Management of Patients With Burn Injury

LEARNING OBJECTIVES

On completion of this chapter, the learner will be able to:

1. Discuss the classification system used for burn injuries.
2. Describe the local and systemic effects of a major burn injury.
3. Describe the three phases of burn care and the priorities of care for each phase.
4. Compare and contrast the potential fluid and electrolyte alterations of the emergent/resuscitative and acute phases of burn management.
5. Describe the goals of the following aspects of burn wound care and the nurse’s role in each: wound cleaning, topical antibacterial therapy, wound dressing, dressing changes, wound débridement, and wound grafting.
6. Describe the nurse’s role in the following areas of management: pain management, restrictions of activity and joint motion, psychological support of the patient and family, nutritional support, pulmonary care, and patient and family education.
7. Use the nursing process as a framework for care of the patient during the three phases of burn care.
The nurse who cares for a patient with a burn injury requires a high level of knowledge about the physiologic changes that occur after a burn, as well as astute assessment skills to detect subtle changes in the patient’s condition. In addition, the nurse must be able to provide sensitive, compassionate care to patients who are critically ill and must initiate rehabilitation early in the course of care. The nurse must also be able to communicate effectively with burn patients, distraught family members, and members of the entire interdisciplinary burn management team. This will ensure quality care, which increases the likelihood of the patient’s survival and promotes optimal quality of life.

Incidence of Burn Injury

The incidence of burn injuries has been declining during the past several decades. Approximately 2 million people require medical attention for burn injury in the United States each year (Kao & Garber, 2000). Of this group, 51,000 require acute hospital admission. About 4,500 people die from burns and related inhalation injuries annually (American Burn Association, 2000). The risk of death 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. The National Center for Injury Prevention and Control lists “fire/burn” among the categories of the 1998 Unintentional Injuries and Adverse Effects. Chart 57-1 presents the ranking of “fire/burn” as cause of death by age group.

Most burn injuries occur in the home, usually in the kitchen while cooking and in the bathroom by means of scalds or immersion. The National Center for Injury Prevention and Control lists “fire/burn” among the categories of the 1998 Unintentional Injuries and Adverse Effects. Chart 57-1 presents the ranking of “fire/burn” as cause of death by age group.

Many burns can be prevented. Nurses can play an active role in preventing fires and burns by teaching prevention concepts and promoting legislation related to fire safety (Chart 57-2). Preventing fires and burns by teaching prevention concepts and promoting legislation related to fire safety (Chart 57-2). Preventing fires and burns by teaching prevention concepts and promoting legislation related to fire safety (Chart 57-2).

<table>
<thead>
<tr>
<th>Age</th>
<th>Rank</th>
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<tr>
<td>1–4</td>
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<td>5–9</td>
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<td>10–14</td>
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<td>25–34</td>
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<td>45–54</td>
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<td>55–64</td>
<td>6</td>
</tr>
<tr>
<td>65–85+</td>
<td>6</td>
</tr>
<tr>
<td>All ages, all races, both sexes</td>
<td>7</td>
</tr>
</tbody>
</table>

The focus of burn care is to prevent complications, improve outcomes, and support the recovery of individuals. Burn injuries are described according to the depth of the injury and the extent of body surface area injured. Burn depth determines whether epithelialization will occur. Determining burn depth can be difficult even for the experienced burn care provider. See Chapter 56 for discussion and a diagram of the skin layers; see also Table 57-1. (The categories of superficial partial-thickness, deep partial-thickness, and full-thickness burns are similar to, but not the same as, first-, second-, and third-degree burns.)

In a superficial partial-thickness burn, the epidermis is destroyed or injured and a portion of the dermis may be injured. The damaged skin may be painful and appear red and dry, as in sunburn, or it may blister.

A deep partial-thickness burn involves destruction of the epidermis and upper layers of the dermis and injury to deeper portions of the dermis. The wound is painful, appears red, and exudes fluid. Capillary refill follows tissue blanching. Hair follicles remain intact. Deep partial-thickness burns take longer to heal and are more likely to result in hypertrophic scars.

A full-thickness burn involves total destruction of epidermis and dermis, and in some cases, underlying tissue as well. Wound color ranges widely from white to red, brown, or black. The burned area

### Pathophysiology of Burns

Burns are caused by a transfer of energy from a heat source to the body. Heat may be transferred through conduction or electromagnetic radiation. Burns are categorized as thermal (which includes electrical burns), radiation, or chemical. Tissue destruction results from coagulation, protein denaturation, or ionization of cellular contents. The skin and the mucosa of the upper airways are the sites of tissue destruction. Deep tissues, including the viscera, can be damaged by electrical burns or through prolonged contact with a heat source. Disruption of the skin can lead to increased fluid loss, infection, hypothermia, scarring, compromised immunity, and changes in function, appearance, and body image.

The depth of the injury depends on the temperature of the burning agent and the duration of contact with the agent. For example, in the case of scald burns in adults, 1 second of contact with hot tap water at 68.9°C (156°F) may result in a burn that destroys both the epidermis and the dermis, causing a full-thickness (third-degree) injury. Fifteen seconds of exposure to hot water at 56.1°C (133°F) results in a similar full-thickness injury. Temperatures less than 111°F are tolerated for long periods without injury.

### CLASSIFICATION OF BURNS

Burn injuries are described according to the depth of the injury and the extent of body surface area injured.

#### Burn Depth

Burns are classified according to the depth of tissue destruction as superficial partial-thickness injuries, deep partial-thickness injuries, or full-thickness injuries. Burn depth determines whether epithelialization will occur. Determining burn depth can be difficult even for the experienced burn care provider. See Chapter 56 for discussion and a diagram of the skin layers; see also Table 57-1. (The categories of superficial partial-thickness, deep partial-thickness, and full-thickness burns are similar to, but not the same as, first-, second-, and third-degree burns.)

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**Gerontologic Considerations**

Reduced mobility, changes in vision, and decreased sensation in the feet and hands place elderly people at higher risk for burn injury; scalds and flames are the leading causes. These changes also place older people at risk for suffering a severe burn because they have difficulty in extinguishing the fire and removing themselves from the burn source. Morbidity and mortality rates associated with burns are usually greater in elderly patients than in younger patients. Thinning and loss of elasticity of the skin in the elderly predispose them to a deep injury from a thermal insult that might cause a less severe burn in a younger person. Moreover, chronic illnesses decrease the older person’s ability to withstand the multisystem stresses imposed by burn injury.

An important goal of nurses in community and home settings is preventing burn injury, especially among the elderly. Nurses need to assess an elderly patient’s ability to perform activities of daily living safely, assist elderly patients and families to modify the environment to ensure safety, and make referrals as needed.

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**Chapter 57 Management of Patients With Burn Injury**

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**Burn Prevention Tips**

- Keep matches and lighters out of the reach of children.
- Never leave children unattended around fire or in bathroom/bathtub.
- Install and maintain smoke detectors in the home.
- Develop and practice a home exit fire drill with all members of the 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 wires when working outside.
- Never store flammable liquids near a fire source, such as a pilot light.
- Use caution when cooking.
- Keep a working fire extinguisher in your home.

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**Outlook for Survival and Recovery**

Great strides in research have helped to increase the survival rate of burn victims. Mortality has fallen to levels never thought possible. Hunt et al. (2000) reported that survival following large burns based on total body surface area (TBSA) appears to have leveled off. Persons older than 70 years are surviving burns of 30% TBSA; those 60 to 70 years of age, 50% TBSA; those 20 to 30 years of age, 80% TBSA; and those 2 to 5 years of age, 75% TBSA. Research in areas such as fluid resuscitation, emergent burn treatment, inhalation injury treatment, and changes in wound care practice with early débridement and excision have contributed greatly to the decrease in burn deaths. Additionally, a better understanding of the importance of adequate nutritional support has contributed to increased survival rates. Very young and very old people have a high risk of death after burn injuries due to immature and stressed immunologic systems and pre-existing medical conditions, respectively. Chances of survival are greater in children older than age 5 and in adults younger than age 40. Inhalation injuries in combination with cutaneous burns worsen the prognosis. Outcome depends on the depth and extent of the burn as well as on the pre-injury health status and age of the patient. Acute care of patients with burn injuries has improved to the point at which survival is expected for most patients, and the burn team has shifted its focus to long-term outcomes for these patients.

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**Chapter 57 Management of Patients With Burn Injury**

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**Classifying Burns**

Burns are classified according to the depth of tissue destruction as superficial partial-thickness injuries, deep partial-thickness injuries, or full-thickness injuries. Burn depth determines whether epithelialization will occur.
Table 57-1 • Characteristics of Burns According to Depth

<table>
<thead>
<tr>
<th>DEPTH OF BURN AND CAUSES (Similar to First Degree)</th>
<th>SKIN INVOLVEMENT</th>
<th>SYMPTOMS</th>
<th>WOUND APPEARANCE</th>
<th>RECUPERATIVE COURSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunburn</td>
<td>Epidermis; possibly a portion of dermis</td>
<td>Tingling</td>
<td>Reddened; blanches with pressure; dry</td>
<td>Complete recovery within a week; no scarring Peeling</td>
</tr>
<tr>
<td>Low-intensity flash</td>
<td></td>
<td>Hyperesthesia (sensitiveness)</td>
<td>Minimal or no edema Possible blisters</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pain that is soothed by cooling</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DEPTH OF BURN AND CAUSES (Similar to Second Degree)</th>
<th>SKIN INVOLVEMENT</th>
<th>SYMPTOMS</th>
<th>WOUND APPEARANCE</th>
<th>RECUPERATIVE COURSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalds</td>
<td>Epidermis, upper dermis, portion of deeper dermis</td>
<td>Pain</td>
<td>Blistered, mottled red base; broken epidermis; weeping surface Edema</td>
<td></td>
</tr>
<tr>
<td>Flash flame</td>
<td></td>
<td>Hyperesthesia</td>
<td>Sensitive to cold air</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DEPTH OF BURN AND CAUSES (Similar to Third Degree)</th>
<th>SKIN INVOLVEMENT</th>
<th>SYMPTOMS</th>
<th>WOUND APPEARANCE</th>
<th>RECUPERATIVE COURSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flame</td>
<td>Epidermis, entire dermis, and sometimes subcutaneous tissue; may involve connective tissue, muscle, and bone</td>
<td>Pain free</td>
<td>Dry; pale white, leathery, or charred Edema</td>
<td></td>
</tr>
<tr>
<td>Prolonged exposure to hot liquids</td>
<td></td>
<td>Shock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric current</td>
<td></td>
<td>Hematuria (blood in the urine) and possibly hemolysis (blood cell destruction) Possible entrance and exit wounds (electrical burn)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical</td>
<td></td>
<td></td>
<td>Edema</td>
<td></td>
</tr>
</tbody>
</table>

is painless because nerve fibers are destroyed. The wound appears leathery; hair follicles and sweat glands are destroyed (Fig. 57-1).

The following factors are considered in determining the depth of the burn:
- How the injury occurred
- Causative agent, such as flame or scalding liquid
- Temperature of the burning agent
- Duration of contact with the agent
- Thickness of the skin

Extent of Body Surface Area Injured

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.

FIGURE 57-1 ZONES OF THE BURN INJURY. Each burned area has three zones of injury. The inner zone (known as the area of coagulation, where cellular death occurs) sustains the most damage. The middle area, or zone of stasis, has a compromised blood supply, inflammation, and tissue injury. The outer zone—the zone of hyperemia—sustains the least damage.

RULE OF NINES

An estimation of the TBSA involved in a burn is simplified by using the rule of nines (Fig. 57-2). The rule of nines is a quick way to calculate the extent of burns. The system assigns percentages in multiples of nine to major body surfaces.

LUND AND BROWDER METHOD

A more precise method of estimating the extent of a burn is the Lund and Browder method, which recognizes that the percentage of TBSA of various anatomic parts, especially the head and legs, and changes with growth. By dividing the body into very small areas and providing an estimate of the proportion of TBSA accounted for by such body parts, one can obtain a reliable estimate of the TBSA burned. The initial evaluation is made on the patient’s arrival at the hospital and is revised on the second and third post-burn days because the demarcation usually is not clear until then.

PALM METHOD

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

LOCAL AND SYSTEMIC RESPONSES TO BURNS

Burns that do not exceed 25% TBSA produce a primarily local response. Burns that exceed 25% TBSA 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 infection can 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. The incidence, magnitude, and duration of pathophysiologic changes in
The percentage of TBSA injured is used to calculate the patient’s fluid replacement needs. In burn victims, the total estimated percentage of total body surface area (TBSA) in the adult is arrived at by sectioning the body surface areas with a numerical value related to nine. (Note: The anterior and posterior head total 9% of TBSA.) In burn victims, the total estimated percentage of TBSA injured is used to calculate the patient’s fluid replacement needs.

Circulating blood volume decreases dramatically during burn shock. In addition, evaporative fluid loss through the burn wound may reach 3 to 5 L or more over a 24-hour period until the burn surfaces are covered.

During burn shock, serum sodium levels vary in response to fluid resuscitation. Usually hyponatremia (sodium depletion) is present. Hyponatremia is also common during the first week of the acute phase, as water shifts from the interstitial to the vascular space.

Immediately after burn injury, hyperkalemia (excessive potassium) results from massive cell destruction. Hypokalemia (potassium depletion) may occur later with fluid shifts and inadequate potassium replacement.

Of the time of burn injury, some red blood cells may be destroyed and others damaged, resulting in anemia. Despite this, the hematocrit may be elevated due to plasma loss. Blood loss during surgical procedures, wound care, and diagnostic studies and ongoing hemolysis further contribute to anemia. Blood transfusions are required periodically to maintain adequate hemoglobin levels for oxygen delivery. Abnormalities in coagulation, including a decrease in platelets (thrombocytopenia) and prolonged clotting and prothrombin times, also occur with burn injury.

Cardiovascular Response

Hypovolemia is the immediate consequence of fluid loss resulting in decreased perfusion and oxygen delivery. Cardiac output decreases before any significant change in blood volume is evident. As fluid loss continues and vascular volume decreases, cardiac output continues to fall and blood pressure drops. This is the onset of burn shock. In response, the sympathetic nervous system releases catecholamines, resulting in an increase in peripheral resistance (vasoconstriction) and an increase in pulse rate. Peripheral vasoconstriction further decreases cardiac output. Myocardial contractility may be suppressed by the release of inflammatory cytokine necrosis factor (Wolf, Prough & Herndon, 2002).

Prompt fluid resuscitation maintains the blood pressure in the low-normal range and improves cardiac output. Despite adequate fluid resuscitation, cardiac filling pressures (central venous pressure, pulmonary artery pressure, and pulmonary artery wedge pressure) remain low during the burn-shock period. If inadequate fluid resuscitation occurs, distributive shock will occur (see Chap. 15).

Generally, the greatest volume of fluid leak occurs in the first 24 to 36 hours after the burn, peaking by 6 to 8 hours. As the capillaries begin to regain their integrity, burn shock resolves and fluid returns to the vascular compartment. As fluid is reabsorbed from the interstitial tissue into the vascular compartment, blood volume increases. If renal and cardiac function is adequate, blood pressure increases. Diuresis continues for several days to 2 weeks.

Burn Edema

Local swelling due to thermal injury is often extensive. Edema is defined as the presence of excessive fluid in the tissue spaces (Lund, 1999). As previously noted, in burns involving less than 25% TBSA, the loss of capillary integrity and shift of fluid are localized to the burn itself, resulting in blister formation and edema only in the area of injury. Patients with more severe burns develop massive systemic edema. Edema is usually maximal after 24 hours. It begins to resolve 1 to 2 days post-burn and usually is completely resolved in 7 to 10 days post-injury. Edema in burn wounds can be reduced by avoiding excessive fluid during the early post-burn period. Unnecessary over-resuscitation will increase edema formation in both burn tissue and non-burn tissue.

As edema increases in circumferential burns, pressure on small blood vessels and nerves in the distal extremities causes an obstruction of blood flow and consequent ischemia. This complication is known as compartment syndrome. The physician may need to perform an escharotomy, a surgical incision into the eschar (devitalized tissue resulting from a burn), to relieve the constricting effect of the burned tissue.

Effects on Fluids, Electrolytes, and Blood Volume

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Pulmonary Response

Inhalation injury is the leading cause of death in fire victims. It is estimated that half of these deaths could have been prevented with use of a smoke detector. Often, burn victims make it out of...
FIGURE 57-3 Overview of physiologic changes that occur after major burn.
a burning home safely. However, once they are outside, they may realize that their loved ones, pets, or valuable items are still inside the burning home. They then re-enter the burning home and are overcome with toxic smoke and fumes and become disoriented or unconscious.

Inhalation injury has a significant impact on survivability of a burn patient. Deterioration in severely burned patients can occur without evidence of a smoke inhalation injury. Bronchoconstriction caused by release of histamine, serotonin, and thromboxane, a powerful vasoconstrictor, as well as chest constriction secondary to circumferential full-thickness chest burns causes this deterioration. One third of all burn patients have a pulmonary problem related to the burn injury (Flynn, 1999). Even without pulmonary injury, hypoxia (oxygen starvation) may be present. Early in the postburn period, catecholamine release in response to the stress of the burn injury alters peripheral blood flow, thereby reducing oxygen delivery to the periphery. Later, hypermetabolism and continued catecholamine release lead to increased tissue oxygen consumption, which can lead to hypoxia. To ensure that adequate oxygen is available to the tissues, supplemental oxygen may be needed.

Pulmonary injuries fall into several categories: upper airway injury; inhalation injury below the glottis, including carbon monoxide poisoning; and restrictive defects. Upper airway injury results from direct heat or edema. It is manifested by mechanical obstruction of the upper airway, including the pharynx and larynx. Because of the cooling effect of rapid vaporization in the pulmonary tract, direct heat injury does not normally occur below the level of the bronchus. Upper airway injury is treated by early nasotracheal or endotracheal intubation.

Inhalation injury below the glottis results from inhaling the products of incomplete combustion or noxious gases. These products include carbon monoxide, sulfur oxides, nitrogen oxides, aldehydes, cyanide, ammonia, chlorine, phosgene, benzene, and halogenes. The injury results directly from chemical irritation of the pulmonary tissues at the alveolar level. Inhalation injuries below the glottis cause loss of ciliary action, hypersecretion, severe mucosal edema, and possibly bronchospasm. The pulmonary surfactant is reduced, resulting in atelectasis (collapse of alveoli). Expectoration of carbon particles in the sputum is the cardinal sign of this injury.

Carbon monoxide is probably the most common cause of inhalation injury because it is a byproduct of the combustion of organic materials and is therefore present in smoke. The pathophysiologic effects are due to tissue hypoxia, a result of carbon monoxide combining with hemoglobin to form carboxyhemoglobin, which competes with oxygen for available hemoglobin-binding sites. The affinity of hemoglobin for carbon monoxide is 200 times greater than that for oxygen. Treatment usually consists of early intubation and mechanical ventilation with 100% oxygen. However, some patients may require only oxygen therapy, depending on the extent of pulmonary injury and edema. Administering 100% oxygen is essential to accelerate the removal of carbon monoxide from the hemoglobin molecule.

Restrictive defects arise when edema develops under full-thickness burns encircling the neck and thorax. Chest excision may be greatly restricted, resulting in decreased tidal volume. In such situations, escharotomy is necessary.

