BURNS

DR Ali Ameen Al-Bazaz
M.B.Ch.B, FICMS

Anatomy of Skin

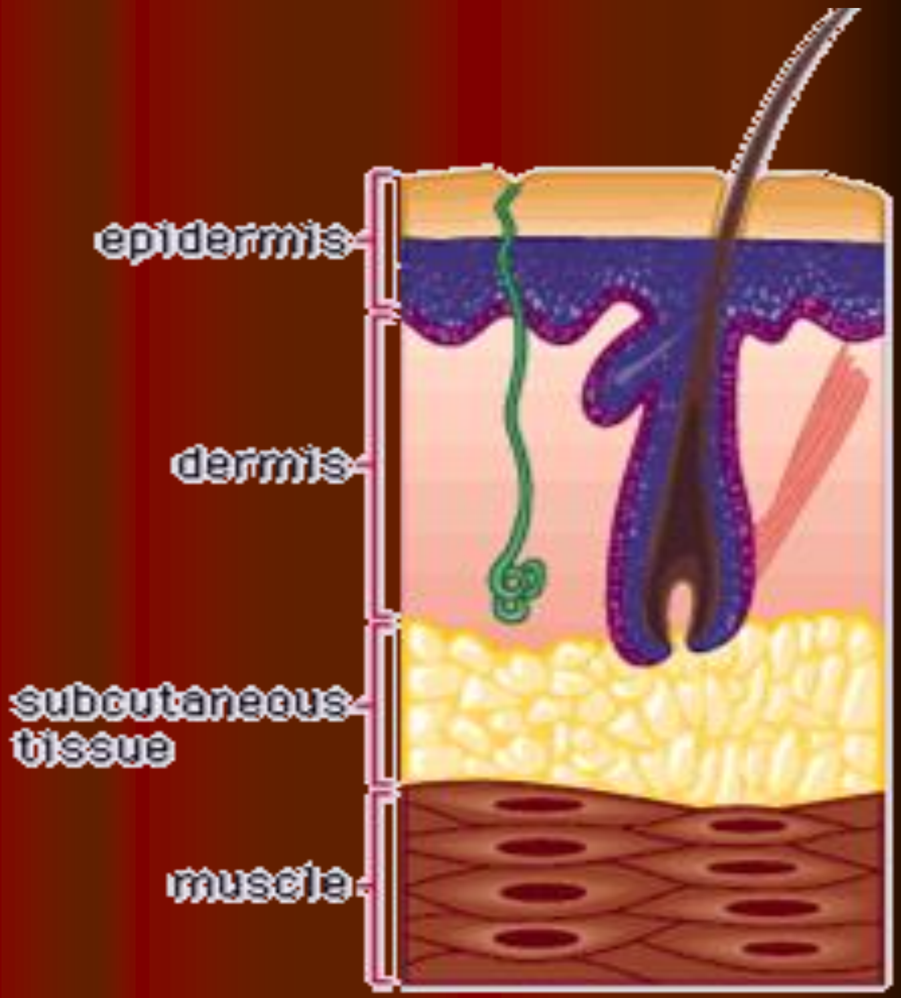
- Largest body organ
- More than just a passive covering

Skin Functions

- Sensation
- Protection
- Temperature regulation
- Fluid retention

Anatomy

- Two layers
  - Epidermis
  - Dermis



Epidermis

- Outer layer
- Top (stratum corneum) consists of dead, hardened cells
- Lower epidermal layers form stratum corneum and contain protective pigments

Dermis

- Elastic connective tissue
- Contains specialized structures
  - Nerve endings
  - Blood vessels
  - Sweat glands
  - Sebaceous (oil) glands
  - Hair follicles

Burn Epidemiology

- 2,500,000/year
- 100,000 hospitalized
- 12,000 deaths

Third leading cause of trauma deaths

Pathophysiology

- Loss of fluids
- Inability to maintain body temperature
- Infection

Critical Factors

- Depth
- Extent

Burn Depth

- First Degree (Superficial)
  - Involves only epidermis
  - Red
  - Painful
  - Tender
  - Blanches under pressure
  - Possible swelling, no blisters
  - Heal in ~7 days

Burn Depth

- Second Degree (Partial Thickness)
  - Extends through epidermis into dermis
  - Salmon pink
  - Moist, shiny
  - Painful
  - Blisters may be present
  - Heal in ~7 to 21 days

Burn Depth

- Burns that blister are second degree.
- But not all second degree burns don't blister.

