PEDIATRIC BURNS: BEWARE OF THE CUP O’ NOODLE

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CLINICAL CONTEXT
Case 1

- ID: 1 year old boy, with no significant PMHx, presenting with a burn and blistering of the right hand.
- HPI: Mother reports putting some boiling hot water in a cup of noodle Styrofoam container for the patient’s older sister at the dinner table. His sister got up from the table to grab a fork. While she was gone, the patient who was sitting next to her in a hook on high chair, tries to grab the container which then tips over and spills on his hand. The mother immediately heard his screams, picked him up, and brought him to the sink to run cold water over his hand for 5 minutes. His grandmother was present and put some unknown cream on the hand. They then placed an ice pack on it and wrapped it with a towel. They brought him here immediately after that.
History

- PMHx: ex-40 weeker via NSVD, delayed hepatitis B immunization at birth and did not get his flu shot this year but otherwise is UTD
- Medications: None
- Allergies NKA
- Development: Last WCC was 1 month ago and no developmental concerns reported
Objective

Vitals

T: 37°C
HR: 150
RR: 30
BP: 110/70
Sat: 100% on RA
Weight: 12 kg
BMI %-tile: 90.5th
**Physical Exam**

General: alert, crying but consolable in mother’s arms and when given a candy

Oral cavity: lips, mucosa, and tongue normal; teeth and gums normal

Eyes: sclerae white, pupils equal and reactive, red reflex normal bilaterally

Ears: ears grossly normal w/o obvious deformities

Neck: supple, no adenopathy, and no masses

Lungs: clear to auscultation bilaterally

Heart: RRR, S1, S2 normal, no m/r/g/c

Abdomen: soft, non-tender; BS+; no masses, no organomegaly

Neuro/Extremities: limited flexion of his fingers 2/2 tenderness and blistering but otherwise no focal findings and reflexes normal and symmetric, sensation intact

Skin: ~10mm erythematous splash marks on his legs predominantly on
Pediatric Burns

United States

- 300 children are seen in the ED each day with a burn-related injury
- Account for 16% of pediatric admissions
- 2/3 of these children die

Globally

- 265,000 deaths related to burns worldwide per year
Pediatric Burns

**Risk Factors**

• #1 most common type of burn in children under 5  
• Regional differences exist with burn risk correlating with SES  
• Most common areas: domestic kitchens, bathrooms, and outdoor areas
Types of Burns

- Electrical
- Chemical
- Contact
  - Tar injury

- Non-burns
  - Toxic epidermal necrolysis
  - SSSS
  - Purpura Fulminans
  - Crush injury
  - Frostbite
  - Tissue infections
Burn Centers in North America

United States Burn Centers

*There are approximately 65 additional burn centers throughout North America that are not American Burn Association verified.*
Figure 1. Representative pictures of the shapes of the soup containers and the angle that was required for the container to “tip over” on to its side.
Categorization

[Diagram showing different layers of skin with categorization for burns: 1st degree, superficial degree, 2nd degree, deep degree, and 3rd degree.]

EPIDERMIS

DERMIS

HYPODERMIS

MUSCLES
New Categorization

**Superficial thickness (first degree)**
- Painful
- Does not blister
- Does not scar
- Blisters and weeps
- With increasing depth, increased risk of infection
- With increasing depth, increased risk of scarring

**Partial or intermediate thickness (second degree)**
- Superficial partial thickness burns do not require surgery, but may scar and be more painful

**Full thickness (third degree)**
- Deep partial thickness burns require surgery and form more scars and are less painful
- Dry
- Insensate to light touch and pin prick
- Small areas will heal with substantial scar or contracture
- Large areas require skin grafting
- High risk of infection
Outpatient vs Inpatient Management

- Use the categorization to help determine Total Body Surface Area (BSA) involved
  - Only using areas that are partial thickness and deeper
- Calculate BSA by using the "rule of palm" = 1%
- Burns involving >15% of BSA should be immediately referred to a burn center
- Special consideration:
  - Particular areas of the body (face, hands, genitalia, or over joints)
  - Circumferential
Relative percentage of body surface area (% BSA) affected by growth

