PEDIATRIC BURNS: BEWARE OF THE CUP O' NOODLE

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CLINICAL CONTEXT

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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

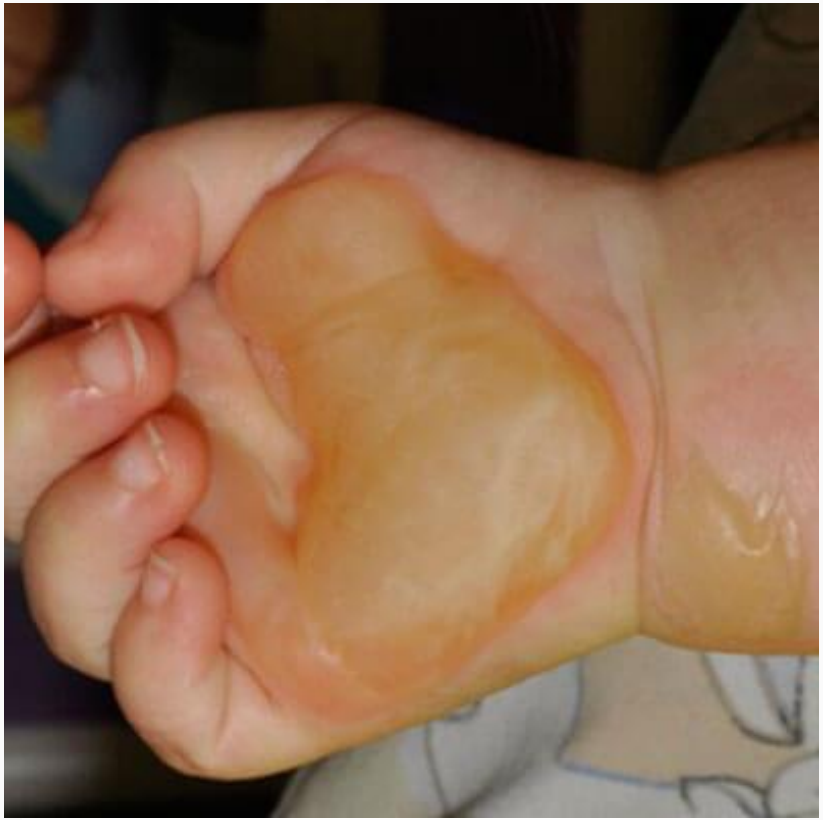
Vitals

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

Objective

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



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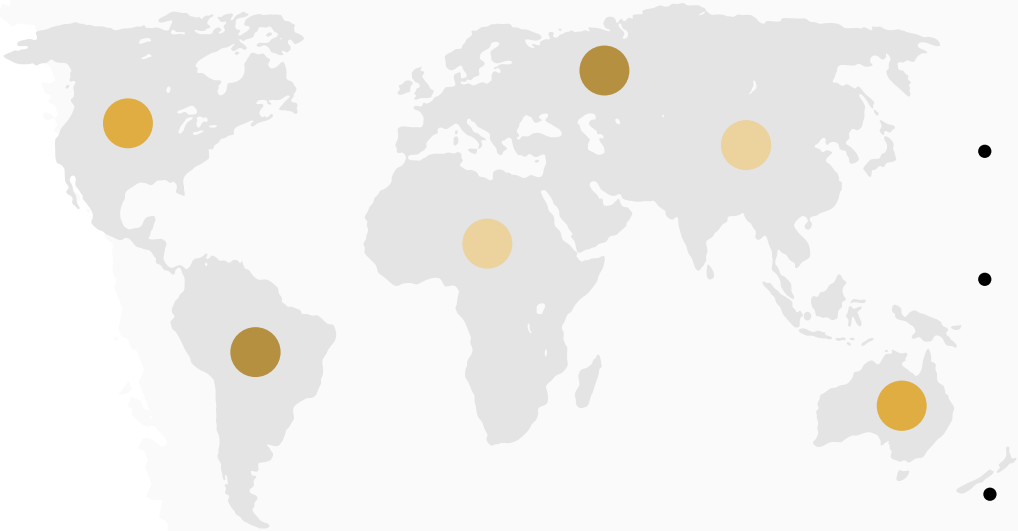
Pediatric Burns



