

Definition

- Thermal, chemical or electrical injury sufficient enough to cause tissue disruption, denaturation, or even death
- Carry a risk of permanent :
 - Disfigurement
 - Impairment of function

Epidemiology

- Males > Females
- 2 peaks at :
 - 0 - 5yrs
 - 25 - 35yrs
- 80% of burns are less than 20% TBSA
- Pediatrics
 - Scald Burns >80%
 - Account for 45% of Hospital Admission
 - 33% due to child abuse
- Elderly :
 - Impaired mobility, poor coordination, decrease awareness to pain in DM
 - Abuse/neglect
- Factors that ñ mortality :
 - Age greater than 60
 - Greater than 40% TBSA
 - Inhalation injury
- Alcohol is a common contributing factor

Types of Burns

- Scalds (hot liquids) à most common type in children
- Flame (thermal) à most common in adults
- Electrical
- Chemical
- Frictional
- Flash
- Contact

Pathophysiology

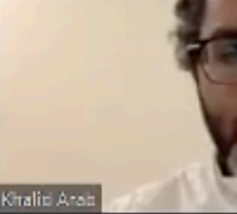
- Increased fluid loss from the surface
 - Normally 15ml/m² increase to 200 ml/m²
- In deep burns, the dermis is converted to coagulum called ESCHAR
- Inflammatory response ranges from
 - Capillary dilatation in sunburn
 - Damaged capillaries and increase permeability and interstitial edema

Pathophysiology

- 2cm increase in leg diameter represent 2L of increase in fluid
- Destruction of epidermis removes the protective bacterial barrier à Contamination à Sepsis à Death

Pathophysiology

Jackson's zones of burn:



Khalid Arab

- **Zone of coagulation**

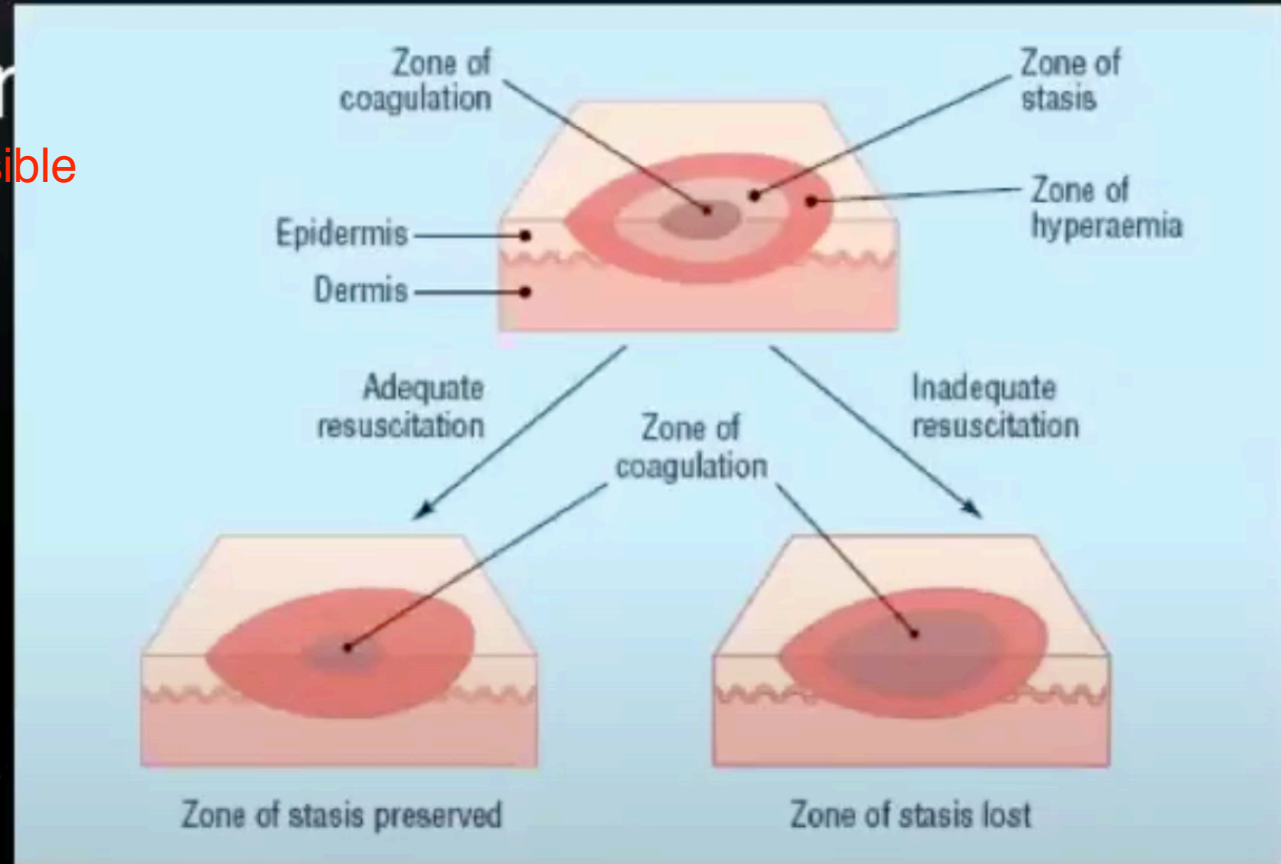
Coagulative necrosis; dead tissue; irreversible

- **Zone of stasis**

Majority of resus. and fluid intake would play a major role; reversible

- **Zone of hyperemia**

Viable cells; reversible



General Effect Of Burns

- Depends on the burn size
- The bigger the burn the more the physiological changes :
 - Water loss
 - Salt loss
 - Protein loss
 - Increased catabolism
 - Edema due to fall in circulating plasma + inc. leakage
 - Damage to RBCs : Immediate or delayed
 - Increase Hct
 - Hypovolumic Shock in severe cases
- Increased Metabolic Rate 7000 Kcal expended daily
 - Daily Wt loss of 0.5kg

Table 4.1 Classification of burn severity

Minor burn

15% TBSA or less in adults

10% TBSA or less in children and the elderly

2% TBSA or less full-thickness burn in children or adults without cosmetic or functional risk to eyes, ears, face, hands, feet, or perineum

Moderate burn

15–25% TBSA in adults with less than 10% full-thickness burn

10–20% TBSA partial-thickness burn in children under 10 and adults over 40 years of age with less than 10% full-thickness burn.

10% TBSA or less full-thickness burn in children or adults without cosmetic or functional risk to eyes, ears, face, hands, feet, or perineum

Major burn

25% TBSA or greater

20% TBSA or greater in children under 10 and adults over 40 years of age

10% TBSA or greater full-thickness burn

All burns involving eyes, ears, face, hands, feet, or perineum that are likely to result in cosmetic or cosmetic impairment

All high-voltage electrical burns

All burn injury complicated by major trauma or inhalation injury

All poor risk patients with burn injury

TBSA, total body surface area.

