A close-up photograph of several marshmallows on sticks, some of which are being roasted over a campfire. The background is filled with the warm, orange and yellow flames of the fire, creating a cozy and inviting atmosphere. The marshmallows are white and appear to be melting slightly from the heat. The sticks are made of wood and are positioned at various angles, some pointing towards the camera and others away from it. The overall scene is a classic representation of a campfire at night.

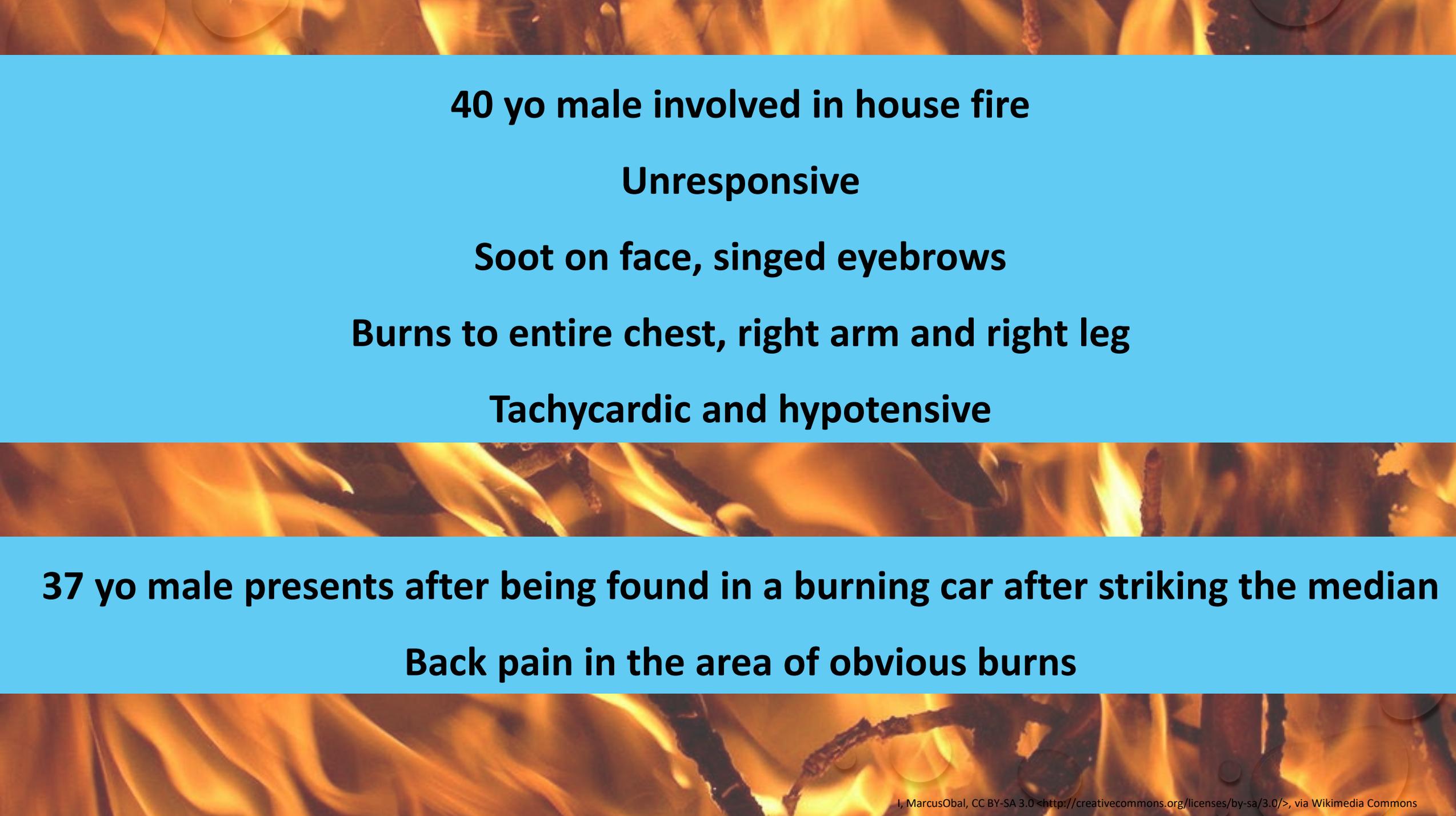
# Challenging ED Burn Cases

Christopher B. Colwell, MD

San Francisco General Hospital and Trauma Center

A large pile of US dollar bills, many bundled with rubber bands, with the text "No Disclosures" overlaid in the center.

No Disclosures

A background image of a fire with bright orange and yellow flames, used as a decorative border for the text.

**40 yo male involved in house fire**

**Unresponsive**

**Soot on face, singed eyebrows**

**Burns to entire chest, right arm and right leg**

**Tachycardic and hypotensive**

**37 yo male presents after being found in a burning car after striking the median**

**Back pain in the area of obvious burns**



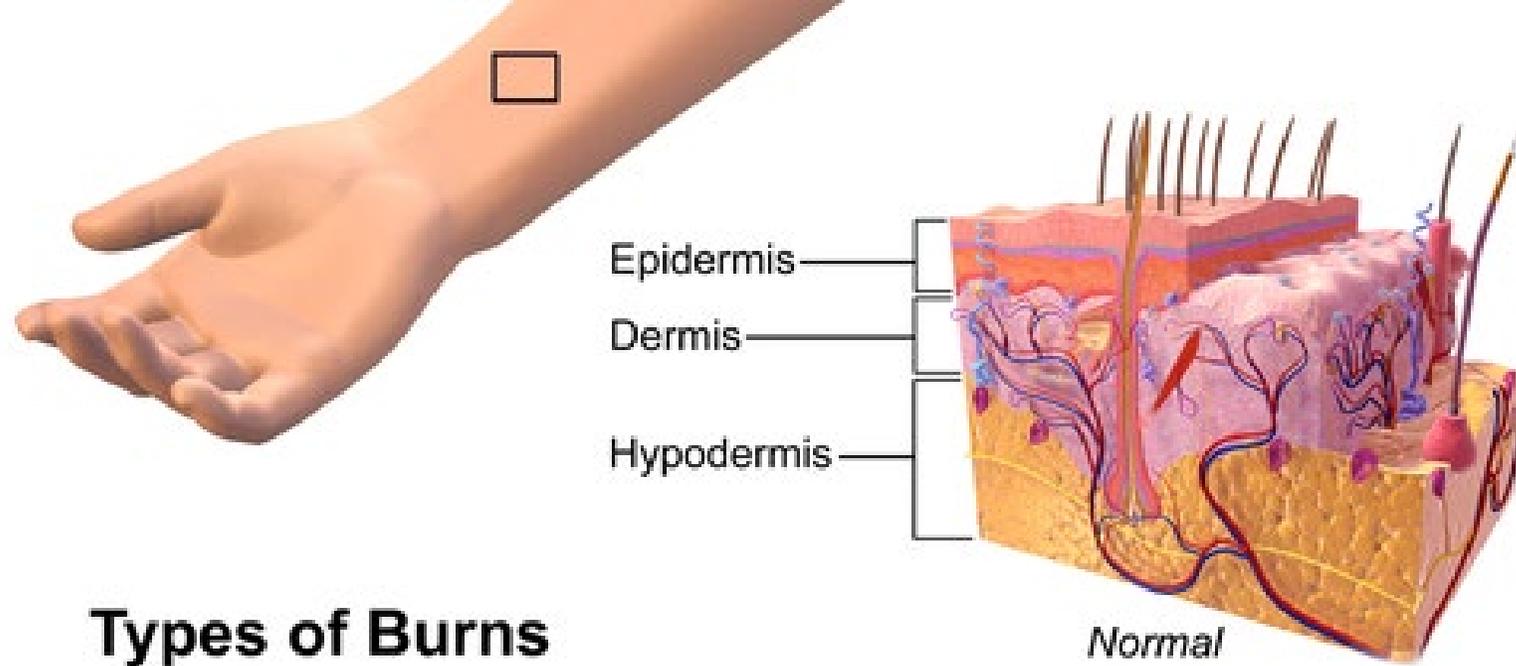


FIRE

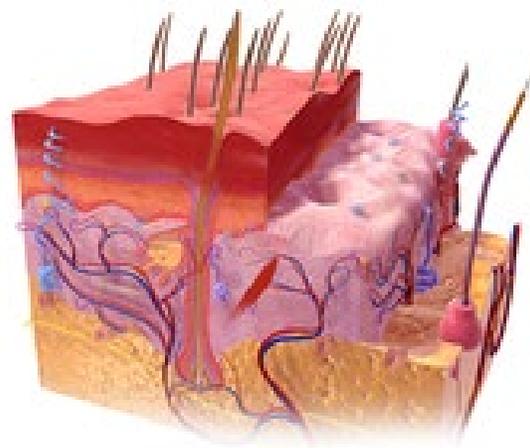
THERMAL BLAST INJURY

CHEMICAL

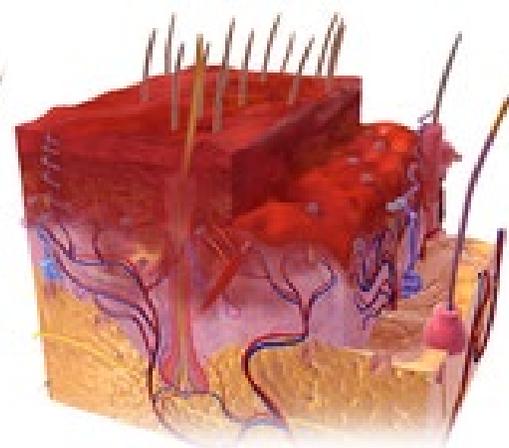
ELECTRICAL



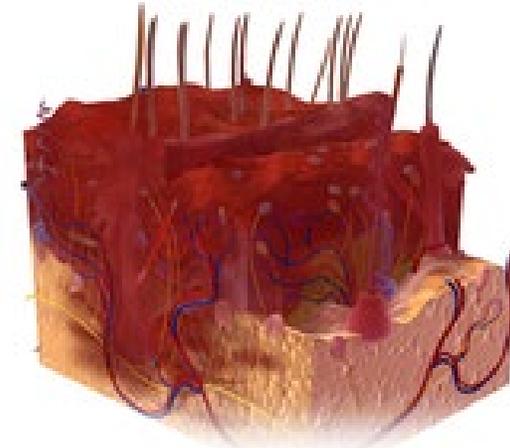
## Types of Burns



*First-degree burn*



*Second-degree burn*



*Third-degree burn*

# BURN CLASSIFICATION

## Superficial

Blanches with pressure  
Red, dry, painful

## Superficial partial-thickness

Blanches with pressure  
Red, moist, weeping, blisters  
Painful to temperature, air, and touch

