PRESENTATION BY

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LECTURER

ICON

BURNS

Introduction

Most burn injuries occur in the home, usually in the kitchen while cooking and in the bathroom by means of scalds or improper use of electrical appliances around water sources (Gordon & Goodwin, 1997). Careless cooking is one of the leading causes of household fires in the United States. The U.S. Fire Administration reports that nearly one third of all residential fires begin in the kitchen. The major factors contributing to cooking fires include unattended cooking, grease, and combustible materials on the stovetop. Burns can also occur from work-related injuries. Education to prevent burn injuries in the workplace should include safe handling of chemicals and chemical products and increasing awareness of the potential for injuries caused by hot objects and substances.

1. Definition

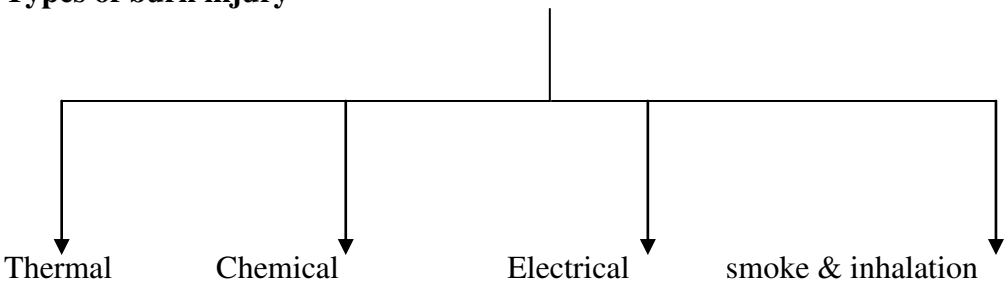
Burns occur when there is an injury to the body tissue caused by various agents.

3. Incidence

The incidence of burn injuries has been declining during the past several decades. The risk ofdeath increases significantly if the patient has sustained both a cutaneous burn injury and a smoke inhalation injury. Young children and elderly people are at particularly high risk for burn injury. The skin in people in these two age groups is thin and fragile; therefore, even a limited period of contact with a source of heat can create a full-thickness burn.

4. Types of burns and Causes

Types of burn injury



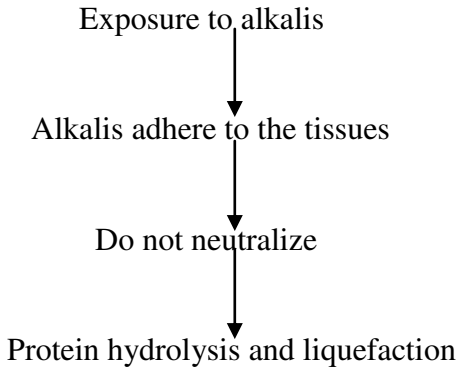
Thermal burns

They are caused by flame, flash, scald, or contact with hot object. Examples: are burns due to fire, combustion of fuels, pouring of hot water, contact with sticky tar, etc.

Chemical burns

They are caused by necrotizing substances like alkalis and acids.Examples of alkalis are cleaning agents, drain cleaners, dyes.Examples of acids are sulphuric acid, HCl

Pathophysiology



Electrical burns

It results from coagulation necrosis that is caused by intense heat generated from an electric current. The severity of burns depends on the amount of voltage, tissue resistance, current pathways and surface area in contact with the current and length of time the current flow was sustained.

Pathophysiology

Exposure to electricity

↓

Massive muscle and blood vessel damage

↓

Release of myoglobin and hemoglobin

↓

Block the renal tubules

↓

Acute tubular necrosis

Smoke and inhalation burns

It results from the inhalation of hot air or noxious chemicals which can cause damage to the tissues of the respiratory tract. There are three types of smoke inhalation burns. They are ;

(i) Carbon monoxide poisoning

It usually occurs in case of fire in a closed area where the individuals cannot escape and the inhale the CO gas. CO is produced as a result of incomplete combustion of burning materials.

