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Burn Teams and Burn Centers: The Importance of a Comprehensive Team Approach to Burn Care

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Synopsis

Advances in burn care have been colossal, but while extra work is needed, it is clear that the organized effort of burn teams can continue making improvements in survival rates and quality of life possible for patients. Burn patients are unique, representing the most severe model of trauma,[33] and hence this necessitates treatment in the best facilities available for that endeavor. Burn centers have developed to meet these intricate needs but can only function productively and most efficiently through well organized, multifaceted, patient-centered teams in areas of clinical care and research.

Keywords

Burn centers; Burn units; Trauma; Multidisciplinary care; Patient care teams; Research personnel

Introduction

Resource requirements and the complexity of the management of severe burn injuries have led to the development of regional burn centers. Centralization of burn services has in turn provided an opportunity for focused basic, translational, and clinical science research in an evolving field. This has led to the significant developments in our understanding and vast improvements in outcomes following major burn injuries over the past few decades.

Advances in an array of medical and scientific fields have dramatically improved the prospects of patients following severe burn injuries over the second half of the 20th century. Major areas of advancement in burn care include fluid resuscitation protocols, early burn wound excision and closure with grafts or skin substitutes, nutritional support regimens, topical antimicrobials and infection control, treatment of sepsis, thermally-neutral environments, and pharmacological modulation of the hypermetabolic response. These factors have contributed to improved wound healing, reduced inflammation and energy demands, attenuated hypermetabolism and muscle catabolism, and consequently decreased morbidity and mortality following severe burns.

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The progress made over this period is reflected in the improvements seen in survival rates. Burns in children of 30% total body surface area (TBSA) led to 50% mortality in the era between the World Wars, with 40% burns resulting in 90% mortality. By 1954 at a pioneering UK unit, 50% expected mortality now necessitated a 50% TBSA burn, with factors considered to have contributed to this advance understood to include blood transfusion, infection control, and early surgery (1). With major advances in burn care, mortality following pediatric burns continued to decline, such that 50% of pediatric patients were expected to survive 91-95% TBSA burns by the late 1990s (2).

Improvements continued over the past two decades such that outside the extremes of age, most patients treated in a modern burn centre should be expected to survive despite the severity of their injury(3). However, reducing mortality for patients 65 years and older, who constitute an expanding part of the US population, remains a significant challenge. Advances continue to lag behind those seen in other age groups, with burn mortality persistently greatest in this age group.

In the US, there are presently 128 designated burn centers in 43 states. Analysis of US records submitted to the national burn repository from 73 burn centers reporting data during the ten year period to 2007 showed that injury from fire and flame led to 40% of presenting cases, with scalds accounting for 30%, and found to be the most prevalent cause in children under 5 years (4). Length of stay has declined over the past 10 years for both sexes from approximately 11 days to 7 days. Mortality for females dropped 2% over 10 years to 4.4% in 2007, whilst male mortality remained constant at 5% (4).

Burn Teams

The management of burn injury may well represent the surgical specialty with the greatest integration of health professionals, seeing the most benefit from the influence of truly multi-disciplinary care. This has occurred as a consequence of the complex nature of burn injury necessitating a diverse variety of skills for optimal modern care. A single specialist cannot be expected to possess the range of skills, knowledge and energy required for the comprehensive care of the patient. Reliance has been placed on a group of specialists to provide integrated care through innovative organization. (Figure 1)

Burn Surgeons

Ultimate responsibility and overall control for the care of a severely burned patient lies with the admitting burn surgeon. Depending on the locale of the burn unit and training system of that region of the world, burn surgeons may come from a training background of either plastic surgery or general surgery. Burn surgeons will also have acquired additional experience of burn surgery and critical care.

Technological advancements within medicine have brought great benefits but have inevitably resulted in increasing sub-specialization. The array of specialist skills potentially required for the care of individual patients is extensive. This requires that surgeons must be aware of their own limitations, knowing when to request the input and advice of specialist colleagues, building on such relationships for the long-term benefit of the unit and avoiding isolation.