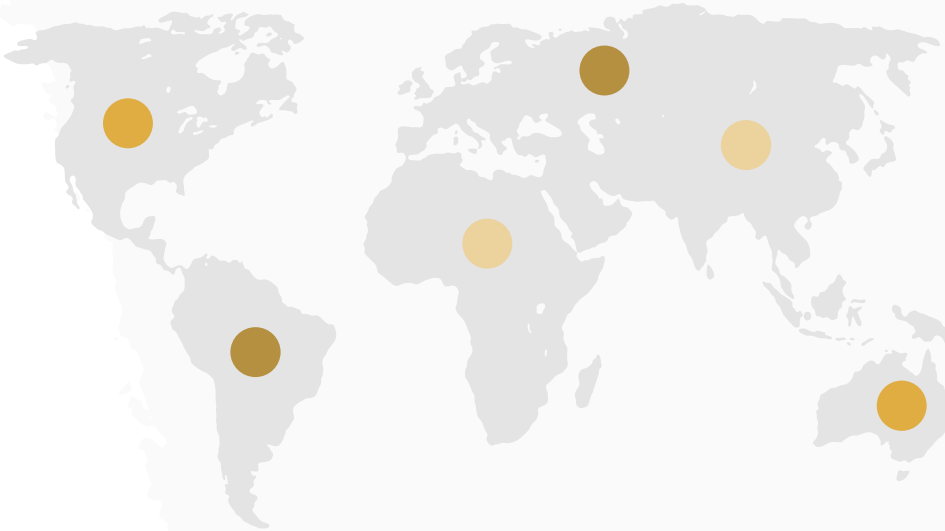
United States

- 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



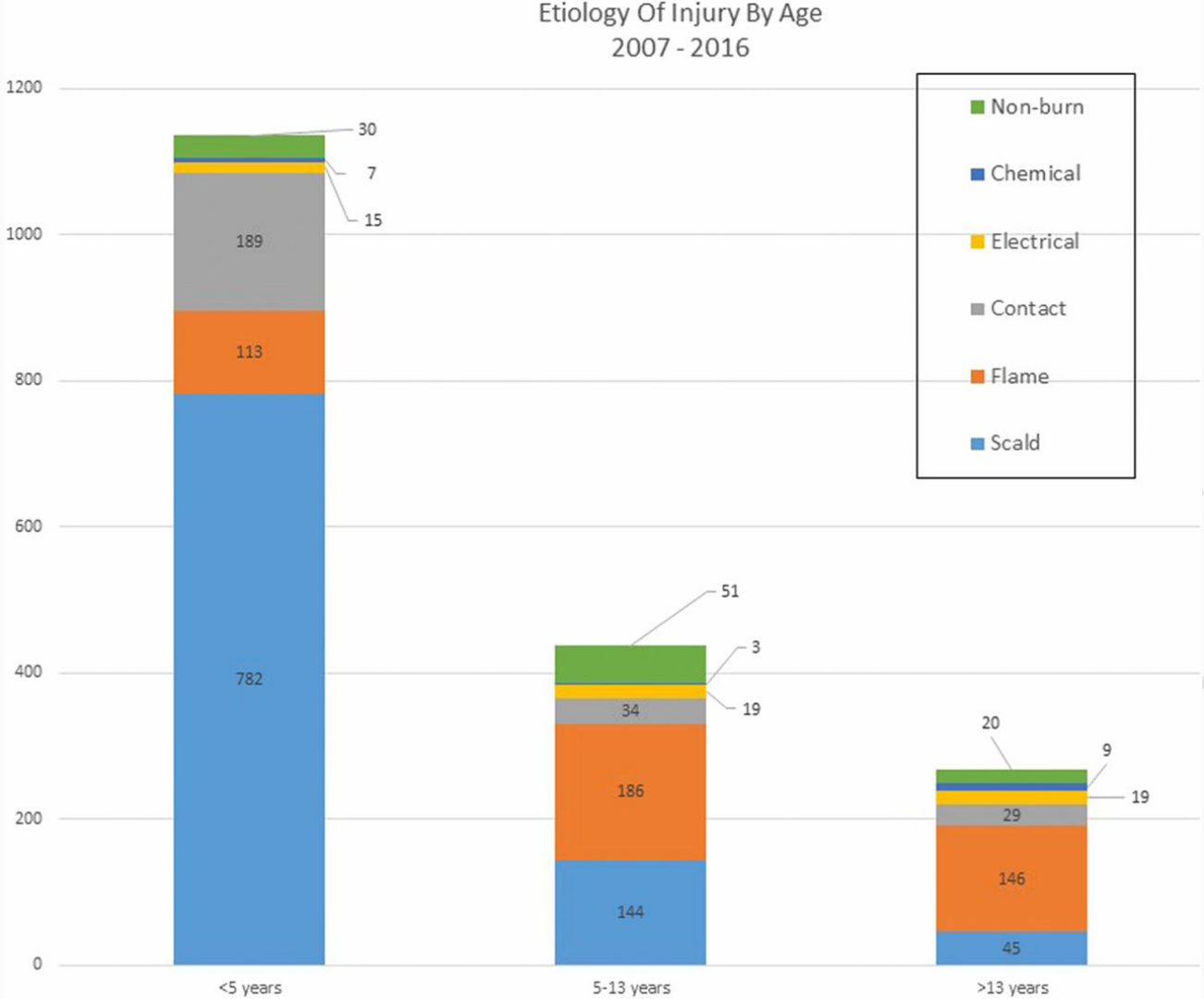
Risk Factors

- #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

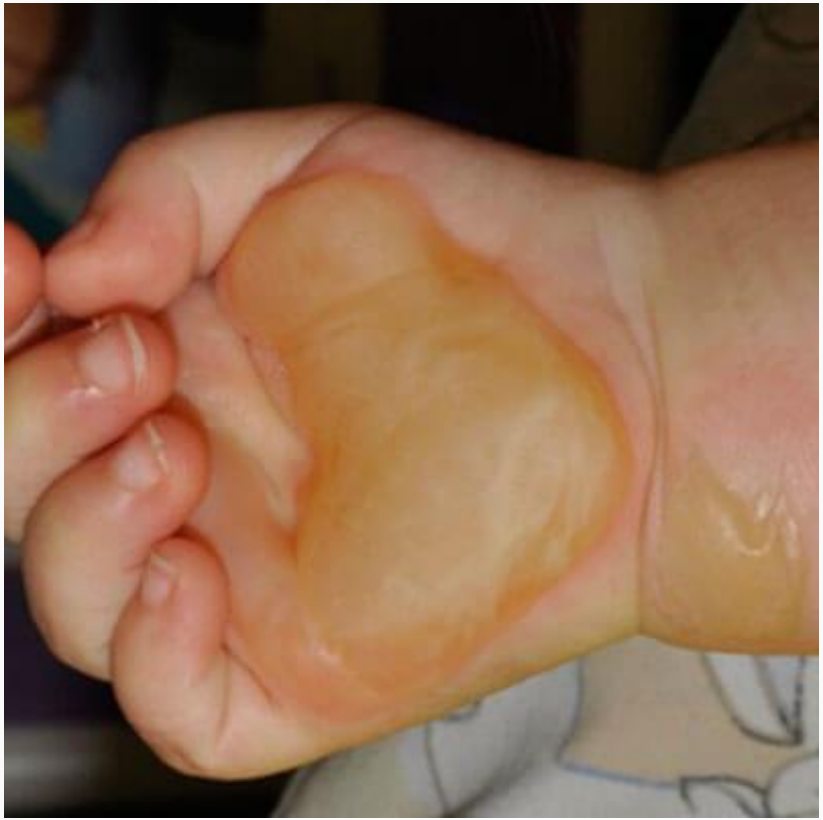
- Electrical
- Chemical
- Contact
  - Tar injury

- Non-burns
  - Toxic epidermal necrolysis
  - SSSS
  - Purpura Fulminans
  - Crush injury
  - Frostbite
  - Tissue infections


Etiology Of Injury By Age
2007 - 2016
1200
1000
800
600
400
200
0
Non-burn
Chemical
Electrical
Contact
Flame
Scald
30
7
15
189
113
782
51
3
19
34
186
144
20
9
19
29
146
45
<5 years
5-13 years
>13 years

[1]

Burn Centers in North America [6]