## Deep partial-thickness

Blanching with pressure may be sluggish  
Variable color, wet or waxy dry, blisters, painful to pressure only

## Full-thickness

No blanching with pressure  
Waxy white, leathery gray, charred and black  
Dry & inelastic, pain to deep pressure only

## Deeper injury

Extends to fascia and/or muscle  
Pain to deep pressure



Age < 5 and Age > 55 -> Deeper Burns (Thinner Skin)

Volar surface of the forearms

Medial thighs

Perineum

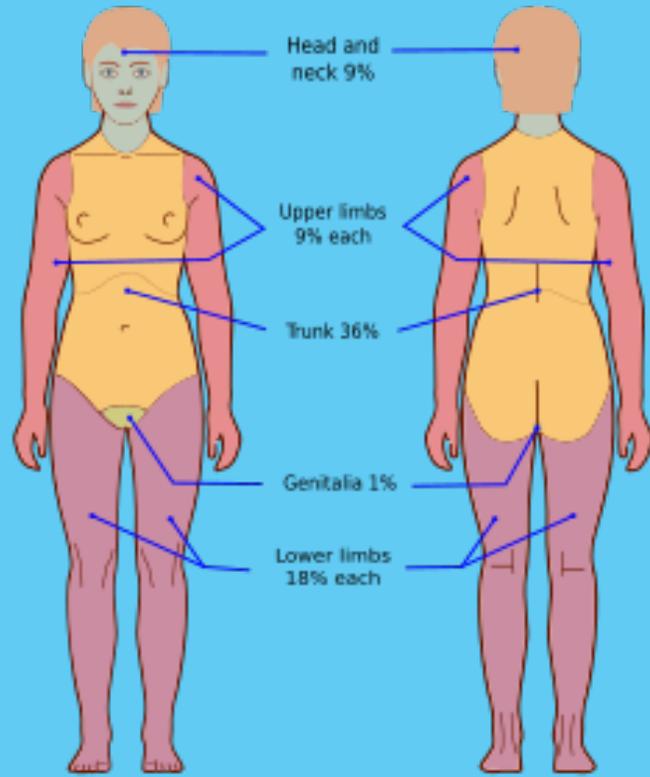
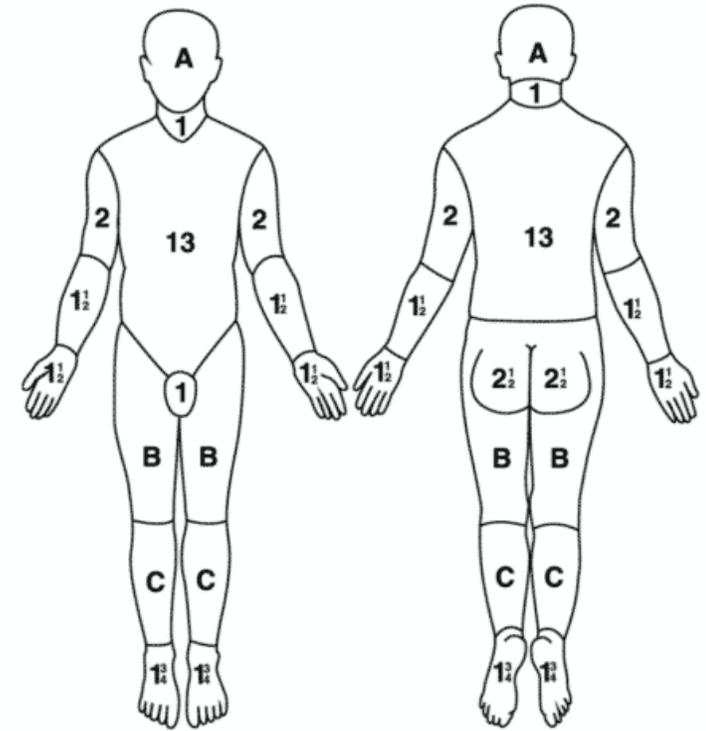
Ears

# Lund & Browder Chart

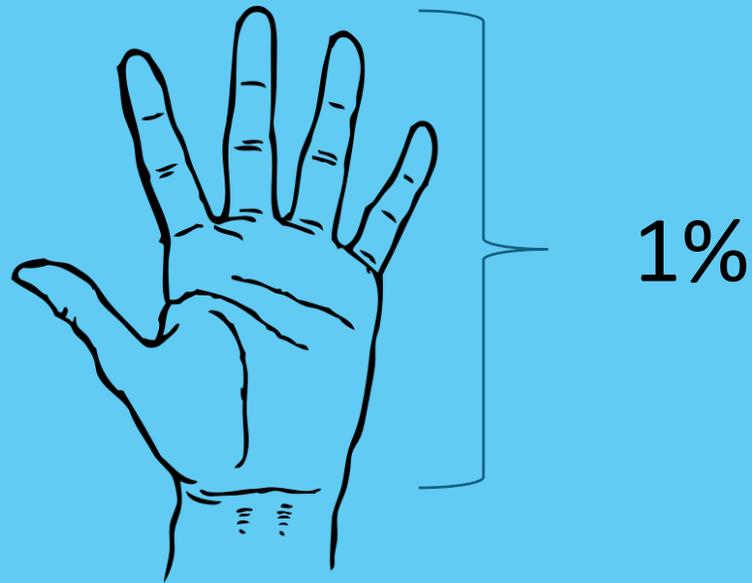
www.ThePlasticsFella.com

1. Mark the areas of the burn
2. Calculate area using the age-table below
3. Do not include superficial burns

Age	0	1	5	10	15	Adult
Front or back half	(%)	(%)	(%)	(%)	(%)	(%)
<b>A</b> (Head)	9½	8½	6½	5½	4½	3½
<b>B</b> (Thigh)	2¼	3¼	4	4¼	4½	4¼
<b>C</b> (Leg)	2½	2½	2¼	3	3¼	3½



Jmarchn, CC BY-SA 3.0 <<https://creativecommons.org/licenses/by-sa/3.0/>>, via Wikimedia Commons