Pulmonary abnormalities are not always immediately apparent. More than half of all burn victims with pulmonary involvement do not initially demonstrate pulmonary signs and symptoms. Any patient with possible inhalation injury must be observed for at least 24 hours for respiratory complications. Airway obstruction may occur very rapidly or develop in hours. Decreased lung compliance, decreased arterial oxygen levels, and respiratory acidosis may occur gradually over the first 5 days after a burn.

Indicators of possible pulmonary damage include the following:

- History indicating that the burn occurred in an enclosed area
- Burns of the face or neck
- Singed nasal hair
- Hoarseness, voice change, dry cough, stridor, sooty sputum
- Bloody sputum
- Labored breathing or tachypnea (rapid breathing) and other signs of reduced oxygen levels (hypoxemia)
- Erythema and blistering of the oral or pharyngeal mucosa

Diagnosis of inhalation injury is an important priority for many burn victims. Serum carboxyhemoglobin levels and arterial blood gas levels are frequently used to assess for inhalation injuries. Bronchoscopy and xenon-133 ($^{133}$Xe) ventilation-perfusion scans can also be used to aid diagnosis in the early postburn period. Pulmonary function studies may also be useful in diagnosing decreased lung compliance or obstructed airflow (Fitzpatrick & Cioffi, 2002; Flynn, 1999).

Pulmonary complications secondary to inhalation injuries include acute respiratory failure and acute respiratory distress syndrome (ARDS). Respiratory failure occurs when impairment of ventilation and gas exchange is life-threatening. The immediate intervention is intubation and mechanical ventilation. If ventilation is impaired by restricted chest excision, immediate chest escharotomy is needed. ARDS may develop in the first few days after the burn injury secondary to systemic and pulmonary responses to the burn and inhalation injury. Respiratory failure and ARDS are discussed in Chapter 23.

Other Systemic Responses

Renal function may be altered as a result of decreased blood volume. Destruction of red blood cells at the injury site results in free hemoglobin in the urine. If muscle damage occurs (eg, from electrical burns), myoglobin is released from the muscle cells and excreted by the kidney. Adequate fluid volume replacement restores renal blood flow, increasing the glomerular filtration rate and urine volume. If there is inadequate blood flow through the kidneys, the hemoglobin and myoglobin occlude the renal tubules, resulting in acute tubular necrosis and renal failure (see Chap. 45).

The immunologic defenses of the body are greatly altered by burn injury. Serious burn injury diminishes resistance to infection. As a result, sepsis remains the leading cause of death in thermally injured patients (Cioffi, 2001). The loss of skin integrity is compounded by the release of abnormal inflammatory factors, altered levels of immunoglobulins and serum complement, impaired neutrophil function, and a reduction in lymphocytes (lymphocytopenia). Research suggests that burn injury results in loss of T-helper cell lymphocytes (Munster, 2002). There is a significant impairment of the production and release of granulocytes and macrophages from bone marrow after burn injury. The resulting immunosuppression places the burn patient at high risk for sepsis.

Loss of skin also results in an inability to regulate body temperature. Burn patients may therefore exhibit low body temperatures in the early hours after injury. Then, as hypermetabolism resets core temperatures, burn patients become hyperthermic for much of the postburn period, even in the absence of infection.
Two potential gastrointestinal complications may occur: paralytic ileus (absence of intestinal peristalsis) and Curling’s ulcer. Decreased peristalsis and bowel sounds are manifestations of paralytic ileus resulting from burn trauma. Gastric distention and nausea may lead to vomiting unless gastric decompression is initiated. Gastric bleeding secondary to massive physiologic stress may be signaled by occult blood in the stool, regurgitation of “coffee ground” material from the stomach, or bloody vomitus. These signs suggest gastric or duodenal erosion (Curling’s ulcer).

Management of the Patient With a Burn Injury

Burn care must be planned according to the burn depth and local response, the extent of the injury, and the presence of a systemic response. Burn care then proceeds through three phases: emergent/resuscitative phase, acute/intermediate phase, and rehabilitation phase. Although priorities exist for each of the phases, the phases overlap, and assessment and management of specific problems and complications are not limited to these phases but take place throughout burn care. The three phases and the priorities for care are summarized in Table 57-2.

EMERGENT/RESUSCITATIVE PHASE OF BURN CARE

On-the-Scene Care

Anyone who encounters a burn victim for the first time may feel overwhelmed. The burned person’s appearance can be frightening at first. It can be difficult not to get caught up with the appearance of the person and instead to concentrate on the burn wounds. However, the burn wound is not the first priority at the scene: the first priority of on-the-scene care for a burn victim is to prevent injury to the rescuer. If needed, fire and emergency medical services should be requested at the first opportunity. Additional emergency procedures are highlighted in Chart 57-3.

AIRWAY, BREATHING, CIRCULATION

Although the local effects of a burn are the most evident, the systemic effects pose a greater threat to life. Therefore, it is important to remember the ABCs of all trauma care during the early postburn period:

- Airway
- Breathing
- Circulation; cervical spine immobilization for patients with high-voltage electrical injuries and if indicated for other injuries; cardiac monitoring for patients with all electrical injuries for at least 24 hours after cessation of dysrhythmia

Some practitioners include “DEF” in the trauma assessment: disability, exposure, and fluid resuscitation (Weibelhaus & Hansen, 2001).

The circulatory system must also be assessed quickly. Apical pulse and blood pressure are monitored frequently. Tachycardia (abnormally rapid heart rate) and slight hypotension are expected soon after the burn. The neurologic status is assessed quickly in the patient with extensive burns. Often the burn patient is awake and alert initially, and vital information can be obtained at that time. A secondary head-to-toe survey of the patient is carried out to identify other potentially life-threatening injuries. (The E and F parameters of trauma assessment are discussed in detail later.) Preventing shock in a burn patient is imperative.

NURSING ALERT No food or fluid is given by mouth, and the patient is placed in a position that will prevent aspiration of vomitus because nausea and vomiting typically occur due to paralytic ileus resulting from the stress of injury.

Usually, rescue workers will cool the wound, establish an airway, supply oxygen, and insert at least one large-bore intravenous line.

Table 57-2 • Phases of Burn Care

<table>
<thead>
<tr>
<th>PHASE</th>
<th>DURATION</th>
<th>PRIORITIES</th>
</tr>
</thead>
</table>
| Emergent or immediate        | From onset of injury to completion of fluid   | • First aid  
| resuscitative                | resuscitation                                 | • Prevention of shock  
|                              |                                               | • Prevention of respiratory distress  
|                              |                                               | • Detection and treatment of concomitant injuries  
|                              |                                               | • Wound assessment and initial care  
| Acute                        | From beginning of diuresis to near completion | • Wound care and closure  
|                              | of wound closure                              | • Prevention or treatment of complications, including infection  
|                              |                                               | • Nutritional support  
| Rehabilitation               | From major wound closure to return to         | • Prevention of scars and contractures  
|                              | individual’s optimal level of physical and    | • Physical, occupational, and vocational rehabilitation  
|                              | psychosocial adjustment                      | • Functional and cosmetic reconstruction  
|                              |                                               | • Psychosocial counseling  

NURSING ALERT Breathing must be assessed and a patent airway established immediately during the initial minutes of emergency care. Immediate therapy is directed toward establishing an airway and administering humidified 100% oxygen. If such a high concentration of oxygen is not available under emergency conditions, oxygen by mask or nasal cannula is given initially. If qualified personnel and equipment are available and if the victim has severe respiratory distress or airway edema, the rescuers can insert an endotracheal tube and initiate manual ventilation.

NURSING ALERT No food or fluid is given by mouth, and the patient is placed in a position that will prevent aspiration of vomitus because nausea and vomiting typically occur due to paralytic ileus resulting from the stress of injury.
is en route to the emergency department so that life-saving measures may be initiated immediately.

The patient is transported to the nearest emergency department. The nurse must also attend to the patient’s emotional needs. The patient’s and family’s coping abilities and available supports are assessed. Circumstances surrounding the burn injury should be considered when providing care. Individualized psychosocial support must be given to the patient and family. Because the emergent burn patient is usually anxious and in pain, those in attendance should provide reassurance and support, explanations of procedures, and adequate pain relief. Because poor tissue perfusion accompanies burn injuries, adequate respiratory status and circulatory status have been established, the patient is assessed for cervical spinal injuries or head injury if the patient was involved in an explosion, a fall, a jump, or an electrical injury. Once the patient’s condition is stable, attention is directed to the burn wound itself. All clothing and jewelry are removed. For chemical burns, flushing of the exposed areas is continued. The patient is checked for contact lenses. These are removed immediately if chemicals have contacted the eyes or if facial burns have occurred.

Emergency Medical Management

The patient is transported to the nearest emergency department. The hospital and physician are alerted that the patient is on route to the emergency department so that life-saving measures can be initiated immediately by a trained team.

Initial priorities in the emergency department remain airway, breathing, and circulation. For mild pulmonary injury, inspired air is humidified and the patient is encouraged to cough so that secretions can be removed by suctioning. For more severe situations, it is necessary to remove secretions by bronchial suctioning and to administer bronchodilators and mucolytic agents. If edema of the airway develops, endotracheal intubation may be necessary. Continuous positive airway pressure and mechanical ventilation may also be required to achieve adequate oxygenation.

After adequate respiratory status and circulatory status have been established, the patient is assessed for cervical spinal injuries or head injury if the patient was involved in an explosion, a fall, a jump, or an electrical injury. Once the patient’s condition is stable, attention is directed to the burn wound itself. All clothing and jewelry are removed. For chemical burns, flushing of the exposed areas is continued. The patient is checked for contact lenses. These are removed immediately if chemicals have contacted the eyes or if facial burns have occurred.

It is important to validate an account of the burn scenario provided by the patient, witnesses at the scene, and paramedics. Information needs to include time of the burn injury, source of the burn, place where the burn occurred, how the burn was treated at the scene, and any history of falling with the injury. A history of preexisting diseases, allergies, and medications and the use of drugs, alcohol, and tobacco is obtained at this point to plan care. A large-bore (16- or 18-gauge) intravenous catheter should be inserted in a non-burned area (if not inserted earlier). Most patients have a central venous catheter inserted so that large amounts of intravenous fluids can be given quickly and central venous pressures can be monitored. If the burn exceeds 25% TBSA or if the patient is nauseated, a nasogastric tube should be inserted and connected to suction to prevent vomiting due to paralytic ileus (absence of peristalsis).

The physician evaluates the patient’s general condition, assesses the burn, determines the priorities of care, and directs the individualized plan of treatment, which is divided into systemic management and local care of the burned area. Nonsterile gloves, caps, and gowns are worn by personnel while assessing the exposed burned areas. Clean technique is maintained while assessing burn wounds.

Assessment of both the TBSA burned and the depth of the burn is completed after soot and debris have been gently cleansed from the burn wound. Careful attention is paid to keeping the burn patient warm during wound assessment and cleansing. Assessment is repeated frequently throughout burn wound care. Photographs may be taken of the burn areas initially and periodically throughout treatment; in this way, the initial injury and burn wound can be documented. Such documentation is invaluable for insurance and legal claims. Clean sheets are placed under and over the patient to protect the area from contamination, maintain body temperature, and reduce pain caused by air currents passing over exposed nerve endings.

An indwelling urinary catheter is inserted to permit more accurate monitoring of urine output and renal function for patients with moderate to severe burns. Baseline height, weight, arterial blood gases, hematocrit, electrolyte values, blood alcohol level, drug panel, urinalysis, and chest x-rays are obtained. If the patient is elderly or has an electrical burn, a baseline electrocardiogram is obtained. Because burns are contaminated wounds, tetanus prophylaxis is administered if the patient’s immunization status is not current or is unknown.

Although the major focus of care during the emergent phase is physical stabilization, the nurse must also attend to the patient’s and family’s psychological needs. Burn injury is a crisis, causing variable emotional responses. The patient’s and family’s coping abilities and available supports are assessed. Circumstances surrounding the burn injury should be considered when providing care. Individualized psychosocial support must be given to the patient and family. Because the emergent burn patient is usually anxious and in pain, those in attendance should provide reassurance and support, explanations of procedures, and adequate pain relief. Because poor tissue perfusion accompanies burn injuries,
only intravenous pain medication (usually morphine) is given, titrated for the patient. If the patient wishes to see a spiritual advisor, one is notified.

TRANSFER TO A BURN CENTER
The depth and extent of the burn are considered in determining whether the patient should be transferred to a burn center. Patients with major burns, those who are at the extremes of the age continuum, those with coexisting health problems that may affect recovery, and those with circumstances that increase their risk for acute and long-term complications are transferred to a burn center. Chart 57–4 lists the American Burn Association’s criteria for burn center referral after initial assessment and management.

If the patient is to be transported to a burn center, the following measures are instituted before transfer:

- A secure intravenous catheter is inserted with lactated Ringer’s solution infusing at the rate required to maintain a urine output of at least 30 mL per hour.
- A patent airway is ensured.
- Adequate pain relief is attained.
- Adequate peripheral circulation is established in any burned extremity.
- Wounds are covered with a clean, dry sheet, and the patient is kept comfortably warm.

All assessments and treatments are documented, and this information is provided to the burn center personnel. The transferring facility must relay accurate intake and output totals to burn center personnel so that adequate fluid resuscitation measures continue.

**Criteria for Classifying the Extent of Burn Injury (American Burn Association)**

<table>
<thead>
<tr>
<th>Minor Burn Injury</th>
<th>Moderate, Uncomplicated Burn Injury</th>
<th>Major Burn Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Second-degree burn of less than 15% total body surface area (TBSA) in adults or less than 10% TBSA in children</td>
<td>• Second-degree burns of 15%–25% TBSA in adults or 10%–20% in children</td>
<td>• Second-degree burns exceeding 25% TBSA in adults or 20% in children</td>
</tr>
<tr>
<td>• Third-degree burn of less than 2% TBSA not involving special care areas (eyes, ears, face, hands, feet, perineum, joints)</td>
<td>• Third-degree burns of less than 10% TBSA not involving special care areas</td>
<td>• All third-degree burns exceeding 10% TBSA</td>
</tr>
<tr>
<td>• Excludes electrical injury, inhalation injury, concurrent trauma, all poor-risk patients (eg, extremes of age, concurrent disease)</td>
<td>• Excludes electrical injury, inhalation injury, concurrent trauma, all poor-risk patients (eg, extremes of age, concurrent disease)</td>
<td>• All burns involving eyes, ears, face, hands, feet, perineum, joints</td>
</tr>
<tr>
<td>• Excludes electrical injury, inhalation injury, concurrent trauma, all poor-risk patients (eg, extremes of age, concurrent disease)</td>
<td>• Excludes electrical injury, inhalation injury, concurrent trauma, all poor-risk patients (eg, extremes of age, concurrent disease)</td>
<td>• All inhalation injury, electrical injury, concurrent trauma, all poor-risk patients</td>
</tr>
</tbody>
</table>

Additional gauges of fluid requirements and response to fluid resuscitation include hematocrit and hemoglobin and serum sodium levels. If the hematocrit and the hemoglobin levels decrease or if the urinary output exceeds 50 mL/hour, the rate of intravenous fluid administration may be decreased. The goal is to maintain serum sodium levels in the normal range during fluid replacement.

Appropriate resuscitation endpoints for burn patients remain controversial. Research in this area has led to the study of hemodynamic and oxygen transport resuscitation endpoints. When these endpoints were used, massive fluid resuscitation volumes were administered that could have deleterious effects. Successful resuscitation is associated with increased delivery of oxygen and consumption of oxygen with declining serum lactate levels (Holm et al., 2000). Attention has been directed recently toward other indicators of adequate resuscitation: base deficit and serum lactate levels. Measurement of serum lactate levels does not appear useful in the treatment of burn patients because of the large amounts of lactate released from burned tissue; however, metabolism of lactate is unaltered. Elevated levels occur despite adequate fluid resuscitation (Yowler & Fratianne, 2000). Factors that are associated with the increased fluid requirements include delayed resuscitation, scald burn injuries, inhalation injuries, high-voltage electrical injuries, hyperglycemia, alcohol intoxication, and chronic diuretic therapy. Second 24-hour post-burn fluid infusion rates incorporate both the maintenance amount of fluid and any additional fluid needs secondary to evaporative water loss through the burn wound.

**Fluid Requirements.** The projected fluid requirements for the first 24 hours are calculated by the clinician based on the extent of the burn injury. Some combination of fluid categories may be used: colloids (whole blood, plasma, and plasma expanders) and crystalloids/electrolytes (physiologic sodium chloride or lactated...
Table 57-3 • Fluid and Electrolyte Changes in the Emergent/Resuscitative Phase

<table>
<thead>
<tr>
<th>Observation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generalized dehydration</td>
<td>Plasma leaks through damaged capillaries.</td>
</tr>
<tr>
<td>Reduction of blood volume</td>
<td>Secondary to plasma loss, fall of blood pressure, and diminished cardiac output</td>
</tr>
<tr>
<td>Decreased urinary output</td>
<td>Secondary to:</td>
</tr>
<tr>
<td></td>
<td>Fluid loss</td>
</tr>
<tr>
<td></td>
<td>Decreased renal blood flow</td>
</tr>
<tr>
<td></td>
<td>Sodium and water retention caused by increased adrenocortical activity</td>
</tr>
<tr>
<td></td>
<td>(Hemolysis of red blood cells, causing hemoglobinuria and myonecrosis or myoglobinuria)</td>
</tr>
<tr>
<td>Potassium (K⁺) excess</td>
<td>Massive cellular trauma causes release of K⁺ into extracellular fluid</td>
</tr>
<tr>
<td></td>
<td>(ordinarily, most K⁺ is intracellular).</td>
</tr>
<tr>
<td>Sodium (Na⁺) deficit</td>
<td>Large amount of Na⁺ is lost in trapped edema fluid and exudate and by shift into cells as K⁺ is released from cells (ordinarily most Na⁺ is extracellular).</td>
</tr>
<tr>
<td>Metabolic acidosis (base-bicarbonate deficit)</td>
<td>Loss of bicarbonate ions accompanies sodium loss.</td>
</tr>
<tr>
<td>Hemoconcentration (elevated hematocrit)</td>
<td>Liquid blood component is lost into extravascular space.</td>
</tr>
</tbody>
</table>

Ringer’s solution). Adequate fluid resuscitation results in slightly decreased blood volume levels during the first 24 post-burn hours and restores plasma levels to normal by the end of 48 hours. Oral resuscitation can be successful in adults with less than 20% TBSA and children with less than 10% to 15% TBSA.

Formulas have been developed for estimating fluid loss based on the estimated percentage of burned TBSA and the weight of the patient. Length of time since burn injury occurred is also very important in calculating estimated fluid needs. Formulas must be adjusted so that initiation of fluid replacement reflects the time of injury. Resuscitation formulas are approximations only and are individualized to meet the requirements of each patient. The various formulas are discussed below and summarized in Chart 57-5.