Burn Depth

- Third Degree (Full Thickness)
  - Through epidermis, dermis into underlying structures
  - Thick, dry
  - Pearly gray or charred black
  - May bleed from vessel damage
  - Painless
  - Require grafting

Burn Depth

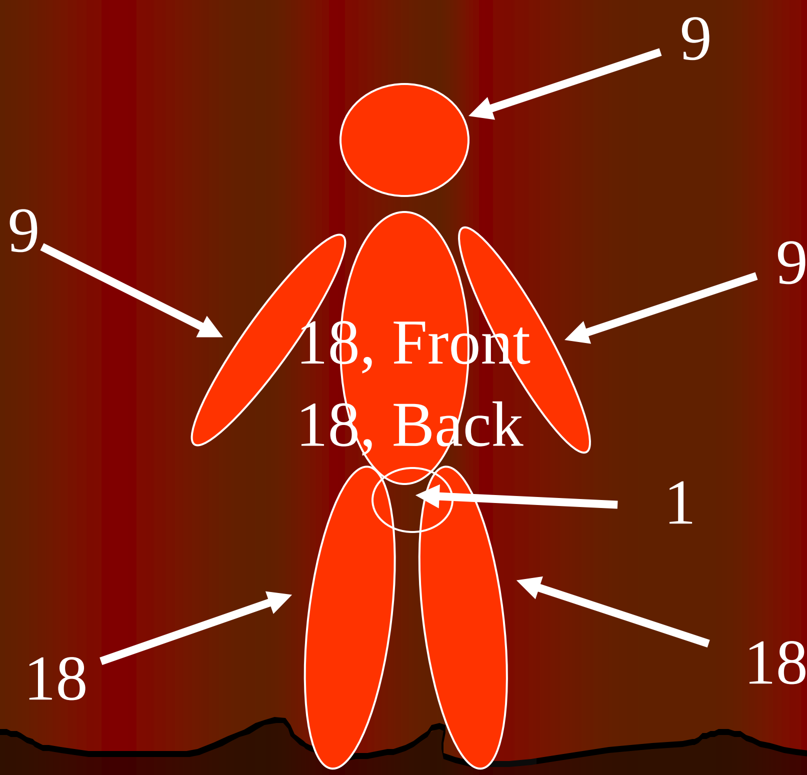
- Often cannot be accurately determined in acute stage
- Infection may convert to higher degree
- When in doubt, over-estimate

