

Burns, forst bite, corrosion

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Thermal injuries

- Effect of heat
- Electricity, Radiation, Chemistry

- Time of exposure
- Type of energy

Mechanism of effect

- Dehydratation
- Formation of free radicals
- Denaturation of proteins (60 C')
- Destruction of DNA mollecule
- Cellular membrane destruction
- Cellular death - apoptosis

Epidemiology and etiology

- 1% of population per year
- 97% ambulatory, 3% hospitalization
- 40% children
- Hot fluids 60%
- Open flame 25%
- Electricity 3,5%
- Chemical burns 4%
- Radiation 1%

Types of burns

- Thermal injuries
- Electricity burns
- Chemical burns -corrosions
- Radiation burns

Types of burns –by depth of injury

- Grade I
- Grade II – Grade IIA
- - Grade IIB
- Grade III
- Grade 4

Grade I - combustio erythematosa

- Injury to the epidermis, dermis intact
- Erythrema
- Pain (48hours)
- No scarrification
- Time of healing 3-6 days



Grade II - combusti bullosa /vesiculosa/

- Grade II A
 - Red undersurface of blister
 - Capillary refill intact
 - Healing time 7-14 days
 - No scar
/hyperpigmentation
- Grade II
 - Purple/white undersurface of blister
 - No capillary refill
 - Healing time 21 days
 - Scar



Grade III - combustio escharotica

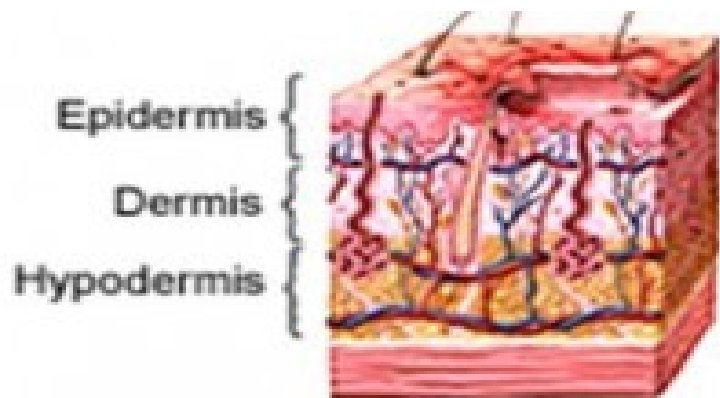
- Damage to all layers of skin
- Pale, wax-like skin
- Necrosis
- No pain – destruction of nerves
- Scar



Grade IV - carbonation

- Destruction of deep underlying tissues /fascias, muscles, bones/

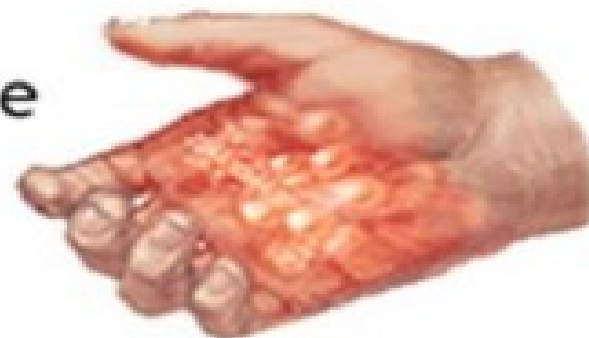
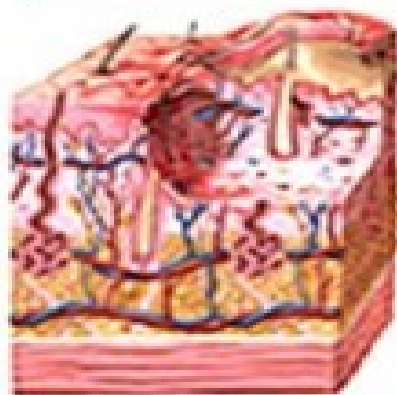