<table>
<thead>
<tr>
<th>Body Part</th>
<th>0 yr</th>
<th>1 yr</th>
<th>5 yr</th>
<th>10 yr</th>
<th>15 yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>a = 1/2 of head</td>
<td>9 1/2</td>
<td>8 1/2</td>
<td>6 1/2</td>
<td>5 1/2</td>
<td>4 1/2</td>
</tr>
<tr>
<td>b = 1/2 of 1 thigh</td>
<td>2 3/4</td>
<td>3 1/4</td>
<td>4</td>
<td>4 1/4</td>
<td>4 1/2</td>
</tr>
<tr>
<td>c = 1/2 of 1 lower leg</td>
<td>2 1/2</td>
<td>2 1/2</td>
<td>2 3/4</td>
<td>3</td>
<td>3 1/4</td>
</tr>
</tbody>
</table>
Outpatient Management

- Cool the skin with room temperature or cool water for 20 minutes
- Remove any applied creams
- Blisters: to drain or not to drain
- Topical antibiotics: Bacitracin, Neosporin, Triple Abx
- Coverage: non-stick gauze and then Kerlix
- 1-2 days after injury, can switch to xeroform or vasoline gauze
- Encourage the use of pain medications (NSAIDs or APAP)
- Consider burn center referral or call burn center for advice
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Cooling Skin

- Prospective Cohort study of 2,500 children with median age 2yo over 3 yrs
- Mostly burns that were 1% of body surface area from scalded injuries
- Primary outcome: need for skin grafting
- **Conclusion:** Running 20 minutes of cool water within 3 hours of injury is superior to 5 minutes and 30 minutes
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Blister Burn Debridement?

- Remains controversial
- Benefits of Keeping Blister Intact
  - Keeps a mechanical barrier and moist environment for re-epithelialization
  - Blister fluid has healing effect with fibroblasts and keratinocytes
- Risks of Keeping Blister Intact
  - Can be painful
  - Blister fluid contains contents that impede fibrinolysis and inhibit opsonic activity against Pseudomonas
- Deroofing vs Aspiration
  - Not one is superior, however, faster re-epithelialization, pain relief, and scar thickness with aspiration
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<table>
<thead>
<tr>
<th>Name</th>
<th>Type of therapy</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacitracin</td>
<td>Topical</td>
<td>Narrow antimicrobial coverage; inexpensive; painless; requires frequent dressing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>changes; can be used on face or near mucous membranes¹</td>
</tr>
<tr>
<td>Mafenide acetate (Sulfamylon)</td>
<td>Topical</td>
<td>Broad-spectrum antimicrobial coverage; penetrates eschar; may delay healing or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cause metabolic acidosis; used for deep burns¹²</td>
</tr>
<tr>
<td>Mupirocin (Bactroban)</td>
<td>Topical</td>
<td>Good gram-positive antimicrobial coverage; expensive; painless; requires</td>
</tr>
<tr>
<td></td>
<td></td>
<td>frequent dressing changes; can be used on face²</td>
</tr>
<tr>
<td>SSD (Silvadene)</td>
<td>Topical</td>
<td>Broad-spectrum antimicrobial coverage; painless; requires frequent dressing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>changes; delays healing; stains tissue; used in deeper partial-thickness burns;</td>
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<tr>
<td></td>
<td></td>
<td>relatively contraindicated in pregnant women, newborns, nursing mothers,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and patients with glucose-6-phosphate dehydrogenase deficiency or sulfa</td>
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<tr>
<td></td>
<td></td>
<td>allergy¹⁰,¹²,²⁴,²⁶</td>
</tr>
<tr>
<td>Aquacel Ag</td>
<td>Absorptive</td>
<td>Silver impregnated; broad-spectrum antimicrobial coverage; decreases dressing</td>
</tr>
<tr>
<td></td>
<td>dressing</td>
<td>changes; reduces pain; decreases use of pain medications; faster wound closure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>than with standard therapies¹⁰,²⁷; decreased total cost compared with SSD¹³</td>
</tr>
<tr>
<td>Biobrane</td>
<td>Biocomposite</td>
<td>Less pain and shorter time to healing than with SSD; expensive but lower total</td>
</tr>
<tr>
<td></td>
<td>dressing</td>
<td>treatment cost compared with SSD¹⁰⁻¹²; one study showed effectiveness in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>superficial burns, but high failure rates with mid-dermal depth burns¹⁴</td>
</tr>
<tr>
<td>Hydrocolloids (Duoderm,</td>
<td>Absorptive</td>
<td>Less pain and shorter time to wound closure than with SSD; good for weeping</td>
</tr>
<tr>
<td>Urgotul)</td>
<td>dressing</td>
<td>burns; malodorous; opaque³⁻¹³,³⁵</td>
</tr>
<tr>
<td>Impregnated nonadherent</td>
<td>Nonabsorptive</td>
<td>No antimicrobial activity; messy; provides a nonadherent barrier over the burn</td>
</tr>
<tr>
<td>gauze (Xeroform,</td>
<td>dressing</td>
<td>for absorptive dressings; used for superficial burns¹</td>
</tr>
<tr>
<td>Vaseline gauze)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silicone (Mepitul)</td>
<td>Nonabsorptive</td>
<td>Expensive; painless; allows seepage of exudates to secondary bandage³</td>
</tr>
<tr>
<td></td>
<td>dressing</td>
<td></td>
</tr>
<tr>
<td>Silver-impregnated</td>
<td>Nonabsorptive</td>
<td>Delivers low concentrations of silver; broad-spectrum antimicrobial coverage;</td>
</tr>
<tr>
<td>dressing (Acticoat)</td>
<td>dressing</td>
<td>nonadherent; reduces pain; expensive³⁻¹⁰,¹²,³⁶</td>
</tr>
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Follow-up