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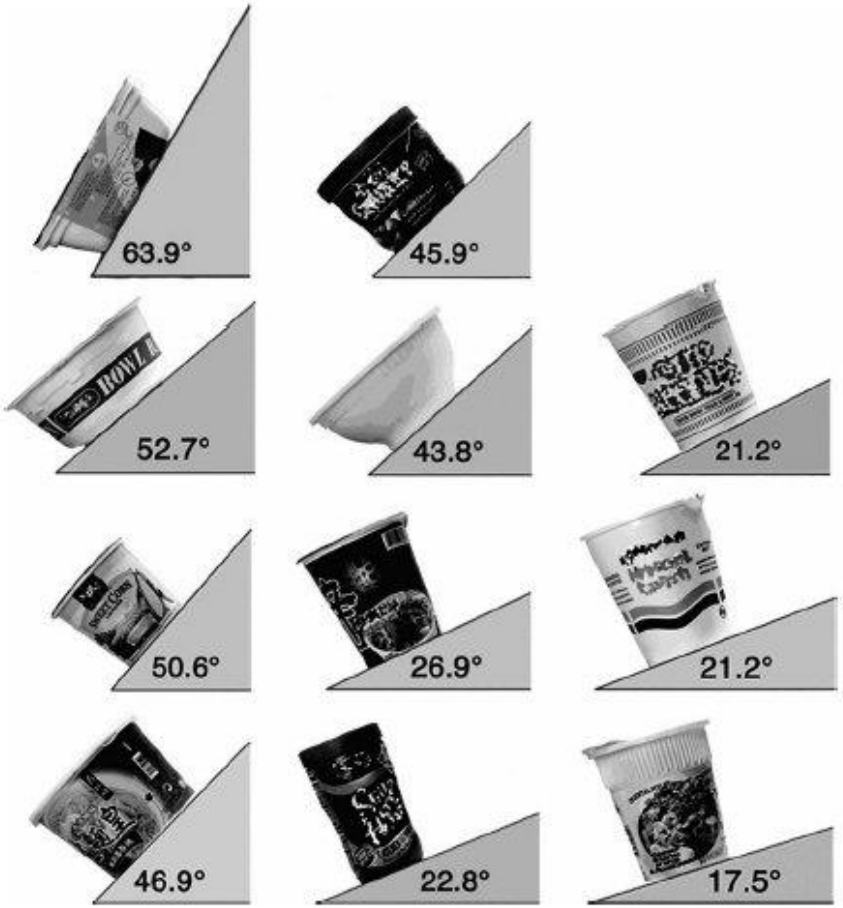
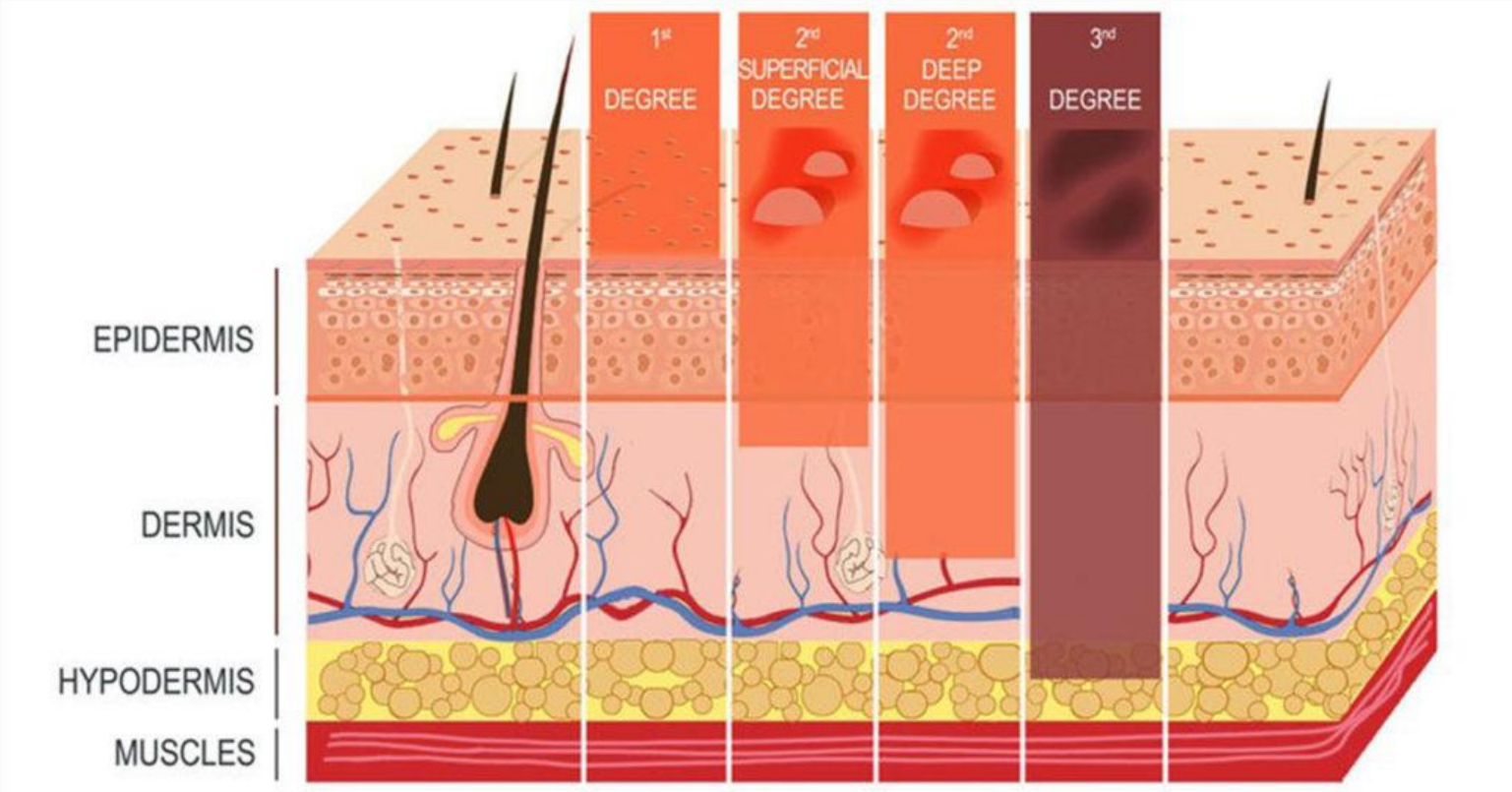


Figure 1. Representative pictures of the shapes of the soup containers and the angle that was required for the container to "tip over" on to its side.

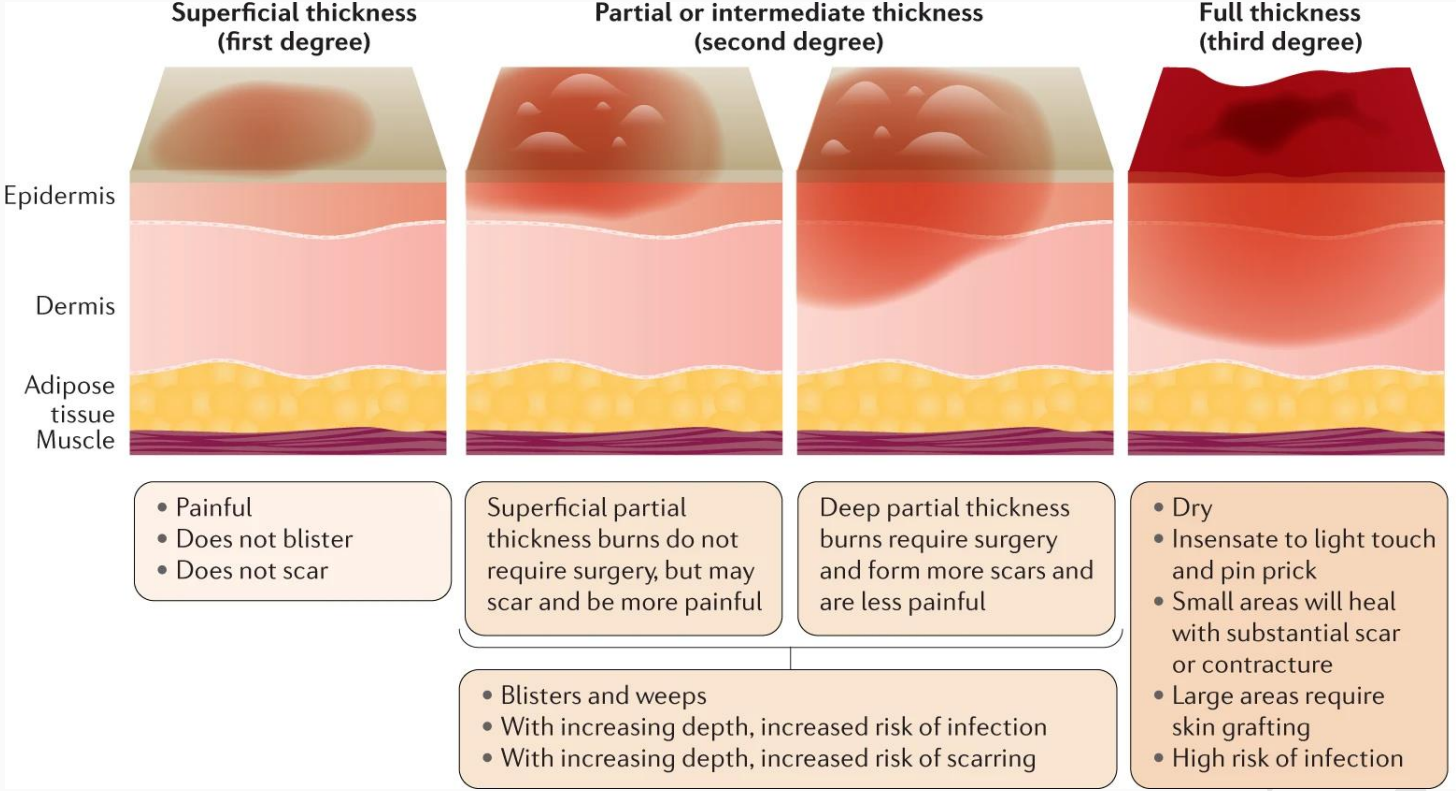
Categorization

[13]



