

# Evidence-Based Guideline — Acute Burn Management

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# Disclosures

None



# Purpose and Scope

## Comprehensive Burn Management

Guideline covers assessment, resuscitation, wound care, and surgical treatment for thermal, electrical, and chemical burns to ensure effective patient care.

## Fluid Resuscitation and Burn Size Estimation

Includes guidance on estimating burn size and fluid resuscitation using the Parkland formula to optimize patient outcomes.

## Surgical and Triage Principles

Outlines operative techniques like split-thickness skin grafting and triage pathways based on total body surface area affected.

## Special Patient Considerations

Addresses tailored care for pediatric, elderly, and inhalation injury patients to enhance treatment effectiveness.



# Key Principles of Burn Management

## **Burn Size Estimation**

Accurate Total Body Surface Area (TBSA) estimation is essential for triage and management decisions in burn patients.

## **Burn Center Referral Criteria**

ABA criteria guide referral, especially for partial-thickness burns over 10% TBSA and burns on critical areas like face and joints.

## **Fluid Resuscitation Protocol**

The modified Parkland formula directs lactated Ringer's solution administration for initial fluid resuscitation based on weight and TBSA.

## **Zone of Stasis Importance**

Early interventions target the zone of stasis to preserve tissue and reduce burn progression.



# Classification and Pathophysiology



BURN  
PREVENTION



# Zones of Injury and Their Clinical Significance

## **Zone of Coagulation**

The central zone with irreversible cell death caused by necrosis represents the most severe tissue damage.

## **Zone of Stasis**

Surrounding tissue with decreased perfusion, viable but vulnerable, requiring early intervention to prevent necrosis.

## **Zone of Hyperemia**

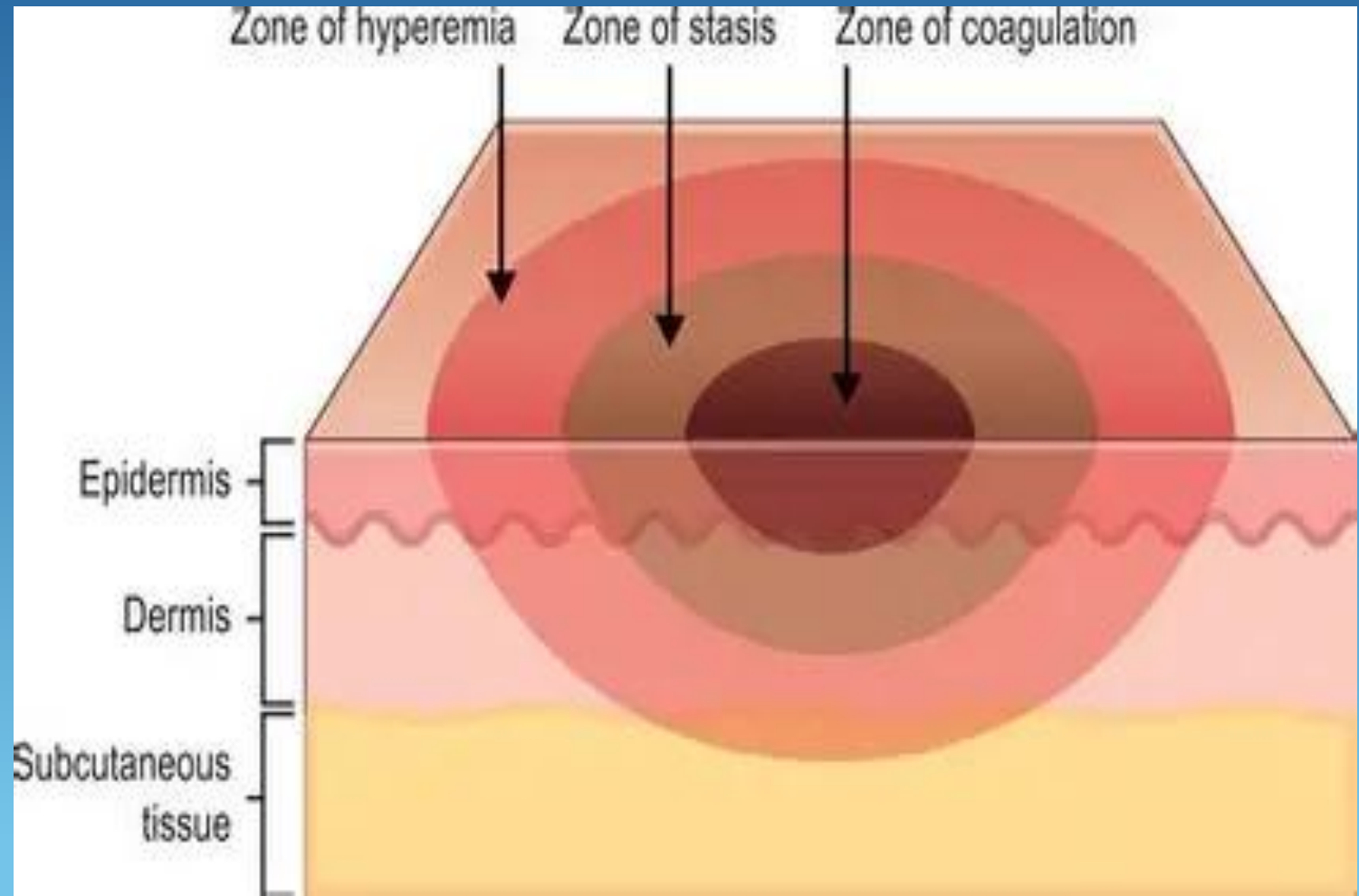
Outermost zone with increased perfusion that usually recovers with minimal intervention and healthy tissue regeneration.