Pathophysiology

Inhalation of CO displaces O2 on the hemoglobin molecule

↓

Hypoxia, carboxyhemoglobinemia

↓

Elevated levels of CO

(If not relieved)

Death

(ii) Inhalation injury above the glottis

Inhalation of smoke, hot air, steam can cause mucosal burns of the oropharynx,and larynx leading to edema and mechanical obstruction and it is a true medical emergency.

(iii) Inhalation injury below the glottis

Depending upon the length of the exposure to smoke and fumes the lower respiratory tract can be injured. Pulmonary edema and acute respiratory syndrome occurs.

5. Classification of the burn injury

A) Extent of burns

Depending upon the depth of skin destruction burn injury is classified as partial and full thickness burns.

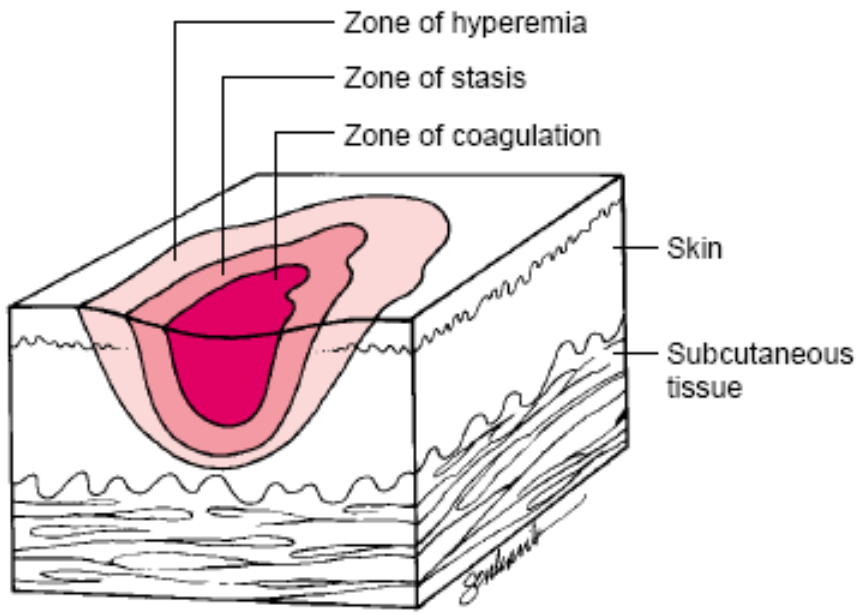
(i) Partial thickness skin destruction

a) Superficial – only superficial devitalization with hyperemia ispresent. Tactile and pain sensation is intact.

b) Deep – epidermis and dermis involved to varying length. Some skinelements from which epithelial regeneration can occur remain viable.

(ii) Full thickness skin destruction

All skin elements and nerve endings are destroyed. Coagulation necrosis occurs.



B) <u>Depth of burns</u>

DEPTH OF BURN AND CAUSES	**SKIN INVOLVEMENT**	**SYMPTOMS**	**WOUND APPEARANCE**	**RECUPERATIVE COURSE**
Superficial Partial-Thickness (Similar to 1°) Sunburn Low-intensity flash	Epidermis; possibly a portion of dermis	Tingling Hyperesthesia (supersensitivity Pain that is soothed by cooling	Reddened; blancheswith pressure; dry.Minimal or no edema	Complete recovery withina week; no scarring Peeling
Deep Partial-Thickness (Similar to 2°) Scalds Flash flame	Epidermis, upper dermis, portion of deeper dermis	Pain Hyperesthesia Sensitive to cold air	Possible blisters Blistered,mottled redbase; broken epidermis; weeping surface Edema	Recovery in 2 to 4 weeks.Some scarring and depigmentation contractures Infection may convert it to full thickness

