Chapter

Advances in Burn Care in Hong Kong: Reflecting on a Decade of Expert Experiences from Local Practice with an International Perspective

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Abstract

The nursing implications of burn injuries extend beyond the immediate health concerns over the loss of skin integrity, the presence of scarring, and the psychological impacts on patients due to disfigurement. Non-fatal burns may lead to long-term disabilities, hence advanced nursing care may be required to prevent such outcomes. In Hong Kong, advances have been made to ensure that sophisticated nursing services and care are in place for affected patients. This chapter discusses how burn injuries are managed at different levels within a publicly funded acute care framework, explains how professional competencies regarding burn care are developed among burn care nurses, delineates the roles of medical technology in supporting wound assessment, explains the application of novel dressing materials for various burn wound conditions, and outlines how the establishment of nurse-led clinics can promote the continuity of care for patients with burn injuries. Written with an international perspective with the authors' practice experiences in Hong Kong (China), this chapter provides evidence-based reference for registered nurses in general, specialty nurses, nurse practitioners, and nurse consultants worldwide.

Keywords: burn care, burn care team, burn care nurses, nurse-led clinic

1. Introduction

Burn injuries are life-threatening and cause significant functional and cosmetic morbidity [1, 2]. Managing patients with burn injuries remains challenging, particularly in severe cases [3].

The most common are scald burn injuries that occur in home settings [4]. Toddlers and children are accidentally scalded by hot fluids due to the carelessness of parents and caregivers [5]. Furthermore, most burns in older adults occur at home since they

stay alone, are more prone to medical comorbidities, and are at high risk for burn and scald injury [6–9]. Nevertheless, over the past decade, significant advances in training and development, burn wound assessment, burn wound closure technologies, and continuity of follow-up have been made [10–12].

2. How burn injuries are managed at different levels within a publicly funded acute care framework

In Hong Kong, under the governance of the Hospital Authority in the acute burn care framework, patients with burn injuries are managed in hospitals with recognized standards and trained specialty healthcare professionals [13–15]. This organizational structure provides a more coordinated care by centralizing patients with severe burn injuries, thereby facilitating the delivery of quality medical and nursing services and early transfer to a burn unit/facility. There remains no universal naming criteria as to what qualifies burn treatment premises to be "burn unit" or "burn facility"; hence, in this chapter, we follow the existing terms of the current treatment premises determined by the Hospital Authority, which is the central governance body of all publicly funded hospitals in Hong Kong. In Hong Kong, some burn units are a major acute hospital among a cluster of regional hospitals caring for patients with major burn injuries, while burn facilities care for patients with moderate sized of burn injuries. According to the severity degree of burn injuries, burn surgeons in accident and emergency unit transfer patients to burn unit or burn facility following consultation when burn injuries meet the referral criteria (**Figure 1**) [15, 16].

Healthcare professionals including burn surgeons, nurses, physiotherapists, and occupational therapists deliver rehabilitation interventions such as medical treatment, therapy, or care for patients with minor burns categorized as Level 1. These patients are stabilized in general surgical or orthopedic units in different hospitals with designated facilities and healthcare professionals with the support of the multidisciplinary team. In Hong Kong, senior burn surgeons act as the directors of

