Burn Injuries & Its Management

Ms. Tejasvini Kalekar
Assistant Profesor
MES College of Nursing

BURNS

Burns occurs when there is injury to the tissues of the body caused by excessive heat, chemicals, fire/steam, radiation and electricity.

Causes

1. excessive heat
2. Chemicals
3. fire/steam
4. radiation
5. electricity

Risk factors

Exposed heating sources, electrical cords, unsafe storage of flammable materials, careless smoking, child abuse, water heater, too much exposure to the sun

BURNS

- Results in 10-20 thousand deaths annually
- Survival best at ages 15-45 yrs
- Survival best burns cover less than 20% of TBA

TYPES OF BURNS

- Thermal

  exposure to flame or a hot object

- Chemical

  exposure to acid, alkali or organic substances

- Electrical

  result from the conversion of electrical energy into heat. Extent of injury depends on the type of current, the pathway of flow, local tissue resistance, and duration of contact

- Radiation

  result from radiant energy being transferred to the body resulting in production of cellular toxins

Chemical Burn

Electrical Burn

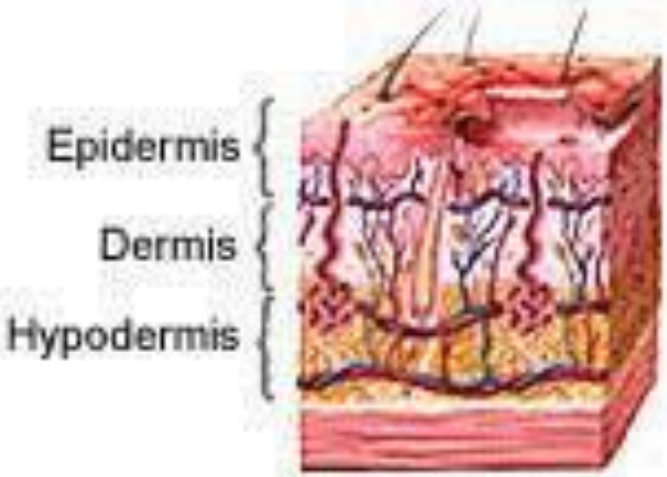
BURN CLASSIFICATION

- Classified according to age of the patient depth of injury, extent of body surface area involved, the presence of inhalation injury, presence of other injuries, location of the injuries.

1. PARTIAL THICKNESS BURNS
   - superficial partial thickness(first-degree)
   - deep partial thickness(second-degree)
2. FULL THICKNESS BURNS(THIRD DEGREE)

Characteristics based on depth

Depth	Superficial partial thickness	Deep partial thickness	Full thickness
Skin involvement	Epidermis	Epidermis, upper dermis, a portion of deeper dermis	Epidermis, dermis, subcutaneous tissues, connective tissue, muscle and bone
Symptoms	Tingling, hyperesthesia Pain that is soothed by cooling	Pain, hyperesthesia Sensitive to cold air	Pain free, shock, hematuria, hemolysis
Wound appearance	Reddened, blanches with pressure, dry, no edema, possible blisters	Blistered, red base, broken epidermis, edema	Dry, pale white, leathery, edema, exposed fat
Duration	Recovery within a week, no scarring	Recovery in 2 to 4 weeks, some scarring and depigmentation, contractures, infection may occur	Eschar sloughs, grafting necessary, scarring and loss of function, contractures, loss of digits or extremity



First degree burn

Second degree burn

Third degree burn

Burn severity

Major burns	Moderate burns	Mild burns
• Age 10-50yrs: partial thickness burns more than 25% TBSA • Burns that involve major joints • Burns in infants and elderly	• Age 10-50 years: partial thickness burns involving 15-25% of TBSA	• Age 10-50 yrs: partial thickness burns less than 15%

Calculation of Burned Body Surface Area

TOTAL BODY SURFACE AREA (TBSA)

- Superficial burns are not involved in the calculation
- Lund and Browder Chart is the most accurate because it adjusts for age
- Rule of nines divides the body – adequate for initial assessment for adult burns