First degree burn



Second degree burn

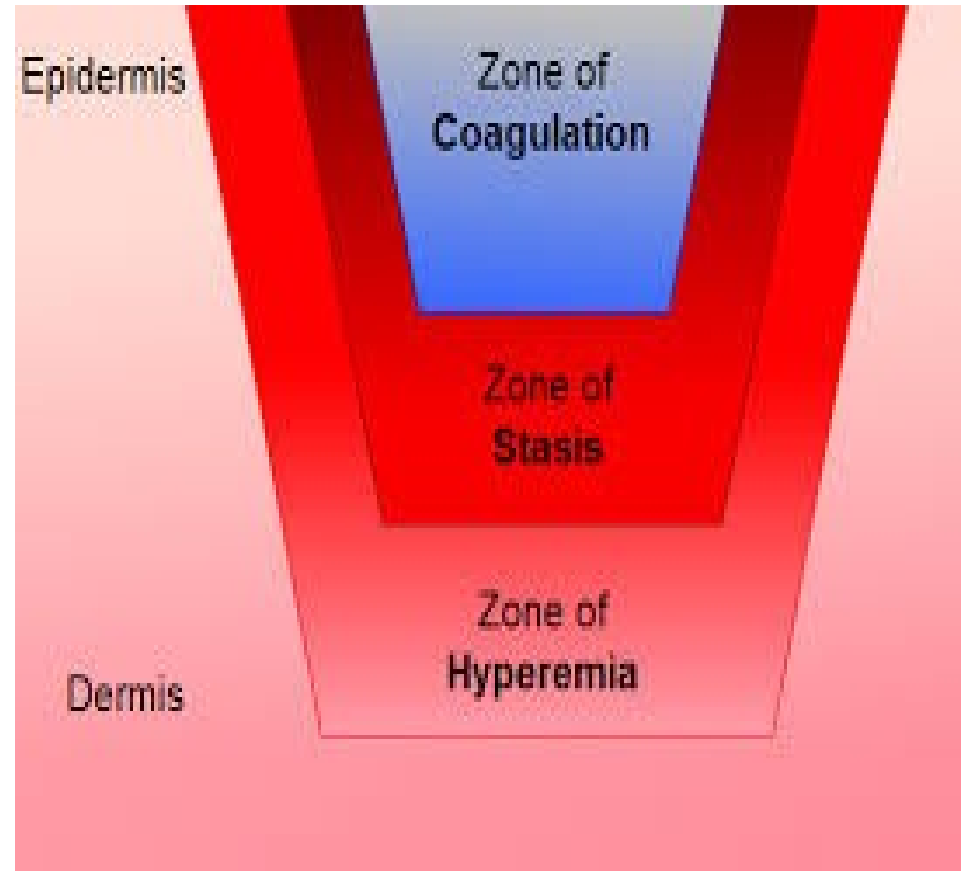


Third degree burn



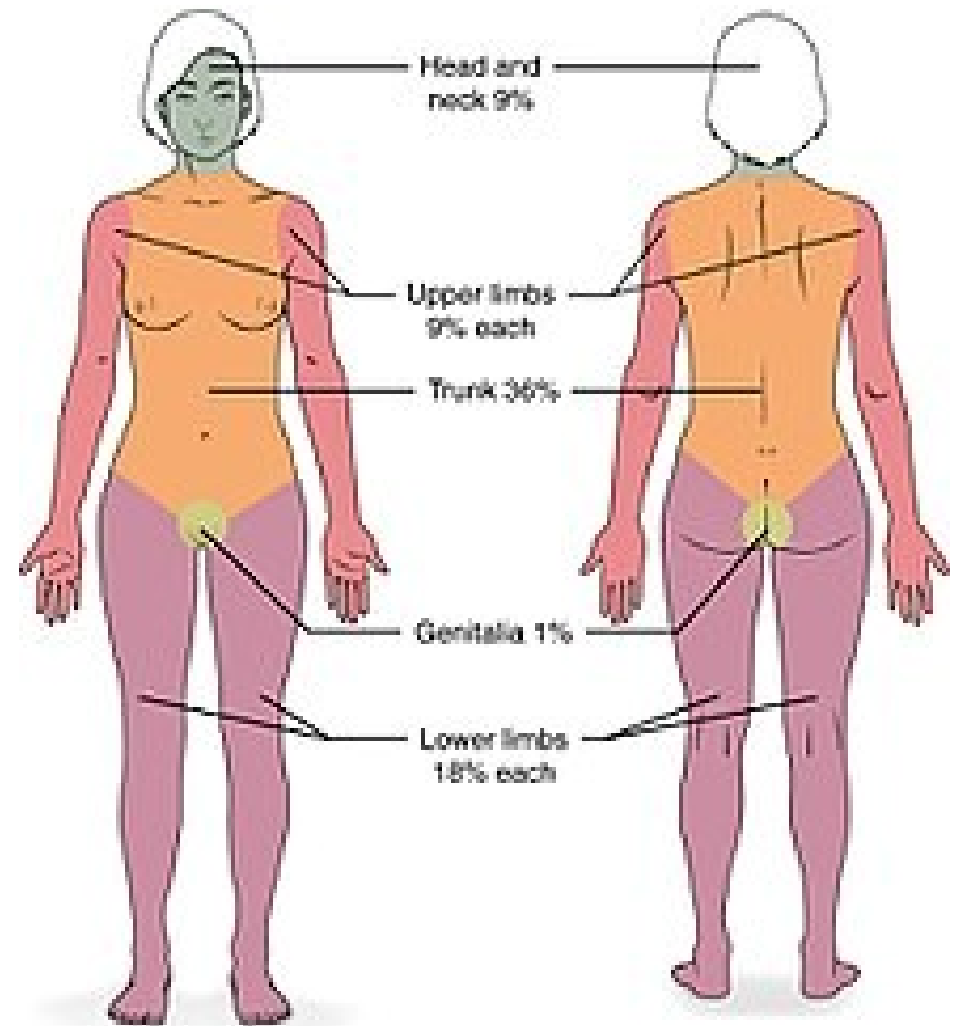
Jackson's burn model

- 1. central zone of coagulation (irreversible)
- 2. zone of stasis (partially reversible)
- 3. marginal zone of hyperaemia (reversible)



Area of burns