Mortality

- In the early post burn period:
 - Inadequate hydration
 - Respiratory issue (inhalation or infection)
- In the late post burn period:
 - Wound sepsis
 - Delayed healing,
 - Increased energy expenditure leading to increased incidence of shock

Burn Classification

- By Types Electrical, chemical etc.
- By TBSA minor, moderate and major burns
- By degree / thickness most common

Burn Classification

By Total Body Surface Area (TBSA)

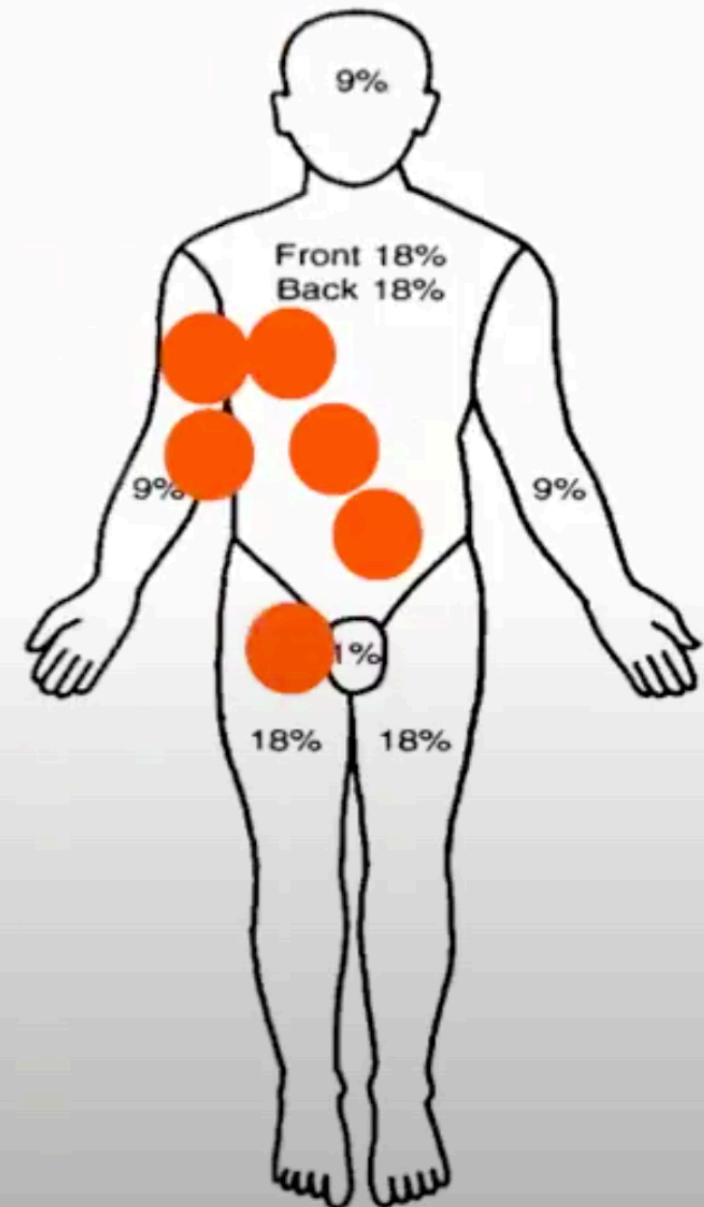
- Wallace rule of



A. Rule of Nines

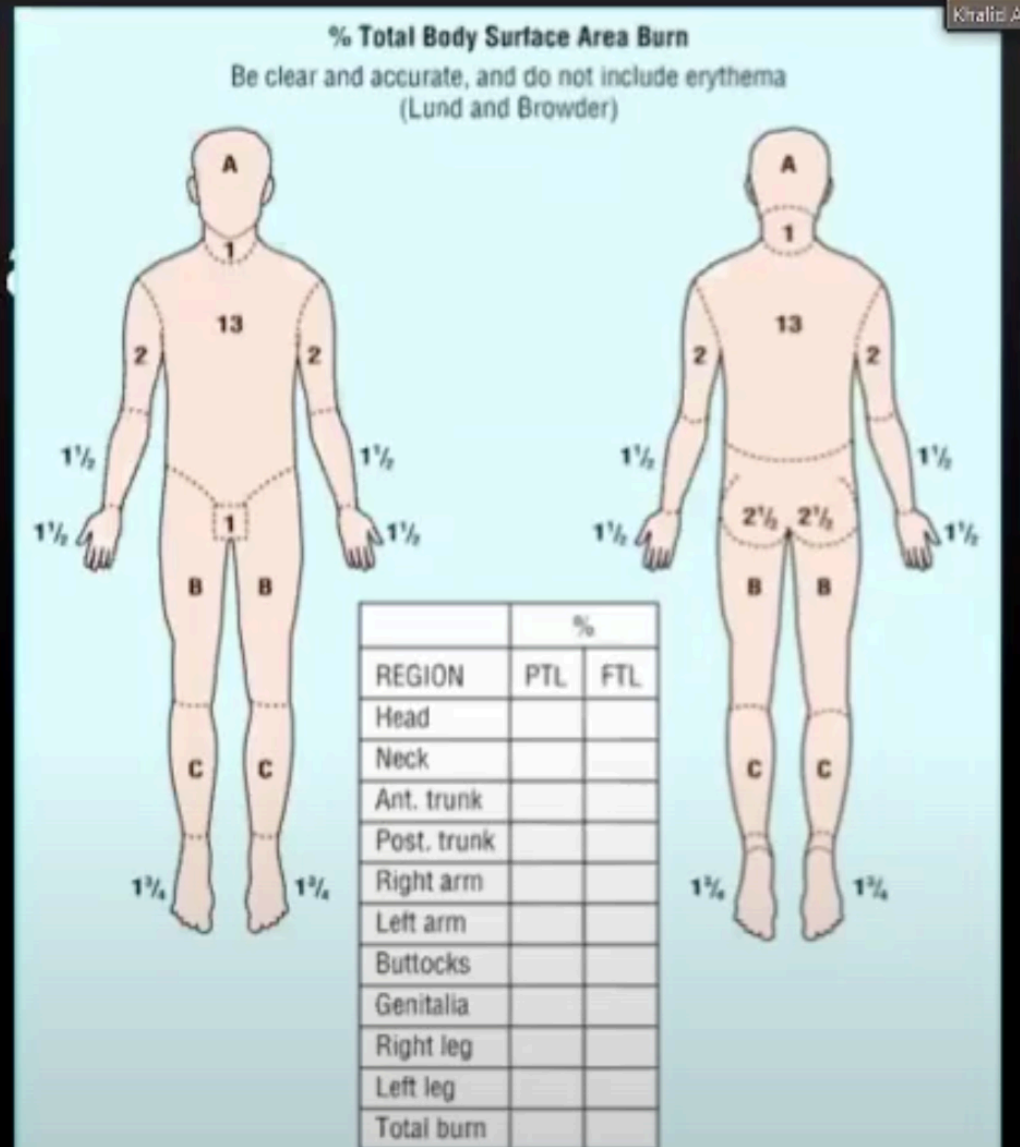
Burn Classification By TBSA

- The Role of Palm
- Pts palm is equal to 1%
- Good for scattered burns



Burn Classification By TBSA

- Lund Browder Chart
for peds.



