Burn Injury: Care of the client

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Introduction

A burn is an injury to the skin caused by chemicals, electricity, friction, heat, or radiation. Burns are classified by depth (1st-degree, superficial and deep partial-thickness, and full-thickness) and percentage of total body surface area (TBSA) involved. Complications and associated problems include hypovolemic shock, inhalation injury, infection, scarring, and contractures.

Structure and functions of the skin

The skin has three layers, the epidermis, dermis and the subcutaneous layer.

The epidermis is the outermost thin layer of the skin composed mostly of keratinocytes which originate from cells in the deepest layer of the epidermis called the basal layer. The outermost portion of the epidermis, known as the stratum corneum, is relatively waterproof and, when undamaged, prevents most bacteria, viruses, and other foreign substances from entering the body. This layer of skin is thicker in some parts of the body, such as the palm and sole of the feet. The basal layer of the epidermis contain cells called melanocytes, which produce the pigment melanin, which gives the skin its color and filter ultra violet radiations from the sun. The epidermis also contains Langerhans cells, which are part of the skin's immune system. The Langerhans cells help detect foreign substances and defend the body against infection, they also play a role in the development of skin allergies.

The dermis, the middle layer of the skin is made up of a thick layer of fibrous and elastic tissue (made mostly of collagen, elastin, and fibrillin) that gives the skin its flexibility and strength. The dermis contains nerve endings (sense pain, touch, pressure, and temperature), sweat glands (produce sweat in response to heat and stress); and sebaceous glands (secrete sebum into hair follicles), hair follicles (produce the various types of hair found throughout the body), and blood vessels (provide nutrients to the skin and help regulate body temperature).

The subcutaneous layer is the layer of fat that lies below the dermis. This layer helps insulate the body from heat and cold, provides protective padding, and serves as an energy storage area. The fat is contained in living

Objectives

- Describe the differences between partial and full-thickness burns.
- Describe how to estimate the size of a burn.
- Define the phases of burn injury and healing.
- Describe initial care of burns.
- Describe follow-up care of partial thickness burns.
- Discuss methods to prevent potential complications related to burn injury.
cells, called fat cells, held together by fibrous tissue. The fat layer varies in thickness in different parts of the body.

Beneath the skin are muscles, bones, and ligaments.

Functions of the skin

- Protection - intact skin is the first line of defense against bacterial and foreign-substance invasion
- Heat regulation
- Sensory perception
- Excretion
- Vitamin D production
- Expression - important with body image - fear of disfigurement

**Causes of burns**

Burns are caused by exposure to thermal (heat), electrical, chemical or radiation sources. Children under 5 years and the elderly are at increased risk of burn injury.

**Incidence of Burn Injury**

Children account for almost half of the population with severe burn injury and children below five years of age account for 50–80% of all childhood burns. Burns are the eleventh most common cause of death in children aged 1–9 years and the fifth most common cause of non-fatal childhood injuries. Globally, the majority of children with burns are boys with a ratio of 2:1 to girls, and there is a higher mortality rate from burns among boys.

According to the American Burn Association (ABA), hospital admission based on the type of burn breaks down as follows: fire or burn injury, 44%, scald injury, 33%, injury from contact with hot objects, 9%, electrical burns, 4%, chemical burns, 3%, miscellaneous causes, 7%.

Most childhood burns occur in the home; scalds are the most common burn type (accounting for 60–70% of all hospitalized burn patients), followed by flame and contact burns. The vast majority of adult burns occur in the home, outdoors or in the workplace. These result from thermal (scalds, flame, contact), electrical or chemical sources. Other important causes include radiation and extreme cold (frostbite).

**Causes/mechanism of burn injuries**

Understanding the pathophysiology of a burn injury is important for effective management. Different causes lead to different injury patterns, which require
different management. It is therefore important to understand how a burn was caused and what kind of physiological response it will induce.

**Thermal injuries**

**Scalds:** About 70% of burns in children are caused by scalds. They also often occur in elderly people. The common mechanisms are spilling hot drinks or liquids or being exposed to hot bathing water. Scalds tend to cause superficial to superficial dermal burns.

**Flame:** Flame burns comprise 50% of adult burns. They are often associated with inhalational injury and other concomitant trauma. Flame burns tend to be deep dermal or full thickness.

**Contact:** In order to get a burn from direct contact, the object touched must either have been extremely hot or the contact was abnormally long. The latter is a more common reason, and these types of burns are commonly seen in people with epilepsy or those who misuse alcohol or drugs. They are also seen in elderly people after a loss of consciousness. Burns from brief contact with very hot substances are usually due to industrial accidents. Contact burns tend to be deep dermal or full thickness.

**Electrical injuries**

About 3-4% of burn unit admissions are caused by electrocution injuries. An electric current will travel through the body from one point to another, creating “entry” and “exit” points. The tissue between these two points can be damaged by the current. The amount of heat generated, and hence the level of tissue damage, is equal to 0.24×(voltage)²×resistance. The voltage is therefore the main determinant of the degree of tissue damage. Electrocution injuries are divided into those caused by low voltage (under 1,000 V) or high voltage (1,000 V or higher). High voltage causes extensive tissue damage and often limb loss.

There is usually a large amount of soft and bony tissue necrosis. Muscle damage gives rise to rhabdomyolysis, and renal failure may occur with these injuries. This injury pattern needs more aggressive resuscitation and debridement than other burns. Electrical injuries can cause death by triggering ventricular fibrillation or paralyzing respiratory muscles. Although dysrhythmias can be triggered by low-voltage injuries, they’re more common in high-voltage injuries.

**Chemical injuries**

Chemical injuries are usually as a result of industrial accidents but may occur with household chemical products. Chemical burns tend to cause deep dermal or full thickness burns because the tissues continue to be damaged
until the chemical is completely removed or neutralized (e.g. by copious irrigation). Alkalis tend to penetrate deeper and cause worse burns than acids. Causes of chemical burns are strong acids, alkalis, and organic compounds.

Acids, common in household cleaners such as rust removers and bathroom cleaners, cause protein coagulation, which results in less extensive injuries.

Alkalis such as oven cleaners, Cement and fertilizers cause deeper burns due to liquefactive necrosis, which lets the chemical penetrate deeper into tissues.

Organic compounds that cause chemical burns include gasoline and chemical disinfectants, which can cause severe coagulative necrosis and produce a layer of thick, nonviable tissue called eschar, normally present in full-thickness burns.

The cardiac status of a client with electrical burns should be closely monitored for at least 24 hours following the injury to detect changes in electrical conduction of the heart.

The initial management of all chemical burns is the same irrespective of the agent. All contaminated clothing must be removed, and the area thoroughly irrigated. This is often best achieved by showering the patient. This has been shown to limit the depth of the burn. Litmus paper can be used to confirm removal of alkali or acid. Eye injuries should be irrigated copiously and referred to an ophthalmologist.

Classifications of burns

Depth/Degrees of injury

First-degree burns (superficial burn) affect only the outermost layer of the skin (epidermis). Symptoms include pain, redness, and swelling. First degree burn never blisters, they heal in three to four days (Usually within a week) without scarring. Sun burn is usually classified as superficial burn.

Second-degree (partial thickness) burns extend beneath the epidermis and into the dermis. Blisters form and the roof of the blister is dead.
skin (epidermis). Symptoms include pain, redness, swelling, and blistering. This type of injury is prone to infection. Second degree burns are divided into two depths:

i. **Superficial partial thickness burns** extend only through the first half of the dermis and generally heal in 10-14 days. Beneath the blister, these wounds are usually pink, moist, and painful and heal with minimal or no scarring or impairment. Deep partial thickness burns extend into the deeper layers of the dermis.

ii. **Deep dermal burns** are usually dry instead of moist, and not very painful. Often they are hard to distinguish from 3rd degree burns. Deep dermal burns heal in 3-8 weeks if they don't become infected. Without specialized care deep dermal burns are likely to leave severe scarring and functional deformity.

**Third-degree (full thickness)** burns extend into deeper tissues, through the dermis into the subcutaneous tissue, and may affect nerve endings. Symptoms include burns that appear white, brown, cherry red or black and may or may not have blisters, charred skin that may be numb. Full thickness burns are usually excised and grafted within days of the injury, to prevent infection usually resulting in a shortened hospital stay and improved outcomes.

Full thickness burns can damage muscles, leading to the development of myoglobinuria, in which urinary output becomes burgundy in color. The client with myoglobinuria may require hemodialysis to prevent tubular necrosis and acute renal failure.

**Table 1: Recognizing Burn Depths**

| Epidermal Burn | • Skin intact, blanch to pressure |
|               | • Erythema not included in % TBSA assessment |
|               | • Heal spontaneously within 3-7 days with moisturizer or protective dressing |
### Superficial Dermal Burn (Superficial Partial Thickness)
- Blisters present or denuded
- Blanch to pressure (under blister)
- Should heal within 7-10 days with minimal dressing requirements

### Mid Dermal Burn (Mid Partial Thickness)
- Heterogeneous, variable depths
- Blanches to pressure may have slow capillary return
- Should heal within 14 days
- Deeper areas or over a joint may need surgical intervention and referral

### Deep Dermal Burn (Deep Partial Thickness)
- Heterogeneous, variable depths
- Deeper areas may not blanch
- Generally need surgical intervention

### Full Thickness Burn
- Outer skin, and some underlying tissue dead
- Present as white, brown, black
- Surgical intervention and long-term scar management required
- Refer to specialist unit

Adapted from Agency for Clinical Innovation 2011 Clinical Practice Guidelines: Burn Patient Management.
Determining the total body surface area (TBSA)

There are three commonly used methods of estimating the burn area, and each has a role in different scenarios. These are

i. The Wallace rule of nine
ii. Palmar surface
iii. Lund and Browder chart

Area of erythema should not be included when calculating burn area. During assessment, it is important that all of the burn is exposed and assessed. The environment should be kept warm, and small segments of skin exposed at a time to reduce heat loss. It may be difficult to assess the skin in very dark individuals, therefore it may necessary to remove all the loose epidermal layers before calculating the burn size.