## **Clinical Importance**

Preserving the zone of stasis is essential for healing and reducing surgical needs in burn treatment.



# Zones of Injury



# Assessment and Resuscitation



# Initial Assessment and Fluid Resuscitation

## Primary Burn Patient Assessment

Assessment follows airway, breathing, circulation, disability, and exposure protocol with emphasis on airway management in inhalation injury cases.

## Burn Size Estimation

Total Body Surface Area (TBSA) is estimated using Rule of Nines for adults and Lund-Browder chart for children to guide treatment.

## Fluid Resuscitation Guidelines

Modified Parkland formula guides fluid resuscitation, adjusted for inhalation injury, electrical burns, and delayed treatment to prevent complications.

## Electrical Burn Monitoring

Electrical burns require close cardiac and biochemical monitoring with increased fluid goals to prevent kidney injury from rhabdomyolysis.

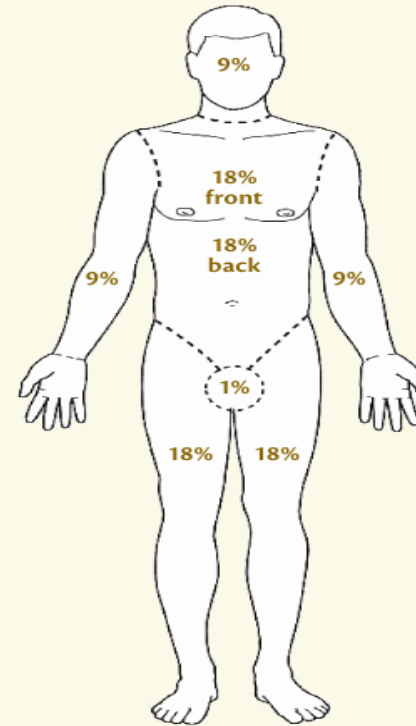


# Rule of Nines Lund-Browder Chart

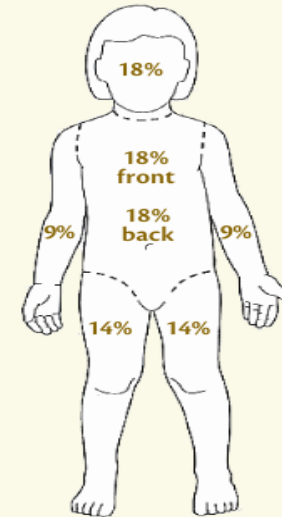
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QUICK REFERENCE CARD: BURN STABILIZATION



**RULE OF NINES**  
for adult and child



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# Wound Care and Surgical Management



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# Topical Agents and Dressing Strategies

## Early Wound Care Steps

Start with cooling burns, removing debris, and maintaining a moist antimicrobial environment for effective healing.

## Common Topical Agents

Silver sulfadiazine, mafenide acetate, and bacitracin ointments are widely used for various burn types and depths.

## Advanced Dressing Options

Silver-impregnated, honey, collagen, and biosynthetic dressings provide sustained antimicrobial effects and tailored wound management.

## Systemic Antibiotic Use

Systemic antibiotics are reserved for documented infections; topical agents effectively reduce local bacteria.



