BURN INJURY

NCMB312 LEC

OUR LADY OF FATIMA UNIVERSITY

LEARNING OBJECTIVES:

1. **Describe the factors that affect the severity of burn injury.**
2. **Describe the local and systemic effects of a major burn injury.**
3. **Compare and contrast the potential fluid and electrolyte alterations of the emergent/resuscitative and acute phases of burn management.**
4. **Describe the goals of burn care and the nurse's role in wound assessment, wound cleansing, topical antibacterial therapy, wound dressing, and débridement.**

BURN

Traumatic injury to the skin and underlying tissues caused by heat, chemical, & electrical injuries (most severe!!!)

degree of tissue damage is related to:

- What agent caused the burn
- Temperature of the burning agent
- Duration of contact with the agent
- Thickness of the skin

PATHOPHYSIOLOGY

Immediate initial cause of cell damage is HEAT

- **Coagulation of CHONs in the cells**
- **Tissue liquefaction** — type of cell death (soft, liquid / semi liquid mass / wound exudate)
- **Electrical burn: internal damage (cardiac dysrhythmias, CNS complications)**

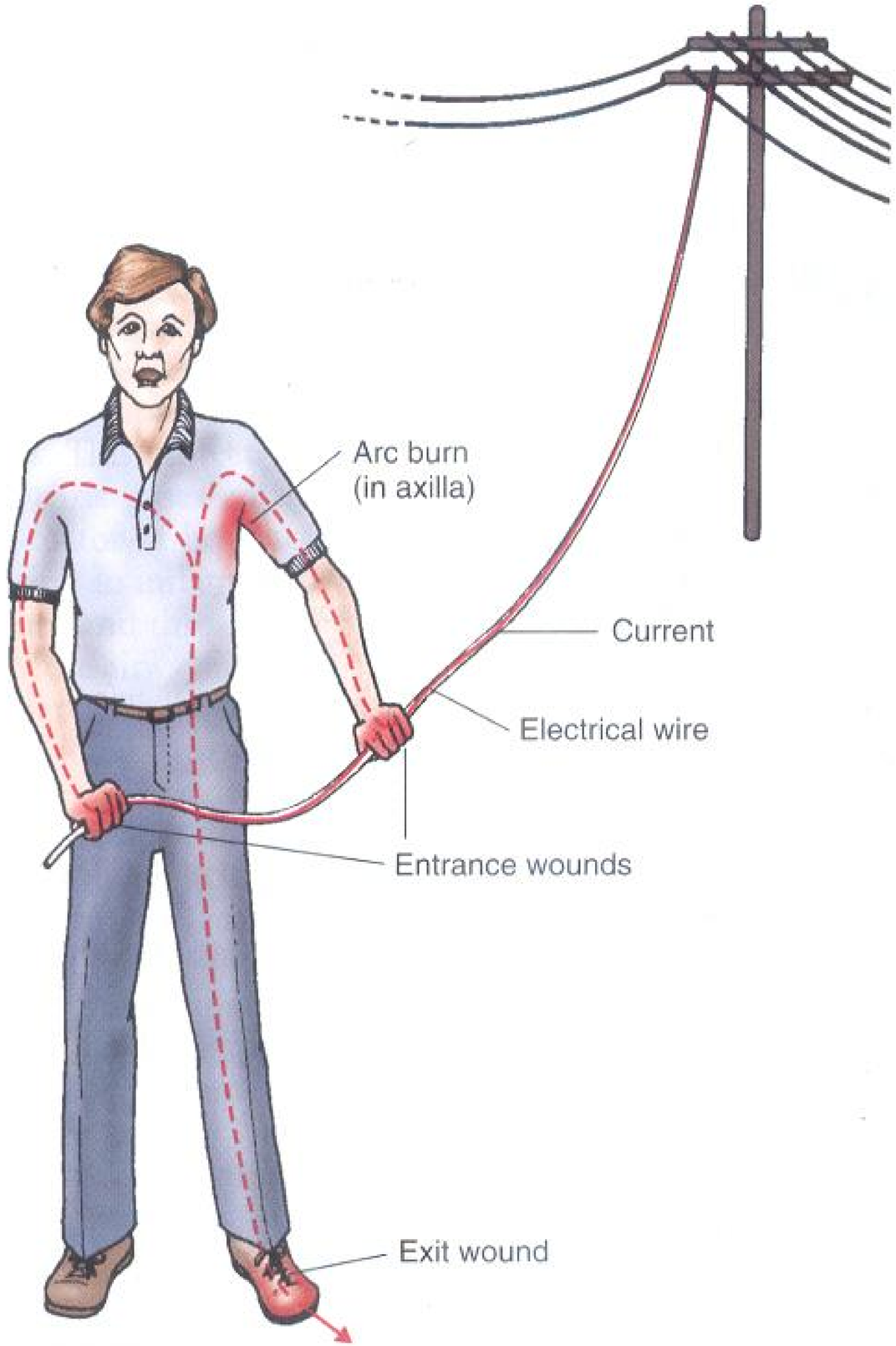


Figure 71-9 ■ The mechanism of electrical injury: Currents passing through the body follow the path of least resistance to the ground.

"Burn Injury"

HEAT → primary destructive factor

- ↳ Thermal burn (skin)
- ↳ Electrical burn (deep internal damage)

CHON denature

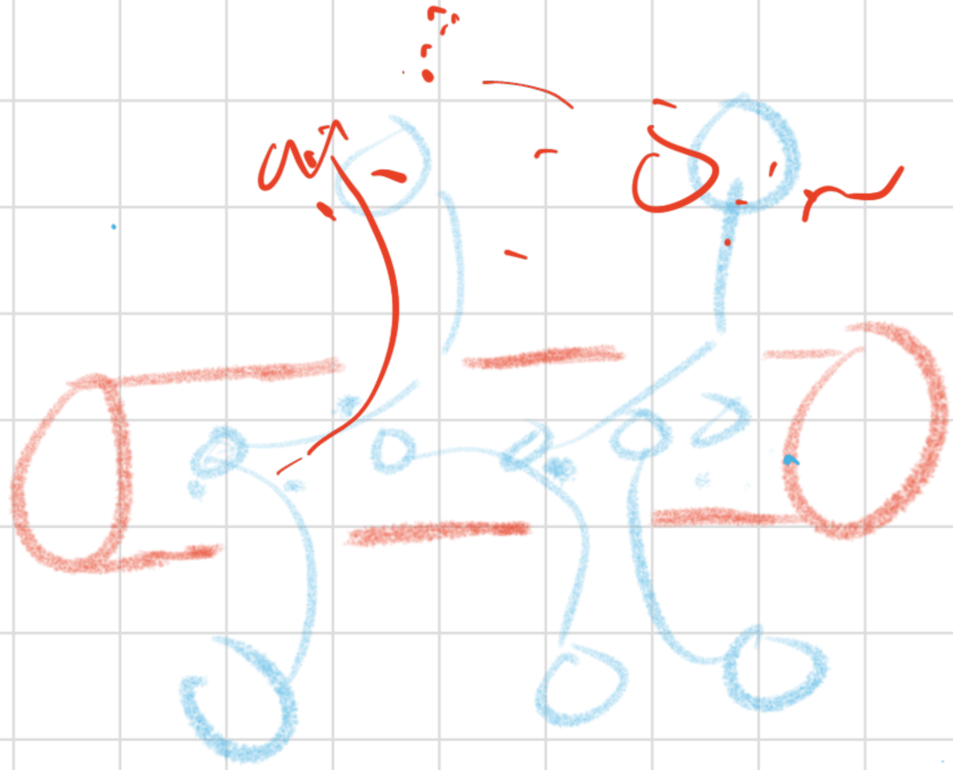
↓ spread into 3 zones (Jackson's Zone)

1. Zone of coagulation - center of injury (irreversibly dead / Eschar) Pinaka damage
2. Zone of stasis - surrounding the midde area (↓ Blood flow / capillary leakage)
3. Zone of hyperemia - outermost (↑ Blood flow (+) redness)

Domage cells ↓ ✓ SAVE

Burn Injury

* SYSTEMIC RESPONSES



① Increase Capillary Permeability

⊕ fluid shifting

↳ plasma, $\bar{e}$, cHon leakage

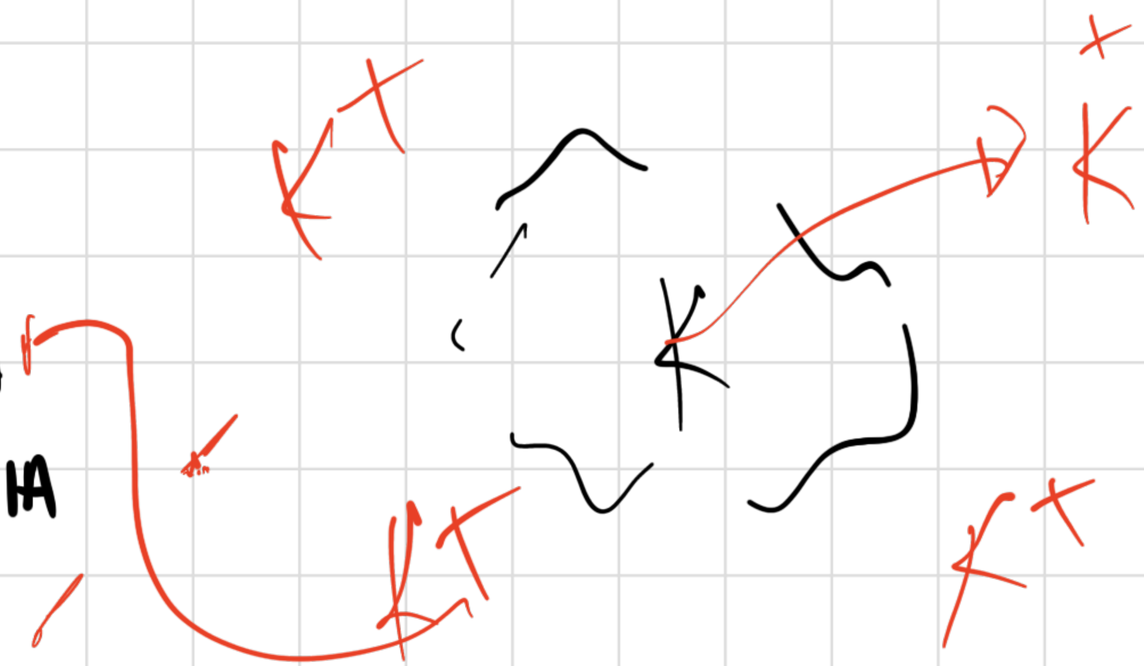
Result : ↓ B.V. → ⊕ hypotension = BURN SHOCK !!