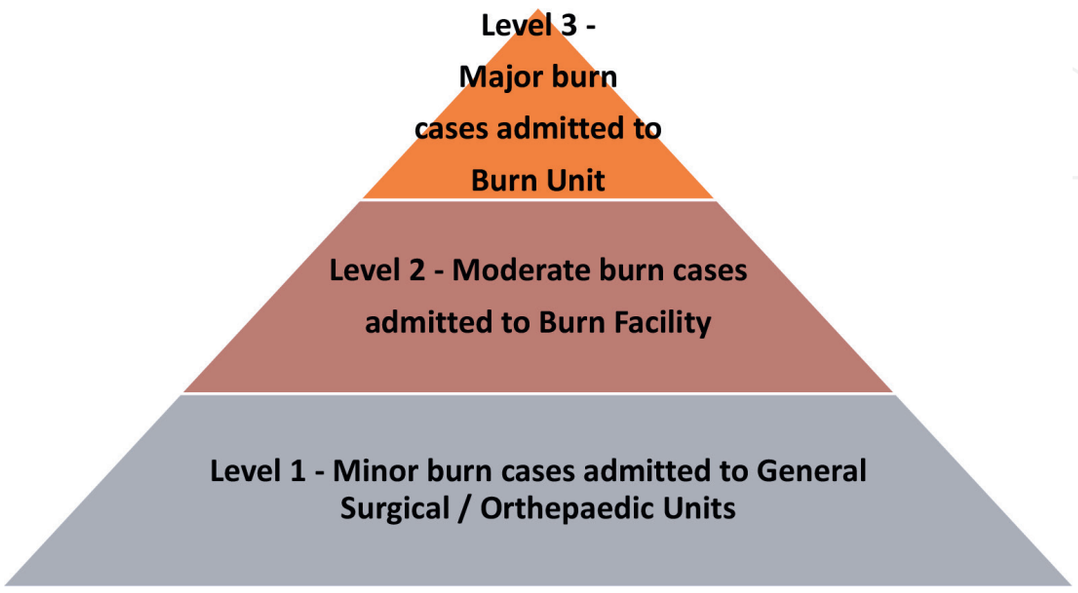

Figure 1.
Networking of burn Service in Hong Kong.

- Burns greater than 5% of total body surface area
- Burns that involve and threaten functional or cosmetic impairment of the face, hands, feet, genitalia, perineum, and major joints
- Full-thickness burns
- Electrical burns
- Chemical burns
- Circumferential burns of the limbs and chest
- Burns at the age-specific considerations (such as children and those age > 60 years old)
- Burns in patients with pre-existing medical conditions, which could complicate management, prolong recovery, or affect mortality
- Inhalation injury without skin involvement is excluded

Table 1.
Burn facility referral criteria at level 2.

the receiving burn units/facilities and coordinate the transfer management for all exposures of vulnerable populations to further risks in burns injuries. At the accident and emergency unit, patients with burn injuries are stabilized prior to transfer to the burn/facility to optimize the quality of care and treatment. Moderate-sized or complex burn injuries categorized as Level 2 are managed in a burn facility (**Table 1**) [17–19]. In Hong Kong, there are 3 burn facilities that care for patients namely Queen Elizabeth, Kwong Wah, and Tuen Mun Hospitals.

Patients with extensive and complicated burn injuries are categorized as Level 3 (**Table 2**) and managed or transferred to the burn unit [13, 17–19]. There are 2 burn units considered as the major acute hospital among a cluster of regional hospitals caring for patients with major burn injuries in Hong Kong. However, immediate resuscitation and intensive care support are mandatory. Therefore, optimal treatment of patients with extensive burn injuries requires advanced healthcare resources, implementation of multidisciplinary acute care collaboration, and planning for long-term rehabilitation.

2.1 Enhancing professional competencies regarding burn care are developed among burn care nurses

James et al. have previously reported a total of 8,991,468 patients with burn injuries in 195 countries and territories from 1990 to 2017 [20]. Previous studies have also reported that an estimated 180,000 deaths annually are attributed to burn injuries combined with electrical injuries, structural collapse, fire escape, airplane

- Burns greater than 20% and 10% of total body surface area for adult patients and children ≦12 years old, respectively
- Burns with major functional and/or cosmetic implications
- Burns in patients with significant pre-existing medical conditions that could complicate management, prolong recovery, or affect mortality
- Inhalation injury without skin damaged is excluded

Table 2.
Burn unit referral criteria at level 3.

crashes, scald burns during assaults, and explosions with airborne flames [21–26]. At the global level, the age-standardized mortality due to burn injuries has significantly decreased from 1990 to 2017; only 3 out of 21 regions reported a significant increase in the incidence rates of burn injuries, and delineated rising rates by more than 30% of age-standardized incidence rates especially in China [20]. The reported indicated that most middle- and high-income regions have invested in resources and safety measures and established access to care to reduce/combat incidence of burn injuries.

A comprehensive burn team approach is important when providing burn care to patients with burn injury by burn care nurses with multidisciplinary care; a burn team consists of burn surgeons, nurses, physiotherapists, occupational therapists, dietitians, and psychologists [10, 27]. Burn care nurses play a crucial role in caring for patients with extensive burns [28] and disaster management, mainly in handling patients with burn injuries [29]. Competency-driven, high-quality, and evidence-based education training programs related to burn injuries are essential when preparing nurses for the full continuum of burn care management [30–32]. The number of burn nursing education and training programs has gradually expanded over the past 20 years [33]. Therefore, most existing training programs in Hong Kong focus on burns injuries management comprise preparedness, response, and recovery phases. Furthermore, most nurse training programs related to burns injuries, especially those targeting registered nurses, have adopted different teaching approaches (online and face-to-face) to ensure flexibility in time, location, and cost effectiveness [34, 35].

