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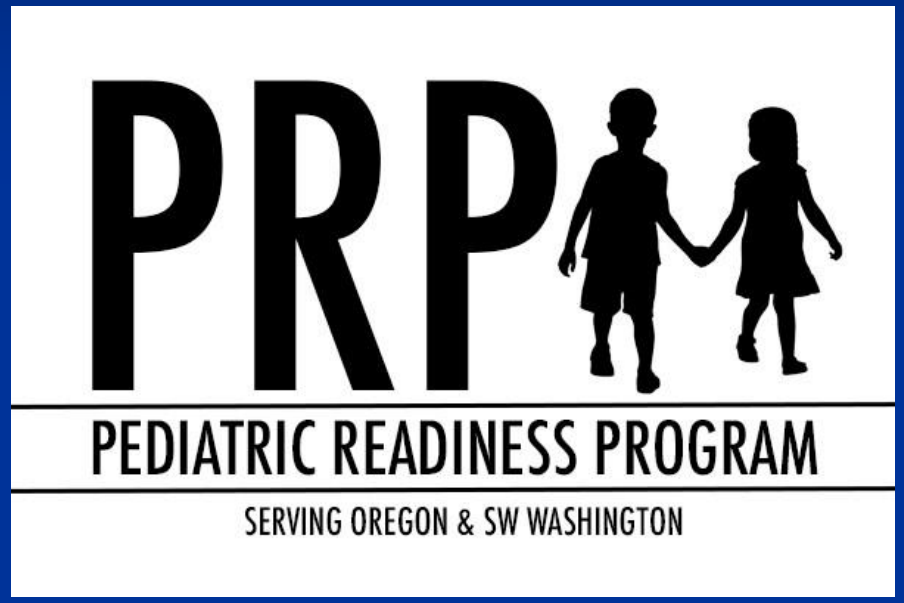
Acute Pediatric Burn Care

August 12, 2021



Niknam Eshraghi, M.D., F.A.C.S
Medical Director Oregon Burn Center
General and Burn Surgery
Legacy Emanuel Hospital
Affiliate Professor of Surgery
Oregon Health Sciences University

Oregon Burn Center

LEGACY Health System

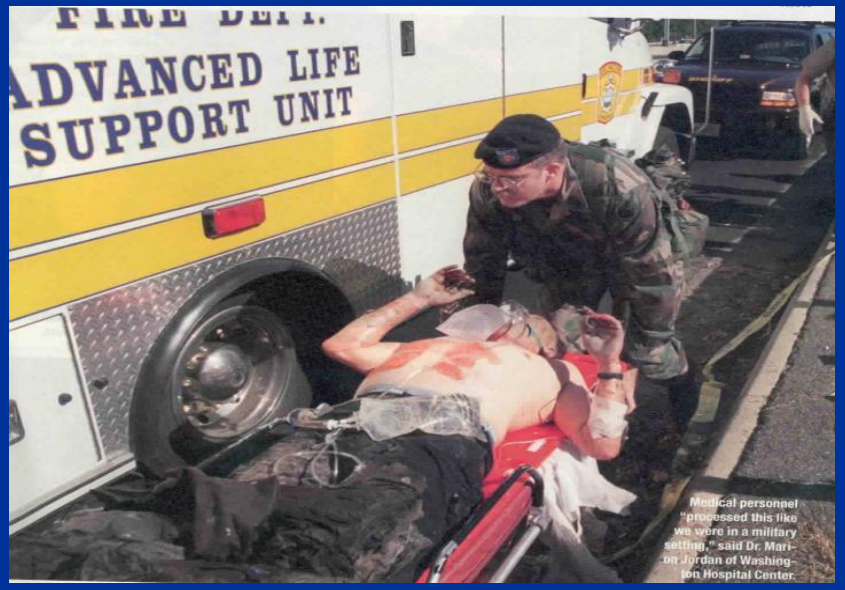
The only one in Oregon. Only at Emanuel.

Objectives

- Define the components of initial burn evaluation.
- Recognize inhalation injury.
- Define initial resuscitation and care for a burn victim.

CME Disclosure

- All activity faculty and planners disclosed they have no relevant financial relationship(s) with any entity producing, marketing, re-selling, or distributing health care goods or services consumed by or used on patients.


ADVANCED LIFE
SUPPORT UNIT
Medical personnel "processed this like we were in a military setting," said Dr. Marion Jordan of Washington Hospital Center.

Topics to be covered

- Burn epidemiology and outcomes
- Initial evaluation and management
- Burn injury classification
- Resuscitation
- Inhalation injury
- Pain and sedation management
- Wound care

Burn Epidemiology and Outcomes

Burn Epidemiology World Wide

- millions of people suffer burn injuries each year
- 1/3 of these are in children

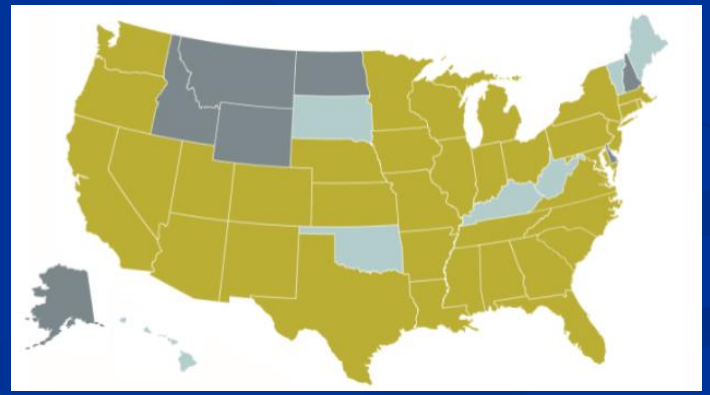
Burn Epidemiology
United States

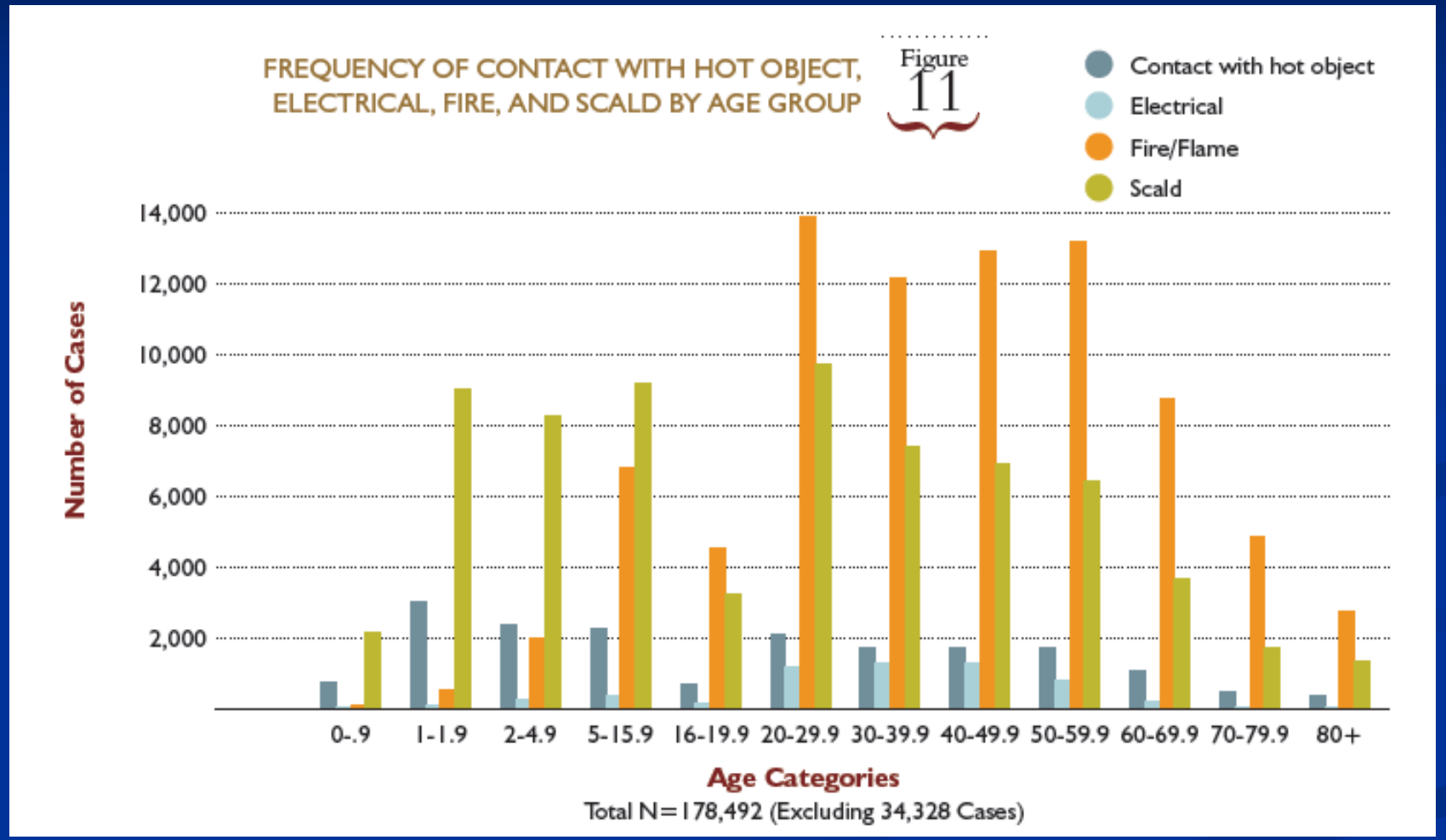
- Burn injuries receiving medical treatment: 486,000 per year
- Fire and Smoke related deaths: 3,275 per year
- Patients hospitalized: 40,000 total with 30,000 in burn centers

American Burn Association, 2016

Burn Centers

- 127 Burn centers with about 1700 beds, admitting an average of 200 patients per year.
- Other 4500 hospitals each admit 3 per year
- Oregon Burn Center admits more than 400 patients with burn or skin disorders.