Full-Thickness (Similar to 3°) Flame Prolonged exposure to hot liquids Electric current Chemical	Epidermis, entire dermis,and sometimes subcutaneous tissue;may involve connectivetissue, muscle,and bone	Pain free Shock Hematuria (blood in the urine) and possibly hemolysis (blood cell destruction) Possible entrance and exit wounds (electrical burn)	Dry; pale white, leathery, or charred Broken skin with fatexposed Edema	Eschar sloughs Grafting necessary Scarring and loss of contourand function;contractures Loss of digits or extremity possible

American classification of burns

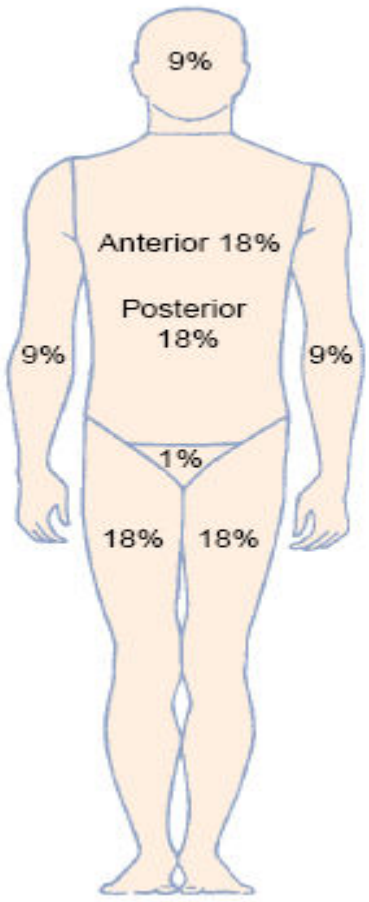
Magnitude of burn injury	**Partial thickness (2^{nd} degree)**	**Full thickness (3^{rd} degree)**
Minor	**<15%**	**<2%**
Moderate	**15%-25%**	**<10%**
Major	**>25%**	**>10%**

C) <u>Location of burns</u>

The location of burns injury depends upon the severity of injury and the area affected. Various methods are used to estimate the TBSA affected by burns;among them are the rule of nines, the Lund and Browder method,and the palm method.

RULE OF NINES

An estimation of the TBSA involved in a burn is simplified byusing the **rule of nines**. The rule of nines is a quickway to calculate the extent of burns. The system assigns percentagesin multiples of nine to major body surfaces.



LUND AND BROWDER METHOD

A more precise method of estimating the extent of a burn is theLund and Browder method, which recognizes that the percentageof TBSA of various anatomic parts, especially the head andlegs, and changes with growth. By dividing the body into verysmall areas and providing an estimate of the proportion of TBSAaccounted for by such body parts, one can obtain a reliable estimateof the TBSA burned. The initial evaluation is made on thepatient's arrival at the hospital and is revised on the second andthird post-burn days because the demarcation usually is not clearuntil then.

