Review of Contemporary Philosophy
ISSN: 1841-5261, e-ISSN: 2471-089X
Vol 22 (1), 2023
Pp 2678 - 2685

The Role of Nurses in the Management of Rare Dermatological Conditions: Evidence and Practice of Major Burns

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Abstract:

Background: Major burn injuries are among the most severe types of trauma, requiring specialized care for optimal recovery. In the United States alone, burn-related fatalities range from 4,000 to 6,000 annually. While burns affect the skin primarily, they can compromise every physiological system. Nurses are the first responders to burn cases and are crucial in the initial management and stabilization of burn victims. Understanding burn classification, initial management, and the roles of healthcare providers, particularly nurses, is essential to improve patient outcomes.

Aim: The aim of this article is to explore the role of nurses in managing major burn injuries, particularly rare dermatological conditions such as full-thickness and extensive burns, emphasizing their involvement in burn classification, resuscitation, and wound care in the critical first 48 hours.

Methods: This article synthesizes current literature on burn care, focusing on the role of nurses in the management of severe burn injuries. It reviews various burn classifications, resuscitation methods, wound care strategies, and nursing interventions required for effective burn management, especially in rare and severe cases.

Results: The results indicate that nurses play a pivotal role in the early management of burn injuries, including accurate burn classification, airway protection, fluid resuscitation, and pain management.

Nursing interventions during the first 48 hours can significantly impact survival and recovery. Moreover, specific management protocols, such as the Parkland Formula for fluid resuscitation and the Rule of Nines for burn surface area estimation, are integral in guiding treatment strategies.

Conclusion: The article concludes that nurses are critical in the initial management of major burn injuries, including rare dermatological conditions. Their involvement in early assessments, fluid management, airway protection, and pain control can greatly influence the clinical outcomes of burn patients. Further research and continuous education on burn care are needed to improve nursing practices in burn units.

Key Words: Burn injuries, nursing management, resuscitation, pain management, wound care, burn classifications, rare dermatological conditions.

Received: 07 october 2023 R**evised**: 22 November 2023 **Accepted**: 06 December 2023

Introduction:

Major burn injuries represent some of the most severe forms of physical trauma and demand highly specialized medical care. While burns are commonly associated with damage to the skin, significant burns can affect every physiological system within moments of the injury. In the United States, burn injuries necessitate medical attention every 30 minutes, with an estimated 4,000 to 6,000 fatalities attributed to burn-related incidents annually [1]. There are approximately 120 burn centers in the U.S., with only half receiving accreditation from the American Burn Association [2]. This means that the majority of individuals do not have immediate access to specialized burn care and must first receive stabilization at local hospitals following the injury. Consequently, it is essential that healthcare professionals, particularly nurses who are typically the first responders, possess fundamental knowledge regarding burn assessment and treatment. Several factors, including geographic location, gender, and age extremes, heighten the risk of burn injuries [1]. A prevalent misconception is that most severe burns are caused by house fires; however, such incidents account for only around 4% of burn admissions [1]. The Southeastern United States exhibits the highest incidence of major burn injuries. Furthermore, men are twice as likely to experience major burns compared to women. Common causes of adult burn injuries include electrical accidents, workplace incidents, automobile fires, and burns sustained while handling trash or yard debris [2]. Vulnerable populations, such as children, the elderly, and individuals with disabilities, are at greater risk due to mobility restrictions and decreased physical coordination.

Burn Classifications

Burn injuries are categorized in various ways, which are essential for determining appropriate treatment. Critical factors for classification include the injury's cause, the depth of the burn, and the extent of skin involvement. Burns can be caused by thermal, chemical, or electrical sources. The depth of a burn is defined by how far the injury extends into the skin layers, with burns classified as partial-thickness or full-thickness. The degree of injury is also used to categorize burns, ranging from first-degree to fourth-degree burns. Partial-thickness burns encompass first- and second-degree burns, while full-thickness burns include third- and fourth-degree burns [3].

