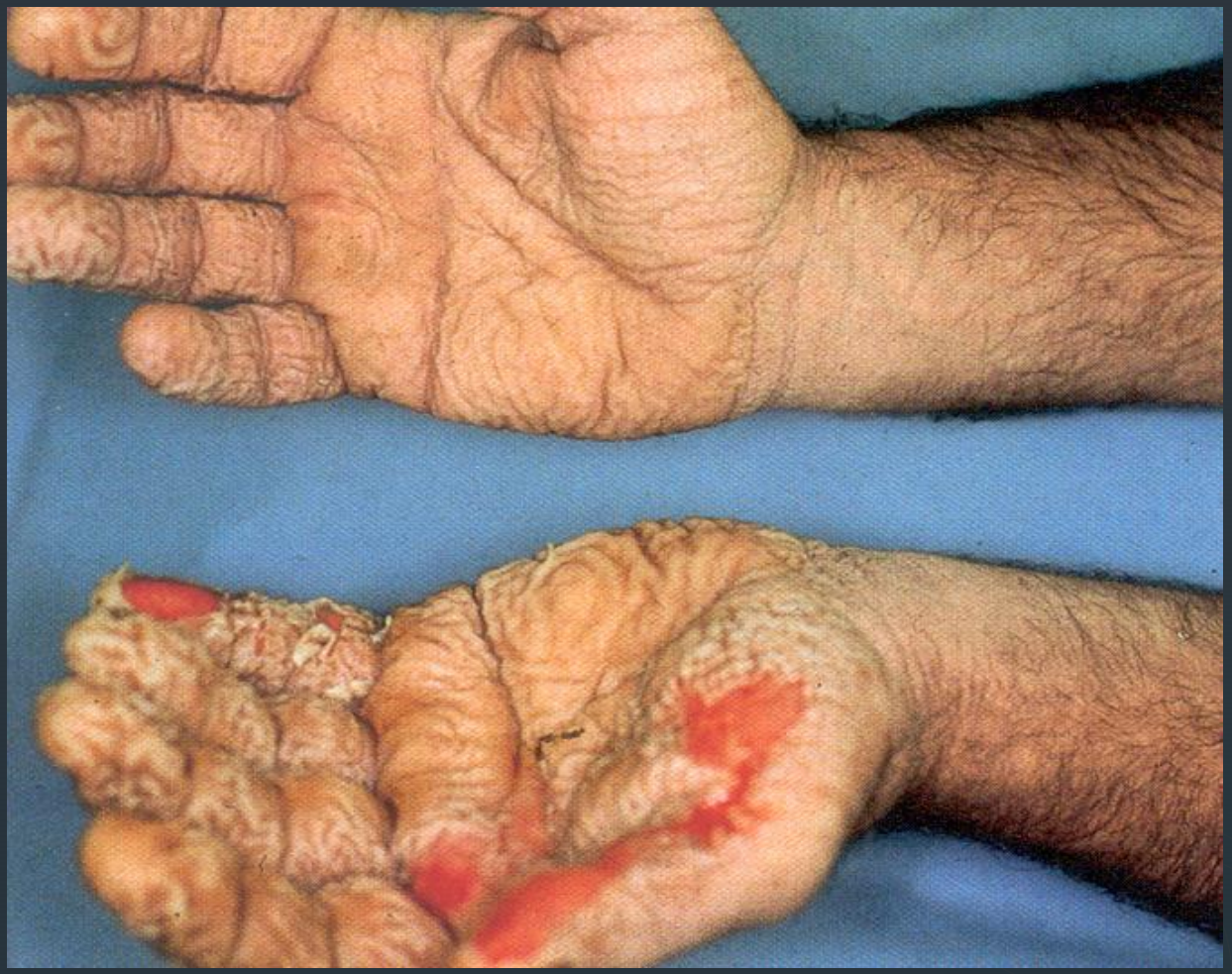
Chemical Burns

- Acids denature tissues by coagulation necrosis and cause protein precipitation Alkalis cause liquefaction necrosis
- Hydrofluoric acid – calcium gel topically; calcium gluconate IV
- Alkali burns usually are much more serious than acid burns
- Penetration is much greater than in acid burns and can induce progressive necrosis for several hours after contact