Lund Browder Chart used for determining BSA

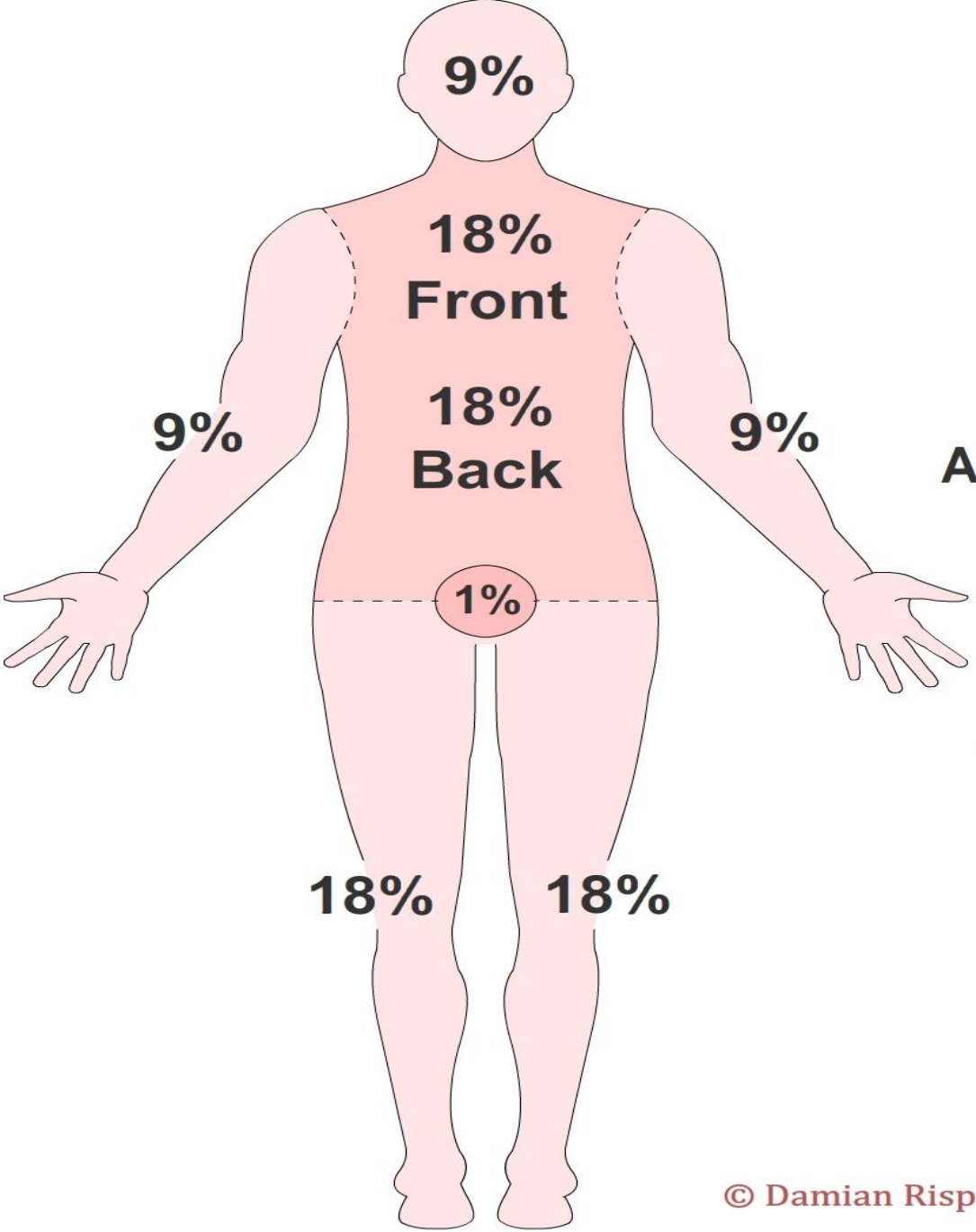
Lund-Browder Chart									
Area	**0-1 Years**	**1-4 Years**	**5-9 Years**	**10-14 Years**	**15 Years**	**Adult**	**% 2nd**	**% 3rd**	**% TOTAL**
Head	19	17	13	11	9	7			
Neck	2	2	2	2	2	2			
Ant. Trunk	13	13	13	13	13	13			
Post. Trunk	13	13	13	13	13	13			
R. Buttock	2.5	2.5	2.5	2.5	2.5	2.5			
L. Buttock	2.5	2.5	2.5	2.5	2.5	2.5			
Genitalia	1	1	1	1	1	1			
R.U. Arm	4	4	4	4	4	4			
L.U. Arm	4	4	4	4	4	4			
R.L. Arm	3	3	3	3	3	3			
L.L. Arm	3	3	3	3	3	3			
R. Hand	2.5	2.5	2.5	2.5	2.5	2.5			
L. Hand	2.5	2.5	2.5	2.5	2.5	2.5			
R. Thigh	5.5	6.5	8	8.5	9	9.5			
L. Thigh	5.5	6.5	8	8.5	9	9.5			
R.L. Leg	5	5	5.5	6	6.5	7			
L.L. Leg	5	5	5.5	6	6.5	7			
R. Foot	3.5	3.5	3.5	3.5	3.5	3.5			
L. Foot	3.5	3.5	3.5	3.5	3.5	3.5			

