


**In Good Hands?**  
**Death of a Child due to Intentional Immersion in Hot Water and the Resulting Complications**

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**Disclosures**

- None



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**Background**

- 2 y/o male in custody of paternal grandmother
- Suffered extensive burns one night which were treated at home
- Presented to hospital 6 days later after becoming unresponsive



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## Hospital findings

- Hgb 5 g/dL with:
  - Blood per rectum and NG tube
  - “Dark” stools and “brownish black” emesis
- Received blood transfusion
- Continued melanotic stools
- Hemodynamically stable with normal mental status on hospital day 5:
  - Scheduled for skin grafting
  - Abrupt drop in hgb → could not be resuscitated



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## Autopsy



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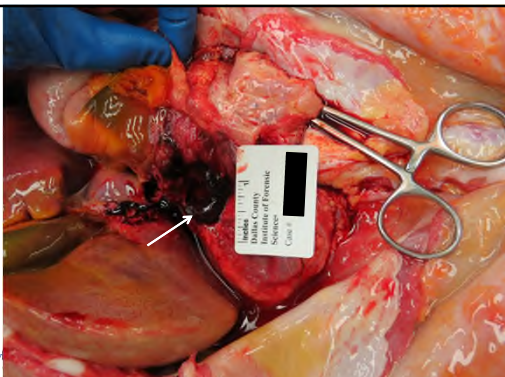
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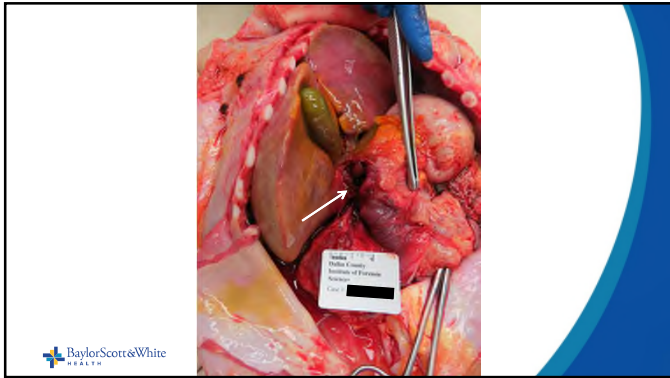
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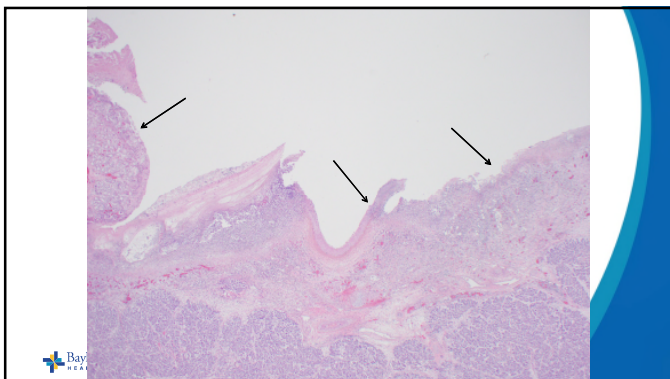
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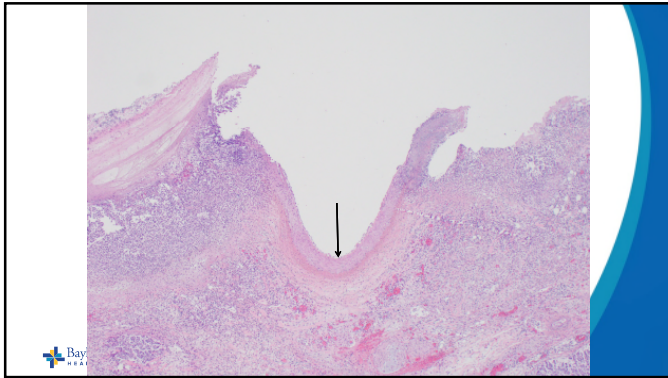
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- Cause of death: Complications of thermal injuries
- Manner of death: Homicide

