



EMERGENCY MEDICAL  
SERVICES AGENCY  
LOS ANGELES COUNTY

Los Angeles County Emergency Medical Services  
Multi-Casualty Burn Disaster: Hospital Management

# BURN RESOURCE MANUAL



EMERGENCY MEDICAL  
SERVICES AGENCY  
LOS ANGELES COUNTY

**COUNTY OF LOS ANGELES DEPARTMENT OF HEALTH SERVICES  
EMERGENCY MEDICAL SERVICES AGENCY  
DISASTER SERVICES**



## **ACKNOWLEDGEMENTS**

**The title of this document is “BURN RESOURCE MANUAL”**

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**For more information, please consult the following points of contact (POC's):**

**Kay Fruhwirth, RN, MSN  
Assistant Director  
Los Angeles County Emergency Medical Services Agency  
10100 Pioneer Blvd, Suite 200  
Santa Fe Springs, CA 90670**

**Roel Amara, RN, BSN, MICN  
Acting Chief, Disaster Management Section  
Los Angeles County Emergency Medical Services Agency  
10100 Pioneer Blvd, Suite 200  
Santa Fe Springs, CA 90670**

**Jacqueline Rifenburg, RN, MICN  
Disaster Training Specialist  
Los Angeles County Emergency Medical Services Agency  
10100 Pioneer Blvd, Suite 200  
Santa Fe Springs, CA 90670**



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## **BURN CARE PLAN**

### **INTRODUCTION AND BACKGROUND**

As participants in the United States Department of Health and Human Services Hospital Preparedness Program, Los Angeles County Emergency Medical Services Agency was charged with the task of creating a plan to surge for 150 burn beds in the event of a multi-casualty burn disaster. This number is based upon the population of Los Angeles County. Currently there are 59 burn beds available in Los Angeles County. After evaluating the burn resources of the county, it was determined that the most viable method of surging beds was to utilize the hospitals already committed to our established trauma system. The trauma program in Los Angeles County includes 13 Level I/Level II trauma centers. Each of these 13 hospitals have been designated as a Burn Resource Center (BRC) and are prepared to accept up to twelve burn patients in the event of a disaster.

Los Angeles County Emergency Medical Services created a Burn Task Force to assist in the development of a plan. Members of this multi-disciplinary group include the Medical Directors of the burn centers in Los Angeles County, representatives of the Emergency Medical Services Agency as well as leaders in the burn community from the greater Los Angeles area.

This Burn Resource Manual has been created as a tool for use by the Emergency Departments in all Los Angeles County Hospitals. The materials were developed and/or selected from the burn literature by a Burn Task Force. This Burn Task Force was created by the Los Angeles County Emergency Medical Services Agency. This multi-disciplinary group included the Medical Directors and Administrative Nurses from the three burn centers in Los Angeles County, one center in Orange County and one center in San Bernardino county and representatives of the Emergency Medical Services Agency.

Resources in this manual include: a) Multiple appendices which outline specific resources and clinical care topics, b) Course materials for "A Multi-Casualty Burn Disaster: Hospital Management Course. This course was delivered at six locations during 2008. The materials provided here include a CD of the PowerPoint Presentation, copy of the handouts and a DVD of the lecture presentation by Warren Garner. These tools are provided to assist the individual hospital in offering this course internally to their employees, and, c) a DVD highlighting the "Care of the Burn Wound".



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## REFERENCES

Guidelines for the Operations of Burn Units (pp. 55-62),  
Resources for Optimal Care of the Injured Patient: 1999, Committee on  
Trauma, American College of Surgeons.

The American Burn Association, Practice Guidelines for Burn Care, 2001,  
[www.ameriburn.org](http://www.ameriburn.org)

[www.ameriburn.org](http://www.ameriburn.org) - The American Burn Association website

Advanced Burn Life Support – [ABLSNow@ameriburn.org](mailto:ABLSNow@ameriburn.org)



**APPENDIX A:  
BURN CARE RESOURCES – Los Angeles County and the  
surrounding area.**

**WARREN GARNER, MD**  
LAC+USC Burn Center  
2051 Marengo – Inpatient Tower – 5D  
Los Angeles, CA 90033  
323-409-7996 – Tel                      323-441-8375 – Fax  
[wgarnersurgery@usc.edu](mailto:wgarnersurgery@usc.edu)