In the United States, different burn centers incorporate competencies within the educational nursing curriculums of training programs with examination aligned with the American Burn Association burn nurse competencies (BNC) [36]. Training programs establish interactive, evidenced-based, comprehensive, preceptor workshop, online learning, and skill practice module consistent with BNC domains. Domains of BNC consist of wound management, and other relevant supports (psychosocial, nutritional, discharge planning, and aftercare) [36].

Meanwhile, in the United Kingdom, registered nurses must complete specific burn courses and be competent in burn care by the end of their second year in burn centers and units [37, 38]. According to the framework of burn care for a burn-injured patient, training programs align with the National Burn Care Standards, and nurses require to attend an accredited course in the emergency management for severe burn [37, 38]. Moreover, lead nurses for the Burn Care Services must complete a specific burn care course to demonstrate competences and require attending burn specific training programs annually [38].

In Hong Kong, registered nurses with three-year experience are considered burn care nurses in different public hospitals and must complete an emergency management of severe burns course [13, 15]. Continuing professional education is vital for the future role of burn care nurses. However, to advance their practice, the *"Post-Registration Certificate Course in Advanced Surgical Nursing"* and *"Post-Registration Certificate Course in Burn and Plastic Surgical Nursing (PRCC in Burn & Plastic)"* are training programs recommend for burn care nurses to increase their competence in burn care nursing and facilitate the development of burn teams in a burn unit to meet the complexity of managing different levels of burn injuries by in-service training in Hong Kong [15].

"Post-Registration Certificate Course in Advanced Surgical Nursing" is an annual training program consisting of different surgical nursing specialties components (breast, urological, stoma and wound, hepatobiliary and pancreatic, head and neck and plastic, and burn and plastic care) with theoretical and practical components.

According to the burn patient population, conduction of *PRCC in Burn and Plastic* is affected by the demand of clinical services (e.g., held in 1997, 2016, and 2019). This program is an 8-month structured training program with examination. The core content of this program emphasizes the theoretical (210 lecture hours) and practical (6 weeks practical attachment) components to enhance the knowledge of burn care nurses in delivering burns nursing interventions [39]. Currently, becoming an experienced burn care nurse requires being a nursing burn team leader that helps to facilitate patients with burn injuries to the optimal level of physical and psychological health and social function [40]. The effect of stimulation training on the development of burn care nurses can positively affect the perceptions of nurses managing patients with burns injuries [32, 41]. The advancement of burn education through simulation training tools aimed at the emerging role of simulation for training to promote knowledge and significantly advance the delivery of burn education. It is crucial for competence enhancement of burn care nurses, such as providing experience with rare and critical incidents, problem-solving skills, decision-making, and team dynamics [13, 42–44]. Debriefing sessions during the simulation training program are critical for nursing education since they provide the opportunity for self-recall and insight into improving learning outcomes (critical analysis and personal growth) following simulation training workshops. This program can enhance the clinical skills critical in assisting new burn care nurses in their transition to practice.

Given the increased occurrence of disasters, including burns injuries, enhancing the readiness of burn care nurses caring for the physical and psychological health of patients is urgently needed [35].

To sustain the standard and competence of clinical practice, *"Advanced Nursing Standards and Specialty Nursing Practice Guidelines"* related to burn and plastic surgical nursing have been adopted in public hospitals and are regularly developed for burn care nurses to enhance their comprehensive knowledge and skills, as well as the guidelines in the whole spectrum of burns injuries management in Hong Kong [15]. All standards and guidelines for advanced nursing practices are designed to support evidence-based practices to ensure the quality and appropriate pathway for nursing professionals to meet the burn injuries challenges [32].

Caring for patients with burn injuries certainly requires teamwork both within and outside the hospital. However, nursing colleges developed a platform between burn care nurses and other health professionals useful for sharing the knowledge and experience of caring for this unique group of patients (such as introduction and elementary understanding of basic burn knowledge and wound dressing technique), thereby reinforcing the roles and functioning of burn care nurses. In Hong Kong, such a network exists; the Hong Kong College of Surgical Nursing (HKCSN) facilitates networking among local surgical professionals and is a good support source. Serving as a platform for healthcare professionals to share experiences in burns nursing, the HKCSN invites both local and international experts to deliver lectures and run courses and seminars for its members [45].