Head	**7%**
Neck	**2%**
Ant.trunk	**13%**
Post. Trunk	**13%**

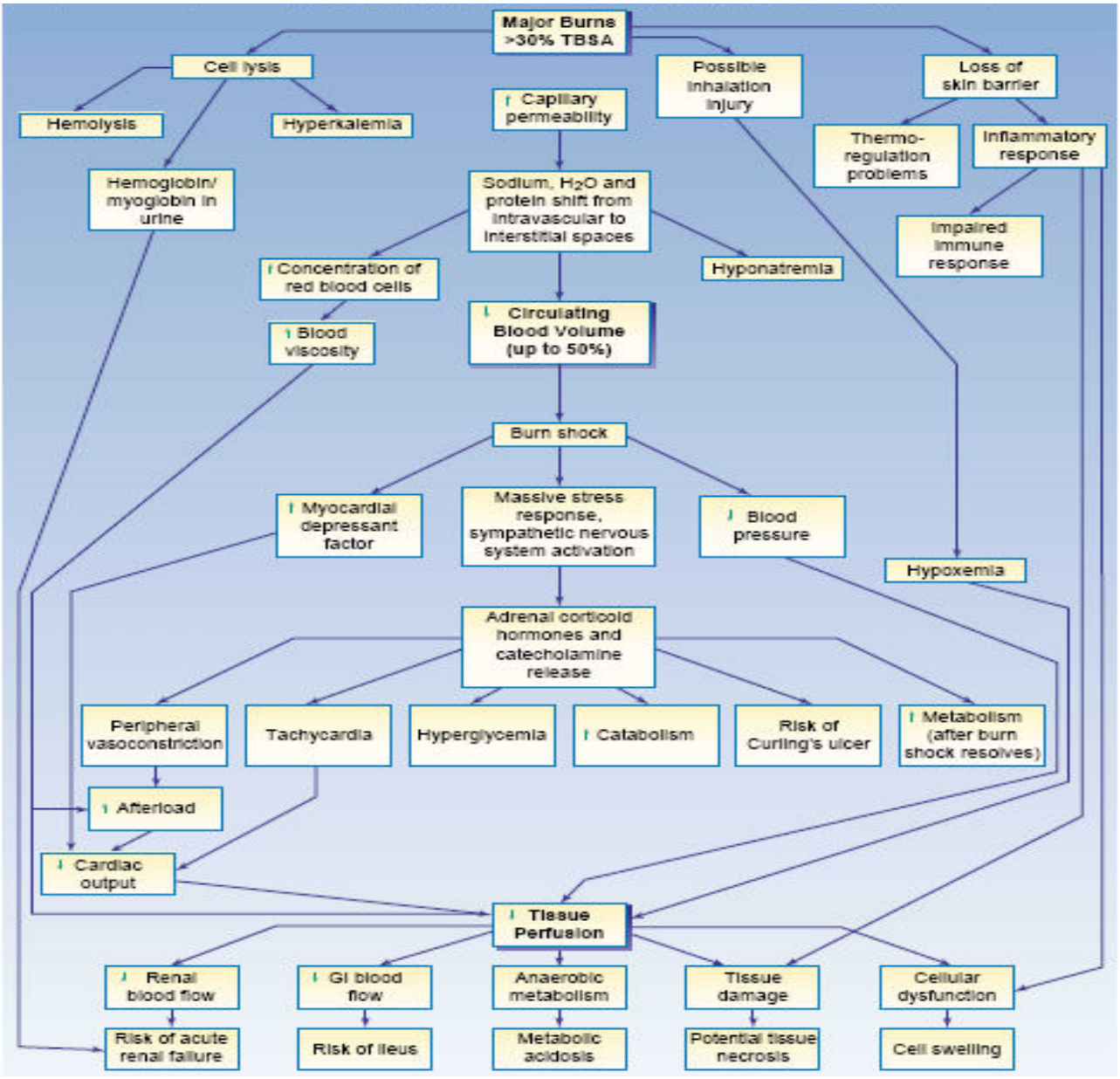
Rt. Buttock	**2 ½%**
Lt. buttock	**2 ½%**
Genitalia	**1%**
Rt. Up arm	**4%**
Lt. up arm	**4%**
Rt. L.arm	**3%**
Lt. L .arm	**3%**
Rt.hand	**2 ½%**
Lt. hand	**2 ½%**
Rt.thigh	**9 ½%**
Lt.thigh	**9½%**
Rt. Leg	**7%**
Lt.leg	**7%**
Rt. Foot	**3½%**
Lt. foot	**3½%**
Total	**100%**

PALM METHOD

In patients with scattered burns, a method to estimate the percentageof burn is the palm method. The size of the patient's palmis approximately 1% of TBSA.