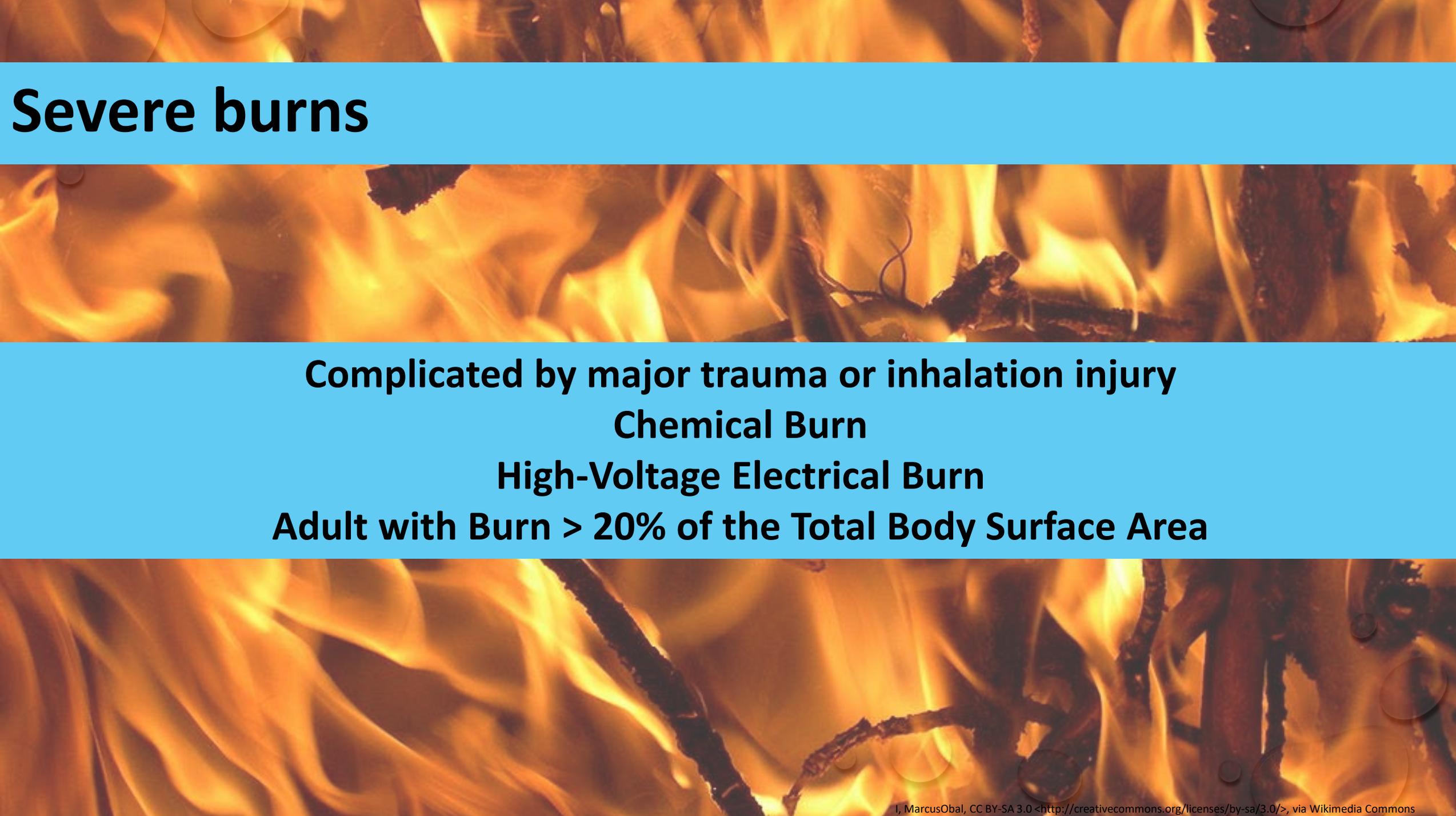
# Minor burns

**Partial-thickness burns < 10% TBSA if 10 to 50 yo**

**Partial-thickness burns < 5% TBSA if under 10 or over 50**

**Full-thickness burns < 2% TBSA in any patient without other injury**

**Additional Criteria: Isolated injury, not circumferential, does not cross major joints, does not involve face, hands, perineum or feet**



# Severe burns

**Complicated by major trauma or inhalation injury**

**Chemical Burn**

**High-Voltage Electrical Burn**

**Adult with Burn > 20% of the Total Body Surface Area**

# Consider abuse

**Scald burns with sharply demarcated edges**

**Burns in shape of an object**

**Circular burns matching a cigarette or cigar tip**

**Burns in perineal area (“dip-in” pattern)**



# MANAGEMENT

Remove Burning Source

Cooling

Cleansing & Debridement

Dressing

Pain Management

Tetanus Prophylaxis

Consider & Identify Associated Injuries

# COOLING

20-30 min of cold water

Or

Saline-soaked gauze cooled to 12C

No ICE

Reduces pain & edema

Reduces depth of burn

Decreases inflammatory response

Improves speed of wound healing

Minimizes scarring

# CLEANSING & DEBRIDEMENT

## CLEANSING

Skin disinfectants  
Mild soap and water

## DEBRIDEMENT

Brushing, Scraping, Curetting, Cutting  
Remove devitalized & necrotic tissue, foreign bodies, debris, ruptured blisters  
Debridement improves tendency to heal in timely manner