The performance of any team relies heavily on timely and good communication between its members. The surgeon leading the team should be a skilled communicator, proficient in providing clear instructions, receiving information, and facilitating discussion within the diverse group of specialists that comprise the team. With the increasing workload associated with centralized burn care, the senior surgeon must be prepared to delegate priority tasks to

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various members of the team, supporting their empowerment and maintaining clear communication channels for feedback.

Nurses

Nursing staff form the largest section of the multidisciplinary burn team, responsible for implementing the daily continuous care of the burn patient. Severely burned patients can be very challenging to care for, requiring intensive support physically as well as emotionally. Burn nurses require a range of skills from management of acutely unwell critical-care patients on mechanical ventilation and renal support, sophisticated wound dressing techniques, to emotional support for patients and their families. Nurses on a burn critical-care unit will often be the first to spot and bring attention to any changes in the condition of a patient and institute remedial action.

Due to the nature of the injury, burn patients often require a prolonged period of recovery both in the acute and rehabilitative phases. Continuity of nursing staff for patients allows trusting relationships and bonds to develop, improving satisfaction for both patients and staff.

The role of nursing staff has also expanded over recent decades to include specialist nurse practitioners as well as research nurses in some burn centers. Experience and knowledge of burn injury can be applied in more varied roles including nurse-led clinics and patient case-management, operating-room practitioners, performing research studies and procedures, and developing wider teaching roles such as burn management courses for non-specialists. Greater autonomy for specialist nurses promotes retention of experienced and senior staff, and enhances the efficiency of the burn team overall.

Anesthesiologists

Anesthesiologists with a specialist interest in burn-care form an integral aspect of the burn team. The treatment of major burn patients presents challenges from a number of aspects where the skills and experience of anesthesiology in managing various aspects of care is invaluable. Burn patients may present a number of complex anesthetic issues including airway management, ventilation, heat-loss, fluid and electrolyte balance, and circulatory instability.

The burn-team anesthesiologist will have the knowledge and expertise to deal with the challenges presented by the pathophysiological changes related to burn injury. The release of inflammatory mediators and consequential systemic hemodynamic instability and metabolic effects of burn injury will reduce a patient's physiological reserves and ability to compensate for the stress of any surgery. Once resuscitated, patients may therefore be most fit for major surgery soon after injury (5). Early excision of the burn wound will aid to reduce inflammation and the risk of infection, but may also mean that the process of resuscitation is still proceeding whilst a patient undergoes surgery.

As part of the multidisciplinary approach, consideration is given to all aspects of a patient's care when, for example, intra-operative management decisions are made, in order to coordinate treatment goals with the team and so facilitate the optimal care of the patient. Burn patients may require multiple operative procedures, dressing changes, and wound assessment during their acute stay on the critical-care unit. Patients at risk of airway compromise due to inhalation injury will require early intubation and may benefit from expertise in fiber-optic guided intubation as well as detailed assessment by subsequent bronchoscopy. On the burn-unit, anesthesiologists will provide expertise in pain control and comfort management and may assist in optimizing mechanical ventilation, fluid management and circulatory support.

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Respiratory Therapists

Pulmonary injury suffered by burn patients can be severe and arises due to inhalation injury, impaired ventilatory mechanics, as well as due to sepsis and the systemic inflammatory response following severe burns. As mortality in the US has declined from earlier predominant causes such as shock and sepsis due to the implementation of early fluid resuscitation, early wound excision and antimicrobial use, smoke inhalation injury in association with burns has become a leading cause of death(6).