New Categorization

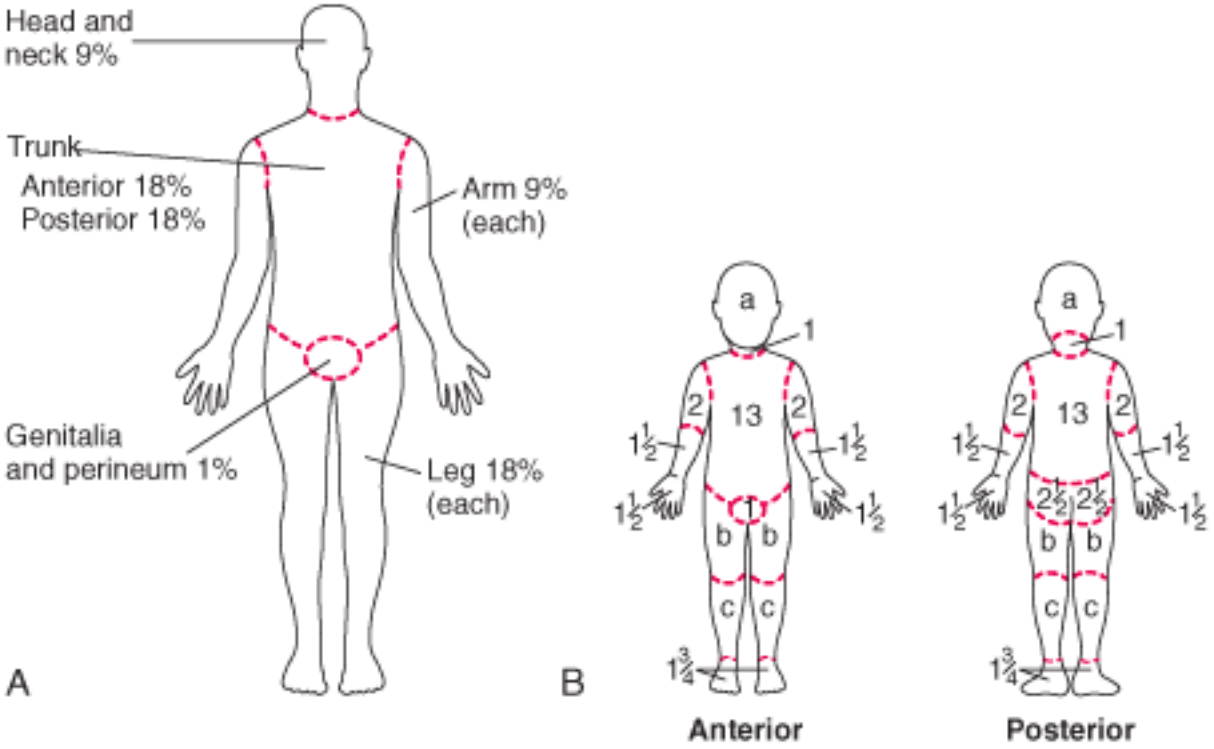
[12]



Outpatient vs Inpatient Managemer

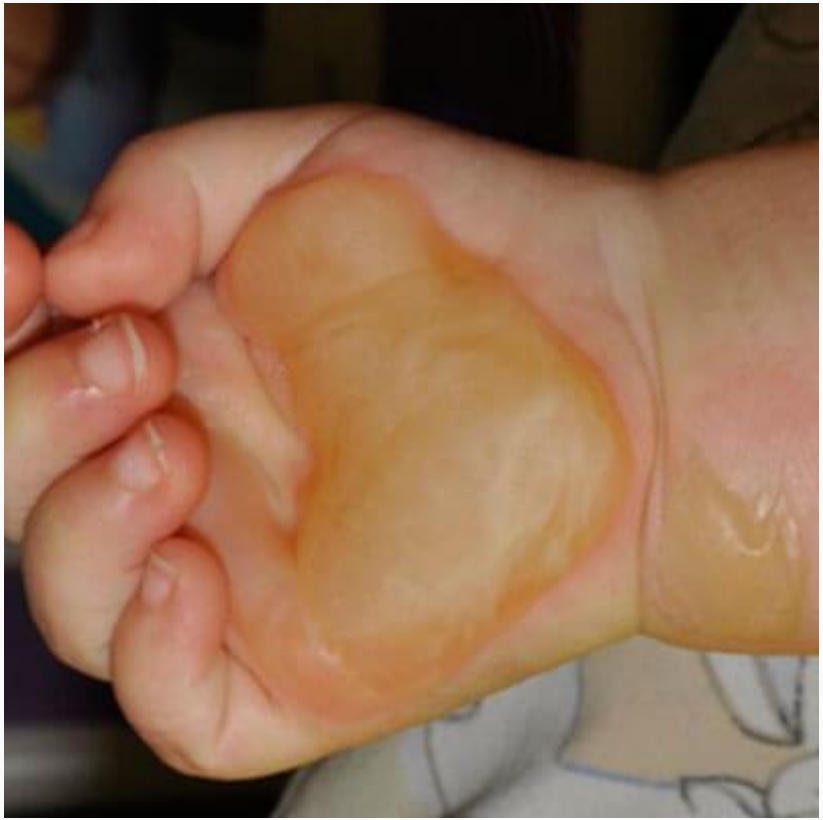
- Use the categorization to help determine Total Body Surface Area (BSA) involved
  - Only using areas that are partial thickness and deeper
- Calculate BSA by using the “rule of palm” = 1%
- Burns involving >15% of BSA should be immediately referred to a burn center
- Special consideration:
  - Particular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

[9]



Relative percentage of body surface area (% BSA) affected by growth

	Age				
Body Part	**0 yr**	**1 yr**	**5 yr**	**10 yr**	**15 yr**
a = 1/2 of head	9 1/2	8 1/2	6 1/2	5 1/2	4 1/2
b = 1/2 of 1 thigh	2 3/4	3 1/4	4	4 1/4	4 1/2
c = 1/2 of 1 lower leg	2 1/2	2 1/2	2 3/4	3	3 1/4



[7]