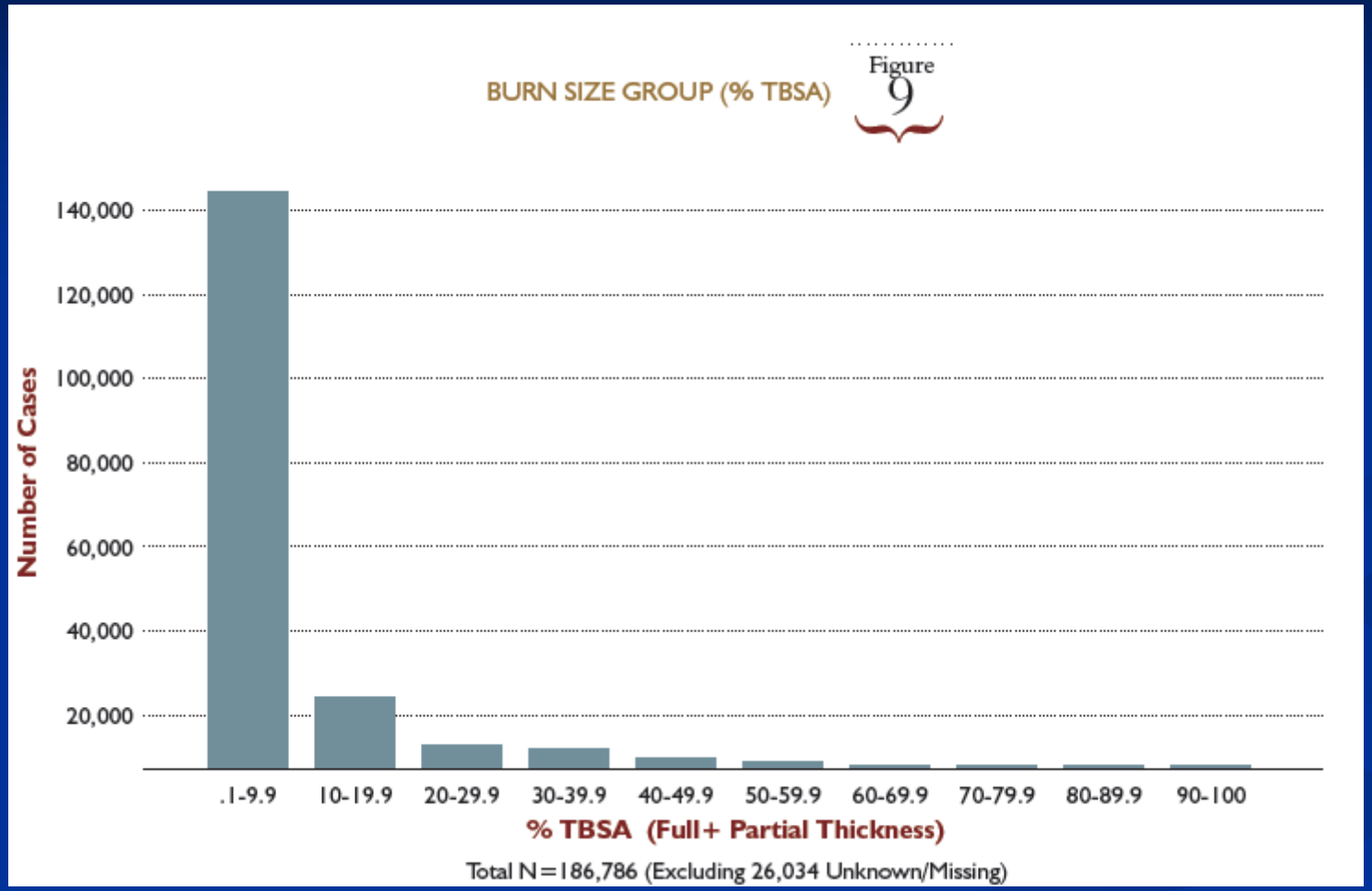
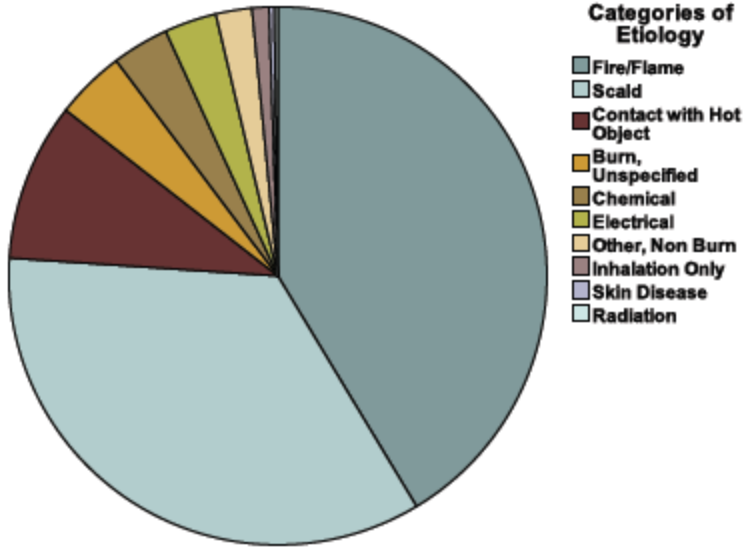
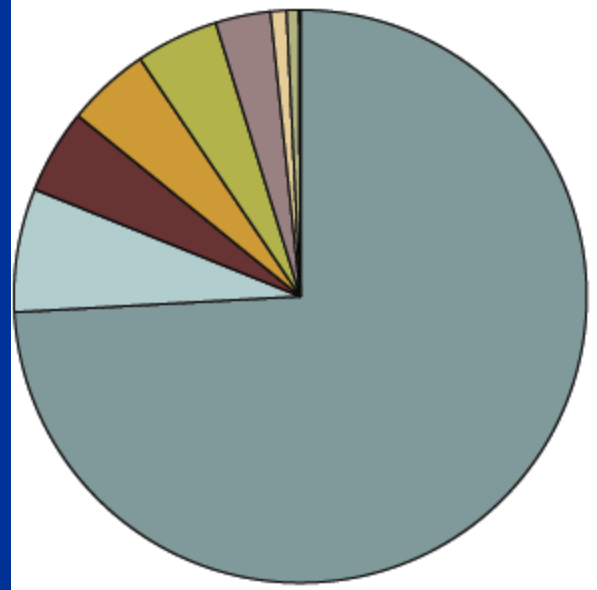


Figure 10 ETIOLOGY



Total N=201,253 (Excluding 11,567 Unknown/Missing)

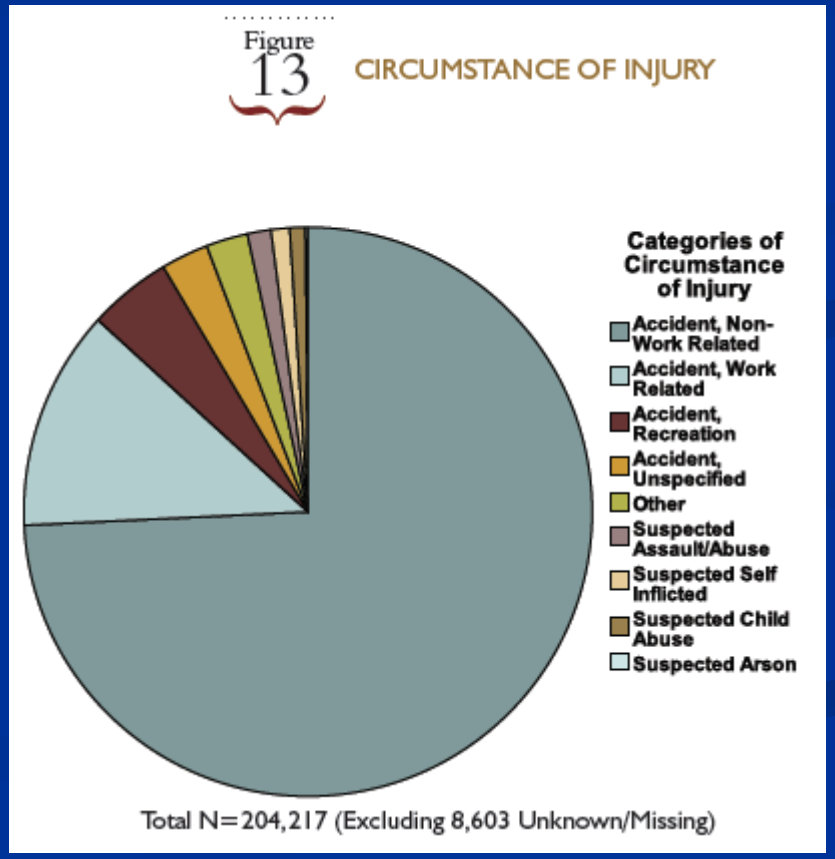
Figure 12 PLACE OF OCCURRENCE - E849 CODE



Total N=186,935 (Excluding 25,885 Unknown/Missing)

What Are the Causes?

