Complex Hand Burns

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Annual Burn Burden

- Receiving Medical Treatment: 450,000
- Hospitalizations: 45,000
- Deaths: 3,500
- Survival Rate: 94.8%
- Gender: 70% male, 30% female
- Cause: 42% fire/flame, 31% scald, 9%
Initial assessment

- ATLS/ABLS protocol and assess for other injuries/fractures based on mechanism
- Inhalational injury
- Vascular compromise:
  - Compartment syndrome
  - Circumferential burns
Transfer Criteria

- Partial thickness burns of >10% TBSA in children <10 years old or adults > 50
- Partial thickness burns >20%
- Hands, face, feet, perineum, genitalia, joints
- Full thickness burns
- Electrical or chemical burns
- Inhalational injury
- Burns in patients with multiple comorbidities or with extensive rehabilitation needs
Multidisciplinary Approach

Nursing
Wound Care Teams
Case Worker
Dietician
ICU staff

OT
Pharmacist
Psychiatrist
Physical Therapist
RTs
Social Worker
Surgeon
Hand Burns

- Hand burns: 50-70% of all burns
- Most commonly in laborers and children
- Frequently not life-threatening, but have a critical effect on long term HRQOL
159 patients with hand burns
- 75% returned to work
  - 30% required job modification
- % TBSA is the largest predictor of the ability to return to work
  - Bilateral hand and trunk burns
- Other: length of hospital stay, age, employment prior to injury, primary wage earners
32 patients with dorsal hand burns involving extensor mechanism

>50% required amputation; 22% boutonniere deformities

40% TAM <180 degrees

JTT scores lower

MHQ: ADL scores lower
• 181 children with hand burns
• Longer hospitalizations, ICU stays, TBSA burns
• 70% recover ADLs
• 20% full normal function
Hand Burn: Management

- ATLS/ABLS ABCs
- Limit zone of stasis demarcation: preserve viable tissue
  - Resuscitation
  - Escharotomies, Fasciotomies
  - Local wound care: Prevent Infection
  - ROM and splinting: Avoid Resting Posture
- Excision of burn injury and coverage
- Rehabilitation
- Late burn care
  - Contracture / Scar Management
  - resection of HO
Hand Burns: Dorsal

- Dorsal skin: thin, mobile, minimal subcutaneous tissue
- “Unprotected”
- Vital structures in close proximity
  - Extensor tendon
  - Joint capsule
Hand Burns: Volar

- Thick, glabrous palmar skin
- “Privileged” – Protected
- Often seen in children as contact burns
- Conservative management with early motion and splinting to prevent contracture
Partial thickness
Superficial vs. Deep

- Epidermis + varying levels of dermis
- Superficial: re-epithelialize in 10-14 days:
  - Blistering, painful
  - Minimal scarring because inflammatory phase is cut short by re-epithelialization
  - Minimal loss of function with early therapy and edema control
Superficial Partial Thickness
Superficial Partial Thickness
Superficial Partial Thickness
Deep Partial Thickness

- Greater depth of dermal injury
- Most epithelial elements are destroyed
- Destruction of nerve endings: insensate
- Poor re-epithelialization
- Scarring likely
  - protracted inflammatory phase
  - excess collagen deposition
- Usually require surgical intervention
- 21 Day Rule
- OT is mandatory
**Full thickness**

- Depth includes epidermis, dermis, subcutaneous tissue
- Will not heal spontaneously and scar extensively
- Require surgical intervention
“4th degree”

- Extension of injury into muscle, tendon, bone
- Usually require debridement, excision, amputation with reconstruction
Assessment: Perfusion

Escharotomy / Fasciotomy

- Decrease/absence of Doppler signals
  - Loss of pulse is late
- Subjective neurosensory disturbance
- Intrinsic minus position of the hand
- Temperature change at fingertips or decrease in pulse oximetry
- Pain with passive stretch
- Interstitial Pressure >30mmHg
Escharotomy

- Improve perfusion by releasing edema pressure under eschar
- Bedside Bovie or scalpel
- Endpoint usually obvious
Digital Escharotomy?

- Possibility of injury to the neurovascular bundles
- Minimal muscle to create rhabdomyolysis
- Significant burns likely involve deeper structures
EVALUATION OF DIGITAL ESCHAROTOMY IN BURNED HANDS

ROGER E. SALISBURY, M.D., JAMES W. TAYLOR, M. D., AND NORMAN S. LEVINE, M.D.