# Wound Depth and treatment



# Burn Depth and Treatment Summary

Burn Depth	Initial Treatment	Final Treatment (include whether surgery & grafting needed)
1st-degree (Superficial) — epidermis only	<ul style="list-style-type: none"> <li>• Cool with lukewarm water 10–20 min</li> <li>• Remove jewelry/clothing if not adherent</li> <li>• Analgesia (acetaminophen/NSAID)</li> <li>• Gentle cleaning, apply emollient or simple sterile dressing</li> <li>• Tetanus as indicated</li> </ul>	<ul style="list-style-type: none"> <li>• Heals in 3–7 days, no scarring</li> <li>• No surgery required</li> <li>• Moisturize, sun protection, and follow-up</li> </ul>
2nd-degree (Partial-thickness) Superficial vs. Deep	<ul style="list-style-type: none"> <li>• Cool 10–20 min, analgesia, tetanus</li> <li>• Clean wound, debride large/contaminated blisters</li> <li>• Apply topical antimicrobial dressing</li> <li>• Fluid resuscitation if &gt;10–20% TBSA</li> <li>• Elevate limb, early physiotherapy</li> </ul>	<ul style="list-style-type: none"> <li>• Superficial partial: heals 7–21 days, no grafting</li> <li>• Deep partial: &gt;21 days, often requires surgical excision ± split-thickness graft</li> <li>• Long-term scar management</li> </ul>
3rd-degree (Full-thickness) — epidermis & dermis destroyed	<ul style="list-style-type: none"> <li>• Stop burn, airway assessment</li> <li>• Avoid prolonged cooling</li> <li>• IV access, large-bore</li> <li>• Analgesia, tetanus, fluid resuscitation</li> <li>• Escharotomy if circulation/ventilation compromised</li> </ul>	<ul style="list-style-type: none"> <li>• Requires surgery: tangential/fascial excision + split-thickness autograft</li> <li>• May need staged grafting or synthetic dressings</li> <li>• Rehab, scar revision, reconstructive surgery</li> </ul>
4th-degree — into subcutaneous tissue, muscle, bone	<ul style="list-style-type: none"> <li>• ABCs, major trauma management</li> <li>• Aggressive resuscitation</li> <li>• Early burn center transfer</li> <li>• Assess for compartment syndrome, fasciotomy/escharotomy as needed</li> </ul>	<ul style="list-style-type: none"> <li>• Surgery mandatory: extensive excision/debridement</li> <li>• Reconstruction: muscle flaps, free tissue transfer, grafting</li> <li>• Possible amputation, prolonged rehab &amp; infection control</li> </ul>



# Operative Management and Graft Physiology

## Early Excision and Grafting

Early excision and grafting treat burns unlikely to heal within 14 to 21 days, improving recovery outcomes.