6. Pathophysiology

Burns may produce both a local and a systemic response and are considered major burn injuries. This systemic response is due to the release of cytokines and other mediators into the systemic circulation. The release of local mediators and changes in blood flow, tissue edema, and infectioncan cause progression of the burn injury. Pathophysiologic changes resulting from major burns during the initial burn-shock period include tissue hypoperfusion and organ hypofunction secondary to decreased cardiac output, followed by a hyperdynamic and hypermetabolic phase.



7. Clinical features

Cardiovascular Response

- Hypovolemia
- Increase in pulse rate.

Burn Edema

- Blister formation and edema only in the area of injury.
- Patients with more severe burnsdevelop massive systemic edema. Edema is usually maximal after24 hours. It begins to resolve 1 to 2 days post-burn and usually iscompletely resolved in 7 to 10 days post-injury.As edema increases in circumferential burns, pressure on smallblood vessels and nerves in the distal

extremities causes an obstructionof blood flow and consequent ischemia. This complicationis known as **compartment syndrome.**

Effects on Fluids, Electrolytes,and Blood Volume

- Circulating blood volume decreases dramatically during burn shock
- Hyponatremia
- Hyperkalemia(excessive potassium) results from massive cell destruction.
- Anemia
- Hematocritmay be elevated due to plasma loss.
- Thrombocytopenia
- Prolonged clotting
- Prolonged prothrombin times.

Pulmonary Response

- Inhalation injury
- Disoriented or unconscious.
- Bronchoconstriction
- Hypoxia
- Upper airway injury
- Inhalation injury below the glottis

Others

- Sepsis
- Low body temperatures
- Gastric bleeding secondary to massive physiologic stress
- Occult blood in the stool
- Regurgitation of "coffee ground" material from the stomach, or bloody vomitus. (Curling's ulcer)

8. Diagnostic evaluation

- History collection
- Physical assessment
- Prolonged clotting, prothrombin time
- Serum carboxyhemoglobin levels
- Arterialblood gas levels are frequently used to assess for inhalation injuries.
- Bronchoscopy
- Xenon-133 (133Xe) ventilation-perfusion scans.
- Pulmonary function studies

9. Management

Burns management is divided into three phases namely the emergent phase(resuscitative), acute phase, and rehabilitative phase.

Emergency first aid management

• **Extinguish the flames.** When clothes catch fire, the flames can be extinguished if the victim falls to the floor or ground and rolls ("drop and roll"); anything available to smother the flames, such as a blanket, rug, or coat, may be used. Standing still forces the victim to breathe flames and smoke, and running fans the flames. If the burn source is electrical, the electrical source must be disconnected.

• **Cool the burn.** After the flames are extinguished, the burned area and adherent clothing are soaked with coolwater, briefly, to cool the wound and halt the burning process. Once a burn has been sustained, the application of cool water is the best first-aid measure. Soaking the burn area intermittently in cool water or applying cool towels gives immediate andstriking relief from pain and limits local tissue edema and damage. However, never apply ice directly to the burn, never wrap burn victims in ice, and neveruse cold soaks or dressings for longer than several minutes; such procedures may worsen the tissue damage and lead to hypothermia in patients with large burns.

• **Remove restrictive objects.** If possible, remove clothing immediately. Adherent clothing may be left in place once cooled. Other clothing and all jewellery should be removed to allow for assessment and to prevent constriction secondary to rapidly developing edema.

• **Cover the wound.** The burn should be covered as quickly as possible to minimize bacterial contamination and decrease pain by preventing air from coming into contact with the injured surface. Sterile dressings are best, but any clean, dry cloth can be used as an emergency dressing. Ointments and salves should notbe used. Other than the dressing, no medication or material should be applied to the burn wound.