Partial-thickness Burns

First-degree burns are superficial injuries affecting only the epidermis. These burns typically present as red skin without blistering, accompanied by tightness, irritation, and pain. The skin will blanch when pressure is applied [3]. Sunburn is a common example of a first-degree burn. Although often uncomfortable, first-degree burns are self-limiting and generally do not require medical treatment unless complications such as dehydration arise or if the burn covers a significant area of the body. Second-degree burns involve both the epidermis and the dermis. These burns can be classified as superficial or deep, depending on their extent into the dermal layers. Superficial second-degree burns appear red with fluid-filled or open blisters, while deeper second-degree burns may exhibit red, pale pink, or yellow coloration [3]. The wound bed may be either wet or dry. Deep second-degree burns are often challenging to

differentiate from third-degree burns and may require prolonged healing, often necessitating surgical intervention.

Full-thickness Burns

Third-degree burns extend through the dermis into the subcutaneous tissue, resulting in damage to the entire skin surface. These burns can appear pale white, gray, yellow, dark red, or even charred [3]. The skin is typically tight and leathery, with reduced flexibility. In these cases, the affected areas do not blanch under pressure, and healing will not occur without surgical intervention. Fourth-degree burns, although less frequently discussed, are a crucial classification for healthcare providers to recognize. These burns involve damage to deeper structures, such as tendons and bones [3]. Fingers and toes are particularly vulnerable to fourth-degree burns. The majority of fourth-degree burns result in the need for amputation due to the extent of bone damage.

Sizing of a Burn Injury

The size and depth of a burn injury are critical determinants in assessing the level of care a patient will require. Extensive burns necessitate intensive, specialized care to achieve the best possible outcomes. One of the most vital initial evaluations in burn care is estimating the total affected body surface area (TBSA). This assessment plays a pivotal role in guiding various aspects of treatment, such as determining the volume of fluids necessary for resuscitation and identifying the resources required to manage the patient effectively. Accurate estimation of burn size is essential but often poses a challenge for healthcare providers, particularly for nurses who may not regularly handle burn cases. Clinicians tend to overestimate rather than underestimate the TBSA, and both miscalculations can adversely affect patient outcomes, increasing the risk of mortality. Several methods are employed to estimate the percentage of body surface area affected by burns, with the most commonly used being the Rule of Nines. This method divides the body into distinct sections, assigning a percentage to each. According to the Rule of Nines, the head accounts for 9%, the torso for 36%, each arm for 9%, each leg for 18%, and the genital area for 1%. These percentages apply to the entire body area, and if only part of an area is burned, the corresponding portion of the percentage is allocated. While the Rule of Nines is also utilized for pediatric burn cases, the calculation differs due to variations in body proportions in children.

Initial Burn Management

The first 48 hours of post-injury are considered the most critical in the management of burn patients. Key nursing priorities during the initial phase of care include ensuring airway protection, fluid resuscitation, thermal regulation, and assessment of the burned tissue. Airway evaluation and protection are especially crucial for patients who may have sustained inhalation injuries or burns to the airways. Individuals exposed to structure fires, automobile fires, or fires in confined spaces are at heightened risk for inhalation injuries.

Airway and Inhalation Injuries

Patients with inhalation injuries often present respiratory symptoms such as dyspnea, coughing, and hypoxia. Additional signs may include a hoarse voice, soot in the nasal or oral cavities, or soot present in airway secretions. Inhalation injuries frequently accompany facial burns, and it is imperative that patients with facial burns be immediately assessed for potential inhalation injuries and closely monitored for any respiratory changes. Protecting the airway is vital due to the possibility of swelling in the airway. For patients with both facial burns and inhalation injuries, intubation and mechanical ventilation are typically required to ensure airway protection. Individuals involved in structure fires, particularly those in confined spaces, face an elevated risk of carbon monoxide and cyanide poisoning. When materials such as plastics burn, they release carbon monoxide, which binds to hemoglobin with greater affinity than oxygen, leading to severe hypoxia and potential fatality. In cases of suspected carbon monoxide poisoning, carboxyhemoglobin levels should be promptly measured. Pulse oximetry (SpO2) is not a reliable indicator of oxygenation in patients with carbon monoxide poisoning and should not be used for assessment. For patients suspected of carbon monoxide poisoning, administration of 100% oxygen (FiO2) should begin