**VIMAL MURTHY, MD**  
Torrance Memorial Burn Center  
3330 Lomita Blvd  
Torrance, CA 90505  
310-517-4622 – Tel                      310-784-4803 – Fax  
[vimal.murthy@tmmc.com](mailto:vimal.murthy@tmmc.com)

**PETER GROSSMAN, MD**  
The Grossman Burn Center – Sherman Oaks  
4929 Van Nuys Blvd.  
Sherman Oaks, CA 91403  
818-907-4580 – Tel                      818-907-2817 - Fax  
[phg@grossmanmed.com](mailto:phg@grossmanmed.com)

**MARIANNE CINAT, M.D.**  
University of California Irvine Regional Burn Center  
101 The City Drive South  
Orange, CA 92868  
714 456-5304 – Tel                      714-456-5305 - Fax  
[mecinat@uci.edu](mailto:mecinat@uci.edu)

**RICHARD GROSSMAN, M.D.**  
The Grossman Burn Center  
at Western Medical Center Santa Ana  
1001 N. Tustin Avenue  
Santa Ana, CA 92705  
714-953-2377 – Tel                      714-953-3362 - Fax

**VICTOR JOE, MD**  
Edward G. Hirschman Burn Center  
at Arrowhead Regional Medical Center  
400 N. Pepper Ave.  
Colton, CA 92324  
909-580-2100- Tel                      909-580-2120 – Fax  
[joev@armc.sbcounty.gov](mailto:joev@armc.sbcounty.gov)



## REMOTE BURN SPECIALISTS

**DAVID GREENHALGH, MD**

**Shriners Hospital for Children**

**2425 Stockton Blvd.**

**Sacramento, CA 95817**

**916-453-2111 – Tel**

**916-453-2373 - Fax**

[David.greenhalgh@ucdmc.ucdavis.org](mailto:David.greenhalgh@ucdmc.ucdavis.org)

**TINA PALMIERI, MD**

**UC Davis Burn Center**

**2315 Stockton Blvd.**

**Sacramento, CA 95817**

**916-734-3636 – Tel**

**916-734-5375 - Fax**

[tpalmieri@shrinenet.org](mailto:tpalmieri@shrinenet.org)

**AMERICAN BURN ASSOCIATION (ABA): [www.ameriburn.org](http://www.ameriburn.org)**

**ABA Central Office – Chicago**

**625 N. Michigan Ave., Ste 2550**

**Chicago, Illinois 60611**

**312.642.9260 - Tel**

**312.642.9130 - FAX**

[info@ameriburn.org](mailto:info@ameriburn.org)



## APPENDIX B:

### TRIAGE DECISION TABLE FOR BURN MASS CASUALTY DISASTER

The American Burn Association has provided a Triage Decision table based on Age, TBSA and survivability. This grid is intended for mass burn casualty disaster only. It should be used where responders are overwhelmed and transfer possibilities are insufficient to meet needs (“Disaster Management and the ABA Plan” Journal of Burn Care and Rehabilitation. Mar/Apr, 2005, pgs. 102-106).

Triage Decision Table of Benefit-to Resource ration based on patient Age and Total Burn Size

**TO BE USED BY RECEIVING HOSPITAL IN CONSULTATION WITH THE BURN LEAD SPECIALIST.**

Age/ Years	Burn Size (% TBSA)									
	0-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91+%
0-1.99	High	High	Medium	Medium	Medium	Medium	Low	Low	Low	Expectant
2-4.99	Outpatient	High	High	Medium	Medium	Medium	Medium	Low	Low	Low
5-19.9	Outpatient	High	High	High	Medium	Medium	Medium	Medium	Medium	Low
20-29.9	Outpatient	High	High	High	Medium	Medium	Medium	Medium	Low	Low
30-39.9	Outpatient	High	High	Medium	Medium	Medium	Medium	Medium	Low	Low
40-49.9	Outpatient	High	High	Medium	Medium	Medium	Medium	Low	Low	Low
50-59.9	Outpatient	High	High	Medium	Medium	Medium	Low	Low	Expectant	Expectant
60-69.9	High	High	Medium	Medium	Medium	Low	Low	Low	Expectant	Expectant
70+	High	Medium	Low	Low	Expectant	Expectant	Expectant	Expectant	Expectant	Expectant