• **Irrigate chemical burns.** Chemical burns resulting from contact with a corrosive material are irrigated immediately. Most chemical laboratories have a high-pressure shower for such emergencies. If such an injury occurs at home, brush off the chemical agent, remove clothes immediately, and rinse all areas of the body that have come in contact with the chemical. Rinsing can occur in the shower or any other source of continuous running water. If a chemical gets in or near the eyes, the eyes should be flushed with cool, clean waterimmediately. Outcomes for the patient with chemical burns are significantly improved by rapid, sustained flushing of the injury at the scene.

a) Emergent phase

It is the period of time required to resolve the immediate problems resulting from burn injury. It may last from burn onset to 5 or more days, but it usually lasts for 24-48 hours. It begins with fluid loss and edema formation and continues until fluid mobilization and dieresis begin. The management includes

Airway management

- Ensure for the patency of airway.
- Early intubation in case of face and neck burns is most important.
- Place the patient on ventilator and oxygenate.
- Assess the ABG values.
- Perform a fiberoptic bronchoscopy to assess the lower respiratory tract.
- Place the patient in high fowler's position unless contraindicated.
- Encourage deep breathing and coughing, provide chest physiotherapy.
- Reposition every 2nd hourly.
- Administer bronchodilators.

Fluid therapy

- Secure one or two large-bore intravenous replacement lines, either peripheral, or central to replace large amount of fluids.
- Assess the extent of burns and calculate the fluid accordingly
- Replace with crystalloids(R.L, saline,dextrose) or colloids or combination of both.

Formula to calculate fluid replacement(Parkland formula)

Total fluid replacement for1st 24 hours= 4ml R.L/Kg body weight/%TBSA

½ of total in 1st 8 hrs

¼ of total in 2nd 8 hrs

¼ of total in 3rd 8 hrs

Ex; for a 60 kg patient with 45% TBSA:

Total fluid for 24hrs = 4mlR.L*60*45% = 10800ml

1st8hrs = 5400ml

2nd 8 hrs = 2700ml

3^{rd}8hrs = 2700ml

- Assess the urinary output. It should be between 30-50ml/hr in adult.
- Monitor the B.P(systolic greater than 90-100mm of Hg), Pulse(<120/min), and Respiration(16-20/min).

Drug therapy

- Analgesics and sedatives

Morphine(drug of choice)

Meperidine

Fentanyl

Haloperidol

Lorazepam

Midazolam

- Tetanus immunization
- Antimicrobial agents
    - Silver sulfadiazine 1%
    - (Silvadene) watersolublecream
    - Mafenide acetate 5%to 10% (Sulfamylon)hydrophilic-basedcream
    - Silver nitrate 0.5%aqueous solution
    - Acticoat

Silver impregnated dressings are effective against many organisms.

Systemic antibiotics are initiated when there is a wound sepsis.

Super infections develop (as a result of antibiotic therapy) which are treated with nystatin.

Wound care

- Start hydrotherapy or cleansing by immersing in tub, shower cart. Use of a surgical detergent, disinfectant or cleansing agent is recommended.
- Debride as necessary. Remove loose necrotic tissue.
- Dress the wound by open or closed method. The dressings may be changed twice or three a day.
- Initiate topical antibiotic therapy
- Administer tetanus toxoid or tetanus antitoxin
- Skin grafting is done either from autografts or allografts

Nutritional therapy

- Begin I.V fluid replacement
- Insert nasogaastric tube for decompression.
- After return of bowel sounds oral intake can be initiated gradually, progressing to a diet high in protein and calories.
- Enteral feeding tube bypassing the stomach can be inserted to provide nutrients as they are absorbed very easily and quickly.

(i) Acute phase

Wound care

- Assess wound daily
- Observe for complications
- Continue hydrotherapy, cleansing
- Continue debridement
- Continue assessing for and treating pain and anxiety

  Wound care consists of daily observation, assessment, cleansing, and debridement. Wound care being in the emergent phase continues during the acute phase. Debridement, dressing changes, topical antibiotic therapy, graft care, and donor site care may be performed from two to three times daily or ones every few days. Enzymatic debriders may be used for the enzymatic debridement of burn wounds. Evacuation of blebs is done by aspiration with a tuberculin syringe or by pricking or cutting the peripheral margin of the bleb to the exit site. Donor site care should be given to promote rapid healing, decrease pain at the donor site, and prevent infection. Dressing of donor site is with acticoat, which releases silver; silver has an antimicrobial effect. Each donor site dressing has specific nursing care aspects.