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### Immersion burns

- Intentional burn injuries:
  - 10% of child abuse cases
  - 10% of pediatric admissions to burn units
  - Almost always < 10 y/o
  - Majority < 2 y/o
- In comparison to accidental burns:
  - Younger
  - Longer hospital stay
  - Higher mortality rate

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## Immersion burns

- Often occur during toilet training
- Frequently a delay in seeking medical attention



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## Characteristics

- Child lowered into water feet first → involuntary flexion of knees and hips
- Characteristic distribution:
  - Sharp line of demarcation with sparing of flexor surfaces and skin in contact with bottom of tub (“donut” pattern)
  - Uniform depth and distribution
  - Circumferential, full thickness, with minimal splash marks
  - “Glove and stocking” pattern



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## Spill or splash burns

- Hot liquid falls from height
- Irregular margins and non-uniform depth
- Liquid cools as it moves away from initial point of contact



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## Burn classifications

- Superficial (formerly first degree burns):
  - Confined to epidermis (ex: sunburn)
  - Dry, painful, do not blister
- Partial thickness (formerly second degree burns):
  - Involve epidermis and dermis
  - Painful, moist, can have blisters
  - Superficial partial thickness:
    - Clear fluid in blisters
    - Will blanch to pressure
  - Deep partial thickness:
    - May have bloody fluid in blisters
    - Will not blanch to pressure



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## Burn classifications

- Full thickness (formerly third degree burns):
  - Involve epidermis, dermis, and subcutaneous tissue
  - May extend to skeletal muscle (formerly fourth degree burns)
  - Can appear black, white, or leathery
  - Do not blanch to touch
  - Not painful (unless edges of burn are partial thickness)



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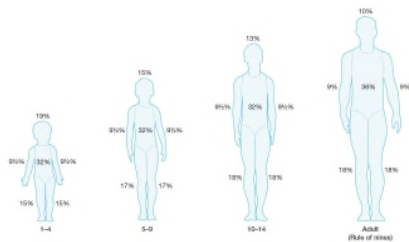
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## Rule of Nines



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## Curling's ulcer

- Thomas Blizard Curling described duodenal ulceration associated with burns in 1842
- Possible mechanisms:
  - Hypoperfusion
  - Hypermetabolism
  - Immune dysregulation
- Incidence dramatically decreased with early medical intervention




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## Additional considerations

- Thorough scene investigation:
  - Max water temp in bathtub = 120 degrees
  - Mop placed over drain as described by grandma →  
3-3.5 inches of water in tub after 6 minutes
  - Height of tub = 14 inches




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**Table 12.3 Water Temperature in Relation to Scalding Burns Time**

Temperature (°F)	Threshold for epidermal injury	Full-thickness burns
120	290 s*	600 s
125	50 s	120 s
130	15 s	30 s
140	2.6 s	~7 s
150	<1 s	2.3 s

\* s = seconds

*Note:* Downward adjustments to time needed for young children.




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## References

- Abbas AK, Aster JC, Kumar V. Robbins and Cotran review of pathology. 9<sup>th</sup> ed. Philadelphia: Elsevier Saunders; 2015.
- Choi YH, Lee JH, Shin JJ, Cho YS. A revised risk analysis of stress ulcers in burn patients receiving ulcer prophylaxis. Clin Exp Emerg Med. 2015;2(4):250–5.
- Collins KA, Byard RW. Forensic pathology of infancy and childhood. New York: Springer; 2014.
- DiMaio VJ, DiMaio D. Forensic pathology. 2<sup>nd</sup> ed. Boca Raton: CRC Press; 2001.
- Herndon DN. Total burn care. 5<sup>th</sup> ed. Edinburgh: Elsevier; 2018.
- Peltier PJ, Purdue G, Shepherd, JR. Burn injuries in child abuse. Washington, DC: Department of Justice (US), Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention; 2001. Available from: Office of Juvenile Justice and Delinquency Prevention's Juvenile Justice Clearinghouse, Washington, DC; NCJ 162424.



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