AREA	Age 0	1	5	10	15	Adult
A = 1/2 OF HEAD	9 1/2	8 1/2	6 1/2	5 1/2	4 1/2	3 1/2
B = 1/2 OF ONE THIGH	2 1/4	3 1/4	4	4 1/2	4 1/2	4 1/2
C = 1/2 OF ONE LOWER LEG	2 1/2	2 1/2	2 1/2	3	3 1/2	3 1/2

Burn Classification

By Degree / Thickness

- Old:
 - 1st degree
 - 2nd degree
 - 3rd degree
 - 4th degree
- New:
 - Superficial (1st degree)
 - Superficial partial thickness (2nd degree)
 - Deep partial thickness (2nd degree)
 - Full thickness

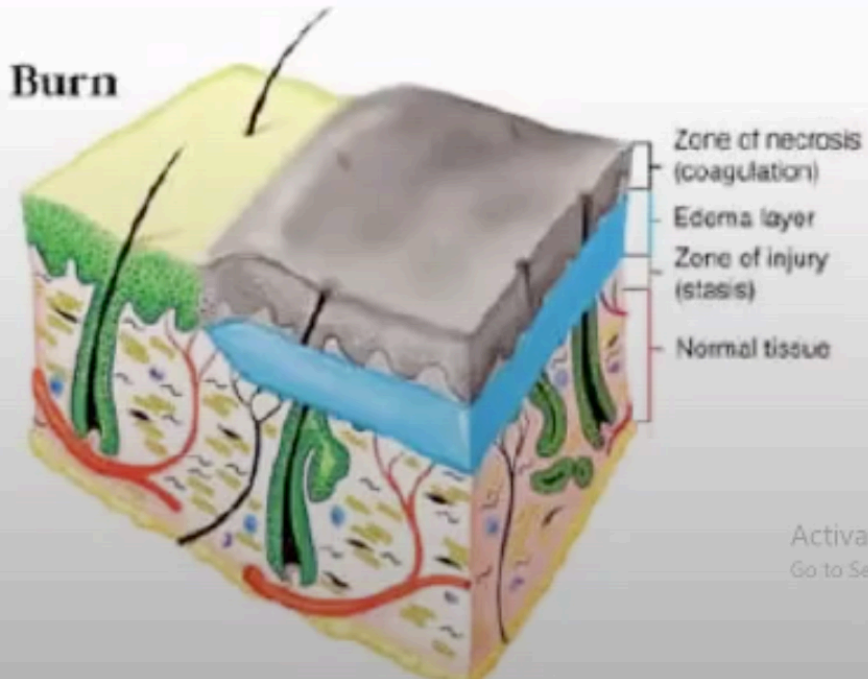
Superficial (1st Degree)

- Damage to the epidermis only *just like tanning*
- No Need for admission
- Heal with in 5 – 7 days
- No scarring
- Needs **ONLY** analgesia *analgesia and moisturizers*

Superficial Dermal Burn

Characteristics

1. Necrosis confined to upper third of dermis
2. Zone of necrosis lifted off viable wound by edema
3. Small zone of injury









Partial Thickness (2nd Degree)

Superficial Partial thickness

- Epidermis and upper dermis
- Pink, painful, swollen
- Fluid loss
- **BLISTER**
- Heal with-in 2 weeks
 - From epidermal appendages
- **DAILY DRESSING** + analgesia for the pain
- Minimal scarring

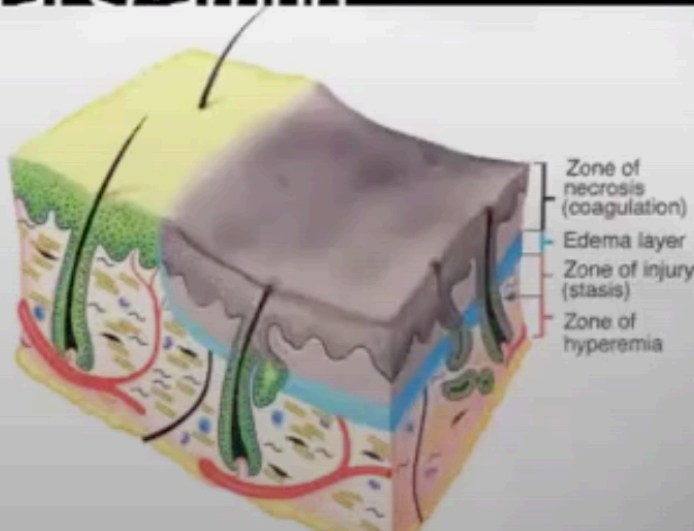
Deep partial thickness

- Epidermis and most of the dermis
- Treat like 3rd degree burn
- Less or not painful insensate; due to disruption of nerve endings
- Rarely Blister
- Prolonged inflammatory phase cause scarring
 - Leave an ugly hypertrophic scar Delay in treatment (more than 7-10 days) leads to this; the earlier the better
- **NEEDS DEBRIDEMENT &**

Mid-Dermal Burn

Characteristics

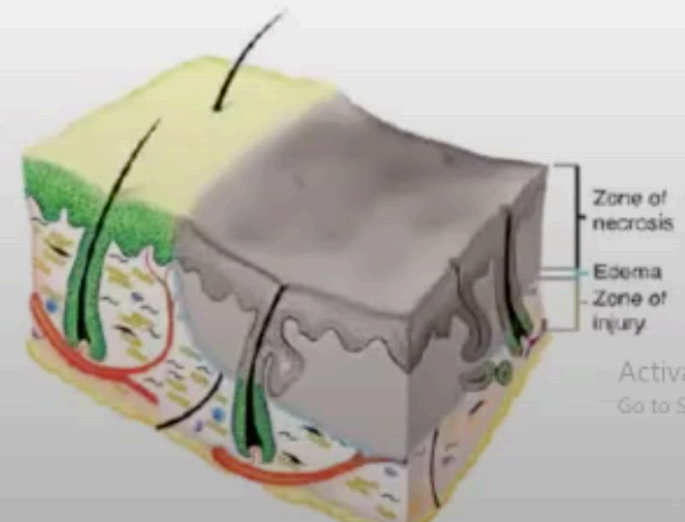
1. Necrosis to mid-dermis
2. Large zone of injury (potential conversion)
3. Eschar separated from viable tissue by edema layer