⊕ Edema

② Electrolyte imbalance

- 1st 24 hrs : HYPERKALEMIA
- After 24hrs : HYPOKALEMIA

⊕ HYPONATREMIA



SYSTEMIC RESPONSE:

3. Cardiovascular Changes

↓ C.O. ⊕ vasoconstriction
♡ tachycardia
cold extremities

4. changes

* Upper Respi ⊕ heat → ⊕ swelling → airway obstruction
* Lower Respi ⊕ toxic gases → ⊕ inflammation → O2 sat ↓ → ARDS
* Carbon monoxide Poisoning
↳ to admin. O2

5. IMMUNE SYSTEM < immune cells
↑ risk for infection

6. HYPERMETABOLISM
→ E" mode !!!

↑ HR
↑ RR
↑ metabolism — DIET : ↑ CHON, ↑ calorie

PATHOPHYSIOLOGY

↓ Fluid in Blood Vessels

↓ Blood Volume → Body will compensate

↓

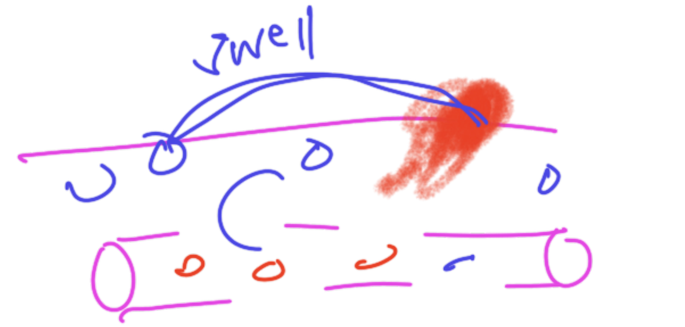
ADH & Aldosterone (save & retain fluid)

Serious burns cause various neuro-endocrine changes within the 1st 24hr

Stress response

- **ACTH (Adrenocorticotropic Hormone) & ADH** (released in response to hypovolemia)
  - **Mineralocorticoid (aldosterone) = Na^+ retention, peripheral edema, oliguria**
  - **Glucocorticoids = causes hyperglycemia**

PATHOPHYSIOLOGY



Intravascular fluid deficit:

- After a burn, fluid from the body moves toward the burned area = edema at the burn site
- Fluid lost (water vapor & seepage)

Burn → fluid leaks out + fluid evaporates → less fluid inside blood vessels = HYPOVOLEMIA

BP SHOCK

Blood vessel → 0°0 → BURN INJURY

SWELLING & EDEMA

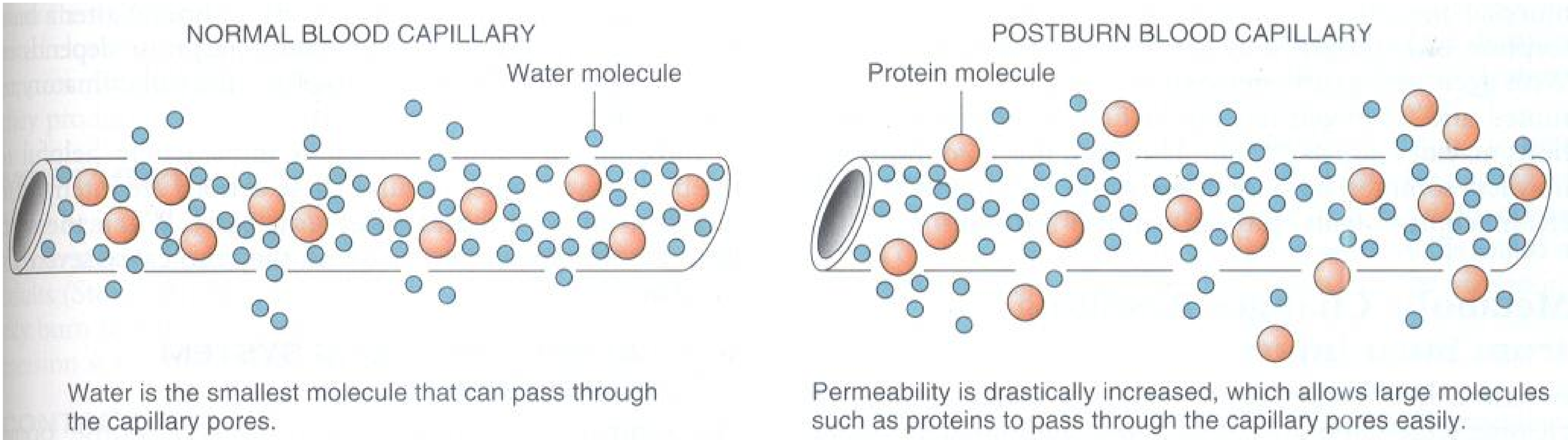


Figure 71-7 ■ The capillary response to burn injury (early phase). This response is also known as "capillary leak syndrome."

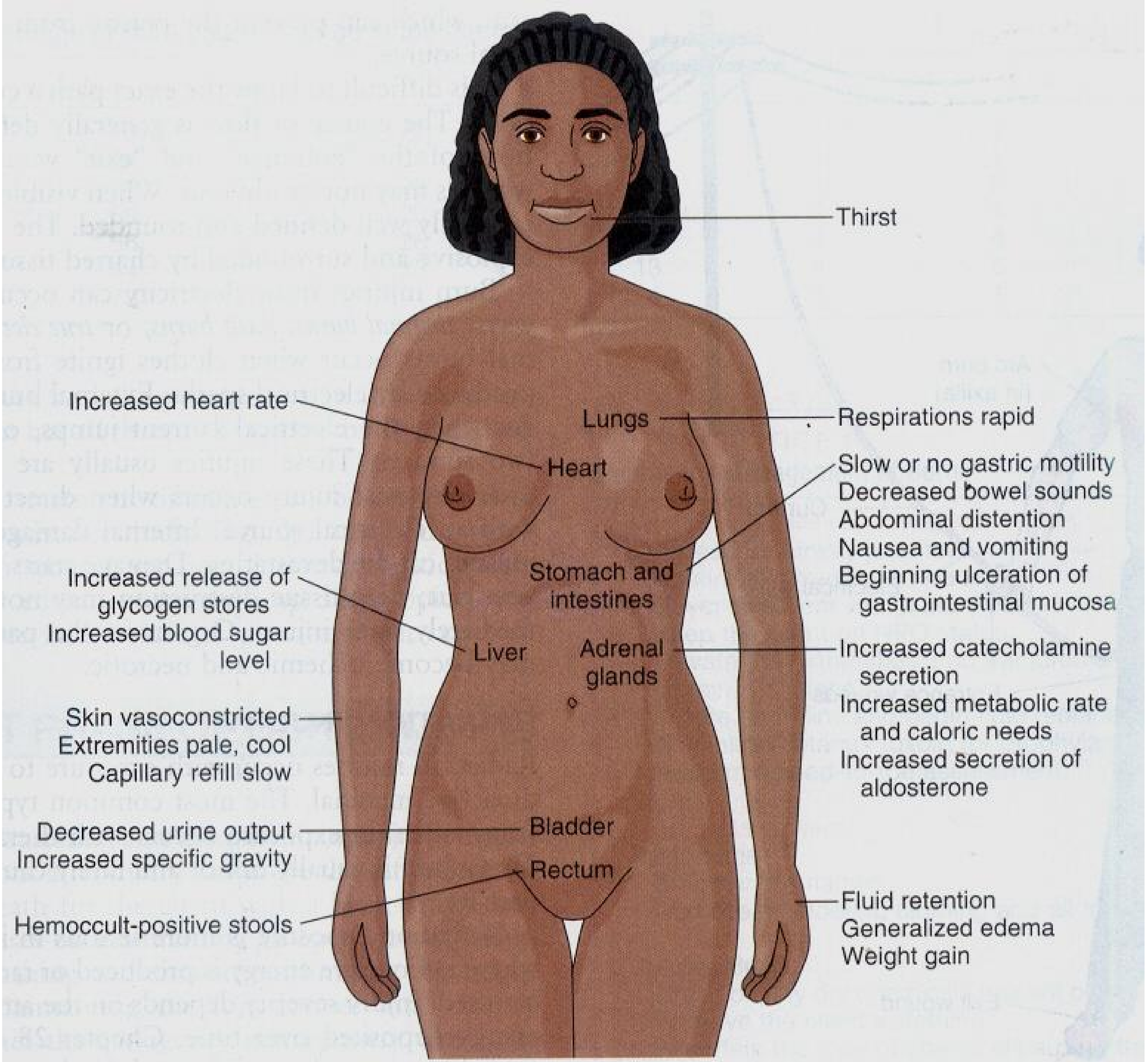


Figure 71-8 ■ The physiologic actions of the sympathetic nervous system compensatory responses to burn injury (early phase).

Risk for Mortality: 90%

- >60y/o
- >40% of TBSA
- presence of inhalation injury

CLASSIFICATION:

1. According to DEPTH
2. According to EXTENT

DEPTH OF BURN INJURY

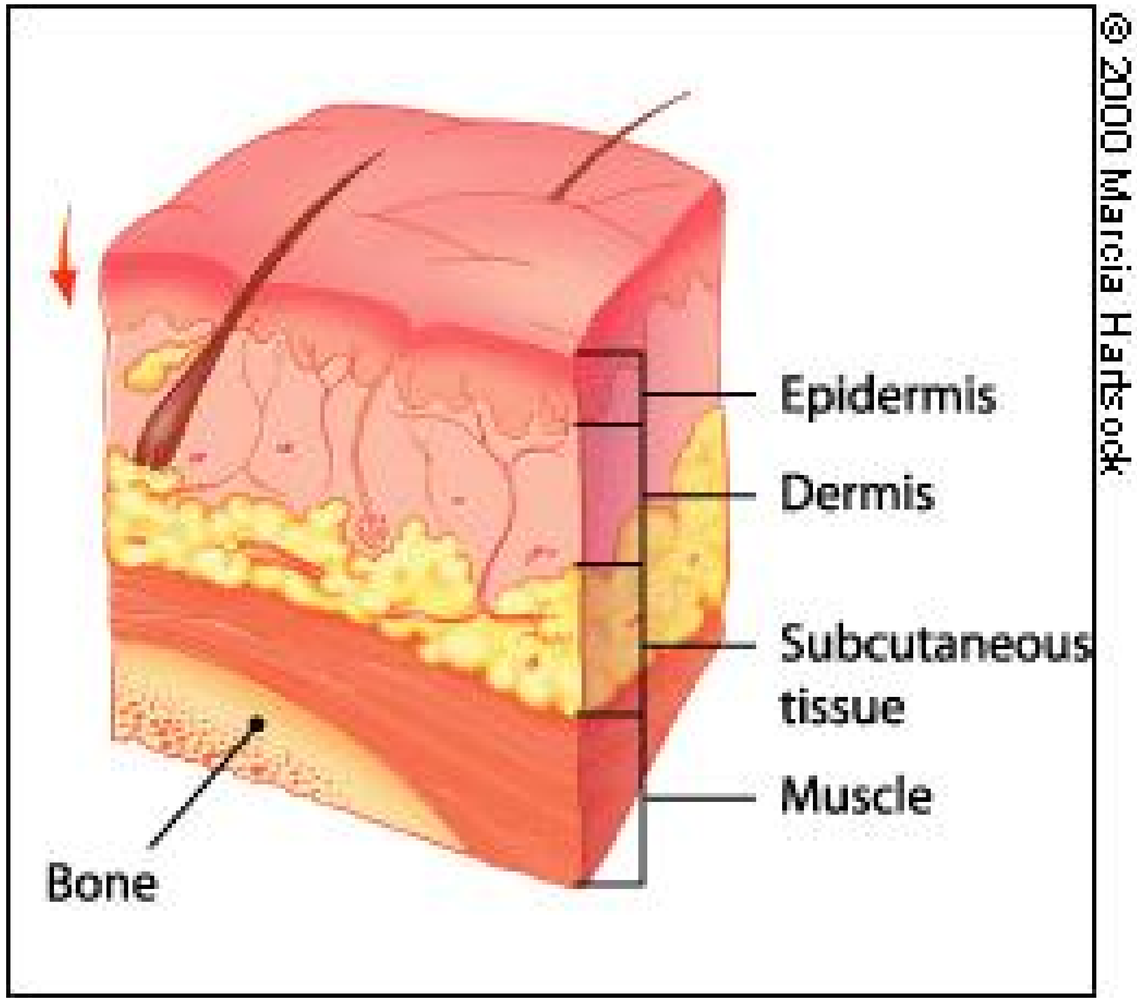
TABLE 71-1 Classification of Burn Depth

Characteristic	Superficial	Partial-Thickness Superficial	Deep Partial-Thickness	Full-Thickness	Deep Full-Thickness
Color	Pink to red	Pink to red	Red to white	Black, brown, yellow, white, red	Black
Edema	Mild	Mild to moderate	Moderate	Severe	Absent
Pain	Yes	Yes	Yes	Yes and no	Absent
Blisters	No	Yes	Rare	No	No
Eschar	No	No	Yes, soft and dry	Yes, hard and inelastic	Yes, hard and inelastic
Healing time	3-5 days	~2 wk	2-6 wk	Weeks to months	Weeks to months
Grafts required	No	No	Can be used if healing is prolonged	Yes	Yes
Example	Sunburn, flash burns	Scalds, flames, brief contact with hot objects	Scalds; flames; prolonged contact with hot objects, tar, grease, chemicals	Scalds; flames; prolonged contact with hot objects, tar, grease chemicals, electricity	Flames, electricity, grease, tar, chemicals

DEPTH OF BURN INJURY

Superficial-thickness wounds

- epidermis is the only part injured;
- desquamation occurs for 2-3 days after the burn & heals in 3-5 days without a scar or complications
  - e.g., sunburn, short (flash) exposure to a high intensity heat

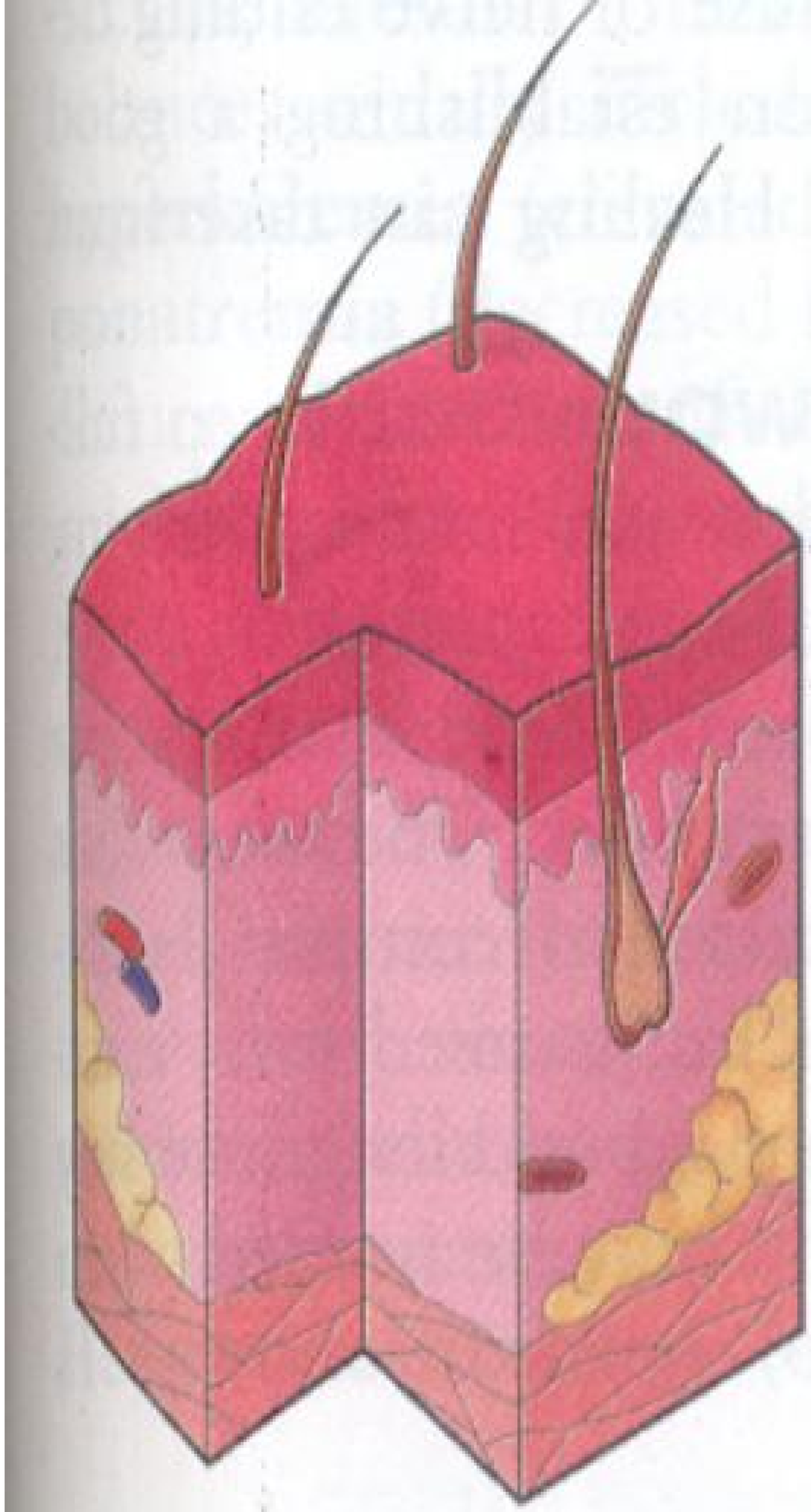


Superficial burns on the trunk and right arm of a young child. Typically, these are red burns that blanch with pressure.

DEPTH OF BURN INJURY

Partial-thickness wound

- entire epidermis & varying depths of the dermis
- 2 types:
  - Superficial partial thickness
  - Deep partial thickness



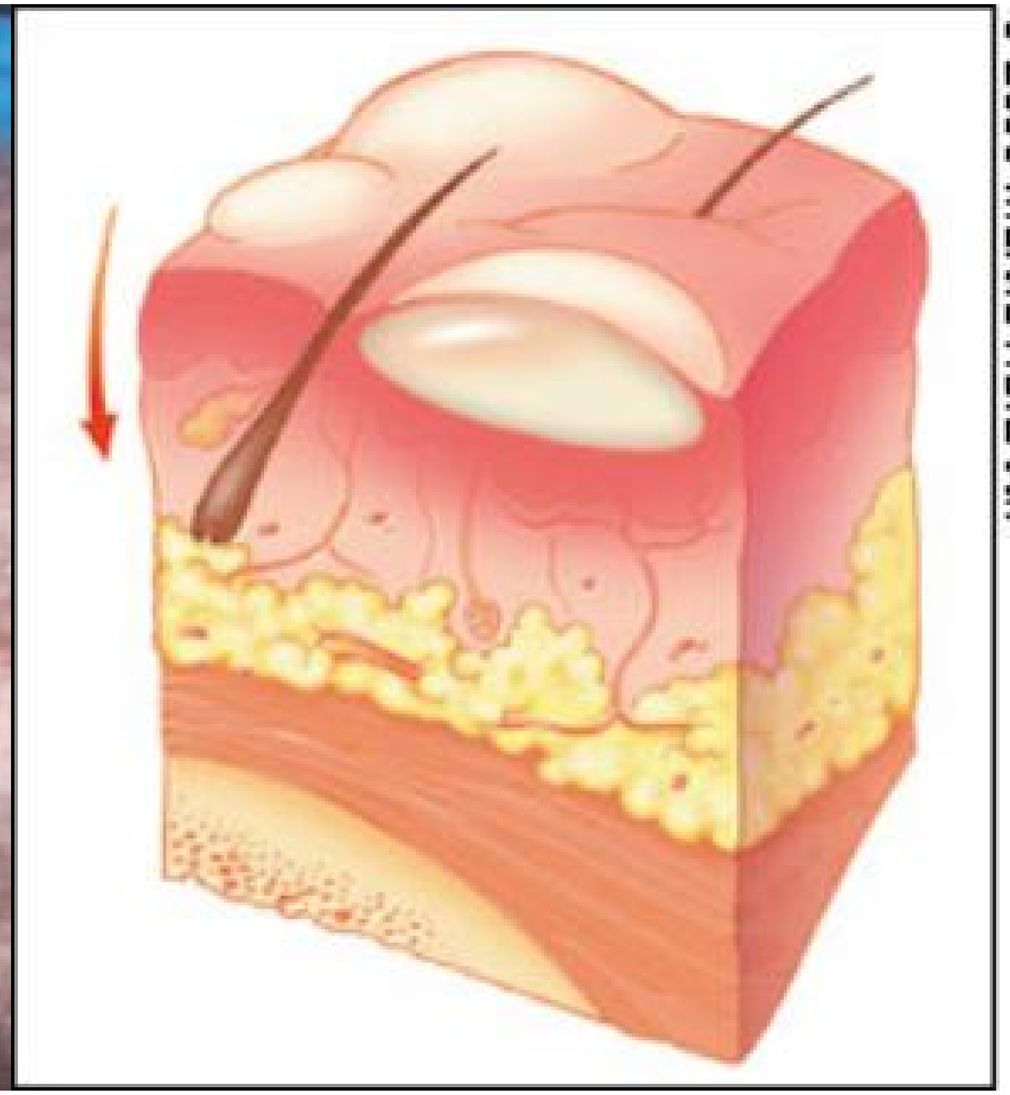
Superficial burns damage only the top layer of the skin—the epidermis. Healing occurs in 3-6 days.