- Estimation of burned area is vital for adequate treatment
- "Rule of hand (1%)"
- "Rule of 9"



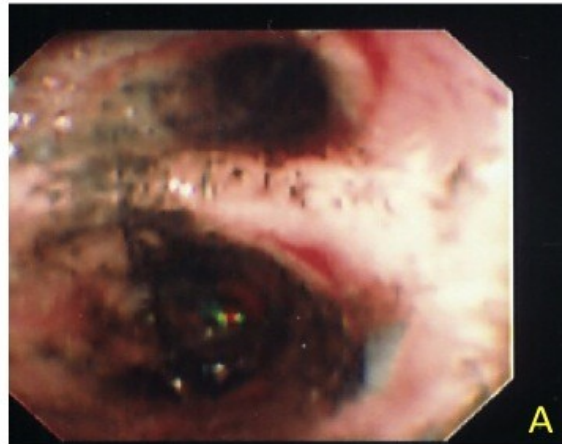
Inhalation thermal trauma

- Airways damage
- Swelling/necrosis
- Airways obstruction!
- CO exposure!
- ARDS
- Rapid therapy!!!
- Secure airways early

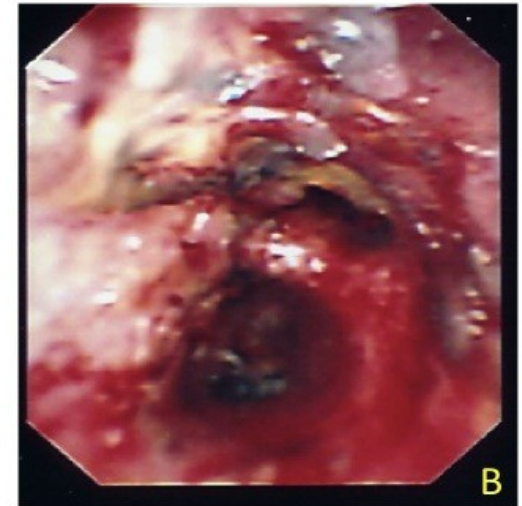
How do I identify inhalation injury?