From the Medical University of South Carolina Children's Hospital Pediatric Burn Intake Form. (Charleston, SC)

- More precise method of estimating the extent of a burn is the lund and browder method
- It recognizes percentage of TBSA of various anatomic parts by dividing
- The size of the palm is approximately 1% of TBSA

RULES OF NINES

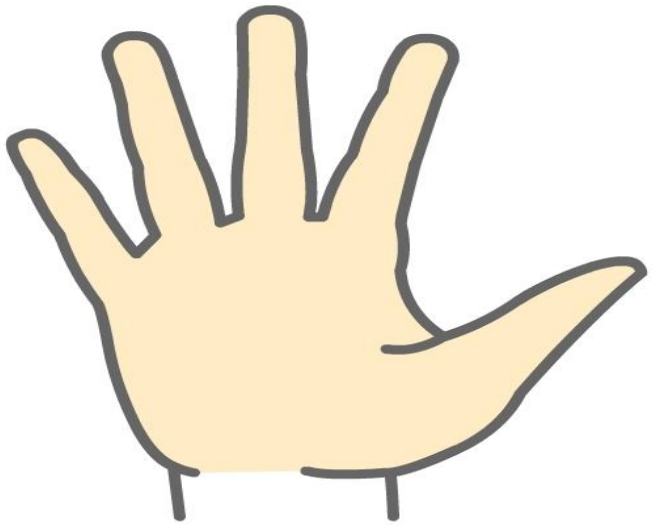
- The body surface is divided into areas representing 9% or its multiples
- Head & Neck = 9%
- Each upper extremity (Arms) = 9%
- Each lower extremity (Legs) = 18%
- Anterior trunk= 18%
- Posterior trunk = 18%
- Genitalia (perineum) = 1%