DEPTH OF BURN INJURY

Superficial partial-thickness wound

- There is involvement of the **upper 3rd of the dermis** leaving a good blood supply; wounds are **red, moist** & blanch (whiten) when pressure is applied
- **Blister formation** (leakage of large amount of plasma from the injured small vessels lifting off the destroyed epidermis)
- **Intense pain** due to exposed nerve endings especially when stimulated by touch & temperature changes
- with standard care, heals in 10-21 days with no scar, but some minor pigment changes may occur

Figure 71-3 ■ The typical appearance of superficial partial-thickness burn injury.



Superficial partial-thickness burn on a man's right knee. Blistering wounds that blanch with pressure are characteristic of superficial partial-thickness burns. These wounds are also typically moist and weeping.

DEPTH OF BURN INJURY

Deep partial-thickness wound

- wounds that extend **deeper into the skin**, **dermis** and fewer healthy cells remain; wounds are **red & dry** (because fewer BV are patent) with white areas in deeper parts
- due to ischemia, hypoxia & even infection it can progress to full-thickness wounds
- **No Blister** formation because dead tissue layer is so thick & sticks to underlying viable dermis that it does not readily lift off the surface
- **Lesser degree of pain** (more nerve endings have been destroyed), moderate edema is present
- generally heals in 3-6 weeks with scar formation

Figure 71-4 ■ The typical appearance of a deep partial-thickness burn injury.

DEPTH OF BURN INJURY

Full-thickness wound

- **destruction of the entire epidermis & dermis**, leaving no residual epidermal cells to repopulate; wound may be waxy, white, deep red, yellow, brown or black, **hard, dry, leathery eschar** (burn crust) [*eschar is a dead tissue; it must slough off or be removed from the burn wound before healing can occur]*
- **avascular, no sensation,** healing can take from weeks to months depending on the establishment of a good blood supply to the injured areas

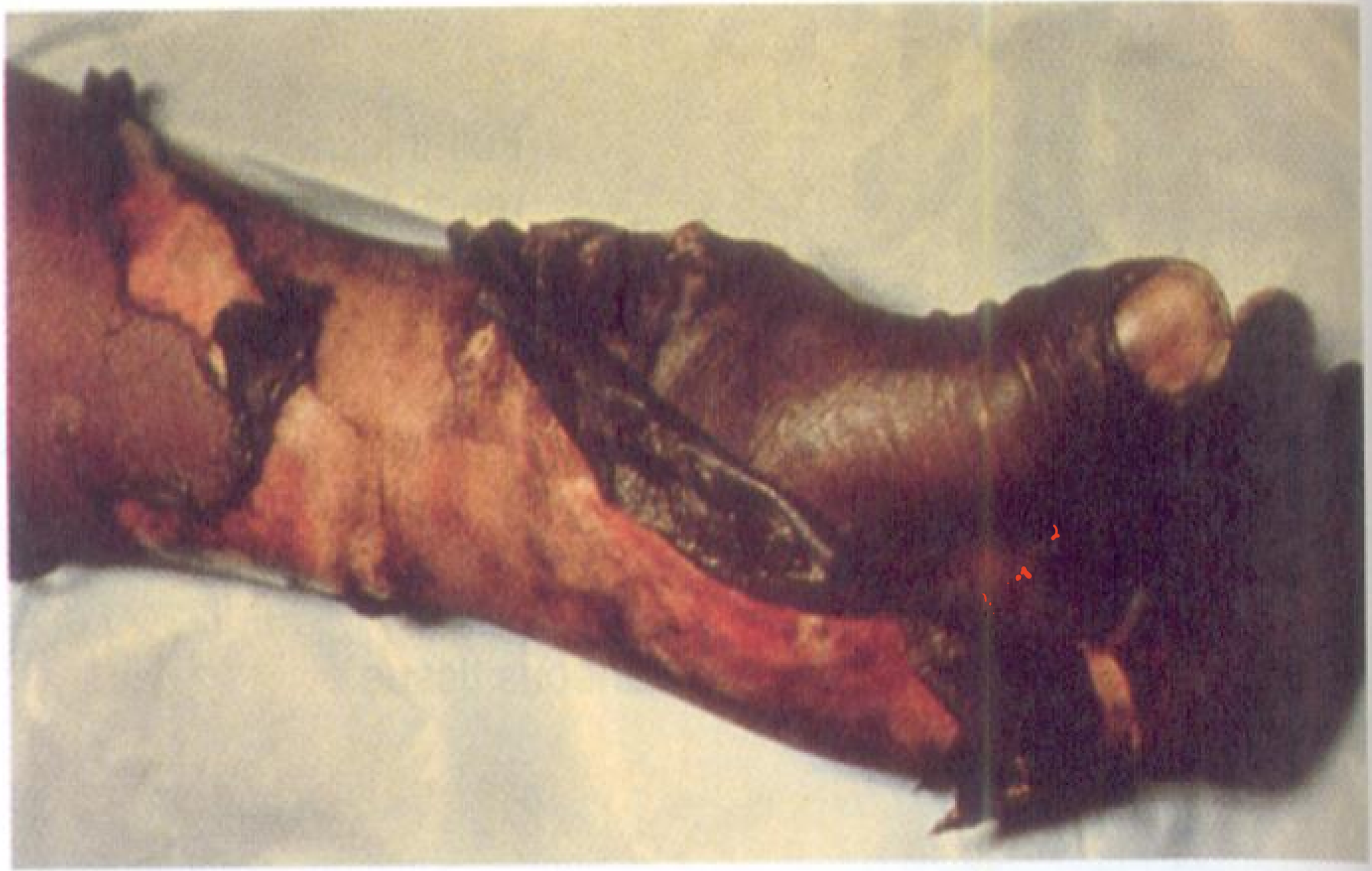
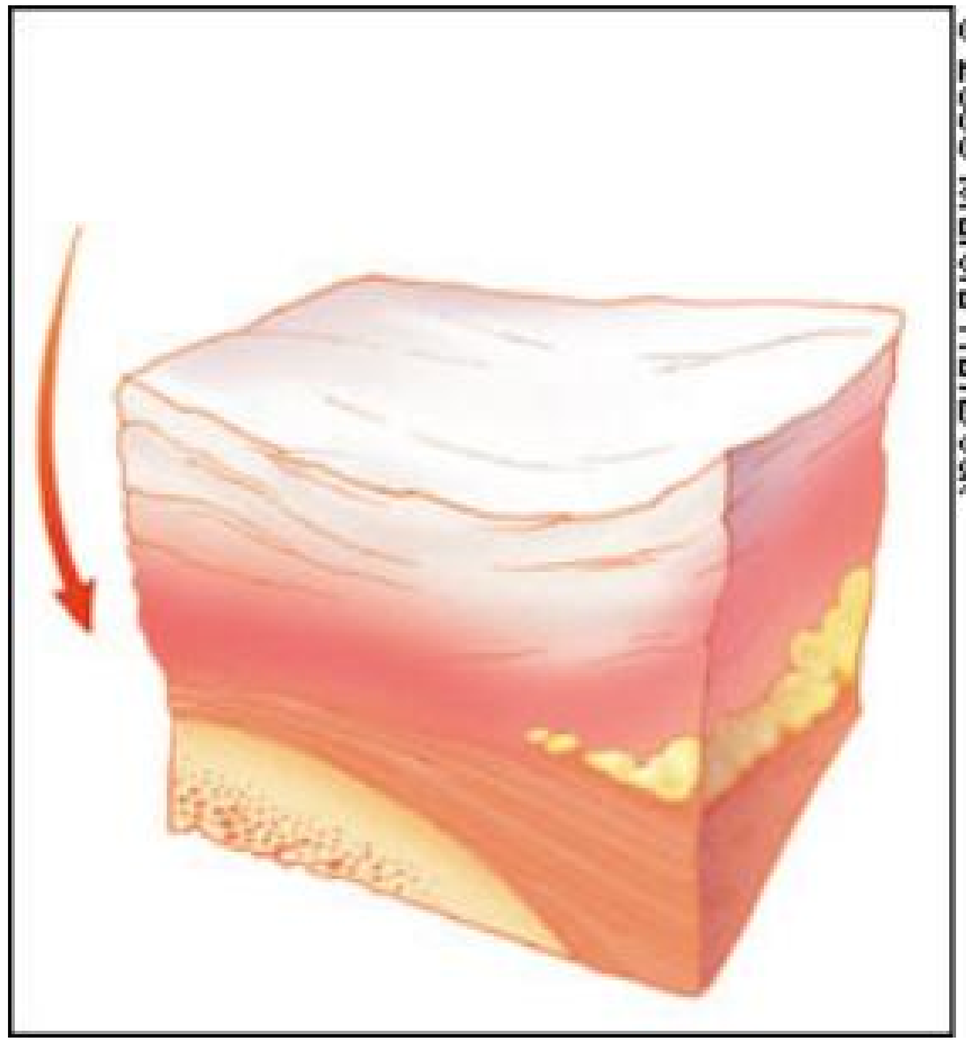


Figure 71-5 ■ The typical appearance of a full-thickness burn injury.



Full-thickness burn on a woman's left flank. Burn areas of this type are characteristically insensate and waxy white or leathery gray in color.