A patient obviously at risk for smoke inhalation injury



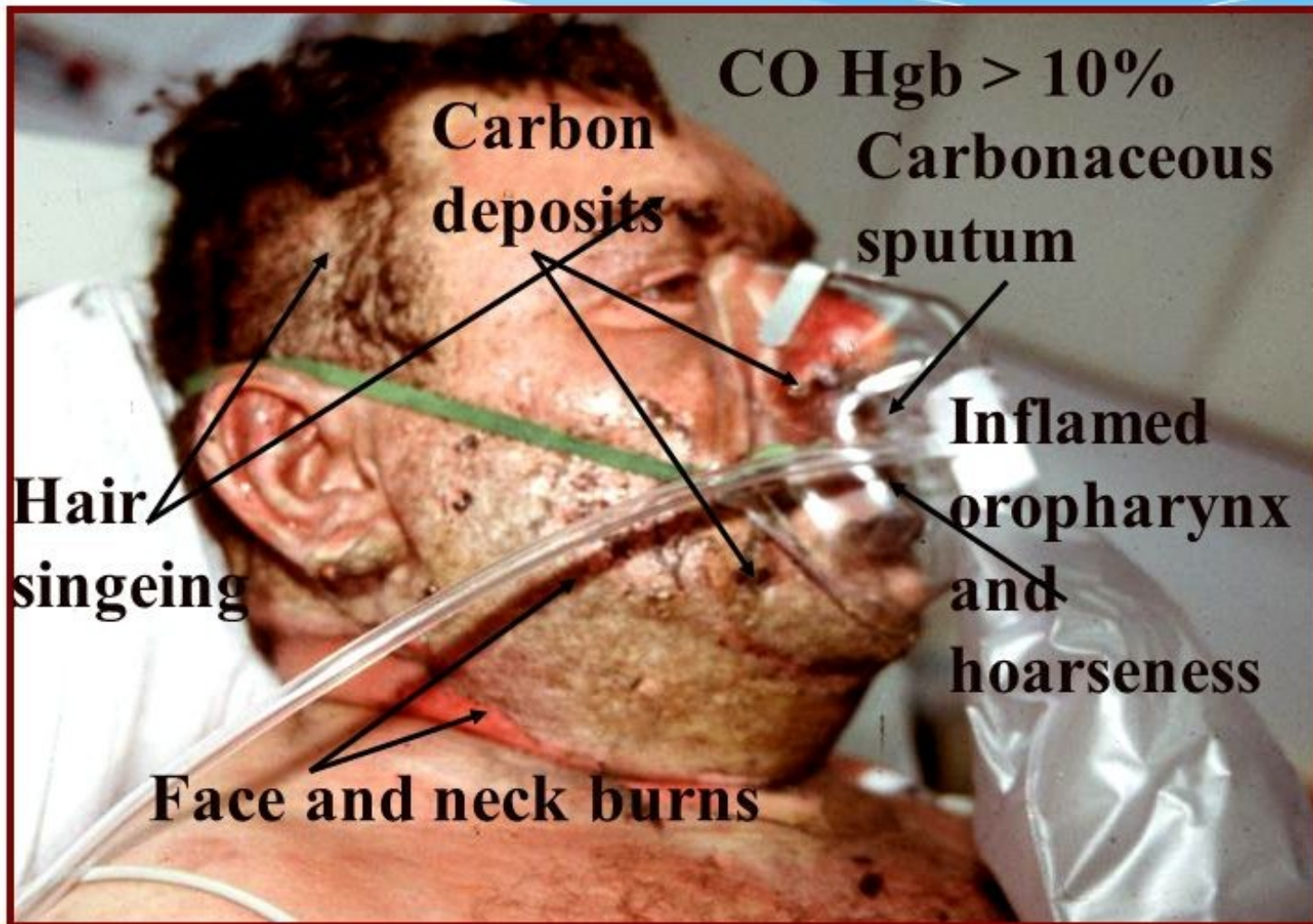
A



B

Figures 3a and 3b: Bronchial injury from inhalation burn from house fire. A) Post-burn day #1 B) Post-burn day #4

Identify inhalation injury?



Barrier function of skin

- Altered in Grade IIB and higher
- Tissue necrosis
- Swelling, hypoxia
- Bacterial contamination and infection
- Typically *Pseudomonas aeruginosa*

- Sterile dressing, TAT, ev. ATB

Local damage

- LIRS... SIRS
- IL1,2, 6, 12, TNF
alpha, Beta
- Histamine
- K⁺, myoglobin
- Pain
- Swelling
- Ischaemia
- Necrosis
- infection

General answer

- SIRS
- Period of shock (24-14 days)
- Acute period of burn disease
- Period of reconstruction
- Loss of plasma, hemoconcentration
- Hypovolemia, AKI
- Toxines resorbtion
- Hypoproteinemia
- Infection, Curling gastric ulcer, liver dysfunction etc.