Deep Dermal Burn

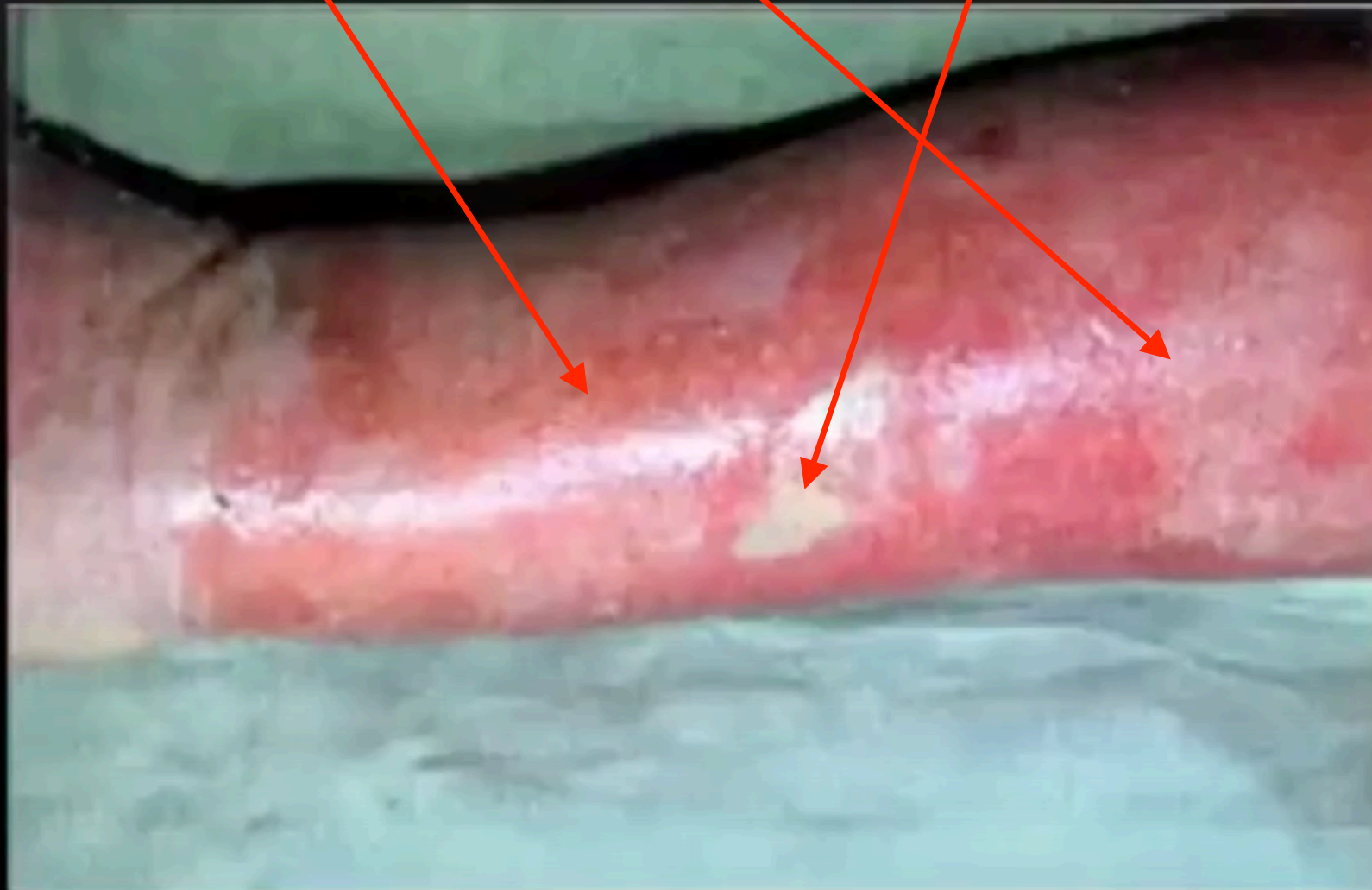
Characteristics

1. Necrosis involving majority of skin layers
2. Zone of necrosis adherent to zone of injury
3. Smaller edema layer





this has both 1st and 2nd degree (superficial and deep) burns

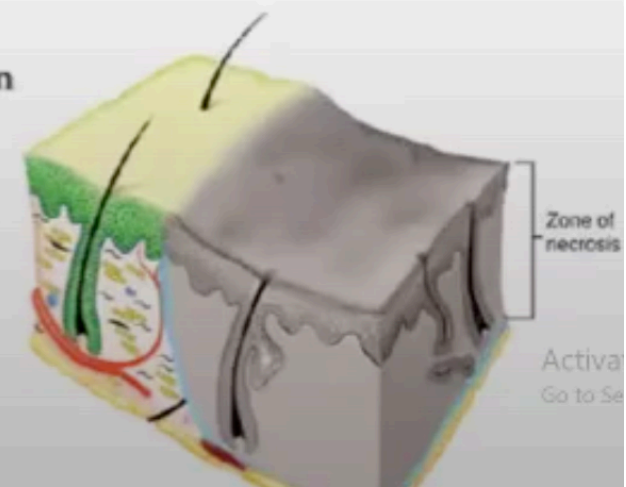


Full Thickness (3rd Degree Burns)

- Epidermis and total dermis including the epidermal appendages
- Destroyed tissue undergoes coagulative necrosis
- Not painful
- No Blister
- Marble or leathery like appearance
- THROMBOSED VEINS
- Cause significant Scarring due inward growing and movement of the cells
- NEEDS DEBRIDEMENT & SKI

Full Thickness Burn

Characteristic
No remaining viable dermis



Full thickness 3rd degree





3rd degree

2nd degree

3rd degree
surrounded by
2nd



Full Thickness (4th Degree)

- Injury extends to the underlying structures
 - Muscle, Fascia, Bone
 - Charring of the tissue

full thickness (deep)



Determination of Burn

Depth

Hx:

- How (mechanism)
- When
- Duration of exposure
- Pain and sensation

- Mechanism
 - Scald : Short Vs. Long
 - Flame, Chemical , Electrical
- Appearance
 - Erythema, Blister, Eschar, thrombosed veins
- Sensation
- Time to healing

Prognosis

- Age, and General condition
- Extent of the Burn
 - The TBSA the smaller the burn the better the prognosis, and vice versa
- Depth of the Burn
 - Superficial burns heal with in 2 – 3 weeks
 - The deeper the burn the higher the risk of infection
- Site of the Burn
 - Due to appearance and functional impairment
- Inhalation Injury

Burn Management

- First Aid
 - Stop the burning process
 - Victim should stay flat to avoid inhalation of smoke and fumes
 - Remove all burned clothes
 - Apply cold water Vs. Hypothermia *recover the patient*
 - Chemical Burns
 - Copious irrigation *with normal saline; unless there is a known antidote. Acid -> NS, alkaline -> NS*
 - Electrical Burns
 - Switch off the current, or by pushing the victim away from the current source with a non-conducting object