DEPTH OF BURN INJURY

Deep full-thickness wound

- **wounds that extend beyond the skin into underlying fascia & tissues**
- **damages the muscle, bone, and tendons & leave them exposed**
- **wound is blackened and depressed, and sensation is completely absent**

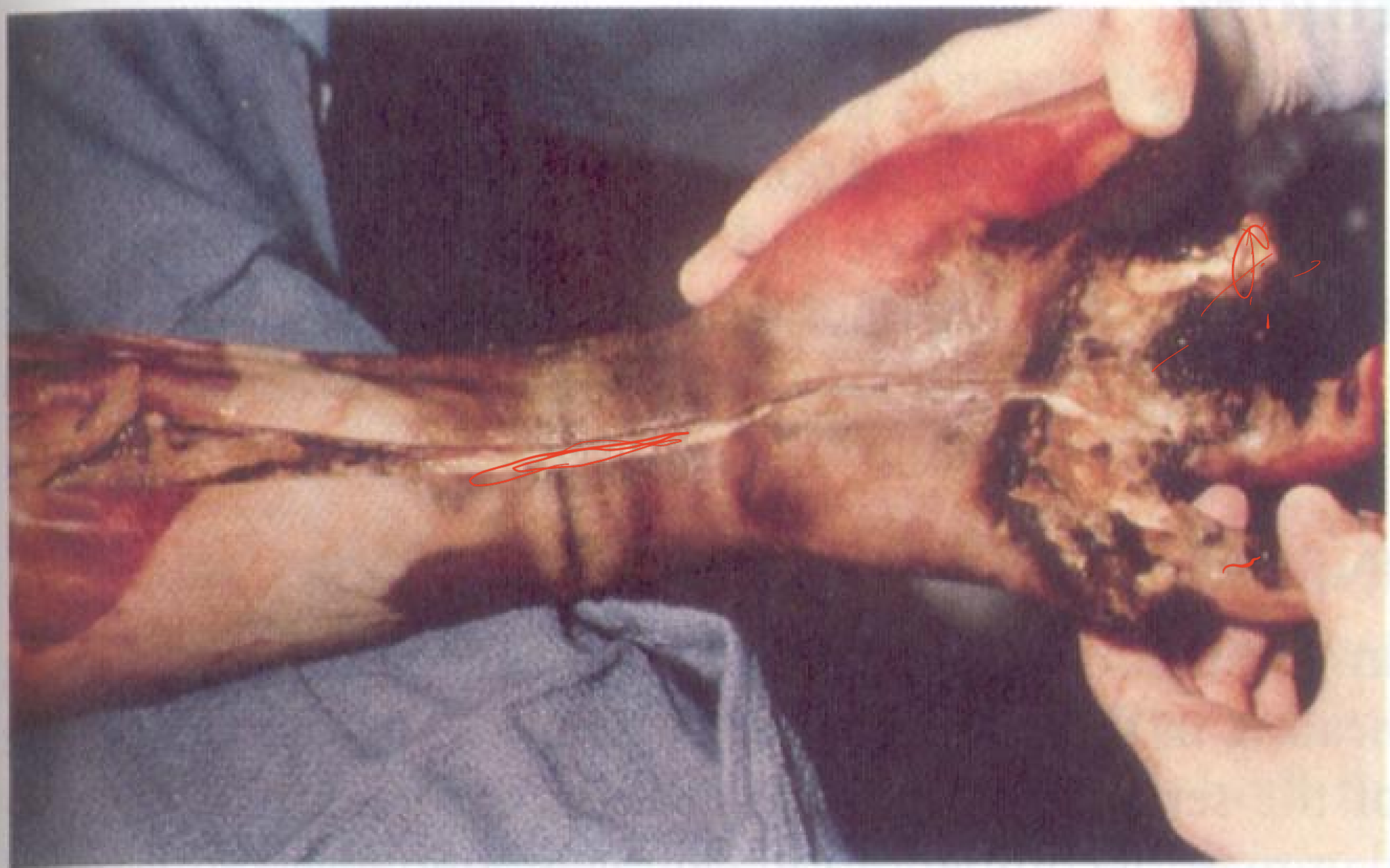


Figure 71-6 ■ The typical appearance of a deep full-thickness burn injury.

EXTENT OF BURN INJURY

How big an area of the body is involved

% of burn injury

- **Rule of Nines**
- **Special charts & graph (Berkow Method)**
- **Palm method**

EXTENT OF BURN INJURY

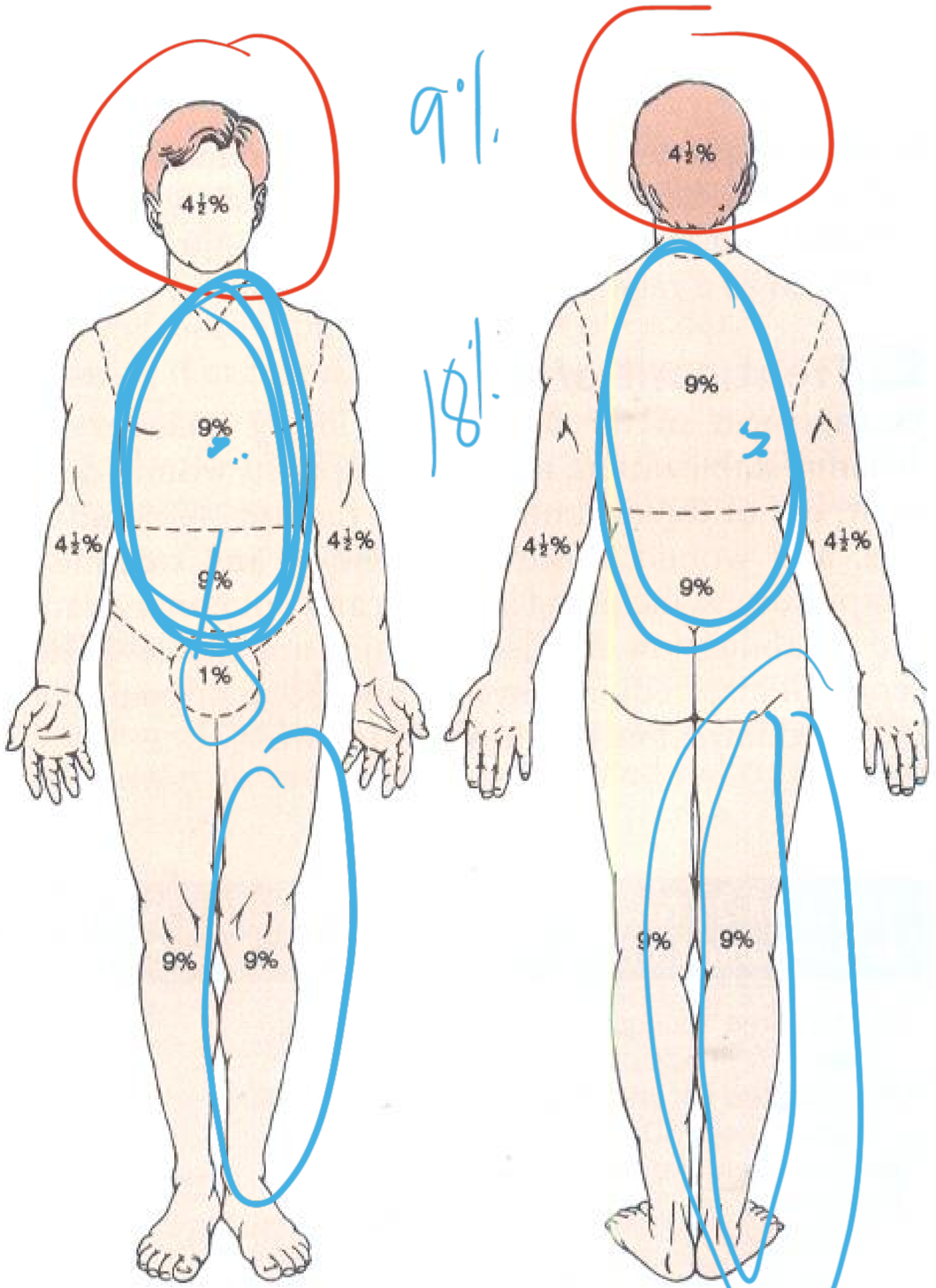


FIGURE 34-4 Rule of nines for calculating total burn surface area (TBSA).

- **Quick initial method**
- **Disadvantage: overestimation**

TBSA : Total Body Surface Area

EXTENT OF BURN INJURY

most practical method employed in patients with scattered burns

the size of the palm of the PATIENT (not the examiner's) is approximately 1% of the TBSA

EXTENT OF BURN INJURY

MINOR BURN

- <15% of TBSA
- Local inflammation
- (+) blister

EXTENT OF BURN INJURY

MODERATE BURN

- 15-25% of TBSA
- Systemic inflammation
- Massive tissue trauma

EXTENT OF BURN INJURY

MAJOR BURN

- **>25% of TBSA**
- **Inhalation injury**
- **Electrical burn, immunocompromised**
- **Affectation of special areas: Face, head, feet, eye, joints and perineum**

EXTENT OF BURN INJURY

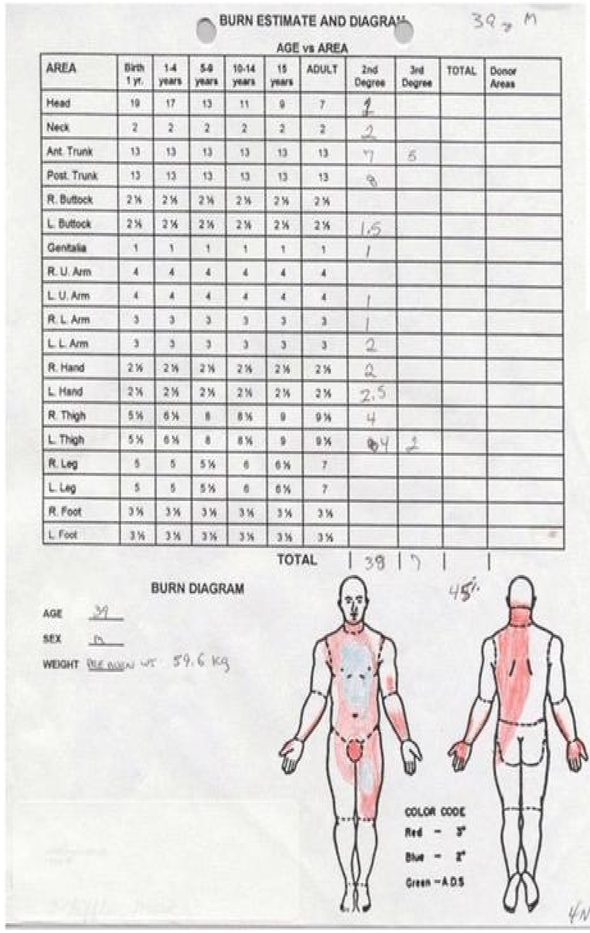
Note:

- **If Full thickness burn is 2% and not on the special area (face, feet, etc.) it is MINOR BURN**
- **If Full thickness burn is <10% and not on the special area it is MINOR BURN**

EXTENT OF BURN INJURY

LAND AND BROWDER METHOD → preferred method for pediatric patients

- most accurate
- A method for estimating the extent of burns that allows for the varying proportion of body surface in persons of different ages.



The Lund Browder Chart is used to accurately map the burn wounds. Accurate estimation of the TBSA involved in the burn injury is important to calculate the fluid resuscitation and to support triage decisions. Red is used for full thickness burns and blue for partial thickness burns.