Respiratory
Bronchoconstriction

Adult respiratory
distress syndrome

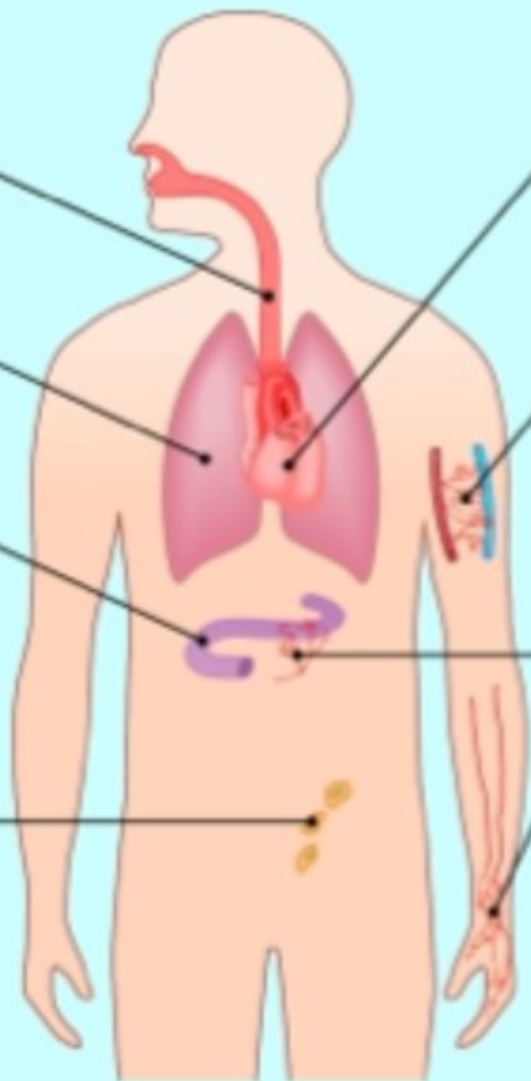
Metabolic
Basal metabolic rate
increased threefold

Immunological
Reduced immune
response

Cardiovascular
Reduced myocardial
contractility

Increased capillary
permeability

Peripheral and splanchnic
vasoconstriction



Treatment

- II. less than 10%
- III. Less than 2%
- Ambulatory treatment
- II. 10-24%
- III. 2-10%
- Hospitalization
• traumacentre
- II: over 25%
- III. Over 10%
- Special cases
- Burn unit

Special cases

- Head and face
- Perineum + genital
- Hands
- Circular burns of chest, neck
- Inhalation thermal injury
- Children under 2yo, II. Type over 5%
- Geriatric patients
- electricity

Treatment - goals

- Reduce local damage
- Prevent/treat general answer
- Prevent complications
- Reconstruct
- Proper treatment in proper time
- Technical help
- Pre-hospital help
- Acute care
 - - symptomatic
 - - supportive
 - - surgical
- Reconstruction and rehabilitation

Symptomatic

- Stop burning process
- Analgesia
- Local hypothermia
- /cooling/
- Sterile dressing
- Prevention of hypothermy



Supportive

- Fluid resuscitation
- Oxygenotherapy
- TAT
- ATB?
- Urinary output
- A,B,C,D



Fluid resuscitation

- Min. 2 i.v. Lines
- ASAP
- Infants over 5%
- Children over 10%
- Adults over 15%
- Crystalloids, colloids?
aminoacids
- Urinary output!!!
- Parkland formula
- RL $4\text{ml} \times \text{kg} \times \%$
- Brook formula 1:3
(crystalloids:colloids)
- $0,5/1,5 \text{ ml} \times \% \times \dots\text{kg}$
- Evans formula 1:1