## Phases of Skin Graft Survival

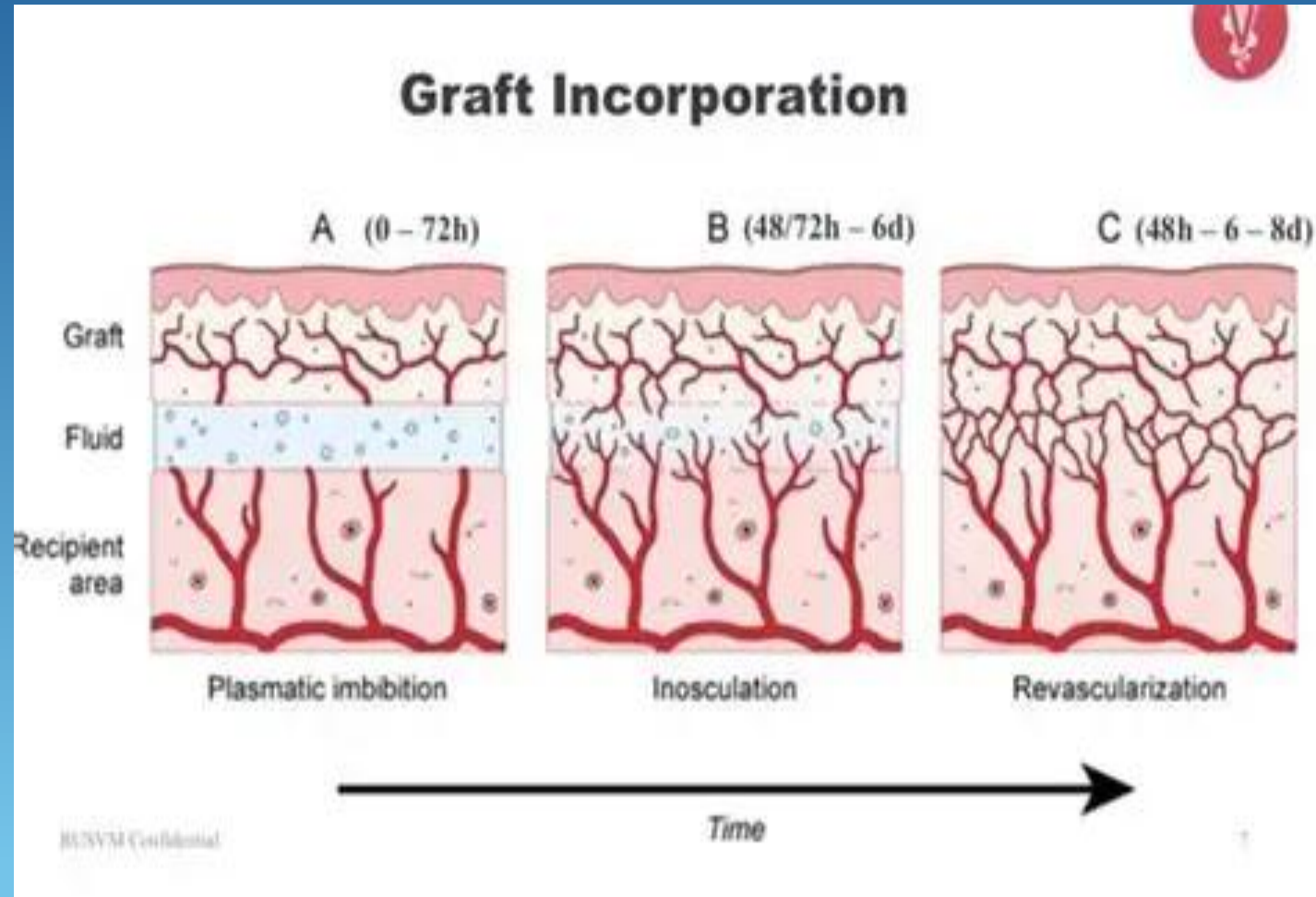
Skin graft survival involves plasmatic imbibition, inosculation, and neovascularization over the first week post-transplant.

## Essential Care for Graft Success

Clean vascularized recipient beds, hemostasis, immobilization, and infection control are vital for graft survival.



# Plasmatic Imbibition, Inosculation, and Neovascularization



# Clinical and Operational Notes

- Partial-thickness burns: superficial vs deep affects surgical decision.
- Fluid resuscitation: adults  $\geq 15\text{--}20\%$  TBSA; use Parkland formula.
- Burn center referral: full-thickness,  $>10\text{--}20\%$  TBSA, special areas (face, hands, feet, joints).
- Emergencies: inhalation injury, circumferential burns – early airway & escharotomy.
- Infection prevention: tetanus, sterile dressings, topical antimicrobials only.
- Rehabilitation: early mobilization, splinting, pressure therapy, scar management.



# Triage and Transfer Criteria



# TBSA-Based Management Pathways

## **Minor Burns Management**

Burns under 10% TBSA can be managed outpatient with wound care, pain relief, and follow-up if superficial and not critical.

## **Moderate Burns Care**

Burns involving 10–20% TBSA may need emergency observation or short hospital admission based on patient factors and burn depth.

## **Severe Burns Treatment**

Burns over 20% TBSA require hospital admission, resuscitation, early wound excision, and multidisciplinary care for optimal recovery.

## **Critical Monitoring and Support**

Monitoring for systemic inflammatory response and organ dysfunction is crucial, with early nutrition and DVT prevention in severe cases.



# Indications for Burn Center Transfer

## **Burn Severity and Location**

Partial-thickness burns over 10% TBSA and burns on face, hands, feet, genitalia, perineum, or major joints require burn center transfer.

## **Specialized Burn Types**

Electrical and chemical burns, inhalation injuries, and burns with major trauma need specialized evaluation and care.

## **Additional Transfer Criteria**

Patients with comorbidities or special rehabilitation needs should be transferred. Early consultation is advised if uncertain.



# Special Populations and Outcomes



# Considerations for Pediatrics and Elderly

## Pediatric Burn Management

Children require lower admission thresholds and use the Lund-Browder chart for accurate TBSA estimation and fluid resuscitation.