- Majority of burn **injuries** are caused by:
  - Lack of knowledge
  - Poor judgment
- Very few are true accidents

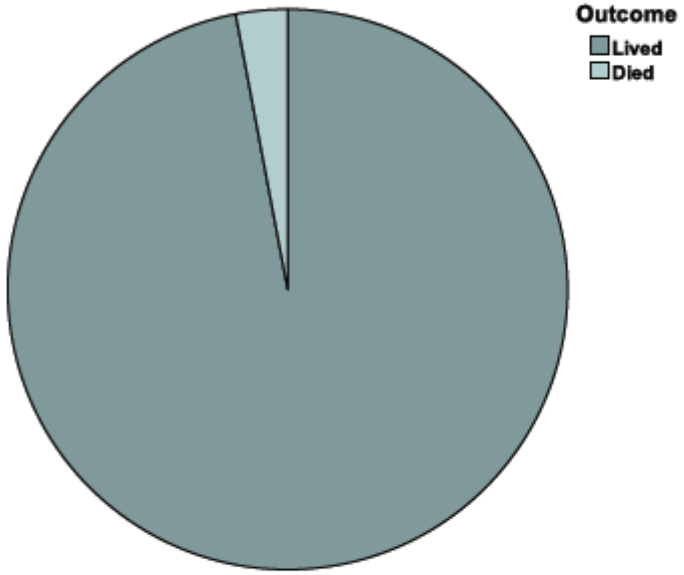


Burn Impact; Mortality

- Causes of death from major burn injuries:
  - Early
    - Burn shock
    - Failure of resuscitation
  - Delayed
    - Wound sepsis
    - Multi-organ failure
    - Respiratory insufficiency

HOSPITAL DISPOSITION

Figure 14



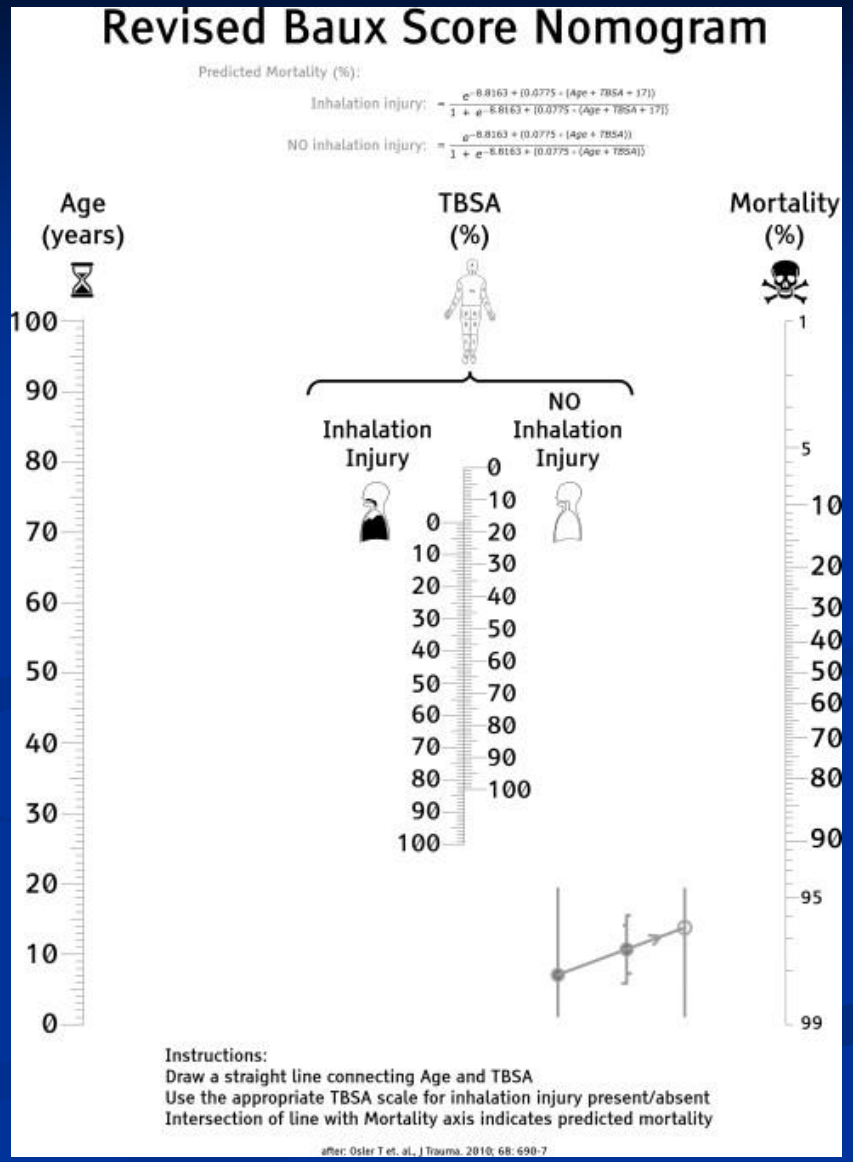
Total N=212,820

Table 9

MORTALITY RATE BY AGE GROUP AND BURN SIZE (EXPRESSED AS THE NUMBER OF DEATHS OVER THE TOTAL NUMBER OF PATIENTS IN THAT GROUP)

	Burn Size (% TBSA)										
Age Group	0.1 - 9.9	10 - 19.9	20 - 29.9	30 - 39.9	40 - 49.9	50 - 59.9	60 - 69.9	70 - 79.9	80 - 89.9	> 90	Total
Birth - .9	0.0	0.3	2.4	16.7	15.8	14.3	50.0	0.0	0.0	0.0	0.5
Died/Total	1/2775	1/379	2/85	6/36	3/19	1/7	1/2	0/3	0/1	0/0	15/3307
1 - 1.9	0.0	0.2	0.4	0.0	4.8	18.8	26.7	0.0	33.3	66.7	0.1
Died/Total	0/10932	3/1683	1/263	0/90	2/42	3/16	4/15	0/7	1/3	2/3	16/13054
2 - 4.9	0.1	0.4	0.8	3.6	6.5	13.3	27.3	20.0	52.9	64.7	0.6
Died/Total	13/10874	7/1627	3/384	7/196	7/107	8/60	12/44	3/15	9/17	11/17	80/13341
5 - 15.9	0.1	0.4	0.8	0.7	6.3	6.3	12.2	16.7	46.3	71.4	0.5
Died/Total	13/15409	9/2313	5/597	2/300	12/189	6/96	9/74	9/54	19/41	15/21	99/19094
16 - 19.9	0.2	0.3	1.4	2.7	3.4	14.8	17.6	26.3	53.3	68.4	0.9
Died/Total	12/7313	4/1235	5/358	4/149	3/88	9/61	6/34	5/19	8/15	26/38	82/9310
20 - 29.9	0.1	0.6	1.7	3.6	8.6	12.4	26.3	42.3	63.0	82.5	1.2
Died/Total	30/22379	24/4019	20/1204	18/500	25/291	19/153	35/133	44/104	51/81	85/103	351/28967
30 - 39.9	0.2	1.0	2.3	7.3	9.6	15.2	37.0	44.9	72.3	87.5	1.8
Died/Total	43/18270	33/3432	25/1099	37/509	28/291	25/164	50/135	40/89	60/83	91/104	432/24176
40 - 49.9	0.4	1.1	4.0	8.7	20.8	34.0	47.4	65.7	84.0	92.5	2.4
Died/Total	71/18496	40/3566	43/1088	44/507	60/289	65/191	63/133	44/67	79/94	86/93	595/24524
50 - 59.9	0.8	2.8	9.0	19.8	37.4	47.6	60.5	74.5	89.0	93.3	4.1
Died/Total	135/17959	96/3370	94/1046	93/469	120/321	100/210	75/124	79/106	81/91	97/104	970/23800
60 - 69.9	1.6	5.7	16.3	37.3	59.7	73.2	84.2	90.9	98.0	91.2	6.8
Died/Total	175/10955	121/2123	112/689	117/314	120/201	109/149	80/95	60/66	50/51	52/57	996/14700
70 - 79.9	3.0	12.1	33.2	59.0	80.7	81.8	98.2	85.7	88.9	92.7	11.6
Died/Total	164/5520	136/1128	127/383	128/217	113/140	63/77	56/57	24/28	32/36	38/41	881/7627
80 or Greater	5.5	24.9	63.6	77.4	85.6	94.2	93.0	97.2	100.0	97.0	19.6
Died/Total	183/3354	199/800	178/280	113/146	83/97	65/69	40/43	35/36	28/28	32/33	956/4886
Total	**0.6**	**2.6**	**8.2**	**16.6**	**27.8**	**37.7**	**48.5**	**57.7**	**77.3**	**87.1**	**2.9**
Died/Total	**840/144236**	**673/25675**	**615/7476**	**569/3433**	**576/2075**	**473/1253**	**431/889**	**343/594**	**418/541**	**535/614**	**5473/186786**

Total N=186,786 (Excluding 26,034 Unknown/Missing)

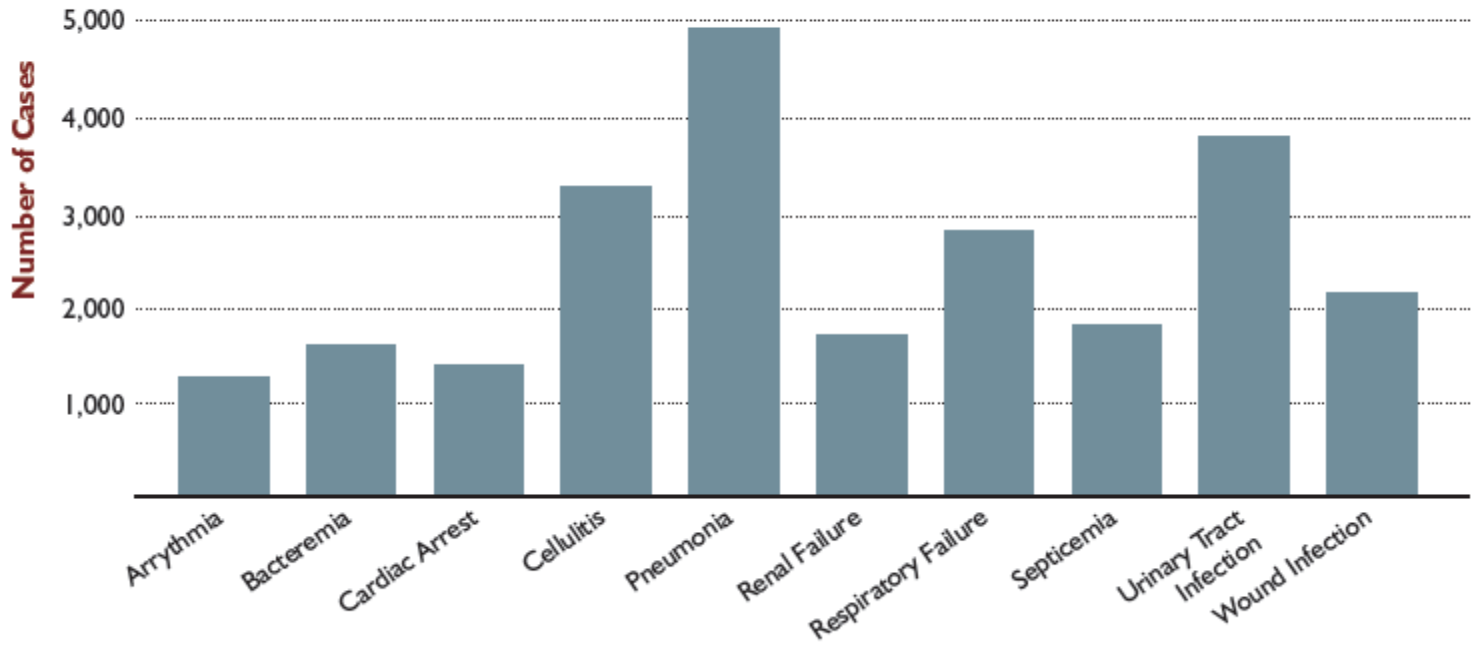


Burn Impact; Morbidity

- Effects of burn injury
  - Early
    - Pain
    - Major illness
    - Prolonged hospitalization
  - Delayed
    - Long recovery
    - Disfigurement, and loss of function
    - Psycho-social impact