Rule of Nines

Measure 2nd and 3rd Degree Burns

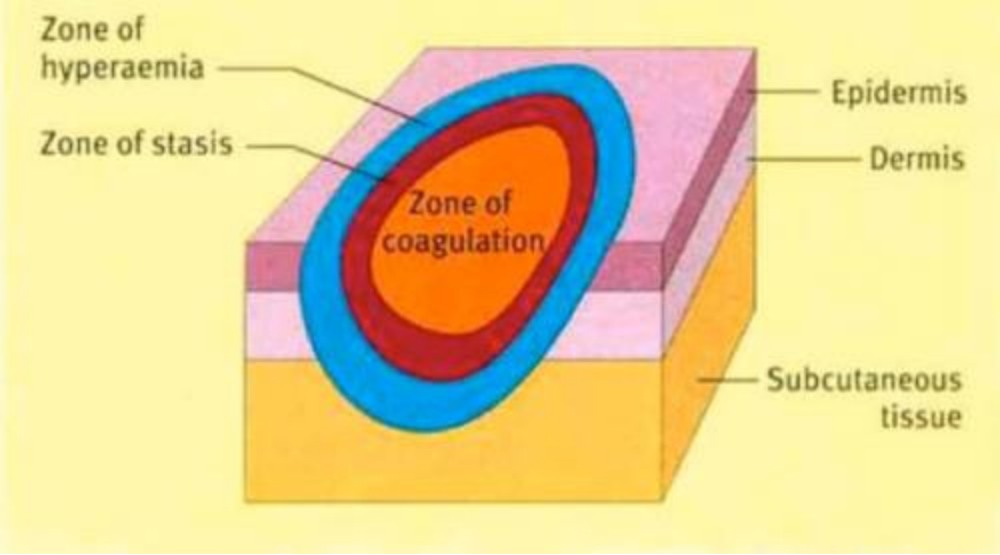
A Patients hand ~ 1% of the total body surface area



Pathophysiology

Zones of burn injury

- Each burned area have three zones of injury
- Zone of coagulation – inner zone where cellular death occurs, most damaged space
- Zone of stasis – middle area where compromised blood supply, inflammation and tissue injury
- Zone of hyperemia- outer zone where sustains least damage



LOCAL AND SYSTEMIC RESPONSES OF BURNS

- Burns that do not exceed 25% TBSA produce a primarily local response
- Burns that exceed 25% may produce both a local and systemic response – major burns

Cardio vascular response

- **Hypovolemia** – resulting in decrease perfusion and oxygen delivery
- Cardiac output decreases
- Blood pressure drops
- As a response sympathetic nervous system release **catecholamine** resulting in increase in pulse rate
- Peripheral vasoconstriction leads to decrease cardiac output
- Myocardial contractility will decrease due to **cytokines** action
- If fluid resuscitation is not adequate – **shock will occur**

VASCULAR CHANGES RESULTING FROM BURN INJURIES

- Circulatory disruption occurs at the burn site immediately after a burn injury
- Blood flow decreases or cease due to occluded blood vessels
- Damaged macrophages within the tissues release chemicals that cause constriction of vessel
- Blood vessel thrombosis may occur causing necrosis

FLUID SHIFT

- Loss of capillary integrity and shift of fluid are localized, resulting in blister formation and edema, only in the area of injury
- Occurs after initial **vasoconstriction,** then **dilation**
- Blood vessels dilate and leak fluid into the interstitial space
- Known as **capillary leak syndrome**
- Causes decreased blood volume and blood pressure
- Occurs within the first 12 hours after the burn and can continue to up to 36 hours

- As edema continues, pressure on small blood vessels and nerves in the distal extremities causes an obstruction of blood flow and ischemia
- This complication is known as **compartment syndrome**
- Escharotomy is the management – surgical incision into the eschar (devitalized tissue resulting from a burn)

- An escharotomy is performed by making an incision through the eschar to expose the fatty tissue below. Due to the residual pressure, the incision will often widen substantially.

- During an escharotomy the patient is often sedated despite the insensate eschar. The burnt skin is incised down to the subcutaneous fat and into the healthy skin (up to 1 cm). The incisions should be deep enough to release all restrictive effects from the eschar. The operation can be performed on the trunk, limbs, or neck, all while avoiding critical nerves, veins, and vessels. Following the operation the wounds are dressed primarily with a flexible, absorbent, bacteria resistant material (such as ACTICOAT), then wrapped lightly in a bandage. Elevation (if possible) and observation are encouraged.