### TABLE I
Comparison of burn injury of patients in this study

<table>
<thead>
<tr>
<th></th>
<th>Conventional Escharotomy</th>
<th>Extended Escharotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of extremities</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Total body burn</td>
<td>67.6</td>
<td>61.9</td>
</tr>
<tr>
<td>Total extremity burn</td>
<td>17.2</td>
<td>17</td>
</tr>
<tr>
<td>Second degree</td>
<td>4.4</td>
<td>5.1</td>
</tr>
<tr>
<td>Third degree</td>
<td>12.8</td>
<td>11.9</td>
</tr>
</tbody>
</table>

### TABLE II
Comparison of results of conventional versus extended escharotomy

<table>
<thead>
<tr>
<th></th>
<th>Conventional Escharotomy</th>
<th>Extended Escharotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of extremities</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>No. of phalanges</td>
<td>182</td>
<td>182</td>
</tr>
<tr>
<td>Necrotic phalanges</td>
<td>38</td>
<td>13</td>
</tr>
<tr>
<td>Percent necrosis</td>
<td>20.8</td>
<td>7.1</td>
</tr>
</tbody>
</table>
# Management: Wound Care

<table>
<thead>
<tr>
<th>Option</th>
<th>Application</th>
<th>Advantage</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver sulfadiazine 1%</td>
<td>QD - BID</td>
<td>Painless, gram negative coverage</td>
<td>Poor eschar penetration; leukopenia 5-15%</td>
</tr>
<tr>
<td>Acticoat: silver rayon mesh</td>
<td>3-7 days</td>
<td>Few dressing changes, antimicrobial</td>
<td>none</td>
</tr>
<tr>
<td>Aquacel: silver impregnated hydrofiber</td>
<td>1-14 days</td>
<td>Painless, excellent antimicrobial coverage</td>
<td>none</td>
</tr>
<tr>
<td>Mafenide solution/cream</td>
<td>BID</td>
<td>Eschar penetration; GP coverage</td>
<td>Painful; no coverage against fungus, metabolic acidosis</td>
</tr>
<tr>
<td>Bacitracin</td>
<td>QD - QID</td>
<td>Painless, inexpensive, superficial burns</td>
<td>Resistance and dermatitis with prolonged use</td>
</tr>
<tr>
<td>Xeroform: 3% bismuth tribromophenate</td>
<td>QD</td>
<td>Some bacteriostatic activity</td>
<td>dessication</td>
</tr>
<tr>
<td>Adaptic: petroleum impregnated dressing</td>
<td>QD</td>
<td>Painless, good moisture</td>
<td>No antimicrobial effect</td>
</tr>
<tr>
<td>Dakins: sodium hypochlorite/oxychlorserine</td>
<td>QD - QID</td>
<td>Excellent antimicrobial coverage</td>
<td>painful</td>
</tr>
<tr>
<td>Collagenase</td>
<td>QD</td>
<td>Penetrates collagen and eschar</td>
<td>Skin irritation</td>
</tr>
</tbody>
</table>
Management: Splinting
Intrinsic Plus Splint
Surgical Management
Excision and grafting

- Split thickness 0.012in sheet graft
  - Optimal durability
  - Function: Reduced Secondary healing
  - Optimal aesthetics

- Dorsal: 0.012”
- Palmar: 0.015-0.018”
  - Full thickness glabrous if available
Split Thickness Graft
Full Thickness Skin Graft
Local Rotation Flap
Local Pedicled Flap: rRF
Distant Pedicled Flap: Louver Flaps

Courtesy Dr Thomas Woloszyn
Amputation
Late Effects of Burn Injury

- Scar contractures
- Hypertrophic scarring
- Heterotopic ossification
- Marjolin’s ulcer
Hypertrophic scarring

- Painful, pruritic, exacerbate contractures
- Can occur in wounds that take longer than 2-3 weeks to heal, or grafted wounds
- Pressure garments, silicone, steroid injection, surgical revision
Web Space Contracture
Z-Plasty
Double Z-plasty
Multiple Z-plasties
Local Pedicled Flap: rPIA
Distant Pedicled Flap: Groin Flap
Free Flap
Free ALT
Free Flap: Toe Transfer
Heterotopic ossification

• Transformation of primitive mesenchymal tissue to mature lamellar bone

• Decreased ROM 6-8 weeks

• 1-3% of all burns
  – Greater incidence with >TBSA injury or Head Injury
  – Elbow most common site, hip, shoulder
  – Bilateral, posteromedial
Heterotopic ossification

- Serum alk phos, calcium, phosphorus, bone scan

- Surgical intervention if decreased ROM compromising ADLs despite therapy
  - Wait at least 6 months from time of injury
  - Resection, XRT, NSAIDS
Summary: Hand burn management

• Prevent stiffness and contracture with early motion / splinting
• Prevent dessication and optimize resuscitation to prevent extension of the burn at zone of stasis
• Low threshold for fasciotomy and escharotomies
• Early excision of deep and full thickness injuries to minimize edema and inflammatory response
• Full thickness grafts for palmar/volar coverage
• Fasciocutaneous flaps for tendon exposure to optimize gliding
• Observe for late complications
• Secondary reconstruction often required