As early as 1978, the NIH Consensus Development Conference on Supportive Therapy in Burn Care established that salt and water are required in burn patients, but that colloid may or may not be useful during the first 24 to 48 post-burn hours. The consensus formula provides for the volume of balanced salt solution to be administered in the first 24 hours in a range of 2 to 4 mL/kg per percent burn. In general, 2 mL/kg per percent burn of lactated Ringer’s solution may be used initially for adults. This is the most common fluid replacement formula in use today. As with the other formulas, half of the calculated total should be given over the first 8 post-burn hours, and the other half should be given over the next 16 hours. The rate and volume of the infusion must be regulated according to the patient’s response by changing the

<table>
<thead>
<tr>
<th>Consensus Formula</th>
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</thead>
<tbody>
<tr>
<td>Lactated Ringer’s solution (or other balanced saline solution): 2–4 mL × kg body weight × % total body surface area (TBSA) burned. Half to be given in first 8 hours; remaining half to be given over next 16 hours.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evans Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Colloids: 1 mL × kg body weight × % TBSA burned</td>
</tr>
<tr>
<td>2. Electrolytes (saline): 1 mL × body weight × % TBSA burned</td>
</tr>
<tr>
<td>3. Glucose (5% in water): 2,000 mL for insensible loss</td>
</tr>
<tr>
<td>Day 1: Half to be given in first 8 hours; remaining half over next 16 hours</td>
</tr>
<tr>
<td>Day 2: Half of previous day’s colloids and electrolytes; all of insensible fluid replacement</td>
</tr>
<tr>
<td>Maximum of 10,000 mL over 24 hours. Second- and third-degree (partial- and full-thickness) burns exceeding 50% TBSA are calculated on the basis of 50% TBSA.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Brooke Army Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Colloids: 0.5 mL × kg body weight × % TBSA burned</td>
</tr>
<tr>
<td>2. Electrolytes (lactated Ringer’s solution): 1.5 mL × kg body weight × % TBSA burned</td>
</tr>
<tr>
<td>3. Glucose (5% in water): 2,000 mL for insensible loss</td>
</tr>
<tr>
<td>Day 1: Half to be given in first 8 hours; remaining half over next 16 hours</td>
</tr>
<tr>
<td>Day 2: Half of colloids; half of electrolytes; all of insensible fluid replacement.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parkland/Baxter Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactated Ringer’s solution: 4 mL × kg body weight × % TBSA burned</td>
</tr>
<tr>
<td>Day 1: Half to be given in first 8 hours; half to be given over next 16 hours</td>
</tr>
<tr>
<td>Day 2: Varies. Colloid is added.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hypertonic Saline Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentrated solutions of sodium chloride (NaCl) and lactate with concentration of 250–300 mEq of sodium per liter, administered at a rate sufficient to maintain a desired volume of urinary output. Do not increase the infusion rate during the first 8 postburn hours. Serum sodium levels must be monitored closely. Goal: Increase serum sodium level and osmolality to reduce edema and prevent pulmonary complications.</td>
</tr>
</tbody>
</table>
hourly infusion rates. Fluid boluses are recommended only in the presence of marked hypotension, not low urine output. Typical fluid rate changes should involve an increase or decrease in flow rate by no more than 25% to 33% (Yowler & Fratianne, 2000).

Studies demonstrate that with large burns, there is a failure of the sodium-potassium pump (a physiologic mechanism involved in fluid–electrolyte balance) at the cellular level. Thus, patients with very large burns may need proportionately more milliliters of fluid per percent of burn than those with smaller burns. Also, patients with electrical injury, pulmonary injury, and delayed fluid resuscitation and those who were burned while intoxicated may need additional fluids.

The following example illustrates use of the formula in a 70-kg (168-lb) patient with a 50% TBSA burn:

1. Consensus formula: 2 to 4 mL/kg/% TBSA
2. 2 × 70 × 0.5 = 7,000 mL/24 hours
3. Plan to administer: First 8 hours = 3,500 mL, or 437 mL/hour; next 16 hours = 3,500 mL, or 219 mL/hour

Most fluid replacement formulas use isotonic electrolyte solutions. Regardless of which standard replacement formula is used, the patient receives approximately the same fluid volume and sodium replacement during the first 48 hours.

Another fluid replacement method requires hypertonic electrolyte solutions. This method uses concentrated solutions of sodium chloride and lactate (a balanced salt solution) so that the resulting fluid has a concentration of 250 to 300 mEq of sodium. The rationale for this replacement method is that by increasing serum osmolality, fluid will be pulled back into the vascular space and remain there for a longer time.

Gerontologic Considerations
Decreased function of the cardiovascular, renal, and pulmonary systems increases the need for close observation of elderly patients with even relatively minor burns during the emergent and acute phases. Acute renal failure is much more common in elderly patients than in those younger than age 40. The margin of difference between hypovolemia and fluid overload is very small. Suppressed immunologic response, a high incidence of malnutrition, and an inability to withstand metabolic stressors (eg, a cold environment) further compromise the elderly person’s ability to heal. As a result of these issues in elderly patients who sustain burn injury, close monitoring and prompt treatment of complications are mandatory.

Nursing Management: Emergent/Resuscitative Phase
Assessment data obtained by prehospital providers (rescuers such as emergency medical technicians) are shared with the physician and nurse in the emergency department. Nursing assessment in the emergent phase of burn injury focuses on the major priorities for any trauma patient; the burn wound is a secondary consider-

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ation. Aseptic management of the burn wounds and invasive lines continues.

The nurse monitors vital signs frequently. Respiratory status is monitored closely, and apical, carotid, and femoral pulses are evaluated. Cardiac monitoring is indicated if the patient has a history of cardiac disease, electrical injury, or respiratory problems, or if the pulse is dysrhythmic or the rate is abnormally slow or rapid.

If all extremities are burned, determining blood pressure may be difficult. A sterile dressing applied under the blood pressure cuff will protect the wound from contamination. Because increasing edema makes blood pressure difficult to auscultate, a Doppler (ultrasound) device or a noninvasive electronic blood pressure device may be helpful. In severe burns, an arterial catheter is used for blood pressure measurement and for collecting blood specimens. Peripheral pulses of burned extremities are checked hourly; the Doppler device is useful for this. Elevation of burned extremities is crucial to decrease edema. Elevation of the lower extremities on pillows and of the upper extremities on pillows or by suspension using intravenous poles may be helpful.

Large-bore intravenous catheters and an indwelling urinary catheter are inserted, and the nurse’s assessment includes monitoring fluid intake and output. Urine output, an indicator of renal perfusion, is monitored carefully and measured hourly. The amount of urine first obtained when the urinary catheter was inserted is recorded. This may assist in determining the extent of preburn renal function and fluid status. Urine specific gravity, pH, and glucose, acetonemia, protein, and hemoglobin levels are assessed frequently.

Burgundy-colored urine suggests the presence of hemochromatosis and myoglobin resulting from muscle damage. This is associated with deep burns caused by electrical injury or prolonged contact with flames. Glucosuria, a common finding in the early postburn hours, results from the release of stored glucose from the liver in response to stress.

Although not responsible for calculating the patient’s fluid requirements, the nurse needs to know the maximum volume of fluid the patient should receive. Infusion pumps and rate controllers are used to deliver a complex regimen of prescribed intravenous fluids. Administering and monitoring intravenous therapy are major nursing responsibilities.

Body temperature, body weight, preburn weight, and history of allergies, tetanus immunization, past medical and surgical problems, current illnesses, and use of medications are assessed. A head-to-toe assessment is performed, focusing on signs and symptoms of concomitant illness, injury, or developing complications. Patients with facial burns should have their eyes examined for potential injury to the corneas. An ophthalmologist is consulted for complete assessment via fluorescent staining.

Assessing the extent of the burn wound continues and is facilitated by anatomic diagrams (described previously). In addition, the nurse works with the physician to assess the depth of the wound and areas of full- and partial-thickness injury. Assessment of the circumstances surrounding the injury is important. Obtaining a history of the burn injury can help to plan the care for the patient. Assessment should include the time of injury, mechanism of burn, whether the burn occurred in a closed space, the possibility of inhalation of noxious chemicals, and any related trauma.

The neurologic assessment focuses on the patient’s level of consciousness, psychological status, pain and anxiety levels, and behavior. The patient’s and family’s understanding of the injury and treatment is assessed as well.

Nursing care of the patient during the emergent/resuscitative phase of burn injury is detailed in the Plan of Nursing Care.

(text continues on page 1718)
### Plan of Nursing Care

**Care of the Patient During the Emergent/Resuscitative Phase of Burn Injury**

<table>
<thead>
<tr>
<th>Nursing Interventions</th>
<th>Rationale</th>
<th>Expected Outcomes</th>
</tr>
</thead>
</table>
| **Nursing Diagnosis:** Impaired gas exchange related to carbon monoxide poisoning, smoke inhalation, and upper airway obstruction  
**Goal:** Maintenance of adequate tissue oxygenation | | |
| 1. Provide humidified oxygen. | 1. Humidified oxygen provides moisture to injured tissues; supplemental oxygen increases alveolar oxygenation. | • Absence of dyspnea  
• Respiratory rate between 12 and 20 breaths/min  
• Lungs clear on auscultation  
• Arterial oxygen saturation >96% by pulse oximetry  
• Arterial blood gas levels within normal limits |
| 2. Assess breath sounds, and respiratory rate, rhythm, depth, and symmetry. Monitor patient for signs of hypoxia. | 2. These factors provide baseline data for further assessment and evidence of increasing respiratory compromise. | |
| 3. Observe for the following:  
   a. Erythema or blistering of lips or buccal mucosa  
   b. Singed nostrils  
   c. Burns of face, neck, or chest  
   d. Increasing hoarseness  
   e. Soot in sputum or tracheal tissue in respiratory secretions | 3. These signs indicate possible inhalation injury and risk of respiratory dysfunction. | |
| 4. Monitor arterial blood gas values, pulse oximetry readings, and carboxyhemoglobin levels. | 4. Increasing PCO₂ and decreasing PO₂ and O₂ saturation may indicate need for mechanical ventilation. | |
| 5. Report labored respirations, decreased depth of respirations, or signs of hypoxia to physician immediately. | 5. Immediate intervention is indicated for respiratory difficulty. | |
| 7. Monitor mechanically ventilated patient closely. | 7. Monitoring allows early detection of decreasing respiratory status or complications of mechanical ventilation. | |
| **Nursing Diagnosis:** Ineffective airway clearance related to edema and effects of smoke inhalation  
**Goal:** Maintain patent airway and adequate airway clearance | | |
| 1. Maintain patent airway through proper patient positioning, removal of secretions, and artificial airway if needed. | 1. A patent airway is crucial to respiration. | • Patent airway  
• Respiratory secretions are minimal, colorless, and thin  
• Respiratory rate, pattern, and breath sounds normal |
| 3. Encourage patient to turn, cough, and deep breathe. Encourage patient to use incentive spirometry. Suction as needed. | 3. These activities promote mobilization and removal of secretions. | |
| **Nursing Diagnosis:** Fluid volume deficit related to increased capillary permeability and evaporative losses from the burn wound  
**Goal:** Restoration of optimal fluid and electrolyte balance and perfusion of vital organs | | |
| 1. Observe vital signs (including central venous pressure or pulmonary artery pressure, if indicated) and urine output, and be alert for signs of hypovolemia or fluid overload. | 1. Hypovolemia is a major risk immediately after the burn injury. Overresuscitation might cause fluid overload. | • Serum electrolytes within normal limits  
• Urine output between 0.5 and 1.0 mL/kg/hr  
• Blood pressure higher than 90/60 mm Hg  
• Heart rate less than 120 beats/min  
• Exhibits clear sensorium  
• Voids clear yellow urine with specific gravity within normal limits |
| 2. Monitor urine output at least hourly and weigh patient daily. | 2. Output and weight provide information about renal perfusion, adequacy of fluid replacement, and fluid requirement and fluid status. | |

(continued)
### Plan of Nursing Care

#### Care of the Patient During the Emergent/Resuscitative Phase of Burn Injury (Continued)

<table>
<thead>
<tr>
<th>Nursing Interventions</th>
<th>Rationale</th>
<th>Expected Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Maintain IV lines and regulate fluids at appropriate rates, as prescribed.</td>
<td>3. Adequate fluids are necessary to maintain fluid and electrolyte balance and perfusion of vital organs.</td>
<td></td>
</tr>
<tr>
<td>4. Observe for symptoms of deficiency or excess of serum sodium, potassium, calcium, phosphorus, and bicarbonate.</td>
<td>4. Rapid shifts in fluid and electrolyte status are possible in the postburn period.</td>
<td></td>
</tr>
<tr>
<td>5. Elevate head of patient’s bed and elevate burned extremities.</td>
<td>5. Elevation promotes venous return.</td>
<td></td>
</tr>
<tr>
<td>6. Notify physician immediately of decreased urine output, blood pressure, central venous, pulmonary artery, or pulmonary artery wedge pressures, or increased pulse rate.</td>
<td>6. Because of the rapid fluid shifts in burn shock, fluid deficit must be detected early so that distributive shock does not occur.</td>
<td></td>
</tr>
</tbody>
</table>

**Nursing Diagnosis:** Hypothermia related to loss of skin microcirculation and open wounds  
**Goal:** Maintenance of adequate body temperature  

1. Provide a warm environment through use of heat shield, space blanket, heat lights, or blankets.  
2. Work quickly when wounds must be exposed.  
3. Assess core body temperature frequently.  

1. A stable environment minimizes evaporative heat loss.  
2. Minimal exposure minimizes heat loss from wound.  
3. Frequent temperature assessments help detect developing hypothermia.  

- Body temperature remains 36.1° to 38.3°C (97° to 101°F)  
- Absence of chills or shivering

**Nursing Diagnosis:** Pain related to tissue and nerve injury and emotional impact of injury  
**Goal:** Control of pain  

1. Use pain intensity scale to assess pain level (ie, 1 to 10). Differentiate from hypoxia.  
2. Administer intravenous opioid analgesics as prescribed. Observe for respiratory depression in the patient who is not mechanically ventilated. Assess response to analgesic.  
3. Provide emotional support and reassurance.  

1. Pain level provides baseline for evaluating effectiveness of pain relief measures. Hypoxia can cause similar signs and must be ruled out before analgesic medication is administered.  
2. Intravenous administration is necessary because of altered tissue perfusion from burn injury.  
3. Emotional support is essential to reduce fear and anxiety resulting from burn injury. Fear and anxiety increase the perception of pain.  

- States pain level is decreased  
- Absence of nonverbal cues of pain

**Nursing Diagnosis:** Anxiety related to fear and the emotional impact of burn injury  
**Goal:** Minimization of patient’s and family’s anxiety  

1. Assess patient’s and family’s understanding of burn injury, coping skills, and family dynamics.  
2. Individualize responses to the patient’s and family’s coping level.  
3. Explain all procedures to the patient and the family in clear, simple terms.  

1. Previous successful coping strategies can be fostered for use in the present crisis. Assessment allows planning of individualized interventions.  
2. Reactions to burn injury are extremely variable. Interventions must be appropriate to the patient’s and family’s present level of coping.  
3. Increased understanding alleviates fear of the unknown. High levels of anxiety may interfere with understanding of complex explanations.  

- Patient and family verbalize understanding of emergent burn care  
- Able to answer simple questions

(continued)
**Plan of Nursing Care**

**Care of the Patient During the Emergent/Resuscitative Phase of Burn Injury** (Continued)

<table>
<thead>
<tr>
<th>Nursing Interventions</th>
<th>Rationale</th>
<th>Expected Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Consider administering prescribed anti-anxiety medications if the patient remains extremely anxious despite nonpharmacologic interventions.</td>
<td>5. Anxiety levels during the emergent phase may exceed the patient’s coping abilities. Medication decreases physiologic and psychological anxiety responses.</td>
<td></td>
</tr>
</tbody>
</table>

**Collaborative Problems:** Acute respiratory failure, distributive shock, acute renal failure, compartment syndrome, paralytic ileus, Curling’s ulcer  
**Goal:** Absence of complications

**Acute Respiratory Failure**
1. Assess for increasing dyspnea, stridor, changes in respiratory patterns.
2. Monitor pulse oximetry, arterial blood gas values for decreasing PO$_2$ and oxygen saturation, and increasing PCO$_2$.
4. Assess for restlessness, confusion, difficulty attending to questions, or decreasing level of consciousness.
5. Report deteriorating respiratory status immediately to physician.
6. Prepare to assist with intubation or escharotomies as indicated.

**Distributive Shock**
1. Assess for decreasing urine output, pulmonary artery and pulmonary artery wedge pressures, blood pressure, and cardiac output, or increasing pulse.
2. Assess for progressive edema as fluid shifts occur.
3. Adjust fluid resuscitation in collaboration with the physician in response to physiologic findings.

**Acute Renal Failure**
1. Monitor urine output and blood urea nitrogen (BUN) and creatinine levels.
2. Report decreased urine output or increased BUN and creatinine values to physician.
3. Assess urine for hemoglobin or myoglobin.
4. Administer increased fluids as prescribed.

**Compartment Syndrome**
1. Assess peripheral pulses hourly with Doppler ultrasound device.

(continued)
Plan of Nursing Care
Care of the Patient During the Emergent/Resuscitative Phase of Burn Injury (Continued)

<table>
<thead>
<tr>
<th>Nursing Interventions</th>
<th>Rationale</th>
<th>Expected Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Remove blood pressure cuff after each reading.</td>
<td>3. Cuff may act as a tourniquet as extremities swell.</td>
<td>• Absence of abdominal distention</td>
</tr>
<tr>
<td>4. Elevate burned extremities.</td>
<td>4. Elevation reduces edema formation.</td>
<td>• Normal bowel sounds within 48 hours</td>
</tr>
<tr>
<td>5. Report loss of pulse or sensation or presence of pain to physician immediately.</td>
<td>5. These signs and symptoms may indicate inadequate tissue perfusion.</td>
<td></td>
</tr>
<tr>
<td>6. Prepare to assist with escharotomies.</td>
<td>6. Escharotomies relieve the constriction caused by swelling under circumferential burns and improve tissue perfusion.</td>
<td></td>
</tr>
</tbody>
</table>

**Paralytic Ileus**
1. Maintain nasogastric tube on low intermittent suction until bowel sounds resume. | 1. This measure relieves gastric and abdominal distention, also prevents vomiting. | |
2. Auscultate for bowel sounds, abdominal distention. | 2. As bowel sounds resume, feeding may be slowly initiated. Abdominal distention reflects inadequate decompression. | |

**Curling’s Ulcer**
1. Assess gastric aspirate for pH and blood. | 1. Acidic pH indicates need for antacids or histamine blockers. Blood indicates possible gastric bleeding. | • Absence of abdominal distention |
2. Assess stools for occult blood. | 2. Blood in stools may indicate gastric or duodenal ulcer. | • Normal bowel sounds within 48 hours |
3. Administer histamine blockers and antacids as prescribed. | 3. Such medications reduce gastric acidity and risk of ulceration. | • Gastric aspirate and stools do not contain blood |

**ACUTE OR INTERMEDIATE PHASE OF BURN CARE**

The acute or intermediate phase of burn care follows the emergent/resuscitative phase and begins 48 to 72 hours after the burn injury. During this phase, attention is directed toward continued assessment and maintenance of respiratory and circulatory status, fluid and electrolyte balance, and gastrointestinal function. Infection prevention, burn wound care (ie, wound cleaning, topical antibacterial therapy, wound dressing, dressing changes, wound débridement, and wound grafting), pain management, and nutritional support are priorities at this stage and will be discussed in detail.