Alkali Burn



Acid Burn

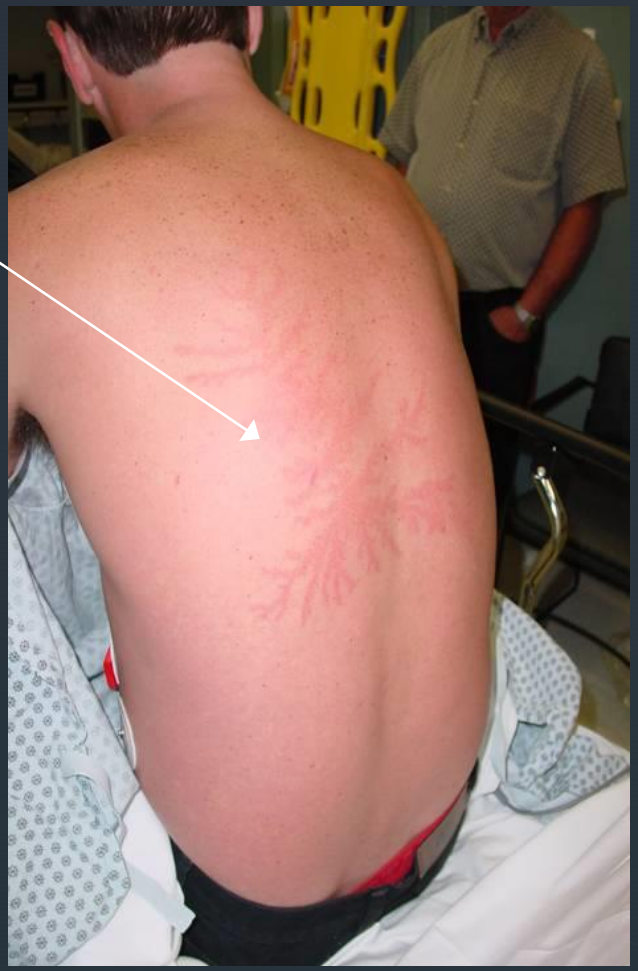


Electrical Injury

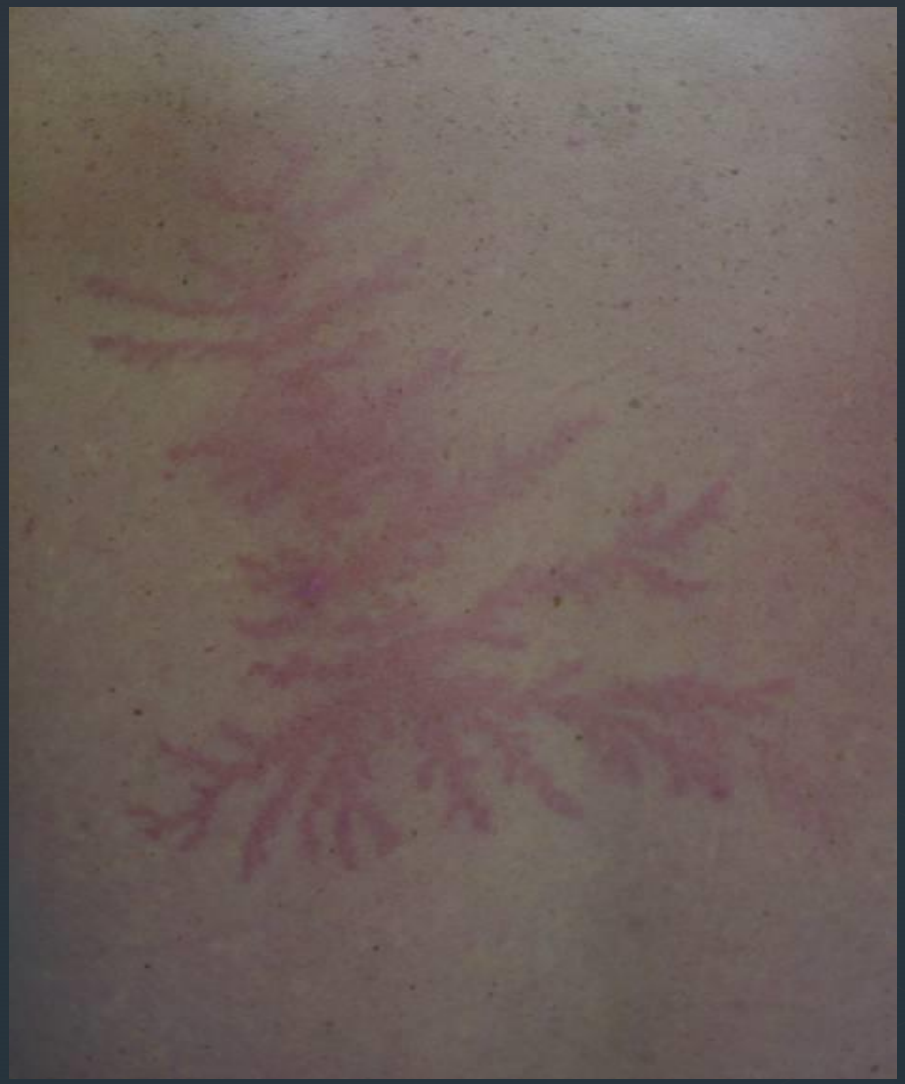
- Greater fluid resuscitation
  - Goal is 75cc/hour of urine output for an adult
  - Goal is 1-2cc/kg/hr in kids
- Burn size estimation is inaccurate
  - Greater burn inside, along path of least resistance
- Complications
  - Cardiac
  - Muscle loss

Lightning Injury

What is this?