Wallace rule of nine: The Wallace rule of nine is a good, quick way of estimating medium to large burns in adults. The body is divided into areas of 9%, and the total burn area can be calculated. It method is not accurate in children.

Rule of 9’s for Adults: 9% for each arm, 18% for each leg, 9% for head, 18% for front torso, 18% for back torso.

Rule of 9’s for Children: 9% for each arm, 14% for each leg, 18% for head, 18% for front torso, 18% for back torso.

Palmar surface: The surface area of a patient’s palm (including fingers) is roughly 0.8% of total body surface area. Palmar surface area can be used to estimate relatively small burns (< 15% of total surface area) or
very large burns (> 85%, when unburnt skin is counted). For medium sized burns, it is inaccurate.

**Lund and Browder chart**: The Lund and Browder chart if used correctly, is the most accurate method of calculating burn area. It compensates for the variation in body shape with age and therefore can give an accurate assessment of burns area in children. The LB chart consists of two drawings of the human body — one of the anterior and the other of the posterior aspect of the human body (see image). The BSAP of the various parts of the body appears on either the corresponding part of the drawing and/or a separate table that goes alongside the drawings. The latter gives the BSAP according to age for the parts of the body that are affected by growth (simple areas of erythema should not be added). By adding up the estimated BSAP of the burn for the various parts of the body, the total BSAP that is affected by burns is calculated.
**More Classification of burn injury**

Burn injury can be classified as minor, moderate or major.

**Minor burn injury** involves a second degree burn or less than 15% of TBSA in adults and less than 10% in children. Or, it can involve a third degree burn of less than 2% TBSA but not involving areas requiring special care (face, eyes, ears, perineum, and joints of hands and feet). Minor burns do not include electrical burn injury, inhalation injury, those clients with concurrent illness or trauma, or age-related considerations.

**Moderate burn injury** involves second degree burns of 15%–20% TBSA in adults, 10%–20% in children, or third degree burns less than 10% TBSA that do not involve special care areas. Moderate burns, like minor burns, do not include electrical or inhalation injury, nor those with concurrent illness, trauma, or age-related considerations.

**Major burn injury** involves second degree burns greater than 25% TBSA in adults, 20% in children, or all third degree burns greater than 10% TBSA. Major burns include all burns involving the structures of the head and face, hands, feet, and perineum as well as electrical and inhalation injury, concurrent illness, and trauma regardless of age.

**Importance of burn injury Location**

Depending on a burn injury’s location, the patient may be predisposed to initial complications or complications during wound healing. Circumferential burns of the extremities, for example, can lead to vascular compromise resulting in compartment syndrome. Circumferential burns to the thorax can impair chest wall expansion, causing pulmonary insufficiency. Burns of the chest, head, and neck are also associated with pulmonary complications.

Facial burns are associated with corneal abrasions and burns of the ears with auricular chondritis. Burns of the perineal area are prone to auto-contamination by urine and feces.

Burns over joints immediately affect the patient's range of motion, which may be exacerbated later by hypertrophic scarring. Intensive therapy to prevent permanent disability is crucial.

**The Body’s response to burns (Pathophysiology of burns)**

**Local response:** The local response to a burn may be divided into three zones.

**Zone of coagulation:** This occurs at the point of maximum damage, usually the center of the injury. There is no tissue perfusion. There is
irreversible tissue loss resulting from denaturation of protein and thus coagulative necrosis.

**Zone of stasis:** The zone surrounds the points of maximum damage (central zone of coagulation). The zone of stasis is characterized by decreased tissue perfusion. The tissue in this zone can be salvaged with adequate management. The main aim of burns resuscitation is to increase tissue perfusion to this area and prevent any damage becoming irreversible. Any additional insults such as prolonged hypotension, infection, or edema can convert this zone into an area of complete tissue loss. The loss of tissue in the zone of stasis will lead to the wound deepening as well as widening.

**Zone of hyperemia:** This is the outermost zone (at the periphery of the wound), tissue perfusion is increased in this area. The tissue here will eventually fully recover unless there is severe sepsis or prolonged hypoperfusion.

**Systemic response**

Once the burn reaches 30% of total body surface area, the release of cytokines and other inflammatory mediators at the site of injury has a systemic effect.
**Cardiovascular changes**: increased capillary permeability, leads to loss of intravascular proteins and fluids into the interstitial compartment. Peripheral and splanchnic vasoconstriction occurs. There is decreased myocardial contractility, possibly due to release of tumor necrosis factor α. These changes, coupled with fluid loss from the burn wound, result in systemic hypotension and end organ hypoperfusion. Patients with electrical burn injury are at high risk for dysrhythmias, initiate continuous cardiac monitoring. Cervical collars and backboards should be used and kept in place until X-rays rule out spinal injury—many electrical injuries occur from contact with high voltage wires, causing a fall.

**Respiratory changes**: Respiratory system effects include direct airway injury; inhalation injury; carbon monoxide poisoning; smoke inhalation (damage to epithelial cells in the lower respiratory tract secondary to inhaling oxides, the products of combustion); alveolar damage; pulmonary edema; and decreased oxygen diffusion. Inflammatory mediators cause bronchoconstriction, and in severe burns adult respiratory distress syndrome can occur.

**Renal changes**: Renal system effects are indirect. Decreased cardiac output leads to decreased renal perfusion and oliguria that can culminate in acute kidney injury (AKI). In addition, after a burn injury, damaged red blood cells release hemoglobin and potassium, and skeletal muscle cells release myoglobin. Both hemoglobin and myoglobin are filtered by the glomerulus and degraded, releasing heme pigment. Heme pigment, especially in the setting of fluid volume deficit, can cause AKI. Marked release of hemoglobin or myoglobin usually causes red or brown urine.

**Neuroendocrine changes/metabolic changes**: Neuroendocrine system effects include increased metabolic rate to compensate for the initial low core body temperature due to loss of skin. The basal metabolic rate increases up to three times its original rate. The increased metabolic rate increases caloric needs and...
leads to catabolism and a negative nitrogen balance that slows tissue building and healing. Increased cortisol levels may cause insulin resistance and hyperglycemia.

*The basal metabolic rate increases up to three times its original rate. This, coupled with splanchnic hypoperfusion, necessitates early and aggressive enteral feeding to decrease catabolism and maintain gastrointestinal integrity.*

**Gastrointestinal changes:** Gastrointestinal system effects include ileus secondary to sympathetic nervous system (SNS) activation. Stress ulcer formation is triggered by the stress response and the histamine released in the acute inflammatory response. Intra-abdominal hypertension and abdominal compartment syndrome can damage the gut, kidneys, and liver.

**Immunological changes:** Immune system effects include immunosuppression secondary to the immediate, prolonged, and severe immunologic and inflammatory response to a major burn injury.

**Musculoskeletal changes:** Musculoskeletal system effects include contractures and complications secondary to immobility and scar tissue formation during the healing process.

Source: [http://www.ncbi.nlm.nih.gov/pmc/articles/PMC421790/bin/burns02.f3.jpg](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC421790/bin/burns02.f3.jpg)
### Assessment of burn injury.

**Table 2: Estimation of burn depth**

<table>
<thead>
<tr>
<th></th>
<th>Bleeding</th>
<th>Sensation</th>
<th>Appearance and blanching</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Bleeding</strong></td>
<td>Test bleeding with a 21 gauge needle. Brisk bleeding on superficial pricking indicates the burn is superficial or superficial dermal. Delayed bleeding on a deeper prick suggests a deep dermal burn, while no bleeding suggests a full thickness burn.</td>
<td><strong>Sensation</strong> Test sensation with a needle also. Pain equates with a superficial or superficial dermal burn, non-painful sensation equates with deep dermal injury, while full thickness injuries are insensate. However, this test is often inaccurate as edema also blunts sensation.</td>
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</table>
| 2 | **Appearance and blanching** Assessing burn depth by appearance is often difficult as burns may be covered with soot or dirt. Blister should be de-roofed to assess the base. | Capillary refill should be assessed by pressing with a sterile cotton bud.  
- A red, moist wound that obviously blanches and then rapidly refills is superficial.  
- A pale, dry but blanching wound that regains its color slowly is superficial dermal  
- Deep dermal injuries have a mottled cherry red color that does not blanch (fixed capillary staining). The blood is fixed within damaged capillaries in the deep dermal plexus  
- A dry, leathery or waxy, hard wound that does not blanch is full thickness. With extensive burns, full thickness burns can often be mistaken for unburnt skin in appearance. |  |

<table>
<thead>
<tr>
<th>Burn type</th>
<th>Superficial</th>
<th>Superficial dermal</th>
<th>Deep dermal</th>
<th>Full thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleeding on pin prick</td>
<td>Brisk</td>
<td>Brisk</td>
<td>Delayed</td>
<td>None</td>
</tr>
<tr>
<td>Sensation</td>
<td>Painful</td>
<td>Painful</td>
<td>Dull</td>
<td>None</td>
</tr>
<tr>
<td>Appearance</td>
<td>Red, glistening</td>
<td>Dry, whiter</td>
<td>Cherry red</td>
<td>Dry, white, leathery</td>
</tr>
<tr>
<td>Blanching to pressure</td>
<td>Yes, brisk return</td>
<td>Yes, slow return</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

The depth of burn is related to the amount of energy delivered in the injury and to the relative thickness of the skin. The dermis is thinner in very young and very old people. While assess burn consider the layers of skin involved as previously discussed. Partial thickness burns do not extend through all skin layers, whereas full thickness burns extend through all skin layers into the subcutaneous tissues. Assessing burn depth can be difficult. The patient's history will give clues to the expected depth: a flash burn is likely to be superficial, whereas a burn from a flame that was not rapidly extinguished will probably be deep.