Airway obstruction caused by upper airway edema can take as long as 48 hours to develop. Changes detected by x-ray and arterial blood gases may occur as the effects of resuscitative fluid and the chemical reaction of smoke ingredients with lung tissues become apparent. The arterial blood gas values and other parameters determine the need for intubation or mechanical ventilation.

As capillaries regain integrity, at 48 or more postburn hours, fluid moves from the interstitial to intravascular compartments, losses of fluid from large burn wounds, and the patient’s physiologic responses to the burn injury. Blood components are administered as needed to treat blood loss and anemia.

Fever is common in burn patients after burn shock resolves. A resetting of the core body temperature in severely burned patients

| Table 57-4 • Fluid and Electrolyte Changes in the Acute Phase |
|------------------|-------------------|
| **OBSERVATION**  | **EXPLANATION**    |
| Hemodilution (decreased hematocrit)  | Blood cell concentration is diluted as fluid enters the intravascular compartment; loss of red blood cells destroyed at burn site. |
| Increased urinary output  | Fluid shift into intravascular compartment increases renal blood flow and causes increased urine formation. |
| Sodium (Na⁺) deficit (occurs occasionally in this phase)  | With diuresis, sodium is lost with water; existing serum sodium is diluted by water influx. |
| Potassium (K⁺) deficit  | Beginning on the fourth or fifth postburn day, K⁺ shifts from extracellular fluid into cells. |
| Metabolic acidosis  | Loss of sodium depletes fixed base; relative carbon dioxide content increases. |
results in a body temperature a few degrees higher than normal for several weeks after the burn. Bacteremia and septicemia also cause fever in many patients. Acetaminophen (Tylenol) and hypothermia blankets may be required to maintain body temperature in a range of 37.2°C to 38.3°C (99°F to 101°F) to reduce metabolic stress and tissue oxygen demand.

Central venous, peripheral arterial, or pulmonary artery thermodilution catheters may be required for monitoring venous and arterial pressures, pulmonary artery pressures, pulmonary capillary wedge pressures, or cardiac output. Generally, however, invasive vascular lines are avoided unless essential because they provide an additional port for infection in an already greatly compromised patient.

Infection progressing to septic shock is the major cause of death in patients who have survived the first few days after a major burn. The immunosuppression that accompanies extensive burn injury places the patient at high risk for sepsis. The infection that begins within the burn site may spread to the bloodstream.

**Infection Prevention**

Despite aseptic precautions and the use of topical antimicrobial agents, the burn wound is an excellent medium for bacterial growth and proliferation. Bacteria such as *Staphylococcus*, *Proteus*, *Pseudomonas*, *Escherichia coli*, and *Klebsiella* find optimal conditions for growth within the burn wound. The burn eschar is a nonviable crust with no blood supply; therefore, neither polymorphonuclear leukocytes or antibodies nor systemic antibiotics can reach the area. Phenomenal numbers of bacteria—more than 1 billion per gram of tissue—may appear and subsequently spread to the bloodstream or release their toxins, which reach distant sites. *Staphylococci* and *enterococci* are the organisms responsible for more than 50% of nosocomial bloodstream infections in patients with burn injuries. Fungi such as *Candida albicans* also grow easily in burn wounds.

When the burn wound is healing through spontaneous re-epithelialization or is being prepared for skin grafting, it must be protected from sepsis. Burn wound sepsis has these characteristics:

- **10^7** bacteria per gram of tissue
- Inflammation
- Sludging and thrombosis of dermal blood vessels

The primary source of bacterial infection appears to be the patient’s intestinal tract, the source of most microbes. The intestinal mucosa normally serves as a barrier to keep the internal environment free from a variety of pathogens. After a severe burn injury, the impaired intestinal mucosal barrier becomes markedly permeable. Because of this impaired intestinal mucosal barrier, the disturbed microbial flora and endotoxins found in the intestinal lumen pass freely into the systemic circulation, finally causing infection. If the intestinal mucosa receives some type of protection against permeability change, infection could be avoided. Early enteral feeding is one step to help avoid this increased intestinal permeability and prevent early endotoxin translocation (Cioffi, 2000; Peng, Yuan & Ziao, 2001).

Infection impedes burn wound healing by promoting excessive inflammation and damaging tissue. A major secondary source of pathogenic microbes is the environment. Infection control is a major role of the burn team in providing appropriate burn wound care. Cap, gown, mask, and gloves are worn while caring for the patient with open burn wounds. Clean technique is used when caring directly for burn wounds.

Tissue specimens are obtained for culture regularly to monitor colonization of the wound by microbial organisms. These may be swab, surface, or tissue biopsy cultures. Swab or surface cultures are noninvasive, simple, and painless. However, data obtained from such cultures apply only to the area sampled; therefore, invasive wound biopsy cultures may be required. Antibiotics are seldom prescribed prophylactically because of the risk of promoting resistant strains of bacteria. Systemic antibiotics are administered when there is documentation of burn wound sepsis or other positive cultures such as urine, sputum, or blood. Sensitivity of the organisms to the prescribed antibiotics should be determined before administration. Several parenteral antimicrobial agents may be given together to treat the infection. Careful attention is paid to antibiotic use in the burn unit because inappropriate use of antibiotics significantly affects the microbial flora present in the unit.

**Wound Cleaning**

Various measures are used to clean the burn wound. Hydrotherapy in the form of shower carts, individual showers, and bed baths can be used to clean the wounds. Total immersion hydrotherapy is performed in some settings. Because of the high risk of infection and sepsis, the use of plastic liners and thorough decontamination of hydrotherapy equipment and wound care areas are necessary to prevent cross-contamination. Tap water alone can be used for burn wound cleansing. The temperature of the water is maintained at 37.8°C (100°F), and the temperature of the room should be maintained between 26.6°C and 29.4°C (80°F to 85°F). Hydrotherapy, in whatever form, should be limited to a 20- to 30-minute period to prevent chilling of the patient and additional metabolic stress.

During the bath, the patient is encouraged to be as active as possible. Hydrotherapy provides an excellent opportunity for exercising the extremities and cleaning the entire body. When the patient is removed from the tub after the bath, any residue adhering to the body is washed away with a clear water spray or shower. Unburned areas, including the hair, must be washed regularly as well. At the time of wound cleaning, all skin is inspected for any hints of redness, breakdown, or local infection. Hair in and around the burn area, except the eyebrows, should be clipped short. Intact blisters may be left, but the fluid should be aspirated with a needle and syringe and discarded.

Conscientious management of the burn wound is essential. When nonviable loose skin is removed, aseptic conditions must be established. Wound cleaning is usually performed at least daily in wound areas that are not undergoing surgical intervention. When the eschar begins to separate from the viable tissue beneath (approximately 1.5 to 2 weeks after the burn), more frequent cleaning and débridement may be in order.

After the burn wounds are cleaned, they are gently patted with towels and the prescribed method of wound care is performed. Physician preferences, the availability of skilled nursing staff, and resources in terms of number of personnel, supplies, and time must be considered in choosing the best method for a given patient. Whatever the method, the goal is to protect the wound from overwhelming proliferation of pathogenic organisms and invasion of deeper tissues until either spontaneous healing or skin grafting can be achieved.

Patient comfort and ability to participate in the prescribed treatment are also important considerations. Wound care procedures, particularly tub baths, are metabolically stressful. Therefore, the patient is assessed for signs of chilling, fatigue, changes
in hemodynamic status, and pain unrelieved by analgesic medications or relaxation techniques.

**Topical Antibacterial Therapy**

There is general agreement that some form of antimicrobial therapy applied to the burn wound is the best method of local care in extensive burn injury. Topical antibacterial therapy does not sterilize the burn wound; it simply reduces the number of bacteria so that the overall microbial population can be controlled by the body’s host defense mechanisms. Topical therapy promotes conversion of the open, dirty wound to a closed, clean one.

Criteria for choosing a topical agent include the following:

- It is effective against gram-negative organisms, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and even fungi.
- It is clinically effective.
- It penetrates the eschar but is not systemically toxic.
- It does not lose its effectiveness, allowing another infection to develop.
- It is cost-effective, available, and acceptable to the patient.
- It is easy to apply, minimizing nursing care time.

The three most commonly used topical agents are silver sulfadiazine (Silvadene), silver nitrate, and mafenide acetate (Sulfamylon). These agents are described in Table 57-5. Many other topical agents are available, including povidone–iodine ointment 10% (Betadine), gentamicin sulfate, nitrofurazone (Furacin), Dakin’s solution, acetic acid, miconazole, and chlortrimazole. Bacitracin may be used for facial burns or on skin grafts initially.

A newer product used in burn wound care is Acticoat Antimicrobial Barrier dressing. Acticoat is a silver-coated dressing approved for treatment of burn wounds and donor sites. This dressing is kept moist with water for a controlled, sustained release of silver over the wound to provide an antimicrobial barrier. Acticoat has been shown to have a better antimicrobial performance than the traditional silver-based products commonly used in burn wound treatment. Acticoat is also cost-effective. The dressing can be left in place for up to 5 days, decreasing patient discomfort, the cost of dressing supplies, and nursing time for dressing changes. The dressing has been shown clinically to be very effective for prevention of burn wound infection (Yin, Langford & Burrell, 1999).

No single topical medication is universally effective. Using different agents at different times in the postburn period may be necessary. Bacteriologic cultures are required to monitor the effect of topical medications. Prudent use and alternation of antimicrobial agents result in less resistant strains of bacteria, greater effectiveness of the agents, and a decreased risk of sepsis.

Before a topical agent is reapplied, the previously applied topical agent must be thoroughly removed. The number of times the dressings are changed and soaked is planned to promote optimal therapeutic use of the topical agent.

**Table 57-5 • Overview of Topical Antibacterial Agents Used for Burn Wounds**

<table>
<thead>
<tr>
<th>AGENT</th>
<th>INDICATION</th>
<th>APPLICATION</th>
<th>NURSING IMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver sulfadiazine 1%</td>
<td>• Most bactericidal agent&lt;br&gt;• Minimal penetration of eschar</td>
<td>Apply 1/16-inch layer of cream with a sterile glove 1–3 times daily.</td>
<td>• Watch for leukopenia 2–3 days after initiation of therapy. (Leukopenia usually resolves within 2–3 days.)&lt;br&gt;• Anticipate formation of pseudoeschar (proteinaceous gel), which is removed easily after 72 hours.</td>
</tr>
<tr>
<td>(Silvadene) water-soluble cream</td>
<td></td>
<td></td>
<td>• Monitor arterial blood gas levels and discontinue as prescribed, if acidosis occurs. Mafenide acetate is a strong carbonic anhydrase inhibitor that may reduce renal buffering and cause metabolic acidosis.</td>
</tr>
<tr>
<td>Mafenide acetate 5% to 10%</td>
<td>• Effective against gram-negative and gram-positive organisms&lt;br&gt;• Diffuses rapidly through eschar&lt;br&gt;• In 10% strength, it is the agent of choice for electrical burns because of its ability to penetrate thick eschar.</td>
<td>Apply thin layer with sterile glove twice a day and leave open as prescribed. Or if the wound is dressed, change the dressing every 6 hours as prescribed.</td>
<td>• Premedicate the patient with an analgesic before applying mafenide acetate because this agent causes severe burning pain for up to 20 minutes after application.</td>
</tr>
<tr>
<td>(Sulfamylon) hydrophilic-based cream</td>
<td></td>
<td></td>
<td>• Monitor serum sodium (Na⁺) and potassium (K⁺) levels and replace as prescribed. Silver nitrate solution is hypotonic and acts as wick for sodium and potassium.</td>
</tr>
<tr>
<td>Silver nitrate 0.5% aqueous solution</td>
<td>• Bacteriostatic and fungicidal&lt;br&gt;• Does not penetrate eschar</td>
<td>Apply solution to gauze dressing and place over wound. Keep the dressing wet but covered with dry gauze and dry blankets to decrease vaporization. Remoisten every 2 hours, and redress wound twice a day.</td>
<td>• Protect bed linen and clothing from contact with silver nitrate, which stains everything it touches black.</td>
</tr>
<tr>
<td>Acticoat</td>
<td>• Effective against gram-negative and gram-positive organisms and some yeasts and molds&lt;br&gt;• Delivers a uniform, antimicrobial concentration of silver to the burn wound</td>
<td>Moisten with sterile water only (never use normal saline). Apply directly to wound. Cover with absorbent secondary dressing. Remoisten every 3–4 hours with sterile water.</td>
<td>• Do not use oil-based products or topical antimicrobials with Acticoat burn dressing. Keep Acticoat moist, not saturated. May produce a “pseudoeschar” from silver after application.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Can be left in place for 3–5 days. Now available in Acticoat 7, which can be left in place for up to 7 days without the need to change the dressing.</td>
</tr>
</tbody>
</table>
Wound Dressing

When the wound is clean, the burned areas are patted dry and the prescribed topical agent is applied; the wound is then covered with several layers of dressings. A light dressing is used over joint areas to allow for motion (unless the particular area has a graft and motion is contraindicated). A light dressing is also applied over areas for which a splint has been designed to conform to the body contour for proper positioning. Circumferential dressings should be applied distally to proximally. If the hand or foot is burned, the fingers and toes should be wrapped individually to promote adequate healing.

Burns to the face may be left open to air once they have been cleaned and the topical agent has been applied. Careful attention must be given to burns left exposed to ensure that they do not dry out and convert to a deeper burn.

Close communication and cooperation among the patient, surgeon, nurse, and other health care team members are essential for optimal burn wound care. Different wound areas on a given patient may require a variety of wound care techniques. Diagrams posted at the bedside are useful to inform staff of the current prescription for wound care, splints to be applied over dressings, and the exercise regimen to be followed before dressings are reapplied.

Occlusive Method

There is a role for occlusive dressings in treating specific wounds. An occlusive dressing is a thin gauze that is impregnated with a topical antimicrobial agent or that is applied after topical antimicrobial application. Occlusive dressings are most often used over areas with new skin grafts. Their purpose is to protect the graft, promoting an optimal condition for its adherence to the recipient site. Ideally, these dressings remain in place for 3 to 5 days, at which time they are removed for examination of the graft.

When these dressings are applied, precautions are taken to prevent two body surfaces from touching, such as fingers or toes, ear and scalp, the areas under the breasts, any point of flexion, or between the genital folds. Functional body alignment positions are maintained by using splints or by careful positioning of the patient.

Dressing Changes

Dressings are changed in the patient’s unit, hydrotherapy room, or treatment area approximately 20 minutes after an analgesic agent is administered. They may also be changed in the operating room after the patient is anesthetized. A mask, goggles, hair cover, disposable plastic apron or cover gown, and gloves are worn by health care personnel when removing the dressings. The outer dressings are slit with blunt scissors, and the soiled dressings are removed and disposed of in accordance with established procedures for contaminated materials.

Dressings that adhere to the wound can be removed more comfortably if they are moistened with tap water or if the patient is allowed to soak for a few moments in the tub. The remaining dressings are carefully and gently removed. The patient may participate in removing the dressings, providing some degree of control over this painful procedure. The wounds are then cleaned and debrided to remove debris, any remaining topical agent, exudate, and dead skin. Sterile scissors and forceps may be used to trim loose eschar and encourage separation of devitalized skin. During this procedure, the wound and surrounding skin are carefully inspected. The color, odor, size, exudate, signs of re-epithelialization, and other characteristics of the wound and the eschar and any changes from the previous dressing change are noted.

Wound Débridement

As debris accumulates on the wound surface, it can retard keratinocyte migration, thus delaying the epithelialization process. Débridement, another facet of burn wound care, has two goals:

- To remove tissue contaminated by bacteria and foreign bodies, thereby protecting the patient from invasion of bacteria
- To remove devitalized tissue or burn eschar in preparation for grafting and wound healing

There are three types of débridement—natural, mechanical, and surgical.

Natural Débridement

With natural débridement, the dead tissue separates from the underlying viable tissue spontaneously. After partial- and full-thickness burns, bacteria that are present at the interface of the burned tissue and the viable tissue underneath gradually liquefy the fibrils of collagen that hold the eschar in place for the first or second postburn week. Proteolytic and other natural enzymes cause this phenomenon. Using antibacterial topical agents, however, tends to slow this natural process of eschar separation. It is advantageous to the patient to speed this process through other means, such as mechanical or surgical débridement, thereby reducing the time during which bacterial invasion and other iatrogenic problems may arise.

Mechanical Débridement

Mechanical débridement involves using surgical scissors and forceps to separate and remove the eschar. This technique can be performed by skilled physicians, nurses, or physical therapists and is usually done with daily dressing changes and wound cleaning procedures. Débridement by these means is carried out to the point of pain and bleeding. Hemostatic agents or pressure can be used to stop bleeding from small vessels.

Dressings are also useful débriding agents. Coarse-mesh dressings applied dry or wet-to-dry (applied wet and allowed to dry) will slowly débride the wound of exudate and eschar when they are removed. Topical enzymatic débridement agents are available to promote débridement of the burn wounds. Because such agents do not have antimicrobial properties, they should be used with topical antibacterial therapy to protect the patient from bacterial invasion.

Surgical Débridement

Early surgical excision to remove devitalized tissue along with early burn wound closure is now being recognized as one of the most important factors contributing to survival in a patient with a major burn injury. Aggressive surgical wound closure has reduced the incidence of burn wound sepsis, thus improving survival rates (Gibran & Heimbach, 2000). Early excision is carried out before the natural separation of eschar is allowed to occur.

Surgical débridement is an operative procedure involving either primary excision (surgical removal of tissue) of the full thickness of the skin down to the fascia (tangential excision) or shaving the burned skin layers gradually down to freely bleeding, viable tissue. Surgical excision is initiated early in burn wound management. This may be performed a few days after the burn or as soon as the patient is hemodynamically stable and edema has decreased.
Ideally, the wound is then covered immediately with a skin graft, if needed, and an occlusive dressing. If the wound bed is not ready for a skin graft at the time of excision, a temporary biologic dressing may be used until a skin graft can be applied during subsequent surgery.

The use of surgical excision carries with it risks and complications, especially with large burns. The procedure creates a high risk of extensive blood loss (as much as 100 to 125 mL of blood per percent body surface excised) and lengthy operating and anesthesia time. However, when conducted in a timely and efficient manner, surgical excision results in shorter hospital stays and possibly a decreased risk of complications from invasive burn wound sepsis.

Gerontologic Considerations

Eschar separation in full-thickness burns is typically delayed in elderly patients, and older patients are frequently poor risks for surgical excision. Therefore, prolonged hospitalization, immobilization, and associated problems may be common. If the elderly patient can tolerate surgery, early excision with skin grafting is the treatment of choice because it decreases the mortality rate in this population. Prevention of complications of prolonged hospitalization, immobilization, and surgery is essential in the care of the elderly burn patient.

Grafting the Burn Wound

If wounds are deep (full-thickness) or extensive, spontaneous re-epithelialization is not possible. Therefore, coverage of the burn wound is necessary until coverage with a graft of the patient’s own skin (autograft) is possible. The purposes of wound coverage are to decrease the risk for infection; prevent further loss of protein, fluid, and electrolytes through the wound; and minimize heat loss through evaporation. Several methods of wound coverage are available; some are temporary until grafting with permanent coverage is possible. Wound coverage may consist of biologic, biosynthetic, synthetic, and autologous methods or a combination of these approaches.