COMPLICATIONS: FREQUENCY OF TOP TEN CLINICALLY RELEVANT COMPLICATIONS

Figure 17



Total N=208,654 (Excluding 4,166 cases from non ABA burn registry software centers)

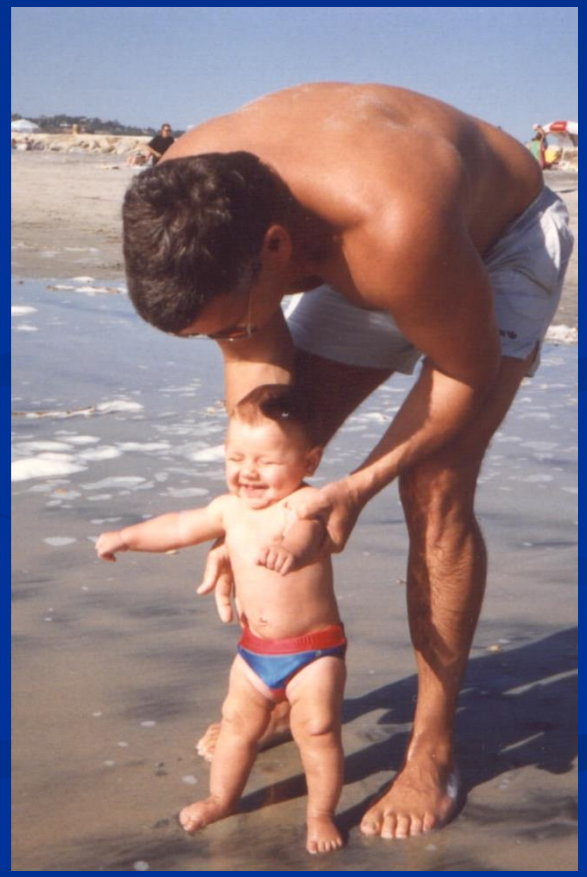
Initial Evaluation and Management

Pediatric Burns

- Children differ from adults
  - Body surface area (BSA)
  - Skin thickness
  - Temperature regulation
  - Airway
  - Burn size estimation
  - Resuscitation
  - Non-accidental injury

Pediatric Burns
Body Surface Area (BSA)

- Children differ from adults
  - Higher BSA/ weight ratio
  - **Adult BSA / wt. ratio set by age 15**



Example: 7kg child

Wt. = 10% of average 70kg adult

BSA = 33% of the adult BSA

Pediatric Burns

- Skin Thickness
  - Children less than 2 have much thinner skin
  - They can get a full thickness burn when an adult would only get a partial thickness burn with the same time and exposure
  - Burns that appear partial-thickness may actually be full-thickness
- Temperature Regulation
  - Higher BSA/wt. ratio means more exposure
  - They can get hypothermic fast

Initial Evaluation

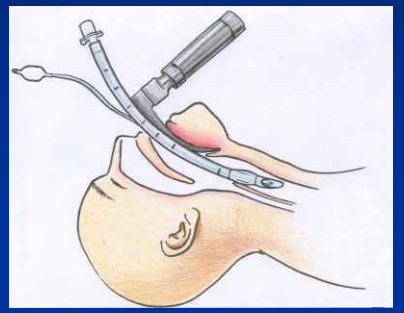
- First
  - Forget the skin
  - Do not get overwhelmed by the looks or the smell of the burn
  - Think systematically and remain objective

Initial Evaluation

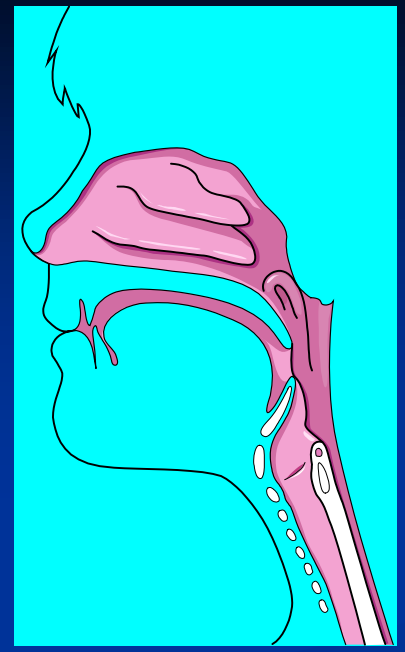
- Next do the **Primary Survey**
  - Airway
  - Breathing
  - Circulation
  - Disability
  - Exposure

Initial Evaluation

- Airway
  - Evaluate
  - Control for
    - Unstable victim, Inhalation injury, large burn, ……
  - Protect the cervical spine
  - Oral tracheal intubation is preferred.
  - Largest appropriate endo-tracheal tube that can be safely inserted should be used



Pediatric Airway



- Anatomical airway differences from adults
  - Larynx located more cephalad
  - Angulation of glottis more acute
  - Glottis more anterior
  - Narrowest point is cricoid, not glottis
- Gauge tube size by external nares or small finger diameter
- NG tube decompression indicated

Pediatric Burns
Airway

- Endotracheal intubation indicated in infants & children with
  - Significant respiratory distress
  - Upper airway compromise by edema
  - Large % BSA burns and large volume resuscitation

Initial Evaluation

- Breathing
  - Listen
  - Administer high flow oxygen
  - Monitor quality and depth of breathing

Initial Evaluation

- Circulation
  - Evaluate blood pressure and pulse
  - Establish IV access
    - Two large bore IV' in unburned areas
    - Intra osseous OK but be aware.

Intra-osseous Infusion

Initial Evaluation

- Disability-If not alert and acting appropriate for age;
  - Associated Injuries?
  - CO poisoning?
  - Hypoxia?
  - Pre-existing medical condition

Initial Evaluation

- Exposure
  - Remove all clothing and jewelry
  - Keep patient warm
    - Warm room
    - Keep patient covered; dry sheets, blankets
    - Warm IV fluids

Burn Evaluation

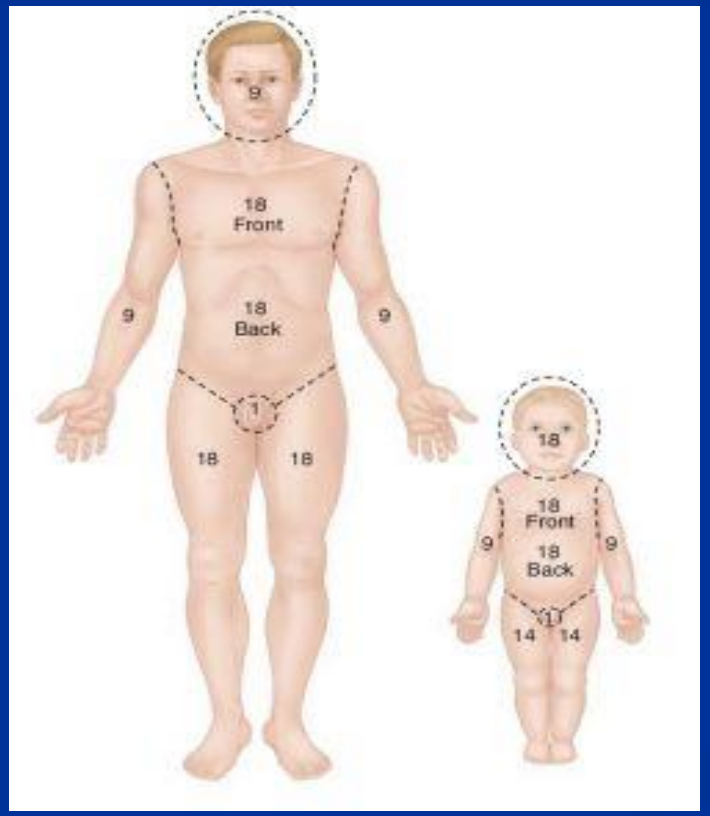
- Estimate the extent of burn injury
- Estimate the depth of burn injury
- Classify the type of burn injury

Burn Size Estimation

Burn size estimation is an important factor in appropriately resuscitating a burn victim