Burn Extent

Rule of Nines

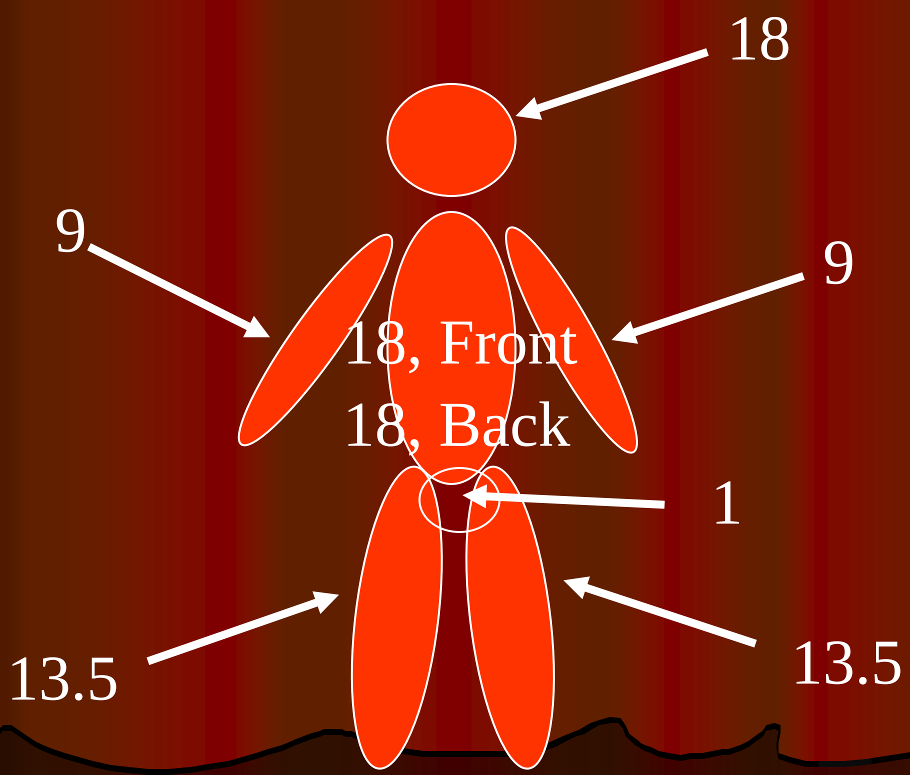
Burn Extent

- Adult Rule of Nines



Burn Extent

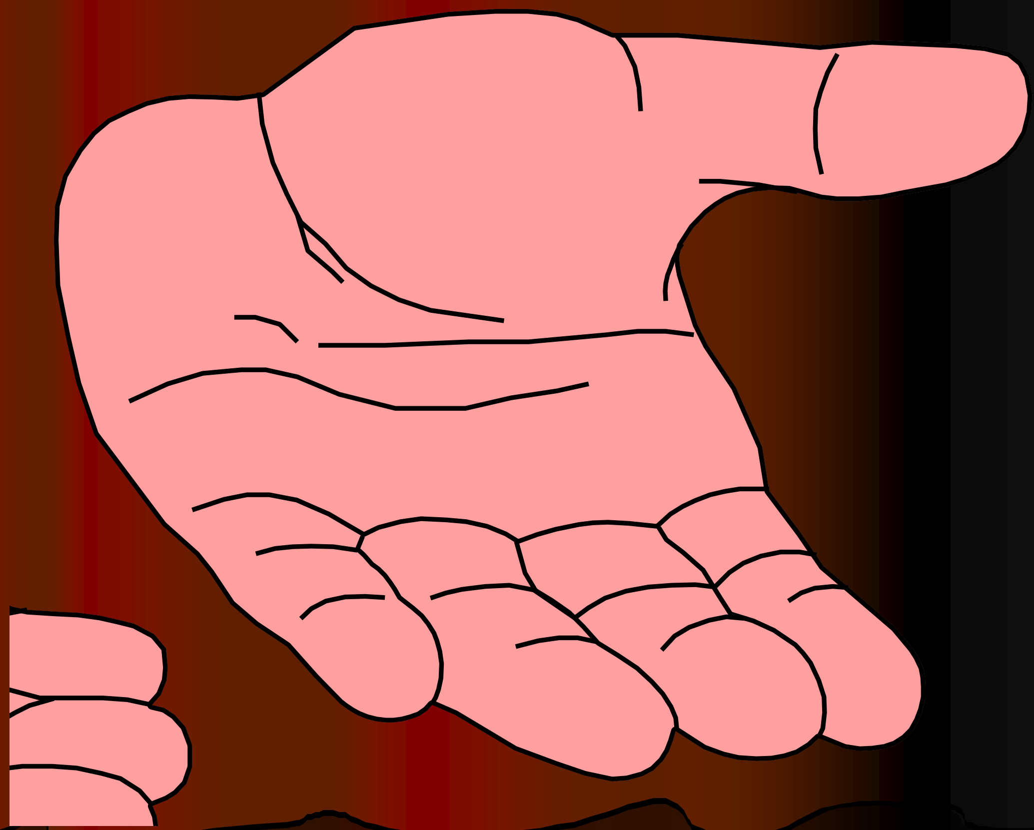
- Pediatric Rule of Nines

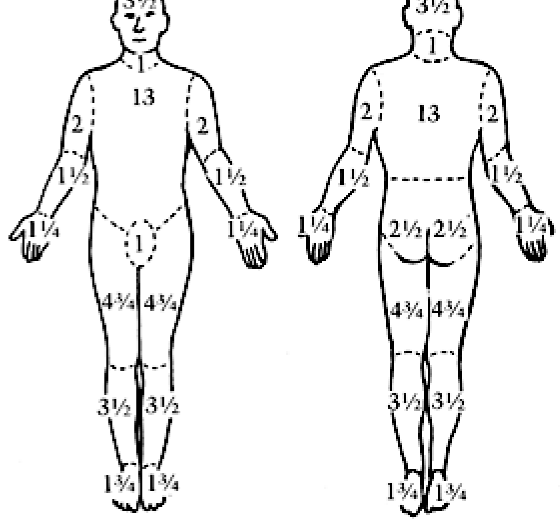


For each year over 1 year of age, subtract 1% from head, add equally to legs.

Burn Extent

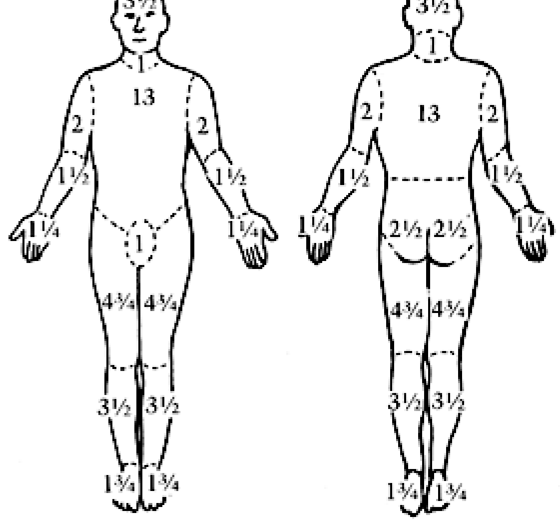
- Rule of Palm
  - Patient's palm equals 1% of his body surface area





Age:
Sex:
Weight:

Area	Birth–1 yr	1–4 yr	5–9 yr	10–14 yr	15 yr	Adult	Partial thickness 2°	Full thickness 3°	Total
Head	19	17	13	11	9	7			
Neck	2	2	2	2	2	2			
Anterior trunk	13	13	13	13	13	13			
Posterior trunk	13	13	13	13	13	13			
Right buttock	2½	2½	2½	2½	2½	2½			
Left buttock	2½	2½	2½	2½	2½	2½			
Genitalia	1	1	1	1	1	1			
Right upper arm	4	4	4	4	4	4			
Left upper arm	4	4	4	4	4	4			
Right lower arm	3	3	3	3	3	3			
Left lower arm	3	3	3	3	3	3			
Right hand	2½	2½	2½	2½	2½	2½			
Left hand	2½	2½	2½	2½	2½	2½			