immediately and continue for 12 to 24 hours. Patients with elevated carboxyhemoglobin levels may require intubation due to the associated inhalation injury, but all such patients should receive 100% FiO2, even if they are not intubated. Follow-up carboxyhemoglobin testing is recommended 5 to 8 hours after the initial measurement to ensure the complete removal of carbon monoxide from the bloodstream. In severe cases of poisoning, hyperbaric oxygen therapy should be considered.

Cyanide Poisoning Considerations

Nurses should also consider the potential for cyanide poisoning in patients with carbon monoxide exposure or those who have been in a confined space for an extended period. Cyanide is released when substances such as plastics and coated textiles burn, which is common in mobile homes, RVs, or campers containing plastic materials or upholstery made from plastic or coated fibers. If a patient exhibits significantly elevated carbon monoxide levels or if there is a strong suspicion of cyanide poisoning, treatment should be initiated promptly.

Burn Shock and Fluid Resuscitation

Immediately following a major burn injury, changes in vascular permeability result in a significant fluid shift from the intravascular compartment to the surrounding tissues, contributing to the onset of burn shock. In these patients, substantial intravenous (I.V.) fluid administration is essential to prevent and manage this condition. The prompt infusion of I.V. fluids is critical to maintaining organ perfusion and preventing organ failure. In the first 24 to 48 hours after a burn injury, patients may require several liters of fluid per hour. Lactated Ringer's solution is the most commonly used fluid during this resuscitation process [6,7]. Fluid resuscitation within the first 24 hours is pivotal in reducing both mortality and morbidity associated with burns. Inadequate or excessive fluid administration can significantly affect patient outcomes. Various methods are available to estimate the volume of fluid needed to resuscitate a burn patient. The Parkland Formula is the standard tool for this purpose, calculating fluid requirements based on burn size, total body surface area (TBSA), and patient weight [8]. According to this formula, half of the calculated fluid is to be administered within the first 8 hours, with the timing starting from the point of injury, not from the patient's hospital admission. Accurate estimation of burn size is essential for the proper application of this formula. For large burn injuries, aggressive fluid resuscitation is crucial in the initial 24 to 48 hours to prevent hypovolemic shock. Many patients will also need vasopressors for hemodynamic support [9]. It is important to note that vasopressors should be used to manage shock and should not replace appropriate fluid resuscitation. Norepinephrine is recommended as the primary vasopressor, with vasopressin often used as a second-line agent. Hourly urine output monitoring is essential for all patients undergoing fluid resuscitation. A urinary catheter should be placed to ensure accurate measurement. Fluid adjustments may be necessary for patients exhibiting shock symptoms or low urine output [4]. If a patient’s urine output does not improve with fluid resuscitation, emergent renal replacement therapy may be required [7,10]. Acute kidney injury is a common complication in patients with severe burn injuries.

Temperature Management

Burn injuries result in significant skin damage, leading to a loss of body heat and impairing the body’s ability to regulate temperature [1]. Due to the potential for rapid onset of hypothermia, continuous temperature monitoring is essential for burn patients. Significant hypothermia can result in complications such as bradycardia, hypotension, and coagulopathy. To mitigate these risks, patients should be kept warm using methods such as regular blankets, shock blankets, warming airflow blankets (e.g., Bair Hugger device), and head coverings. Wet clothing should be removed immediately upon initial assessment. If conventional warming techniques are insufficient, more advanced methods such as esophageal warming probes or centrally placed warming catheters may be required to maintain appropriate body temperature.