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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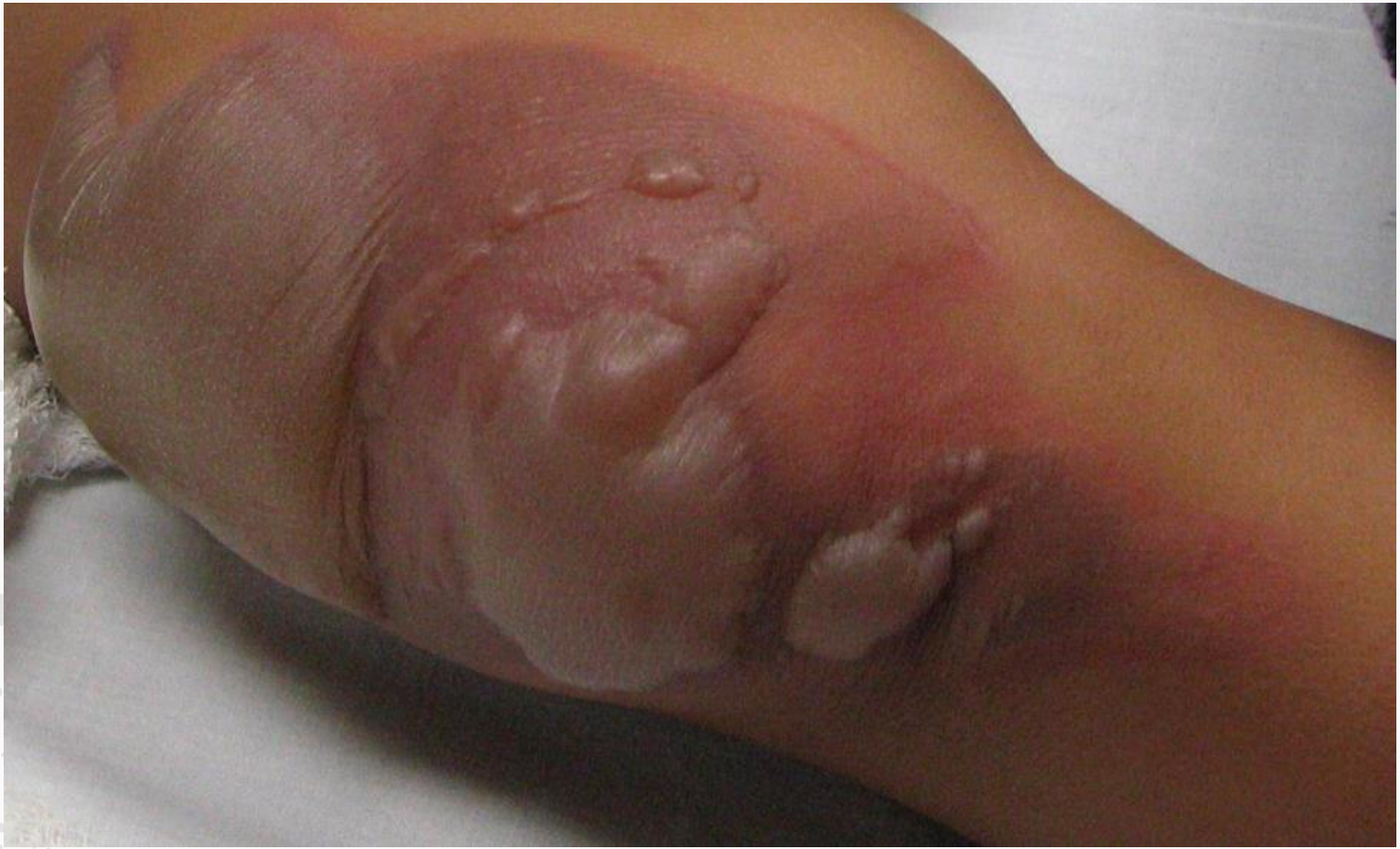
Blister Burn Debridement?

- 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 again Pseudomonas
- Deroofing vs Aspiration
  - Not one is superior, however, faster re-epithelialization, pain relief, and scar thickness with aspiration



[17]

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[17]

Table 3. Commonly Used Topical Medications and Wound Membranes

Name	*Type of therapy*	*Characteristics*
Bacitracin	Topical	Narrow antimicrobial coverage; inexpensive; painless; requires frequent dressing changes; can be used on face or near mucous membranes[1]
Mafenide acetate (Sulfamylon)	Topical	Broad-spectrum antimicrobial coverage; penetrates eschar; may delay healing or cause metabolic acidosis; used for deep burns[1,12]
Mupirocin (Bactroban)	Topical	Good gram-positive antimicrobial coverage; expensive; painless; requires frequent dressing changes; can be used on face[3]
SSD (Silvadene)	Topical	Broad-spectrum antimicrobial coverage; painless; requires frequent dressing changes; delays healing; stains tissue; used in deeper partial-thickness burns; relatively contraindicated in pregnant women, newborns, nursing mothers, and patients with glucose-6-phosphate dehydrogenase deficiency or sulfa allergy[1,6,12,24-26]
Aquacel Ag	Absorptive dressing	Silver impregnated; broad-spectrum antimicrobial coverage; decreases dressing changes; reduces pain; decreases use of pain medications; faster wound closure than with standard therapies[12,27]; decreased total cost compared with SSD[33]
Biobrane	Biocomposite dressing	Less pain and shorter time to healing than with SSD; expensive but lower total treatment cost compared with SSD[28-30]; one study showed effectiveness in superficial burns, but high failure rates with mid-dermal depth burns[34]
Hydrocolloids (Duoderm, Urgotul)	Absorptive dressing	Less pain and shorter time to wound closure than with SSD; good for weeping burns; malodorous; opaque[1,31,35]
Impregnated nonadherent gauze (Xeroform, Vaseline gauze)	Nonabsorptive dressing	No antimicrobial activity; messy; provides a nonadherent barrier over the burn for absorptive dressings; used for superficial burns[1]
Silicone (Mepitel)	Nonabsorptive dressing	Expensive; painless; allows seepage of exudates to secondary bandage[3]
Silver-impregnated dressing (Acticoat)	Nonabsorptive dressing	Delivers low concentrations of silver; broad-spectrum antimicrobial coverage; nonadherent; reduces pain; expensive[1,10,12,36]

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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°F
- Monitor children carefully when an exercise treadmill is in use
- Do not leave a child unattended near a fireplace