ASSESSMENT FINDINGS:

Skin color: light pink to black (depth)

Edema or blistering

Pain in all areas (except full thickness burn)

Hypotension, tachycardia, oliguria or anuria (hypovolemic shock)

Breathing may be compromised (inhalation injury)

- Sore throat, singed nasal hairs, eyebrows, eyelashes, hoarseness, carbon in sputum, shortness of breath, stridor

Entrance & exit wounds (electrical burns)

TABLE 71-4 Factors Determining Inhalation Injury or Airway Obstruction

- Individuals who were injured in a closed space
- Clients with extensive burns or with burns of the face
- Intra-oral charcoal, especially on teeth and gums
- Clients who were unconscious at the time of injury
- Clients with singed hairs, nasal hairs, eyelids, or eyelashes
- Clients who are coughing up carbonaceous sputum
- Changes in voice such as hoarseness or brassy cough
- Use of accessory muscles or stridor
- Poor oxygenation or ventilation
- Edema, erythema, and ulceration of airway mucosa
- Wheezing, bronchospasm

MEDICAL MANAGEMENT

Outcome depends on the initial 1st aid provided and the subsequent treatment in the hospital or burn center

- Life threatening:
  - inhalation injury
  - hypovolemic shock
  - infection

MEDICAL MANAGEMENT

Initial 1st Aid

- Prevent further injury (at the scene of the fire)
- Observed closely for respiratory difficulty (inhalation injury) during transport
  - O_2 is administered, IV fluid

MEDICAL MANAGEMENT

Acute Care

Quick assessment (extent of burn injury, additional trauma – fractures, head injuries, lacerations)

Maintain adequate ventilation

- Bronchoscopy (assess internal airway)
- Warmed humidified O2
- ET should be available for insertion
- Eschar (a hard leathery crust of dehydrated skin) in the neck area = tracheostomy

Endotracheal tube

MEDICAL MANAGEMENT

Acute Care

- **Mechanical ventilation**
- **Hyperbaric O_2 treatment (100% O_2 3x greater than atmospheric pressure in a specifically designed chamber)**

Initiating fluid resuscitation

- **Goal:**
  - **Restore IVF, Prevention of tissue & cellular ischemia, maintenance of vital organ function**
  - **UO: 0.3-0.5 ml/kg/hr = SUCCESFUL!!!**
- **Fluid-replacement regimen is calculated from the time the burn injury occurred**

MEDICAL MANAGEMENT

Lactated Ringers: alkalinizing sol'n; Na^+, Cl^-, K^+, Ca^{++} plus Lactate w/c is converted to HCO^-_3 in the Liver (met. acidosis)

TABLE 71-6 Common Fluid Resuscitation Formulas for the First 24 Hours After a Burn Injury

	Formula	Solution	Rate of Administration
Modified Brooke	0.5 mL/kg/% TBSA burn 1.5 mL/kg/% TBSA burn	Protenate or 5% albumin in isotonic saline Lactated Ringer's without dextrose	½ given in first 8 hr ½ given in next 16 hr
Parkland (Baxter)	4 mL/kg/% TBSA burn for 24-hr period	Crystalloid only (lactated Ringer's)	½ given in first 8 hr ½ given in next 16 hr
Monafo		Crystalloid (hypertonic saline: sodium = 250 mEq/L)	Adjust to maintain urine output of 30 mL/hr
Modified Parkland	4 mL/kg/% TBSA burn + 15 mL/m² of TBSA	Crystalloid only (lactated Ringer's)	½ given in first 8 hr ½ given in next 16 hr
Winski	2 mL/kg/% burn + maintenance fluid	Crystalloid only (lactated Ringer's)	½ given in first 8 hr ½ given in next 16 hr

Isotonic

it balances Na, Cl, K^+, Ca & it contains lactate

LACTIC ACIDOSIS

PARKLAND (BAXTER) FORMULA :

TBSA % x kg x 4mL

= 24hr Fluid Resuscitation !!

1st 8hrs = 50 %

next 16 hrs = 50 %

Rate of Administration!

* IVF of choice for Burn injury = LACTATED RINGER !!

fights acidosis

contains lactate

HCO_3

Burn Shock = poor tissue perfusion

LACTIC ACIDOSIS build up

metabolic

↓ HCO_3

↓ pH

Practice #1 ☺

30% × 70 × 4ml = 8,400 ml → 1st 24hrs

1st 8hr. 4,200 mL = 525ml/hr

A 70-kg adult has 30% TBSA burn. The burn occured 2 hours ago. Using the Parkland Formula, how much of the calculated fluid should be given during the first 8 hrs after the burn?

PRACTICE #2 :

18 + 9 = 27%

27% x 4ml x 70kg = 7,560 mL

A 70-kg adult has burns involving the entire anterior trunk and the entire right arm.

- Using the adult Rule OF Nines, what TBSA should be used for fluid resuscitation?
- How much crystalloid fluid should be given on the first 24 hours after the burn?

8hrs = 3,780ml = rate

472.5 ml/hr

Minor → < 15% TBSA

Moderate → 15 - 25% TBSA

Major Burn → > 27% TBSA / any special areas affected

- inhalation
- electrical burn

MEDICAL MANAGEMENT

Chart 57-5 **Guidelines and Formulas for Fluid Replacement in Burn Patients**

Consensus Formula

Lactated Ringer's solution (or other balanced saline solution): 2–4 mL × kg body weight × % total body surface area (TBSA) burned. Half to be given in first 8 hours; remaining half to be given over next 16 hours.

Evans Formula

1. Colloids: 1 mL × kg body weight × % TBSA burned
2. Electrolytes (saline): 1 mL × body weight × % TBSA burned
3. Glucose (5% in water): 2,000 mL for insensible loss

Day 1: Half to be given in first 8 hours; remaining half over next 16 hours
Day 2: Half of previous day's colloids and electrolytes; all of insensible fluid replacement
Maximum of 10,000 mL over 24 hours. Second- and third-degree (partial- and full-thickness) burns exceeding 50% TBSA are calculated on the basis of 50% TBSA.

Brooke Army Formula

1. Colloids: 0.5 mL × kg body weight × % TBSA burned
2. Electrolytes (lactated Ringer's solution): 1.5 mL × kg body weight × % TBSA burned
3. Glucose (5% in water): 2,000 mL for insensible loss

Day 1: Half to be given in first 8 hours; remaining half over next 16 hours
Day 2: Half of colloids; half of electrolytes; all of insensible fluid replacement.
Second- and third-degree (partial- and full-thickness) burns exceeding 50% TBSA are calculated on the basis of 50% TBSA.

Parkland/Baxter Formula

Lactated Ringer's solution: 4 mL × kg body weight × % TBSA burned
Day 1: Half to be given in first 8 hours; half to be given over next 16 hours
Day 2: Varies. Colloid is added.

Hypertonic Saline Solution

Concentrated solutions of sodium chloride (NaCl) and lactate with concentration of 250–300 mEq of sodium per liter, administered at a rate sufficient to maintain a desired volume of urinary output. Do not increase the infusion rate during the first 8 postburn hours. Serum sodium levels must be monitored closely. Goal: Increase serum sodium level and osmolality to reduce edema and prevent pulmonary complications.

MEDICAL MANAGEMENT

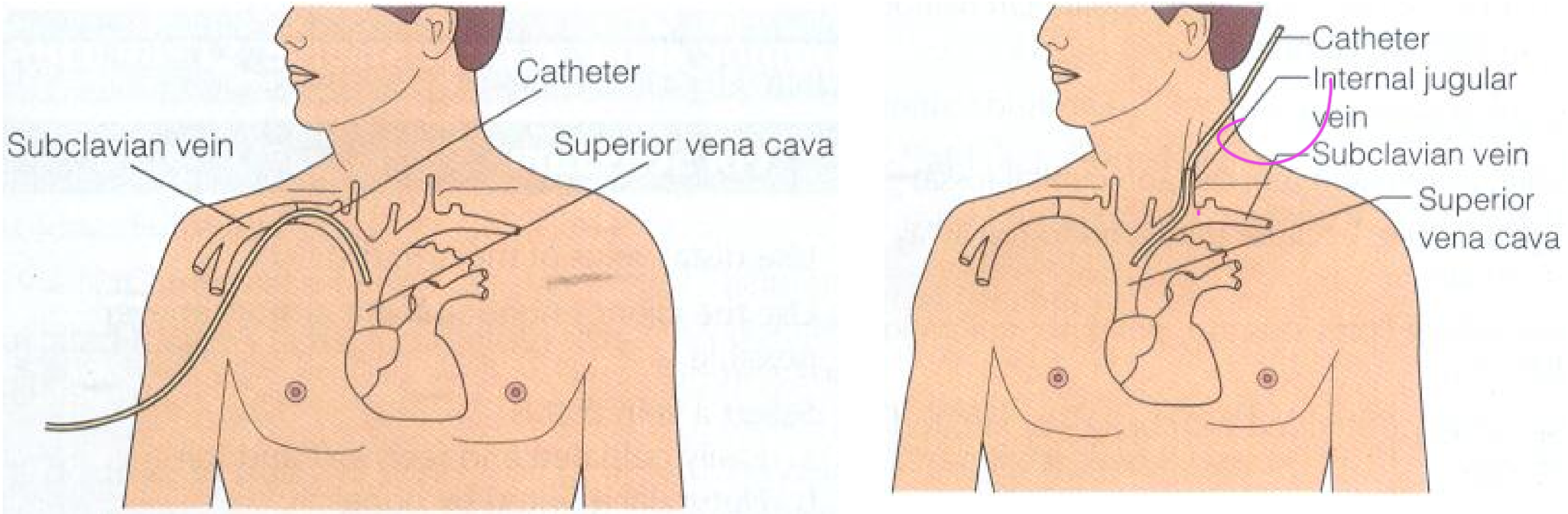


Figure 48–14 Central venous lines with *A*, subclavian vein insertion, and *B*, left jugular insertion.

management of extensive burns may require placement of a large-bore central venous catheter so that massive fluid loads can be given

peripheral lines are less useful because they become dislodge or fluid flow is cut off when massive peripheral edema compresses the IV catheter

MEDICAL MANAGEMENT

Pain

- Morphine is generally the DOC
- Severe: 50 mg/hr
- If respiratory depression occurs: naloxone (Narcan)

- Tetanus immunization is also administered

WOUND MANAGEMENT

Wear powder-free sterile gloves

Body hair around the perimeter of the burns is shaved

Blisters that have ruptured are removed with scissors

Clean the burned areas to remove debris

- **Open method**
    - **Wound is left uncovered**
- **Closed method**
    - **Wound is covered**

WOUND MANAGEMENT: OPEN METHOD (EXPOSURE METHOD)