# **DRESSINGS**

## **BASIC DISCHARGE DRESSING**

**Topical antibiotic**

**Silver Sulfadiazine no longer recommended**

**Nonadherent gauze**

**Fluffed dry gauze**

**Elastic gauze roll**

**Keep blisters intact**

## **BURN CENTER TRANSFERS**

**Nonstick gauze**



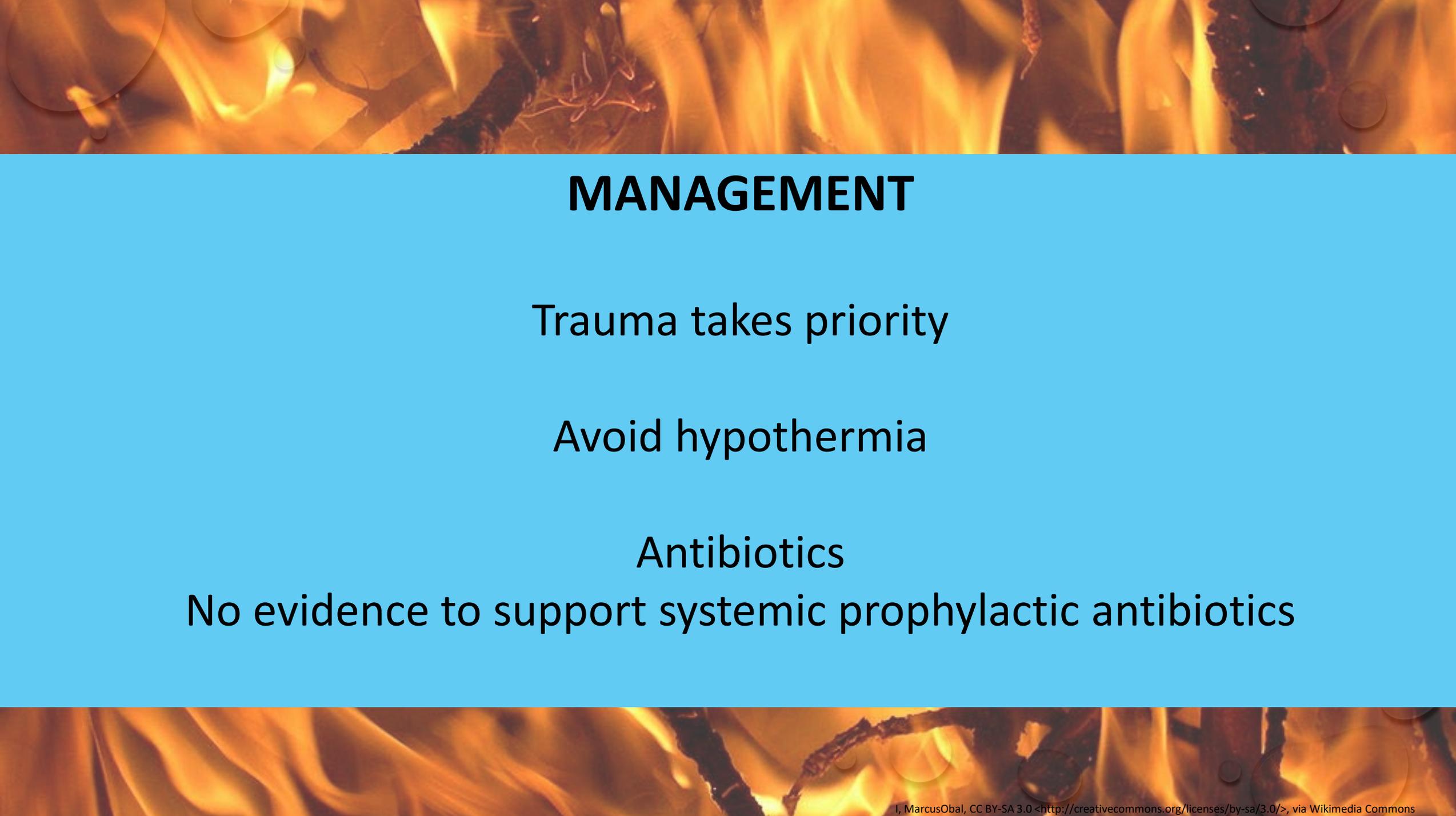
# PAIN MANAGEMENT

Acetaminophen

NSAIDS

Opioids

Anxiolytics



# MANAGEMENT

Trauma takes priority

Avoid hypothermia

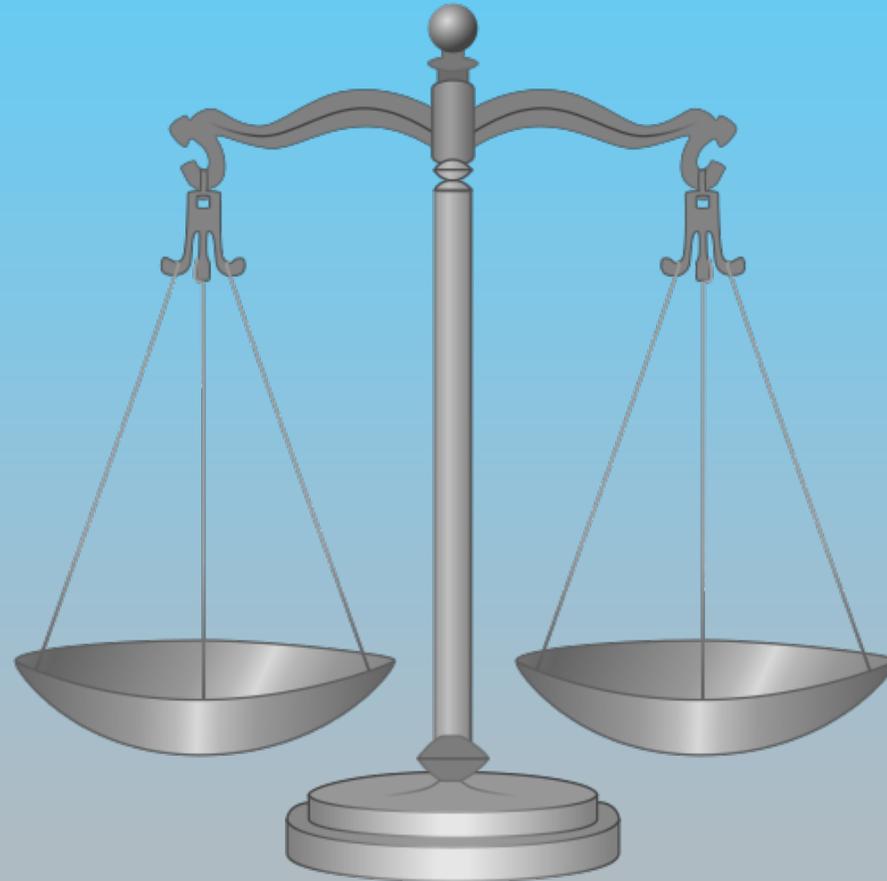
Antibiotics

No evidence to support systemic prophylactic antibiotics

# Fluid Under-resuscitation

## Shock

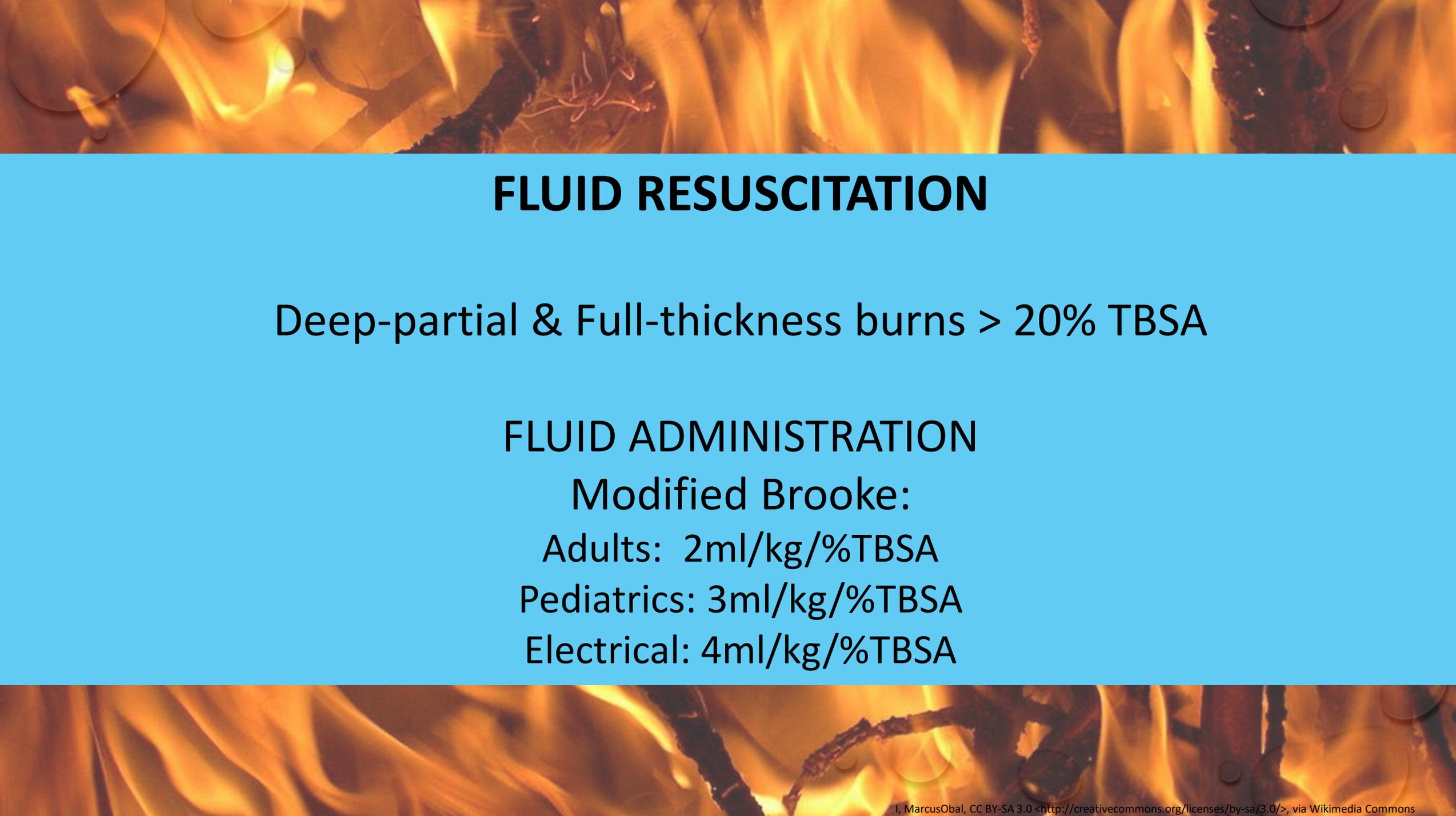
Suboptimal Tissue Perfusion  
Ischemic End-Organ Injury  
Multiple organ failure  
Renal Failure



# Fluid Over-resuscitation

## ARDS

Pneumonia  
Bacteremia  
Interstitial edema  
Multiple organ failure  
Death



# FLUID RESUSCITATION

Deep-partial & Full-thickness burns > 20% TBSA

## FLUID ADMINISTRATION

Modified Brooke:

Adults: 2ml/kg/%TBSA

Pediatrics: 3ml/kg/%TBSA

Electrical: 4ml/kg/%TBSA



# FLUID RESUSCITATION

Deep-partial & Full-thickness burns > 20% TBSA

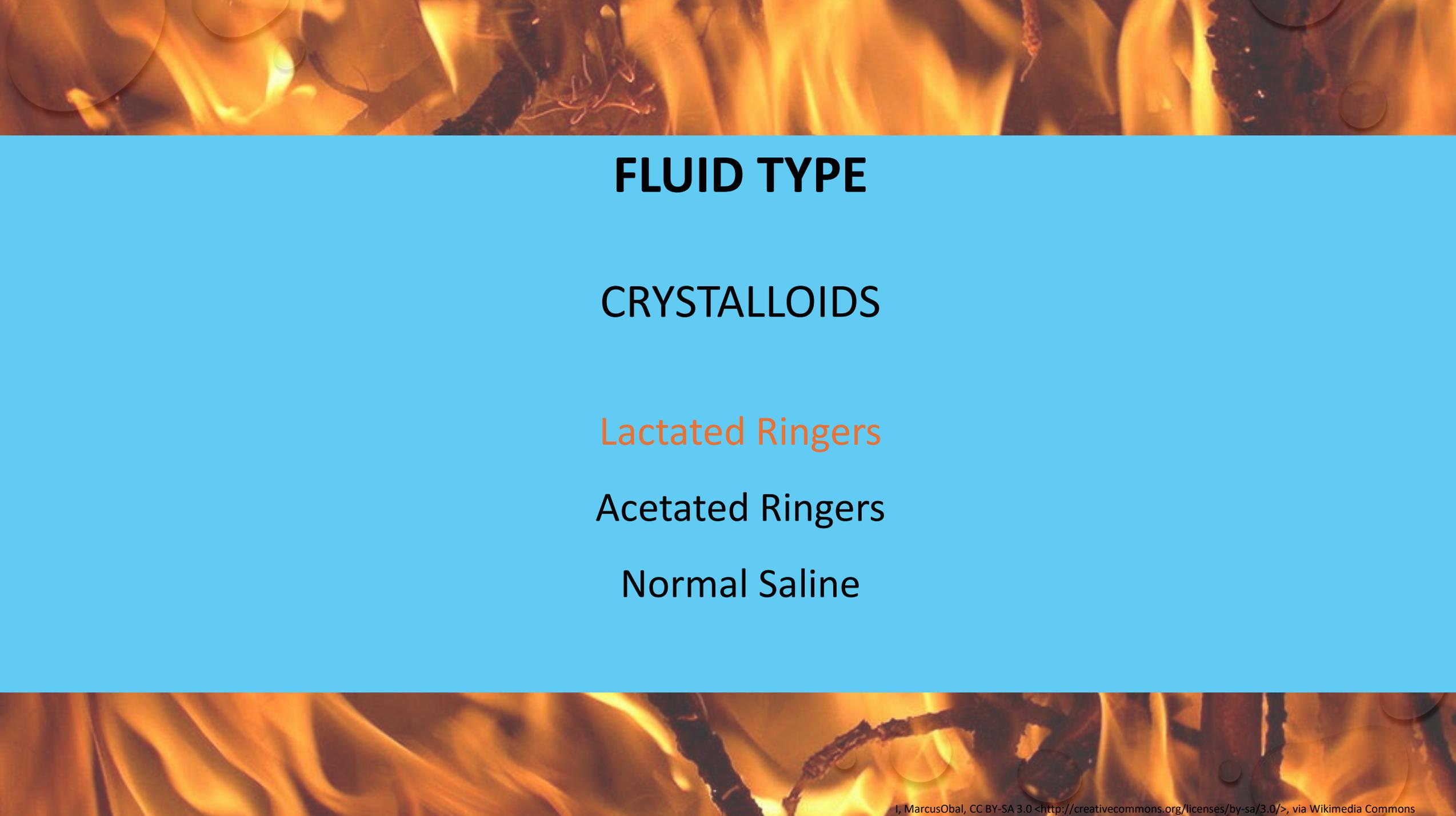
## URINE OUTPUT TARGETS

Adults: 0.5 ml/kg/hr

Pediatrics: 1 ml/kg/hr

Electrical: 1-1.5 ml/kg/hr

Most adult burn units accept 30-50 ml/hr UOP



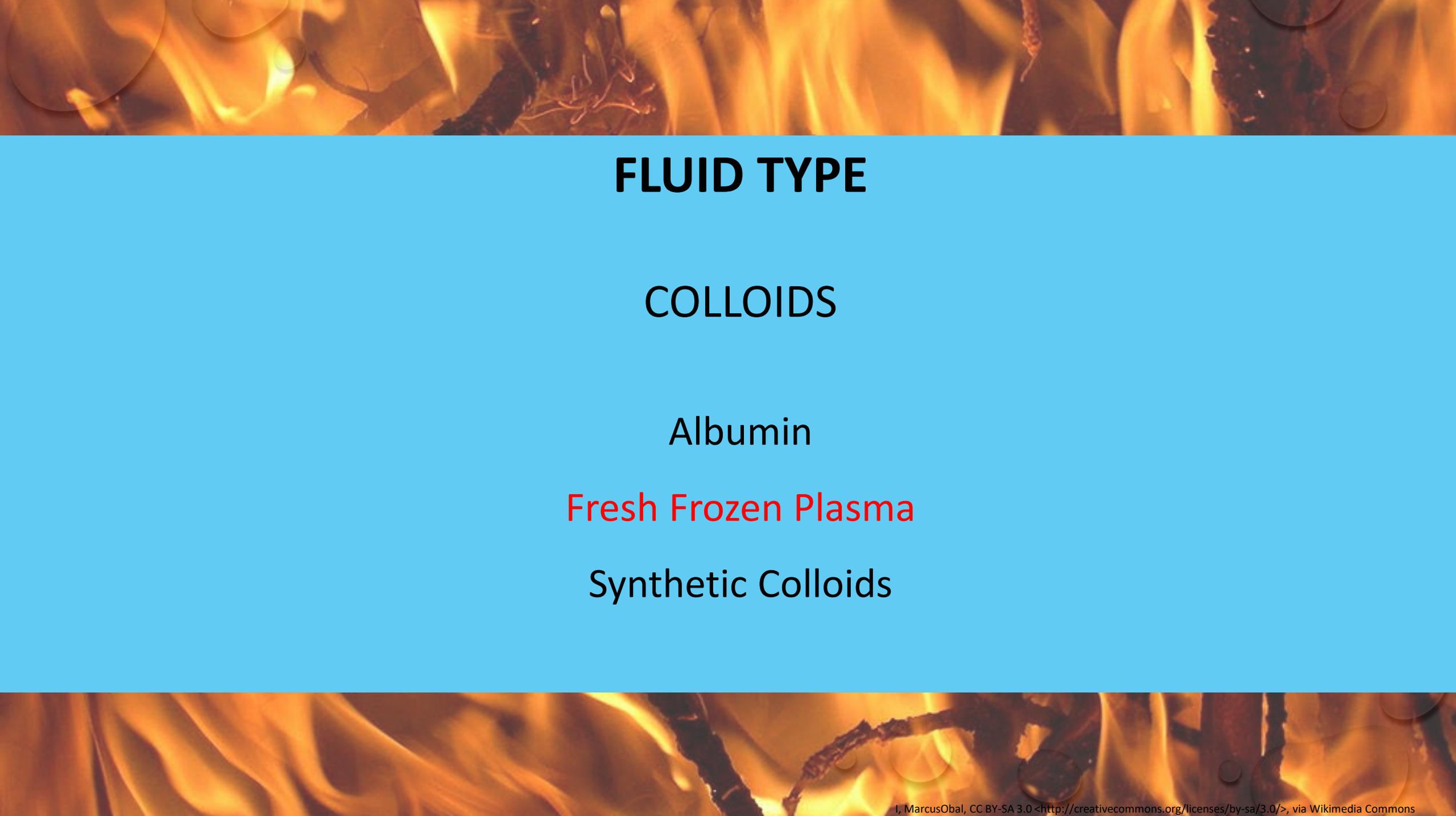
# FLUID TYPE

## CRYSTALLOIDS

Lactated Ringers

Acetated Ringers

Normal Saline