Burn care nurses frequently attend different faculty/organizational development conferences, both local and international, e.g., Burn and Plastic Forums organized by local burn unit and burn facilities and International Burn Conferences and Annual Scientific Meetings organized overseas [13, 15, 46]. These conferences help burn care nurses caring for patients with burn injuries to learn new strategies and information regarding the global insight of nursing education and practices on burn management. In addition, conferences have been held on the ability of nursing professionals to transfer new knowledge into their nursing practices for patients with burn injuries

in clinical settings. Knowledge transfer may benefit from a better understanding of professional development related to burn care in clinical settings [47], which includes best practices in non-boundary burn and plastic specialty, advanced technology in burn care, and wound dressing techniques that can be integrated into local practice.

2.2 Roles of medical technology in supporting wound assessment

Patients with burn injuries benefit from early wound closure with local treatment consisting of cleansing, debridement, and routine burn wound dressing changes to minimize or control infection and improve wound healing [48, 49]. However, at the early stages of injury, it may be difficult to accurately define the depth of burn wounds. In Hong Kong, burn care nurses use laser Doppler imaging (LDI) (**Figure 2**) with non-invasive and non-contact devices for more accurate assessments that deliver a two-dimensional image of the burn area as an early objective determination of wound depth (depth analysis of the dermal circulation).

Figure 2.
Laser Doppler imaging device.

This technique also helps to predict the healing outcome of burn wounds before providing initial burn patient management [50–53], while the wound depth assessment is commonly determined and diagnosed by experienced burn surgeons using this imaging technique. This diagnostic intervention can be performed on patients with burns; hence wounds can be assessed early, between 48 hours to 5 days post-burn for diagnostic and therapeutic management [49, 52, 54].

There is a mandatory requirement to complete the LDI training qualification, which provides assessment knowledge and application skill essential for nursing clinicians in using this technique for therapeutic decisions for patients with burn injuries [51, 52, 54]. The completion requirement in operating LDI includes scanning technique, interpretation of results, awareness of safety practice, and elimination of confounding factors, including the presence of infection or tattoos [53–56]. However, the low power of the LDI laser light can penetrate the burn wound and detect circulating blood cells in capillaries, arterioles, and venules [49, 52, 55]. Moreover, LDI can identify a color-coded blood flow map showing microcirculatory blood perfusion in patients with burn injuries. LDI can differentiate superficial dermal burns, mid to deep dermal burns, and full-thickness burn wounds [51]. The utilization of LDI provides an early accurate assessment, thereby facilitating early burn treatment strategies, which can reduce costs, patient morbidity, length of hospitalization, and unnecessary surgery for patients with burns [55].

2.3 Application of novel dressing materials for various burn wound conditions

Burn care nurses perform routine burn wound dressing changes for patients with burn injuries, and their healing outcomes have been previously reviewed [48, 50, 57]. Burns can be classified by the depth of injury into either superficial, superficial dermal, deep dermal, full-thickness, and deeper injury [58–60]. According to the depth of the burn, various specialized management and treatment modalities are available and focus on specific anatomic sites; different therapeutic wound dressing materials are applied for the recovery of the underlying physiological processes in tissue repair such as antimicrobial agents, including gauze, non-adherent films, and antimicrobial agents [39, 61, 62]. The selection and application of dressing materials and topical agents are based on the nature of and benefits to the burn wound, a specific wound quality or presence of contamination or infection, and patient allergy.

Superficial burn wounds comprise superficial dermal and partial-thickness wounds that are pinkish in color, with blister formation, epidermis slough off, and excruciating pain [63]. Wound care promotes wound epithelialization and prevents infection. Furthermore, biological dressings, including porcine skin and amniotic membrane, are applied to relieve wound pain and enhance epithelialization [62, 63].