On direct examination, four elements that should be assessed; bleeding on needle prick, sensation, appearance, and blanching to pressure. The nurse or the person doing the assessment will need a 21 gauge needle to complete the assessment. See table 1. Most burns are a mixture of different depths. Assessment of depth is important for planning treatment, as more superficial burns tend to heal spontaneously whereas deeper burns need surgical intervention, but is not necessary for calculating resuscitation formulas. In an acute situation, delaying fluid resuscitation to complete lengthy depth calculation is inappropriate.

**Phases of Burn Injury.**

Burn injury can be divided into three phases: emergent, acute and rehabilitative.

**Emergent or resuscitative phase**

Onset of injury to completion of fluid resuscitation

Begins with the burn injury, assessing severity, initial care and ends when the patient is stable and begins to diurese and no longer requires fluid therapy. Usually lasting about 72 hours. Care during this period focuses on stabilization and transport. The first 24 hours are the most critical.

**Acute or intermediate phase**

From beginning of diuresis to wound closure

Return of fluid from the cells (intracellular fluid) and between the cells (interstitial fluid) to the intravascular space and continuous care of the wounds to promote grafting, prevent infections, and promote healing. (May take weeks to months). The acute phase of injury is the majority of the patient’s time in the hospital. The focus during this time is infection control, wound care, pain control, nutritional support (as much as 10,000 calories a day may be required), surgical intervention, physical and occupational therapy, and
psychosocial support. Most patients are discharged home or to rehabilitation centers in the acute phase of injury.

**Rehabilitation phase**

From wound closure to return to optimal physical and psychosocial adjustment.

Helping the patient return to previous or optimal level of functioning. Many aspects of rehabilitation begins at the time of emergent care and continue through the phases. This phase can last for years. Complete rehabilitation may be lifelong, involving reconstructive procedures and contracture releases and attempts to reintegrate into society, school, work and relationships.

**Emergent or Resuscitative Phase**

During the emergent phase, rapid assessment and intervention are essential. During the emergent phase, the priority of client care involves maintaining an adequate airway and treating the client for burn shock. Initial assessment comprise a primary survey at the site of the injury that includes a rapid examination of the ABCs. *See below for first aid treatment.* It is crucial to determine if the client should be transferred to a burn center (see table 2 what patient should be transferred to the Burn specialty center?) In the secondary survey, a more comprehensive examination is needed. During the initial assessment, it is important to rule out associated trauma, determine the extent and depth of the burn, minimize edema by removing jewelry and elevating extremities, and monitor closely for changes in status. Fluid resuscitation should begin once TBSA is estimated (See fluid resuscitation after burn injury below).

History taking also is important during the emergent phase. The acronym AMPLE is a reminder to gather the basics: allergies, medications, past medical history, last meal and events preceding injury.

**First Aid Treatment for Burns**

Danger – Always ensure your own safety and wear appropriate personal protective equipment (PPE).

- Stop the burning process
- Cool the burn wound
  - Running water available - cold water irrigation for 20 minutes under cold running tap water (~15° C or 59° F).
Still cold water available - Submerge burned area in water or use towels/cloths soaked in water and applied to burns. Refresh the water in the towels every two to three minutes for total of 20 minutes. Remove jewelry and restrictive objects and cover the wound once cooling commenced.

Gently pat dry with clean towel

Keep non-burn area warm

Cover with non-adherent sterile (or at least clean) dressing (cling film (not face) or non-adherent dressing) to minimize bacterial contamination

If chemical burn: Brush off chemical contaminants, removing contaminated clothing, and flushing the area with running water.

Seek medical attention/help.

Then the ABCs

- A – Airway (protecting cervical spine)
- B – Breathing (add oxygen)
- C – Circulation (add hemorrhage control): large-bore IVs

Do assessment surveying all body systems and obtain a history of the incident and pertinent patient history

*Note: treat patient with falls and electrical injuries as for potential cervical spine injury*

Ice, ice-water or icepacks should never be used – it causes vasoconstriction leading to further tissue damage and hypothermia.

By understanding the types of burns and how to assess and manage them, nurses can immediately implement effective interventions while arrangements are made for patient transfer to a burn specialty center.

**Treat airway and breathing**: Maintaining the airway is the primary concern, especially if a patient has an inhalation injury. Assess for stridor (an ominous sign that suggests the patient’s upper airway is at least 85% narrowed), facial burns, soot in the nares or mouth, singed facial hair or nasal hair, edema of the lips and oral cavity, blisters in the roof of the mouth, coughing, hoarse voice, and circumferential neck burns. Endotracheal intubation with assisted ventilation might be required to achieve adequate oxygenation.

**Breathing**. Determine adequacy of ventilation by assessing the patient's respiratory rate and depth and observing for dyspnea. Auscultate the lungs, noting any adventitious breath sounds. Obtain a pulse oximetry reading (remembering that it may be inaccurate in the presence of carbon monoxide), and a co-oximetry reading if indicated and available.
Ensure proper circulation: Observe for obvious arterial bleeding. Assess for the presence, symmetry, amplitude, rate, and rhythm of pulses; evaluate capillary refill time, skin color, and temperature. Compromised circulation is evident by slowed capillary refill, a drop in normal blood pressure, and decreased urinary output. These symptoms signal impending burn shock.

Carbon monoxide poisoning

It is important to remember that the actual burns might not be the biggest survival issue facing burn clients. Carbon monoxide from inhaled smoke can develop into a critical problem as well. Carbon monoxide combines with hemoglobin to form carboxyhemoglobin, which binds to available hemoglobin 200 times more readily than with oxygen. Carbon monoxide poisoning causes a vasodilating effect, making the client have a characteristic cherry red appearance. Interventions for carbon monoxide poisoning focus on early intubation and mechanical ventilation with 100% oxygen.

Disability. Use the AVPU (Alert, Verbal, Pain stimuli, Unresponsive) scale to determine the patient's level of consciousness and carefully evaluate any abnormalities. Assess for hypoxia, decreased cerebral perfusion related to hypovolemia, and cerebral injury resulting from head trauma. Assess the patient's pupillary response to light and sensory and motor function.

Exposure/environmental control. Gently remove the patient’s nonadherent clothing and jewelry to prevent continued tissue damage. If the patient's face is burned, remove glasses or contact lenses. Cover the patient with a dry sterile sheet to prevent further contamination of the burn wounds and to provide warmth.

Obtain vital signs and establish I.V. access with two large-bore catheters if the patient has burns over 15% of TBSA. Under ABA practice guidelines, fluid resuscitation is indicated for any patient with nonsuperficial burns covering more than 15% of TBSA. Elevate burned extremities above heart level to decrease edema. Administer I.V. analgesia as prescribed and assess its effectiveness often, using a valid and reliable pain intensity rating scale.

Fluid and Electrotype Shifts—Emergent Phase

- Reduced blood volume and hemoconcentration (elevated hematocrit)

Fluid resuscitation after a burn.

The first 12 hours is very critical for the burn victim. Colloids have no advantage over crystalloids in maintaining circulatory volume. Fast fluid boluses probably have little benefit, as a rapid rise in intravascular hydrostatic pressure will just drive more fluid out of the circulation. However, much protein is lost through the burn wound, so there is a need to replace this oncotic loss. Some resuscitation regimens introduce colloid after the first eight hours, when the loss of fluid from the intravascular space is decreasing.
- Decreased urine output
- Trauma causes release of potassium into extracellular fluid: hyperkalemia
- Sodium traps in edema fluid and shifts into cells as potassium is released: hyponatremia
- Metabolic acidosis

**Table 2: What patient should be transferred to the Burn specialty center?**

Patients with burn injuries who should be referred to a burn center include:

- Extremes of age
  - All patients under age 1.
  - All patients ages 1 to 2 with burns over 5% or more of TBSA.
- Patients of any age with full-thickness burns of any size.
- Patients over age 2 with partial-thickness burns greater than 10% of TBSA.
- Patients with burns of special areas such as the face, hands, feet, genitalia, perineum, or major joints.
- Non-accidental injury
- Patients with chemical and electrical burns, including lightning injuries
- Patients with inhalation injury resulting from a fire or hot liquid burn.
- Patients with circumferential burns of the limbs or chest.
- Patients with preexisting medical (comorbid) conditions that could complicate burn management, prolong recovery, or affect survival.
- Patients with burns and concomitant trauma.
- Children with burns who are suspected to be victims of child abuse.
- Patients with septic burn wounds (Non-healed burn three weeks after injury)
- Patients whose burns require treatment that exceeds the capabilities of the referring facility.
Fluid resuscitation after burn injury

Fluid resuscitation efforts should be started as soon as possible for patients with burns covering more than 15% of TBSA; otherwise, the patient may experience hypovolemic shock. The nurse should insert an indwelling urinary catheter to closely monitor urinary output. The main aim of resuscitation is to maintain tissue perfusion to the zone of stasis and so prevent the burn deepening. Therefore fluid losses from the injury must be replaced to maintain homoeostasis. Several fluid resuscitation formulas are available and are based on the percentage of TBSA burned, the patient's weight in kilograms (kg), and the patient's age. All the fluid formulas are only guidelines, and their success relies on adjusting the amount of resuscitation fluid against monitored physiological parameters. Maintaining homeostasis is not a simple process, too little fluid will cause hypoperfusion whereas too much will lead to edema that will cause tissue hypoxia. Several fluid resuscitation formulas are available (for example, the Parkland formula) and usually is prescribed by the burn trauma surgeon. All formulas are based on the percentage of TBSA burned, the patient's weight in kilograms (kg), and the patient's age. This formula is only a guideline, since it does not take into consideration depth of burn, presence of inhalation injury, delay in treatment and alcohol use at time of injury. The presence of any of these factors may result in increased fluid needs.