The main areas for skin grafting include the face (for cosmetic and psychological reasons); functional areas, such as the hands and feet; and areas that involve joints. Grafting permits earlier functional ability and reduces contractures (shrinkage of burn scar through collagen maturation). When burns are very extensive, the chest and abdomen may be grafted first to reduce the burn surface.

Granulation tissue fills the space created by the wound, creates a barrier to bacteria, and serves as a bed for epithelial cell growth. Richly vascular granulation tissue is pink, firm, shiny, and free of exudate and debris. It should have a bacterial count of less than 100,000 per gram of tissue to optimize graft take. If the wound is not ready for skin grafting, the burn wound is excised and allowed to granulate. Once the wound is excised, a wound covering is applied to keep the wound bed moist and promote the granulation process.

BIOLeGIC DRESSINGS (HOMOGraftS AND HETEROGraftS)

Biologic dressings have several uses. In extensive burns, they save lives by providing temporary wound closure and protecting the granulation tissue until autografting is possible. Biologic dressings are commonly used in patients with large areas of burn and little remaining normal skin donor sites. Biologic dressings may also be used to débride wounds after eschar separation. With each biologic dressing change, débridement occurs. Once the biologic dressing appears to be “taking,” or adhering to the granulating surface with minimal underlying exudation, the patient is ready for an autograft.

Biologic dressings also provide temporary immediate coverage for clean, superficial burns and decrease the wound’s evaporative water and protein loss. They decrease pain by protecting nerve endings and are an effective barrier against water loss and entry of bacteria. When applied to superficial partial-thickness wounds, they seem to speed healing. Biologic materials can be left open or covered. They stay in place for varying lengths of time but are removed in instances of infection or rejection.

Biologic dressings consist of homografts (or allografts) and heterografts (or xenografts). Homografts are skin obtained from living or recently deceased humans. The amniotic membrane (amnion) from the human placenta may also be used as a biologic dressing. Heterografts consist of skin taken from animals (usually pigs). Most biologic dressings are used as temporary coverings of burn wounds and are eventually rejected because of the body’s immune reaction to them as foreign.

Homografts tend to be the most expensive biologic dressings. They are available from skin banks in fresh and cryopreserved (frozen) forms. Homografts are thought to provide the best infection control of all the biologic or biosynthetic dressings available. Revascularization occurs within 48 hours, and the graft may be left in place for several weeks. Cost, availability, and the possibility of transmission of disease limit the use of homografts.

Amnion is less expensive and is available in hospitals with burn centers and specialized tissue banks, which obtain and process it in cooperation with obstetric services. However, amnion grafts do not become vascularized by the patient’s vessels and can be left in place only for short periods.

Pigskin is available from commercial suppliers. It is available fresh, frozen, or lyophilized (freeze-dried) for longer shelf life. Pigskin impregnated with a topical antibacterial agent such as silver nitrate is also available. Pigskin is widely used for temporary covering of clean wounds such as superficial partial-thickness wounds and donor sites. Although pigskin does not vascularize, it will adhere to clean superficial wounds and provides excellent pain control while the underlying wound epithelializes.

BIOSYNTHETIC AND SYNTHETIC DRESSINGS

Problems with availability, sterility, and cost have prompted the search for biosynthetic and synthetic skin substitutes, which may eventually replace biologic dressings as temporary wound coverings. Currently the most widely used synthetic dressing is Biobrane, which is composed of a nylon, Silastic membrane combined with a collagen derivative. The material is semitransparent and sterile. It has an indefinite shelf life and is less costly than homograft or pigskin. Like biologic dressings, Biobrane protects the wound from fluid loss and bacterial invasion.

Biobrane adheres to the wound fibrin, which binds to the nylon–collagen material. Within 5 days, cells migrate into the nylon mesh. Generally, adherence to the wound surface correlates directly with low bacterial counts. When the Biobrane dressing adheres to the wound, the wound remains stable and the Biobrane can remain in place for 3 to 4 weeks. Biobrane dressings (Fig. 57-4) readily adhere to donor sites and meticulously clean débrided partial-thickness wounds; they will remain until spontaneous epithelialization and wound healing occur. Biobrane can be laid on top of a wide-meshed autograft to protect the wound until the autograft epithelium grows out to close the interstices.
Burns that are between superficial and deep partial thickness in depth can be treated with a promising new temporary biologic covering, TransCyte, a material composed of human newborn fibroblasts, which are cultured on the nylon mesh of Biobrane. The thin silicone membrane bonded to the mesh provides a moisture vapor barrier for the wound. TransCyte is used to treat burns in which the depth is indeterminate. TransCyte delivers a variety of biologically active proteins, which may benefit the wound healing process. Research has shown that wounds treated with TransCyte healed more quickly and with less hypertrophic scarring than burns treated with the traditional silver sulfadiazine protocols (Noordenbos, Dore & Hansbrough, 1999).

**DERMAL SUBSTITUTES**

In an attempt to develop the ideal burn wound covering product, dermal substitutes have been created. Two such products are Integra Artificial Skin and Alloderm.

Artificial skin (Integra) is the newest type of dermal substitute. A dermal analog, Integra is composed of two main layers. The epidermal layer, consisting of Silastic, acts as a bacterial barrier and prevents water loss from the dermis. The dermal layer is composed of animal collagen. It interfaces with the open wound surface and allows migration of fibroblasts and capillaries into the material. This “neodermis” becomes a permanent structure. The artificial dermis is biodegraded and reabsorbed. The outer silicone membrane is removed 2 to 3 weeks after application and is replaced with the patient’s own skin in the form of a thin epidermal skin graft. Long-term effects of Integra include minimal contracture formation. The graft site is very pliable, almost eliminating the need for repeated cosmetic surgery. Most importantly, Integra has resulted in less hypertrophic scarring (Fig. 57-5), thus eliminating the need for compression devices once the burn wound has healed. The use of Integra is increasing the survivability of burns and improving the functional and cosmetic qualities of the healed burn (Winfrey, Cochran & Hegarty, 1999).

Another promising dermal substitute is Alloderm. It is processed dermis from human cadaver skin, which can be used as the dermal layer for skin grafts. When a donor site (the area from which skin is taken to provide a skin graft for another part of the body) is harvested for an autologous skin graft, both the epidermal and dermal layers of skin are removed from the donor site. Alloderm provides a permanent dermal layer replacement. Its use allows the burn surgeon to harvest a thinner skin graft consisting of the epidermal layer only. The patient’s epidermal layer is placed directly over the dermal base (Alloderm). The new graft is then treated according to the burn unit’s protocol. Use of Alloderm has also resulted in less scarring and contractures with healed grafts; donor sites heal much more quickly than conventional donor sites because only the epidermal layer has been harvested. This is important when donor sites are limited because of extensive burns (Luterman, 2000).

**AUTOGRANTS**

Autografts remain the preferred material for definitive burn wound closure following excision. Autografts are the ideal means of covering burn wounds because the grafts are the patient’s own skin and thus are not rejected by the patient’s immune system. They can be split-thickness, full-thickness, pedicle flaps, or epithelial grafts. Full-thickness and pedicle flaps are commonly used for reconstructive surgery, months or years after the initial injury.

Split-thickness autografts can be applied in sheets or in postage stamp–like pieces, or they can be expanded by meshing so that they can cover 1.5 to 9 times more than a given donor site.
area. Skin meshers enable the surgeon to cut tiny slits into a sheet of donor skin, making it possible to cover large areas with smaller amounts of donor skin. These expanded grafts adhere to the recipient site more easily than sheet grafts and prevent the accumulation of blood, serum, air, or purulent material under the graft. However, any kind of graft other than a sheet graft will contribute to scar formation as it heals. Using expanded grafts may be necessary in large wounds but should be viewed as a compromise in terms of cosmesis.

If blood, serum, air, fat, or necrotic tissue lies between the recipient site and the graft, there may be partial or total loss of the graft. Infection and mishandling of the graft, as well as trauma during dressing changes, account for most other instances of graft loss. Using split-thickness grafts allows the remaining donor site to retain sweat glands and hair follicles and minimizes donor site healing time.

Use of cultured epithelial autograft (CEA) is common at several burn centers. This involves a biopsy of the patient’s skin in an unburned area. Keratinocytes are then isolated and epithelial cells are cultured in a laboratory. The original epithelial cell sample can multiply to 10,000 times its original size over 30 days. These cells are then attached to the burn wound. Varying degrees of success have been reported, and results are encouraging. However, the disadvantages of the CEA are that the grafts are thin and fragile and can shear easily. Research has shown that the outcomes of use of CEA are not as positive as once thought. The quality of burn scars is better, but patients have longer hospital stays and higher hospital costs and require more surgical procedures than those treated by traditional methods. In addition, patients require more reconstructive procedures in the first 1 to 2 years postinjury. Therefore, CEA use is very limited and reserved for burn patients whose donor sites are limited (Noordenbos et al., 1999).

Care of the Patient with an Autograft. Occlusive dressings are commonly used initially after grafting to immobilize the graft. Occupational therapists may be helpful in constructing splints to immobilize newly grafted areas to prevent dislodging the graft. Homografts, heterografts, or synthetic dressings may also be used to protect grafts. The graft may be left open with skin staples to immobilize it, which allows close observation of progress.

The first dressing change is usually performed 3 to 5 days after surgery, or earlier in the case of purulent drainage or a foul odor. If the graft is dislodged, sterile saline compresses will help prevent drying of the graft until the physician reapplies it.

The patient is positioned and turned carefully to avoid disturbing the graft or putting pressure on the graft site. If an extremity has been grafted, it is elevated to minimize edema. The patient begins exercising the grafted area 5 to 7 days after grafting.

Care of Donor Site. A moist gauze dressing is applied at the time of surgery to maintain pressure and to stop any oozing. A thrombostatic agent such as thrombin or epinephrine may be applied directly to the site as well. The donor site may be treated in several ways, from single-layer gauze impregnated with petrolatum, scarlet red, or bismuth to new biosynthetic dressings such as Biobrane or BCG Matrix. Some burn centers are using the Acticoat dressing on donor sites. Despite the type of donor site covering, donor sites must remain clean, dry, and free from pressure. Because a donor site is usually a partial-thickness wound, it will heal.

**FIGURE 57-5** Comparison of Integra template site (right leg) to split thickness autograft site (left leg).
Used with permission from Glenn Warden, MD.
spontaneously within 7 to 14 days with proper care. Donor sites are painful, and additional pain management must be a part of the patient’s care.

Pain Management

Pain is inevitable during recovery from any burn injury. Pain in the burn patient has been described as a tormenting consequence of burn injury and wound healing (Jonsson, Holmsten, Dahlstrom & Jonsson, 1998). Burn pain is thought to have both nociceptive and neuropathic pain components. Management of the often-severe pain is one of the most difficult challenges facing the burn team. Many factors contribute to the burn patient’s pain experience. These factors include but are not limited to the severity of the burn, the adequacy of the health care provider’s assessment of the pain, the appropriateness and adequacy of pharmacologic treatment of pain, the multiple procedures involved in burn care (e.g., wound care, rehabilitative exercises), and appropriate evaluation of the effectiveness of pain relief measures. The outstanding features of burn pain are its intensity and long duration. Further, necessary wound care carries with it the anticipation of pain and anxiety.

In partial-thickness burns, the nerve endings are exposed, resulting in excruciating pain with exposure to air currents. Although nerve endings are destroyed in full-thickness burns, the margins of the burn wound are hypersensitive to pain, and there is pain in adjacent structures. Healing of full-thickness burns creates significant discomfort as regenerating nerve endings become entrapped in scar formation. Most severe burns are a combination of partial-thickness and full-thickness burns.

Burn patients have been described as having three types of pain: background or resting pain, procedural pain, and breakthrough pain. Background pain is pain that exists on a 24-hour basis. Procedural pain is pain caused by procedures such as burn wound care or range of motion exercises. Breakthrough pain occurs when blood levels of analgesic agents fall below the level required to control background pain. The patient’s pain level must be assessed throughout the day because each type of pain is different and various pain management strategies may be needed to address different types of pain (McCaffrey & Pasaro, 1999).

The primary pain from the burn itself is intense in the initial acute postburn phase. In the next few weeks thereafter, until the skin heals or skin grafts are applied and heal, the pain intensity remains high because of treatment-induced pain. Wound cleaning, dressing changes, debridement, and physical therapy can all cause intense pain. Donor sites may be intensely painful for several days. Discomfort related to tissue healing, such as itching, tingling, and tightness of contracting skin and joints, adds to the duration, if not the intensity, of pain over weeks or months. Because pain cannot be eliminated short of complete anesthesia, the goal is to minimize the pain with analgesic agents to an acceptable goal set by the patient.

Opioid administration via the intravenous (IV) route, particularly in the emergent and acute phases of burn management, remains the mainstay for pharmacologic management of burn pain. Use of opioids is complicated by the fluctuation in the bioavailability of drugs, protein binding of the drug, and the drug clearance related to the hemodynamic and fluid volume shifts that occur with a burn injury. Absorption of the opioid also may be affected. Titrating analgesic agents to obtain pain relief while minimizing side effects is crucial. The burn patient’s requirements for analgesia are often high, but fear of addiction on the part of the patient and health care provider hamper adequate opioid administration.

Morphine sulfate remains the analgesic of choice for treatment of acute burn pain. It is titrated to obtain pain relief based on the patient’s self-report of pain using a standardized pain rating scale.

Fentanyl is another useful opioid for burn pain, particularly procedural burn pain. It has been shown to be effective for management of intense pain of short duration. Fentanyl has a rapid onset, high potency, and short duration, all of which make it effective for use with burn wound procedures. Appropriate cardiac and respiratory monitoring must be carried out during its administration.

Patient-controlled analgesia (PCA), in which a pump is used to administer a continuous infusion of an opioid, maintains a steady level of opioid for pain relief. Use of continuous infusion requires close monitoring of the patient’s responses.

Sustained-release opioids, such as MS Contin or oxycodone (OxyContin), have also been used successfully in the treatment of burn pain. These medications can effectively treat the resting pain that is often associated with burn injury. Additional medications must be prescribed with these medications to cover breakthrough pain.

Some burn units use self-administered nitrous oxide during burn wound procedures. Proper ventilation and monitoring equipment and availability of qualified personnel to administer nitrous oxide limit its use.

Anxiety and pain go hand in hand for burn patients. The entire burn experience can produce severe anxiety, which can, in turn, exacerbate pain. Therefore, the ideal pain management regimen must incorporate the treatment of pain and anxiety and must be individualized for each patient. Sedation with anxiolytic medications such as lorazepam (Ativan) and midazolam (Versed) may be indicated in addition to the administration of opioids.

The use of nonpharmacologic measures has also proven effective in the management of burn pain. These measures include relaxation techniques, deep breathing exercises, distraction, guided imagery, hypnosis, therapeutic touch, humor, information giving, and music therapy (McCaffrey & Pasaro, 1999).

Music therapy has gained interest recently in the treatment of pain. Researchers have found that music affects both the physiologic and psychological aspects of the pain experience. Music diverts the patient’s attention from the painful stimulus; provides reality orientation, distraction, and sensory stimulation; and allows for patient self-expression (Fratianne et al., 2001; Prensner et al., 2001).

Nutritional Support

Burn injuries produce profound metabolic abnormalities fueled by the exaggerated stress response to the injury. The body’s response has been classified as hyperdynamic, hypermetabolic, and hypercatabolic. Hypermetabolism can affect morbidity and mortality by increasing the risk of infection and slowing the healing rate. Patients’ metabolic demands vary with the extent of the burn injury. Hypermetabolism is evident immediately after a burn injury. The degree of the response depends on the size of the burn and the patient’s age, body composition, size, and genetic response to insult. Persistent hypermetabolism may last up to 1 year after burn injury (Hart et al., 2000).

Major metabolic abnormalities seen after a burn injury include increased catabolic hormones (cortisol and catecholamines); decreased anabolic hormones (human growth factor and testosterone); a marked increase in the metabolic rate; a sustained increase in body temperature; a marked increase in glucose demands; rapid skeletal
muscle breakdown with amino acids serving as the energy source; lack of ketosis, indicating that fat is not a major source of calories; and catabolism that does not respond to nutrient intake (Demling & Seigne, 2000). Therefore, it is essential to control the stress response by increasing the anabolic process through adequate nutrition and increased muscle activity, decreasing heat loss from wounds, and maintaining a warm environment. Controlling secondary stress, such as pain and anxiety, also helps to control the stress response.

The most important of these interventions is to provide adequate nutrition and calories to decrease catabolism. Nutritional support with optimized protein intake can decrease protein losses by approximately 50% (Cioffi, 2000). Healing of the burn wound consumes large quantities of energy. Effective nutrition management depends on how well the energy expenditure due to the burn injury can be estimated and matched with appropriate amounts of micronutrients, carbohydrates, lipids, and protein. The goal of nutritional support is to promote a state of positive nitrogen balance by optimizing nutrition to match nutrient utilization. The nutritional support required is based on the patient’s preburn status and the TBSA burned.

Several formulas exist for estimating the daily metabolic expenditure and caloric requirements of patients with burn injuries. The most commonly used formulas include the Curreiri formula, which uses body weight and percent burn, and a variation of the Harris-Benedict equation, which determines basal energy requirements based on stress and burn size (Demling & Seigne, 2000). Protein requirements may range from 1.5 to 4.0 g of protein per kilogram of body weight every 24 hours. Lipids are included in the nutritional support of every burn patient because of their importance for wound healing, cellular integrity, and absorption of fat-soluble vitamins. Carbohydrates are included to meet caloric requirements as high as 5,000 calories per day and to spare protein, which is essential for wound healing. The patient also needs adequate vitamins and minerals. Existing formulas may underestimate the daily metabolic expenditures associated with burns. The formulas fail to account for added stressors such as pain, anxiety, daily dressing changes, and decreased activity levels. These must be considered when estimating appropriate nutritional support. Research findings have brought about changes in specific guidelines for estimating energy expenditure during the various phases of postburn recovery. The proportions of fat, protein, and carbohydrate must be carefully planned for maximal use (Demling & Seigne, 2000).

The enteral route of feeding is far superior to the parenteral route. Enteral feedings preserve the intestinal barrier function and absorption of peptides and amino acids, which leads to higher nitrogen retention. Feedings are started as soon as possible. If a feeding tube is used, placement into the duodenum is ideal to prevent aspiration and to allow for continuous, uninterrupted feedings during surgical procedures. If the oral route is used, high-protein, high-calorie meals and supplements are given. Dietary consultations are useful in helping patients meet their nutritional needs. Daily caloric counts aid in assessing the adequacy of nutritional intake. Overfeeding must be avoided because it increases metabolism, O₂ consumption, and CO₂ production.

Patients lose a great deal of weight during recovery from severe burns. Reserve fat deposits are catabolized, fluids are lost, and caloric intake may be limited. Because a burn injury lowers the patient’s resistance to infection and disease, the nutritional status must be improved and maintained although the patient has a poor appetite and is weak.

Indications for parenteral nutrition include weight loss greater than 10% of normal body weight, inadequate intake of enteral nutrition due to clinical status, prolonged wound exposure, and malnutrition or debilitated condition before injury. The risk of infection at the site of the central venous catheter required for parenteral nutrition must be considered. Moreover, the risk of Curling’s ulcer continues in the acute phase.