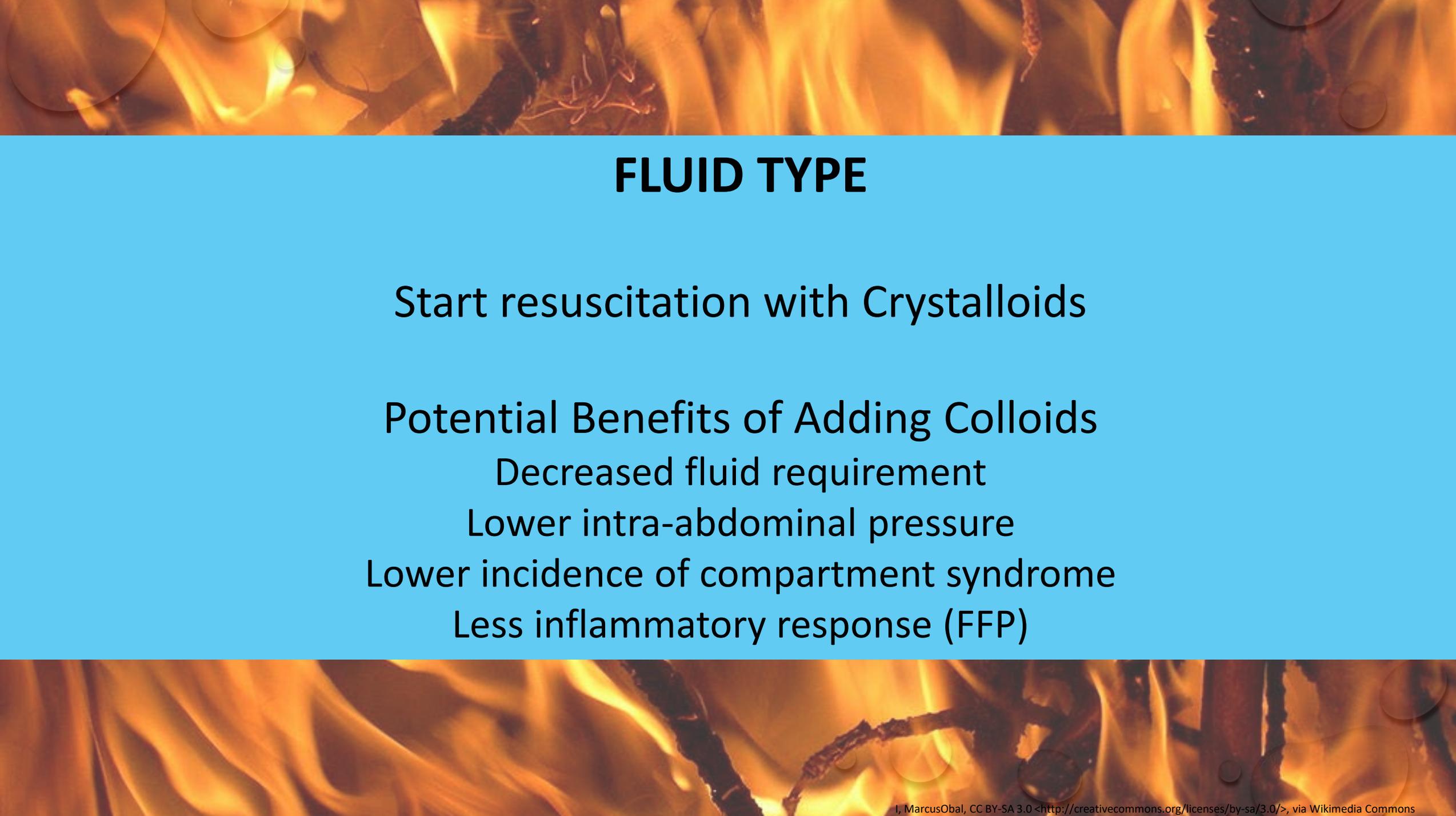
# FLUID TYPE

## COLLOIDS

Albumin

Fresh Frozen Plasma

Synthetic Colloids



# FLUID TYPE

Start resuscitation with Crystalloids

Potential Benefits of Adding Colloids

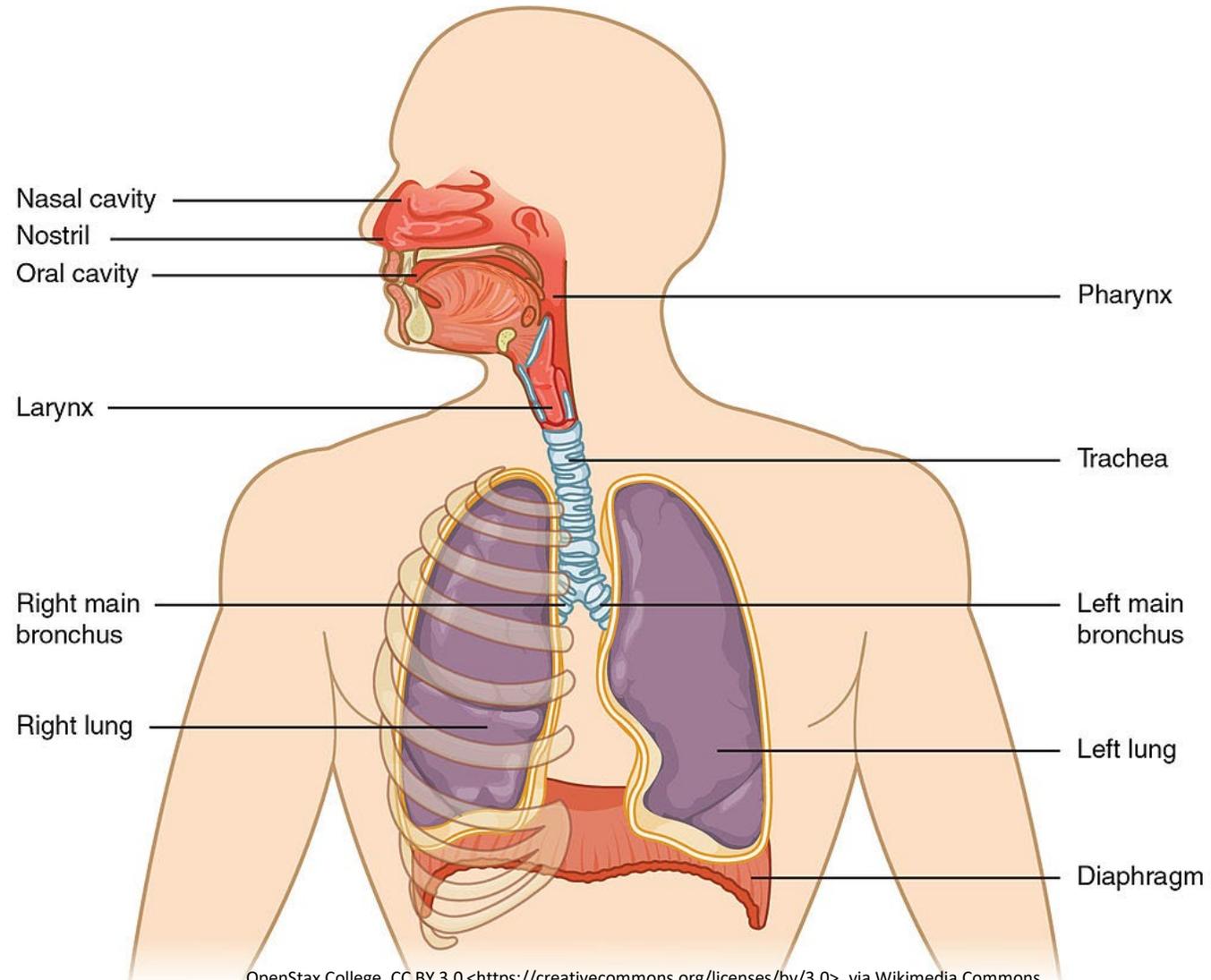
Decreased fluid requirement

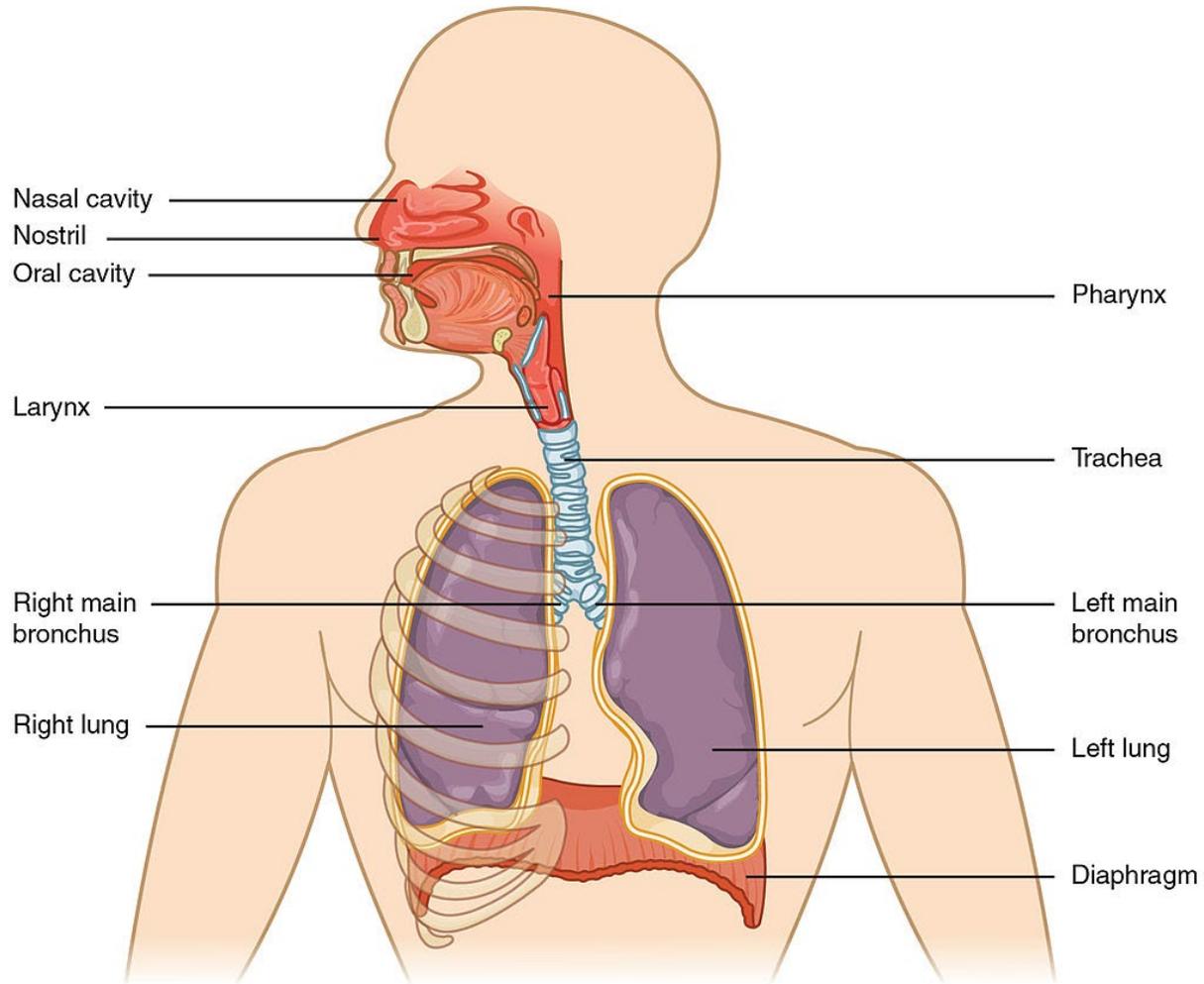
Lower intra-abdominal pressure

Lower incidence of compartment syndrome

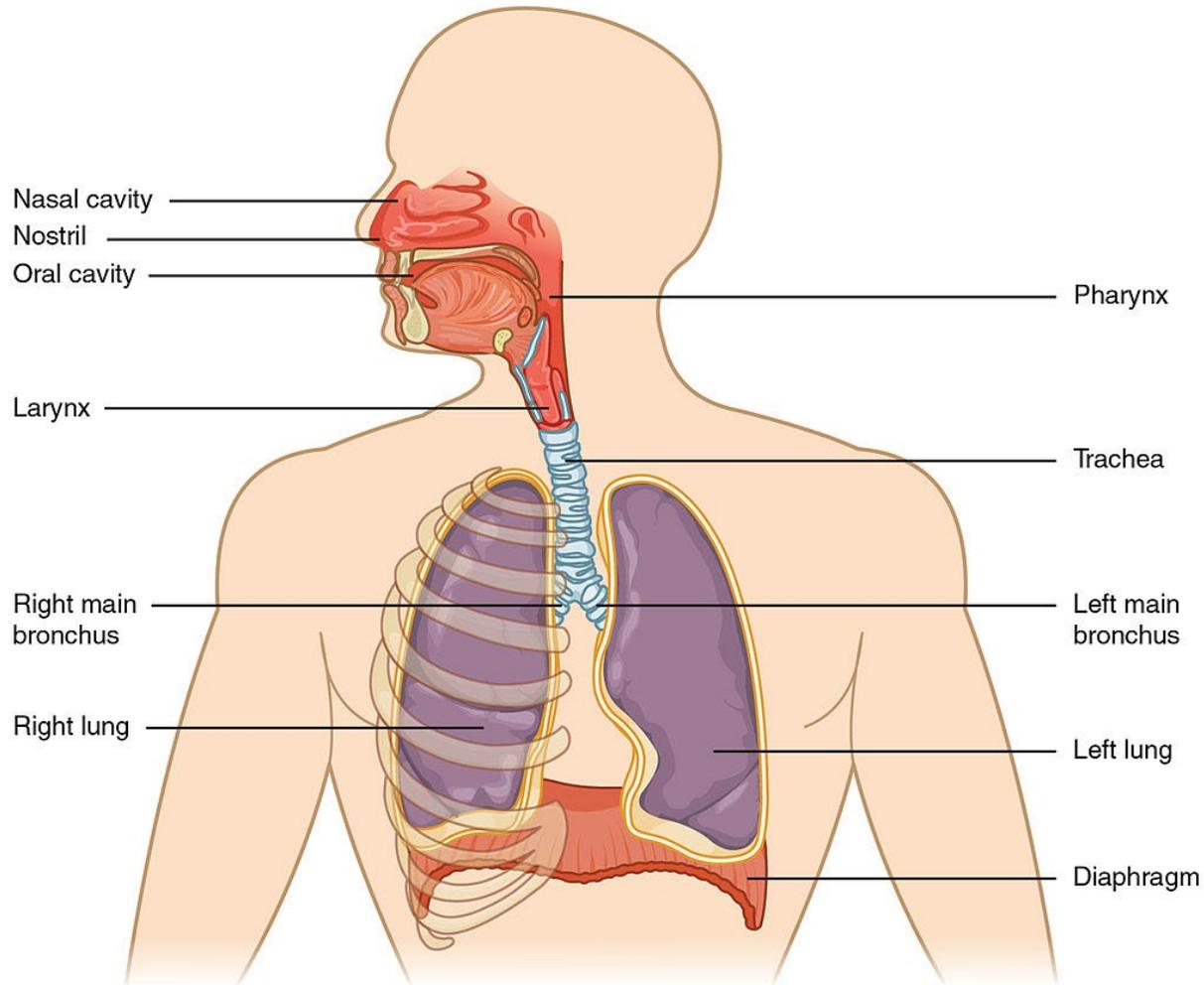
Less inflammatory response (FFP)