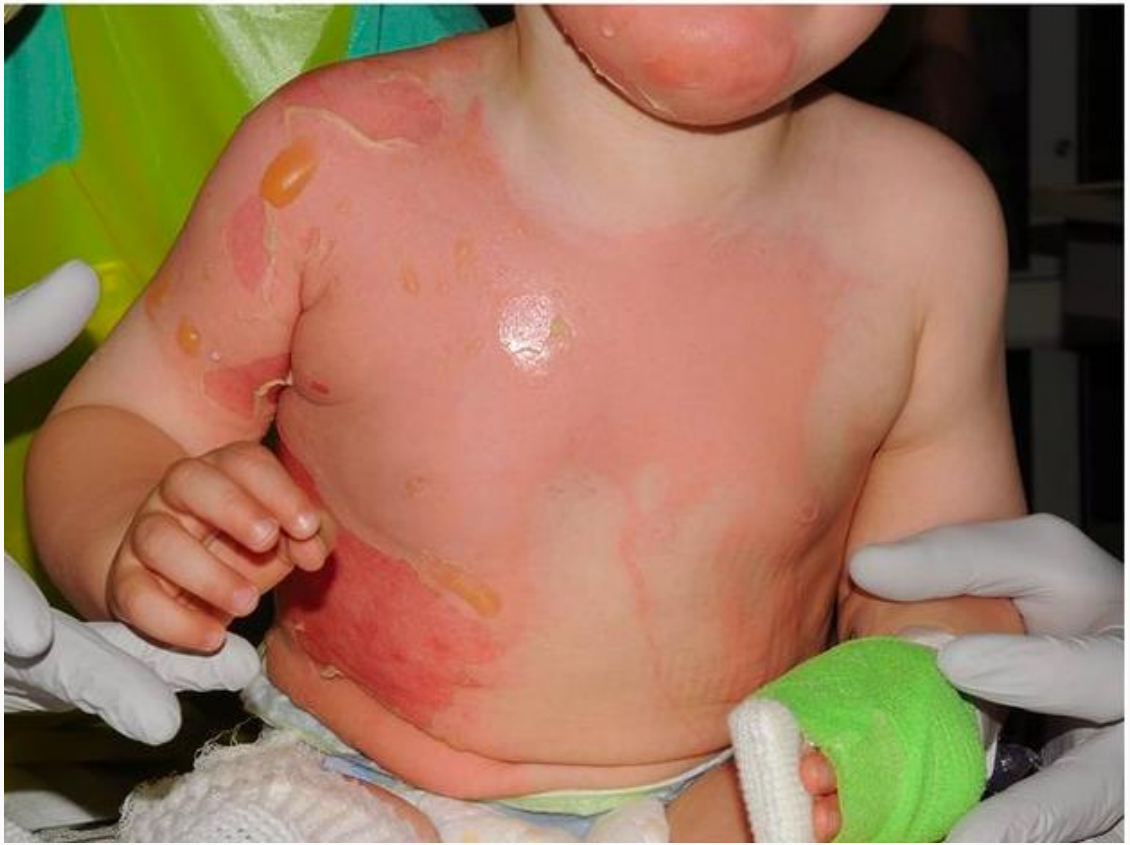
[18]

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.

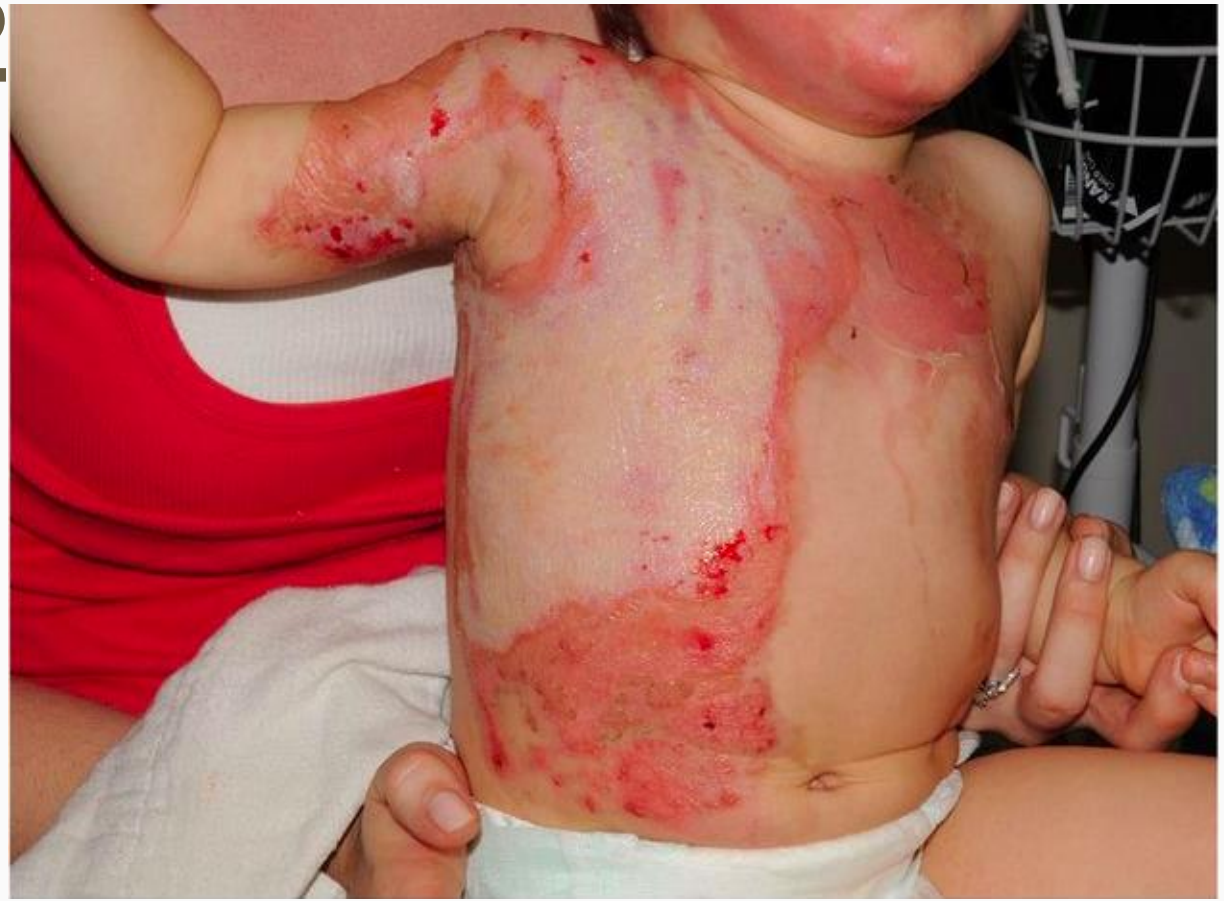
[19]

Case 2



[17]

Case 2



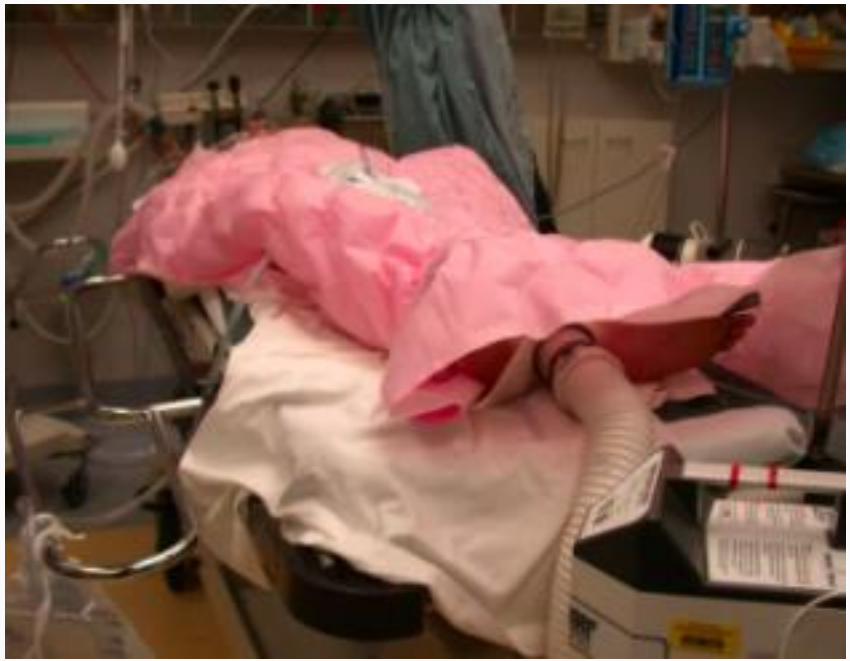
[17]

