

OVERVIEW

Burn Rehabilitation: An Overview

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Burn injuries result in significant physical and psychologic complications that require comprehensive rehabilitation treatment and coordination with the acute care burn team. This interdisciplinary rehabilitation treatment is focused on preventing long-term problems with scarring, contractures, and other problems that limit physical function. Adequate pain management and recognition of psychologic issues are important components of treatment after burn injuries. Burn injuries present significant barriers to community integration, but many people can successfully return to work and other activities.

Key Words: Burns; Rehabilitation.

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BURN INJURIES CAUSE significant physical and psychologic complications that require an interdisciplinary rehabilitation team working closely with the acute care burn team. In the United States, there are an estimated 500,000 people treated for burn injuries every year, with 40,000 hospitalizations.^{1,2} Although prevention measures such as smoke alarms in homes and changes in workplace safety have resulted in a decreased incidence of burn injuries, deaths caused by burn injury are the fifth most common cause of unintentional injury deaths in the United States.^{2,3} Overall mortality caused by burn injuries has declined significantly because of the development of comprehensive burn centers with the associated advances in treatment, including improvements in the resuscitation of patients with severe burns, topical antimicrobial agents, newer antibiotics, early excision and grafting, and more recently, the use of artificial skin substitutes.^{4,5} In the 1980s, the median lethal dose (LD₅₀), defined by the size of burn resulting in death in 50% of patients, was 65% of the total body surface area (TBSA), and this has improved to a TBSA of over 80%.^{6,7} Because small burns do not have a high risk of mortality, the most significant improvement in survival has been in people with large burns (>50% of TBSA).⁷ In a study of children admitted with significant burn injuries caused by large burns (>60% of TBSA), the mortality rate was 33.3% during 1974 to 1980 and only 14.3% during 1991 to 1997. In this study there were no mortalities during 1991 to 1997 in people with burns of less than 60% of TBSA.⁸

An inhalation injury significantly increases the risk of mortality unless the burn is very small (<10% of TBSA).^{6,9} Age is also an important predictor of survival. The LD₅₀ TBSA is relatively low in the very young, but it increases with age and decreases again in the elderly. For example, the LD₅₀ for those over age 70 years is estimated to be approximately 30% of TBSA.⁶ Variables during hospitalization such as sepsis and ventilator dependency are additional predictors of mortality.¹⁰

The majority of adults with burn injuries are young men, and 60% of all burn injuries are caused by fire. Scald burns are more common in children, accounting for 30% of all burn injuries in children and only 10% in adults. The industrial workplace exposes workers to the risk of burn injuries, including high-voltage electrical injuries, and accounts for a large number of burn injuries. In the National Institute on Disability and Rehabilitation Research (NIDRR)—funded Burn Model System (BMS), although only 59% of adults were employed before their burn injuries, 23% of all the people in the database sustained their injuries in the workplace.¹¹ In another study of the Model System database of people who were employed before their burn injuries, 42% were burned at the workplace.¹² These studies underscore the need to assist patients' return to the workplace, often the place where the injury occurred.

The improved survival of people with large burn injuries has increased the need for comprehensive rehabilitation services during hospitalization and transition to the community. Physical complications after burn injuries are caused by contractures, hypertrophic scarring, weakness due to loss of muscle mass, heterotopic ossification, amputations, and nervous system injury. People with burn injuries frequently have difficulty with thermoregulation and pruritus. Adequate assessment and management of pain and psychologic issues are also important after burn injuries.

Physical Complications

A common and clinically significant complication after severe burn injuries is contractures leading to decreased range of joint motion, joint deformities, and deformities of the facial structures. Contractures can be caused by immobility and heterotopic ossification at the elbow joints,¹³ but are frequently caused by hypertrophic scarring.^{14,15} Hypertrophic scarring is characterized by red, raised, and rigid scar tissue that contracts and limits normal motion of the skin. Studies document a prevalence of hypertrophic scarring ranging from 32% to 67% in people with severe burn injuries.¹⁶⁻²⁰ Hypertrophic scarring is often treated with pressure garments to provide continuous pressure to the healing skin,²¹⁻²³ but pressure garments are difficult to put on and are often uncomfortable, resulting in inadequate compliance with their use.^{24,25} Scarring is also treated with splinting, range of motion (ROM) exercises, and stretching.²⁶ There are few controlled studies that evaluate the effectiveness of pressure garments, splinting, and stretching after burn injuries. Further research is needed to evaluate treatments aimed at preventing hypertrophic scarring and contractures that result in long-term functional impairments and disabilities.