# Smoke inhalation





# Doubles Mortality



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## SIGNS

Singed Hairs

Facial Burns

Black Soot on Lips or in Mouth

Carbonaceous sputum

Swollen Neck

## SYMPTOMS

Hoarseness

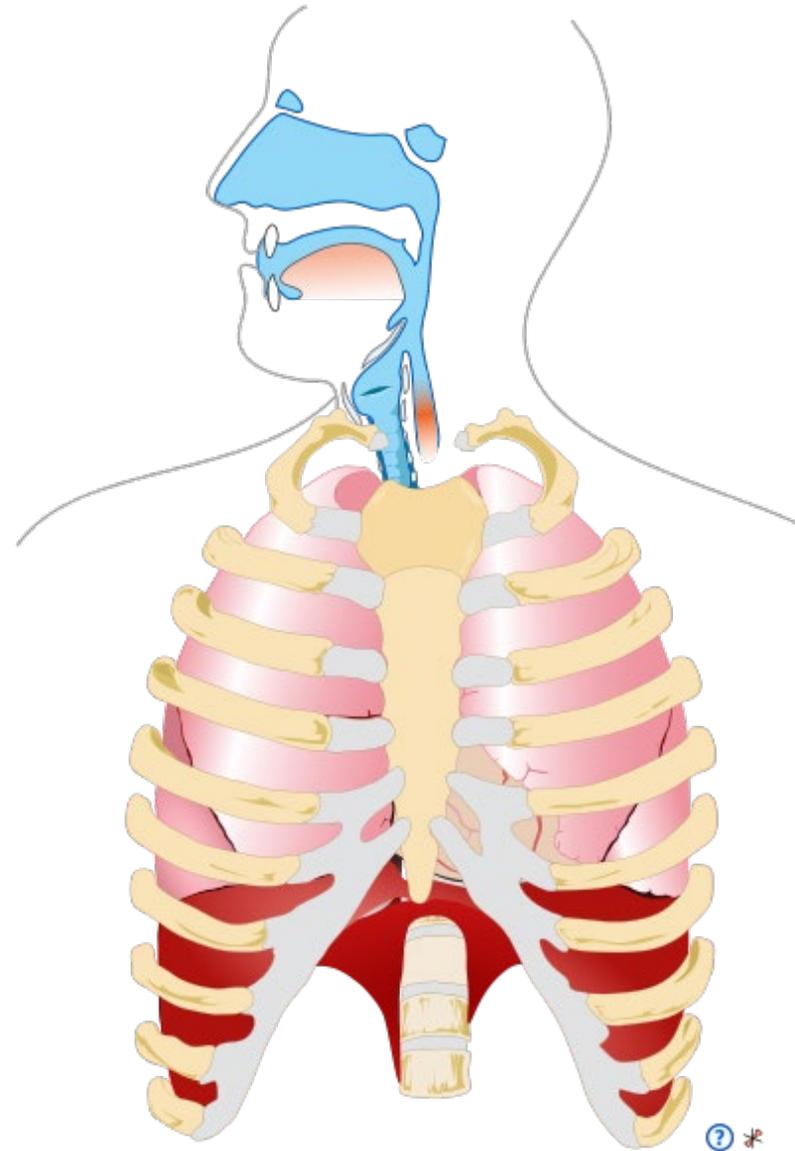
Cough

Shortness of Breath

# Thermal Injuries

Carbon Monoxide

Cyanide



# INTUBATION

## CONSIDERATIONS

Likelihood of difficult airway may triple 2 hours post burn

1/3 of burn patients unnecessarily intubated



Huang RY, et al.  
BMC Emergency Medicine 2022  
Retrospective Review

355 Facial Burn Patients  
121 Intubated  
73 (60.3%) Confirmed Inhalation Injury

SOB, High TBSA = independent risk factors  
For Inhalation Injury

Physical Signs = Not Predictive

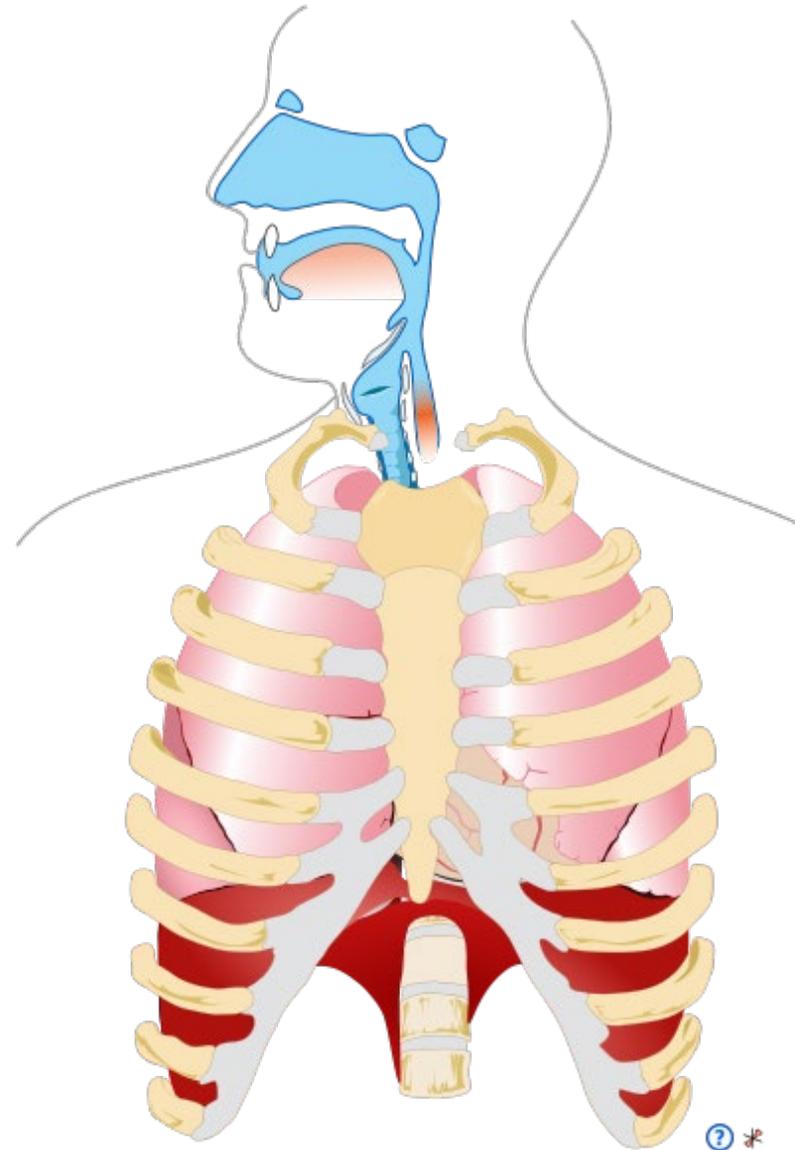
# INTUBATION

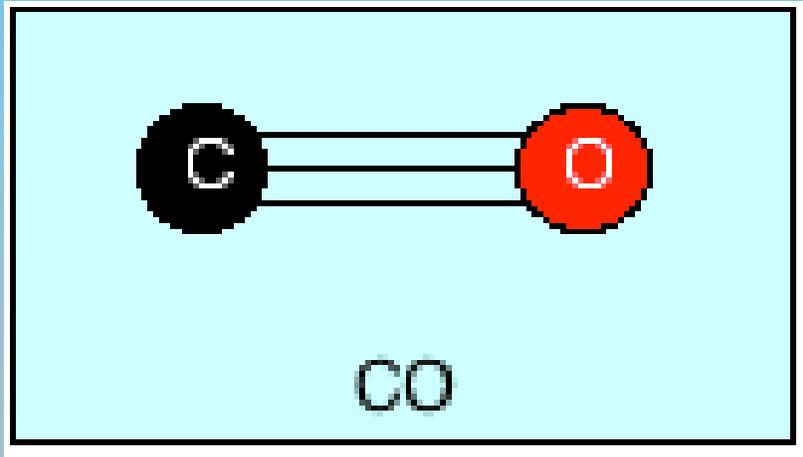
Deep burns face or neck  
Oropharynx blisters or edema  
Stridor

Accessory muscle use  
Respiratory distress  
Sub- and suprasternal retractions  
Hypoventilation



Thermal Injuries  
Carbon Monoxide  
Cyanide





## SYMPTOMS

Headache

Dizziness

Weakness

Mental Status Changes

Nausea

Syncope

Coma

## LAB FINDINGS

Lactic acidosis

Elevated COHg level

# TREATMENT



## High Flow Oxygen

### COHg Half-Life

Room Air -> 250 to 320 min

Oxygen > 15L/min -> 45 to 90 min

Hyperbaric oxygen -> 30 min



## HYPERBARIC CHAMBER CONSIDERATION

COHb > 25% (> 15% if pregnant)

Unconscious at scene or hospital

AMS, coma, focal neurologic deficit

pH < 7.25 after cyanide treatment

End organ ischemia present

## HISTORY

Burn in enclosed space  
Textiles/Plastics

## SYMPTOMS

Nausea/Vomiting  
Headache  
Confusion

## LAB FINDINGS

Anion Gap Metabolic Acidosis  
Lactate > 8



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CYANOKIT<sup>MD</sup> est une marque déposée de  
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**CYANOKIT<sup>MD</sup> 5g**

HYDROXOCOBALAMIN POWDER FOR INFUSION  
HYDROXOCOBALAMINE POUDRE POUR PERFUSION

Altered + soot in mouth/nose



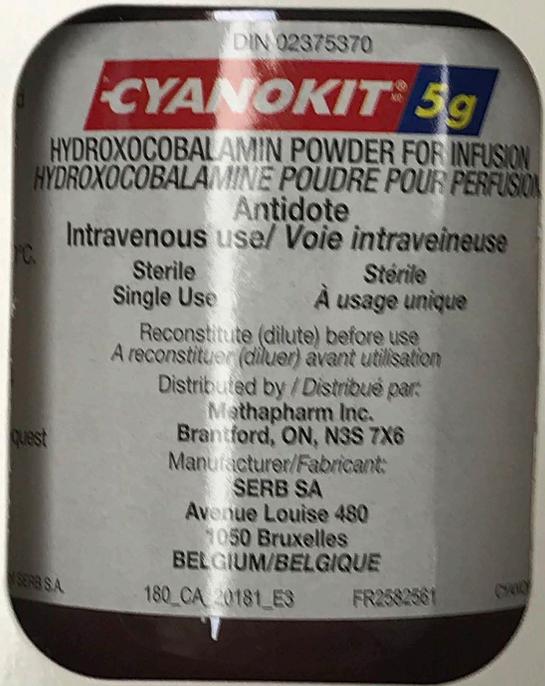
60% likelihood CN poisoning

Altered + soot in mouth/nose  
+ hypotension/cardiac arrest



80% likelihood CN poisoning

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**CYANOKIT<sup>MD</sup> 5g**  
HYDROXOCOBALAMIN POWDER FOR INFUSION  
HYDROXOCOBALAMINE POUDRE POUR PERFUSION