Estimating the Extent of the Burn

Rule of nines – widely used but can be inaccurate

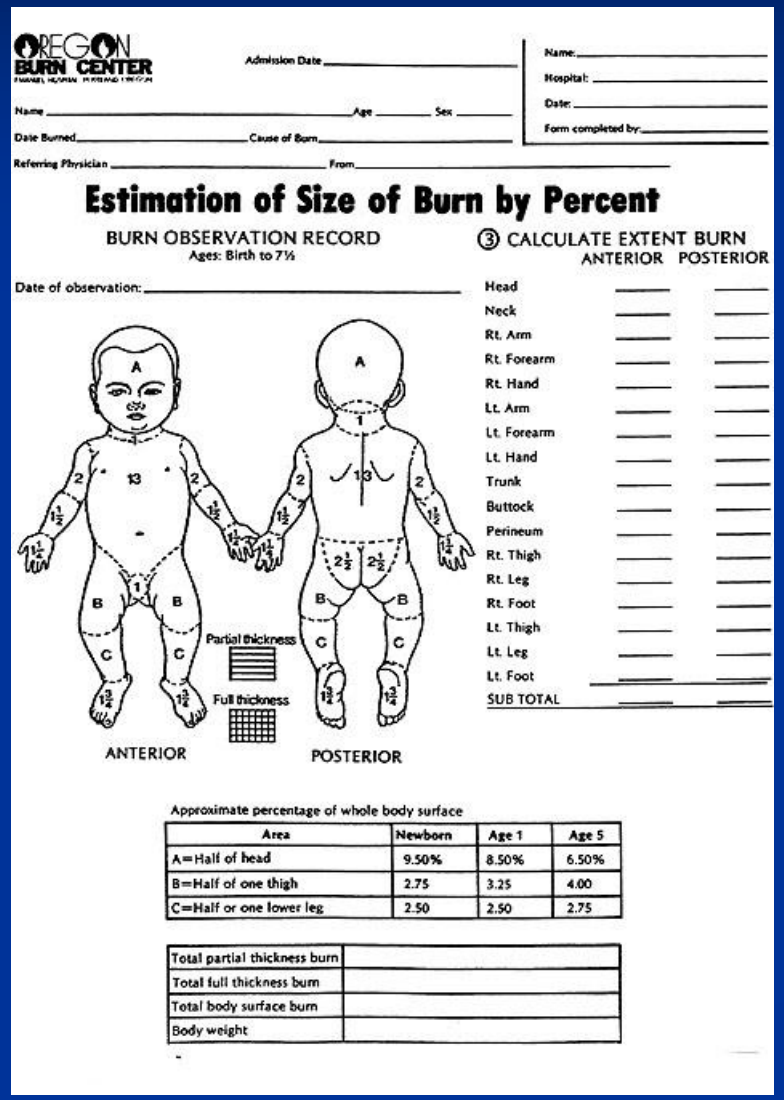


Rule of palm – patient's own palmar surface area is about 1% of the body surface area

Knaysi proposed the rule of nine, NY presentation 1967

Lund and Browder

Developed in 1944



OREGON BURN CENTER

Admission Date _____

Name _____ Age _____ Sex _____

Date Burned _____ Cause of Burn _____

Referring Physician _____ From _____

Name: _____

Hospital: _____

Date: _____

Form completed by: _____

Estimation of Size of Burn by Percent

BURN OBSERVATION RECORD
Ages: Birth to 7½

Date of observation: _____

ANTERIOR POSTERIOR

Partial thickness

Full thickness

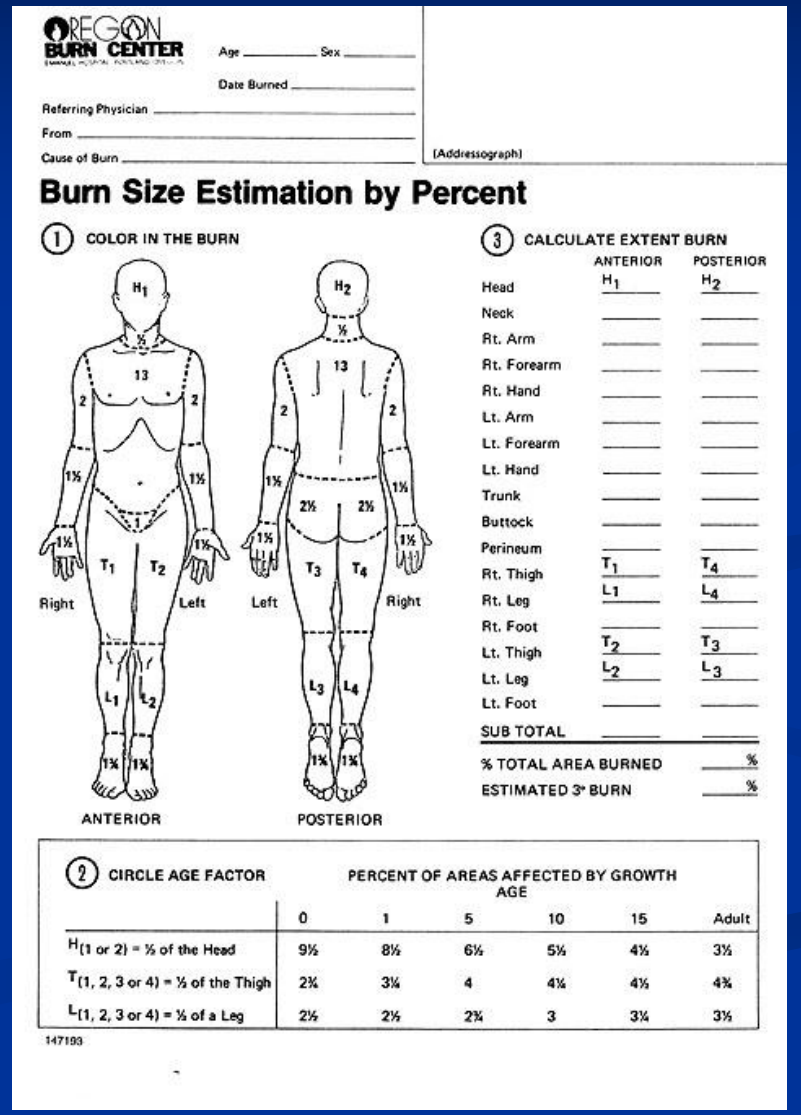
③ CALCULATE EXTENT BURN

	ANTERIOR	POSTERIOR
Head		
Neck		
Rt. Arm		
Rt. Forearm		
Rt. Hand		
Lt. Arm		
Lt. Forearm		
Lt. Hand		
Trunk		
Buttock		
Perineum		
Rt. Thigh		
Rt. Leg		
Rt. Foot		
Lt. Thigh		
Lt. Leg		
Lt. Foot		
SUB TOTAL		

Approximate percentage of whole body surface

Area	Newborn	Age 1	Age 5
A=Half of head	9.50%	8.50%	6.50%
B=Half of one thigh	2.75	3.25	4.00
C=Half or one lower leg	2.50	2.50	2.75

Total partial thickness burn	
Total full thickness burn	
Total body surface burn	
Body weight	



OREGON BURN CENTER

Age _____ Sex _____

Date Burned _____

Referring Physician _____

From _____

Cause of Burn _____

(Addressograph)

Burn Size Estimation by Percent

① COLOR IN THE BURN

Right Left Left Right

ANTERIOR POSTERIOR

③ CALCULATE EXTENT BURN

	ANTERIOR	POSTERIOR
Head	H_1	H_2
Neck		
Rt. Arm		
Rt. Forearm		
Rt. Hand		
Lt. Arm		
Lt. Forearm		
Lt. Hand		
Trunk		
Buttock		
Perineum		
Rt. Thigh	T_1	T_4
Rt. Leg	L_1	L_4
Rt. Foot		
Lt. Thigh	T_2	T_3
Lt. Leg	L_2	L_3
Lt. Foot		
SUB TOTAL		
% TOTAL AREA BURNED		%
ESTIMATED 3° BURN		%

② CIRCLE AGE FACTOR

	PERCENT OF AREAS AFFECTED BY GROWTH AGE					
	0	1	5	10	15	Adult
H(1 or 2) = ½ of the Head	9½	8½	6½	5½	4½	3½
T(1, 2, 3 or 4) = ½ of the Thigh	2¾	3¼	4	4¼	4½	4¾
L(1, 2, 3 or 4) = ½ of a Leg	2½	2½	2¾	3	3¼	3½

147193

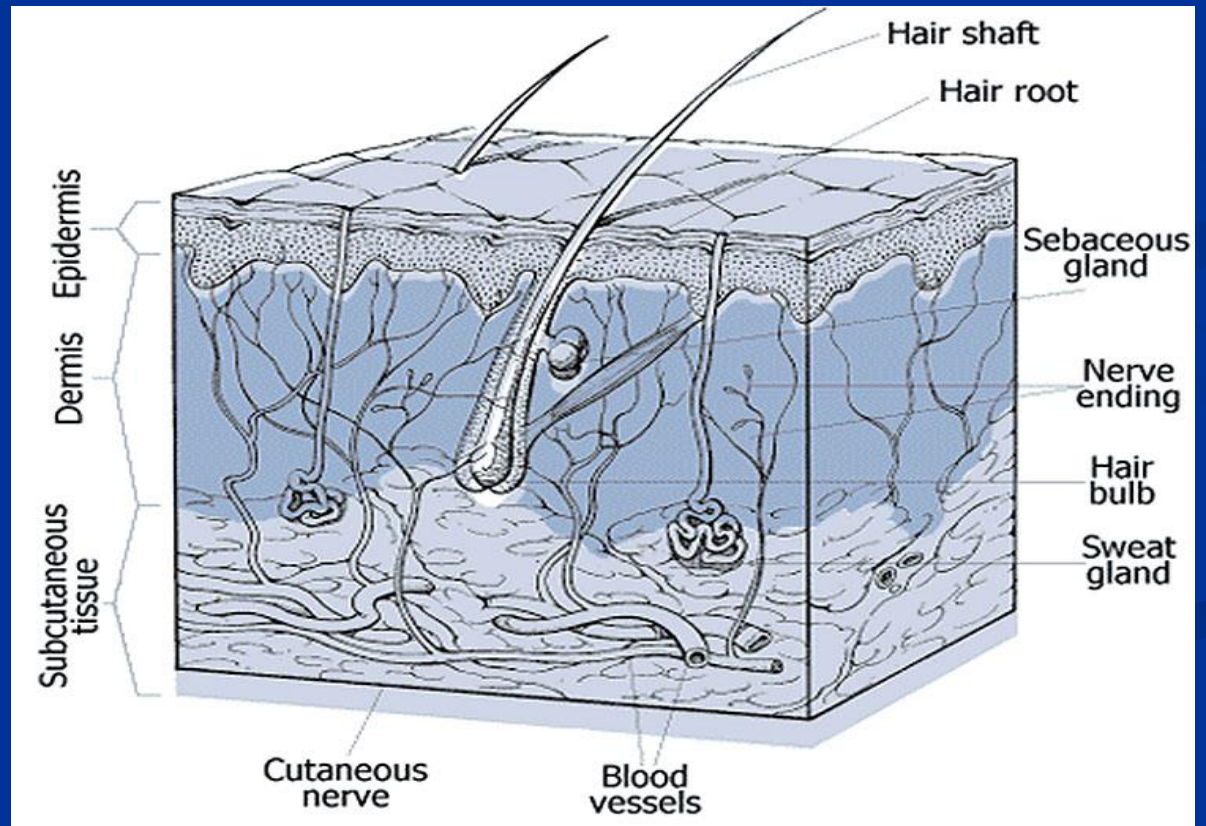
Burn Evaluation

- Estimate the extent of burn injury
- Estimate the depth of burn injury
- Classify the type of burn injury