#### LEGEND:

**Outpatient**, survival and good outcome expected without requiring initial admission;

**High benefit/resource**, survival and good outcome expected (survival > 90%) with limited/short-term initial admission and resource allocation (length of stay, <14 days, one to two surgical procedures);

**Medium benefit-resource**, survival and good outcome likely (survival, >50%) with aggressive care and comprehensive resource allocation, including initial admission (> 14 days), resuscitation, multiple surgeries;

**Low benefit-resource**, survival and good outcome <50%, even with long-term, aggressive treatment and resource allocation;

**Expectant**, survival < 10% even with unlimited, aggressive treatment





**APPENDIX C:**

**BURN DISASTER PLAN – PATIENT TRANSPORT FORM**

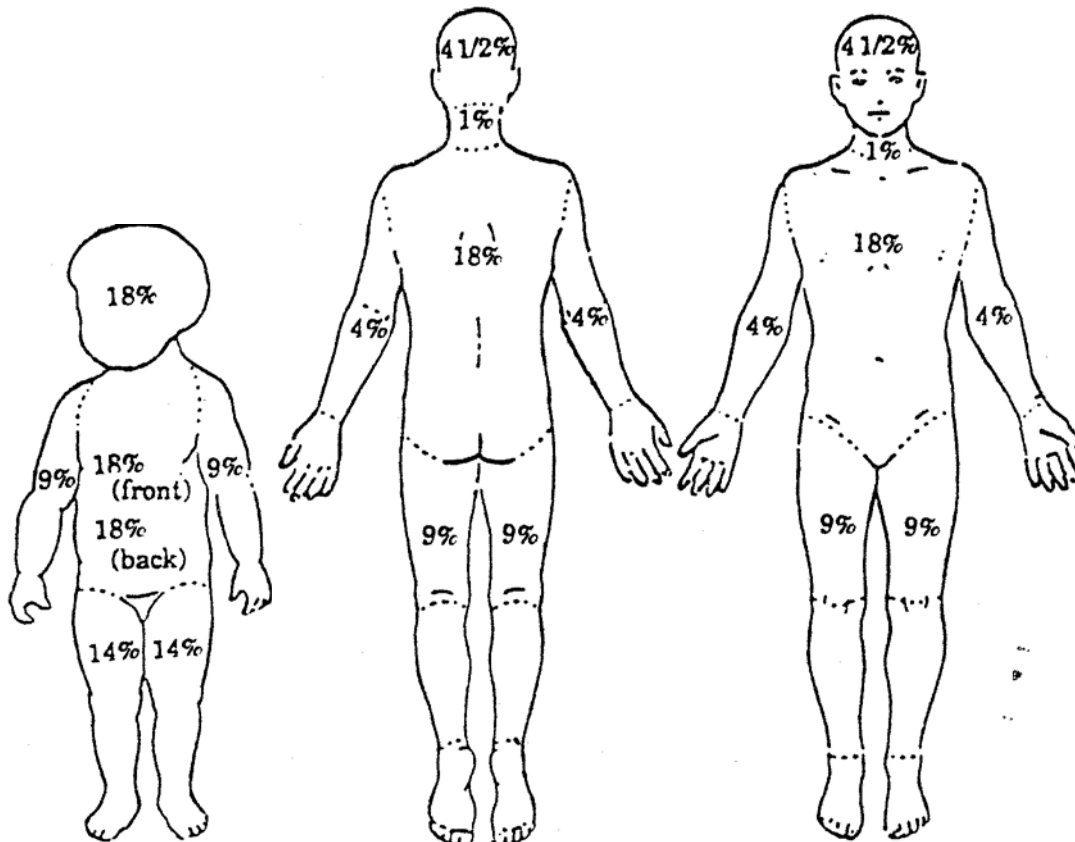
Hospital Name:	
Patient Identification	Sex: Male___ FEMALE___ AGE: DOB: Weight:___kg
TRANSFER TO:	
Authorized by:	
Date/Time of Injury	DATE: TIME:
TBSA  Cutaneous Burn Size Total burned surface area ___%  Please mark superficial burns as dots, partial thickness burns as stripes and full thickness burns as solid areas.	
INHALATION INJURY	NO:___ POSSIBLE:___ YES:___
OTHER INJURIES	Describe:
FLUID VOLUME	Total Fluid ( ) ml (Oral + Infused fluid) Infused Fluid ( ) ml Time ( ) (Duration of infusion)
FLUID TYPE	L/R: ( ) ml Saline: ( ) ml Other: ( ) ml
Completed by:	Name: PHONE:

**FAX: (562) 906-4300**

**24 Hour Phone: (866) 940-4401**



## APPENDIX D: Estimating Total Body Surface Area (TBSA) Burned RULE OF NINES



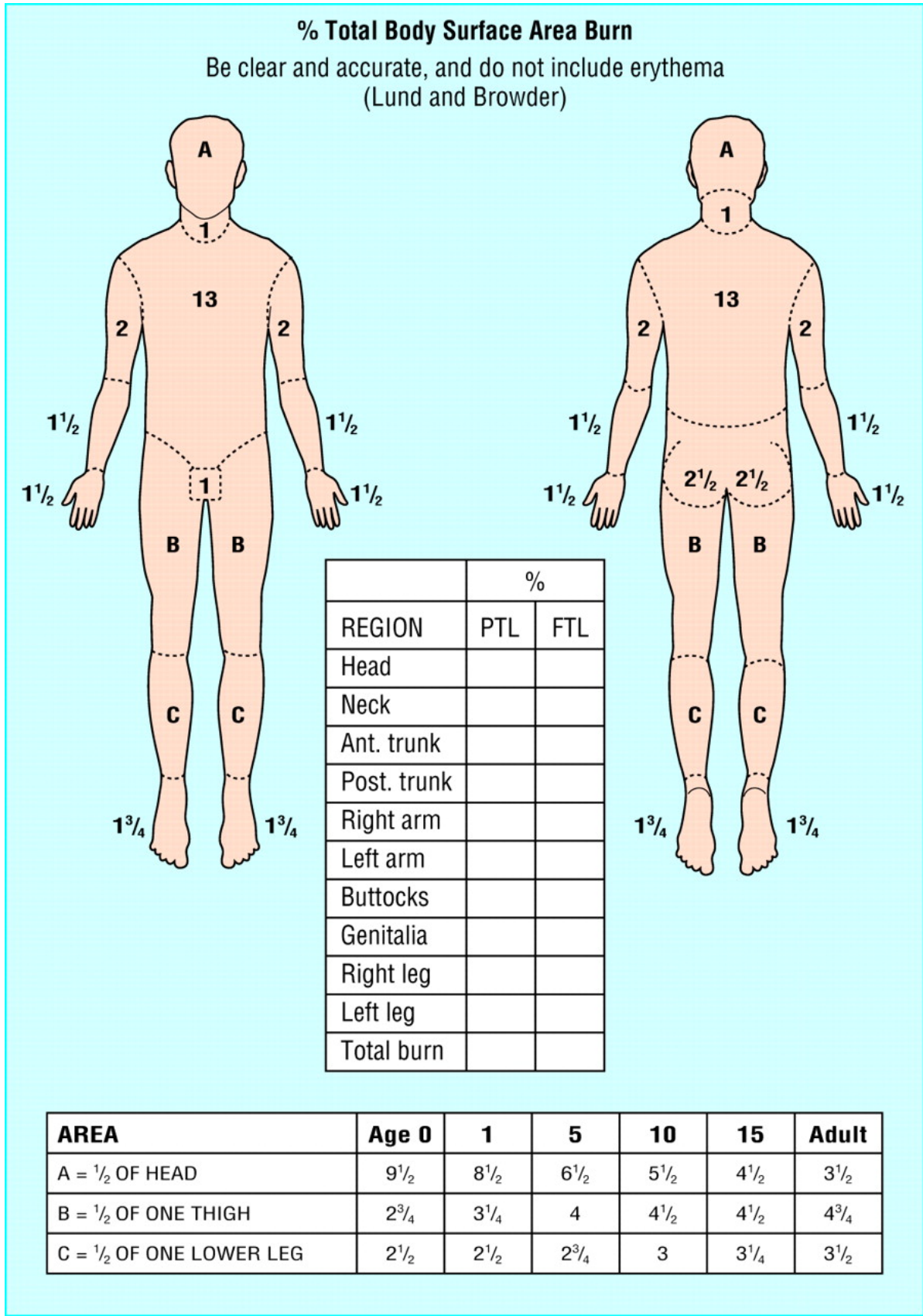
### INSTRUCTIONS:

The Rule of Nines is used in the pre-hospital setting. In the adult, the large body parts are designated as either 9% or twice this – 18%.