Burn Management

- Avoid Wound Contamination
 - Burn must be covered with clean sheet
 - Avoid using house hold items
 - It might convert partial injury to a full thickness one

Burn Management

- ABCs - Life preservation
- History:
 - Agent of injury
 - Medical co-morbidities
- Physical exam:
 - Inhalational component?
 - Estimation of depth
 - Estimation of TBSA of burn
- *start IV fluids ASAP*
Determination: Severity of injury and triage/transfer
- Irrigation and debridement of wounds

Transfer Criteria

Burn Center Referral Criteria

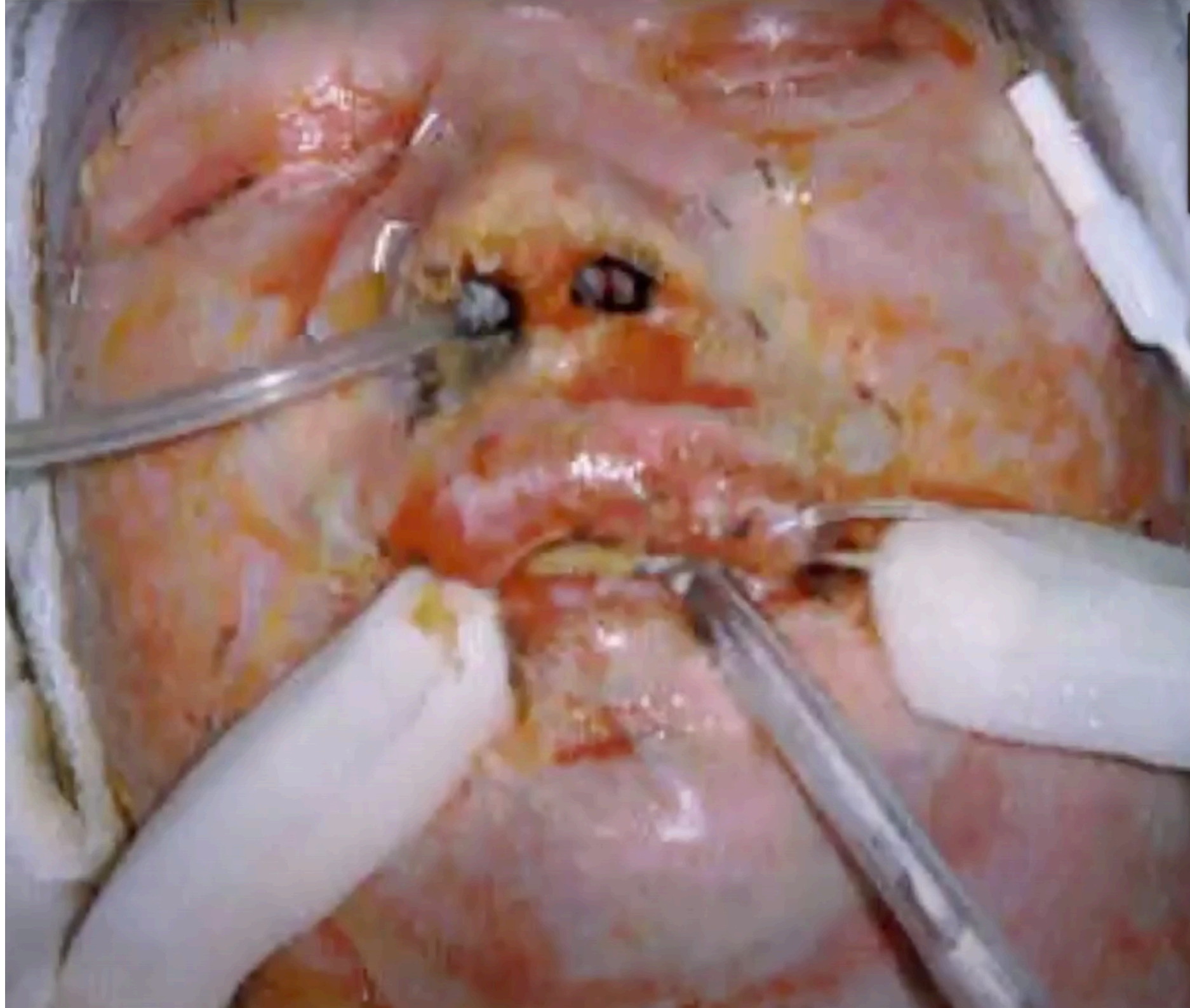
the doc went through it

1. Partial-thickness and full-thickness burns totaling greater than 10% TBSA in patients under 10 or over 50 years of age.
2. Partial-thickness and full-thickness burns totaling greater than 20% TBSA in other age groups.
3. Partial-thickness and full-thickness burns involving the face, hands, feet, genitalia, perineum, or major joints.
4. Full-thickness burns greater than 5% TBSA in any age group.
5. Electrical burns, including lightning injury.
6. Chemical burns.
7. Burn injury in patients with preexisting medical disorders that could complicate management, prolong the recovery period, or affect mortality.
9. Any burn with concomitant trauma (e.g., fractures) in which the burn injury poses the greatest risk of morbidity or mortality. If the trauma poses the greater immediate risk, the patient may be treated initially in a trauma center until stable, before being transferred to a burn center. The physician's decisions should be made with the regional medical control plan and triage protocols in mind.
10. Burn injury in children admitted to a hospital without qualified personnel or equipment for pediatric care.
11. Burn injury in patients requiring special social, emotional, and/or long-term rehabilitative support, including cases involving suspected child abuse.

Inhalation Injuries

Requires a high index of suspicion

- The mechanisms of inhalation injury can be divided into three broad areas
 - Inhalation of products of combustion
 - Carbon monoxide inhalation
 - Direct thermal injury to the upper aero-digestive tract
- Suspect inhalation injury if:
 - Flame burn in a closed space
 - Singed (burned) nasal hair
 - Facial or oropharyngeal burns
 - Expectoration of carbonaceous (blackish) sputum
 - Signs of upper respiratory obstruction—such as crowing, dyspnoea, cough, stridor, or air hunger



Inhalation Injury / CO

- Odourless, tasteless gas
- Impairs tissue oxygenation by preferentially binding to Hgb
- Affinity 240 times that of oxygen
- shifts the Hb dissociation curve to the left decreasing O₂ delivery
- Signs include:
 - Headache
 - cherry red lips
 - arrhythmias
 - acidosis
 - seizures
 - LOC

Inhalation Injury

Carbon Monoxide

- Treatment
 - 100 % O₂ +/- intubation and ventilation
 - t_{1/2} of CO is 5 to 6 hours on R/A
 - 45 min on 100% O₂
 - 27 min HBO @ 3 atm
 - Indications for HBO therapy
 - Coma
 - LOC
 - ischemic ECG changes
 - focal neurological deficits
 - +/- CO Hb >40%
- Pregnant ladies

full thickness burn over the chest that has altered this pt's ventilation



ct



Burn Management

- Non – Surgical
 - Tetanus Vaccine
 - Fluid
 - Nutrition
 - Physiotherapy
 - Dressing