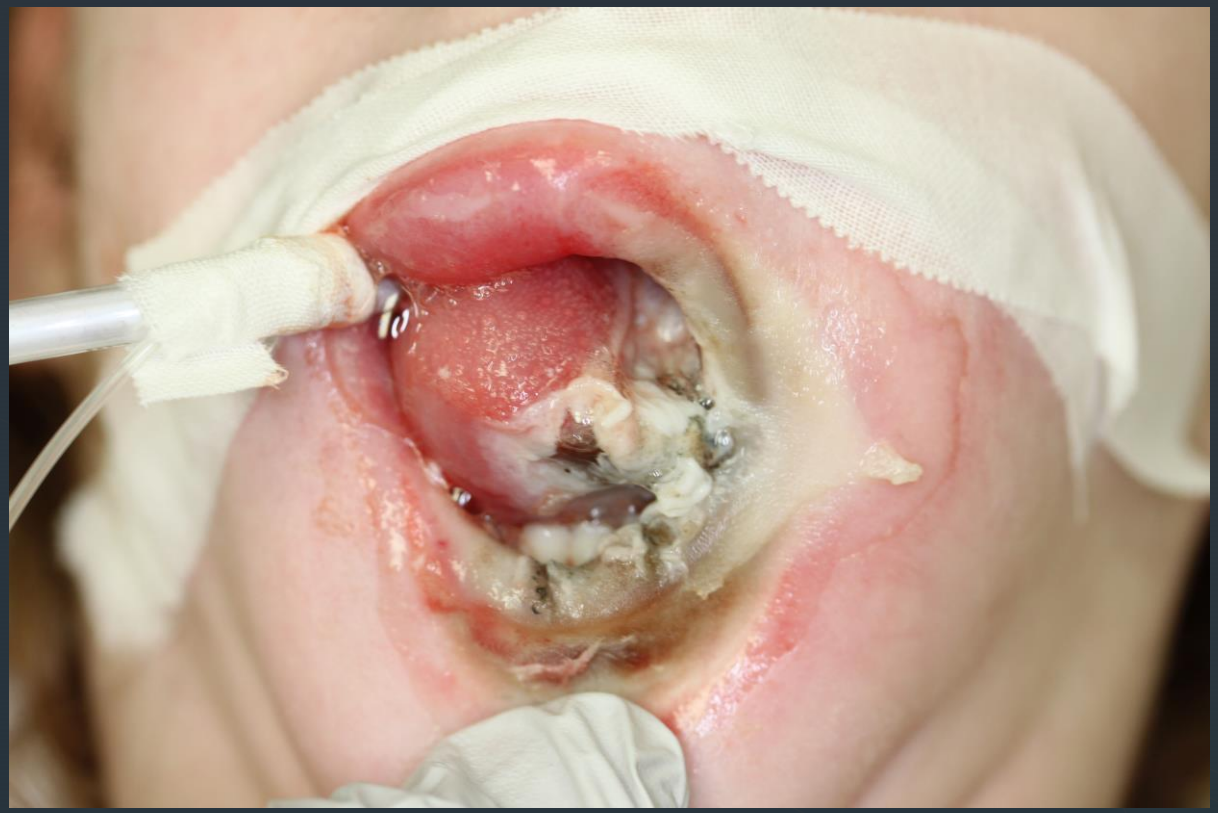
Ferning

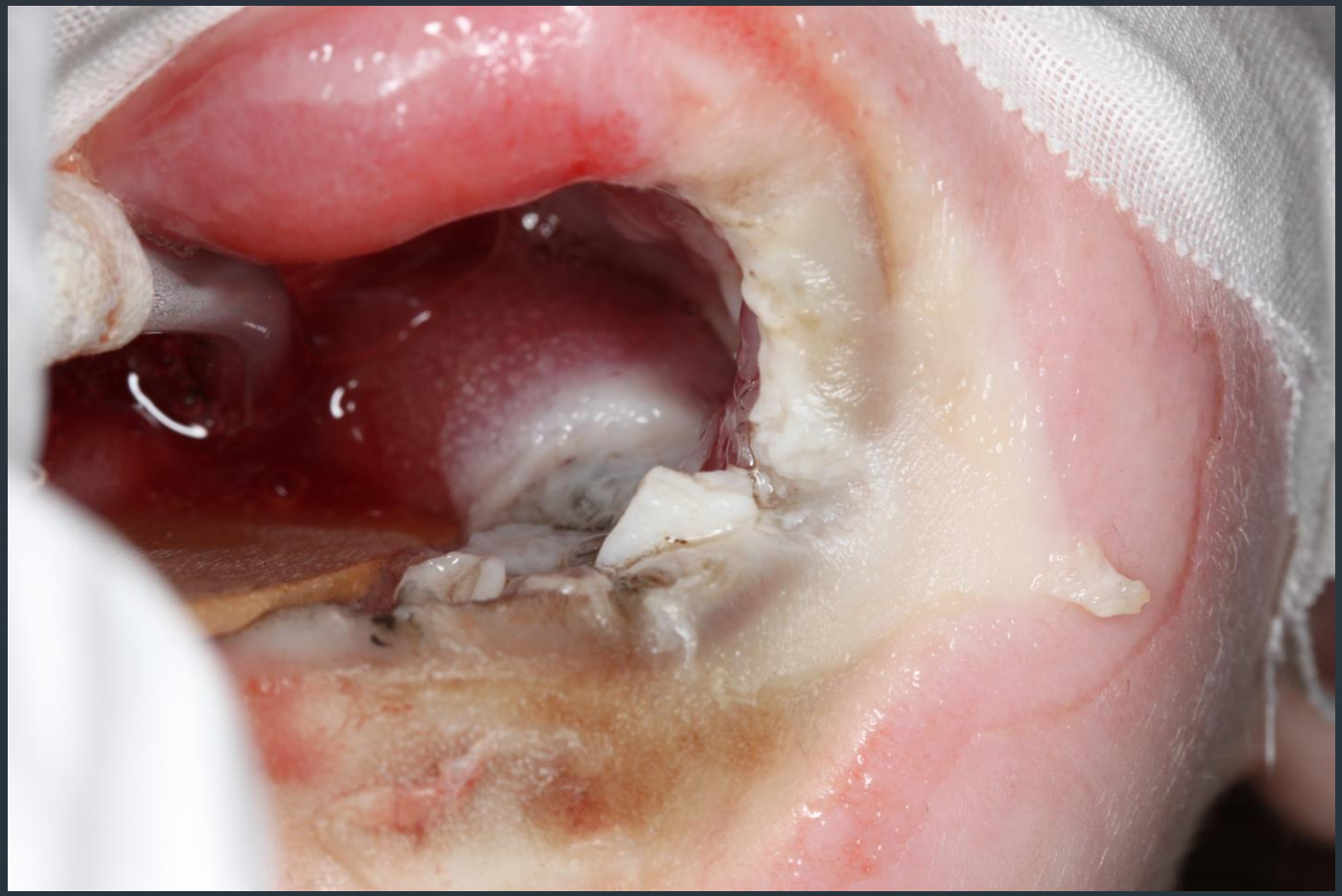


Electrical Cord Burn

- Heat generated may be greater than 1371°C (2500°F), resulting in severe destruction of the mouth and contiguous tissue.
- Edema subsides from 5-12 days after injury – then as devitalized tissue sloughs, bleeding from the labial artery may complicate its separation

Burn to mouth





Stabilization of the Burn Patient

- Safety first!
- ABC's
- 6 Vital Signs (HR, RR, o2 sat, temp, wt)
- Primary Survey
- Secondary Survey
- Remove jewelry and constricting clothing

Evaluation of the patient

- Is the patient safe to be around?
  - Don’t become another victim
  - Are there odors present?
- How did the patient become burned? Are there associated injuries?
- Remove the patient from the source of the burn
- ABCDE’s
- Consider trauma from the blast, etc.

Decontamination

- Chemical Burns:
  - Treat by removing any dry powder residue that is visible. Don’t want to activate powder with water.
  - Otherwise, flush with gross amounts of water for at LEAST 15 min.