Early excision and grafting

Early removal of the necrotic tissue followed by application of split-thickness autograft skin. This therapy has changed the management and mortality rate of burn patients. During the procedure of excision and grafting, eschar is removed down to the subcutaneous tissue or fascia, depending on the dgree of injury. A graft is then placed on clean, viable tissue and application of topical thrombin or epinephrine, after which the wound is covered with autograft (person's own) skin. Donor skin is taken from the patient for grafting by mean of

a dermatome, which removes a thin layer (split-thickness) of skin from an unburned site. Cultured epithelial autograft (CEA) is one method of obtaining skin tissue from a person with limited available skin for harvesting, CEA is grown from biopsies obtained from the patient's own skin.

- Provide homografts
- Provide autografts

Pain management

- Opiods every 1 to 3 hours for pain.
- The second intervention involves the use of several drugs in combination such as morphine with haloperidol (Haldol), lorazepam, diazepam or midazolam.
- Nonpharmacologic strategies such as the use of relaxation tapes.
- Hypnosis, art and play therapy, visualization, guided imagery, biofeedback, and meditation. These techniques are used as adjuncts to traditional pharmacologic treatments of pain. They are not meant to be used exclusively to control pain in the burn patient. The use of patient-controlled analgesia (PCA) is also important.

Physical & occupational therapy

A good time for exercise is during and after hydrotherapy when the skin is softer and bulky dressing are removed. Passive and active ROM should be performed on all joints.

The patient with neck burns should sleep without pillows or with the head hanging slightly over the top of the mattress to encourage hyperextension.

Splints should be custom-fitted by the occupational therapist and used to keep joints in functional positions and reexamined frequently to ensure an optimal fit.

Begin physical therapy for maintenance and rehabilitation of motion. Early ambulation is most important.

Nutritional therapy

The alert patient should be encouraged to eat high-carbohydrate foods to meet increased caloric needs. Ideally, weight loss should not be more than 10% of pre burn weight. Caloric requirements should be recalculated.

Psychosocial care

Provide support and counseling services

Pastoral services must be arranged if requested by patients or their family members.

Surgical management

Surgical options include;

- Split thickness and full thickness grafts.
- Skin flaps
- Z- plasties
- Tissue expansion

(ii) Rehabilitation phase

- Counsel and teach patient and family
- Encourage and assist patient in resuming self care
- Prevent or minimize contractures and scarring by using pressure garments.
- Use water based moisturizers and diphenhydramine to reduce itching.
- Protect healed burn area from sunlight to prevent hyperpigmentation.
- Discuss possible cosmetic or reconstructive surgery.

10. Complications

- Infection
- Delirium
- Electrolyte imbalances
- Contractures
- Curling's ulcer
- Hyperglycemia
- Paralytic ileus (absence of intestinal peristalsis)

11. Prevention of burns

- Keep matches and lighters out of the reach of children.
- Never leave children unattended around fire or inbathroom/bathtub.
- Install and maintain smoke detectors in the home.
- Develop and practice a home exit fire drill with all members ofthe household.
- Set the water heater temperature no higher than 120°F.

- Do not smoke in bed. Do not fall asleep while smoking.
- Do not throw flammable liquids onto an already burning fire.
- Do not use flammable liquids to start fires.
- Do not remove radiator cap from a hot engine.
- Watch for overhead electrical wires and underground wireswhen working outside.
- Never store flammable liquids near a fire source, such as a pilotlight.
- Use caution when cooking.
- Keep a working fire extinguisher in your home.

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