Advantages

- Reduces labor-intensive care
- Causes less pain during wound care
- Facilitates inspection
- Decreases expense

Disadvantages

- Contributes to wound desiccation (dryness)
- Promotes loss of water and body heat
- Exposes wound to pathogens
- Contributes to pain during repositioning
- Compromises modesty

WOUND MANAGEMENT: CLOSED METHOD (EXPOSURE METHOD)

Advantages

Maintains moist wound

Promotes maintenance of body temperature

Decreases cross contamination of wound

Provides wound debridement during dressing removal

Keeps skin fold separated

Reduces pain during position changes

Disadvantages

Requires more time

Adds to expense

Enhances growth of pathogens beneath dressings

Interferes with wound assessment

Causes more blood loss with removal

Can interfere with circulation if tightly applied

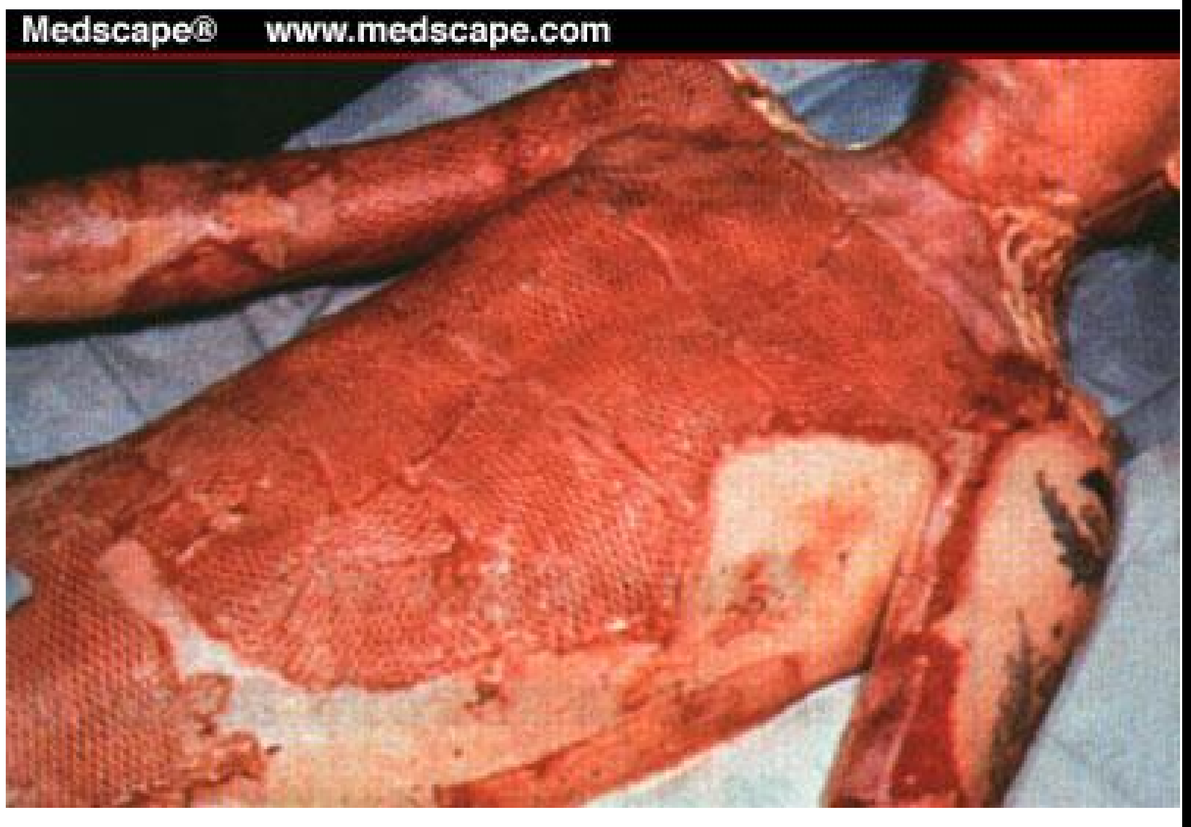
WOUND MANAGEMENT

Open method (exposure method)

- **Abandoned already (except in face & perineum)**

A

B



WOUND MANAGEMENT

Closed method – current preferred method

- **Covered first with non adherent & absorbent dressings (gauze impregnated w/ petroleum jelly or ointment-based antimicrobials)**
- **Occlusive or semi occlusive dressing made of polyvinyl, polyethylene, polyurethane & hydrocolloid materials as final dressing**

ANTIMICROBIAL THERAPY

Silver sulfadiazine (Silvadene) 1% ointment

Mafenide (Sulfamylon)

Silver nitrate ($AgNO_3$) 0.5% solution

Acticoat (contains a thin, soluble film coat of silver)

Povidone-iodine (Betadine)

Gentamicin (Garamycin) 0.1% cream

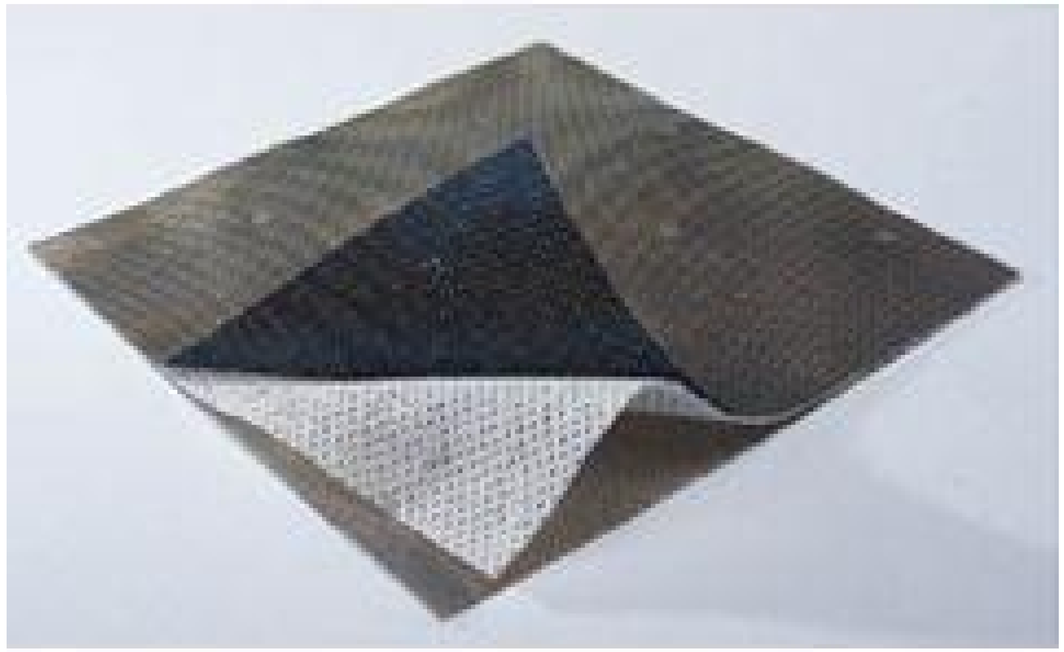
Nitrofurazone (Furacin)

Mupirocin (Bactroban)

Clotrimazole (Lotrimin)

Ciclopirox (Loprox)

ANTIMICROBIAL THERAPY



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SURGICAL MANAGEMENT

Additional treatment modalities to promote healing includes:

- Debridement
- Skin grafting
- Application of a skin substitute
- Application of cultured skin

SURGICAL MANAGEMENT

Debridement - Removal of necrotic tissue

Done in one of four ways:

- **Natural** (tissue sloughs away)
- **Mechanical** (tissue adheres to dressings or detached during cleansing)
- **Enzymatic** (application of topical enzymes)
- **Surgical** (use of forceps & scissors)

SURGICAL MANAGEMENT

Skin grafting

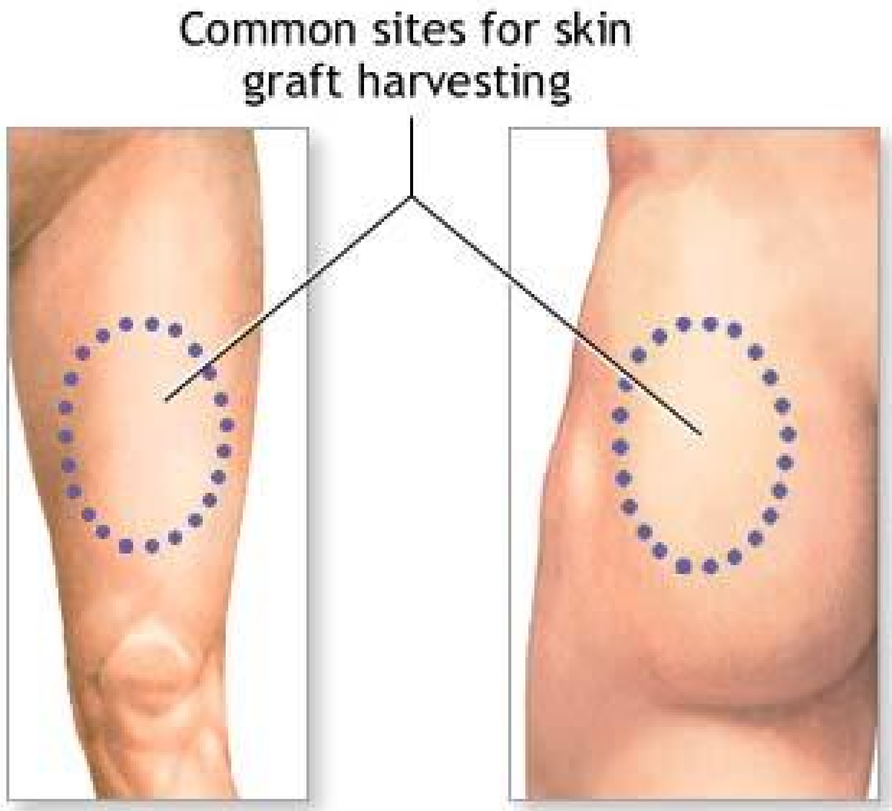
- **Necessary for deep partial-thickness & full-thickness burns**
- **Purpose:**
  - **Lessen the potential for infection**
  - **Minimize fluid loss by evaporation**
  - **Hasten recovery**
  - **Reduced scarring**
  - **Prevent loss of function**