Respiratory therapy forms an essential aspect of the burn treatment program if a favorable outcome is to be achieved. Through a protocol-based approach, respiratory therapists provide a range of skills to evaluate pulmonary mechanics, enhance patient ventilation, and reduce the risks of complications. On the burn unit, these may include assistance with airway management and diagnostic bronchoscopy in cases of inhalation injury, arterial blood gas assessment, optimizing mechanical ventilator settings, and chest physiotherapy to relieve atelectasis and the reduce the risks of pneumonia. In the clinical research and rehabilitation setting, evaluation may include indirect calorimetry to calculate resting energy expenditure, and pulmonary function testing.

Occupational & Physical Therapists

Rehabilitation following severe burn injuries requires an individualized multidisciplinary approach to achieve the optimum functional outcome possible for every patient. Planning of a program begins on admission and is tailored to the individual needs of a patient through the various recovery stages. Burn patients require intensive dedicated input from rehabilitation therapy members of the team if burn sequelae such as scarring, contractures, and loss of function are to be minimized. Treatment modalities available include a variety of splints and pressure garments to minimize scaring and contractures, to aerobic and resistive exercise to maintain function, strength and range of movement.

Considerable technical and creative skill is required to construct and adapt items and programs to match the particular needs of a patient, based on knowledge and familiarity with burn injuries. Post-burn resistance and aerobic exercise programs have been shown to improve muscle strength and power and lean body mass gain during the rehabilitation stages (7), and reduce the number of surgical interventions required for scar contracture release (8).

Substantial time and effort will be invested in providing explanation, persuading and motivating patients, obtaining their cooperation and trust in order to guide them through interventions that are often initially uncomfortable or painful, inconvenient, and time-consuming. Long-term compliance is rewarded with optimal functional and aesthetic outcomes.

Dietician

Patients with major burns require intense nutritional support to address massively elevated energy and protein demands. Hypermetabolism and muscle-protein catabolism following major burns increases proteolysis by up to 50% and leads to debilitating losses in lean body mass (9). The dietician or nutritionist on the burn team monitors the dietary needs of the patient and provides the nutritional recommendations and feeding regimen to meet changing demands. Nutritional assessment should review any relevant features such as pre-existing medical conditions, malnutrition, malabsorption, dental disease, drug dependency and alcoholism, all of which may impact the nutritional status of the patient. Nutritional monitoring following injury may be complex and may be aided by objective assessment of resting energy expenditure through the use of indirect calorimetry.

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Implementation of early enteral feeding has been shown to improve outcomes and should be considered the first choice in suitable patients. Enteral nutrition can be started safely within hours of burn injury and was shown to reduce caloric deficit and improve nitrogen balance (10-12) Preservation of gut mucosal integrity as a barrier to bacterial translocation may also reduce rates of sepsis (13,14). Goal-directed nutritional support is essential in improving outcomes following burn injury.

Psychosocial Experts

Burn injury can have a devastating impact on the emotional and psychological well-being of a patient and their families. Depending on the mechanism of injury, bereavement, deliberate self-harm, and non-accidental injury may raise further issues that impact the psychological health of the patient. Psychologists, psychiatrists and social workers in the multidisciplinary team provide expertise in assisting patients and their families to cope with the effects of the injury and manage the transition to come to terms with the grief and consequences of the injury.

The patient's mental state will impact on various aspects of their care including pain tolerance, anxiety level, and motivation, and addressing the psychological aspects of a patient care facilitates their overall treatment. Disfigurement with the loss of facial and body image is also a bereavement experience, and how this is addressed in the early stages may be critical in the long-term(15). Care-givers may also require support from psychosocial experts in dealing with the emotional issues of treating severely injured patients (16).

Centralization of burn-care has allowed greater resources and expertise to be devoted to treating and studying the psychological and social impact of burn injury, and enabled further research into developing optimal therapeutic techniques and strategies. As mortality is reduced as a consequence of improved burn management, greater emphasis should continue to be devoted to improving the long-term psychosocial health of patients. With appropriate support and interventions, severe burn patients are presently able to reintegrate into society and lead productive and fulfilling lives.