**DISORDERS OF WOUND HEALING**

Disorders of wound healing in the burn patient result from excessive abnormal healing or inadequate new tissue formation. Hypertrophic scarring and keloid formation result from excessive abnormal healing.

**Scars**

One of the most devastating sequelae of a burn injury is the formation of hypertrophic scars. Clinicians cannot reliably predict or prevent the formation of hypertrophic scars. Hypertrophic scars are more common in children, in people with dark skin, and in areas of stretch or motion. The pathophysiology behind these scars is not completely understood, but they are characterized by an overabundant matrix formation, especially collagen.

Hypertrophic scars and wound contractures are more likely to occur if the initial burn injury extends below the level of the deep dermis. Healing of such deep wounds results in the replacement of normal integument with highly metabolically active tissues that lack the normal architecture of the skin. In the collagen layer beneath the epithelium, many fibroblasts proliferate gradually. Myofibroblasts, cells that have the ability to contract, are also present in immature wounds. As the myofibroblasts contract, the collagen fibers, which normally lie in flat bundles, tend to form a wavy pattern. Eventually the collagen bundles take on a supercoiled appearance and collagen nodules develop. The scar becomes red (because of its hypervascular nature), raised, and hard.

Burn personnel must be proactive in the prevention and management of scar formation. Compression measures are instituted early in burn wound treatment. Ace wraps are used initially to help promote adequate circulation, but they can also be used as the first form of compression. Scar management occurs mainly in the rehabilitative phase, after the wounds are closed. Hypertrophic scarring may cause severe contracture across involved joints. Therefore, prevention and management of this type of scarring is essential (see “Prevention of Hypertrophic Scarring” in the rehabilitation phase discussion). However, these scars are limited to the area of injury and gradually regress over time.

**Keloids**

A large, heaped-up mass of scar tissue, a keloid, may develop and extend beyond the wound surface. Keloids tend to be found in people with darkly pigmented skin, tend to grow outside of wound margins, and are likely to recur after surgical excision.

**Failure to Heal**

Failure of the wound to heal may result from many factors, including infection and inadequate nutrition. A serum albumin level of less than 2 g/dL is usually a factor in impaired healing in the burn patient.
Contractures

Contractures are another concern as wounds heal. The burn wound tissue shortens because of the force exerted by the fibroblasts and the flexion of muscles in natural wound healing. An opposing force provided by splints, traction, and purposeful movement and positioning must be used to counteract deformity in burns affecting joints.

NURSING PROCESS: CARE OF THE PATIENT DURING THE ACUTE PHASE

Assessment

Continued assessment of the burn patient during the early weeks after the burn injury focuses on hemodynamic alterations, wound healing, pain and psychosocial responses, and early detection of complications. Assessment of respiratory and fluid status remains the highest priority for detection of potential complications.

The nurse assesses vital signs frequently. Continued assessment of peripheral pulses is essential for the first few postburn days while edema continues to increase, potentially damaging peripheral nerves and restricting blood flow. Observation of the electrocardiogram may give clues to cardiac dysrhythmias resulting from potassium imbalance, preexisting cardiac disease, or the effects of electrical injury or burn shock.

Assessment of residual gastric volumes and pH in the patient with a nasogastric tube is also important. Blood in the gastric fluid or the stools must also be noted and reported.

Assessment of the burn wound requires an experienced eye, hand, and sense of smell. Important wound assessment features include size, color, odor, eschar, exudate, abscess formation under the eschar, epithelial buds (small pearl-like clusters of cells on the wound surface), bleeding, granulation tissue appearance, status of grafts and donor sites, and quality of surrounding skin. Any significant changes in the wound are reported to the physician, because they usually indicate burn wound or systemic sepsis and require immediate intervention.

Other significant and ongoing assessments focus on pain and psychosocial responses, daily body weights, caloric intake, general hydration, and serum electrolyte, hemoglobin, and hematocrit levels. Assessment for excessive bleeding from blood vessels adjacent to areas of surgical exploration and debridement is necessary as well. The Plan of Nursing Care provides an outline of nursing activities in the acute phase of burn care.

Diagnosis

NURSING DIAGNOSES

Based on the assessment data, priority nursing diagnoses in the acute phase of burn care may include the following:

- Excessive fluid volume related to resumption of capillary integrity and fluid shift from the interstitial to intravascular compartment
- Risk for infection related to loss of skin barrier and impaired immune response
- Imbalanced nutrition, less than body requirements, related to hypermetabolism and wound healing needs
- Impaired skin integrity related to open burn wounds
- Acute pain related to exposed nerves, wound healing, and treatments
- Impaired physical mobility related to burn wound edema, pain, and joint contractures
- Ineffective coping related to fear and anxiety, grieving, and forced dependence on health care providers
- Interrupted family processes related to burn injury
- Deficient knowledge about the course of burn treatment

COLLABORATIVE PROBLEMS/POTENTIAL COMPLICATIONS

Based on the assessment data, potential complications that may develop in the acute phase of burn care may include:

- Heart failure and pulmonary edema
- Sepsis
- Acute respiratory failure
- Acute respiratory distress syndrome
- Visceral damage (electrical burns)

Planning and Goals

The major goals for the patient may include restoration of normal fluid balance, absence of infection, attainment of anabolic state and normal weight, improved skin integrity, reduction of pain and discomfort, optimal physical mobility, adequate patient and family coping, adequate patient and family knowledge of burn treatment, and absence of complications. Achieving these goals requires a collaborative, interdisciplinary approach to patient management.

Nursing Interventions

RESTORING NORMAL FLUID BALANCE

To reduce the risk of fluid overload and consequent congestive heart failure, the nurse closely monitors IV and oral fluid intake, using IV infusion pumps to minimize the risk of rapid fluid infusion. To monitor changes in fluid status, careful intake and output and daily weights are obtained. Changes in pulmonary artery, wedge, and central venous pressures, as well as in blood pressure and pulse rate, are reported to the physician. Low-dose dopamine to increase renal perfusion and diuretics may be prescribed to promote increased urine output. The nurse’s role is to administer these medications as prescribed and to monitor the patient’s response.

PREVENTING INFECTION

A major part of the nurse’s role during the acute phase of burn care is detecting and preventing infection. The nurse is responsible for providing a clean and safe environment and for closely scrutinizing the burn wound to detect early signs of infection. Culture results and white blood cell counts are monitored.

Clean technique is used for wound care procedures. Aseptic technique is used for any invasive procedures, such as insertion of IV lines and urinary catheters or tracheal suctioning. Meticulous hand hygiene before and after each patient contact is also an essential component of preventing infection, even though gloves are worn to provide care.

The nurse protects the patient from sources of contamination, including other patients, staff members, visitors, and equipment. Invasive lines and tubing must be routinely changed according to recommendations of the Centers for Disease Control and Prevention. Tube feeding reservoirs, ventilator circuits, and drainage containers are replaced regularly. Fresh flowers, plants, or fresh
# Plan of Nursing Care

## Care of the Patient During the Acute Phase of Burn Injury

### Nursing Interventions | Rationale | Expected Outcomes
--- | --- | ---
**Nursing Diagnosis:** Fluid volume excess related to resumption of capillary integrity and fluid shift from interstitial to intravascular compartment  
**Goal:** Maintenance of optimal fluid balance

1. Monitor vital signs, intake and output, weight. Assess for edema, jugular vein distention (JVD), crackles, increased arterial pressures.  
   1. These signs reflect fluid status.  
   - Intake, output, and body weight correlate with expected pattern  
   - Vital signs and arterial pressures remain within designated limits  
   - Urine output increases in response to diuretic and vasoactive medications

2. Notify physician of urine output <30 mL/hr, weight gain, JVD, crackles, increased arterial pressures.  
   2. These indicate increased fluid volume.

3. Maintain intravenous fluids on pumps or rate controllers.  
   3. Regulation prevents unintentional fluid bolus.

4. Administer dopamine or diuretics as prescribed. Assess response.  
   4. Dopamine increases renal perfusion, which increases urine output. Diuretics promote increased urine formation and urine output and decrease intravascular volume.

**Nursing Diagnosis:** Risk for infection related to loss of skin barrier and impaired immune response  
**Goal:** Absence of localized or systemic infection

1. Use asepsis in all aspects of patient care:
   a. Meticulous hand hygiene before and after patient care.
   b. Use clean or sterile gloves for wound care.
   c. Wear isolation gown or protective plastic apron for patient care.
   d. Wear mask and hair cover when wounds are exposed and during sterile procedures.
   e. Change invasive lines and tubings as recommended by CDC.  
   1. Aseptic techniques minimize risk of cross-contamination and spread of bacterial contamination.  
   - Wound cultures show minimal bacteria  
   - Negative blood, urine, and sputum cultures  
   - Urine output and vital signs within acceptable range  
   - Absence of signs and symptoms of infection and sepsis

2. Screen visitors for respiratory, gastrointestinal, or integumentary infections. Provide isolation gowns for visitors without active infection and instruct in hand hygiene.  
   2. Avoiding known infecting agents prevents introduction of additional microorganisms.

3. Exclude plants and flowers in water from patient’s room.  
   3. Stagnant water is a potential source of bacterial growth.

4. Inspect wound for signs of infection, purulent drainage, or discoloration.  
   4. Such signs indicate localized infection.

5. Monitor white blood cell (WBC) count, culture and sensitivity results.  
   5. Increased WBC count indicates infection. Culture and sensitivity indicate microorganisms present and appropriate antibiotics to be used.

6. Administer antibiotics as prescribed.  
   6. Antibiotics reduce bacteria.

7. Provide regular linen changes and assist patient with personal hygiene.  
   7. These measures reduce potential bacterial colonization of burn wound.

8. Report to physician decreased bowel sounds, tachycardia, decreased blood pressure, decreased urine output, fever, and flushing.  
   8. These signs may indicate sepsis.

   9. These agents are used to maintain tissue perfusion in sepsis.

(continued)
## Plan of Nursing Care

### Care of the Patient During the Acute Phase of Burn Injury (Continued)

<table>
<thead>
<tr>
<th>Nursing Interventions</th>
<th>Rationale</th>
<th>Expected Outcomes</th>
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| **Nursing Diagnosis:** Altered nutrition, less than body requirements, related to hypermetabolism and wound healing  
**Goal:** Attainment of anabolic nutritional status  
1. Provide high-calorie, high-protein diet; include patient preferences and home-made food. Provide nutritional supplements as prescribed.  
2. Monitor patient’s daily weight and calorie count.  
3. Administer supplemental vitamins and minerals as prescribed.  
4. Administer enteral or parenteral nutrition per protocol if dietary needs are not met through oral intake.  
5. Report abdominal distention, large gastric residual volumes, or diarrhea to physician. | 1. The patient needs sufficient nutrients for wound healing and increased metabolic requirements.  
2. These measures assist in determining whether dietary needs are being met.  
3. These help meet additional nutritional needs; adequate vitamins and minerals are necessary for wound healing and cellular function.  
4. Nutritional techniques ensure that nutritional needs are met.  
5. These signs may indicate intolerance of route or type of feeding. | • Gains weight daily after initial loss  
• Exhibits no signs of protein, vitamin, or mineral deficiencies  
• Meets required nutritional needs entirely by oral intake  
• Participates in selection of diet with prescribed nutrients  
• Serum protein levels within acceptable range |
| **Nursing Diagnosis:** Impaired skin integrity related to open burn wounds  
**Goal:** Demonstration of improved skin integrity  
1. Clean wounds, body, and hair daily.  
2. Provide wound care as prescribed.  
3. Apply topical antibacterial agents and dressing as prescribed.  
4. Prevent pressure, infection, and mobilization of skin grafts.  
5. Provide donor site care.  
6. Provide adequate nutritional support.  
2. Care promotes wound healing.  
3. Wound care regimen reduces bacterial colonization and promotes healing.  
4. These measures promote graft take and healing.  
5. Care promotes healing of donor site.  
6. Adequate nutrition is essential for normal granulation and healing.  
7. Early intervention for poor wound healing or graft take is essential. Grafted or healed burn wounds are susceptible to trauma. | • Skin is generally intact, and free of signs of infection, pressure, and trauma  
• Open wounds are pink, reepithelializing, and free of infection  
• Donor sites are clean and reepithelializing  
• Healed wounds are soft and smooth  
• Skin is lubricated and elastic |
| **Nursing Diagnosis:** Pain related to exposed nerves, wound healing, and treatments  
**Goal:** Reduction or control of pain  
2. Educate the patient about the usual pain trajectory in burn recovery and options for pain control. Allow patient as much control as possible regarding pain management.  
3. Offer analgesics approximately 20 minutes before painful procedures.  
4. Provide analgesia before pain becomes severe.  
5. Instruct and assist patient in relaxation, imagery, distraction techniques. | 1. Pain assessment data provide baseline for assessing response to interventions.  
2. Knowledge reduces fear of the unknown and provides some measure of control to the patient.  
3. Premedication allows time for therapeutic response.  
4. Pain is more easily controlled before it becomes severe.  
5. Nonpharmacologic pain measures provide multiple interventions to decrease pain sensation. | • Requests analgesics for specific wound care procedures or physical therapy activities  
• States pain is minimal  
• Gives no physiologic or nonverbal cues of moderate or severe pain  
• Uses pain control measures such as nitrous oxide, relaxation, imagery, and distraction techniques to assist with coping with pain  
• Can sleep without being disturbed by pain  
• Reports skin is comfortable with no itching or tightness |
### Nursing Interventions | Rationale | Expected Outcomes
--- | --- | ---
7. Administer antianxiety and antipruritic agents as indicated. | These medications help to increase patient’s comfort. | 7. These medications help to increase patient’s comfort. |
8. Lubricate healing burn wounds with water- or silica-based lotion. | These preparations decrease sensation of skin tightness. | 8. These preparations decrease sensation of skin tightness. |

**Nursing Diagnosis:** Impaired physical mobility related to burn wound edema, pain, and joint contractures  
**Goal:** Achievement of optimal physical mobility

1. Position patient carefully to prevent flexed position in burned areas. | Proper positioning reduces risk of flexion contractures. | • Improves range of motion of joints daily  
• Demonstrates preinjury range of motion of all joints  
• Absence of signs of periarticular calcification  
• Participates in activities of daily living |
2. Implement range-of-motion (ROM) exercises several times daily. | ROM exercises minimize muscle atrophy. | |
3. Assist with early sitting and ambulation. | Early mobility encourages increased use of muscles. | |
4. Use splints and exercise devices recommended by occupational and physical therapists. | Such devices encourage activity while maintaining proper position of joints. | |
5. Encourage self-care to the extent of the patient’s ability. | Self-care promotes both independence and increased activity. | |

**Nursing Diagnosis:** Ineffective individual coping related to fear and anxiety, grieving, and forced dependence on health care providers  
**Goal:** Use of appropriate coping strategies to deal with postburn problems

1. Assess patient for coping abilities and previous successful coping strategies. | Psychosocial data provide baseline for planning care. | • Verbalizes reactions to burns, therapeutic procedures, losses  
• Identifies effective coping strategies used previously in stressful situations  
• Accepts dependency on health care providers during acute illness  
• Resolves grief over losses resulting from burn injury  
• Participates in decision making regarding care  
• Has hopeful attitude toward future |
2. Demonstrate acceptance of patient. Provide positive feedback and support. | Acceptance encourages self-esteem and continued progress toward independence. | |
3. Assist patient to set achievable short-term goals for increased independence in activities of daily living. | Short-term goal setting leads to pattern of success for patient. Long-term goals may seem unrealistic or unattainable to patient. | |
4. Use multidisciplinary approach to promote mobility and independence. | Communication among disciplines provides consistent approach. | |
5. Consult with health care team members for assistance with regressive or maladaptive behaviors. | Collaboration uses the expertise of others. | |

**Nursing Diagnosis:** Altered family processes related to burn injury  
**Goal:** Achievement of appropriate patient/family processes

1. Assess patient and family’s perception of impact of burn injury on family functioning. | Assessment data provide baseline from which to plan care. | • Patient verbalizes feelings regarding alteration in family interactions  
• Family can emotionally support the patient during hospitalization  
• Family states that needs are met |
2. Demonstrate willingness to listen. Provide realistic support. Refer family to social services and other resources as needed. | Empathetic attitude promotes verbalizing of concerns. | |
3. Explain the burn patient’s coping patterns to family. Discuss ways that they can support the patient. | Collaboration assists to address concerns comprehensively. | |
4. Explainations help decrease anxiety about the unknown and promote appropriate support of patient by family. | |
### Plan of Nursing Care

**Care of the Patient During the Acute Phase of Burn Injury (Continued)**

<table>
<thead>
<tr>
<th>Nursing Interventions</th>
<th>Rationale</th>
<th>Expected Outcomes</th>
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</table>
| **Nursing Diagnosis:** Knowledge deficit about the course of burn treatment  
**Goal:** Verbalization of understanding of the course of burn treatment by patient and family | 1. Limit education to patient’s and family’s ability to process information.  
2. This information provides a baseline for explanations and indication of patient’s and family’s expectations.  
3. Knowing what to expect prepares patient and family for upcoming events.  
4. This information provides specific direction to patient.  
5. Honesty promotes realistic expectations. | States rationale for different aspects of treatment  
States realistic time period for recovery  
Patient and family participate in management plans as appropriate |
| 1. Assess readiness of patient and family to learn.  
2. Explore patient’s and family’s previous experience with hospitalization and illness.  
3. Review general course of burn treatment with patient and family.  
4. Explain importance of patient participation in care for optimal results.  
5. Realistically explain length of time involved in burn recovery. |  |  |
| **Collaborative Problems:** Congestive heart failure, pulmonary edema, sepsis, acute respiratory failure, ARDS, visceral damage (electrical burns)  
**Goal:** Absence of complications | 1. These signs may indicate decreased cardiac output and the onset of CHF.  
2. Increased pressures indicate increased preload and intravascular volumes. Decreasing cardiac output reflects less oxygen and nutrients available to the tissues and may indicate the onset of CHF.  
3. Such signs may indicate progression of CHF to pulmonary edema.  
4. Prompt medical intervention is needed.  
5. Elevation facilitates gas exchange.  
6. Diuretics increase urine output and decrease cardiac preload and intravascular volumes. | Lungs clear to auscultation  
Absence of dyspnea, orthopnea, JVD, and S$_3$ or S$_4$ heart sounds  
Urinary output, arterial pressures, and cardiac output within normal limits |
| **Congestive Heart Failure (CHF) and Pulmonary Edema** |  |  |
| 1. Assess for decreased urine output, JVD, or an S$_3$ or S$_4$ heart sound.  
2. Monitor for increases in arterial pressures or decrease in cardiac output. |  |  |
| 3. Assess for crackles on lung auscultation, dyspnea, orthopnea, or decreased oxygenation detected by pulse oximetry or arterial blood gas values.  
4. Report the above mentioned signs and symptoms to the physician.  
5. Position patient with the head of bed up 45° to 90° as tolerated.  
| **Sepsis** |  |  |
| 1. Assess for fever, increased pulse, widened pulse pressure, and flushed, dry skin in unburned areas. Watch trends and notify physician if noted.  
2. Monitor wound and blood cultures and notify physician of positive cultures.  
3. Administer fluids, vasoactive medications and antibiotics as prescribed. Monitor for therapeutic response. Check that infecting organisms are sensitive to prescribed antibiotics.  
4. Monitor for therapeutic serum antibiotic levels. | 1. Such signs may indicate impending sepsis.  
2. Positive cultures indicate infection and possible sepsis.  
3. Antibiotics kill susceptible bacteria. Intravenous fluids and vasoactive medications maintain intravascular volume and blood pressure.  
4. Antibiotics are most effective at therapeutic levels. Excessive levels can cause organ damage. | Negative blood, sputum, and urine cultures  
Absence of tachycardia, widening pulse pressure, and flushed, dry skin in unburned areas |

(continued)
MAINTAINING ADEQUATE NUTRITION

Oral fluids should be initiated slowly when bowel sounds resume. The patient’s tolerance is noted. If vomiting and distention do not occur, fluids may be increased gradually and the patient may advance to a normal diet or to tube feedings.