SURGICAL MANAGEMENT

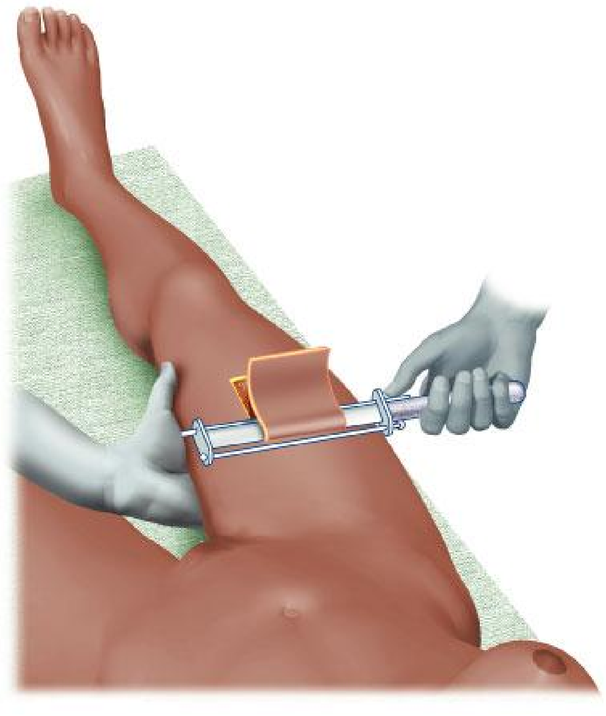
Sources for skin graft:

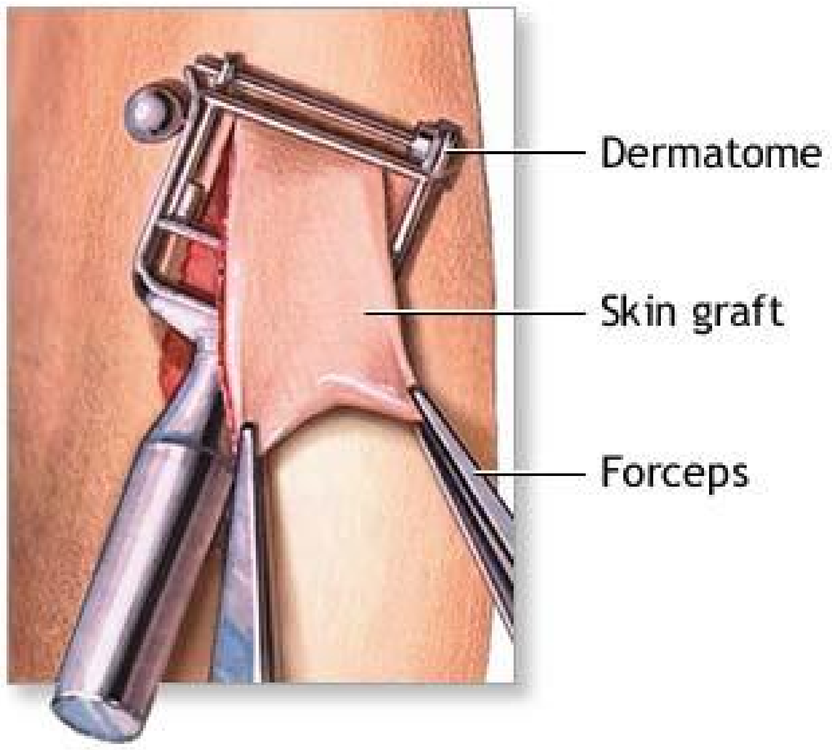
- **Autograft** (client's own skin – BEST method – No rejection)
- **Allograft or homograft** (from same specie eg. cadaver)
  - Temporarily covers large areas of tissue (slough away approx 1 week)
  - Short supply; it could be a source of other pathogen
- **Heterograft or xenograft** (from animals)
  - Temporary
  - Rejected in days to weeks & must be removed & replaced at that time

SURGICAL MANAGEMENT



A.D.A.M.





A.D.A.M.

SURGICAL MANAGEMENT

SURGICAL MANAGEME

Types of Autografts

Split-thickness graft

- Epidermis & a thin layer of dermis are harvested
- Cosmetic appearance is less than desirable, less elastic, hair does not grow from their surface

Full-thickness graft

- Epidermis, dermis & some subcutaneous tissue
- Comparable appearance to normal skin
- Tolerate more stress once they become permanently attached to the burn wound

SURGICAL MANAGEMENT

71-14 ■ Models wearing pressure garments. (C
sdorf-Jobst, Inc., Charlotte, NC.)

Smooth the grafted skin, reducing scarring & the potential for wound contractures

SURGICAL MANAGEMENT

Skin substitute

SURGICAL MANAGEMENT

Skin substitute

- **Biobrane (nylon silicone membrane coated with a protein derived from pig tissue)**

BioBrane i interacts with clotting fa e dressing to adhere bet

SURGICAL MANAGEMENT

PROCESS OF APPLICATION

Identify appropriate wound

Remove the sterile biobrane sheet from package

Cut to fit and apply under a moderate stretch,

Attached product to surrounding unburned skin with steri-strips

BIOBRANE REMOVAL

When healed biobrane turns whitish and dry in appearance Gently peel off then that wound with moisturizer If small area still open, treat with bacitracin or Neosporin (triple mix).

SURGICAL MANAGEMENT

Skin substitute

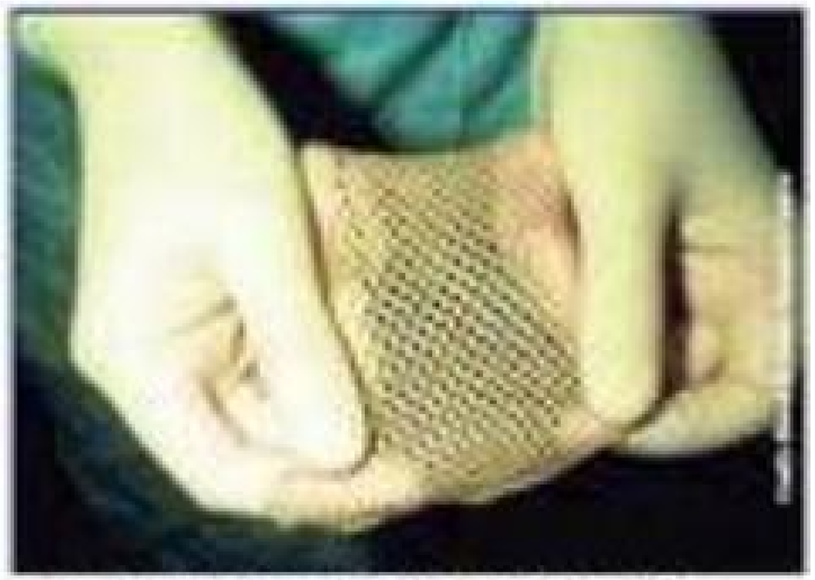
- **TranCyte (from cultured human fibroblasts from the dermis with a biosynthetic semipermeable membrane attached to nylon mesh)**

TransCyte is stored and sealed in a cassette with two pieces per cassette. Product is thawed just prior to use.

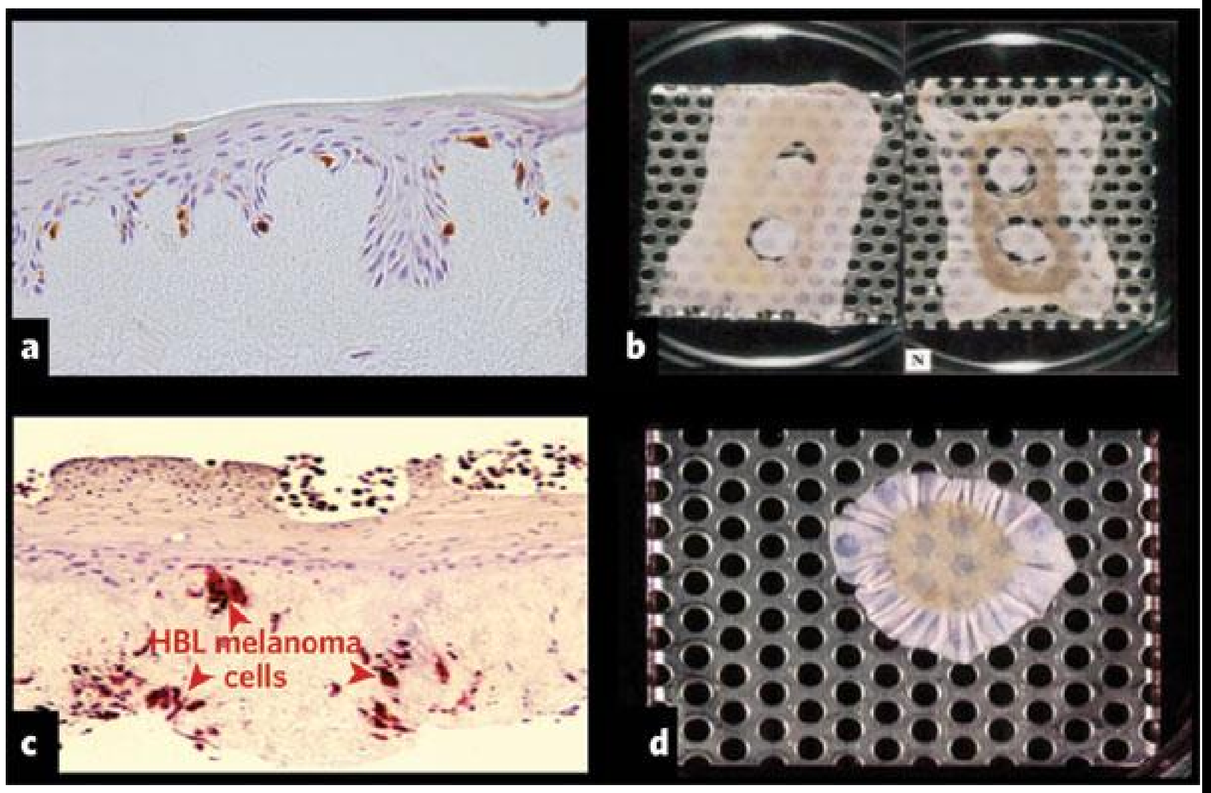
SURGICAL MANAGEMENT

Cultured Skin

- **Growing the client's own skin cells in a laboratory culture medium**
- **Postage stamp-sized skin entire body (3weeks)**
- **Disadvantage: pigmentation does not perfectly match the original skin**



A physician holds a section of meshed skin ready for grafting.



NURSING MANAGEMENT

Focus: assessing the wound & how the burn injury has affected the client's status

Calculates fluid-replacement requirements & infuses the prescribed volume according to agency's protocol

Quickly recognized & efficiently treats signs of shock

Administer prescribed analgesics

Wound care

Helps the client & family to cope with the change in body image

Health teaching (pressure garments, skin care, etc…)

THANK YOU!

PLEASE PREPARE FOR THE QUIZ!

GOOD LUCK!