Patients with severe burns have increased catabolism with loss of lean body mass that leads to weakness and decreased functional ability. People with burn injuries will often com-

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plain of weakness and fatigue causing difficulty in completing daily activities and returning to work. Studies^{27,28} have documented that treatment with anabolic agents and exercise in people with severe burn injuries results in increased strength and lean body mass.

Full-thickness burns damage the dermal appendages, including the sweat glands, resulting in problems with thermoregulation. The inability to adequately regulate body temperature and sensitivity to heat affects a person's ability to complete physical activity and return to work in hot environments.²⁹

Amputations after burn injuries are complicated by the associated fragile skin and contractures that make prosthetic fitting challenging. Major amputations are common in high-voltage electrical injuries, but thermal injuries can frequently result in finger amputations.³⁰⁻³² Although upper-extremity or lower-extremity amputations will result in significant problems with daily activities, a study³³ of children with burn injuries of more than 80% of TBSA showed that finger amputations are also associated with significantly greater dependence with activities of daily living.

Neuropathy is common after burn injuries, and studies³⁴⁻³⁶ have documented an incidence from 11% to 41%. Neuropathy can involve a single peripheral nerve (mononeuropathy), can involve 1 or more peripheral nerves consistent with mononeuritis multiplex, or can present as a generalized polyneuropathy. Neuropathy after burn injury is often not recognized or diagnosed but can affect strength and function.

Pruritus frequently occurs after severe burn injury, but the exact prevalence is not known. One survey³⁷ of patients after burn injury reported an overall prevalence of 15% with persistent pruritus and 44% with occasional pruritus. Pruritus can be treated with medication and other modalities but is often a symptom that has a significant impact on quality of life (QOL).

Pain Management

Pain management is an important part of a comprehensive treatment program after burn injuries. Acute burn injuries result in constant background pain, but the need for daily painful treatments such as wound débridement and ROM exercises results in episodic procedural pain. Pain management requires a coordinated plan by the burn team that includes medication management, and it is important to adequately treat background pain with long-acting medications and procedural pain with short-acting pain medications.³⁸ There is also good evidence that the use of hypnosis and virtual reality can decrease pain and lessen the need for pain medications.^{39,40}

Psychosocial Adjustment

The evaluation and treatment of posttraumatic stress, depression, anxiety, and sleep disturbances are important after burn injuries. Symptoms of posttraumatic stress, such as reexperiencing the trauma and increased arousal, are common early after a burn injury, and at 1 year postinjury approximately 20% of people meet diagnostic criteria for posttraumatic stress syndrome. A number of factors contribute to the development of symptoms of posttraumatic stress, but studies^{41,42} have shown that the size of the burn injury does not predict posttraumatic stress symptoms. Over 50% of people with burn injuries report moderate or severe depression symptoms early in their hospitalizations, and almost half report moderate to severe depression at 2 years postinjury.^{43,44} The severity of the burn injury, as measured by the percentage of TBSA, does not predict psychologic

problems after burn injuries.⁴²⁻⁴⁴ A person's coping style or the presence of a higher level of psychologic symptoms during early recovery after a burn injury are predictive of longer-term psychologic issues.^{41,45}

Community Integration

Treatment to improve community integration, such as the return to work, school, and community activities, is increasingly important given the increased survival of people with large burn injuries. People with burn injuries have difficulties returning to work and school and with participation in social activities.⁴⁶ Most people admitted to burn units are able to return to work, with an average time off work of 17 weeks and up to 90% of people followed up at 2 years postinjury having returned to work.⁴⁷ A study⁴⁸ of people with burn injuries who were employed at the time of injury showed that they were more likely to sustain a hand burn and have hand surgery, indicating that hand burns are more common in work-related injuries, which affects the ability to return to work.

Burn Rehabilitation Research

A systematic review⁴⁹ of the burn rehabilitation literature in 2006 showed a large body of literature supporting rehabilitation treatment after burn injuries but few controlled studies supporting rehabilitation techniques used in the treatment of subjects with burn injuries. Additional research is needed to examine the effectiveness of rehabilitation interventions after burn injury including treatment of hypertrophic scarring and treatments to support the transition to the community. Funding for the necessary research can come from a variety of sources including the National Institutes of Health and NIDRR. Since 1994, NIDRR has funded BMS centers under their Disability Rehabilitation Research Projects (DRRP). NIDRR states that "The purpose of the DRRP program is to plan and conduct research, demonstration projects, training, and related activities to develop methods, procedures, and rehabilitation technology that maximize the full inclusion and integration into society, employment, independent living, family support, and economic and social self-sufficiency of individuals with disabilities, especially individuals with the most severe disabilities, and to improve the effectiveness of services. . . ."^{50(p7297)} The future of the field of burn rehabilitation depends on researchers evaluating current treatments and developing new and innovative treatments to improve the function and QOL of people with burn injuries.

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