Depth of Burn Injury

Skin Anatomy

- Integument system
- Largest human organ
- 2 distinct zones with sub-layers



Burn Depth

- Superficial (1st degree)
- Partial thickness (2nd Degree)
- Full thickness (3rd degree)
- Deep into underlying tissue (3rd degree with loss or 4th degree)

Superficial Burn

- Intact skin
- Red appearance
- Painful
- Burn depth within epidermis
- Usually heals in 5-10 days

Partial Thickness Burn

- Burn through the epidermis and into the dermis
- Blistered but this may be delayed
- Loose or sloughed epidermis
- Moist, red to non-blanching and white appearance
- Subcutaneous edema may be present

Full Thickness Burn

- Burned through epidermis, dermis, and subcutaneous tissue
- Dry appearance
- May be red, white, black, or brown in color
- Leathery in appearance

Burn Beyond Skin

- Burned through epidermis, dermis, subcutaneous tissue, muscle, and bone
- Charred appearance
- May appear cracked
- Immobility of area

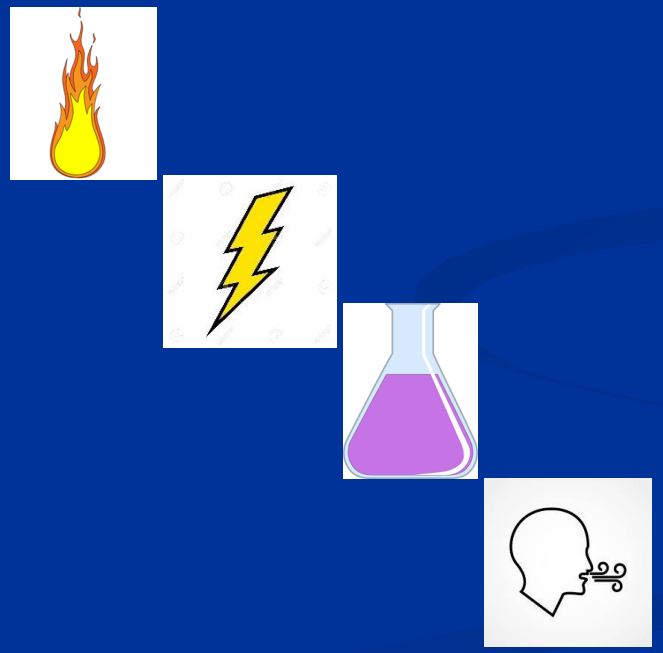
Burn Evaluation

- Estimate the extent of burn injury
- Estimate the depth of burn injury
- Classify the type of burn injury

Types of Burn Injury

Burn Injury Classification

- Thermal
- Electrical
- Chemical
- Inhalation



Scalds

- Scalds account for up to 85% of severe pediatric burns
- Hot tap water and hot foods and beverages are the most common causes
- Prevalent in child abuse

Tap Water Scald - 7 month old getting a bath in kitchen sink

Hot chocolate

Stepped in pot of hot salsa that was set on the floor to cool off.

Scald Burn

Flame Burns

- Second most common cause of burn injury
- Most common burn injury in children more than 16 years of age
- Associated factors
  - Inhalation injury
  - Carbon monoxide/other poisoning
  - Associated trauma

6 y/o playing with matches

Contact Burns

- Occur when the child touches a hot object
- The skin can adhere to the object prolonging the time of contact and increasing the seriousness of the burn

Glass front fireplace

Hand landed on hot burner

MVA – 16 y/o not wearing seatbelt. Ejected from car. Car rolled onto leg causing a burn from the muffler.

Frostbite
A thermal burn

Electrical Burns

- Household, low voltage current is most often involved
  - Toddlers chewing on electrical cords
  - Child putting object into light socket
- Higher fluid needs

Chemical Burns

- Occur when child handles or swallows a caustic substance
- Caused most often by household products

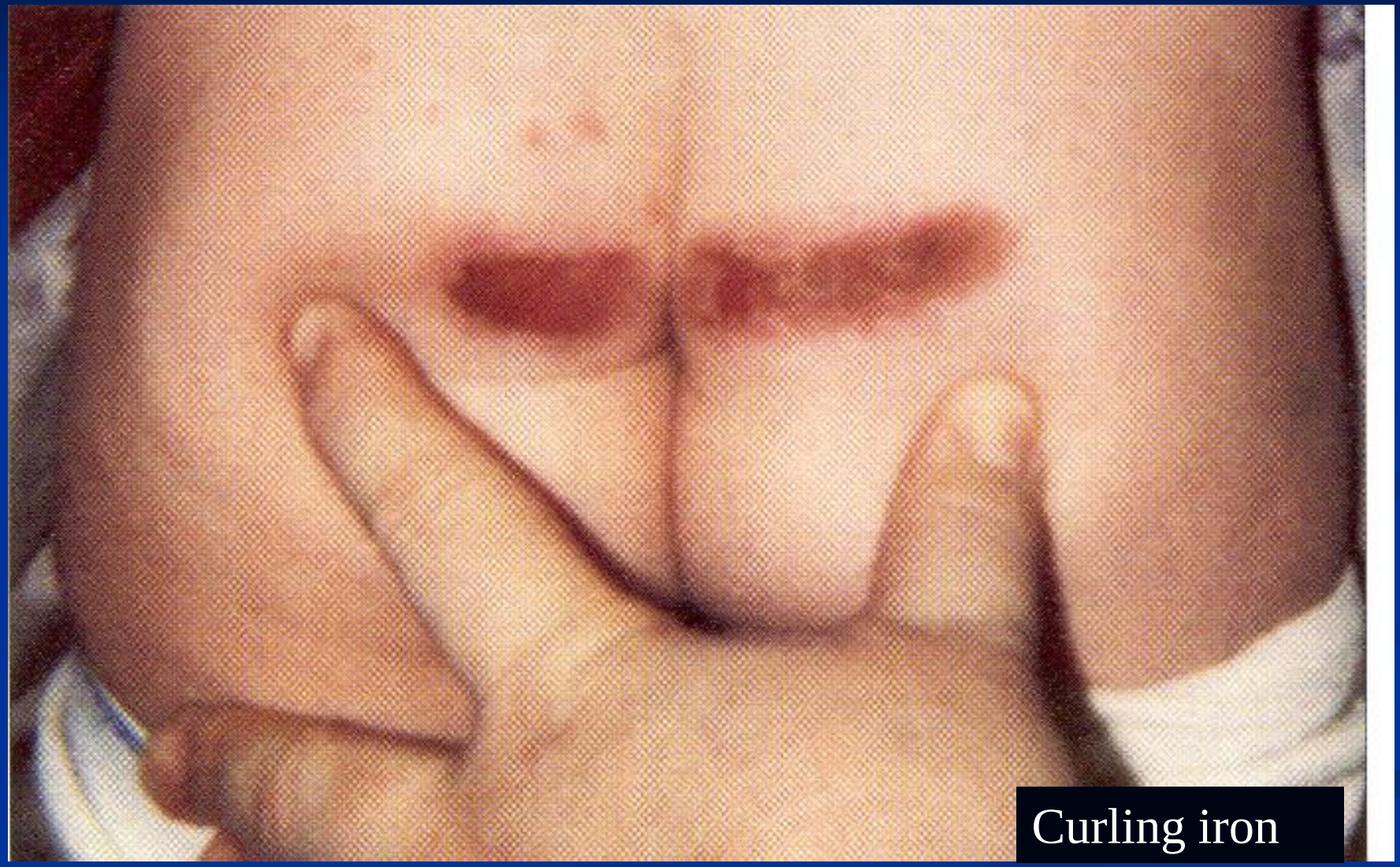
Anti-neoplastic
drugs

Child Abuse

- Up to 20% of pediatric burn injuries can be caused by child abuse
- Most occur in children under the age of 3
- Most are scald or contact burns

Signs Suggesting Abuse

- Injury is inconsistent with history
- Injury is localized to perineum, genitals or buttocks
- Injury is inconsistent with the developmental capabilities of the child
- Sock line pattern
- Delay in seeking medical attention


Curling iron

Immersion

Sock line pattern

Resuscitation

Resuscitation Goal

- Maintain tissue perfusion and organ function while avoiding inadequate or excessive fluid therapy

Indication for Resuscitation

- Burn injury less than 10% body surface
  - Oral fluids should be adequate
- Burn injury 10%-15%
  - Oral fluids plus maintenance intravenous fluids should be given
- Burn injury >15%
  - intravenous fluid resuscitation should be initiate

Over Resuscitation

- Children are particularly sensitive:
  - Exaggerate edema formation and compromise the local blood supply and delivery of nutrients
  - Compartment syndrome
  - Pulmonary edema