Pain Management

Effective pain management is a critical component of the initial care for patients with extensive burn injuries. Burn injuries are associated with severe pain, necessitating adequate analgesia. Most patients

with large burns will require intubation and mechanical ventilation, which allows for continuous medication infusion for both pain control and sedation. In some cases, intubation may be necessary for pain management purposes alone. Although no standard guidelines exist for pain management in burn patients, a multimodal approach is typically employed to address various pain mechanisms. Nonsteroidal anti-inflammatory drugs (NSAIDs) are generally avoided in large burns due to the potential for acute kidney injury and bleeding. Additionally, propofol is not recommended for sedation in burn patients, as it has been associated with the development of fatty liver disease in this population. Fentanyl and midazolam (Versed) infusions are commonly used for sedation and pain management in the first 24 to 48 hours post-injury [11,12]. Dexmedetomidine may be used for pain management in patients with smaller burns, those who are not intubated, or later in the clinical course when patients need to be more alert and responsive. Enteral analgesics can be introduced after the first 24 to 48 hours. Long-acting opioids, such as methadone, may be incorporated into the pain management regimen. Additionally, medications like gabapentin or pregabalin are often used in combination with narcotics to address pain associated with nerve damage.

Initial Wound Management

The approach to managing burn injuries in the initial phase is determined by the size, depth, and anatomical location of the burns. Full-thickness and circumferential burns can result in compartment syndrome due to the constriction imposed by the burnt tissue. Particularly, circumferential burns to the limbs may lead to potential limb loss if the restrictive pressure is not alleviated. In these instances, escharotomies are a critical emergent intervention, involving surgical incisions made to release the constricting tissue. These procedures are typically conducted on the limbs but may also extend to the chest and abdomen [1]. Patients with severe burns should be promptly transferred to a specialized burn center to optimize clinical outcomes, as they require multiple surgical interventions. Initial wound management strategies vary according to institutional capabilities; however, maintaining warmth and preventing hypothermia are paramount. In cases where the patient is normothermic, moist sterile dressings—moistened with saline or antimicrobial solutions such as Dakin's—should be applied. In the case of hypothermic patients, it is crucial to shield them with sterile towels or sheets until normothermic conditions are restored.

Nonsurgical Management

Superficial partial-thickness burns affecting less than 10% of total body surface area (TBSA) are typically classified as minor burn injuries and may be managed conservatively with topical treatments. Common practices include the application of topical antimicrobials such as silver sulfadiazine, with oral antibiotics generally not required unless signs of infection or delayed wound presentation occur. Patients who have not received a tetanus vaccine within the past five years should be administered one. Special consideration is warranted for burns involving critical areas such as the hands, face, genitals, joints, or any circumferential burns. The American Burn Association advises that even minor burns to these regions be evaluated and referred to certified burn centers due to the heightened risk of complications, including scarring and loss of functionality.

Surgical Management

Severe burn injuries necessitate multiple surgical procedures over the span of weeks to months, depending on the extent of the burn and the presence of any comorbid conditions. The risk of infection remains high until the damaged areas have healed. In large burns, it is imperative that initial surgical excision occurs within 48 hours of the injury, as this intervention reduces infection risks and enables the preservation of viable tissue [1]. The wound bed is then typically covered with a temporary skin substitute, known as an allograft, which aids in protecting the wound and prepares it for the eventual application of a permanent autograft. Rapid skin closure is crucial for optimizing patient recovery outcomes. Allografts, often sourced from cadaver skin and sterilized, serve as temporary skin substitutes. These grafts foster an ideal environment for the wound bed by promoting granulation and maturation, making the area more receptive to subsequent autografting. The advantages of allografts include moisture retention and infection

prevention through the barrier they provide. Alternatives to allografts include porcine skin (xenografts) and placental stem cell-based grafts [1]. Autografts, derived from the patient's own skin, are permanent and typically applied to full-thickness burns or areas where other treatments have failed. During an autografting procedure, healthy skin is harvested from a donor site and placed over the burn site to facilitate healing. The donor site, a new wound itself, typically heals within two weeks. In cases of extensive burns where donor sites are insufficient, skin can be cultured from biopsied samples in a laboratory, resulting in cultured epithelial autografts that serve the same function as native skin [13].

