Management of Burn Wounds

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Management of Burn Wounds

• History of Burn Care
• Pathophysiology of Burn
• Acute burn care resuscitation
• Acute burn wound care

History of burn care

• Ebers papyrus: 1500 B.C.
  – Describes a 5 day treatment regimen
  • Mixture of cattle dung, bees wax, ram’s horn, barley porridge soaked in resin dressing and black mud was “just want the doctor ordered” for burn wound

History of burn care

• Hippocrates: 500 B.C.
  – Advised the application of melted skin of swine mixed with a resin of bitumen

History of burn care

• Hong Ge – AD 300
  – Described burn as an external disease
  – Treatment of topical ointment to reduce wound infection:
    • old calcarea blended with plant oil
    • pig fat cooked with willow bark

History of burn care

• Roman Empire: mid-16th Century
  – Paracelsus, a botanist
  • Use salve of fat from wild hogs and bears soaked in red wine, with roasted earthworms, and moss that grew on the skull of a dead man
• Renaissance physicians
  – Applied boiling hot oil for acute management of burn wounds
History of burn care

• Fabricius Hildanus – 15th century German physician
  – Classify burns into 3 degrees

• Dupuytren – 19th century French surgeon
  – “Burns had been the object of one of the most bizarre treatment methods.”

History of burn care

• WWII – Consensus reached
  – Best management of deep burn wounds include:
    • excision
    • skin transplantation
    • pain management

History of burn care

• 1950’s [Korean War]
  – Establishment of the ISR at BAMC
  – Skin graft for management of burns >30% TBSA
  – Burn mortality has decreased as a result of:
    • Early excision and grafting
    • Control of sepsis
    • Advances in ventilator management
    • Advances in nutritional support
    • Wound care adjuncts

Pathophysiology of burn

SKIN
  – Largest organ in the body
  – Barrier
    • External: pathogens
    • Internal: prevents loss of water, protein, electrolytes
  – Burns
    • 40-50,000 admission per year in the US
    • 80% of these are candidates for outpatient treatment

Pathophysiology of burn

Extent of Burn injury
  – Zones of tissue damage

Pathophysiology of burn

Zones of Injury
  – Zone of Coagulation
    • Irreversibly damaged tissue
Pathophysiology of burn

Zones of Injury
- Zone of Coagulation
- Zone of Stasis
  - Moderately injured tissue
  - Vasoconstriction
  - Tenuous zone
  - Necrosis vs. viability depends on resuscitation

Pathophysiology of burn

Zones of Injury
- Zone of Coagulation
- Zone of Stasis
- Zone of Hyperemia
  - Viable but inflamed tissue

Pathophysiology of burn

First degree burn
- Equivalent to sunburns
- Thermal injury limited to the epidermis
- All dermal appendages are intact
- Skin:
  - Erythematous
  - Painful
  - Blanches with touch, no blistering

Pathophysiology of burn

First degree burn
- Treatment
  - Moisture cream
  - NSAIDS/Tylenol for pain
- Prognosis
  - Skin regeneration within a few days
  - Damaged epidermal layer desiccates and sloughs off
Pathophysiology of burn

Second degree burn
- Thermal injury of the epidermis and dermis
- Two classifications
  - Superficial
  - Deep
- Depth of injury is important for treatment and prognosis

Pathophysiology of burn

Superficial partial thickness burn
- Characteristics
  - Erythematous
  - Moist
  - Blanches with touch
  - Blisters
  - PAINFUL
    - Intact dermal appendages
    - Intact sensory nerve endings

Pathophysiology of burn

Superficial partial thickness burns
- Zone of injury can extend to the area of stasis
  - Resuscitation with fluids
  - Wound care
    - Moist antimicrobial environment
  - Re-epithelialization [14 days]
    - Rete ridges
    - Hair follicles
    - Sweat glands
Pathophysiology of burn

Superficial partial thickness burns
- Discoloration
- Scarring

Deep partial thickness burns
- Extends to the deep dermal layer
- "Spontaneous healing" possible
- Problems:
  - Higher rate of conversion to full thickness burns
  - Develop infection
  - Form contracture

Deep partial thickness burns with conversion
Pathophysiology of burn

Full thickness burns [3rd degree]
- Spontaneous healing
  - Wound contracture from non-burned edges
- Mainstay of therapy
  - Early excision and grafting