Right thigh	5½	6½	8	8½	9	9½			
Left thigh	5½	6½	8	8½	9	9½			
Right leg	5	5	5½	6	6½	7			
Left leg	5	5	5½	6	6½	8			
Right foot	3½	3½	3½	3½	3½	3½			
Left foot	3½	3½	3½	3½	3½	3½			
						Total			



Age: ____________
Sex: ____________
Weight: __________

Area	Birth–1 yr	1–4 yr	5–9 yr	10–14 yr	15 yr	Adult	Partial thickness 2°	Full thickness 3°	Total
Head	19	17	13	11	9	7			
Neck	2	2	2	2	2	2			
Anterior trunk	13	13	13	13	13	13			
Posterior trunk	13	13	13	13	13	13			
Right buttock	2½	2½	2½	2½	2½	2½			
Left buttock	2½	2½	2½	2½	2½	2½			
Genitalia	1	1	1	1	1	1			
Right upper arm	4	4	4	4	4	4			
Left upper arm	4	4	4	4	4	4			
Right lower arm	3	3	3	3	3	3			
Left lower arm	3	3	3	3	3	3			
Right hand	2½	2½	2½	2½	2½	2½			
Left hand	2½	2½	2½	2½	2½	2½			
Right thigh	5½	6½	8	8½	9	9½			
Left thigh	5½	6½	8	8½	9	9½			
Right leg	5	5	5½	6	6½	7			
Left leg	5	5	5½	6	6½	8			
Right foot	3½	3½	3½	3½	3½	3½			
Left foot	3½	3½	3½	3½	3½	3½			
						Total			