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

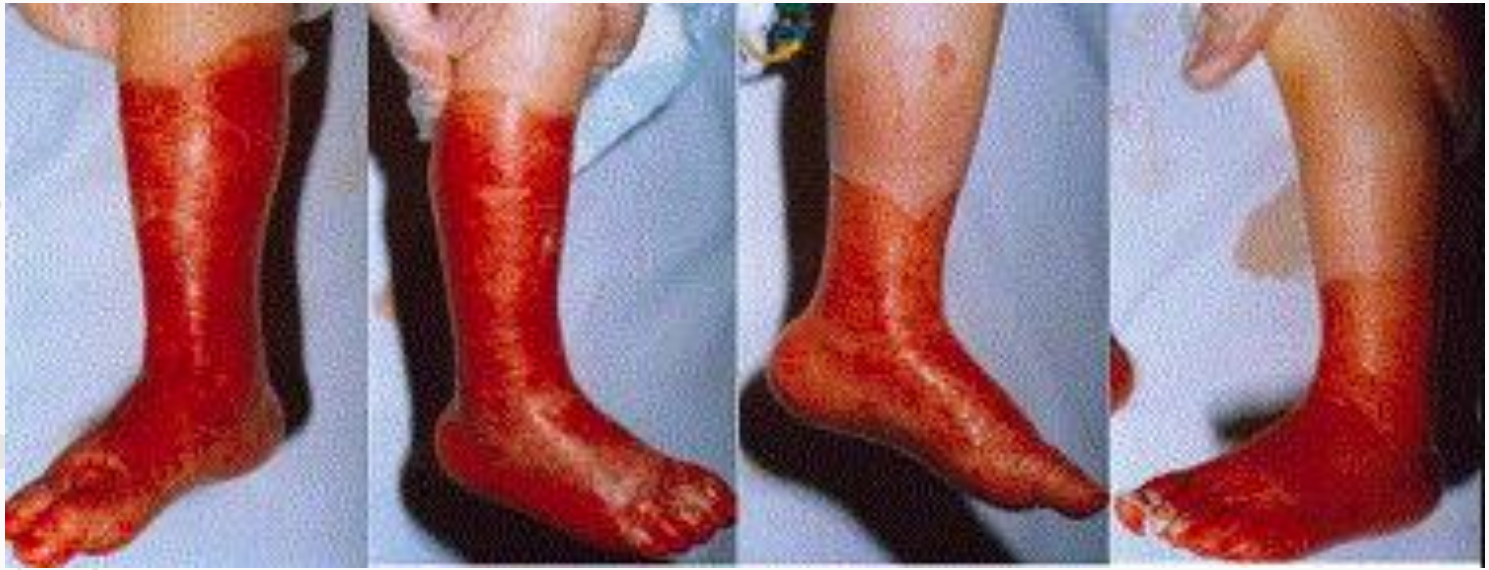


[20]

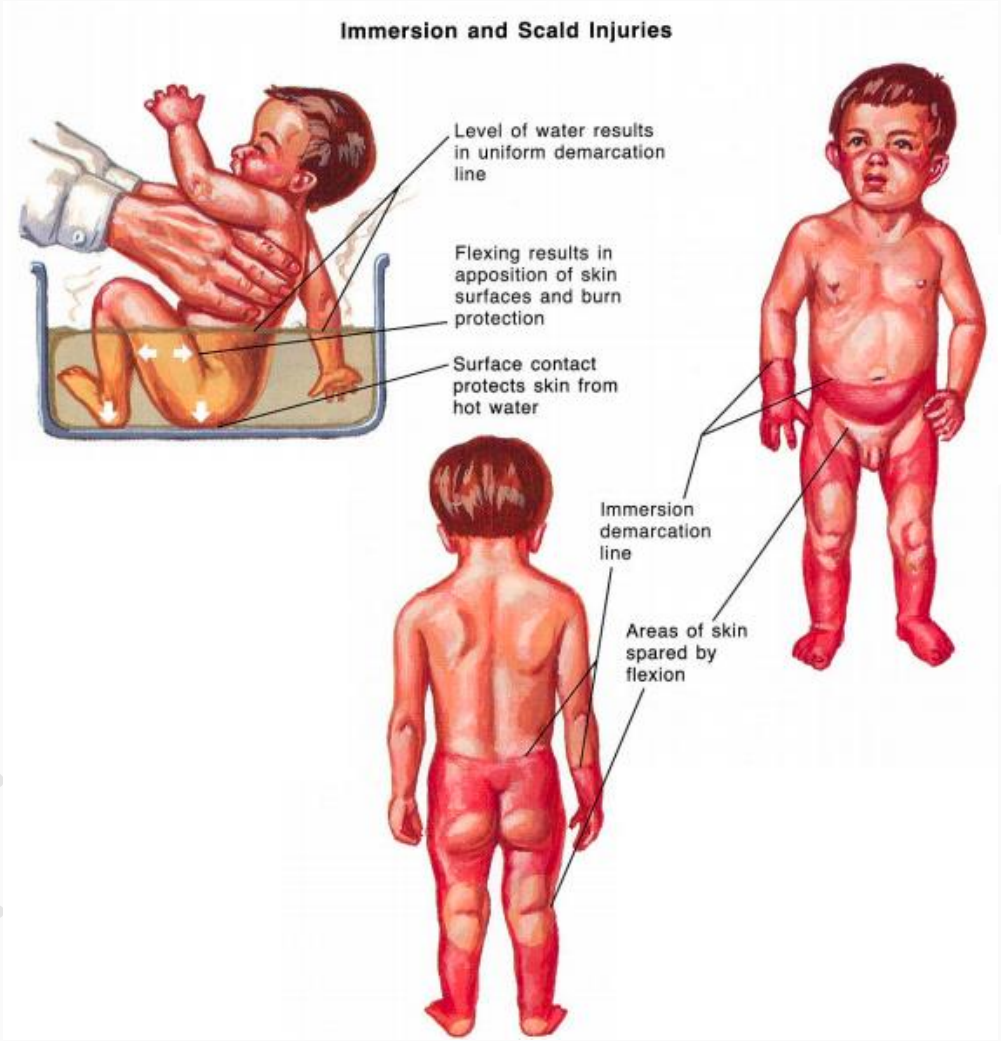
Case 3

- 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.

