Resuscitation and Wound Management of the Pediatric Burn Patient

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Verified Burn Center by the American Burn Association and the American College of Surgeons
Disclosure

No Financial Conflicts of Interest
Objectives

Burn Assessment
- Source, size, depth

Burn Treatment
- Burn Resuscitation (>20% TBSA Burns)
- Burn Management (including chemical burns, tar burns, electrical injury)
- Treatment Options
Burn Sources

Sources of Burns

- Hot liquids
- Contact
- Flame
- Radiant
- Cold injury
- Chemical
- Electrical
Burn Assessment

Initial Assessment

- Complete Primary and Secondary survey

_Determine:_

- How large (% TBSA) is the burn?
- How deep is the burn?
- How did the burn occur?
- When did the burn occur?
- What, if any, initial treatment was used?
- Pattern of burns- does it match story?
Burn Assessment

Threats To Survival

- Inhalation injury
  - Thermal or Chemical burn to airway
  - CO, Cyanide
- Eschar to trunk can reduce chest wall compliance
- Eschar to limb can cause reduced blood flow to distal limb, acting like a tourniquet
- Shock
  - Loss of volume, shifted volume, infection
Burn Assessment

Concerning Burn Patterns

Stocking and Glove Pattern

Dip Line
Burn Assessment

Ways to Assess Burn Size

**Rule of Nines Diagram**
- Way to quickly estimate burn size

**Rule Of Palms**
- 1% TBSA = patient's palm w/ fingers
- Estimate small, scattered burns

**Lund-Browder Diagram**
- Gold standard for most accurate estimation of burn size
Burn Assessment

Rule of Nines Diagram

Child
Burn Assessment

Rule of Palms

The Patient's Palm Represents 1% of his or her body surface.
**Burn Assessment**

**Lund-Browder Diagram**

<table>
<thead>
<tr>
<th>Body Part</th>
<th>Birth-1</th>
<th>1.5 yr</th>
<th>3.5 yr</th>
<th>10-14 yr</th>
<th>15 yr</th>
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**Table Totals**

<table>
<thead>
<tr>
<th>Subtotals</th>
<th>Total TBSA</th>
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</table>

**Diagram Notes**

- Name: 
- Date: 
- Age: 
- Height: 
- Weight: 
- Admission: 
- Operation: 
- Grafting: 
- Post op: 
- % take: 
- TBSA: 
- Final Version: 

*Adapted from: Heming, D. Total Burn Care, Guideline Index. Royal Children's Hospital, Melbourne, AU.*
Burn Depth
Burn Depth

Classification

1\textsuperscript{st} Degree (not counted in %TBSA)
- Pink, tender, no blistering or open wound

2\textsuperscript{nd} Degree (partial thickness- superficial to deep)
- Blistering
  - Superficial is pink to red, wet, tender
  - Deep is red to pale in color, wet, dulled sensation

3\textsuperscript{rd} Degree (full thickness)
- Dry, stiff, non-tender
- White, non-blanching, leathery feel
Burn Depth

First Degree Burn
Burn Depth

Second Degree Burn
Burn Depth

Third Degree Burn
Burn Treatment

Initial Management

- High flow O2 if suspected inhalation injury
- Do not apply ice or wet dressings to burn area
- Elevate affected extremities to reduce swelling
- Do not bolus fluids unless hypotensive
- If >20% TBSA, keep room 90°F, use Burn Precautions
- Consider Baseline labs, CO, Cyanide (if appropriate)
- EKG if suspected electrical injury
Burn Treatment

Burn Resuscitation (>20% TBSA Burn)

- In first 24 hours major factors are tissue edema and intravascular hypovolemia (especially in first 8-12 hours)
- Maintenance of end organ perfusion, *not* rapid achievement of normovolemia, is the goal of burn resuscitation

**Formula:** Ringer’s Lactate- 2cc/kg/% TBSA in 24 hours (half of which in first 8 hours) NO BOLUS
(and keep in mind any boluses given pre-hospital)
Burn Treatment

Chemical Burns

Acids/Bases
- First step is to remove offending agent such as affected clothing, brush off any powder, etc.
- Next flush skin with water at least 30 minutes, and if Alkali, up to 1-2 hours to obtain skin pH of 7
- Hydrofluoric Acid burns are a special case: Treat with calcium gluconate gel to prevent hypocalcemia
Burn Treatment

Tar Burns

- If tar is cool, saturate with mineral oil to loosen tar to remove. Do not attempt to simply pull off tar as can cause additional injury.
- If it is a hand, place in nitrile glove filled with mineral oil to soak tar off.
Burn Treatment