The nurse collaborates with the dietitian or nutrition support team to plan a protein- and calorie-rich diet that is acceptable to the patient. Family members may be encouraged to bring nutritious and favorite foods to the hospital. Milkshakes and sandwiches made with meat, peanut butter, and cheese may be offered as snacks between meals and late in the evening. Nutritional supplements such as Ensure and Resource may be provided. Caloric intake must be documented. Vitamin and mineral supplements may be prescribed.

If caloric goals cannot be met by oral feeding, a feeding tube is inserted and used for continuous or bolus feedings of specific formulas. The volume of residual gastric secretions should be checked to ensure absorption. Parenteral nutrition may also be required but should be used only if gastrointestinal function is compromised (see Chap. 36).

Patients should be weighed each day and their weights graphed. Patients can use this information to set goals for their own nutritional intake and to monitor weight loss and gain. Ideally, the patient will lose no more than 5% of preburn weight if aggressive nutritional management is implemented.

The patient with anorexia requires encouragement and support from the nurse to increase food intake. The patient’s surroundings should be as pleasant as possible at mealtime. Catering to food preferences and offering high-protein, high-vitamin snacks are ways of encouraging the patient to increase intake.

PROMOTING SKIN INTEGRITY

Wound care is usually the single most time-consuming element of burn care after the emergent phase. The physician will prescribe the desired topical antibacterial agents and specific biologic, biosynthetic, or synthetic wound coverings and will plan for surgical excision and grafting. The nurse needs to make astute assessments of wound status, to use creative approaches to wound dressing, and to support the patient during the emotionally distressing and very painful experience of wound care.

The nurse serves as the coordinator of the complex aspects of wound care and dressing changes for the patient. The nurse must be aware of the rationale and nursing implications for the various wound management approaches. Nursing functions include assessing and recording any changes or progress in wound healing and keeping all members of the health care team informed of changes in the wound or treatment. A diagram, updated daily by the nurse responsible for the patient’s care, helps to inform all those concerned about the latest wound care procedures in use for the patient.
The nurse also assists the patient and family by providing instruction, support, and encouragement to take an active part in dressing changes and wound care when appropriate. Discharge planning needs for wound care are anticipated early in the course of burn management, and the strengths of the patient and family are assessed and used in preparing for eventual discharge and home care.

**RELIEVING PAIN AND DISCOMFORT**

Pain measures discussed earlier are continued during the acute phase of burn recovery. Analgesic agents and anxiolytic medications are administered as prescribed. Frequent assessment of pain and discomfort is essential. To increase its effectiveness, analgesic medication is provided before the pain becomes severe. Nursing interventions such as teaching the patient relaxation techniques, giving the patient some control over wound care and analgesia, and providing frequent reassurance are helpful. Guided imagery may be effective in altering the patient’s perceptions of and responses to pain. Other pain-relieving approaches include distraction through video programs or video games, hypnosis, biofeedback, and behavioral modification.

The nurse works quickly to complete treatments and dressing changes to reduce pain and discomfort. The patient is encouraged to take analgesic medications before painful procedures. The patient’s response to the medication and other interventions is assessed and documented.

Healing burn wounds are typically described by patients as itchy and tight. Oral antipruritic agents, a cool environment, frequent lubrication of the skin with water or a silica-based lotion, exercise and splinting to prevent skin contracture, and diversional activities all help to promote comfort in this phase.

**PROMOTING PHYSICAL MOBILITY**

An early priority is to prevent complications resulting from immobility. Deep breathing, turning, and proper repositioning are essential nursing practices that prevent atelectasis and pneumonia, control edema, and prevent pressure ulcers and contractures. These interventions are modified to meet the patient’s needs. Low-air-loss and rotation beds may be useful, and early sitting and ambulation are encouraged. Whenever the lower extremities are burned, elastic pressure bandages should be applied before the patient is placed in an upright position. These bandages promote venous return and minimize swelling.

The burn wound is in a dynamic state for a year or more after wound closure. During this time, aggressive efforts must be made to prevent contracture and hypertrophic scarring. Both passive and active range-of-motion exercises are initiated from the day of admission and are continued after grafting, within prescribed limitations. Splints or functional devices may be applied to extremities for contracture control. The nurse monitors the splinted areas for signs of vascular insufficiency and nerve compression.

**STRENGTHENING COPING STRATEGIES**

In the acute phase of burn care, the patient is facing the reality of the burn trauma and is grieving over obvious losses. Depression, regression, and manipulative behavior are common responses of

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**NURSING RESEARCH PROFILE 57-1**

*Burn Pain and Anxiety*


**Purpose**

Pain associated with burns and treatment of burn wounds is common and often excruciating. Its management is important in patient care and is often a nursing challenge. The purpose of this study was to examine burn patients’ experiences with pain and anxiety during rest and during painful wound care procedures.

**Study Sample and Design**

A descriptive study was conducted; the sample included 23 acutely burned adults in a southeastern level I trauma center who were undergoing wound care and who had not had previous surgery to treat their burn wounds. Ages ranged from 18 to 75 with a mean age of 33 ± 13.2. Data on pain and anxiety levels were collected in three phases: at the time of recruitment of subjects, at baseline (defined as at least 8 hours after the last procedure), and during burn wound care procedures (within 5 minutes of scrubbing/debridement/before dressings were reapplied).

Subjects completed the Visual Analogue Scale (VAS-pain) to assess the level of pain they considered acceptable, with possible scores ranging from no pain to worst pain possible. The Short-Form McGill (SF-M) questionnaire was used to measure the sensory and affective dimensions of pain, as well as the patient’s present pain on a Likert-type scale (0 = no pain; 5 = excruciating). A Visual Analogue Scale (VAS-anxiety) was used to measure anxiety, with scores ranging along a continuum from no anxiety to worse anxiety possible. Subjects were asked to mark both VAS instruments with an X, indicating the severity of their pain and anxiety. Other data collected included demographic data, analgesic and sedative use, and use of nonpharmacologic methods as distraction techniques during procedures. Descriptive and nonparametric statistical tests were used to analyze data.

**Findings**

Results showed that burn patients report higher levels of pain during procedures than when at rest. A strong positive relationship between pain and anxiety was found. The most frequently reported pain descriptor on the SF-M was “tender” during baseline measurements. Frequent descriptors during procedures included “throbbing,” “hot-burning,” and “aching.” There were no significant differences in anxiety between resting conditions and procedural dressing changes (p > 0.16). There were significant differences between burn patients’ acceptable level, resting level, and procedural pain levels (p = 0.01). Patients reported their baseline pain as less than their acceptable level of pain. Other findings noted that family presence during procedure was related to decreased procedural pain and decreased use of medications prescribed for relief of anxiety.

**Nursing Implications**

Because burn patients describe burn wound care procedures to be the most painful experience, efforts should be made to identify strategies that are effective in reducing pain intensity. Also, since pain and anxiety were linked, strategies need to be developed to decrease both. The researchers suggested that use of both pharmacologic and nonpharmacologic interventions during wound care procedures may be warranted to help patients cope with anxiety, resting pain, and pain associated with wound care procedures. Future studies of the effect of different pharmacologic interventions with larger and more diverse samples are needed.
patients who have burn injuries. Withdrawal from participation in required treatments and regression must be viewed with an understanding that such behavior helps the patient cope with an enormously stressful event. Much of the patient’s energy goes into maintaining vital physical functions and wound healing in the early postburn weeks, leaving little emotional energy for coping in a more effective manner. Nurses can assist patients to develop effective coping strategies by setting specific expectations for behavior, promoting truthful communication to build trust, helping patients practice appropriate strategies, and giving positive reinforcement when appropriate. Most importantly, the nurse and all members of the health care team must demonstrate acceptance of the patient.

The patient frequently vents feelings of anger. At times the anger may be directed inward because of a sense of guilt, perhaps for causing the fire or even for surviving when loved ones perished. The anger may reach outward toward those who escaped unharmed or to those who are now providing care. One way to help the patient handle these emotions is to enlist someone to whom the patient can vent feelings without fear of retaliation. A nurse, social worker, psychiatric liaison nurse, or clergy member who is not involved in direct care activities may fill this role successfully.

Burn patients are very dependent on health care team members during the long period of acute illness. However, even when physically unable to contribute much to self-care, they can be included in decisions regarding care and encouraged to assert their individuality in terms of preferences and recognition of their unique identities. As patients improve in mobility and strength, the nurse works with them to set realistic expectations for self-care, including self-feeding, assistance with wound care procedures, exercise, and planning for the future. Many patients respond positively to the use of contractual agreements and other strategies that recognize their independence and their specific role as part of the health care team moving toward the goal of self-care.

SUPPORTING PATIENT AND FAMILY PROCESSES

Family functioning is disrupted with burn injury. One of the nurse’s responsibilities is to support the patient and family and to address their spoken and unspoken concerns. Family members need to be instructed about ways that they can support the patient as adaptation to burn trauma occurs. The family also needs support by the health care team. The burn injury has tremendous psychological, economic, and practical impact on the patient and family. Referrals for social services or psychological counseling should be made as appropriate. This support continues into the rehabilitation phase.

Burn patients are commonly sent to burn centers far from home. Because burn injuries are not anticipated, family roles are disrupted. Therefore, both the patient and the family need thorough information about the patient’s burn care and expected course of treatment. Patient and family education begins at the initiation of burn management. Barriers to learning are assessed and considered in teaching. The preferred learning styles of both the patient and family are assessed. This information is used to tailor teaching activities. The nurse assesses the ability of the patient and family to grasp and cope with the information. Verbal information is supplemented by videos, models, or printed materials if available. Patient and family education is a priority in the rehabilitation phase.

MONITORING AND MANAGING POTENTIAL COMPLICATIONS

Heart Failure and Pulmonary Edema

The patient is assessed for fluid overload, which may occur as fluid is mobilized from the interstitial compartment back into the intravascular compartment. If the cardiac and renal systems cannot compensate for the excess vascular volume, congestive heart failure and pulmonary edema may result. The patient is assessed for signs of heart failure, including decreased cardiac output, oliguria, jugular vein distention, edema, and the onset of an S₁ or S₂ heart sound. Increasing central venous, pulmonary artery, and wedge pressures indicate increased fluid volume.

Crackles in the lungs and increased difficulty with respiration may indicate a fluid buildup in the lungs, which is reported promptly to the physician. In the meantime, the patient is positioned comfortably, with the head of the bed raised (if not contraindicated because of other treatments or injuries) to promote lung expansion and gas exchange. Management of this complication includes providing supplemental oxygen, administering IV diuretic agents, carefully assessing the patient’s response, and providing vasoactive medications, if indicated.

Sepsis

The signs of early systemic sepsis are subtle and require a high index of suspicion and very close monitoring of changes in the patient’s status. Early signs of sepsis may include increased temperature, increased pulse rate, widened pulse pressure, and flushed dry skin in unburned areas. As with many observations of the burn patient, one needs to look for patterns or trends in the data. (See Chap. 15 for a more detailed discussion of septic shock.)

Wound and blood cultures are performed as prescribed, and results are reported to the physician immediately. The nurse also observes for and reports early signs of sepsis and promptly intervenes, administering prescribed IV fluids and antibiotics to prevent septic shock, a complication with a high mortality rate. Antibiotics must be given as scheduled to maintain proper blood concentrations. Serum antibiotic levels are monitored for evidence of maximal effectiveness, and the patient is monitored for toxic side effects.

Acute Respiratory Failure and Acute Respiratory Distress Syndrome

The patient’s respiratory status is monitored closely for increased difficulty breathing, change in respiratory pattern, and onset of adventitious (abnormal) sounds. Typically at this stage, signs and symptoms of injury to the respiratory tract become apparent. Respiratory failure may follow. As described previously, signs of hypoxia (decreased O₂ to the tissues), decreased breath sounds, wheezing, tachypnea, stridor, and sputum tinged with soot (or in some cases containing sloughed tracheal tissue) are among the many possible findings. Patients receiving mechanical ventilation must be assessed for a decrease in tidal volume and lung compliance. The key sign of the onset of ARDS is hypoxemia while receiving 100% oxygen, decreased lung compliance, and significant shunting. The physician should be notified immediately of deteriorating respiratory status.

Medical management of the patient with acute respiratory failure requires intubation and mechanical ventilation (if not already in use). If ARDS has developed, higher oxygen levels, positive end-expiratory pressure, and pressure support are used with mechanical ventilation to promote gas exchange across the alveolar–capillary membrane.

Visceral Damage

The nurse must be alert to signs of necrosis of visceral organs due to electrical injury. Tissues affected are usually between the entrance and exit wounds of the electrical burn. All patients with electrical burns should undergo electrocardiographic monitoring, with dysrhythmias being reported to the physician. Careful attention must also be paid to signs or reports of pain related to
deep muscle ischemia. To minimize the severity of complications, visceral ischemia must be detected as early as possible. The physician can perform **fasciotomies** to relieve the swelling and ischemia in the muscles and fascia and to promote oxygenation of the injured tissues. Because of the deep incisions involved with fasciotomies, the patient must be monitored carefully for signs of excessive blood loss and hypovolemia.

**Evaluation**

**EXPECTED PATIENT OUTCOMES**

Expected patient outcomes may include:

1. Achieves optimal fluid balance
   a. Maintains intake and output and body weight that correlate with expected pattern
   b. Exhibits vital signs and central venous, pulmonary artery, and pulmonary artery wedge pressures within designated limits
   c. Demonstrates increased urine output in response to diuretic and vasoactive medications
   d. Has heart rate less than 110 beats/min in normal sinus rhythm
2. Has no localized or systemic infection
   a. Has wound culture results showing minimal bacteria
   b. Has normal urine and sputum culture results
3. Demonstrates anabolic nutritional status
   a. Gains weight daily after initial loss secondary to fluid diuresis and no oral intake of food or fluid
   b. Shows no signs of protein, vitamin, or mineral deficiencies
   c. Meets required nutritional needs entirely by oral intake
   d. Participates in selecting diet containing prescribed nutrients
   e. Exhibits normal serum protein levels
4. Demonstrates improved skin integrity
   a. Sustains generally intact skin that remains free of infection, pressure, and injury
   b. Demonstrates remaining open wound areas that are pink, re-epithelializing, and free of infection
   c. Demonstrates donor graft sites that are clean and healing
   d. Has healed wounds that are soft and smooth
   e. Demonstrates skin that is lubricated and elastic
5. Has minimal pain
   a. Requests analgesic agents for specific wound care procedures or physical therapy activities
   b. Reports minimal pain
   c. Gives no physiologic, verbal, or nonverbal cues that pain is moderate or severe
   d. Uses pain control measures such as nitrous oxide, relaxation, imagery, and distraction techniques to cope with and alleviate pain and discomfort
   e. Can sleep without being disturbed by pain
   f. Reports skin is comfortable, with no itching or tightness
6. Demonstrates optimal physical mobility
   a. Improves range of motion of joints daily
   b. Demonstrates preinjury range of motion of all joints
   c. Has no signs of calcification around the joints
   d. Participates in activities of daily living
7. Uses appropriate coping strategies to deal with postburn problems
   a. Verbalizes reactions to burns, therapeutic procedures, losses
   b. Identifies coping strategies used effectively in previous stressful situations
   c. Accepts dependency on health care providers during acute phase
   d. Verbalizes realistic view of problems resulting from burn injury and plans for future
   e. Cooperates with health care providers in required therapy
   f. Participates in decision making regarding care
   g. Resolves grief over losses resulting from burn injury and circumstances surrounding injury (eg, death of others, damage to home or other property)
   h. States realistic objectives for plastic surgery, further medical intervention, and results
   i. Verbalizes realistic abilities and goals
   j. Displays hopeful attitude toward future
8. Relates appropriately in patient/family processes
   a. Patient and family verbalize feelings regarding change in family interactions
   b. Family emotionally supports the patient during the hospitalization
   c. Family states that own needs are met
9. Patient and family verbalize understanding of the treatment course
   a. States rationale for different aspects of treatment
   b. States realistic time period for recovery
10. Absence of complications
    a. Lungs clear on auscultation
    b. Exhibits no dyspnea or orthopnea and can breathe easily when standing, sitting, and lying down
    c. Exhibits no S3 or S4 heart sounds or jugular venous distention
    d. Exhibits urine output; central venous, pulmonary artery, and pulmonary artery wedge pressures; and cardiac output within normal or acceptable limits
    e. Exhibits normal blood, sputum, and urine culture results
    f. Maintains arterial blood gas values within normal or acceptable limits
    g. Has normal lung compliance
    h. Has no visceral organ damage
    i. Has stable cardiac rhythm

**REHABILITATION PHASE OF BURN CARE**

Although long-term aspects of burn care are discussed last in this chapter, rehabilitation begins immediately after the burn has occurred—as early as the emergent period—and often extends for years after injury. In the aftermath of the acute stages of injury, the burn patient increasingly focuses on the alterations in self-image and lifestyle that may occur. Wound healing, psychosocial support, and restoring maximal functional activity remain priorities. The focus on maintaining fluid and electrolyte balance and improving nutritional status continues. Reconstructive surgery to improve body appearance and function may be needed.

Burn injuries can have a major impact on quality of life. Changes in physical activity and social, psychological, and employment status may occur. Therefore, psychological and vocational counseling and referral to support groups may be helpful to promote recovery and quality of life. Family members also need support and guidance in assisting the patient to return to optimal health.
Prevention of Hypertrophic Scarring

The wound is in a dynamic state for 1.5 to 2 years after the burn occurs. If appropriate measures are instituted during this active period, the scar tissue loses its redness and softens. Healed areas that are prone to hypertrophic scarring require the patient to wear a pressure garment (Fig. 57-6). These devices are especially useful for partial-thickness wounds that required more than 2 weeks to heal and for the edges of grafted skin. Applying elastic pressure garments loosens collagen bundles and encourages parallel orientation of the collagen to the skin surface, with the disappearance of the dermal nodules. As pressure continues over time, there is a restructuring of the collagen and a decrease in vascularity and cellular activity (Serghiou, Young, Ott et al., 2002).

The physical therapist, occupational therapist, or a representative of the manufacturer of elastic pressure garments measures the patient for correct fit. While awaiting the arrival of the garment, soft, tubular, knitted elastic pressure bandages can be used to help desensitize the patient’s skin, protect healing areas, apply pressure, and promote venous return. Patients must be instructed about the need for lubrication and protection of the healing skin and the need for pressure garments for at least a year after the injury. A program including elastic pressure garments, splints, and exercise under the supervision of an experienced physical and occupational therapy team is recommended for optimal functional and cosmetic results.