- Thermal: Do NOT use cold water to “cool” the burn. This can enhance the depth of the injury.
  - **In kids, they can become hypothermic.**
- NEVER transport a burn patient with wet clothes or wet dressings.

- After properly decontaminating the patient,
  - A
  - B
  - C

Airway

- Inhalation burns may at first appear benign
  - Assess for obvious signs
    - Stridor
    - Hoarseness
    - Drooling
    - Gagging
    - Tripod position
    - Retractions
- – Potential signs – soot in nose, or mouth

Airway

- Humidified oxygen
- Consider racemic epi neb as you prepare to intubate

Airway

- In patients who have burns to the face and neck, intubate the patient.
  - BUT….do this in an environment where it is the safest for the patient.
  - Be sure not to cause further injury
  - Be prepared for the difficult airway – LMA, BVM
  - Pay attention to what you see when you intubate
    - Soot in the mouth, soot on the cords, swollen tissue, etc.

Airway

- The tube should be secured appropriately
  - In patients with burns to the face, an alternate means other than tape should be used such as umbilical ties

Breathing

- Inhalation injuries are one of the main causes of death in thermally injured patients
- It is difficult, but not impossible, to sustain an inhalation injury outdoors.
- Inhalation injuries are frequently chemical in nature due to inhaled partially combusted materials and toxins.

Breathing

- Toxic Smoke Compounds
  - Carbon Monoxide Poisoning
    - Treat all burn patients with high flow O2 throughout transfer to a burn center
  - Hydrogen Cyanide Toxicity
    - Can be seen in mobile home and industrial fires

Circulation

- Heart rate will most likely be elevated
- The strength of the pulses should be closely monitored in burned extremities

Fluid Therapy

- Maintenance fluids should be added on top of this and should include dextrose for kids (ex. D5 LR)
- Fluid boluses should be subtracted from the total
- Lactated Ringers is the preferred fluid choice

- For longer transports, this fluid calculation should be done prior to transport.