In a child, the percentages are slightly different. The head of a child is much larger in proportion to the body than in an adult. Therefore, the head is 18%. Notice also that the legs are 14% each, not 18%.



## LUND BROWDER DIAGRAM





## APPENDIX E RESUSCITATION

**PURPOSE:** The purpose of this guideline is to provide the hospital-based physician and staff with information on assessment and management of fluid resuscitation in the burn injured patient. The American Burn Association, Advanced Burn Life Support course curriculum was used as a guideline for preparation of this appendix.

### GOAL OF RESUSCITATION:

Maintain tissue perfusion and organ function. Avoid complications of excessive or inadequate fluid resuscitation.

### EXCESSIVE RESUSCITATION

Edema is part of the natural history of burn injuries. Maximum edema is seen 24 – 48 hours post burn. Those particularly sensitive to excessive resuscitation are: elderly, children and persons with preexisting cardiac disease.

### INADEQUATE RESUSCITATION

Prompt administration of adequate fluid is essential to a good outcome. Inadequate fluid therapy may result in shock, organ failure, acute renal failure and death.

### CALCULATE PERCENT TOTAL BODY SURFACE AREA BURN

Obtain patient weight

Calculate percent burn using the Lund Browder diagram or the rule of nines (Appendix 1).

Establish peripheral IV access or central line if necessary.

Well-accepted formulas for burn resuscitation for adults and children are shown below in Tables 1 and 2. For a detailed discussion of Burn Shock Resuscitation please refer to Practice Guidelines for Burn Care, Chapter 7, pgs. 27S -37S.

**TABLE 1: Formula for adult resuscitation needs**

	Calculated volume	Timing	Solution
<b>PARKLAND</b>	<b>4ml/kg/%Burn in 24 hours time</b>	<b>1/2 of total in first 8 hours</b>	<b>Lactated Ringers</b>
		<b>Second 1/2 over next 18 hours</b>	<b>Lactated Ringers</b>



**TABLE 2: Formulas for estimating pediatric resuscitation needs**

<b>Age</b>	<b>Calculated volume to begin resuscitation</b>	<b>Timing</b>	<b>Solution</b>
<b>Children (2 – 12 years)</b>	<b>3- 4 ml x kg x %TBSA burn</b>	<b>1<sup>st</sup> 8 hours</b>	<b>Lactated Ringers</b>
		<b>2<sup>nd</sup> 8 hours</b>	<b>Lactated Ringer's</b>
		<b>3<sup>rd</sup> 8 hours</b>	<b>Lactated Ringer's</b>
<b>Infants and Young Children 0 – 2 years As above for children and Supplement with:</b>	<b>Maintenance As below</b>	<b>1<sup>st</sup> 24 hours</b>	<b>D5LR</b>

**MAINTENANCE CALCULATIONS for adults and children:**

**1<sup>st</sup> 10 kg – 4 cc/kg/hr**

**2<sup>nd</sup> 10 kg – 2 cc/kg/hr**

**Each kg above 20kg – 1cc/kg/hr**

**Recommendations for ongoing resuscitation are from the American Burn Association, Advanced Burn Life Support course curriculum.**

**Monitoring and observation should include the following:**

- Measurement of urine output hourly
- Frequent assessment of general condition including mental status
- Baseline Hematocrit, hemoglobin, serum chemistries and arterial blood gases. Repeat as indicated

**HOURLY URINARY OUTPUT**

- **Obtain hourly urine output with the use of an indwelling bladder catheter.**
- **Adults 0.5 cc per Kg per hour (or 30-50cc/hour)**
- **Children weighing less than 30 Kg: 1cc per Kg per hours**
- **Increase or decrease fluid infusion rate by 1/3 if the output falls below or exceed this limits by one-third for 2-3 hours.**



## **MANAGEMENT OF OLIGURIA**

Oliguria is most likely due to inadequate fluid administration. In this case, diuretics are contraindicated. The rate of fluid infusion should be increased.

## **HEMOCHROMOGENURIA**

High voltage injury may result in high levels of myoglobin and hemoglobin in the urine.