The greatest amount of fluid loss in burn patients is in the first 24 hours after injury. For the first eight to 12 hours, there is a general shift of fluid from the intravascular to interstitial fluid compartments. This means that any fluid given during this time will rapidly leave the intravascular compartment. Calculations are guidelines only and refer to fluid required from the time of burn injury, not the time of presentation. Volumes refer to fluid resuscitation for the first 24 hours: half is given in the first 8 hours, and half over the subsequent 16 hours.

Fluid replacement formulas are calculated from the time of injury rather than from the time of arrival in the emergency room.

Fluid resuscitation is usually accomplished with an isotonic crystalloid such as lactated Ringer's solution or Hartmann’s solution. The lactate helps to buffer the metabolic acidosis commonly seen with hypoperfusion and burn
shock. Half of the prescribed fluid volume is administered in the first 8 hours postburn, and the remainder is given over the next 16 hours. The ABA recommends titrating the fluids to maintain a urine output of 30 to 50 mL/hour in adults and 1 mL/kg/hour in children weighing less than 30 kg (66.1 lb). The adult guideline is used for children weighing 30 kg or more. In the case of a patient who's sustained a high-voltage electrical burn, the target range for urine output is 75 to 100 mL/hour to prevent renal tubular obstruction from heme pigment. The nurse should monitor the patient's mental status, vital signs, hourly urine output, and urine specific gravity; these are valuable indicators of the patient’s response to fluid resuscitation.

Colloid use is controversial: some units introduce colloid after eight hours, as the capillary leak begins to shut down, whereas others wait until 24 hours. Fresh frozen plasma is often used in children, and albumin or synthetic high molecular weight starches are used in adults. The patient laboratory result should be evaluated at intervals of four to six hours for monitoring a patient’s resuscitation status. These include packed cell volume, plasma sodium, base excess, and lactate.

All pain medication should be given intravenously, tetanus status should be checked and baseline laboratory values obtained. Once stabilized, some patients are more appropriately cared for at burn centers. Initial wound care should include stopping the burning process, covering the burn wound and keeping the patient warm.

**Additional intervention during the emergent phase**
These additional interventions are taken after assessment of airway and establishing IV access for fluid replacement. Airway and maintaining fluid volume take priority over all the other interventions:

- Administering a tetanus booster
- Inserting a urinary catheter for determining hourly output
- Inserting a nasogastric tube attached to low suction to minimize aspiration
- Elevating burned extremities to lessen edema formation

**Potential Complications during the Emergent Phase of Burn Care**

**Acute respiratory failure:** Assess for increasing dyspnea, stridor, and changes in respiratory patterns; monitor pulse oximetry and ABG values to detect problematic oxygen saturation and increasing CO2; monitor chest x-rays; assess for cerebral hypoxia (e.g., restlessness, confusion); report deteriorating respiratory status immediately to the physician; and assist as needed with intubation or escharotomy.

**Distributive shock:** Maintain blood pressure of greater than 100 mm Hg systolic and urine output of 30-50 mL/hr, maintain serum sodium at near-normal levels. Prompt fluid resuscitation maintains the blood pressure in the low-normal range and improves cardiac output. Monitor for early signs of shock (decreased urine output, cardiac output, pulmonary artery pressure, pulmonary capillary wedge pressure, blood pressure, or increasing pulse) or progressive edema. Administer fluid resuscitation as ordered in response to physical findings; continue monitoring fluid status.

**Acute renal failure:** Monitor and report abnormal urine output and quality, blood urea nitrogen (BUN) and creatinine levels; assess for urine hemoglobin or myoglobin; administer increased fluids as prescribed.

**Compartment syndrome:** Assess peripheral pulses hourly with Doppler; assess neurovascular status of extremities hourly (warmth, capillary refill, sensation, and movement); remove blood pressure cuff after each reading; elevate burned extremities; report any extremity pain, loss of peripheral pulses or sensation; prepare to assist with escharotomies.

**Paralytic ileus:** Maintain nasogastric tube on low intermittent suction until bowel sounds resume; assess the abdomen regularly for distention and bowel sounds.

Curling’s ulcer: Assess gastric aspirate for blood and pH; assess stools for occult blood; administer proton pump inhibitors, antacids and histamine blockers (e.g., protonix or ranitidine [Zantac]) as prescribed.
**Acute/ Intermediate Phase**

The acute or intermediate phase begins 48 to 72 hours after the burn injury. The nurse should continue to assess and maintain respiratory and circulatory support. Prevention of infection, wound care, pain management, and nutritional support are priorities in this stage. Changes in capillary permeability and a return of osmotic pressure bring about diuresis or increased urinary output. If renal and cardiac functions do not return to normal, the added fluid volume, which prevented hypovolemic shock, might now produce symptoms of congestive heart failure. Assessment of central venous pressure provides information regarding the client’s fluid status.

**Fluid and Electrolyte Shifts—Acute Phase**

During the acute phase fluid reenters the vascular space from the interstitial space leading to

- Hemodilution
- Increased urinary output
- Sodium is lost with diuresis and due to dilution as fluid enter vascular space: hyponatremia
- Potassium shifts from extracellular fluid into cells: potential hypokalemia
- Metabolic acidosis

Wound care treatment choices are determined by the depth and location of the burn, healing time, available resources, comorbid medical conditions and the likelihood of patient compliance. During the intermediate phase, attention is given to removing the eschar and other cellular debris from the burned area. Debridement, the process of removing eschar, can be done placing the client in a tub or shower and gently washing the burned tissue away with mild soap and water or by the use of enzymes, substances that digest the burned tissue. Santyl (collagenase) is an important debriding agent for burn wounds. The dead skin of open blisters should be removed, and large or friable blisters should also be “deroofed” (the outer layer removed). Small blisters may be left intact. Following debridement, the wound is treated with a topical antibiotic and a dressing is applied.

*Note: Enzymatic debridement should not be used for burns greater than 10% TBSA, for burns near the eyes, or for burns involving muscle.*
Most topical Because of their bacteriostatic and bactericidal properties, topical agents containing silver are commonly used for treating burns. Commonly used topical antibiotics include; silver sulfadiazine (Silvadene); mafenide acetate (Sulfamylon); and silver nitrate, which can be used in an aqueous solution of 0.5% or Acticoat, a prepared dressing impregnated with silver nitrate.

- Silver nitrate has bacteriostatic properties that inhibit bacterial growth.
- Mafenide acetate, although painful, is useful in preventing Pseudomonas infections.
- Silvadene cools and soothes the burn wound but does not prevent infection.

The objectives of dressing for burn injury

Dressing is a therapeutic method which aims to

- prevent infection
- facilitate healing
- diminish pain
- limit the care load
- avoid limitation of movement.

Methods of treating burns

Open method or Exposure method: Burn is covered with topical antibiotic with no dressing over the wound.

- Face, neck, perineum, trunk
- Allowing exudate to dry in 3 days

Occlusive: Multiple dressing changes: sterilized gauze dressings are laid over a topical antibiotic; dressings may be changed from 1-3 times every 12 hours to once every 3 days

- Less pain, absorption of secretion, comfort, transportability, accelerated debridement
- Aesthetic considerations

Semi-open method: consists of covering the wound with topical Antimicrobial agents and gauze.

- Covering of wound with topical antimicrobials:
  - Silver sulfadiazine 1% (Flamazine)
  - Silver nitrate 0.5% sol’n
  - Mafenide acetate (sulfamylon acetate)
Dressings for Burns

Dressings for burns include standard wound dressings (sterile gauze) and biologic or biosynthetic dressings (grafts, amniotic membranes, cultured skin, and artificial skin).

**Standard Wound Dressings:** The use of standard wound dressings makes the client more comfortable by preventing exposure of the wound to air. These dressings are usually applied every shift or once a day.

**Biologic or Biosynthetic Dressings (Skin Graft):** Biologic dressings are obtained from either human tissue (homograft or allograft) or animal tissue (heterograft or xenograft). These dressings, which are temporary, are used for clients with partial thickness or granulating full thickness injuries. The type of biologic dressing used depends on the type of wound and availability of the graft.

Homografts or allografts are taken from cadaver donors and obtained through a skin bank. These grafts are expensive and there is a risk of blood-borne infection. Heterografts or xenografts are taken from animal sources. The most common heterograft is pigskin because of its compatibility with human skin.

Amniotic membrane is used for full thickness burns because it adheres immediately to the wound. It is also an effective covering for partial thickness burns until reepithelization occurs. Amniotic membrane is low in cost, and its size allows for coverage of large wounds.

Cultured skin can be obtained by using a biopsy of epidermal cells taken from unburned portions of the client’s body. The cells are grown in a laboratory and grafted to generate permanent skin. The process is long and costly, and extreme care is needed to prevent damage and loss of the graft.

Artificial skin (Integra) made of synthetic material and animal collagen becomes a part of the client’s skin. The graft site is pliable, there is less hypertrophic scarring, and its use is helping to eliminate the need for compression dressings like the Jobst garment during the rehabilitative phase of care.