Deep burn wounds consist of deep partial thickness, full thickness, and deeper injury, and require burn wound excision and graft coverage. Mid- and deep-dermal burn wounds are mottled pinkish or whitish, have a dull sensation, and are sloughy [63]. The aims of wound care for deep burn wounds are minimizing necrotic tissue and preventing wound infection. First, wound irrigating disinfectant (e.g., Granudacyn® irrigation solution) is used to cleanse and moisturize the wound; it contains hypochlorous acid, a reliable cleansing solution [64] and can prevent the proliferation of Gram-positive and -negative bacteria. Subsequently, nurses should thoroughly cleanse and debride sloughy and necrotic tissue on a burn wound. A single-use sterile cloth, "UCS® debridement cloth", is pre-moistened and used for wound cleansing and debridement of the surrounding wound areas. Furthermore,

enzymatic debridement agents (e.g., Iruxol® mono ointment dressing) are used to remove slough and promote burn wound healing and achieving a significant therapeutic effect [13].

Moreover, full-thickness burn wounds require eschar debridement and/or excision and original autologous meshed skin grafting for charred and leathery wound [63]. The use of skin grafts on full-thickness burn wounds results in no or minimum hypertrophic scar formation [65]. Simultaneously, burn care nurses require additional knowledge and skills to care for patients with burn injuries and guide the appropriate care of both the recipient (burn area with skin graft) and donor sites (donation skin site) [66].

2.4 Advancement of wound management for preventing hypertrophic scarring

Biodegradable temporizing matrix (BTM) is used for full or deep burn wounds [67–69] to cover excised deep burn wounds for at least 3 weeks, aiming at temporary wound closure and supporting the reconstruction of the dermis. BTM intergradation into the wound bed through cellular infiltration is time consuming. New blood vessels grow and become full of fibroblasts production; therefore, when the neodermis becomes vascularized, a thin skin graft can be applied to a deep burn wound [67, 70].

Dermal regeneration templates (e.g., Nevelia®) used for full or deep burn wounds or reconstructive surgery are made for collagen layering, which promotes dermal regeneration [71, 72]. First, it is used to cover an excised burn wound or excised scarring for approximately 3 weeks [73] and consists of a matrix of bovine collagen, which facilitates integration into the wound tissue [74]. Next, a split-thickness skin graft is required to cover burn wounds, provides better functional and esthetic outcomes, and reduces hypertrophic scar formation [75, 65].

2.5 Nurse-led burn clinics promote continuity of care for patients with burn injuries

Hong Kong has only one nurse-led burn clinic in public hospital, which plays a crucial role for patients with burn injuries by function-limiting sequelae such as contractures, scarring, thermoregulatory anomalies, amputation, and nurse-led burn clinic by promoting the continuity of care, quality of life, and psychosocial well-being during their rehabilitation and return home within the long-term recovery period, and by decreasing the length of hospitalization [39]. The aims of nurse-led burn clinics include: independent burn care nurses with delegated authority to make decisions regarding patients with burn injuries; delivering full support while maintaining continuity of care after discharge; implementation of multidisciplinary acute care collaboration and planning for long term rehabilitation and burn wound management; evaluating the patient's response to both physical and psychological treatments and counseling; referring the patient to the appropriate resources for support; assessing and evaluating the patient's ability to perform activities of daily living and self-care; providing educative advice on rehabilitation for patients with burn injuries [57]. Nurse-led burn clinics and services also provide healthcare (e.g., ability to prescribe optimal wound management) to referrals with minor burns from the Accident and Emergency Unit [76, 77]. In addition, burn care nurses at nurse-led burn clinics have the authority and autonomy in performing burn wound management recognized by hospitals in the provision of care for patients with burn injuries based on the assessed needs of patients and caregivers.

3. Conclusion

Despite the recent developments in caregiving approaches for patients with burn injuries, morbidity and mortality continue to increase worldwide. Several comprehensive programs related to burn care have been implemented to enhance nurse's competency to care for patients with burn injuries in the acute care framework. In Hong Kong, burn care nurses at nurse-led clinic educate patients with burn injuries and their families/caregivers throughout the hospitalization period, discharge planning, and rehabilitative journey to ease their anxiety and promote recovery. Moreover, burn care nurses attend continuing education programs, in-service training programs, and both local and international conferences to enhance their knowledge and readiness to respond to burns injuries, as well as management and leadership in local practice with a global perspective. Nurse-led clinic and referral pathway can reduce patient hospitalization and foster better long-term rehabilitation and return home. The incentives of Hospital Authority to increase the number of nurses attending burn care training courses to enhance high quality care to patients with burn injuries. No LDI study has objectively assessed the different severity of burn depth of perform by nurses; therefore, we recommend that burn care nurses conduct a study focusing on the objective LDI assessment of diverse severity of burn depth.

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Conflict of interest

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