Quality Care Impact on Patient Outcomes

Burn injuries are inherently complex, with high mortality rates, given their traumatic nature and the rapid onset of profound shock. The systemic impact of burns extends to every organ system, necessitating immediate, comprehensive assessment and intervention. Nurses play a pivotal role in the initial management of burn patients, prioritizing airway assessment, burn cause, depth, and TBSA evaluation to facilitate effective resuscitation and minimize the risk of burn shock. As burn patients are highly susceptible to infection and hypothermia, it is crucial for nurses to maintain body temperature and transfer the patient to a certified burn center without delay. Early, high-quality care is critical to improving outcomes for patients with significant burn injuries.

Parkland Calculation Example

In the case of a patient with a 55% total body surface area (TBSA) burn and a body weight of 72 kg, the total volume of fluid required for the first 24 hours can be calculated using the Parkland formula, which is expressed as: surface area (%) x weight (kg) x fluid volume (mL). For this patient, the calculation is as follows: 55 x 72 x 4 = 15,840 mL. Thus, the total fluid required during the first 24 hours is 15,840 mL. To determine the fluid administration for the first 8 hours, half of the total fluid volume is typically given, which equals 7,920 mL (15,840 mL / 2). Consequently, the infusion rate for the first 8 hours is calculated as 7,920 mL divided by 8 hours, resulting in an infusion rate of 990 mL per hour. For the remaining 16 hours, the second half of the fluid volume is administered, at a rate of 495 mL per hour (7,920 mL / 16 hours). This ensures that the patient receives the necessary volume of fluids over the course of the 24-hour period, adhering to the guidelines established in the Parkland formula for burn resuscitation [14].

Burn Center Referral Criteria

Certain burn injuries necessitate referral to a specialized burn center to ensure optimal patient care and outcomes. These criteria include second-degree burns involving more than 10% of the total body surface area (TBSA), burns to critical areas such as the genitals or perineum, the face, major joints, or the hands and feet. Additionally, third-degree burns, electrical burns, and burns accompanied by inhalation injuries require specialized treatment that may be beyond the capabilities of general hospitals. Burns resulting from trauma, where the burn injury represents the most significant risk to the patient's survival, also warrant referral. Patients with preexisting medical conditions that significantly increase the risk of mortality from burn injuries, as well as those whose current medical facilities lack the resources to provide adequate care, should also be transferred to a certified burn center. These criteria ensure that patients receive the level of care necessary for recovery from complex and life-threatening burn injuries [14].

Conclusion:

Burn injuries, particularly major burns, represent some of the most challenging conditions in trauma care, affecting not just the skin but also the body's physiological functions. Nurses, as frontline healthcare providers, play an essential role in the management of these injuries, especially in the critical first 48 hours following the injury. The rapid and efficient management of burns can make the difference between life and death. Nurses are responsible for conducting a thorough assessment of the burn's severity and classification, which informs subsequent treatment protocols. The correct categorization of burns—whether superficial, partial-thickness, or full-thickness—determines the level of intervention needed, including the need for surgical interventions or specialized care. Key nursing responsibilities also include fluid resuscitation, airway management, and pain control. Fluid resuscitation is paramount, as inadequate

or excessive fluid replacement can lead to complications such as shock, kidney failure, and mortality. Nurses follow guidelines such as the Parkland Formula to ensure appropriate fluid administration, thereby stabilizing patients and preventing organ dysfunction. Similarly, airway protection is crucial, particularly in cases where patients have inhalation injuries or facial burns, as swelling can obstruct breathing. Nurses must be vigilant in recognizing signs of airway compromise, ensuring prompt action, such as intubation and mechanical ventilation when necessary. Pain management, particularly for patients with extensive burns, presents another significant challenge. Nurses often manage pain through a combination of sedation and analgesia, carefully choosing appropriate medications while balancing potential side effects. Multimodal pain management strategies help address both physical and psychological aspects of burn pain, improving the patient's overall experience and recovery trajectory. Finally, nurses must act swiftly to address complications like burn shock, hypothermia, and infections. They are responsible for monitoring vital signs, ensuring adequate temperature regulation, and preventing infection through sterile techniques and wound care. In severe cases, when complications like compartment syndrome arise, nurses must recognize the need for urgent surgical interventions like escharotomy to release pressure and prevent limb loss. In conclusion, the role of nurses in managing major burns extends beyond routine care and requires specialized knowledge in areas such as burn classification, resuscitation, pain management, and infection prevention. Their critical involvement in the first 48 hours after a burn injury can greatly influence outcomes, and ongoing education is essential for improving care and supporting burn patients' recovery. Therefore, nurses must receive continuous training in burn care to keep pace with evolving practices and ensure the best possible outcomes for burn patients.