Permanent grafts include the autograft or skin transferred from an unburned area of the client’s body to the burn wound. The client generally experiences more pain from the donor site than from the burn wound because the donor site has many pain receptors. The client should receive pain medication, and both the donor site and graft site should be carefully monitored for signs of infection.
**Graft Survival depends on**

- Recipient bed must have adequate blood supply
- Graft must be in close contact with recipient bed
- Graft must be immobilized
- Free from infection

Once a burn has healed, the graft area should be regularly moisturized and protected from the sun by sunblock cream or clothing. Physiotherapy may be required to prevent burn contractures.

**Other special burn care measures**

- Facial care: Open method used. Gently debride nose; skin care if NG tube
- Eye care: antibiotic ointment used; assess periorbital edema
- Ears should be kept free of pressure- may lose cartilage if rub too hard; antibiotic ear drops to prevent infection.
- NO pillows! Neck may grow together; ears may get rubbed off
- Hands and arms: extended and elevated on pillows or slings to decrease dependent edema; assess for limb compartment syndrome (CMS-circulation/motor/sensory)- may need escharotomy; fingers and toes wrapped individually so they don’t heal (grow) together.
- Splints & exercise to prevent contractures (Physical Therapy)

**Potential Complications during the Acute Phase of Burn Care**

Complications found during the intermediate phase include infections, the development of Curling’s ulcer, paralytic ileus, anemia, disseminated intravascular coagulation, and acute respiratory failure.

**Heart failure:** Assess for fluid overload, decreased cardiac output, oliguria, jugular vein distention, edema, or onset of S3 or S4 heart sounds.

**Pulmonary edema:** Assess for increasing CVP, pulmonary artery and wedge pressures, and crackles; report promptly. Position comfortably with head elevated unless contraindicated. Administer medications and oxygen as prescribed and assess response.

**Sepsis:** Sepsis is the leading cause of death following burn injury. Bacterial infections (staphylococcus, proteus, pseudomonas, escherichia coli, and klebsiella) are common due to optimal growth conditions posed by the burn wound; however, the primary source of infection appears to be the client’s own intestinal tract. As a rule, systemic antibiotics are avoided unless an actual infection exists.
Assess for increased temperature, increased pulse, widened pulse pressure, and flushed, dry skin in unburned areas (early signs), and note trends in the data. Perform wound and blood cultures as prescribed. Give scheduled antibiotics on time.

**Acute respiratory failure:** Monitor respiratory status for dyspnea, change in respiratory pattern, and onset of adventitious sounds. Assess for decrease in tidal volume and lung compliance in patients on mechanical ventilation. The hallmark of onset of ARDS is hypoxemia on 100% oxygen, decreased lung compliance, and significant shunting; notify physician of deteriorating respiratory status.

**Visceral damage (electrical burns):** Monitor electrocardiogram (ECG) and report dysrhythmias; pay attention to pain related to deep muscle ischemia and report. Early detection may minimize severity of this complication. Fasciotomies may be necessary to relieve swelling and ischemia in the muscles and fascia; monitor patient for excessive blood loss and hypovolemia after fasciotomy.

**Management during the rehabilitative Phase of Burn Care**

Rehabilitation is begun as early as possible in the emergent phase and extends for a long period after the injury. Focus is on wound healing, psychosocial support, self-image, lifestyle, and restoring maximal functional abilities so the patient can have the best quality life, both personally and socially. The patient may need reconstructive surgery to improve function and appearance. Vocational counseling and support groups may assist the patient. Patient and family education is a priority in the acute and rehabilitation phases. In the rehabilitative phase, the focus is on helping the client return to preinjury life. If that is not possible, the focus is on helping the client adjust to the changes the injury has imposed.

**Nursing diagnosis during the rehabilitation phase of Burn injury**

- Activity intolerance related to pain on exercise, limited joint mobility, muscle wasting, and limited endurance
- Disturbed body image related to altered appearance and self-concept
- Deficient knowledge of post discharge home care and recovery needs

**Potential Complications during the rehabilitation Phase of Burn Care**

**Skin and joint contractures:** (most common complication during this phase). Provide early and aggressive physical and occupational therapy; support patient if surgery is needed to achieve full range of motion.
Inadequate psychological adaptation to burn injury: Reintegration into society is difficult due to the disfigurement associated with burn injury. Support is available through various groups typically based at burn centers. School re-entry programs are available to help children with the transition back to school. A peer support counseling network, Survivors Offering Assistance in Recovery, is available throughout many areas of the country. A burn injury is challenging and requires specialized care across the continuum. Nurses are ideally suited to facilitate this process. Obtain psychological or psychiatric referral as soon as evidence of major coping problems appears.

Nursing and collaborative care during rehabilitation phase

- Both patient and family actively learn how to care for healing wounds
- An emollient water-based cream should be used
- Pressure garments to reduce hypertrophic scarring by providing even pressure on the skin. Wear 6 months to year post graft-23 hrs a day.
- Cosmetic surgery is often needed following major burns
- Exercise extremely important; constant encouragement and
- Reassurance; address spiritual and cultural needs; maintain a high-calorie diet; occupational therapy

Pruritus can be problematic, caused by a combination of dry skin and the release of histamine during scar remodeling. The oral antihistamines diphenhydramine (Benadryl) and hydroxyzine (Altarax) can be helpful. Topical and oral doxepin (Prudoxin) can minimize pruritus. Other relief strategies include cool or tepid baths, pressure garments, massage, avoidance of caffeine and the application of ice.

Sensitivity to heat and cold is a problem for many patients with a high TBSA. These patients should avoid extremes in temperature, especially in the first year post-injury. They should dress appropriately for the weather, with an emphasis on layers of clothing that can be removed as needed.

Grafted areas have decreased sensation and require visual inspection for open areas. Educate patients about signs of heat sensitivity and methods to avoid overheating, particularly patients with large areas of skin grafting. The sweat glands are not intact in grafted areas.

Diagnostic Tests for Review in Burn injury

The following are routine tests done on most all hospital admissions. For the client, it is a way of monitoring the hemodynamic changes (development of anemia and so on) as well as changes in renal function. The chest x-ray lets the nurse know whether there has been an inhalation injury, a development of
pneumonia, changes associated with ARDS, and so on. The complete metabolic panel gives information on electrolyte status, guiding the type of IV fluid to use, as well as whether additional electrolytes are needed. The following are the tests that should be performed:

- CBC
- Complete metabolic panel
- Urinalysis
- Chest x-ray

**Medications used in the management of burn injury**

A client with burn injuries is particularly vulnerable to infection because he has lost the first line of defense, the skin. In fact, post-burn infection is a major cause of morbidity and mortality; therefore, it is helpful to review topical antibiotics used to treat those with burns. Other complications of burns include anemia and stress ulcers. A review of medications used to treat anemia as well as medications to prevent ulcers and the bleeding that can occur will be helpful. Narcotic analgesics, particularly opiate derivatives are used in controlling pain and providing sedation during the emergent and intermediate phases of burn care. A review of these categories, as seen in the following list, will better prepare you to care for a client with burns:

- Topical antibiotics
- Antianemicals
- Antacids
- Narcotic analgesics

**Pain Management after burn injury**

Burn pain has been described as one of the most severe forms of acute pain. Pain accompanies care, and treatments such as wound cleaning and dressing changes. Analgesics such as Morphine and Fentanyl are administered IV during emergent and acute phases. Pain medication is given intravenously to provide quick, optimal relief and to prevent overmedication as edema subsides and fluid shift is resolving. Medicate patient before procedures-debridement, exercise, etc.

**Nutritional Support after burn injury**

Burn injuries produce profound metabolic abnormalities, and patient with burns have great nutritional needs related to stress response, hypermetabolism, and requirement for wound healing. Anaemia and malnutrition prevent burn wound healing and result in failure of skin grafts.
Goal of nutritional support is to promote a state of nitrogen balance and match nutrient utilization. Fluid replacement takes priority over nutritional needs. Early and aggressive nutritional support within hours of burn injury to decrease mortality and complications; optimize wound healing; minimize negative effects; central line with TPN

Enteral feedings are usually instituted within the first 24 hours to meet the client’s increased caloric needs and maintain the integrity of the intestinal mucosa thereby minimizing systemic sepsis.

**Hypermetabolic state:** Resting metabolic expenditure may be increased by 50% to 100% above normal; core temperature is elevated; caloric needs are about 5000 kcal/day; TPN and early continuous enteral feeding promotes optimal conditions for wound healing; supplemental vitamins and iron may be given. This state of hypermetabolism lasts through wound closure at end of acute phase.

Nutritional management of the burn patient is promotion of protein anabolism. Nutritional support is based upon patient preburn status and % of TBSA burned. Enteral route is preferred. Jejunal feedings are frequently utilized to maintain nutritional status with lower risk of aspiration in a patient with poor appetite, weakness, or other problems.

TPN through central line and once bowel function return - NG tube feedings or oral feedings; caloric needs should be calculated by dietitian; high-protein, high carbohydrate foods; diet supplements (as egg nog); patients should be weighed regularly.

**Gerontology considerations:** Normal aging puts the patient at risk for injury because of unsteady gait; failing eyesight; diminished hearing; preexisting medical conditions; wounds take longer to heal

**Emotional needs of patient and family:** Family members need to understand. Importance of reestablishing the patients independence; encourage the family to participate as team members during hospitalization; early psychiatric intervention; sexuality addressed; family and patient support groups.