Fasciotomy

- It is a surgical procedure where the fascia(A **fascia** is connective tissue fibers, primarily collagen, that form sheets or bands beneath the skin to attach, stabilize, enclose, and separate muscles and other internal organs) is cut to relieve tension or pressure commonly to treat the resulting loss of circulation to an area of tissue or muscle.
- Done to treat compartment syndrome

FLUID IMBALANCES

- Occur as a result of fluid shift and cell damage
- Hypovolemia
- Hyperkalemia
- Hyponatremia
- Hemoconcentration (elevated blood osmolarity, hematocrit/hemoglobin) due to dehydration

FLUID REMOBILIZATION

- Occurs after 24 hours
- Capillary leak stops
- **diuretic stage** where edema fluid shifts from the interstitial spaces into the vascular space
- Blood volume increases leading to increased renal blood flow and diuresis
- Body weight returns to normal

Gastrointestinal alteration

- **CURLING'S ULCER** -Acute ulcerative gastro duodenal disease
- Occur within 24 hours after burn
- Due to reduced GI blood flow and mucosal damage
- Ischemia and cell necrosis of the gastric mucosa will occur
- Treat clients with H2 blockers, mucoprotectants, and early enteral nutrition
- Watch for sudden drop in hemoglobin

- **PARALYTIC ILEUS** – absence of intestinal peristalsis

ABDOMINAL COMPARTMENT SYNDROME -

- Occurs when the abdomen becomes subject to increased pressure. Increasing pressure reduces blood flow to abdominal organs and impairs pulmonary, cardiovascular, renal and gastrointestinal function, causing multiple organ dysfunction syndrome and death

Pulmonary response

- **Inhalation injury** is the leading cause of death in fire victims
- Due to smoke inhalation, bronchoconstriction caused by release of **histamine, serotonin and thromboxane** (vasoconstrictors)
- Hypoxia due to **catecholamine** release in response to stress of burn injury

- Most common harmful smoke includes **carbon monoxide, sulfur oxides, nitrogen oxides, cyanide, ammonia**
- Due to this ciliary action will loss
- Mucosal edema, hyper secretion and bronchospasam follows and leads to atelectasis

- Carbon monoxide is most common cause of inhalation injury
- Carbon monoxide combine with hemoglobin to form carboxyhemoglobin
- 100% oxygen supplementation is essential to accelerate the removal of the carbon monoxide from the hemoglobin molecule
- Airway obstruction caused is relieved by intubation and oxygen supplementation

Other systemic responses

- Renal function may be altered as a result of decrease blood volume
- Destruction of red blood cells at the injury site results in free hemoglobin in the urine
- If muscle damage occurs – myoglobin is released from the muscle cells and excreted by the kidney
- Immunologic defenses of the body altered by burn injury – risk for infection
- Sepsis can occur and lead to death
- Loss of skin integrity is common and there by lose of thermoregulation

MANAGEMENT OF BURNS

PHASES OF BURN CARE

PHASE	DURATION	PRIORITIES
EMERGENT / RESUSCITATIVE	From onset of injury to completion of fluid resuscitation	First aid Prevention of shock Prevention of respiratory distress
ACUTE/ INTERMEDIATE	From beginning of diuresis to near completion of wound closure	Wound assessment and initial care Wound care and closure Prevention
REHABILITATIO N	From major wound closure to return to individuals optimal level of physical and psychosocial adjustment	Prevention of scars and contractures Physical, occupational and vocational rehabilitation Functional and cosmetic reconstruction Psychosocial counseling

Emergent phase

On the scene care

- Burn wound is not the first priority at the scene, the first priority of the scene to prevent injury to the rescuer
- Inform the fire and emergency medical services
- Inspect the patient for effective **airway, breathing and circulation**
- If the patient is awake, ask only about the cause of the injury to start management

Emergency activities at the burn scene

Extinguish the flames

- When clothes catch fire, fall to the floor or ground and roll
- Blanket, coat can be used to cover the body
- Standing still allows the victim to breath the flames and smoking
- If burn source is electrical, the electrical source must be disconnected