## TREATMENT

Hydroxocobalamin (Cyanokit)  
70 mg/kg up to 5 gm IV

Repeat dose in 15 min if not improved

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**CYANOKIT<sup>MD</sup> 5g**

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HYDROXOCOBALAMINE POUDRE POUR PERFUSION

## TREATMENT

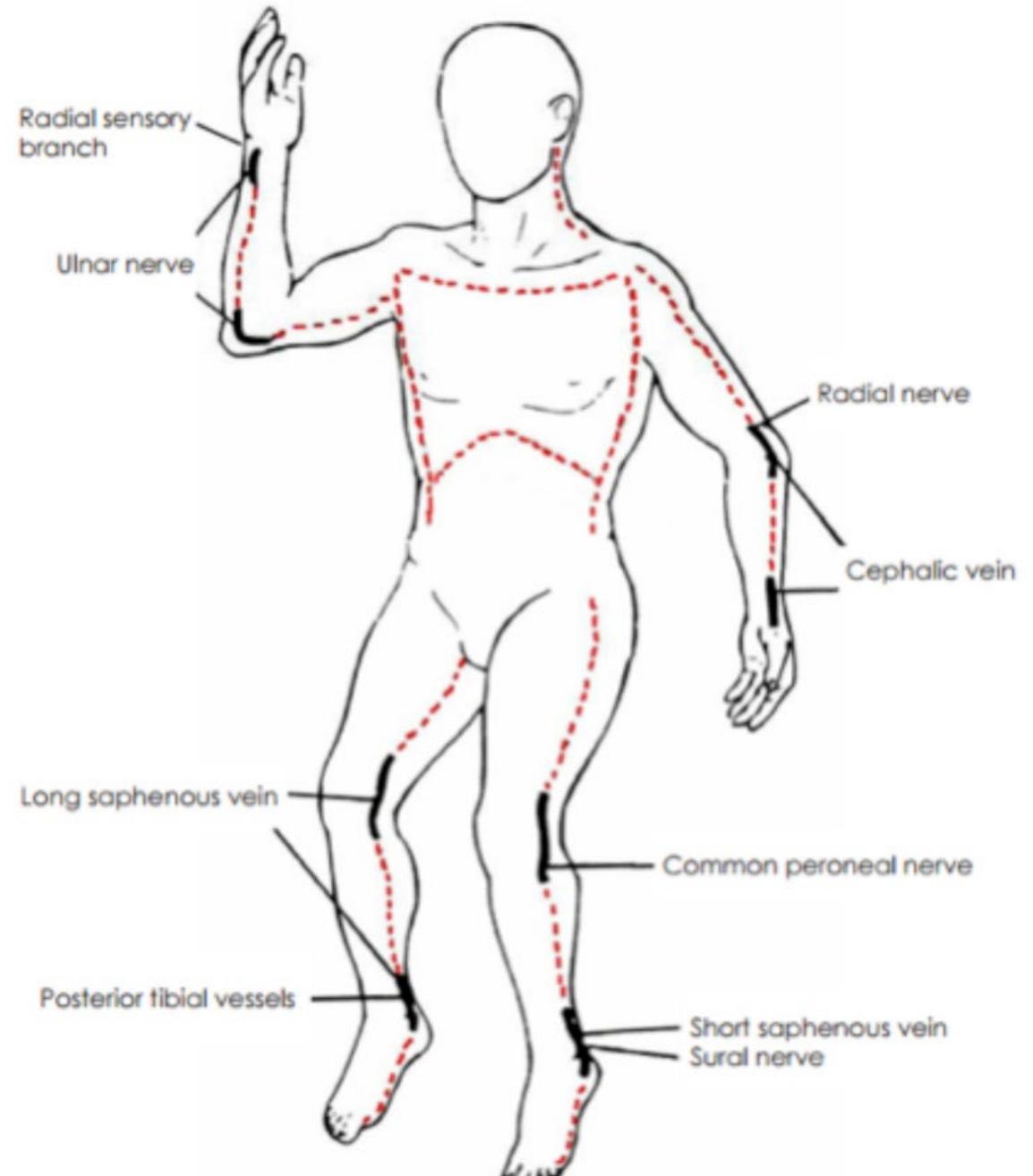
Previous Kits

Amyl Nitrite, Sodium Nitrite, Sodium Thiosulfate

~~Amyl Nitrite, Sodium Nitrite ->  
Methemoglobinemia~~

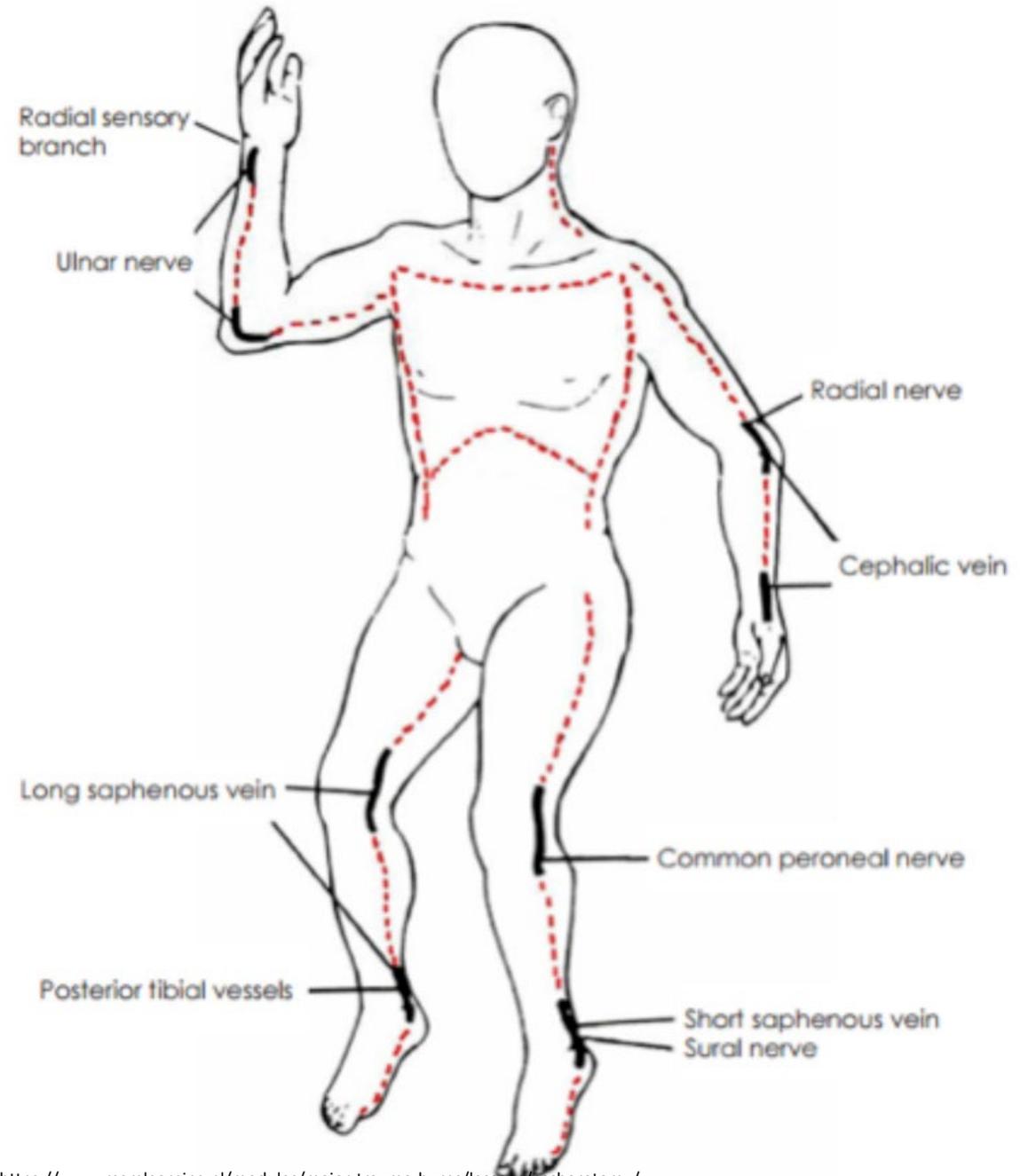
Sodium Thiosulfate -> Sulfur donor -> increased  
transformation of cyanide to thiocyanate

# ESCHAROTOMIES



# ESCHAROTOMY INDICATIONS

Eschar causing inadequate ventilation  
Absent or decreased pulses  
New neurologic deficits



# Transfer criteria

**Full-thickness burns**

**Partial-thickness burns > 10% TBSA**

**Burns involving face, hands, feet, genitalia, perineum, major joints**

**Electrical burns (lightning injury included)**

**Chemical burns**

**Inhalation injury**

**Presence of medical disorders complicating management or recovery**

**Requiring special social, emotional, or rehabilitative intervention**

**Children in hospital without qualified personnel or equipment**

**Concomitant trauma where burn poses greatest risk**



## **SUMMARY**

**Calculate TBSA**

**Assess fluid resuscitation with urine output**

**Trauma takes priority over burns**

**Transfer early when appropriate**

**Consider smoke inhalation, carbon monoxide, & cyanide**