**Prevention of complications**

**Escharotomy:** A circumferential deep dermal or full thickness burn is inelastic and on an extremity will not stretch. Fluid resuscitation leads to the development of burn wound edema and swelling of the tissue beneath this inelastic burnt tissue. Tissue pressures rise and can impair peripheral circulation. Circumferential chest burns can also cause problems by limiting
chest excursion and impairing ventilation. Escharotomy, division of the burn eschar is performed. Only the burnt tissue is divided, not any underlying fascia, differentiating this procedure from a fasciotomy.

- **Disfigurement: Prevention of Contractures After Burn Injury:**
  Physical and occupational therapy: good time for exercise is during cleaning; passive and active ROM; splints should be custom-fitted and used to provide functional positioning of body part.

- **Scaring:** Elastic Pressure Garments Prevent hypertrophic burn scarring.

- **Infection**

- **Post-traumatic stress disorder:** Psychosocial care by social worker; nursing staff; pastoral care
Learn more about it/ References


**NCLEX style question.**

1. The nurse is observing a co-worker who is caring for a client who is brought to the burn center for extensive burn injury to the trunk and extremities. Which of these actions when noted by the nurse during assessment of a burn patient indicate the most appropriate action?
   a. The nurse pulls the privacy curtain closed, washed her hands and exposes the client’s whole body to assess the burn area.
   b. The nurse performed hand hygiene, explains what she is doing to the client and proceeds to sequentially expose small area at a time.
   c. The nurse starts washes her hands, and proceeded to expose the entire area of burns for assessment.
   d. The nurse washes her hand, assesses the client’s wounds and proceeds to administer the prescribed pain medication.

2. The nurse is caring for a client admitted after a 20% TBSA burn injury. The nurse should monitor and document these indicators of adequate fluid resuscitation. Select all that apply.
   a. Patient’s mental status clear sensorium
   b. Patient’s urine output Q 4 hours
   c. Patient’s systolic blood pressure > 100 mmHg
   d. Patient’s heart rate between 100 and 120b/m
   e. Patient’s urine specific gravity

3. The nurse is collecting admission data on a client who experienced a burn injury during a house fire. Which of the following clinical manifestation should alert the nurse to possible carbon monoxide poisoning?
   a. Pulse oximetry reading of 80%
   b. Expiratory stridor and nasal flaring
   c. Presence of carbonaceous particles in the sputum
   d. Cherry red color to the mucous membranes

4. A client with burn injury is admitted. Upon assessment the nurse finds 12 hours after the client was initially burned, bowel sounds are absent in all four abdominal quadrants. What is the nurse’s best action?
   a. Reposition the client onto the right side.
   b. Document the finding as the only action.
   c. Notify the emergency team.
   d. Increase the IV flow rate

5. A client with burn injury is admitted. Upon assessment the nurse finds 12 hours after the client was initially burned, bowel sounds are absent in all four abdominal quadrants. The nurse recognizes that because of the client’s diagnosis, the findings are probably due to
a. Bowel obstruction  
b. Curling ulcers  
c. Fluid overload  
d. Paralytic ileus

6. The nurse is caring for a client with scheduled to have pigskin graft to a burn area. The nurse will correctly explain to the client that the surgeon will apply which type of graft? (pg. 1823)  
a. Isograft  
b. Heterograft.  
c. Autograft  
d. Allograft  
e. Homograft

7. A client with third degree buns to the face asked the nurse, “What exactly is this Mechanical debridement the doctor keeps talking about?” Which of these would represent the most appropriate response by the nurse? “Mechanical debridement is

a. the use of topica enzymatic agent to remove dead tissue from the burn areas.”  
b. the use of surgical tools to separate and remove burnt dead skin to promote healing.”  
c. The use of chemicals to remove dead tissue and cover the wound with donor skin.  
d. The surgical incision into the eschar to relieve the pressure on the tissue beneath the burn.

8. The nurse is performing assessment on a client with second degree burn. Which image below correctly illustrates the client’s diagnosis?
9. The nurse is performing assessment on a client with second degree burn. The shaded area in the image indicates the part of the body burnt. Calculate the percentage of the body that was burnt using the Rule of Nines.

10. The nurse is performing assessment on a client with second degree burn. The shaded area in the image indicates the part of the body burnt. Calculate the percentage of the body that was burnt using the Rule of Nines.

11. The nurse is caring for a client with severe burn. Which of these lab test are most indicative for assessment of fluid loss?
   a. Blood urea Nitrogen
   b. Blood pH value
   c. Hematocrit levels
   d. Erythrocyte sedimentation rate.
12. The nurse is planning care for a client with extensive burn injury 3 days after admission. The nurse would be most concerned about which of these client’s problems.
   a. Severe pain
   b. Maintenance of sterility
   c. Alteration in body image
   d. Frequent dressing changes

13. A client has a nursing diagnosis of disturbed body image related to burn injury. Which of these actions by the nurse would represent appropriate care for this client?
   a. Removing mirror until the client's physical appearance has improved
   b. Conveying a positive attitude towards the client
   c. Reminding the family members to avoid comments about the client’s appearance
   d. Arranging for the client to meet other clients with burn injuries.

14. The nurse is caring for a client who sustained a partial thickness burn to the lower leg accounting for 5% of the total body surface area 1 day ago. Which of these represents an appropriate primary short-term goal established by the nurse and client?
   a. The burns will heal free of infection.
   b. The airway will remain patent
   c. The pain will remain at 2 or less on a scale of 0 to 10
   d. The urine output will exceed 30 mL every hour.

15. After reviewing a client serum electrolyte levels the provider prescribes an isotonic intravenous (IV) infusion. Which IV solution should the nurse plan to administer?
   a. 5% dextrose in water
   b. 10% dextrose in water
   c. 3% sodium chloride solution
   d. 0.45% sodium chloride solution

16. The nurse is caring for a client who is receiving parenteral nutrition through a central venous catheter. Which of these actions by the nurse would represent appropriate care for this client to prevent infection?
   a. Track the client’s oral temperature
   b. Administer antibiotics intravenously
   c. Use sterile technique for dressing changes
   d. Evaluate the differential of the leukocytes

17. A client has just been admitted to the burn unit. The client is being evaluated for burns to his chest and upper leg. The client complained of thirst then asked for a drink. What is the most appropriate nursing action?
   a. Order the client a meal tray
   b. Keep the client NPO
   c. Give a glass of clear liquid
   d. Give a glass of full liquid
18. A factory worker burn injury from steam pipe explosion. The burn areas are painful, mottled red, weeping and edematous. Which of these is the most appropriate classification of the burn by the nurse?

   a. Full thickness burn
   b. Deep partial thickness burn
   c. Eschar
   d. Superficial partial thickness burn

19. The nurse is caring for a client during the first few hours after admission to the burn unit with partial thickness burns of the trunk and head. Which of these potential problems will be of the least concern for the nurse during the emergent phase of a burn injury?

   a. Leukopenia
   b. Pain
   c. Laryngeal edema
   d. Fluid volume deficit.

20. The nurse is caring for a client during the first few hours after admission to the burn unit with partial thickness burns of the trunk and head. Which of these potential problems will be of great concern for the nurse during the emergent phase of a burn injury? Select all that apply.

   a. Pain
   b. Leukopenia
   c. Circulatory collapse
   d. Laryngeal edema
   e. Fluid volume deficit.

21. The nurse is conducting assessment of multiple burn victims after a gas explosion at welding factory. Which of these client should be transferred immediately to the burn center? Select all that apply.

   a. Third-degree burns covering more than 5% of TBSA
   b. Burn injury caused by lightening
   c. Chemical burns with threat of functional compromise
   d. Second degree burns to 2.5% of the leg.
   e. Circumferential burns on the extremities or the chest
   f. Second-degree burns involving the hands and feet

22. The nurse is caring for a client who weighs 198 lbs. with second degree burn to the shaded area in the indicated in the image. Using The Parkland formula calculate the amount of fluid required by this client the first 24 hours.
23. (From question 22 above) How much fluid should the nurse plan to administer to the client in the first 8 hours?
   a. 12,960 mL
   b. 28,512 mL
   c. 21,384 mL
   d. 9,720 mL

24. The nurse is caring for a client who weighs 180 lbs. with second degree burn to the shaded area in the indicated in the image. Using The Parkland formula calculate the amount of fluid required by this client the first 8 hours.

25. The nurse is caring for a client during the emergent phase of a severe burn injury. Which parenteral intervention prescribed by the provider should the nurse question?
a. Hypertonic saline solution
b. Potassium chloride solution
c. Lactated ringers solution
d. Intravenous Colloids

26. The nurse is performing assessment on a client during the first 24 hours after a burn injury. Which of the following findings indicate adequate fluid replacement therapy?

a. Slowing of a previously rapid pulse
b. Decreasing CVP reading
c. Urinary output of 18 to 25 mL per hour
d. Increased hematocrit level from 50% to 55%

27. The nurse places a client with severe burns on a circulating air bed. The nurse accurately explains the primary reason for this intervention to the client as

a. “The bed increases mobility.”
b. “The bed prevents contracture.”
c. “The bed will limit orthostatic hypotension”
d. “The bed will prevent Pressure on the peripheral blood vessels.”