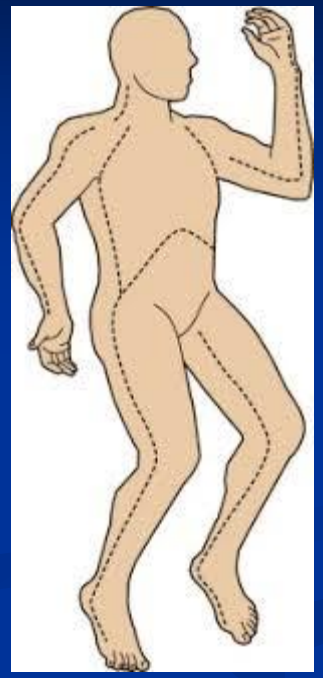
Abdominal Compartment Syndrome

- Also known as intra-abdominal hypertension
- A constellation consisting of cardiovascular, pulmonary, and renal compromise produced by increased intra-abdominal pressure
- Definition
  - Pressure >25 mmHg
  - Tense abdomen
  - Decreased pulmonary compliance
  - Oliguria

Other Compartment Syndromes

Procedure

- Avoid major vessels, bony prominences and tendons
- Medial and lateral aspect
- Extend down through eschar, to subcutaneous fat
- Extend from the edge of burn to opposite edge and across involved joints



Under Resuscitation

- Shock.
- Organ failure, most commonly acute renal failure.
- Requires larger volume to catch up

Fluid Resuscitation

- Infants and children are particularly prone to shock because their fluid losses are proportionally larger than that of adults.
- A 20 % burn in a 10 kg child causes a loss of about 475 ml = 60% of their circulating volume.
- The same burn in a 70 kg adult causes the loss of 1.1 L = 20% of their circulating volume.

Immediate Fluid Needs

- Ringer's lactate (LR)
- 3-4 ml x body weight (kg) x %burn/2x8
  - calculated hourly rate per parkland formula
- This is only a guide – titrate to urine output of 1ml/kg/hour
- Current ABA guideline is 3 ml for pediatric burn victims

Maintenance Fluids

- Children less than 30 kg have limited glycogen stores.
- They should receive a fluid with 5% dextrose at a maintenance rate.
  - 100cc/kg/24hr for 1st 10 kg.
  - 50 cc/kg/24hr for 2nd 10 kg.
  - And 20 cc/kg/24hr for each kg over 20.

  - 4-2-1 ml rule

Inhalation Injury

Definition

- **Definition:** Inhalation and/or aspiration of superheated gases, steam, hot liquids or products of incomplete combustion

Inhalation Injury

- Causes
  - Hot air or steam upper airway burn
  - Toxic substances, and smoke particles
- Increases
  - ICU stay
  - Fluid resuscitation requirement
  - Risk of infection and Mortality

Inhalation Injury Diagnosis

- History:
  - Closed space injury
  - Obtunded patient at the scene
  - Suspected inhalation of steam or smoke
- Exam:
  - Facial burns, sooth on face and airway
  - Singed hair
  - Hoarseness or wheezing
- Findings:
  - Early
    - Upper airway edema
    - Bronchospasm
  - Late
    - Sloughed endobronchial lining
    - Small airway obstruction
    - Alveolar flooding
    - Pulmonary fibrosis

What is Inhalation Injury?

- Three locations of airway injury from superheated gases/steam or products of combustion:
  - Supra-glottic
  - Tracheobronchial
  - Parenchymal
- The degree of airway injury depends on the duration of smoke exposure and the composition of the smoke.
- Most damage is attributable to chemical injury from noxious organic agents present on smoke particles that are deposited in the lower airways and parenchyma according to size.

Types of inhalation injury

- Systemic toxins
  - carbon monoxide & cyanide
- Upper airway injury above the vocal cords
  - Direct heat or chemicals – airway edema
- Lower airway below the vocal cords
  - Chemicals, sometimes direct heat (Steam)
  - Pulmonary edema

Products of Combustion

- Toxic contents of smoke vary based according to the source of combustion and amount of O2
  - Carbon Monoxide (CO)
  - Aldehydes
  - Hydrogen Cyanide
  - Sulphur and nitrogen containing oxide
  - Zinc Chloride (smoke bombs)

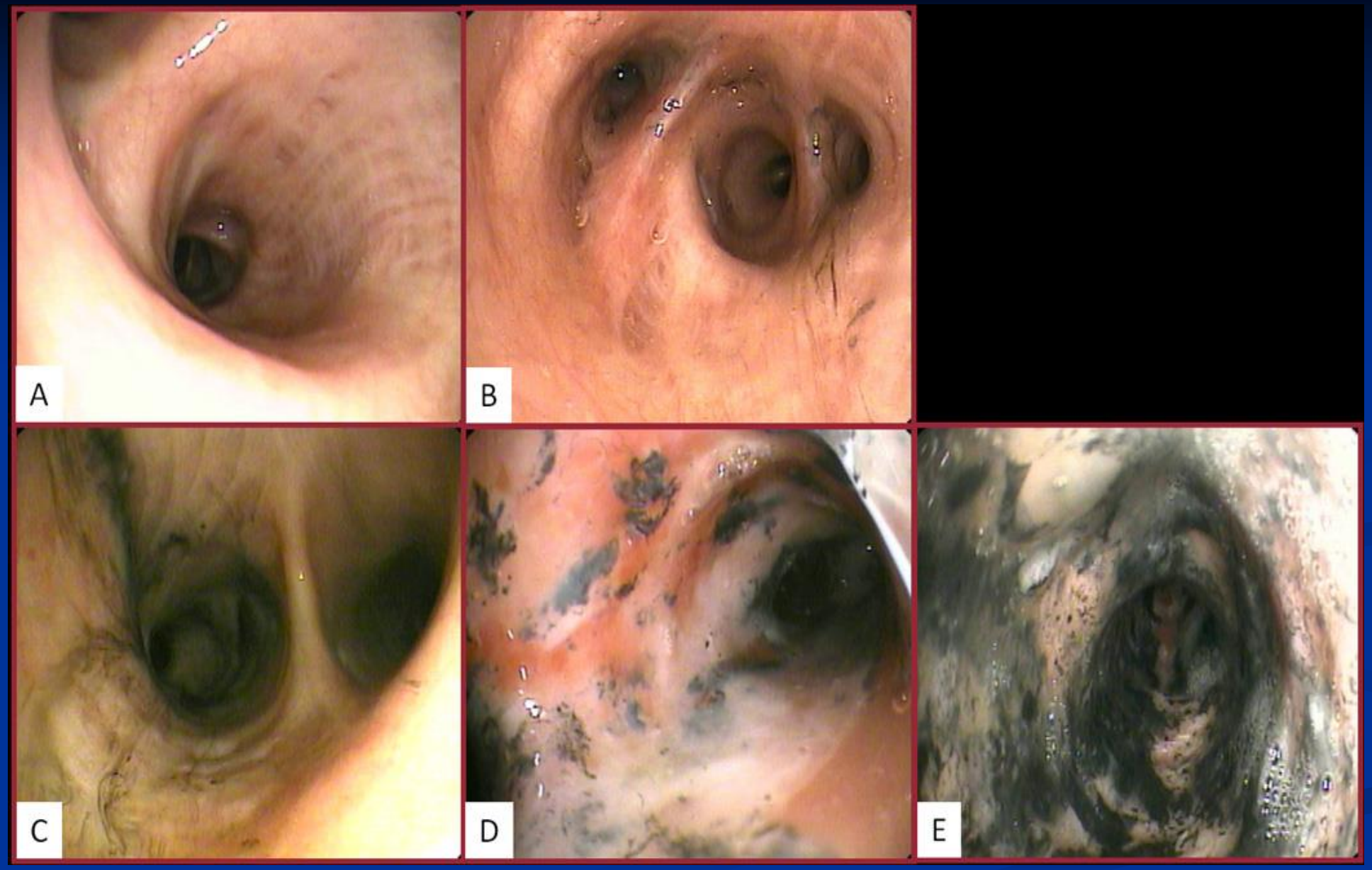
Fiberoptic Bronchoscopy: grading the severity of inhalation injury

- Bronchoscopy is performed on admission to evaluate the airway and graded the degree of inhalation injury according to the Abbreviated Injury Score (AIS):

Table 1 Abbreviated Injury Score grading scale for inhalation injury on bronchoscopy [1]

Grade	Class	Description
0	No injury	Absence of carbonaceous deposits, erythema, edema, bronchorrhea, or obstruction
1	Mild injury	Minor or patchy areas of erythema, carbonaceous deposits, bronchorrhea, or bronchial obstruction
2	Moderate injury	Moderate degree of erythema, carbonaceous deposits, bronchorrhea, or bronchial obstruction
3	Severe injury	Severe inflammation with friability, copious carbonaceous deposits, bronchorrhea, or obstruction
4	Massive injury	Evidence of mucosal sloughing, necrosis, endoluminal obstruction

Albright JM, Davis CS, Bird MD, Ramirez L, Kim H, Burnham EL, et al. The acute pulmonary inflammatory response to the graded severity of smoke inhalation injury. Crit Care Med. 2012;40:1113–21.