Pathophysiology of burn

- Full thickness burns [3rd degree]
  - Epidermal and dermal destruction
  - Needs early excision and grafting
  - Skin
    - Insensate
    - Leathery
    - Dry
    - No tissue edema
Pathophysiology of burn

Circumferential burns
- Burn wound involves the entire
  - Chest wall
  - Arm/leg
  - Abdomen
- Tissue edema develops under constrictive skin
  - Decrease perfusion
    - Increasing pressure + ischemia → limb loss

Pathophysiology of burn

Circumferential burns: Compartment syndrome
- Thorax
  - Increasing peak airway pressures
  - Decrease chest wall compliance
    - Inability to ventilate and oxygenate
  - Rx: escharotomy

Pathophysiology of burn

Circumferential burns: Compartment syndrome
- Extremities
  - Pain out of proportion with injury
  - Parenthesis
  - Paralysis
  - Pale extremities
  - Pulse-less exam
**Epidemiology**

- **MOST COMMON out-patient burns**
  - Non-intentional scalding burn
  - Most are preventable [woman and children]
  - Between 1985-2009: mortality decreases over time
    - Burn size and age are most important determinants

- **Socioeconomics**
  - Admission for burns increase with decreasing socioeconomic status
    - Highest risk are children in households without a separate kitchen, kitchen without doors, or uses kerosene lamps

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**Acute burn resuscitation**

Four periods of treatment

- **Emergent**
  - Field triage
  - Begin resuscitation
  - Transport to definitive care

- **Acute**
  - Resuscitation
  - Determine burn depth after initial debridement
  - Coverage plan
  - Pain control
  - Nutrition

- **Chronic**
  - Wound care
  - Physical therapy

- **Rehabilitation**
  - Physical therapy
  - Psychosocial management

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**Acute burn resuscitation**

- **Airway**
- **Breathing**
- **Circulation**
- **Disability**
- **Exposure**

**Burn Assessment**

- How the burn occurred
- Size and depth of burn
- TBSA
- Mechanism of injury
  - Is the burn >15% TBSA partial thickness?
    - Fluid resuscitation should begin
    - Go to a burn center
Acute burn resuscitation

Accurate assessment of % TBSA

- Needs LR resuscitation if >15% TBSA partial thickness burn
  - Parkland formula: \([4 \text{ml}] \times [\text{Kg}] \times [\%\text{TBSA}]\)
  - Brooke’s: \([2 \text{ml}] \times [\text{Kg}] \times [\%\text{TBSA}]\)
  - Replace ½ over first 8 hours
  - Starts from the time of injury
  - Next ½ over the next 16 hours

Fluid resuscitation

- Resuscitation goals:
  - HR [normal range for age]
  - UOP 0.5 to 1 ml/kg/hr
  - Temp > 37F

The first 24-48 hours

- Extent of injury may not be clear
  - Inadequate fluid resuscitation may hinder healing
  - Acute infection will delay healing

Criteria for transport to Burn center

- Partial thickness burn >10% TBSA
- Face, hands, feet, genitalia, major joints
- Full thickness burn of any age
- Electrical burns
- Chemical burns
- Inhalation injury

- Patient with multiple pre-existing medical problems + burn of any size
- Burn + Trauma
- Burn + Child
- Burn + Elderly
- Burn in patients with special needs
Acute burn wound care

Access the depth of the burn

SKIN LAYERS
- Epidermis
- Dermis
- Subcutaneous fat
- Muscle
- Nerve ending
- Hair follicle
- Sweat gland

BURN DEPTHS
- First Degree
- Second Degree
- Partial
- Deep
- Third Degree

Acute burn wound care

Cover the clean wound in bacitracin and telfa

Acute burn wound care

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Acute burn wound care

Acute burn wound care

Acute burn wound care
Acute burn wound care

Is this a wound that will require operative management?

YES
Full thickness burns

Don’t know

NO
First degree burns

Acute burn wound care

• Pigment management

• Risk of hypertrophic scarring
  – Healing time
    • 14-21 days: ~30% risk
    • >21 days: ~70%

• Pain management

Chronic burn wound care

• Occupational therapy

• Physical therapy

• Hypertrophic scar management

• Psychosocial trauma

Questions?

References

• ABLS
• Trauma. Mattos et al. 5th edition.
• Cuttle et al. The optimal duration and delay of first aid treatment for deep partial thickness burn injuries. Burns 2010; 36(3) 389-96.
• Mistry et al. Socioeconomic deprivation and burns. Burns 2010; 36(3):403-8