Surgical

- **Urgent care:**
- Escharotomy
- Fasciotomy

- **On-demand/ planned:**
- Necrectomy
- Wound treatment

When you do an
Escharotomy
you get
L A I D

Longitudinal incisions

Axial planes

In to normal skin

Down to subcutaneous fat

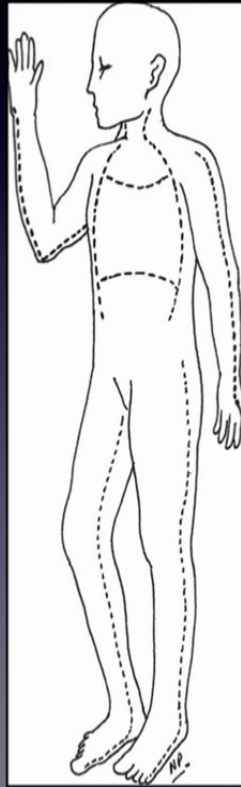
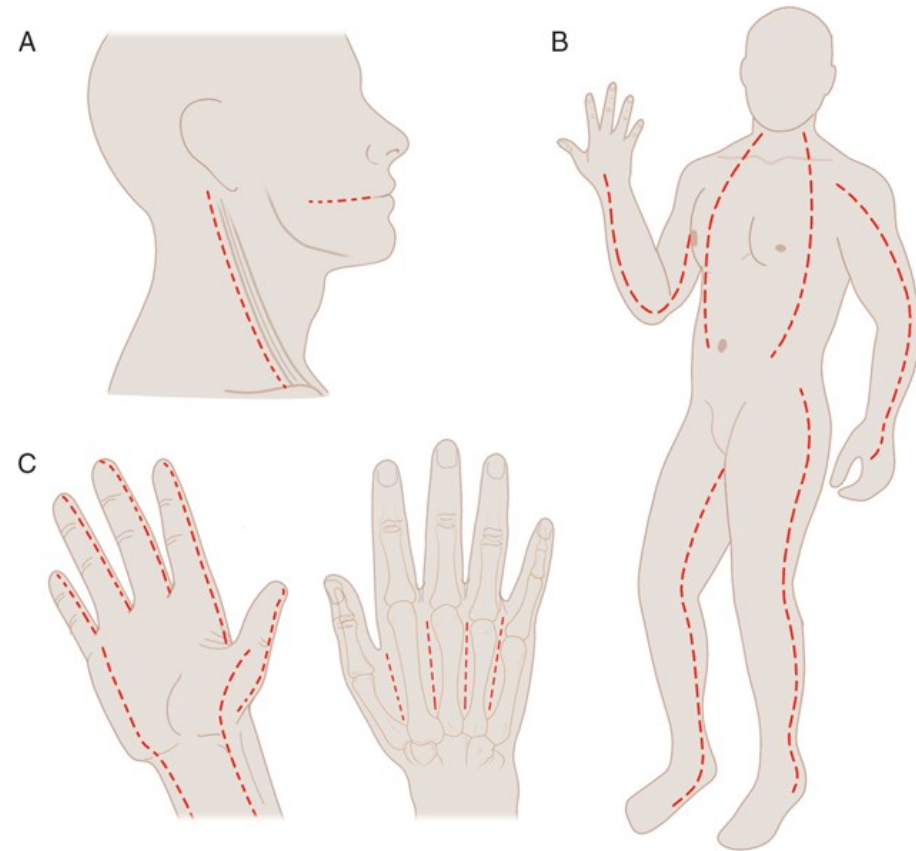
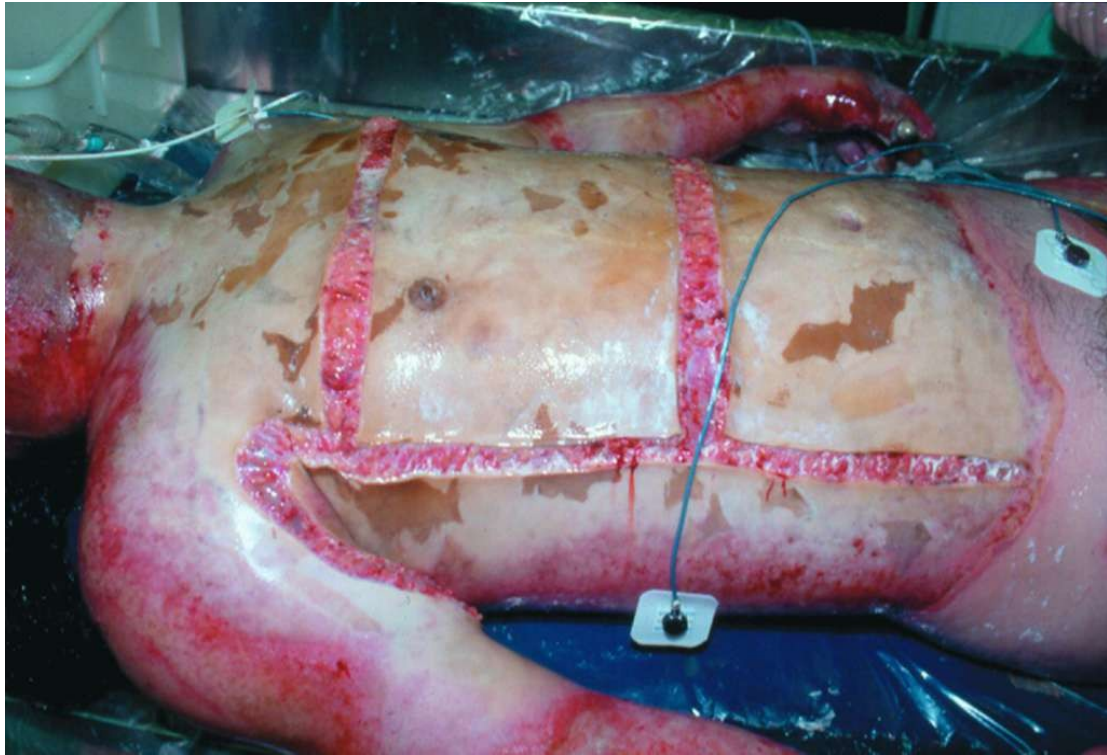