## Elderly Burn Patient Risks

Elderly have higher mortality at lower burn sizes, influenced by comorbidities and need early burn center involvement.

## Inhalation Injury Management

Common in both groups, inhalation injuries require early intubation and increased fluid resuscitation for better outcomes.

# Baux Score

## ◆ Original Baux Score

Formula:

$$\text{Baux Score} = \text{Age} + \% \text{Total Body Surface Area (TBSA) burned}$$

Interpretation:

- The score roughly estimates the **mortality percentage** for adult burn patients.
- Example:  
A 50-year-old with 40% TBSA burns → **Baux Score = 90** → **~90% mortality** (in older data before modern burn care improvements).



# Revised Baux score

## ◆ Revised Baux Score

Because burn care outcomes have improved significantly (especially with early excision, grafting, and critical care), the **Revised Baux Score** adds consideration for **inhalation injury**, which still worsens prognosis.

**Formula:**

$$\text{Revised Baux Score} = \text{Age} + \% \text{TBSA burned} + 17 \text{ (if inhalation injury present)}$$

**Interpretation:**

- This version more accurately reflects modern survival rates.
- For example:
  - A 40-year-old with 40% TBSA → **Revised Baux = 80** → roughly 30–40% mortality depending on comorbidities and burn center level.
  - If there's an inhalation injury, add 17 → **97** → higher mortality risk.



# Summary Table

Parameter	Original Baux	Revised Baux	Meaning
Components	Age + %TBSA	Age + %TBSA + 17 (if inhalation injury)	Predicts burn mortality
Approximate Mortality	≈ Baux Score (%)	More accurate with modern data	Risk of death (%)
Limitations	Doesn't account for comorbidities or modern burn care	Better predictive accuracy	Still an estimate only



# Revised Baux score Mortality

Age (yrs)	%TBSA Burned	Inhalation Injury (Add 17)	Revised Baux Score	Predicted Mortality (%)
20	20	No	40	2%
30	30	No	60	8%
40	40	No	80	30%
50	50	No	100	65%
60	60	No	120	90%
70	70	No	140	98%
40	40	Yes (+17)	97	55%
60	50	Yes (+17)	127	88%
70	60	Yes (+17)	147	99%



# Morbidity and Mortality Predictors

## **TBSA and Mortality Risk**

Total Body Surface Area burned is the primary predictor of mortality, with sharp increases around 40–50% TBSA in adults.

## **Advancements in Burn Care**

Specialized burn care including early excision, grafting, and resuscitation has improved survival rates significantly.

## **Other Mortality Factors**

Age, inhalation injury, and comorbidities also critically affect patient outcomes after burns.

## **Clinical Decision Making**

Understanding predictors guides clinicians in treatment intensity and optimal resource allocation for burn patients.



# Practical Tools and Limitations



# Emergency Department Checklist

## **Primary Assessment and Burn Cooling**

Conduct a primary survey focusing on airway protection and cool thermal burns with room-temperature water immediately.

## **Burn Size and Depth Evaluation**

Estimate total body surface area and determine burn depth to guide resuscitation and treatment plans.

## **Intravenous Access and Fluid Resuscitation**

Establish two large-bore IV lines and initiate lactated Ringer's solution for burns over 20% TBSA with urine output monitoring.

## **Additional Care and Consultation**

Provide analgesia, update tetanus prophylaxis, apply topical care, and consult a burn center, as necessary.



# Limitations and Practical Notes

## Guideline Scope and Variability

Guidelines summarize broad evidence, but local protocols and resources may affect management decisions in practice.

## Complex Care Scenarios

Specific cases like electrical injuries require consulting specialized burn center protocols for safe and effective treatment.

## Adaptation for Individual Needs

Recognizing limitations allows adaptation of care to patient specifics and institution capabilities, improving outcomes.

# Key points

- Large contemporary registries and reviews indicate improved survival over decades with specialized burn centers, early excision/grafting, improved resuscitation and critical care, though outcomes still depend on age, inhalation injury, comorbidity, and TBSA
- If >10% partial-thickness, any full-thickness, face/hands/feet/genitalia/joints, electrical, chemical or inhalation burns → consult and likely transfer to a burn center. (ABA).
- Use Parkland as a starting estimate (4 mL/kg/%TBSA LR) but titrate to urine output and avoid fluid creep.
- Preserve the zone of stasis — early resuscitation and infection control improves tissue salvage and outcomes.



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