Burn Severity

- Based on
  - Depth
  - Extent
  - Location
  - Cause
  - Patient Age
  - Associated Factors

Critical Burns

- 3rd Degree >10% BSA
- 2nd Degree > 25% BSA (20% pediatric)
- Face, Feet, Hands, Perineum
- Airway/Respiratory Involvement
- Associated Trauma
- Associated Medical Disease
- Electrical Burns
- Deep Chemical Burns

Moderate Burns

- 3rd Degree 2 to 10%
- 2nd Degree 15 to 25% (10 to 20% pediatric)

Minor Burns

- 3rd Degree <2%
- 2nd Degree <15% (<10% pediatric)

Associated Factors

- Patient Age
  - < 5 years old
  - > 55 years old
- Burn Location
  - Circumferential burns of chest, extremities

MANAGEMENT

Stop Burning Process

- Remove patient from source of injury
- Remove clothing unless stuck to burn
- Cut around clothing stuck to burn, leave in place

CASUALITY MANAGEMENT

1. *I.V Line: Unburned skin (preferable)*

   Burned skin (sterile) .

2. *Folleys catheter.*
3. *N/G tube (for severe burn).*
4. *Analgesia.*
5. *A.T.S.*
6. *Keep warm .*
7. *Topical antibiotics.*
8. *fluid resuscitation .*

Assess Airway/Breathing

- Start oxygen if:
  - Moderate or critical burn
  - Decreased level of consciousness
  - Signs of respiratory involvement
  - Burn occurred in closed space
  - History of CO or smoke exposure
- Assist ventilations as needed

Assess Circulation

- Check for shock signs /symptoms

Early shock seldom results from effects of burn itself.

Early shock = Another injury until proven otherwise

Obtain History

- How long ago?
- What has been done?
- What caused burn?
- Burned in closed space?
- Loss of consciousness?
- Allergies/medications?
- Past medical history?

Rapid Physical Exam

- Check for other injuries
- Rapidly estimate burned, unburned areas
- Remove constricting bands

BURN EDEMA:

- * Burn edema decrease tissue oxygenation, blood flow, increase, ischemea and infection so it increase the work of breathing.
- 1. Edema of burned tissue .
- 2. Edema of unburned tissue .
- * Increase microvascular fluid flux and transient decrease in blood flow that lead to arterial vasodilatation .
- * The rate and amount of edema is proportional with the degree of thermal injury and fluid resuscitation .
- * Max. at 18-24 h

*Puls rate less than 120/min. means adequate vol. In young patients .

*In old it is not reliable .

*Only few patients will benefit from invasive haemodynamic monitoring .(old patients with cardirespiratory dis.)

*Swan-Gans monitoring of pulmunary artery and cardiac out put is preferable to C.V.line.

*Urin out put is best indicator of resuscitation ; 0.5-1 ml/kg/h .

*urin must not be glycosuric not produced by osmotic load .

*Increase A.D.H.

*Persistent metabolic acidosis means in-adequate perfusion .

*Serial haematocrit determination can give an idea to determine the adequacy of resuscitation .

FLUID MANAGEMENT

THE AIM :

1. Maintain adequate tiss. Oxygenation .
2. Maintain adequate tiss. perfusion .
3. Avoid organ ischemea .
4. Preserve heat injured but viable soft tiss. While minimizing exogenous contribution .

*No formula is alicense to put the patient on autopilot .

*All formulas are guide lines only .

*Careful precise monitoring of the patient from minute to minute is mandatory .

*high blood pressure is not good indicator of the status of resuscitation

*Puls rate is better indicator .

FLUID THERAPY

- MANY formulae established to calculate the quantity of fluid given to the severely burned patient ,but no formula is able to give us 100% accuracy so the secret of perfect rehydration is minute to minuet observation and manipulating the quantity and quality of IV fluid given to the patient.

RESUSCITATION FORMULAS :-

ISOTONIC CRYSTALOIDS:-

* Simple .