Administer fluids at a rate to maintain 1.0-1.5 ml/Kg/Hr (75-100cc/hour) to clear the heme products without having to use a diuretic.

If not effective, add 12.5 Gm of osmotic diuretic, Mannitol to each liter of resuscitation fluid. Discontinue when pigment density decreases. Add sodium bicarbonate to maintain slightly alkaline urine.

Persistent hemochromogenuria may indicate compartment syndrome.

## **BLOOD PRESSURE**

Misinterpretation of blood pressure can lead to massive fluid overload. Sphygmomanometric measurements may diminish as edema progresses. Intra-arterial monitoring may be unreliable as well due to peripheral vasoconstriction.

## **HEART RATE**

HR is not a useful tool for monitoring resuscitation. A rate of 100-120 in adults is common in an adequately resuscitated patient. In children the levels of tachycardia are dependent on their normal heart rate.

## **HEMATOCRIT and HEMOGLOBIN**

Not reliable guides to resuscitation in the first 24 hours. Whole blood or PRC are indicated for anemia associated with pre-existing disease or blood loss from concomitant trauma. RBC transfusion is not necessary in the ED for isolated cutaneous injury. Should Hg/Hct fall considerably alternative sources of blood loss should be considered.

## **SERUM CHEMISTRIES**

Obtain baselines for significant burns or inhalation injury. Ongoing measurements as needed. Treat hyperkalemia and other electrolyte imbalances.



## **APPENDIX F INHALATION INJURY**

### **PURPOSE**

The purpose of this guideline is to provide the hospital-based physician and staff with information on assessment and management of inhalation injury. The American Burn Association, Advanced Burn Life Support course curriculum was used as a guideline for preparation of this appendix.

### **INTRODUCTION**

**There are three types of airway inhalation injury:**

**Carbon monoxide poisoning  
Inhalation injury above the glottis  
Inhalation injury below the glottis**

### **DIAGNOSIS**

- 1) Supported by one or more specific points from patient history:  
closed space exposure to hot gasses, steam or products of combustion
- 2) Physical exam (as below)
- 3) Airway visualization
- 4) Laboratory findings –Arterial blood gases to check for elevated carboxyhemoglobin, unexplained acidosis.

### **PHYSICAL ASSESSMENT**

#### **CO<sub>2</sub> INTOXICATION**

**Early signs – Headache, tachycardia, irritability, cutaneous flushing**

**Behavioral changes: mental confusion, vomiting, incontinence, appears intoxicated**

**Acute: Bounding pulse, dilated pupils, cyanosis or pall**

#### **RESPIRATORY TRACT INJURY**

- **Soot on tongue/in pharynx**
- **Facial burns, singed nasal or other hair**
- **Coughing/wheezing**
- **Agitation, anxiety, stupor, cyanosis, general signs of hypoxemia**



- **Restless/confused**
- **Carbonaceous sputum**
- **Hoarse voice, brassy cough, grunting, guttural respiratory sounds**
- **Rales, rhonchi or distant breath sound**
- **Erythema or swelling of the tissues of the oropharynx or nasopharynx**
- **Inability to swallow**
- **Labored or rapid breathing**
- **Stridor**
- **Decreased air exchange**

## **TREATMENT**

### **Carbon Monoxide Poisoning:**

- Treat with 100% oxygen until a level of <10% is achieved.
- Half-life of carbon monoxide on room air is 4 hours. This is reduced to 1 hour on 100% oxygen.

### **Injury above the Glottis:**

- Because this injury progresses rapidly –
- Intubate as soon as possible.

### **Injury below the glottis:**

- Intubate to clear secretions, relieve dyspnea and ensure adequate oxygenation and ventilation, particularly if the patient is being transferred.
- This type of injury may result in airway obstruction that develops over time – may occur 24 -72 hours post burn. Watch for:
  - Progressive hoarseness
  - Increased stridor
  - Retractions

## **OTHER CONSIDERATIONS:**

Circumferential burns of the chest or abdomen may result in compromised ventilation. If this occurs, escharotomies may be indicated to improve ventilation.





## **APPENDIX G ESCHAROTOMY**

### **PURPOSE**

This guideline is to review the principles of monitoring burned extremities for the presence of compartmental compression or ischemia and of performing escharotomy for relief of elevated tissue pressure.