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ور الممرضين في إدارة الحالات الجلدية النادرة: الأدلة والممارسات لحروق الدرجة الكبرى

الملخص:

الخلفية: تعد إصابات الحروق الكبرى من بين أكثر أنواع الإصابات شدة، وتتطلب رعاية متخصصة لتحقيق الشفاء الأمثل. في الولايات المتحدة وحدها، تتراوح الوفيات المرتبطة بالحروق بين 4,000 و6,000 حالة سنويًا. وعلى الرغم من أن الحروق تؤثر أساسًا على الجلد، إلا أنها قد تؤثر على كل نظام فيزيولوجي في الجسم. يعد الممرضون أول المستجيبين لحالات الحروق وهم عنصر حاسم في الإدارة الأولية واستقرار حالة ضحايا الحروق. إن فهم تصنيف الحروق والإدارة الأولية وأدوار مقدمي الرعاية الصحية، خاصة الممرضين، أمر ضروري لتحسين نتائج المرضى.

الهدف: الهدف من هذه المقالة هو استكشاف دور الممرضين في إدارة إصابات الحروق الكبرى، وخاصة الحالات الجلدية النادرة مثل الحروق الكاملة السُمك والشديدة، مع التركيز على مشاركتهم في تصنيف الحروق، الإنعاش، والعناية بالجروح في الـ 48 ساعة الأولى الحرجة.

الطرق: تقوم هذه المقالة بتجميع الأدبيات الحالية المتعلقة بالعناية بالحروق، مع التركيز على دور الممرضين في إدارة إصابات الحروق الشديدة. وهي تستعرض تصنيفات الحروق المختلفة، وطرق الإنعاش، واستراتيجيات العناية بالجروح، والتدخلات التمريضية اللازمة لإدارة الحروق بفعالية، خاصة في الحالات النادرة والشديدة.

النتائج: تشير النتائج إلى أن الممرضين يلعبون دورًا محوريًا في الإدارة المبكرة لإصابات الحروق، بما في ذلك تصنيف الحروق بدقة، وحماية مجرى الهواء، والإنعاش السوائل، وإدارة الألم. يمكن أن تؤثر التدخلات التمريضية خلال الـ 48 ساعة الأولى بشكل كبير على البقاء على قيد الحياة والتعافي. علاوة على ذلك، تعد البروتوكولات الإدارية الخاصة، مثل صيغة باركلاند للإنعاش بالسوائل وقاعدة التسع للتمثيل التقريبي لمساحة الحروق، جزءًا أساسيًا من توجيه استراتيجيات العلاج.

الخلاصة: تختتم المقالة بأن الممرضين يعدون عنصرًا حاسمًا في الإدارة الأولية لإصابات الحروق الكبرى، بما في ذلك الحالات الجلدية النادرة. إن مشاركتهم في التقييمات المبكرة، وإدارة السوائل، وحماية مجرى الهواء، والتحكم في الألم يمكن أن تؤثر بشكل كبير على النتائج السريرية لمرضى الحروق. هناك حاجة إلى مزيد من البحث والتعليم المستمر في مجال العناية بالحروق لتحسين ممارسات التمريض في وحدات الحروق.

الكلمات المفتاحية: إصابات الحروق، إدارة التمريض، الإنعاش، إدارة الألم، العناية بالجروح، تصنيفات الحروق، الحالات الجلدية النادرة.