Cool the burn

- After the fire extingusion, cool the area along with cool water
- Soaking in cool water or applying cool towels gives immediate relief from pain and limits tissue damage
- Never apply ice directly, or wrap burn victims in ice, this can leads to hypothermia and worsen the tissue damage

Remove restrictive objects

- Remove clothing immediately
- Do not try to remove the deeply adherent clothing
- All jewelry should be removed and assess

Cover the wound

- Wound should be covered as soon as possible to prevent bacterial contamination
- Sterile dressings are best, but any clean dry cloth can be used
- No medications should applied over the dressings

Irrigate chemical burns

- Corrosive materials are irrigated immediately
- Rinse all areas of the body that have come in contact with chemical
- If chemical gets into eyes, the eyes should be flushed with cool, clean water immediately

EMERGENCY MEDICAL MANAGEMENT

- **The hospital physician are alerted** before the admission of the patient for initiating life saving measures
- **Humidified oxygen** should be given and patient is encouraged to cough so that **secretions** can be removed **by suctioning**
- If edema occurs – **Endotracheal intubation** should be done
- Ventilatory support also should be provided
- Assess for any head injury and cervical spine injury

- Once the **patient is stable take a detail history** of burns and its cause from the patient (if able) or from the witness to start the treatment
- A large bore (16 or 18 guage**) iv catheter** is inserted in non burned area

- If burns **exceeds 25% Nasogastric tube** should be inserted
- **Sterile techniques** should be maintained
- **Photographs** may be taken of the burn injury periodically through out the treatment to document the changes

- Maintain body temperature and reduce pain
- Indwelling urinary catheter is inserted for assessing the urinary output and renal function
- Baseline height, weight, arterial blood gases, electrolyte values, hematocrit, ECG, urinalysis and chest x rays are obtained.
- Although physical stabilization is the aim, nurse must also provide psychological support to the patient and family.

Transfer to burn center

- Based on depth and extent of burn injury the patient is shifted to burn center for further detailed care

Before transporting the following measure are obtained

- A secure iv line
- Ringer lactate infusion at a rate of 30 ml per hour to maintain urine output
- A patent airway, Adequate pain relief management
- Wounds are covered with a clean, dry sheet
- Proper documentation and reporting

Management of fluid loss and shock

Fluid replacement therapy

- The fluid replacement for the first 24 hours are classified by the extent of the burn injury
- Combination of fluids may be used
- **Colloids** (whole blood, plasma and plasma expanders) **crystalloids / electrolyte** (physiologic sodium chloride and RL solution)
- If TBSA is less than 20% oral resuscitation is enough

Formulas for fluid replacement in burns

Consensus formula

- RL souluiton = 2-4 ml x body weight x % of total body surface area (TBSA) burned
- Half to be given in first 8 hours, remaining half to be given over next 16 hours

Parkland / baxter formula

- RL solution = 4ml x kg body weight x % TBSA burned
- Day 1 – half to be given in first 8 hours, half to the given over next 16 hours
- Day 2 – colloid is added

Evans formula

- Colloids – 1 ml x kg body weight x % TBSA burned
- Electrolytes – 1 ml x kg body weight x % TBSA burned
- Glucose (5% in water) – 2000 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
- Maximum of 10,000 ml over 24 hours

Brooke army formula

- Colloids – 0.5 ml x kg body weight x % TBSA burned
- Electrolytes – 1.5 ml x kg body weight x % TBSA burned
- Glucose (5% in water) – 2,000 ml for insensible loss

NURSING DIAGNOSIS IN THE EMERGENT PHASE

- Decreased CO
- Deficient fluid volume r/t active fluid volume loss
- Ineffective Tissue perfusion
- Ineffective breathing pattern
- Hypothermia related to loss of skin layer and open wounds
- Pain related to tissue and nerve injury
- Anxiety related to fear and emotional impact of injury

Acute or intermediate phase

- This phase follows emergent / resuscitatvie phase
- Begins 48 to 72 hours after the burn injury
- In this phase attention is directed toward continued assessment and maintenance of respiratory and circulatory status, burn wound care, pain management, nutritional support and infection prevention