Initial fluids for patients with visibly large burns are based on patient age:

<6 years old : 125 ml Lactated Ringers (LR) per hour

6-13 years old: 250 ml LR per hour

>13 years old: 500 ml LR per hour

IManagement Principles and Adjuncts

Fluid Resuscitation The adjusted fluid rates are calculated according to the table below:

Category	Age and weight	Adjusted fluid rate
Flame or scald rate	< 30kg	**3** ml LR x kg x % TBSA Plus D5LR at maintenance
	≥30kg and <14 years old	**3** ml LR x kg x % TBSA
	≥ 14 years old	**2** ml LR x kg x % TBSA
Electrical Injury	All ages	**4** ml LR x kg x % TBSA Plus D5LR at maintenance rate for infants and young children*

Total above is for 24 hours: ½ given in first 8 hours; then ½ over 16 hours.
*Rule of 4-3-2 and is NOT adjusted for Urine output
Check the patient's urinary output and physiological response to decide further fluid titration.
>20% should have urinary catheter placed

Burn Assessment

- Rule of nines (Adults and > 10yoa)

  9% to head

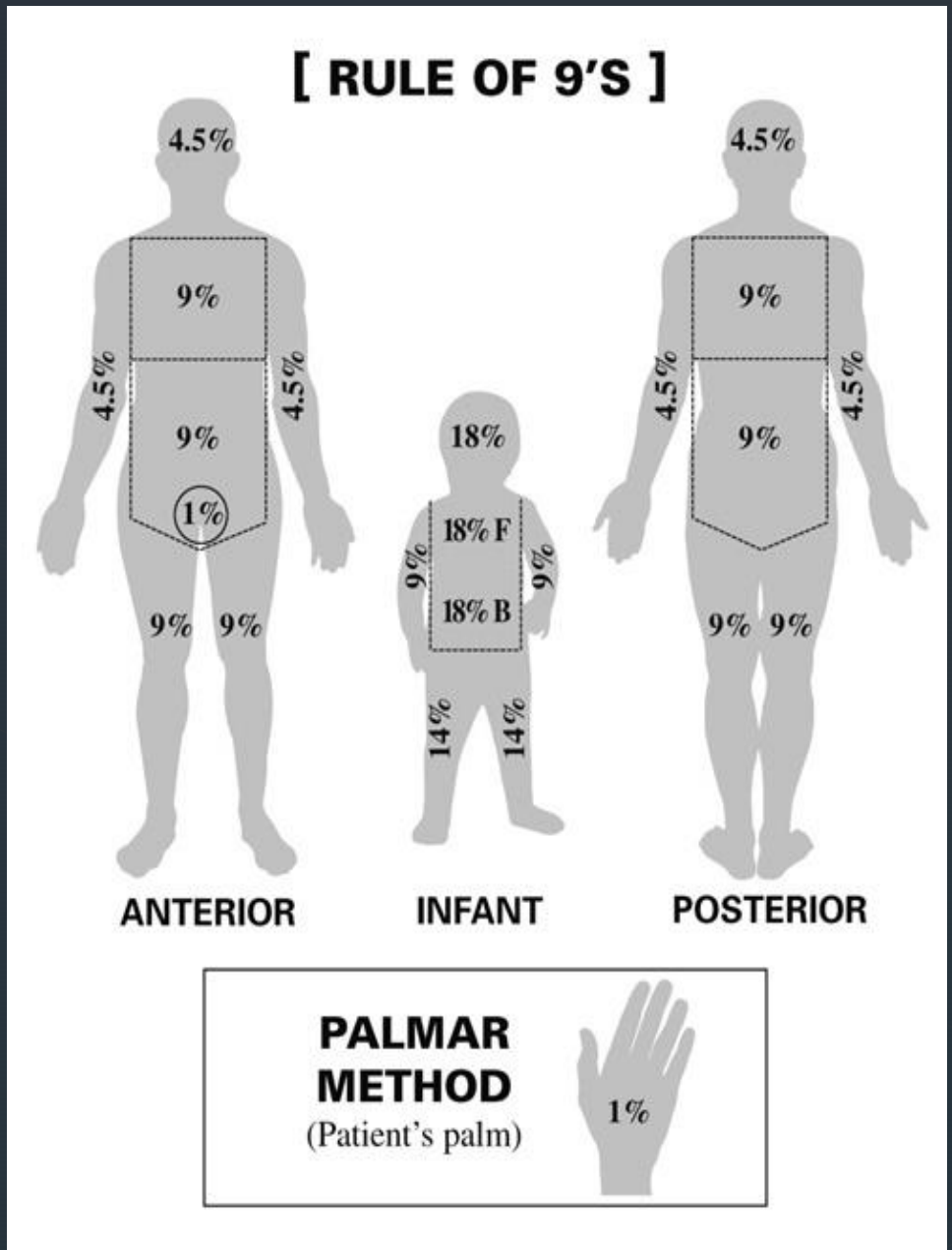
  9% to each upper extremity (arm)