Dynamics and Functioning of the Burn Team

The multidisciplinary approach to burn care involves considering all aspects of a patient's care when treatment decisions are made. By considering subsequent effects and consequences of any decisions, and with individuals coordinating with all team members, the team may hope to deliver the optimal possible outcome for a patient from every aspect of their care.

Research into the area of multidisciplinary teams has highlighted the wide range and variety of such teams within the healthcare setting, as well as some shortcomings in evidence for their efficacy (17) Clearly defining the various components of these teams will allow improved analysis in the future. The different features are useful to consider when assessing how well a team is functioning. (Table 1)

Effective communication is one of the key factors determining the successful functioning of the team, both within the team and with patients and their families. The diverse background and professions within the team, constitutes a major positive attribute, but also has the potential for elevated conflict and dysfunction of the team, as well as the possibility of variable and confused messages between different specialists and the patient and their family, leading to a loss of confidence (18).

The team will have the same overall aim of providing the best care possible that leads to the optimal functional outcome for the burn patient. Despite this, it is inevitable that different professions will have varying and conflicting opinions as to the best course of action at varying

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stages. Additionally, patients and their families also need to cooperate and are in a position to further increase differences within the team, and to manipulate care-givers against one another (19). Such disagreements are minimized through frequent and open communication.

Skill in managing the emotional dynamics of the team to resolve conflicts, through understanding and respecting diverse perspectives, and acknowledging the value of each members input has been closely linked to smooth and effective functioning of groups (20, 21). The role of the chief burn surgeon as leader of the unit involves both deciding upon and directing the team towards achieving tasks, as well as facilitating positive interaction between members to enhance feelings of worth (22,23). It must be remembered that effective leadership is not domination, but the art of persuading people to work toward a common goal (20). A functioning team is formed from individuals of a group once members are able to share common goals, and meet objectives that serve coinciding values (24).

Centralized Care – Importance of the Burn Unit

Prior to the development of burn units, for many years burn patients were attended to in general hospitals similar to any other trauma. With an increased understanding of the extent, severity and prolonged requirements of burn injury, it became clear that specialized burn units would be needed to adequately address the needs of these patients. The development of burn units, where care is centralized, envisaged a core team absorbed in the problems of the patient, with a multidisciplinary team of experts contributing nuanced perspectives to treat patients holistically. This patient centered approach is necessary for the development of continuous feedback from therapeutic responses during the emotional, psychological, and physiological recovery and rehabilitation of the burned patient. The success of this model is reflected by an overall survival of 95.1% of burned patients in 2007 and a decrease in length of stay to almost half in the last nine years in US burn centers (25).

The skin, as the largest organ in the body, is a primary line of defense of the immune response, designed to defend against infection(26). Severely burned patients not only lose this protection to a major extent, becoming particularly susceptible to infection (27), but also lose a great amount of heat, plasma and liquids that if left uncorrected, will cause hypothermia, hypovolemic shock and renal insufficiency (28). These conditions must be addressed properly in the first hours following injury and once stabilized, the patient will require specialized wound coverage and a sterile and warm environment. The centralized attention offered in the burn center not only provides this controlled and standardized environment, indispensable for the survival of these critically ill and immunocompromised patients, but also presents the best opportunity for clinical and basic science research.

Although the definition of centralize is to concentrate control or power under a single authority (29), and in organizational theory, it is related to administrative function between corporations (30), here we are not questioning either the hierarchical relationships needed in organizational structures nor the benefits of dispersing decision-making into lower organizational structures. Instead we are emphasizing the need for highly specialized personnel together in a customized facility where the resources necessary are readily available to provide the best possible attention to the acute and long term care aspects of burns care.