*Low coast. PARKLAND FORMULA=4ml/kg/%

* Safe.

colloid administered in the second 24 hours after burn was more effective than crystalloid in restoring plasma volume and maintaining cardiac output. This colloid advantage was not seen in the first 24 hours. Some feel that extravasated colloid in interstitial space will obligate the formation of increased interstitial water and therefore may make later edema mobilization more difficult. However, recent evidence has shown that nonburned tissue and lung capillaries recover their ability to sieve protein with greater rapidity than was believed when the Parkland formula was developed. The early addition (i.e., 8–12 hours post burn) of colloid to the resuscitation regimen may decrease the total fluid volume given.

Treat Burn Wound

- Cover with DRY, CLEAN SHEETS
- Do NOT rupture blisters
- Do NOT put goo on burn

Special Considerations

- Pediatrics
- Geriatrics

Pediatrics

- Thin skin, increased severity
- Large surface to volume ratio
- Poor immune response
- Small airways, limited respiratory reserve capacity
- Consider possibility of abuse

Geriatrics

- Thin skin, poorly circulation
- Underlying disease processes
  - Pulmonary
  - Peripheral vascular
- Decreased cardiac reserve
- Decreased immune response

Geriatrics

- Percent mortality = Age + % BSA Burned

Inhalation Injury

Problems

- Hypoxia
- Carbon monoxide toxicity
- Upper airway burn
- Lower airway burn

Carbon Monoxide

- Product of incomplete combustion
- Colorless, odorless, tasteless
- Binds to hemoglobin 200x stronger than oxygen
- Headache, nausea, vomiting, “roaring” in ears

Carbon Monoxide

Exposure makes pulse oximeter data meaningless!

Upper Airway Burn

- True Thermal Burn
- Danger Signs
  - Neck, face burns
  - Singing of nasal hairs, eyebrows
  - Tachypnea, hoarseness, drooling
  - Red, dry oral/nasal mucosa

Lower Airway Burn

- Chemical Injury
- Danger Signs
  - Loss of consciousness
  - Burned in a closed space
  - Tachypnea (+/-)
  - Cough
  - Rales, wheezes, rhonchi
  - Carbonaceous sputim

Chemical Burns

Concerns

- Damage to skin
- Absorption of chemical; systemic toxic effects
- Avoiding EMS personnel exposure

Management

- Remove chemical from skin
- Liquids
  - Flush with water
- Dry chemicals
  - Brush away
  - Flush what remains with water

Special Concerns

- Phenol
  - Not water soluble
  - Flush with alcohol
- Sodium/Potassium
  - Explode on water contact
  - Cover with oil

Special Concerns

- Tar
  - Use cold packs to solidify tar
  - Do NOT try to remove
  - Tar can be dissolved with organic solvents later

Chemical in Eyes

- Flush with NS or Ringers
- No other chemicals in eye
- Flush out contacts

Electrical Burns

Considerations

- Intensity of current
- Duration of contact
- Kind of current (AC or DC)
- Width of current path
- Types of tissues exposed (resistance)

Voltage

Voltage Does Not Kill Current Kills

Electrical Burns

- Conductive injuries
  - "Tip of Iceberg"
  - Entrance/exit wounds may be small
  - Massive tissue damage between entrance/exit

Electrical Burns

- Nonconductive injuries
  - Arc burns
  - Ignition of clothing

Other Complications

- Cardiac arrest/arrhythmias
- Respiratory arrest
- Spinal fractures
- Long bone fractures