- Surgical within 7-10 days
 - Escharotomy if there is any evidence of circumferential burn
 - Debridement
 - Grafting

Non-Surgical Burn Management

Fluid Resuscitations

- Burns over 15% TBSA in Adults or 10% in Children
 - Require IVF administrations
 - Through a peripheral Vein
 - Or Internal Jugular or subclavian vein line if peripheral line is not possible
- Withdraw blood for CBC, Electrolytes, CO level
- Foley catheter to monitor urine output and, hence, adequate hydration

Non-Surgical Burn Management

Fluid Resuscitations

- Crystalloid Vs. Colloid

crystalloid is preferred in the first 24 hrs

Non-Surgical Burn Management

Fluid Resuscitations N.B

- **Parkland Formula** Most commonly used formula
 - $\text{Wt in Kg} \times \text{TBSA \%} \times 4\text{cc}$
 - 1st 1/2 in the 1st 8 hrs and 2nd 1/2 in the next 16 hrs these are calculated from the time of injury not admission
 - Use R/L
 - Only for 2nd degree burns or deeper
- **Modified Brooke**
 - $\text{Wt in Kg} \times \text{TBSA \%} \times 2\text{cc}$
- **Hypertonic Saline**
 - 250-300meq
 - Decrease the fluid requirement
 - Require regular Na monitoring

Non-Surgical Burn Management

Fluid Resuscitations

- **Children** will need the maintenance IVF add to there fluid resuscitations
 - 100ml / kg / 24hr 1st 10 kg
 - 50ml / kg / 24hr 2nd 10kg
 - 20ml / kg / 24hr 3rd on kg
- To avoid Hypoglycemia
- Use D5% 1/2 NS fluid

Non-Surgical Burn Management

Fluid Resuscitations

- Colloid Replacement formula
 - 0.5ml/kg/%of burn
- Blood transfusion
 - After 24hrs
 - Mainly needed in pts with full thickness burn
 - Regular Hb, Hct monitoring is mandatory

Non-Surgical Burn Management

Fluid Resuscitations

- Adequate fluid resuscitation is monitored by :
- Urine Output or the urea and uric acid
 - 0.5 – 1 ml/kg/hr for Adult
 - 1 ml/kg/hr for Children
- In cases of ***electrical burns*** more urine is needed to protect the kidney more likely to develop rhabdomyolysis
 - 2 – 3ml/kg/hr so extra fluids need to be given
- ***Inhalational injury*** patients also ***need*** extra fluids

Non-Surgical Burn Management

Nutrition

- Due to increased energy expenditure following severe burn
 - High caloric protein diet once the pt can take orally or via NGT
 - Daily requirement is $20\text{kcal/kg} + 70\text{kcal/kg}/\%$ of burn ($1\text{g/kg} + 3\text{g/kg}/\%$ of burn of protein)
- Vitamins Supplement
 - Vit C
 - Zinc
 - Multi-Vitamins

Non-Surgical Burn Management Physiotherapy

- Splints to prevent contractures
- Range of motion exercises to prevent stiffness especially in burns involving the knees and elbows

Non-Surgical Burn Management Dressing

- Local wound management
 - Cover burn regularly to avoid infection which is the main threat to life once the 1st 24hrs have passed
- Initial cleansing and debridement
 - Cleanse wound with antiseptic & saline
 - Blister are punctured

change the dressing every 24-48 hrs
- No role for IV or Oral Abx only when there is a +ve culture not only colonization
- Do not forget tetanus

Non-Surgical Burn Management Dressing

- Destruction of the epidermis removes the normal barrier to infection
- Full thickness burn impairs the normal response to infection
- The organism colonize the burn wound
- Staphylocococi the most common
- Pseudomonos remains troublesome in most burn units in DM and in pts with other comorbidities

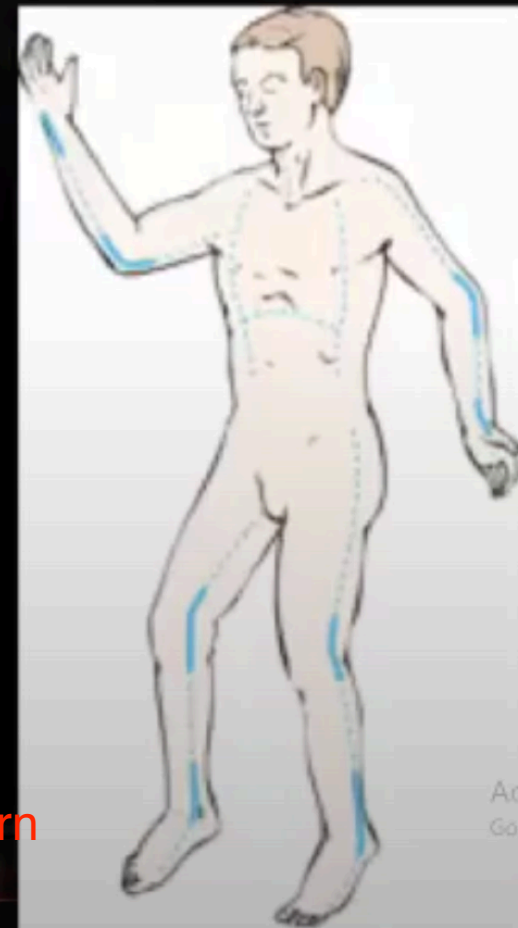
Non-Surgical Burn Management Dressing

- **Flamazine** (Silver sulphadiazine) the most common burn dressing used
 - Must be applied daily
 - S/E neutropenia and methemoglobinemia
 - Can not be used in infants under 6/12 of age
- Open Vs. Closed dressing
- Fucidine or bacitracine ointment
 - To prevent super-infection of the burn wound from the colonized organisms