28. The nurse is caring for a client with a circumferential deep dermal burn to the left thigh who has no pedal pulse. Which of these actions by the nurse would represent appropriate care for this client?

a. Perform escharotomy immediately
b. Notify the physician immediately.
c. Document the finding and continue to monitor.
d. Elevate the legs on a pillow immediately

29. A client with burn injury is being treated with moist exposure burn therapy method. Which of these information should the nurse include in the teaching plan for the client?

a. Dressings will be changed every 3 days
b. Aseptic techniques are required
c. Bathing will not be permitted
d. Room temperature must be kept at 72°F

30. A severely burned client has been hospitalized for 2 days. Until now recovery has been uneventful, but the client begins to exhibit extreme restlessness. The nurse recognizes that because of the client’s diagnosis, the findings are probably due to

a. Kidney failure
b. Cerebral hypoxia
c. Fluid overload
d. Metabolic acidosis

31. The nurse is caring for a client with 35% total body surface area burn in a fire. The client is 48 hours post burn. The nurse documents that the client is moving from the emergent to the acute phase of burn management. Which of these findings supports the nurse’s conclusion?
a. Hypokalemia  
b. Decreased blood pressure  
c. Increased urine specific gravity  
d. Hypoglycemia

32. A student nurse asks the nurse about the meaning of full thickness burn. The nurse accurately responds that burns classified as full thickness involve tissue destruction down to which of these levels

a. Epidermis  
b. Subcutaneous tissue  
c. Bone  
d. Dermis

33. The nurse is teaching a group of high school students the layer of tissue burned during a second degree burn. Which of these locations should the nurse identify to the students?

34. Which stated by a client would indicate that the client has achieved expected outcomes after a burn injury? Select all that apply.

a. “I used to wake up almost every hour with nightmares of being burned, but now it occurs once or twice a night.”  
b. “How do you like my new wig? My husband helped me select it. I always wanted a blond hair, and I think it makes me look terrific.”  
c. “Now that I am in outpatient rehabilitation, I have ben socializing a lot more with my friends, I even joined a yoga class.”  
d. “I wish I had not picked up that burning pan from the stove to throw it outdoors; but it was such an instant react.”
e. “I haven’t been able to think about returning to work yet; I am so busy with my daily physical therapy and learning how to do the dressing changes for myself.”

35. The client returns from the operating room with a partial thickness skin graft on her left arm following a burn injury. The donor tissue was taken from her left hip. It would be most appropriate for the nurse to include these interventions during the immediate post-op period. Select all that apply.

a. Monitor the pulse in the left arm every 4 hours.
b. Change the dressing on the graft site every 8 hours.
c. Elevate the left arm and provide complete rest of the grafted area.
d. Administer pain medication every 4 hours as ordered for pain at the donor site.
e. Encourage the client to ambulate as desired on the first postoperative day.
f. Perform range of motion (ROM) exercises to the left arm every 4 hours.

36. The nurse in the burn unit is admitting a client with partial thickness burns on the anterior and posterior aspect of both arms. Using the Rule of Nines, what percentage of the body is burned?

37. The nurse is assisting a client with burn injury to identify foods that will meet the requirement for a high protein, high calorie, and high residue diet. Which of the following represent correct choices for this diet?

a. Roast beef, a slice of white bread, a slice of cheese, and fruit cup.
b. Grilled fish, green beans, whole grain pasta, and ice cream
c. Cottage cheese, tomatoes, fried chicken, and cup of coffee
d. Fried chicken, green peas, white rice, and a chocolate bar.

38. A client has extensive burn with eschar on the anterior trunk. What is the nurse's primary concern regarding eschar formation?

a. It restricts the client’s ability to move around.
b. It prevents fluid remobilization in the first 48 hours after burn trauma.
c. Infection is difficult to assess before the eschar sloughs.
d. Circulation to the extremities is diminished because of edema formation

39. A 65 year old client was pulled out of a burning building with burns to the back and bilateral upper extremities and neck. During initial care of this client the nurse should focus on which of the following? Select all that apply.

a. Providing oral analgesics for pain management.
b. Cooling the burn with ice packs.
c. Establishing and maintaining a patent airway.
d. Keeping the patient warm to prevent heat loss.
e. Covering the burn wound.
f. Replacing lost fluids by intravenous fluids administration.
g. Replenishing protein loss by providing protein rich food orally.
40. Following a full-thickness (third-degree) burn of his left arm, a male client is treated with artificial skin. Which of the following statement by the client would indicate that the client understand the nurse’s instructions for postoperative care of artificial skin during the first 7 days? “I will restrict:
   a. High Protein diet.
   b. Fluid intake to 1.5 liters daily.
   c. Going outdoors during the day.
   d. Movement of the left arm

41. The nurse is caring for a client with burns on the legs. Which of these actions by the nurse would represent appropriate care for this client for the prevention of contractures?
   a. Applying knee splints to both legs
   b. Elevating the foot of the bed
   c. Hyperextending the client’s palms
   d. Encouraging the client to perform shoulder range-of-motion exercises.

42. The nurse in Wound Clinic is changing a dressing for a client after burn injury. Which of the following actions should the nurse take first?
   a. Putting on clean gloves and examine the wound.
   b. Slowly removing the soiled dressing from the wound.
   c. assessing and documenting the wound drainage in the dressing
   d. Performing a thorough hand washing

43. A male patient who weighs 70 kg sustained full-thickness burns over 40% of his body in an industrial accident is in the burn unit receiving fluid resuscitation. Which observations by the nurse would indicate that the fluid resuscitation is benefiting the patient?
   a. A weight gain of 4 lb (2 kg) in 24 hours
   b. Body temperature readings all within normal limits
   c. A urine output consistently above 100 ml/hour
   d. An electrocardiogram (ECG) showing no arrhythmias

44. The nurse is caring for a client admitted with burn injury. Upon assessment the nurse finds the patient is drooling and having difficulty swallowing. What is the nurse’s best first action?
   a. Begin intravenous fluids
   b. Preparing for intubation
   c. Loosening any dressings on the chest
   d. Obtain an electrocardiogram (ECG)
   e. 

45. The nurse is observing a co-worker who is performing sterile dressing change for a client who sustained burn injury to the right arm. Which of the following actions by the co-worker would require the nurse to intervene? The co-worker is

Client with burn injury.     Westafricaneducatednurses.org     8-May-16     pg. 42
a. Holding sterile objects above the waist  
b. Pouring solution onto a sterile field cloth  
c. Considering a 1” edge around the sterile field as being contaminated  
d. Opening the outermost flap of a sterile package away from the body

46. The nurse is teaching an adult client about recovery after burn injury. Which of the following statements by the client indicates correct understanding of rehabilitation after burn injury?
   a. “I will never be fully recovered from the burn, I have to learn to deal with it.”  
   b. “I am considered fully recovered when all the wounds are closed and there is no risk for infect.”  
   c. “I will be fully recovered when I am able to perform all the activities I did before my injury.”  
   d. “I will be fully recovered when I achieve the highest possible level of functioning that I can.”

47. A patient is brought to the emergency department with the following burn injuries: a blistered and reddened anterior trunk, reddened lower back, and pale, waxy anterior right arm. Calculate the extent of the burn injury (TBSA) using the rule of nines.

48. A patient is being discharged after treatment for a scald burn that caused a superficial burn over one hand and a superficial partial-thickness burn on several fingers. What should be included in this patient’s discharge instructions? Select all that apply.
   a. Report any fever to your healthcare provider.  
   b. Report development of purulent drainage to your healthcare provider.  
   c. Use only sterile dressings on the fingers.  
   d. Cleanse the areas every hour with alcohol to prevent infection.  
   e. Wrapped the fingers individually.  
   f. Apply the topical antimicrobial agent as instructed.

49. A client is admitted to the emergency department with a thermal burn to the right arm and leg. Which of these assessment findings require immediate action by the nurse?
   a. Burnt hair in the scalp  
   b. Increased thirst  
   c. Coughing and wheezing  
   d. Bright red skin with small blisters on the burn sites.

50. A nurse completed teaching a patient with a partial-thickness wound how to wear his elastic pressure garment. Which statements by the client would indicate accurate understanding of the nurse’s instructions?
   a. “I will need to wear the garment for 4 to 6 hours a day for 6 months.”  
   b. “I will wear the pressure garment during waking hours for 2 to 3 months after the injury.”  
   c. “I will wear the pressure garment continuously.”  
   d. “I will wear it at night while sleeping for a year after the injury.”
51. An 8 year old client is admitted to the burn unit after being rescued from a burning house. Which of these is the most appropriate method for the nurse to use while estimating the total body surface area affected by the burn injury?

   a. Rule of Nines
   b. Lund and Browder Method
   c. Palmer method
   d. Ruler estimator method.

52. A client with documented TBSA of 36% on admission is being reassessed by the nurse 56 hours after a burn injury. The nurse documented that the client has 46% TBSA injury. What is the most appropriate interpretation of the difference in TBSA?

   a. Increased tissue damage due to fluid and electrolyte loss.
   b. A partial-thickness burn injury can become full thickness injury with 48 hours.
   c. Mechanical debridement performed on admission can increase the total body surface area injury.
   d. Demarcation of the wound and its depth can be identified more clearly after the first few days.

53. The school nurse has completed health education on fire safety and minor burn care for a group of high school seniors. Which of these statements by one the student would require further instruction from the nurse? Select all that apply.

   a. “I will cool the burn continuously for 20 minutes under cool running water.”
   b. “I can cool the burn for 20 minutes using ice packs or any object from the freezer.”
   c. “I can apply butter to any blisters immediately to prevent it from popping.”
   d. “If a very young child gets blisters immediately to prevent it from popping.”
   e. “I have to keep my two year old brother away from all open flame like candles.”
   f. “My little 3 year old brother is too young to understand fire safety so I have to protect him.”

54. The nurse is taking care of a client who had homograft after a burn injury. During the nurse’s most recent assessment, the nurse observes that the graft is newly covered with purulent exudate. Which of these is the most appropriate action by the nurse?

   a. Perform mechanical debridement to remove the exudate and prevent further infection.
   b. Inform the primary care provider promptly because the graft may need to be removed.
   c. Perform range of motion exercises to increase perfusion to the graft site and facilitate healing.
   d. Document this finding as an expected phase of graft healing.
Answers and Rationales to NCLEX Style Questions

1. **Rationale: Correct answer B.** During assessment, it is important that all of the burn is exposed and assessed. The environment should be kept warm, and small segments of skin exposed at a time to reduce heat loss. While hand washing is important exposing the entire burnt area can lead to heat loss.