Electrical Injury

Electric Injury

Cardiac dysrhythmia, abnormal EKG, electrical current pathway through thorax, inhalation injury or other respiratory distress

- YES → TICU admission
  - Telemetry monitoring
  - Serial physical exam*
  - Monitor urine output
  - EKG

- NO

Prolonged exposure, Lightning strike, Pregnancy, Significant associated blunt injury

- YES → TICU admission
  - As above
  - If pregnant, OB/GYN consult and fetal monitoring if viable pregnancy, (> 20 weeks)

- NO

Abnormality found on physical exam, burns or tissue damage, confusion or change in mental status, loss of consciousness

- YES → Telemetry admission
  - Serial examinations

- NO

Asymptomatic, no loss of consciousness, injury involves ≤ 240 volts, normal physical exam

- YES → EKG
  - Telemetry monitoring x 4 hours
  - Repeat physical and EKG prior to discharge

*Serial examination must include foley catheter, strict I & O, urine myoglobin, serial physical examination q3-4 hours, examination of muscle compartments, neurovascular checks, ophthalmology consultation
Burn Treatment

Treatment Pearls

- Burns CAN be washed—shower or bath daily with gentle soap and water
- Do not splint burn—patient should MOVE to minimize loss of function
- Burns to lower extremities may throb when walking—may use ace wrap from toes up leg to provide gentle compression and reduce swelling

(caution in infants as difficult for patient to express ace wrap is too tight)
Burn Treatment

Topicals:

- Silvadene
- Sulfamylon Cream
- Silver Dressings (Acticoat, Aquacel Ag, Mepilex Ag)
- Bacitracin
- Bacitracin Ophthalmic
- Xeroform
Burn Treatment

Sulfa Based- with Silver
*(Silvadene Cream)*

- Broad spectrum of activity
- Usually painless to apply
- Possible silver staining - never use on face
- 2nd degree burns (or 3rd degree burns when alternating with Sulfamylon Cream Q12 hours)
Burn Treatment

Sulfa Based- Mafenide Cream  
(*Sulfamylon 8.5% Cream*)

- Penetrates burn eschar and ear cartilage well
- Can cause transient burning pain
- Potential for metabolic acidosis (Large doses)
- Alternate with Silvadene for large burns Q12 hours
- Used for Deep 2\textsuperscript{nd} and 3\textsuperscript{rd} degree burns and burns of the ear
Burn Treatment

Bacitracin

• Safe for all ages
• Apply to face 3 times a day and prn
• Do not dress face burns
• Use opthalmic bacitracin near the eye area or forehead. Bacitracin zinc into eye may cause irritation
Burn Treatment

Silver Dressings (Acticoat-3, Acticoat-7)

- Silver-coated polyethylene mesh with nanocrystalline silver
- Absorbs exudate, releases silver
- Advantages
  - Lasts 3 to 7 days without dressing changes
- Disadvantages
  - Must be kept moist with sterile water
  - Can be painful/sting when dampened
  - Not MRI compatible
Burn Treatment

Silver Dressings (Aquacel Ag)

- Ionic silver in a hydrofiber base
- Absorbs exudate, releases silver

**Advantages**
- Lasts 7 days without dressing changes
- Relatively pain free
- MRI compatible

**Disadvantages**
- Forms hard “Shell” when dries, can limit mobility
- Shrinks, which can expose edges of burn
Burn Treatment

Silver Dressings (Mepilex Ag)

- Sustained release silver impregnated polyurethane foam dressing with silicone layer
- Absorbs exudate, releases silver

**Advantages**
- Lasts 7 days without dressing changes
- Relatively pain free
- Does not shrink
- Can be used over joints

**Disadvantages**
- Not MRI compatible
Burn Treatment

Silver Gel (Silvasorb)

- Ionic silver in an amorphous hydrogel
- **Advantages**
  - Apply only once daily
  - Appropriate as alternative to Silvadene in a sulfa allergic patient
- **Disadvantages**
  - Not MRI compatible
Burn Treatment

Xeroform

- Donor site/Graft site
  - Petroleum impregnated gauze with 3% Bismuth tribromophenate (small bacteriostatic effect)
  - Protective dressing to donor site and graft
Summary

• **Burn Assessment**
  • Source, size, depth

• **Burn Treatment**
  • Burn Resuscitation (>20%TBSA Burns)
  • Burn Management
  • Topical Dressing Options
Resources


UptoDate. “Local treatment of burns: Topical antimicrobial agents and dressings”

Rhode Island Burn Center at Rhode Island Hospital Burn Manual 2012.
Questions?