AIS for Inhalation injury: Grade 0=no, 1=mild, 2=moderate, 3=severe, 4=massive

Carbon Monoxide Poisoning

- Carbon monoxide (CO) is a colorless, odorless gas that is a product of incomplete combustion
- CO intoxication is the leading cause of death due to poisoning in the U.S.
- In patients who die early from CO, the brain is edematous with diffuse petechia and hemorrhages
- If a patient dies a couple weeks later, the brain typically shows signs of ischemic anoxia

Carbon Monoxide Poisoning: Symptoms Early

Severity of symptoms correlates roughly with level of COHb

COHb %	Symptoms
10	Asx +/- headache
20	Dizziness, nausea, dyspnea
30	Visual disturbances
40	Confusion, syncope
50	Seizures, coma
≥60	Cardiopulmonary dysfxn, death

Carbon Monoxide Poisoning: Treatment

- Mainstay of treatment is:
  - Supplemental O2
  - Ventilatory support
  - Monitoring for cardiac dysrhythmias

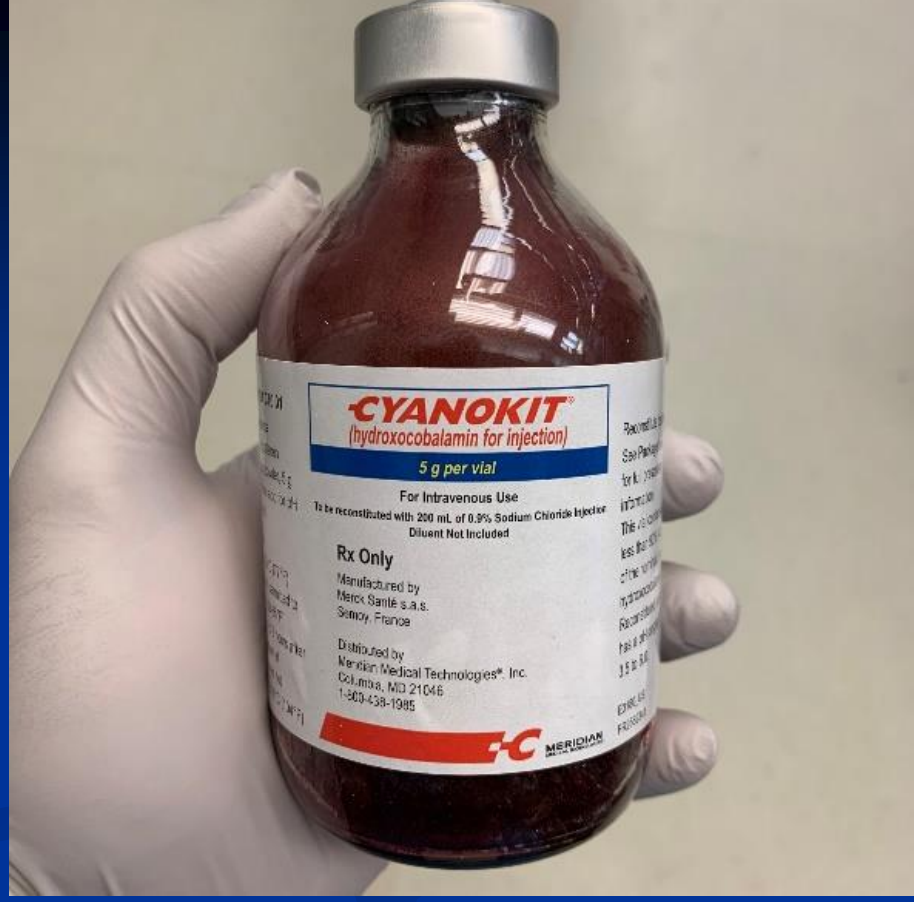
Cyanide Poisoning

Cyanide Toxicity: Pathophysiology

- CN is an inhibitor of the enzyme cytochrome c oxidase (found in mitochondria and important in the electron transport chain)
- Thus, impairs transport of electrons from cytochrome c oxidase to O2 >> decreased ATP production
- Leads to hypoxia, ischemia, and metabolic acidosis
- Particularly important on CNS and heart

Cyanokit

- Adult dosing
  - 5g IV infusion over 15 minutes; additional 5 g IV may be given depending on severity of poisoning and clinical response
- Pediatric dosing
  - 70 mg/kg IV infusion over 15 minutes; additional dose of 35 mg/kg IV may be given depending on severity of poisoning and clinical response
- Appropriate for
  - acidotic patients
  - Obtunded comatose patients exposed to smoke
- Complications
  - nausea. vomiting. diarrhea. stomach pain. acne. skin rash or itching. warmth or redness skin.
  - Pigmented plasma effects laboratory studies (Burgundy urine), lasts for days
  - Acute hypertension
  - Flash Pulmonary edema



Pain and Sedation Management

- Pain
  - Background
  - Breakthrough
  - Procedural
  - Post operative
- Sedation and anxiety
  - For the critically ill
  - Procedural

Pain and Sedation Management

- Consequences of treatment following initial burn injury
  - higher pain intensity
  - Hyperalgesia, Itching
  - Chronic or persistent pain
  - Decreased pain thresholds

- Paucity of research on longitudinal outcomes
  - Strong evidence suggests early physical trauma can alter pain perception
  - Late effects of pain process in kids after burns remains unclear.

- Nelson,S *et al*;The biopsychosocial model of pain in the context of pediatric burn injuries. European Journal of Pain 23 (3): 421-343. 2019

Pain and Sedation Management

- 90% of both adults and children with burn injuries report at least one symptom of acute stress disorder.
- 30% develop PTSD.
- PTSD is more likely to occur if the burn injury is an assault or a repeated trauma (such as ongoing abuse).
- Burn survivors most at risk for PTSD are those with a history of anxiety disorders (generalized anxiety, panic disorder) or depression.
- Burn survivors are also at risk for developing PTSD from the current burn injury.
- Burn survivors with high levels of pain and anxiety while in the hospital may be more at risk of developing PTSD after discharge.
- Caregivers and the burn team should effectively manage pain and anxiety from a burn wound to avoid future distress. Children are more at risk of developing PTSD if their parents are experiencing such symptoms.

Post-Traumatic Stress Disorder (PTSD) After Burn Injury was developed by Shelley A. Wiechman, Ph.D., ABPP in collaboration with the Model Systems Knowledge Translation Center, 2017

Pain Management

Initial

- IV pain medications
  - Small frequent dosing of short acting narcotic medications.
  - Gauge the patient's response and treatment efficacy
  - Avoid overdosing and respiratory depression.

Pain Management

Secondary

- Oral multimodal treatment.
  - Acetaminophen
  - Ibuprofen
- Oral opioids

Pain Management

Consider

- Background pain
  - Oral multimodal treatment.
- Breakthrough and procedural pain.
  - Oral and IV opioids

Pain Management

Consider other options

- Distraction
- Family support
- Elevate
- Compression
- Handling

Family Involvement

- If family members are able, use them to help provide comfort, support and guidance for the child.
- Emotions can be running high, may need to separate family from the patient for a time.

Treatment of Burns

- Wound care
- Surgery
- Rehabilitation
- Recovery

Burn Wound Dressing

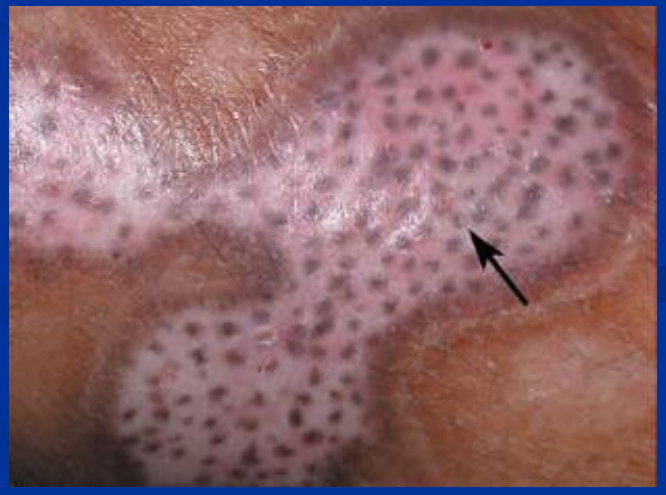
- Characteristics of a good dressing
  - Well tolerated
  - Allows drainage
  - Barrier against environment
  - Does not allow drying and desiccation
  - Easy to remove
  - Simple
  - Inexpensive

Common topical agents and dressings

- Petroleum gauze
- Bacitracin zinc / double antibiotic ointment
- Silver sulfadiazine
- Mafenide Acetate
- Silver dressings

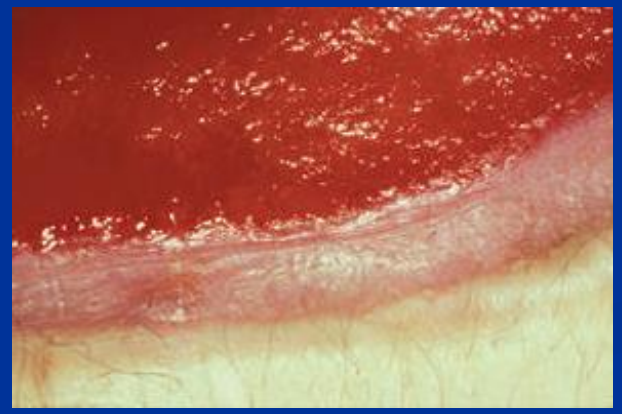
Burn Wound Evolution

- Partial thickness burns.



Burn Wound Evolution

- Full thickness burns.



Burn wound treatment and scarring

Burn wound treatment and scarring

Burn wound treatment and scarring

Burn Care

- Other important factors
  - Nutritional support and modification of hypermetabolism
  - Pain and anxiety management
  - Scar management
  - Therapy
  - Reconstruction and rehabilitation
  - Funding and work force issues

- References and acknowledgement

  - National Burn Repository, American burn association
  - Advance burn life support, American burn association
  - Diagnosis and management of inhalation injury: an updated review, Walker, P et all, Crit Care. 2015; 19: 351.
  - Nelson,S *et al*;The biopsychosocial model of pain in the context of pediatric burn injuries. European Journal of Pain 23 (3): 421-343. 2019
  - Post-Traumatic Stress Disorder (PTSD) After Burn Injury was developed by Shelley A. Wiechman, Ph.D., ABPP in collaboration with the Model Systems Knowledge Translation Center, 2017
  - Chang YT, et al Neuroimaging studies in carbon monoxide intoxication, Cognitive and Clinical Neuroscience, 2012
  - Walker PF, et al. Diagnosis and management of inhalation injury, an update. *Critical Care* **volume 19**, Article number: 351 (2015)
  - And more citations

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