2. **Rationale: Correct answer A, C, E.** The nurse should monitor the patient’s mental status, vital signs, hourly urine output, and urine specific gravity; these are valuable indicators of the patient’s response to fluid resuscitation. Every fours for urine output in a client with burn injury is a very long time.

3. Rationale: Correct answer D. The saturation of hemoglobin molecules with carbon monoxide and the subsequent vasodilation induces a “cherry red” color of the mucous membranes in these clients. The other manifestations are associated with inhalation injury, but not specifically carbon monoxide poisoning.

4. Rationale: Correct answer B. Decreased or absent peristalsis is an expected response during the emergent phase of burn injury as a result of neural and hormonal compensation to the stress of injury. No currently accepted intervention changes this response, and it is not the highest priority of care at this time.

5. Rationale: Correct answer D. Gastrointestinal system effects of sever burn injury include ileus secondary to sympathetic nervous system (SNS) activation. This is expect and the client should be NPO with NG tube placed to decompress the stomach. Bowel sounds usually return at the end of the emergent phase.

6. Rationale: Correct answer B.

7. Rationale: Correct answer B.

8. Rationale: Correct answer A.

9. Rationale: Correct answer is = 23.5%
   Face- 4.5%
   Anterior torso-18%
   Genital – 1%
   Total BSA = 23.5%

10. Rationale: Correct answer = 49.5%
   ½ anterior trunk = 9%
   Anterior torso-18%
   Back of head – 4.5
   ½ left leg – 9%
   Posterior Right leg – 18%

11. Rationale: Correct answer C.

12. Rationale: Correct answer A.
13. Rationale: Correct answer B.

14. Rationale: Correct answer C.

15. Rationale: Correct answer A.

16. Rationale: Correct answer C.

17. Rationale: Correct answer B.

18. Rationale: Correct answer B.

19. Rationale: Correct answer A.

20. Rationale: Correct answer A, C, D, E.

21. Rationale: Correct answer A, B, C, E, F.

22. Rationale: Correct answer A. The Parkland formula for calculating fluid needs for burn victims in the first 24 hours is as follows:

\[
\text{Fluid requirement (mL)} = (4 \text{ mL of crystalloid}) \times (\% \text{TBSA burned}) \times \text{body weight (kg)}
\]

Convert 198 pounds to Kg = 198/2.2 = 90 kg.

\[
4 \times 36 = 144 \times 90 \text{ Kg} = 12960 \text{ mL or 12.96 liters}
\]

23. Rationale: Correct answer D: Half of the fluids should be administered during the first 8 hours.

24. Answer = 7,527.44 mLs or 7.527 liters should be given in the first 8 hours.

\[
\text{TBSA burned = arm 9\% + Anterior trunk 18\% + genital 1\% + One leg 18\% = 46\%}
\]

Convert 180 lbs to Kg 180 lbs / 2.2 = 81.82 kg

\[
\text{Fluid requirement (mL)} = (4 \text{ mL of crystalloid}) \times (\% \text{TBSA burned}) \times \text{body weight (kg)}
\]

\[
4\text{mL} \times 46 \times 81.82 = 15,054.88 \text{ mLs}
\]

\[
15,054.88 \text{ devide by 2} = 7,527.44 \text{ mLs or 7.527 liters}
\]

25. Rationale: Correct answer B.

26. Rationale: Correct answer A.

27. Rationale: Correct answer D.

28. Rationale: Correct answer B: A circumferential deep dermal or full thickness burn is inelastic and on an extremity will not stretch. Fluid resuscitation leads to the development of burn wound edema and swelling of the tissue beneath this inelastic burnt tissue. Tissue pressures rise and can impair peripheral circulation. Escharotomy, division of the burn eschar should be performed immediately. The nurse need to notify the surgeon immediately. The nurse should not be performing the procedure.

29. Rationale: Correct answer B
30. Rationale: Correct answer B.

31. Rationale: Correct answer A.

32. Rationale: Correct answer B.

33. Rationale: Correct answer B. A second degree burn involves the epidermis and some of the dermis, (also called partial thickness burn) and may be characterized by blisters or penetrate as far down as the dermis.

34. Rationale: Correct answer B, C. The statements shows that the client has adapted to an altered body image and has improved self-concept. And has greater tolerance for increased activity.

35. Rationale: Correct answer A, C, D. The left arm should be elevated to reduce edema. Complete rest of the arm is required to allow the graft to adhere. The donor site is usually more painful than the graft site, the client will require pain medication to manage pain. Because adequate circulation is needed for graft healing, the nurse should monitor the presence of pulse. Changing the dressing on the graft site every 8 hours, performing range of motion (ROM) exercises to the left arm every 4 hours, and ambulating the first day are inappropriate nursing care because postop graft site require immobilization.

36. Rationale: Correct answer = 18%

37. Rationale: Correct answer B.

38. Rationale: Correct answer C.

39. Rationale: Correct answer C, D, E, F. Initial wound care should include stopping the burning process, covering the burn wound and keeping the patient warm. Ice, ice-water or icepacks should never be used – it causes vasoconstriction leading to further tissue damage and hypothermia. A client who sustain extensive burn injury should be placed on NPO due to increased risk for altered gastrointestinal motility.

40. Rationale: Answer D. To prevent disruption of the artificial skin’s adherence to the wound bed, the client should restrict range of motion of the involved limb. Protein intake and fluid intake are important for healing and regeneration and shouldn’t be restricted. Going outdoors is acceptable as long as the left arm is protected from direct sunlight.

41. Rationale: Answer A. Applying knee splints prevents leg contractures by holding the joints in a position of function. Elevating the foot of the bed can’t prevent contractures because this action doesn’t hold the joints in a position of function. Hyperextending a body part for an extended time is inappropriate because it can cause contractures. Performing shoulder range-of-motion exercises can prevent contractures in the shoulders, but not in the legs.

42. Rationale: Correct answer D. When caring for a patient, the nurse must first wash her hands. Putting on gloves, removing the dressing, and observing the drainage are all parts of performing a dressing change after hand washing is completed.
43. Rationale: Correct answer C. In a client with burns, the goal of fluid resuscitation is to maintain a mean arterial blood pressure that provides adequate perfusion of vital structures. If the kidneys are adequately perfused, they will produce an acceptable urine output of at least 0.5 ml/kg/hour. Thus, the expected urine output of a 155-lb client is 35 ml/hour, and a urine output consistently above 100 ml/hour is more than adequate. Weight gain from fluid resuscitation isn’t a goal. In fact, a 4-lb weight gain in 24 hours suggests third spacing. Body temperature readings and ECG interpretations may demonstrate secondary benefits of fluid resuscitation but aren’t primary indicators.

44. Rationale: Correct answer B. Difficulty swallowing and drooling are indications of oropharyngeal edema and can precede pulmonary failure. The client’s airway is in severe jeopardy and intubation is highly likely to be needed shortly.

45. Rationale: Correct answer B. Pouring solution onto a sterile field cloth violates surgical asepsis because moisture penetrating the cloth can carry microorganisms to the sterile field via capillary action. The other options are practices that help ensure surgical asepsis.

46. Rationale: Correct answer D. Although a return to pre burn functional levels is rarely possible, burned clients are considered fully recovered or rehabilitated when they have achieved their highest possible level of physical, social, and emotional functioning.

47. Rationale: Correct Answer: 22.5
The anterior trunk has superficial partial-thickness burns and is calculated in TBSA as 18%. The arm has a deep partial-thickness burn and is calculated as 4.5%. The burn on the lower back is superficial and is not calculated in TBSA.

48. Rationale: Correct Answer A, B, C, E, F. Fever or purulent drainage are indicative of development of infection and should be reported to the healthcare provider. Sterile dressings only should be used on the areas of the superficial partial-thickness burns where the skin is not intact. The fingers should be wrapped individually so they do not stick together. Cleansing is necessary no more often than daily to the intact skin areas and only soap and water should be used, not alcohol. Topical agents may be ordered by the health care provider and the patient should follow directions for applying to help prevent infection of the areas.

49. Rationale: Correct Answer C.

50. Rationale: Correct answer C. Elastic pressure garments are worn continuously (i.e., 23 hours a day).

51. Rationale: Correct answer B. The Lund and Browder Method is a more precise method of estimating the extent of burn injury especially in children. The method recognizes the percentage of surface area of various anatomic parts as it relates to age and growth of the patient.

52. Rationale: Correct answer D. Burn wounds are dynamic and need reassessment in the first 24-72 hours because depth can increase as a result of inadequate treatment or superadded infection.
53. Rationale: Correct answer B, C & F. Prompt irrigation with running cool tap water for at least 20 minutes (but no more than one hour) provides appropriate cooling. If cooling is commenced within 3 hours of injury, it can significantly reduce pain and edema, decrease cell damage by slowing cell metabolism in hypoxic tissue, decrease inflammatory response, stabilize vasculature and ultimately improve wound healing and reduce scarring. Very cold water, ice and objects from a freezer to cool the area should be avoided as these cause vasoconstriction and may worsen tissue ischemia and local edema. Butter is contraindicated. It is crucial to supervise children's activities and never leave children alone with open flame. It is important to educate children about the dangers of fire, it is never too early to start.

54. Rationale: Correct answer B. An infected graft may need to be removed, thus the care provider should be promptly informed. ROM exercises will not resolve this problem and the nurse would not independently perform debridement.