Surgical Burn Management

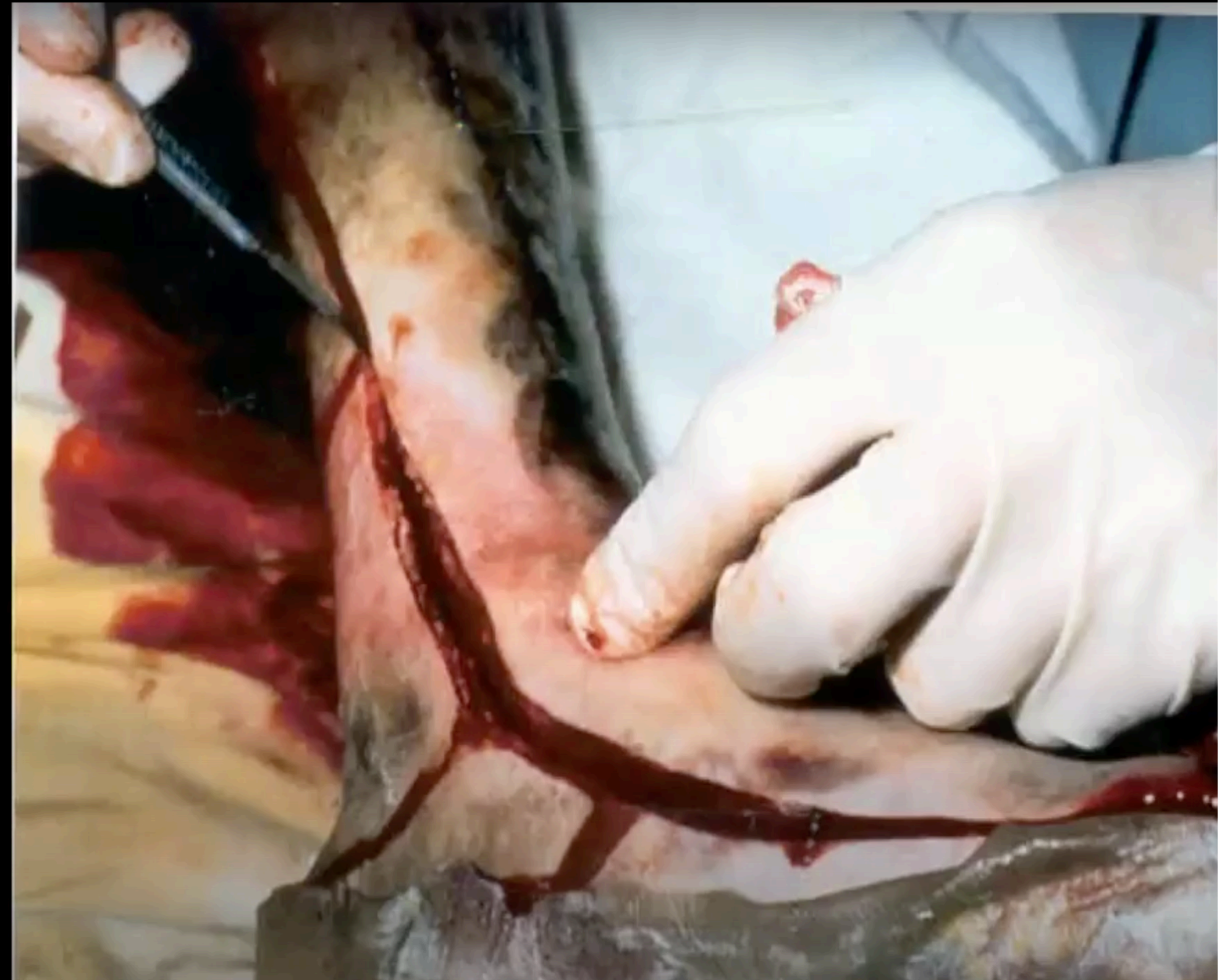
Escharotomy*

- Mid – Axial incision in the eschar only of full thickness burn
- To relieve the tourniquet effect of the circumferential full thickness burns on
 - Extremity
 - Trunk if
 - Breathing was an issue
 - Increase intra-abdominal pressure
- Due to interstitial fluids accumulation from the excessive IV fluid



* an incision is made from normal skin to another; bypassing the full thickness burn





Surgical Burn Management

Escharotomy





Skin Grafts

Split Thickness (STSG)

Full Thickness (FTSG)

Epidermis + part of the dermis

Contains the epidermis and only the superficial part of the dermis.

The remaining dermis (of the donor) is still there, so the granulation would happen in this area and skin will replicate.

Advantages:

Donor heals spontaneously

Large donor area, can be reused

Higher chance of take in less ideal conditions

Can be taken from any part of the donor's body.
The same area can be used after 14 days.
Only disadvantage: higher (secondary) contracture rate.

Epidermis and entire dermis

Contains the epidermis and the entire dermis.

No chance of having new skin so you need to approximate the donor's skin to close it.

Advantages:

Less contraction

Grows with the patient

Secrets oil and sweat

Better donor site scar and less pain

More stable/durable

Any part as well; it is used for the recipient's face to avoid patchiness and contracture.

Surgical Burn Management Debridement, and Skin Graft



Surgical Burn Management Debridement, and Skin Graft



Surgical Burn Management Debridement, and Skin Graft



Surgical Burn Management Debridement, and Skin Graft





Surgical Burn Management

Debridement, and Skin Graft

Primary contracture of a harvested skin graft. This is common in the full thickness skin graft while secondary contracture (after application) is more common in split thickness graft.