This guideline is designed to aid those physicians who are responsible for the triage and initial management of burn patients.

**SIGNS AND SYMPTOMS:** Monitor for the following signs and symptoms in full thickness, circumferential burn injuries, which may indicate a circulation deficit of the compromised extremity or torso:

- Cyanosis of distal unburned skin on a limb
- Unrelenting deep tissue pain
- Progressive paresthesias
- Progressive decrease or absence of pulse
- Inability to ventilate in patients with deep circumferential burns of the chest and abdomen

### **DIAGNOSIS and TREATMENT:**

- If signs and symptoms are present, treat as below.
- Escharotomy to divide the eschar is performed at the bedside.
- Utilize a clean field and electrocautery device or scalpel.
- IV Narcotics, ketamine or propofol for analgesia
- Incise mid-lateral or mid-medial aspect of the extremity or the anterior/axillary line of the chest/abdomen with sub-clavicular and sub-costal incisions to avoid major nerves and vessels- extend through eschar into the SQ fat to permit adequate separation of the cut edges for decompression. Contact the Burn Lead Specialist for further assistance.

### **BACKGROUND:**

The American Burn Association, Practice Guidelines for Burn Care, 2001 and the ABLS Curriculum were used as guides in the preparation of this document.



## Clinical Problem

Circumferential extremity burns may lead to neurovascular compromise and tissue ischemia secondary to elevated pressure. This is particularly a problem when a full-thickness injury is present. In the presence of progressive fluid extravasation beneath an unyielding eschar, the potential exists for tissue pressure to increase to such a point that tissue ischemia can occur.

Because the process of transscapillary fluid efflux is gradual, elevated tissue pressures necessitating escharotomy are rarely observed in the immediate post injury period, and are most likely to develop gradually over the 24 hours following injury.

Hemodynamic or pulmonary abnormalities can be attributed to full thickness, circumferential burns of the chest or abdomen.

Diagnosis:

Photoplethysmography or pulse oximetry

Intercompartmental tissue pressures are the standard objective method of analysis. Values of 25-40 mmHg have been used as the level at which an escharotomy should be performed.

Escharotomy is done midlateral or mid medial in the supinated extremity to minimize injury to underlying structures.



## **APPENDIX H: WOUND CARE (Also see BURN WOUND CARE training CD).**

### **PURPOSE**

This guideline is designed to aid those physicians and clinical staff caring for burn wounds in the first 72 hours following burn injury.

The American Burn Association, Practice Guidelines for Burn Care, 2001 and the ABLS curriculum were used as guides in the preparation of this document.

### **POLICY**

If transfer to a burn center is delayed beyond 24 hours specific burn wound care should be done.

### **PROCEDURE**

Provide burn wound care on the burn patient daily. MAINTAIN BODY TEMPERATURE.

Keep room warm

Use heating lamps

Bathe the patient in warm water with soap. Wound care may be very painful. Provide intravenous narcotic in small, frequent doses as necessary throughout treatment.

- Debride blisters > 2cm and cleanse with soap and water.
- Shampoo hair and shave male faces
- Dry thoroughly – keep patient warm
- Apply silver sulfadiazine impregnated cream to all burned areas. Be careful not to constrict edematous extremities with wrapped dressings. Lay the dressings over the wound and secure with burn net dressings.
- Treat any escharotomy sites with liberal amounts of the same cream



### **Special Considerations by Anatomic area:**

**FACE** – prone to swelling – elevate the HOB to 30 degree if patient if not hypotensive. Use water or saline to clean the face. Protect the eye. Shave the face as needed. **No creams on the face, use antibiotic ointment.**

**EARS:** Avoid pressure on the ear. Avoid occlusive dressings and pillows under the head. Use sulfamylon cream on third degree burns of the ear.

**HANDS:** Elevate hands on pillows to prevent edema. Avoid restrictive dressings. Promote active range of motion hourly to minimize swelling and preserve function

Monitor vascular status and consider escharotomy if vascular compromise. Consult with a burn specialist before performing escharotomy.

**FEET:** Assess circulation and neuro status hourly. Elevate extremities and avoid restrictive dressings.

**GENITALIA/PERINEUM:** Burns of the penis with swelling require insertion of a Foley catheter. Scrotal swelling is common. No special treatment is indicated.