Image: <http://emedicine.medscape.com/article/80583>

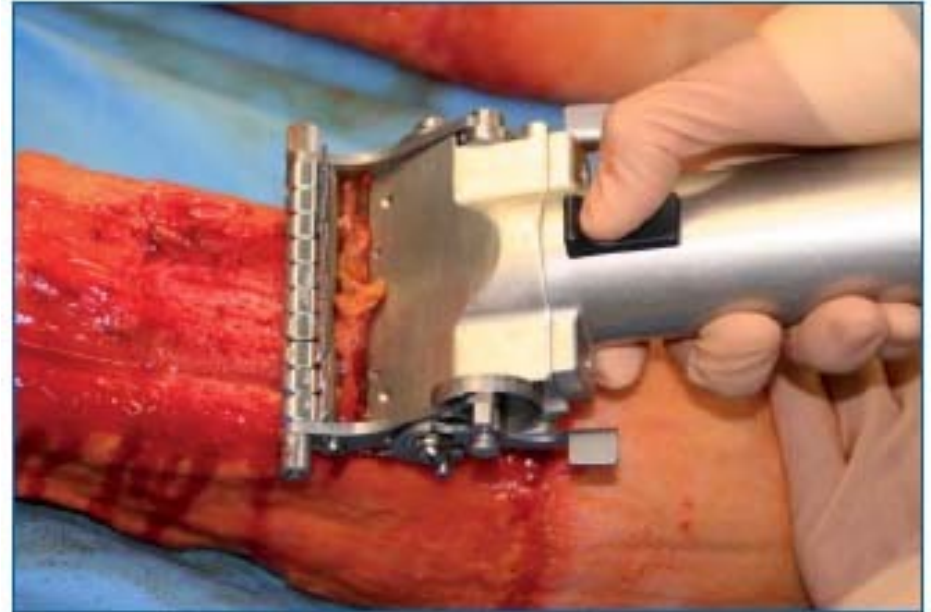


Source: Reichman EF: *Emergency Medicine Procedures, Second Edition*: www.accessemergencymedicine.com
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Necrectomy

- Surgical
- fascial vs. tangential
- Chemical
- 40% benzoic acid
- 40% salicylic acid
- Enzymatical - less
- collagenase
- protease





Debridement

Reparation, reconstructive surgery

- Plastic surgeons
- Dermo-epidermal graft
- Skin transplant
- Musculofascial flaps
- ...
- Autotransplant
- Allotransplants
- Xenotransplants
- Synthetic materials
- (bovine collagene, Synkrit...)





Frostbites - congelationes

- Effect of low temperature
- Not necessary below 0 C'
- Wind, wet
- Exposed skin
- Peripheral areas /acra/
- General state of patient

Types

- Frostnip
- Frostbite
 - 1st Degree
 - 2nd Degree
 - 3rd Degree
 - 4th Degree
- Non- freezing injury (Trench foot)
- Hypothermia

Frostnip

- mildest form of cold injury
- Initial pain, pallor, numbness
- reversible, no tissue loss
- Th: rewarming



.Frostbite

- 1st Degree: hyperemia, swelling, no skin necrosis
- 2nd Degree: clear blister formations, hyperemia, edema, partial-thickness skin necrosis
- 3rd Degree: full-thickness and subcutaneous tissue necrosis, hemorrhage vesicle formation
- 4th Degree: full-thickness skin necrosis + muscles, bones, gangrene



Trenchfoot

- endothelial damage, stasis, vascular occlusion
- Long-term exposure to wet conditions, temperatures just above freezing point
- Soldiers, sailors, fishermen...