Management

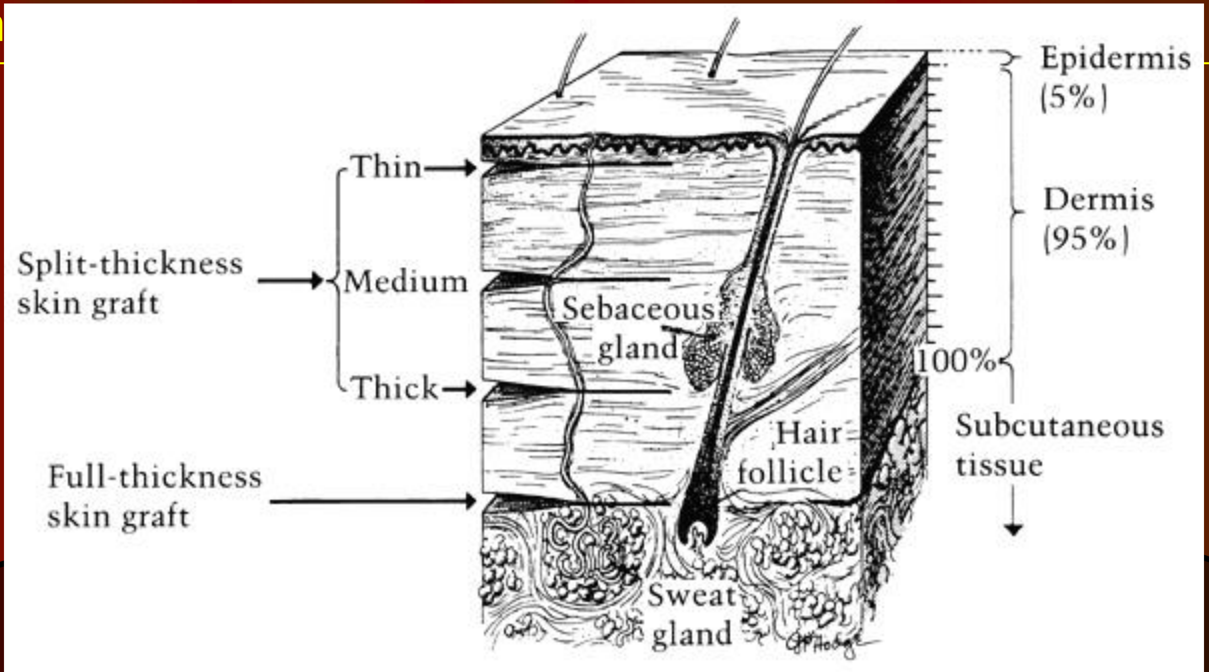
- Make sure current is off!
- Check ABCs
- Assess carefully for other injuries
- Patient needs hospital evaluation, observation

Skin grafts :

are a valuable option for closing defects that cannot be closed primarily. A skin graft consists of epidermis and some portion of dermis that is removed from its blood supply and transferred to another location.

Skin Graft Types :

A skin graft may either be full or split thickness, depending on how much dermis is included. Split-thickness skin grafts contain varying thicknesses of dermis while a full-thickness skin graft contains the entire dermis. All such grafts contain adnexal structures such as sweat glands, sebaceous glands, hair follicles, a




17 5 2005


17 5 2005


16 6 2005


27 9 2005

Skin Graft Donor Sites :

The donor site epidermis regenerates from the immigration of epidermal cells originating in the hair follicle shafts and adnexal structures left in the dermis. In contrast, the dermis never regenerates. Since split-thickness grafts remove only a portion of the dermis, the original donor site can be used again for subsequent split-thickness graft harvest. Thus, the number of split-thickness grafts harvested from a donor site is directly dependent on the donor dermis thickness.

Skin grafts can be taken from anywhere on the body, although the color, texture, thickness of the dermis, vascularity, and donor site morbidity vary considerably. Skin grafts taken from above the clavicles provide a superior color match for defects of the face. The upper eyelid skin can also be used, as it provides a small amount of very thin skin. Full-thickness skin graft harvest sites can be closed primarily. The abdominal wall, buttocks, and thigh are common donor sites for split-thickness skin grafts.

Four theories have been proposed for graft revascularization:

(1) There is neovascularization of the graft in which new vessels from the recipient bed invade the graft to form the definitive vascular structure of the graft.

(2) communication occurs between existing graft vessels and those in the recipient site.

(3) there is a combination of ingrowth of new vessels and reestablishment of flow into existing vessels.

(4) the vasculature of the skin graft is made up, primarily, from its original vessels before transfer.

Recipient site preparation:1.

1 Skin grafts require a vascular bed and will seldom take in exposed bone, cartilage, or tendon devoid of its periosteum, perichondrium, or paratenon. There are exceptions, however, as skin grafts are frequently successful inside the orbit or on the temporal bone, despite removal of the periosteum.

2. Close contact between the skin graft and its recipient bed is essential.
3. Hematomas and seromas under the skin graft will compromise its survival.
4. immobilization of the graft is essential.