  18% to anterior (front) and posterior (back) portions of trunk

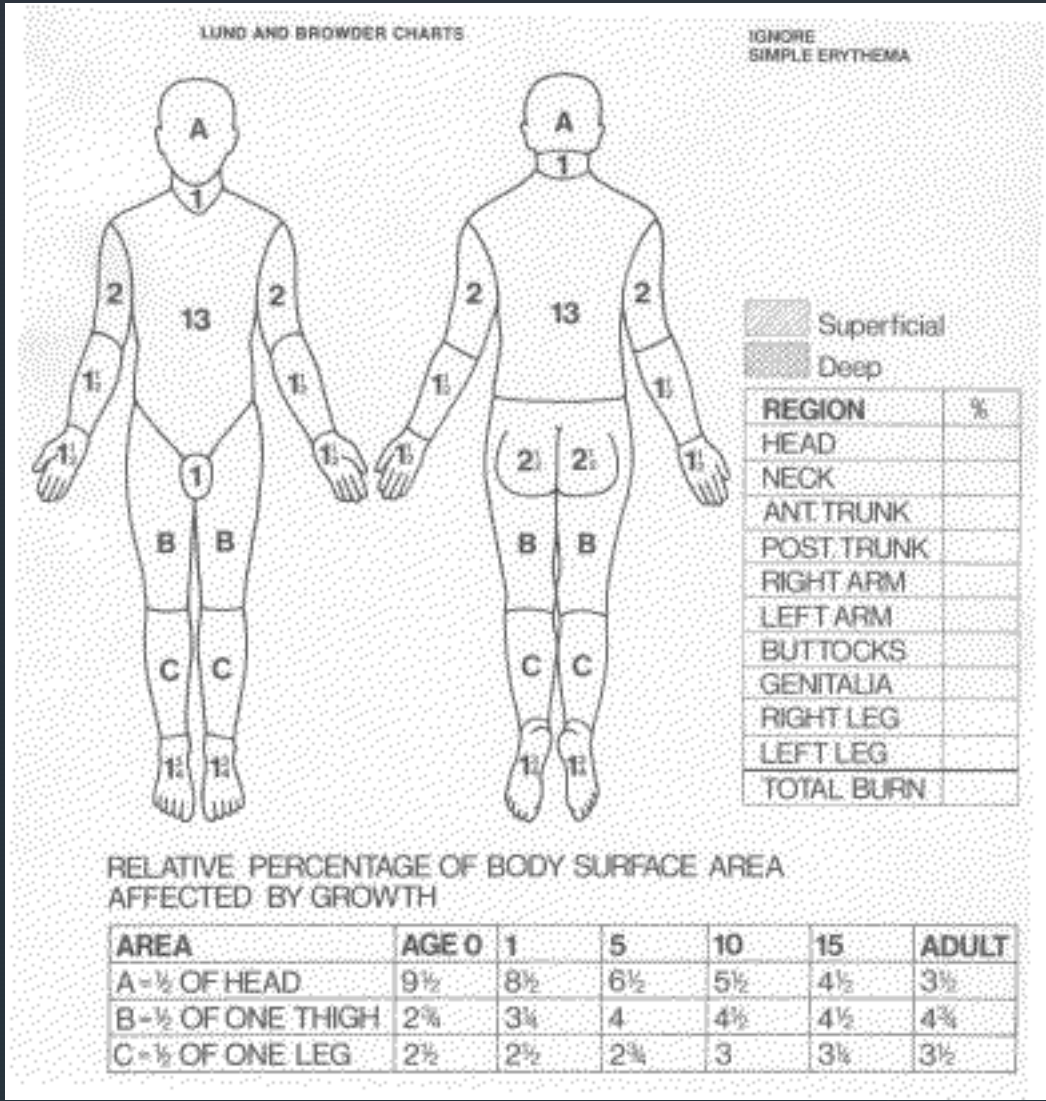
  18% to each lower extremity (leg)