**NURSING PROCESS: CARE OF THE PATIENT DURING THE REHABILITATION PHASE**

**Assessment**

Information about the patient’s educational level, occupation, leisure activities, cultural background, religion, and family interactions is obtained early. The patient’s self-concept, mental status, emotional response to the injury and hospitalization, level of intellectual functioning, previous hospitalizations, response to pain and pain relief measures, and sleep pattern are also essential components of a comprehensive assessment. Information about the patient’s general self-concept, self-esteem, and coping strategies in the past will be valuable in addressing emotional needs.

Ongoing physical assessments related to rehabilitation goals include range of motion of affected joints, functional abilities in activities of daily living, early signs of skin breakdown from splints or positioning devices, evidence of neuropathies (neurologic damage), activity tolerance, and quality or condition of healing skin. The patient’s participation in care and ability to demonstrate self-care in such areas as ambulation, eating, wound cleaning, and applying pressure wraps are documented on a regular basis. In addition to these assessment parameters, specific complications and treatments require additional specific assessments; for example, the patient undergoing primary excision requires postoperative assessment.

Recovery from burn injury involves every system of the body. Therefore, assessment of the burn patient must be comprehensive and continuous. Priorities will vary at different points during the rehabilitation phase. Understanding the pathophysiologic responses to burn injury forms the framework for detecting early progress or signs and symptoms of complications. Early detection leads to early intervention and enhances the potential for successful rehabilitation.

**Diagnosis**

**NURSING DIAGNOSES**

Based on the assessment data, priority nursing diagnoses in the long-term rehabilitation phase of burn care may include the following:

- Activity intolerance related to pain on exercise, limited joint mobility, muscle wasting, and limited endurance
- Disturbed body image related to altered physical appearance and self-concept
- Deficient knowledge about postdischarge home care and follow-up needs

**COLLABORATIVE PROBLEMS/POTENTIAL COMPLICATIONS**

Based on the assessment data, potential complications that may develop in the rehabilitation phase include:

- Contractures
- Inadequate psychological adaptation to burn injury

**Planning and Goals**

The major goals for the patient include increased participation in activities of daily living; increased understanding of the injury, treatment, and planned follow-up care; adaptation and adjustment to alterations in body image, self-concept, and lifestyle; and absence of complications.

**Nursing Interventions**

**PROMOTING ACTIVITY TOLERANCE**

Nursing interventions that must be carried out according to a strict regimen and the pain that accompanies movement take their toll on a burn patient. The patient may become confused and disoriented and lack the energy to participate optimally in care. The nurse must schedule care in such a way that the patient has periods of uninterrupted sleep. A good time for planned patient rest is after the stress of dressing changes and exercise, while pain interventions and sedatives may still be effective. This plan must be communicated to family members and other care providers.

Burn patients may have insomnia related to frequent nightmares about the burn injury or to other fears and anxieties about the outcome of the injury. The nurse listens to and reassures the

**FIGURE 57-6** Elastic pressure garments. Application of pressure garments helps prevent hypertrophic burn scarring. Used with permission of Jobst Institute, Inc., Toledo, Ohio.
patient and administers hypnotic agents, as prescribed, to promote sleep.

Reducing metabolic stress by relieving pain, preventing chilling or fever, and promoting the physical integrity of all body systems will help the patient conserve energy for therapeutic activities and wound healing.

The nurse incorporates physical therapy exercises in the patient’s care to prevent muscle atrophy and to maintain the mobility required for daily activities. The patient’s activity tolerance, strength, and endurance will gradually increase if activity occurs over increasingly longer periods. Fatigue, fever, and pain tolerance are monitored and used to determine the amount of activity to be encouraged on a daily basis. Activities such as family visits and recreational or play therapy (eg, video games, radio, TV) can provide diversion, improve the patient’s outlook, and increase tolerance for physical activity.

**IMPROVING BODY IMAGE AND SELF-CONCEPT**

Burn patients frequently suffer profound losses. These include not only a loss of body image due to disfigurement but also losses of personal property, homes, loved ones, and ability to work. They lack the benefit of anticipatory grief often seen in a patient approaching surgery or a person dealing with the terminal illness of a loved one.

As care progresses, the patient who is recovering from burns becomes aware of daily improvement and begins to exhibit basic concerns: Will I be disfigured? How long will I be in the hospital? What about my job and family? Will I ever be independent again? How can I pay for my care? Was my burn the result of my carelessness? As the patient expresses such concerns, the nurse must take time to listen and to provide realistic support. The nurse can refer patients to a support group, such as those usually available at regional burn centers or through organizations such as the Phoenix Society. Through participation in such groups, patients will meet others with similar experiences and learn coping strategies to help them deal with their losses. Interaction with other burn survivors allows the patient to see that adaptation to the burn injury is possible. If a support group is not available, visits from burn survivors can be helpful to the patient coping with such a traumatic injury.

A major responsibility of the nurse is to assess constantly the patient’s psychosocial reactions. What are the patient’s fears and concerns? Does the patient fear loss of control of care, independence, or sanity itself? Is the patient afraid of rejection by family and loved ones? Does he or she feel being unable to cope with pain or physical appearance? Does the patient have concerns about sexuality, including sexual function? Being aware of these anxieties and understanding the basis of the patient’s fears enable the nurse to provide support and to cooperate with other members of the health care team in developing a plan to help the patient deal with these feelings.

When caring for burn patients, the nurse needs to be aware that there are prejudices and misunderstandings in society about those who are viewed as different. Opportunities and accommodations available to others are often denied those who are disfigured. Such amenities include social participation, employment, prestige, various roles, and status. The health care team must actively promote a healthy body image and self-concept in burn survivors so that they can accept or challenge others’ perceptions of those who are disfigured. Survivors themselves must show others who they are, how they function, and how they want to be treated.

The nurse can help patients practice their responses to people who may stare or inquire about their injury once they are discharged from the hospital. The nurse can help patients build self-esteem by recognizing their uniqueness—for example, with small gestures such as providing a birthday cake, combing the patient’s hair before visiting hours, giving information about the availability of a cosmetician to enhance appearance, and teaching the patient ways to direct attention away from a disfigured body to the self within. Consultants such as psychologists, social workers, vocational counselors, and teachers are valuable participants in assisting burn patients to regain their self-esteem.

**MONITORING AND MANAGING POTENTIAL COMPLICATIONS**

**Contracts**

With early and aggressive physical and occupational therapy, contracts are rarely a long-term complication. However, surgical intervention is indicated if a full range of motion in the burn patient is not achieved. (See Chap. 11 for a discussion of prevention of contracts.)

**Impaired Psychological Adaptation to the Burn Injury**

Some patients, particularly those with limited coping skills or psychological function or a history of psychiatric problems before the burn injury, may not achieve adequate psychological adaptation to the burn injury. Psychological counseling or psychiatric referral may be made to assess the patient’s emotional status, to help the patient develop coping skills, and to intervene if major psychological issues or ineffective coping is identified.

**PROMOTING HOME AND COMMUNITY-BASED CARE**

**Teaching Patients Self-Care**

As the inpatient phase of recovery becomes shorter, the focus of rehabilitative interventions is directed toward outpatient care or care in a rehabilitation center. In the long term, much of the care of healing burns will be performed by the patient and others at home. Throughout the phases of burn care, efforts are made to prepare the patient and family for the care that will continue at home. Thus, they are instructed about the measures and procedures that they will need to perform. For example, patients commonly have small areas of clean, open wounds that are healing slowly. They are instructed to wash these areas daily with mild soap and water and to apply the prescribed topical agent or dressing.

In addition to instructions about wound care, patients and families require careful written and verbal instructions about prevention of complications, pain management, and nutrition. Information about specific exercises and use of pressure garments and splints is reviewed with both the patient and family; written instructions are provided for reference. They are taught to recognize abnormal signs and instructed to report them to the physician. All of this information will enable patients to progress successfully through the rehabilitative phase of burn management. The patient and family are assisted in planning for the patient’s continued care by identifying and acquiring supplies and equipment that are needed at home (Chart 57-6).

**Continuing Care**

Follow-up care by an interdisciplinary burn care team will be necessary. Preparations should begin during the early stages of care. Patients who receive care in a burn center usually return to the burn clinic or center periodically for evaluation by the burn team, modification of home care instructions, and planning for reconstructive surgery. Other patients receive ongoing care from the general or plastic surgeon who cared for them during the acute phase of their management. Still other patients require the services
# Chart 57-6
## Home Care Checklist • The Patient with a Burn Injury

At the completion of the home care instruction, the patient or caregiver will be able to:

<table>
<thead>
<tr>
<th>Patient</th>
<th>Caregiver</th>
</tr>
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</table>

### Mental Health
Identify strategies to promote own mental health; for example:
- Remember that changes in lifestyle take time.
- Resume previous interests and activities gradually.
- Take one day at a time to regain physical and mental strength.
- Be aware of own feelings and fears and discuss them with selected others.
- Expect concerns, frustrations, and depression about changes in appearance.
- Be honest with self, family, and friends about needs, hopes, and fears.
- Realize that emotional adjustment to the burn injury will occur with time.

### Burn Skin Precautions and Wound Care
Identify the following skin precautions and wound care:
- Wear sun block with the highest SPF possible to protect burned skin from the sun.
- Avoid further trauma to burned skin; leave unbroken blisters that may form.
- Lubricate healed burned skin with mild lotion (as prescribed); avoid scratching.
- Wear wide-brimmed hats if face has been burned to protect the area from the sun.
- Use only mild soap and lotion (ie, products without perfume) on burned areas.

### Exercise
Describe the following guidelines for exercise:
- Do as much for self as possible.
- Adhere to the exercise regimen given by the therapist.
- Participate in exercise every day, several times a day, even when “not feeling like it.”

### Nutrition
Identify the following guidelines for nutrition:
- Eat a diet high in calories and protein.
- Drink adequate volume of fluids to prevent constipation associated with use of analgesic medications.

### Pain Management
Describe the following steps for managing pain:
- Take analgesic medication as prescribed.
- Avoid situations that require alertness (analgesic agents may produce drowsiness).
- Use analgesic medication as prescribed (30 minutes before painful procedures such as dressing changes).
- Use relaxation and distraction to relieve pain and discomfort.

### Thermoregulation
Identify strategies to compensate for inability to regulate body temperature:
- Dress to accommodate cold and hot weather or environment.
- Avoid extremes of temperature.

### Clothing Considerations
State the following strategies in selection of clothing to wear:
- Avoid tight clothing over burned areas.
- Select white cotton, loose-fitting clothing so that dyes in colored clothes do not irritate healing skin.
- Wear clothing and gloves to protect healing skin from unnecessary bruises, bumps, and scratches.

### Management of Burn Scar
Describe the following strategies to manage burn scar:
- Massage and stretch skin to maintain/increase its elasticity.
- Use lotion for massage as recommended by therapist.
- Wear compression garments 23 hours a day.

### Resumption of Sexual Relations
Identify the following guidelines regarding resumption of sexual relationships:
- Realize that resumption of sexual relationships is the rule rather than the exception.
- Expect sensitivity of and around the genital area for several months if these areas were burned.
- Resume sexual activity slowly; endurance will increase with time.

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Adapted with permission from Orlando Regional Medical Center Burn Unit’s *Personal Guide to Burn Care.*
of a rehabilitation center and may be transferred to such a center for aggressive rehabilitation before going home. Many patients require outpatient physical or occupational therapy, often several times weekly. It is often the nurse who is responsible for coordinating all aspects of care and ensuring that the patient’s needs are met. Such coordination is an important aspect in assisting a burn victim to achieve independence.

Patients who return home after a severe burn injury, those who cannot manage their own burn care, and those with inadequate support systems will need referral for home care. During visits to the patient at home, the home care nurse assesses the patient’s physical and psychological status as well as the adequacy of the home setting for safe and adequate care. The nurse monitors the patient’s progress and adherence to the plan of care and notes any problems that interfere with the patient’s ability to carry out the care. During the visit, the nurse assists the patient and family with wound care and exercises. Patients with severe or persistent depression or difficulty adjusting to changes in their social and/or occupational roles are identified and referred to the burn team for possible referral to a psychologist, psychiatrist, or vocational counselor.

The burn team or home care nurse identifies community resources that may be helpful for the patient and family. Several burn patient support groups and other organizations throughout the United States offer services for burn victims. They provide caring people (often recovered burn victims) who can visit a burn patient in the hospital or home or telephone the patient and family periodically to provide support and counseling about skin care, cosmetics, and problems related to psychosocial adjustment. Such organizations, and many regional burn centers, sponsor group meetings and social functions at which outpatients are welcome. Some also provide school-reentry programs and are active in burn prevention activities. If more information is needed regarding burn prevention, the American Burn Association can help locate the nearest burn center and offer current burn prevention tips (see Chart 57-2).

Because so much attention is given to the burn wound and the treatments that are necessary to treat the burn wound and to prevent complications, the patient, family, and health care providers may inadvertently ignore the patient’s ongoing needs for health promotion and screening. Thus, the patient and family are reminded of the importance of periodic health screening and preventive care (eg, gynecologic examinations, dental care).

### Evaluation

**EXPECTED PATIENT OUTCOMES**

Expected patient outcomes may include:

1. Demonstrates activity tolerance required for desired daily activities
   a. Obtains sufficient sleep daily
   b. Reports absence of nightmares or sleep disturbances
   c. Shows gradually increasing tolerance and endurance in physical activities
   d. Can concentrate during conversations
   e. Has energy available to sustain desired daily activities
2. Adapts to altered body image
   a. Verbalizes accurate description of alterations in body image and accepts physical appearance
   b. Demonstrates interest in resources that may improve body appearance and function
   c. Uses cosmetics, wigs, and prostheses as desired to achieve acceptable appearance

3. Demonstrates knowledge of required self-care and follow-up care
   a. Describes surgical procedures and treatments accurately
   b. Verbalizes detailed plan for follow-up care
   c. Demonstrates ability to perform wound care and prescribed exercises
   d. Returns for follow-up appointments as scheduled
   e. Identifies resource people and agencies to contact for specific problems

4. Exhibits no complications
   a. Demonstrates full range of motion
   b. Shows no signs of withdrawal or depression
   c. Displays no psychotic behaviors

### Burn Care in the Home

More and more burns are being treated exclusively in outpatient settings, including wound clinics, physicians’ offices, and emergency department clinics. The outpatient setting is appropriate for the care of minor burns and most moderate burns. However, a number of factors must be considered in determining the appropriate site of care. These factors include the age of the patient, the extent and depth of the burn, the availability of family support systems and community resources to assist the patient, the patient’s adherence to the prescribed plan of care, and the distance from home to the outpatient setting.

Initially, looking at and touching the burn wound may be difficult and even frightening to some family members and patients. However, with encouragement and support, most can handle burn wound care with little need for daily professional care. Instructions, both verbal and written, are given to the patient about burn wound care, pain management strategies, the need for adequate nutrition, and the importance of exercise and rest. Instruction is also given about signs and symptoms of infection that should be reported to the physician. The importance of notifying the physician about complications early and of keeping follow-up appointments is emphasized to the patient and family.

### Gerontologic Considerations

Nursing assessment of the elderly burn patient should include particular attention to pulmonary function, response to fluid resuscitation, and signs of mental confusion or disorientation. A careful history of preburn medications and preexisting illnesses is essential.

Nursing care promotes early mobilization, aggressive pulmonary care, and attention to preventing complications. Because of lowered resistance, burn wound sepsis and lethal systemic septicemia are more likely in elderly patients. Moreover, fever may not be present in the elderly to signal such events. Therefore, surveillance for other signs of infection becomes even more important.

Rehabilitation must take into account preexisting functional abilities and limitations, such as arthritis and low activity tolerance. Elderly patients commonly lack family members who can provide home care, so social services and community nursing services must be contacted to provide optimal care and supervision after hospital discharge.
Critical Thinking Exercises

1. A 60-year-old man weighing 50 kg is transferred to the emergency department after his tractor caught on fire, burning both of his legs circumferentially, his anterior chest, and his entire right upper extremity. Using the rule of nines chart, estimate the percent of TBSA burned. What are the emergent priorities for this patient? What are the fluid resuscitation requirements for this patient based on his percent burn and his weight? What assessment parameters would you be monitoring closely?

2. Your 25-year-old patient received burns over 60% of her body, including her upper extremities and face, as a result of a kitchen fire 2 weeks ago. She is depressed and distraught about the pain associated with wound care and the changes in her appearance. What assessments are important in her care, and what nursing interventions would be appropriate for her at this time?

3. Your 26-year-old burn patient is scheduled for surgery. The burn physician plans on using Integra on his upper extremity burns after débridement and to apply Acticoat to the superficial burns. What patient education would you give this patient about Integra and Acticoat? Explain what these two products are, their purpose, and the benefits of their use. Explain how the implications for nursing care differ for the two products.

4. Your 41-year-old patient, an attorney, is expected to be discharged from the hospital in a week following 6 weeks of treatment for severe burns to the lower part of her body. She has used a wheelchair for the last 20 years as a result of a spinal cord injury. The burns occurred when she was lighting a candle at home and it fell onto her clothing. What preparation would be important in making arrangements for referral and home care if she lives alone? What specific safety precautions should be included in discharge teaching for her?

REFERENCES AND SELECTED READINGS

Books


Journals

Asterisks indicate nursing research articles.


Chapter 57 Management of Patients With Burn Injury

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Koschel, M. J. (2002). Where there’s smoke, there may be cyanide. American Journal of Nursing, 102(8), 39–42.


Also see issues of *The Journal of Burn Care and Rehabilitation* and *Burns—The Journal of the International Society for Burn Injuries*.

RESOURCES AND WEBSITES


American Red Cross, P.O. Box 37243, Washington, DC 20013; (800) HELPNOW; http://www.redcross.org.


Burn Children Recovery Foundation, P.O. Box 246, Arlington, VA 22283; (800) 799-BURN; http://www.burnchildrenrecovery.org.

Burn Foundation, 1128 Walnut St., Philadelphia, PA 19107; (215) 629-9200; e-mail: burncts@aol.com.

Burn Institute, 3702 Ruffin Rd. #101, San Diego, CA 92123-1812; (619) 541-2277; http://www.burninstitute.com.

Burn Prevention, (610) 481-9810; http://www.burnprevention.org.


Firefighters Pacific Burn Institute, 3101 Stockton Blvd., Sacramento, CA 95820; (916) 739-8525; http://www.ffpbi.org.

Integra Life Sciences Corporation, P.O. Box 688, 105 Morgan Lane, Plainsboro, NJ 08536; (800) 654-2873; fax: (609) 799-3297; http://www.integra-ls.com.


International Society for Burn Injuries; Dr. Keith Judkins, ISBI Secretary/Treasurer, Medical Director for Burn Care, Pinderfields Hospital, Aberford Road, Wakefield, WFl 4DG, England. Phone: +44 1924 212331; http://www.worldburn.org.

LifeCell Corporation, 3606 Research Forest Dr., The Woodlands, TX 77381; (800) 367-5737; http://www.lifecell.com.

Phoenix Society for Burn Survivors, 11 Rust Hill Rd., Levittown, PA 19056; (215) 946-BURN; (800) 888-BURN; http://www.phoenix-society.org.