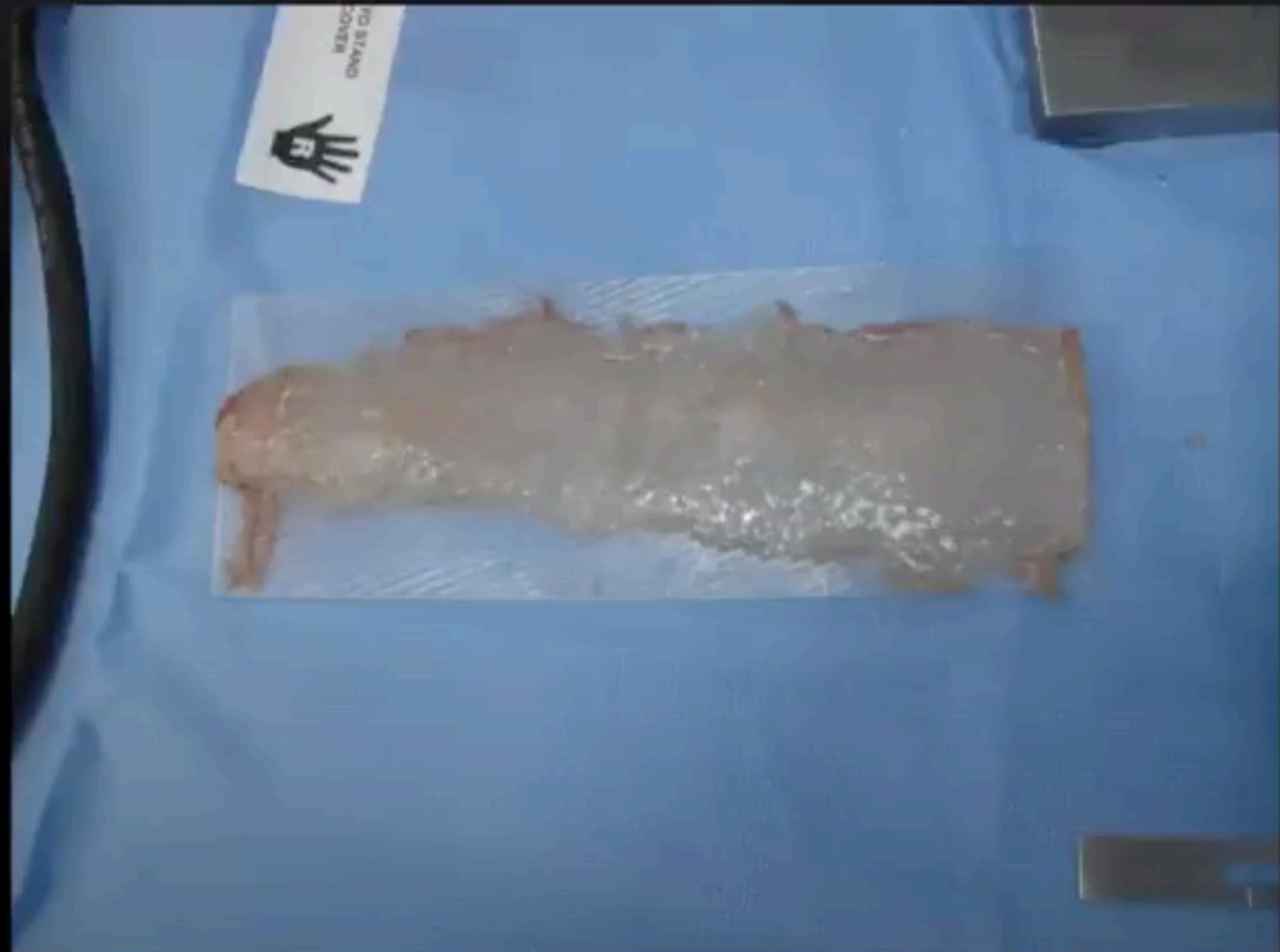


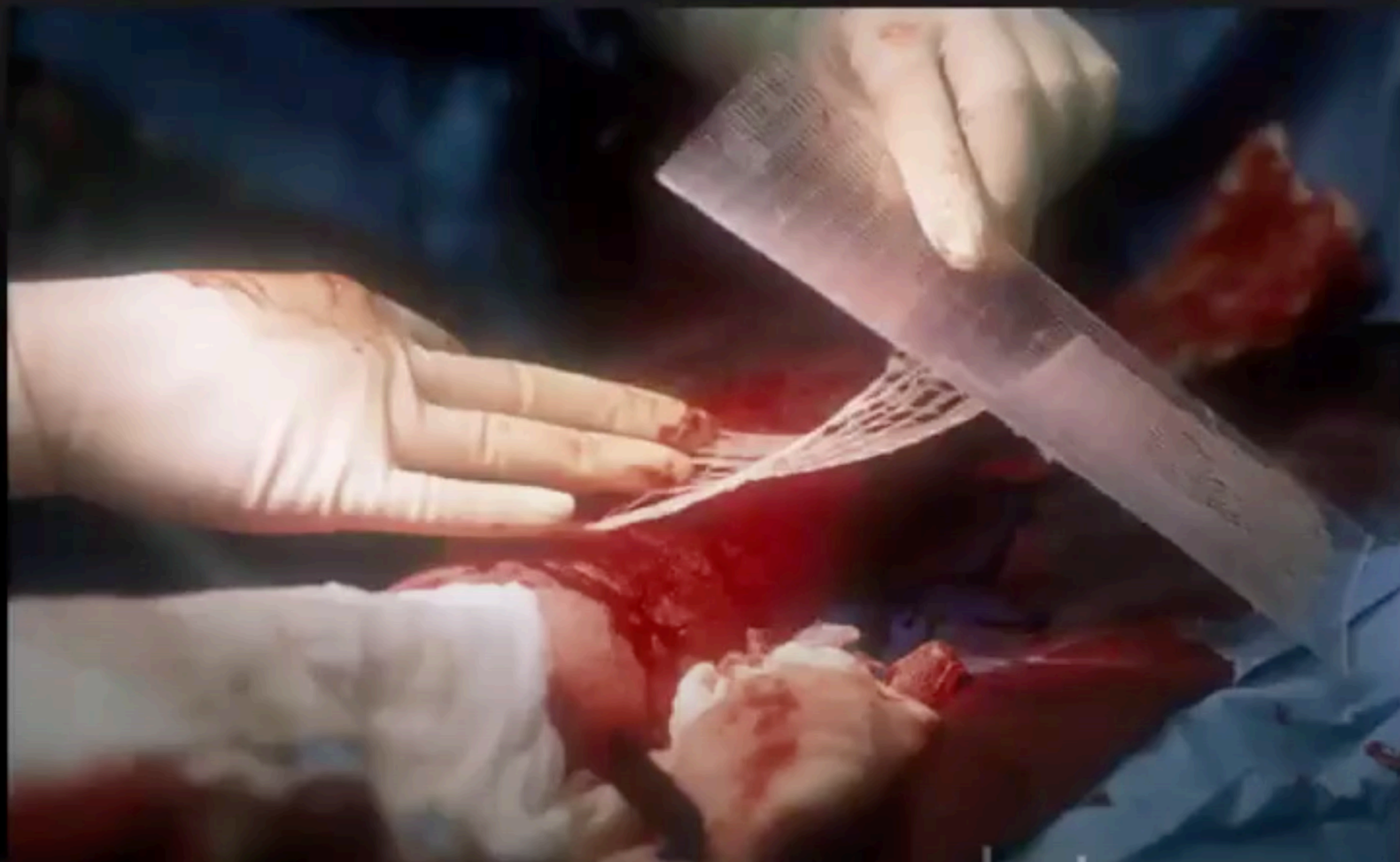
Surgical Burn Management

Debridement, and Skin Graft



Surgical Burn Management Debridement, and Skin Graft







Chemical Burn

- ATLS
- Remove the etiology
 - Including cloth
- Irrigation
- Ensure no Inhalation, GI involvement, Ocular Involvement
- Antidote if available
- Burn Treatment
- Acid Vs. Alkali

Electrical Burn

- High Voltage Vs. Low Voltage
- ATLS
- Management
 - IVF add 30% to TBSA
 - Cardiac
 - Kidney In high voltage burns there is a high chance of rhabdomyolysis; kidney failure.
 - Air/Way
 - Fasciotomy
- Burn Management















Jul 16, 08

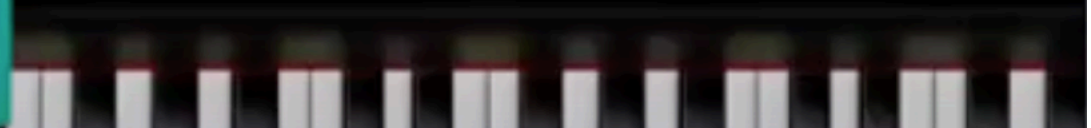








Escharotomy Vs. Fasciotomy



Surgical Burn Management Fasciotomy



Surgical Burn Management Escharotomy