[22]



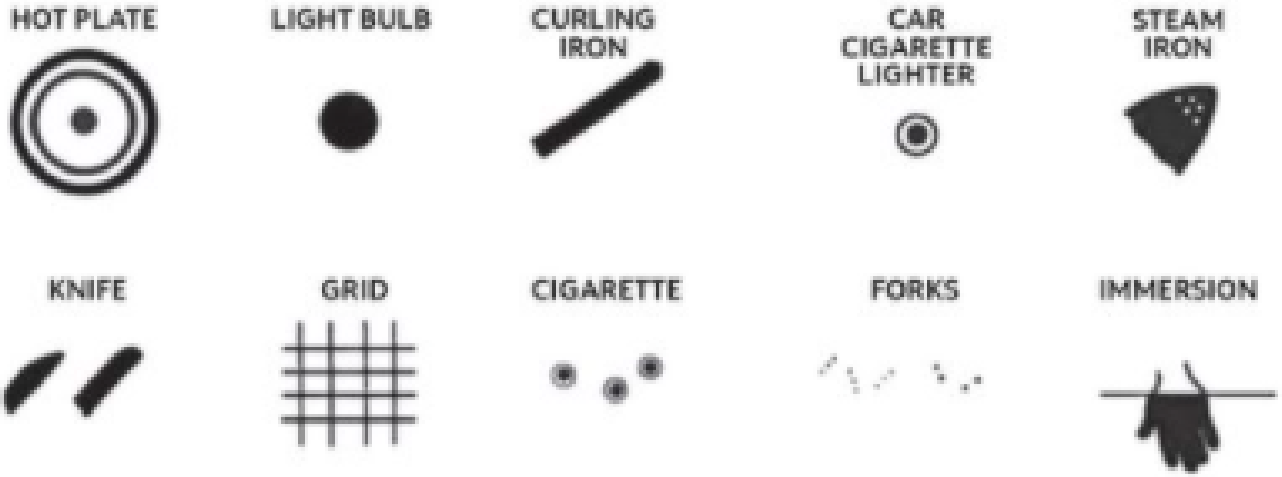
Look For The Signs



[21]

[23]

Figure 2.
Burn Marks



(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?

[24]

Resources

1. Sheridan, R.., MD. *Burn Care for Children.* Pediatrics in Review. June 2018, 39 (6) 273-286; DOI: https://doi.org/10.1542/pir.2016-0179.
2. *Griffin BR, et al. Cool Running Water First Aid Decreases Skin Grafting Requirements in Pediatric Burns: A Cohort Study of Two Thousand Four Hundred Ninety-five Children. Ann Emerg Med. 2020 Jan;75(1):75-85. Epub 2019 Aug 29. PMID: 31474480*
3. Hippoed.com. 2021. *March 2020 - Burns And The Cup-O-Noodles - Beware The Eyes Of March | Peds RAP*. [online] Available at: <https://www.hippoed.com/peds/rap/episode/bewaretheeyesof/burnsandthecupo> [Accessed 25 January 2021].
4. Hippoed.com. 2021. *February 2016 - Introduction: Pediatric Burns - Nice Dermatitides | Peds RAP*. [online] Available at: <https://www.hippoed.com/peds/rap/episode/nice/introduction> [Accessed 25 January 2021].
5. Abramowicz S, Allareddy V, Lee MK, Nalliah RP, Rampa S, Allareddy V. Hospital-Based Emergency Department Visits With Pediatric Burns: Characteristics and Outcomes. Pediatr Emerg Care. 2020 Aug;36(8):393-396. doi: 10.1097/PEC.0000000000001699. PMID: 30624417.
6. Brc.iaff.org. 2021. *Burn Center Locations*. [online] Available at: <http://brc.iaff.org/phone/burn-center-locations.html> [Accessed 25 January 2021].
7. Shrinershospitalsforchildren.org. 2021. *Burn Care | Shriners Hospitals For Children — Boston*. [online] Available at: <https://www.shrinershospitalsforchildren.org/boston/burn-care> [Accessed 25 January 2021].

Resources

8. Greenhalgh DG, Bridges P, Coombs E, Chapyak D, Doyle W, O'Mara MS, Palmieri TL. *Instant cup of soup: design flaws increase risk of burns.* J Burn Care Res. 2006 Jul-Aug;27(4):476-81. doi: 10.1097/01.BCR.0000226021.78139.49. PMID: 16819351.
9. MSD Manual Professional Edition. 2021. *Figure: (A) Rule Of Nines (For Adults) And (B) Lund-Browder Chart (For Children) For Estimating Extent Of Burns - MSD Manual Professional Edition*. [online] Available at: <https://www.merckmanuals.com/professional/multimedia/figure/phy_rule_of_nines> [Accessed 25 January 2021].
10. CitadelCPM. 2021. *Olive View Medial Center Room Replacement.* <https://citadelcom.com/projects/view/26> [Acessed 25 January 2021].
11. Who.int. 2021. *Burns*. [online] Available at: <https://www.who.int/en/news-room/fact-sheets/detail/burns> [Accessed 25 January 2021].
12. Jeschke, M.G., van Baar, M.E., Choudhry, M.A. *et al.* Burn injury. *Nat Rev Dis Primers* **6,** 11 (2020). https://doi.org/10.1038/s41572-020-0145-5
13. Elite Medical Center. 2021. *Identifying A Severe Burn - Elite Medical Center*. [online] Available at: <https://elitelv.com/doctors-corner/identifying-a-severe-burn/> [Accessed 26 January 2021].
14. *Griffin BR, et al. Cool Running Water First Aid Decreases Skin Grafting Requirements in Pediatric Burns: A Cohort Study of Two Thousand Four Hundred Ninety-five Children. Ann Emerg Med. 2020 Jan;75(1):75-85. Epub 2019 Aug 29. PMID: 31474480*

Resources

15. Cuttle L, Kempf M, Kravchuk O, Phillips GE, Mill J, Wang XQ, Kimble RM. The optimal temperature of first aid treatment for partial thickness burn injuries. Wound Repair Regen. 2008 Sep-Oct;16(5):626-34. doi: 10.1111/j.1524-475X.2008.00413.x. PMID: 19128257.
16. Ro, Hyung-Suk et al. “Effectiveness of aspiration or deroofing for blister management in patients with burns: A prospective randomized controlled trial.” *Medicine* vol. 97,17 (2018): e0563. doi:10.1097/MD.0000000000010563
17. Lloyd EC, Rodgers BC, Michener M, Williams MS. Outpatient burns: prevention and care. Am Fam Physician. 2012 Jan 1;85(1):25-32. Erratum in: Am Fam Physician. 2012 Jun 15;85(12):1127. PMID: 22230304.
18. Weill Cornell Brain and Spine Center. 2021. *Neurological Surgery Residency Program*. [online] Available at: <https://weillcornellbrainandspine.org/neurosurgery-residency-program> [Accessed 27 January 2021].
19. Green, Tracy E. BSN, RN, CPN Pediatric burns: Initial response, lasting effects, Nursing2010: August 2010 - Volume 40 - Issue 8 - p 42-49 doi: 10.1097/01.NURSE.0000383896.57848.7a
20. Vic Burns. 2021. *Prevent Heat Loss - Vic Burns*. [online] Available at: <https://www.vicburns.org.au/severe-burns/early-management/prevent-heat-loss/> [Accessed 27 January 2021].
21. Neurosurgeryresidnet.net. April 2019. *Viktor’s Notes.* < http://www.neurosurgeryresident.net/Ped.%20Pediatrics/Ped3.%20Child%20Maltreatment%20(Abuse%20and%20Neglect).pdf >

Resources

22. reenbaum AR, Donne J, Wilson D, Dunn KW. Intentional burn injury: an evidence-based, clinical and forensic review. Burns. 2004 Nov;30(7):628-42. doi: 10.1016/j.burns.2004.03.019. PMID: 15475134.
23. Science, F., 2021. *Pediatric Burns: Discerning Accidental Cases From Child Abuse*. [online] Critical Analysis RN Consulting. Available at: <https://criticalanalysisrn.com/pediatric-burns-discerning-accidental-cases-from-child-abuse/> [Accessed 27 January 2021].
24. Horizon Learning Center. 2021. *Raising-Hands ~ Horizon Learning Center*. [online] Available at: <https://horizonlearning.net/staff-spotlight/raising-hands/> [Accessed 27 January 2021].