## **APPENDIX I NUTRITION**

### **PURPOSE**

The purpose of these guidelines is to summarize the role of nutritional assessment and support in the early (<72 hours after injury) acute management of the burn patient

The purpose of this guideline is to review the physiologic background and efficacy of nutritional support during the initial care of burn patients.

### **BACKGROUND:**

The American Burn Association, Practice Guidelines for Burn Care, 2001 was used as a guide in the preparation of this document. Nutritional supplementation plays a key role in the support of the burn patient, supporting the immune system and blunting the hypermetabolic response.

### **POLICY:**

Enteral feeding should be initiated as soon as practical following burn injury >20% TBSA. Goal is to feed within 24 hours of injury. Nutritional support is associated with fewer infections and better survival.

Nutritional support should be used in preference to parenteral support when possible. A calorie/nitrogen ratio of 110:1 or less with provision of adequate calories to meet energy needs should be used for patients with burn >20% TBSA.

Estimate energy requirement periodically. Patients with burns require twice as many calories as they would without thermal injuries. Encourage oral intake and assess adequacy. Not patients cannot achieve goals without supplementation with enteral or parenteral feeds.

### **Curreri formula – ADULT**

$25\text{kcal} \times \text{weight (kg)} + 40 \text{ kcal} \times \% \text{BSA}$

### **Hildreth + Associates – CHILD – under 1 year of age**

$2100 \text{ kcal/m}^2 \text{ BSA/day} + 100 \text{ kcal/m}^2 \text{ burned/day}$



## **MULTICASUALTY BURN DISASTER: HOSPITAL MANAGEMENT**

### *Program Overview/Purpose*

The potential for a disaster large enough to overwhelm the current system is certainly real and warrants the attention of health providers. This educational course seeks to enhance the ability of first providers, trauma hospitals and burn centers in our region to manage a disaster and provide the best care possible in the worst situation.

This course serves two purposes. First, it provides information about the Burn Care Plan formulated by Los Angeles County Emergency Medical Services to be activated in the event of a multi-casualty burn disaster. Secondly, it provides information for medical personnel pertaining to the triage, initial care and early management of patients with burn injuries.

### **COURSE DESCRIPTION:**

The purpose of this course is to provide hospital management guidelines in the event of a multi-casualty burn disaster. Information on activation of the multi-casualty burn disaster care plan in Los Angeles as well as guidelines for the non-burn center hospital management of burn injured patients during the first hours to days post burn injury will be discussed.

Topics include:

- \* Burn Disaster Plan Activation,
- \* Pathophysiology of burn and smoke inhalation injury
- \* Emergency management priorities (ABC's)
- \* Fluid Resuscitation and Depth and Extent of Burn
- \* Pain Management
- \* Antibiotic prophylaxis and GI Considerations
- \* Wound Management-Circumferential burns, high voltage electrical injury, chemical burns
- \* Triage priorities in severe burns,
- \* Nutritional support
- \* Psychosocial Care/Rehabilitation
- \* Prevention and Management of Complications
- \* Care beyond the first 24 hours



## EDUCATIONAL OBJECTIVES:

Upon Completion of this course of study the student will be able to:

- \* Outline how Los Angeles County defines a burn disaster and the plan to receive a surge of burn patients.
- \* Define the role of Burn Lead Specialist and give examples of when he/she may be contacted.
- \* Identify triage priorities in a burn disaster setting.
- \* Describe the pathophysiology of burn shock.
- \* Identify the systemic effects of thermal injury from burn injury physiologic response within the first 24 hours.
- \* Describe care of inhalation injury including airway and breathing management.
- \* List measures for managing exposure and environmental control.
- \* Identify appropriate intravenous fluids.  
Describe fluid formulae for the burn patient (adult, child and infant) initially, in the 2<sup>nd</sup> 24 hours and after 48 hours.
- \* Define the differences in depths of burns.
- \* List treatment measures for pain management, antibiotic prophylaxis and gastrointestinal considerations.
- \* Define and state specific considerations in wound care
- \* Identify pathophysiology, treatment and care for high voltage, electric injury, chemical burns, military vesicants and sulfur mustard.
- \* Describe nutritional guidelines for burn patients.
- \* Discuss complications of burn care.
- \* List the guidelines for psychosocial/rehabilitation care.
- \* Describe appropriate interventions beyond 24 hours post burn.