Infection prevention

- Infection is common, if not cared properly
- Staphylococcus, pseudomonas, eschercia coli and klebsiella are mostly seen in burn wound area
- The burn eschar is nonviable crust with no blood supply, there for leukocytes and antibodies cant reach there
- The primary source of bacterial infection is patients **intestinal tract**
- The intestinal mucosa **normally** servers as a **barrier** to keep the internal environment free from pathogens
- After severe burn the mucosal barrier will become **permeable and microbes enter in to circulation**

- Cap, gown, mask, and gloves are worn when caring directly over burn wounds
- Clean technique is used
- Tissue specimens are obtained for culture
- Systemic antibiotics are administered to control the sepsis based on sputum, urine and blood culture

Wound cleaning

- **Hydrotherapy** – in the form of shower, bed baths
- Total immersion hydrotherapy is preformed in some settings
- The temperature of the water is maintained at 100 degree F and the temperature of the room should be 80-85 degree F
- It should be given less than 20-30 minute period to prevent chilling of the patient

Topical antibacterial therapy

- It reduces the number of bacteria
- Convert open, dirty wound to a closed and clean one
- **Silver sulfadiazine, silver nitrate**
- **Povidone iodine, gentamicin sulfate, nitrofurazone**
- **Acticoat antimicrobial barrier dressing** – acticoats a silver coated dressing approved for the treatment of burn wounds and donor sites
- The dressing can be left in place for up to 5 days

Wound dressing

- Light dressing is used over joint area to allow motion
- Dressings should be applied distally to proximally
- If fingers are involved cover the finger and toes individually to promote adequate healing

Occlusive method

- An occlusive dressing is thin gauze that is impregnated with a topical antimicrobial agent
- These dressing area also used over areas with new skin grafts
- It will protect the graft, and promote healing

Dressing changes

- Dressings should be removed only after 10-15 minutes after analgesic agent administration
- Wounds are then cleaned and debrided
- The color, odor, size, exudates, signs or re epithelialisation and other characteristics should be noted.

Wound debridement

- Natural debridement
- Mechanical debridement

Surgical debridement follows skin grafting

Grafting the burn wound

- **Autograft** – from patient own skin
- Grafting help to prevent early healing, prevent infection and electrolytes and minimize heat loss through evaporation
- Main areas of skin grafting including face, hands and feet, areas involve joints
- Grafting permits earlier functional ability and reduces contractures
- Allograft and xenografts are also being used as biologic dressings

Biosynthetic and synthetic dressings

- Used as a temporary wound coverings
- **Biobrane** which composed of nylon, silicone membrane combined with collagen derivative
- It is semitransparent and sterile
- Less costly than homograft and xenograft
- It protects fluid loss and bacterial invasion
- It adheres to the wound fibrin and binds
- With in 5 days cells migrate into the nylon mesh
- Eventually healing takes place and the biobrane is gradually separates

Dermal substitutes

- **Integra (**artificial skin) and alloderm
- Composed of two main layers – the **epidermal layer** which is made up of silicone, consisting of bacterial barrier and prevents water loss from the dermis and a **dermal layer** which composed of animal collagen
- The dermis is biodegraded and reabsorbed
- The outer silicone layer is removed 2-3 weeks after application.

- **Alloderm** – it is a processed dermis from a human cadaver skin which can be used as the dermal layer of the skin grafts

NURSING DIAGOSIS IN THE ACUTE PHASE

- Impaired skin integrity
- Risk for infection
- Imbalanced nutrition
- Impaired physical mobility
- Disturbed body image

Rehabilitation phase

- This phase begins immediately after the burn has occurs and often extends for years after injury
- Mainly focusing alterations in self image and lifestyle development
- Wound healing, psychosocial support, and restoring maximal functional activity remain priorities
- Fluid and electrolyte balance and improving nutritional status also should continue
- Reconstructive surgeries for improving body appearance and function