- Follow-up should occur after 24-72 hours from injury
- Approximately 3 weeks to heal
- Gentle cleansing should be performed in the office
- Instruction on wound care should be provided to parents or any guardian
- Return precautions should be given
Prevention

- Minimize use of front burners on stoves
- Do not let cooking appliance electric cords hang off counters
- Careful with hot beverages particularly when children are close to the table, such as when sitting in your lap
- Teach older children how to safely remove hot food from a microwave, stove top, and toaster oven
- Adjust the water heater to $<120^\circ F$
- Monitor children carefully when an exercise treadmill is in use
- Do not leave a child unattended near a fireplace
Case 2

- ID: 3yo girl, with a history of anaphylactic nut allergy, was brought in by her father.
- HPI: Father reports that his wife is out of town for work, so he was in charge of cooking this evening, which he does not usually do. He turned his back from the stove to cut vegetables and left a pan of hot oil on the front burner. He suddenly heard screaming and saw that his daughter grabbed the handle of the pan and got hot oil on her. She was brought to the ED immediately.
Case 2
Case 2
ED Management
FLUIDS, FLUIDS, FLUIDS!

- LR preferred due to risk of acidosis with NS
- ≥ 14yo = 2 mL / kg / % body surface area that was burnt over 24 hrs
  - 1/2 of that in the first 8 hrs
  - The other half in the remaining 16 hours
- ≤ 13yo = 3 mL / kg / % body surface area
- If < 30kg, give MIVF w/ D5LR as well as above fluid
- Adjust based on UOP
Mitigate Heat Loss
Case 3

- **ID:** 5yo boy with no known medical history is brought in for bilateral burns of the feet.
- **HPI:** Per the mother, the patient jumped into the bathtub before it was ready for him and he burned both feet. He was brought in right after the incident.
Look For The Signs

Immersion and Scald Injuries

Level of water results in uniform demarcation line

Flexing results in apposition of skin surfaces and burn protection

Surface contact protects skin from hot water

Immersion demarcation line

Areas of skin spared by flexion
Figure 2. Burn Marks

- HOT PLATE
- LIGHT BULB
- CURLING IRON
- CAR CIGARETTE LIGHTER
- STEAM IRON
- KNIFE
- GRID
- CIGARETTE
- FORKS
- IMMERSION

(Kennah, 2011)
Summary

- Pediatric burns are common: 120,000 in ED and 15,000 hospitalized annually
- New categories of burns: superficial, superficial partial thickness, deep partial, full thickness
- Any partial and/or full thickness burn involving >15% of total BSA required referral to the burn center
- Most can be handled in the outpatient setting with gentle cleaning, debridement (or not based on clinical judgement), topical abx
- Don’t forget prevention counseling
- If hospitalized, resuscitation and heat loss mitigation is key
Any Questions?
Resources