Burns care requires more than fluid administration, antibiotics, and skin grafting; even in the early acute phases, the patients need physiotherapy, diverse types of splinting and personalized exercise programs that need to be readjusted by therapists according to the daily needs of the patients. Psychological evaluation is needed in acute care, as depression and acute stress disorder can be found with burned patients (31), and should be identified as soon as possible by psychiatrists or psychologists to initiate early treatment. Intensive respiratory therapy is needed as pneumonia is the most frequent complication in burned patients (25), and assisted

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ventilation is frequently needed, making respiratory therapists indispensable in these situations. These circumstances highlight the need for the multidisciplinary burn team to be present in the daily assessment of the patient.

Once the wounds are healed and the patients are released from the burns unit, they should be re-evaluated on a regular basis by the burn surgeon to assess the evolution of their scars in order to identify contractures or hypertrophic scars for prompt treatment; the range of motion should be evaluated to assess the efficacy of physical rehabilitation or the need for the physiotherapists to readjust the splints; psychological evaluation is required, as these patients can develop post-traumatic stress disorder and depression (32); pediatric patients need to be evaluated to assess whether growth and weight gain are adequate; the family of the patient need to be educated in the early identification of complications, the proper administration of medication and application of pressure garments. The administrative personnel and physicians assistants must coordinate the surgeries and follow up visits. Standardized pictures should be taken at every visit by the photography department. If the patients are enrolled in a long term study, research nurses and the research team should evaluate the compliance of the patient with the protocol to obtain pertinent data.

All these aspects are better achieved if all the specialists are in the same unit, allowing an integral examination in a shorter time and at lower costs than if they were in different facilities. This is particularly important and convenient for patients, as many have to travel long distances from their homes for follow up visits.

Burns Research

As medical knowledge has evolved as a consequence of advances made in medical research, similarly, the quality and techniques of care for burns patients have dramatically improved due to advances in burns research. This is certainly a fortunate development, most clearly for burns victims and their families. These advances also have wider application to other branches of medical care.

Burns research is applicable to some degree to most trauma patients, for example critical-care patients commonly seen in surgical intensive care units (ICU), and as burns patients often represent the most severe form of trauma patient (33), research and expertise can be of particular importance. Continued investment and scientific interest in basic and clinical burns research has meant that medical literature has increased logarithmically. This can be seen in the 8,000 burns related articles published in the previous 10 years, a stark contrast to the 11,000 articles published in the previous 90 years (figures according to Medline).

The multidisciplinary approach, including collaboration between direct-care providers and basic scientific disciplines, has been a component feature of this advancement, one that deserves some emphasis (34). From the first burn centers in the United States, the organizational design of these centers has played its part in stimulating collaboration, leading to a self-perpetuating feedback loop of clinical and basic scientific inquiry(35). In essence, this consists of clinicians and scientists presenting their findings to one another, fostering debate and enquiry, and resulting in potential new treatments and approaches for clinicians. This engenders new challenges and aids in the development of new avenues of investigation for further basic scientific enquiry. If successful, the end result is a sustained positive-feedback loop that provides practical benefits to patients whilst also enhancing academic stimulation and achievement for the team.

The research team is traditionally considered to consist of the research fellows and post-doctoral positions dedicated full-time to research. In reality, the team comprises every single person involved in the medical attention of the burn patient, including but not limited to

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residents, nurses, therapists, physician assistants, specialists, and others who contribute to the practical success of the research carried out.

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Figure 1.
The importance of a multidisciplinary approach involving the entire burn team working towards the common goal of optimizing the burn patient's care cannot be understated.

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Table 1

Analysis of multidisciplinary team effectiveness and function (Adapted from Schofield & Amodeo)[17]

Size of team
Composition (professions represented)
Specific responsibilities
Leadership style (individual or co-leadership / voluntary or assigned / stable or rotating / authoritarian or non-authoritarian)
Scope of work (consultation or intervention or both / idea generating / decision making)
Organizational support
Communication and interactional patterns within the team (eg frequency / intensity / type)
Contact with the patient, family, or care system (eg frequency / intensity / type)
Point in treatment process when team is involved (eg intake through to discharge, one phase only, only if case not progressing)