  1% to perineum (groin)

Determining BSA



Lund and Browder – more accurate



REGION	%
HEAD	
NECK	
ANT. TRUNK	
POST. TRUNK	
RIGHT ARM	
LEFT ARM	
BUTTOCKS	
GENITALIA	
RIGHT LEG	
LEFT LEG	
TOTAL BURN	

RELATIVE PERCENTAGE OF BODY SURFACE AREA AFFECTED BY GROWTH

AREA	AGE 0	1	5	10	15	ADULT
A = ½ OF HEAD	9½	8½	6½	5½	4½	3½
B = ½ OF ONE THIGH	2¾	3¼	4	4½	4½	4¾
C = ½ OF ONE LEG	2½	2½	2¾	3	3¼	3½

Transfer of the Burn Patient

- Why transfer?
  - Burn patients require a lot of resources to care for them
  - Well trained teams prepared for involved course of treatment
- Where to transfer to?
  - Closest burn center is usual choice. Our surgeons want to take care of patient's with 50% TBSA burns or less. Call the on call surgeon to discuss transfer.

When to Transfer

- Partial thickness burns to 10 percent or more TBSA
- Burns involving the face, hands, feet, genitalia, perineum, or major joints
- Third degree burns in any age group
- Electric burns, including lightning injury
- Chemical burns
- Inhalation injury
- Burn injury in patients with preexisting medical disorders that could complicate management, prolong recovery, or affect mortality
- Burn injury with concomitant trauma

Criteria for Transfer to Burn Center – American Burn Assoc.

Who gets hospitalized

- 3rd degree burns greater than 5% TBSA
- 2nd or 3rd degree burns greater than 10% TBSA in patients younger than 10yrs
- 2nd or 3rd degree burns greater than 20% TBSA
- 2nd or 3rd degree burns that involve the face, hands, feet, genitalia, perineum, or major joints

Who Gets Hospitalized

- 2nd or 3rd degree burns that involve the eyes or ears
- Inhalational injury
- Electrical burns, including lightening
- Chemical burns
- Burn injury in patients with preexisting medical disorders that could complicate management, prolong recovery, or affect mortality
- Burn injury with concomitant trauma

Preparing the Wounds

- Clean, DRY dressings should be applied to all burn wounds prior to transport
  - Don’t worry about the bandages sticking to the wounds
- Not necessary to debride wound prior to transport
- Do not apply antimicrobials to wounds
- Keep the patient warm

Care of Wounds Here

- For small wounds that don’t need the Burn team immediately:
  - Take down the blisters
  - Apply Bacitracin and cover the wound
    - Bacitracin is easy to get off the next day and doesn’t form a pseudoeschar like silvadene does
  - Follow up with Burn in 1-2 days

Pain

- Treat pain generously.
  - Morphine
  - Fentanyl – IV or IN
  - Ketamine
  - Versed
- If you cannot safely treat the pain without airway compromise, intubate the patient and control their pain.

Summary

- Pediatric Burns are common: Be prepared
- Remember your ABCs after you decontaminate the patient
- Evaluate burn depth and % TBSA involved
- Pain control and fluid resuscitation very important
- When in doubt call Wolfson Peds ED or General surgery for advice.

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