.Trenchfoot

- Cold and numb tissue /24hours/ - due to arterial vasospasm
- progressing to hyperemia, pain, hysestesia
- Edema, blisters, redness, ulcerations
- Local infection, cellulitis, gangrena



Local and general answer

- Vasospasm
- Ischemia
- Swelling
- Necrosis
- Secondary complications
- Infections
- Sepsis
- Hypothermia - less than 36 C'
- Mild - 32-35C'
- Moderate – 30-32 C'
- Severe- less than 30C'
- Neurological problems
- Ayrtmia
- Cardiac arrest

Treatment

- **Exposure!**

- **Re-warm**

- Local/circulating water 40C°/

(no dry heat, no rubbing!!!, pain management)

- Systematic – hot drinks, i.v. fluids

- **Wound care**

- Goal – prevent infection, preserve damaged tissue

- elevation, avoid opening clear blisters, immobilisation, TAT, ATB?

Corrosion - chemical burns

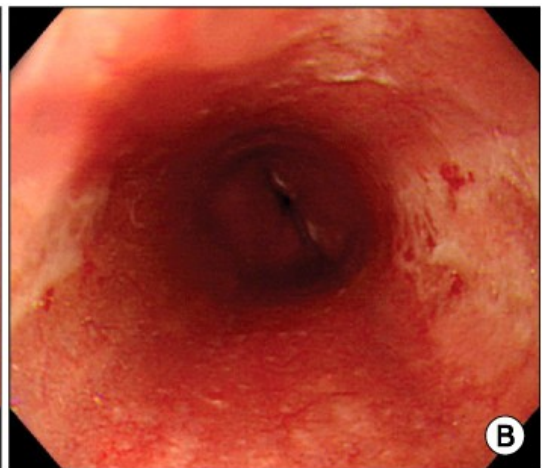
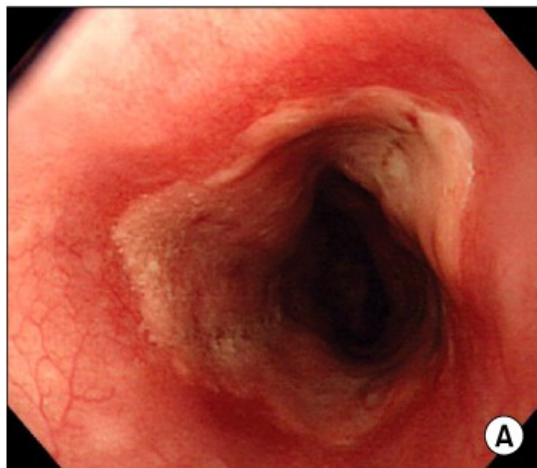
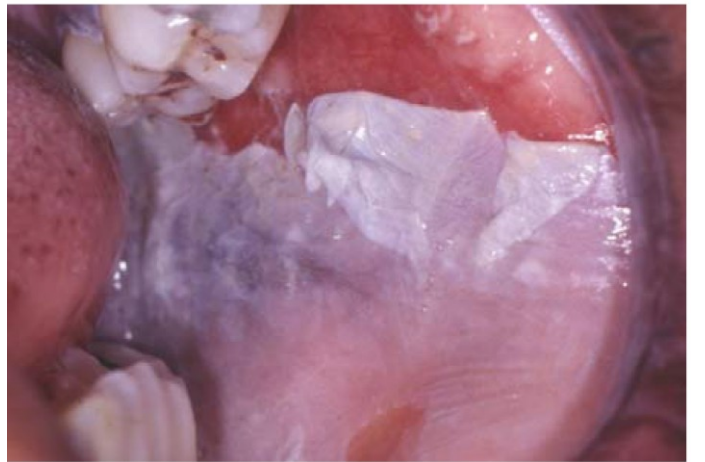
- Exposure to acids, alkalies, petroleum products
- Acids - coagulation
- Alkalies – colliquation (deeper penetration)
- Injury influenced by:
 - Type, amount, concentration, time of exposure
- Treatment: rapid removal, neutralization(?), irrigation, sterile dressing, TAT, ATB?



Internal use of chemicals

- Accidental, suicidal
- Alkalies, acids /
- Hyperemia, flegmona, necrosis, ulcers, perforation... chronicity - stenosis
- Dyspnoe, odynophagia, hoarseness, pain, laryngeal spasm, metabolic disorder
- GFS? PPI, NGT, irrigation, ATB, PEN





Thank you

