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Advances in the Management of Second-Degree Burns: A Comprehensive Review of Treatment Modalities, Complications, and Demographic Insights

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ABSTRACT

Second-degree burns, or partial-thickness burns, involve damage to the epidermis and part of the dermis, posing significant challenges in wound healing and infection prevention. This review explores the latest advancements in the management of second-degree burns, focusing on evidence-based treatment modalities such as topical antimicrobial agents, collagenase ointment, advanced dressings, and innovative therapies like allogeneic cord blood platelet gel and cultured keratinocytes. These treatments aim to promote healing, minimize scarring, and reduce complications such as infection and pigmentation changes. Additionally, the review highlights the demographic patterns of second-degree burns, emphasizing the vulnerability of pediatric populations and young adult males to scald and flame injuries. By synthesizing current literature, this review underscores the importance of individualized treatment plans, early referral to burn specialists, and targeted prevention strategies to improve patient outcomes. The findings suggest that integrating advanced therapies and improving access to care are critical to addressing the global burden of second-degree burns and enhancing the quality of life for affected individuals.

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INTRODUCTION

Second-degree burns, also known as partial-thickness burns, involve the epidermis and part of the dermis. These burns can be further classified into superficial and deep partial-thickness burns. Treatment options for second-degree burns aim to promote healing, prevent infection, and minimize scarring. The medical literature provides several treatment modalities:

1. **Topical Antimicrobial Agents:**
   Silver sulfadiazine cream is a widely used topical antimicrobial agent for second-degree burns. It helps prevent wound sepsis and is applied under sterile conditions, typically once or twice daily, until healing occurs or the site is ready for grafting. However, newer studies suggest that while silver sulfadiazine is effective, other treatments may offer advantages in specific contexts.[1-2]

2. **Collagenase Ointment:**
   Collagenase has been compared to silver sulfadiazine in the treatment of deep second-degree burns. While both treatments showed similar wound healing times, collagenase significantly reduced the time required for necrotic tissue removal.[2]
3. **Advanced Dressings:**
   Bio-degradable synthetic membranes, such as Suprathel®, have been used to treat superficial and deep second-degree burns. These membranes provide a moist environment conducive to healing, reduce pain, and minimize the need for frequent dressing changes.[3]
4. **Allogeneic Cord Blood Platelet Gel:**
   This treatment utilizes growth factors to promote re-epithelialization and tissue regeneration. It has shown promise in accelerating healing and reducing inflammation and scarring in second-degree burns, although it is not yet a routine treatment.[4]
5. **Cultured Allogenic Keratinocytes:**
   These have been used effectively in deep second-degree burns to promote faster re-epithelialization compared to traditional dressings.[5]
6. **Combination Dressings:**
   The use of silver foam dressings combined with zinc-hyaluronic gel has been reported to promote epithelialization and provide favorable cosmetic outcomes in pediatric patients with partial-thickness burns.[6]

Mixed second degree burn, predominantly superficial. Treatment: furocinated gauze is applied

The choice of treatment depends on the burn's depth, location, and the patient's overall health status. It is crucial to evaluate each case individually to determine the most appropriate treatment strategy.

Common Complications Associated with Second-Degree Burns

Second-degree burns, also known as partial-thickness burns, involve the epidermis and part of the dermis. These burns can lead to several complications, including infection, hypertrophic scarring, and pigmentation changes.

1. **Infection:**
   Infection is a significant concern due to the loss of the protective barrier of the skin, which can lead to both local wound infections and systemic infections if not properly managed. The literature emphasizes the importance of appropriate wound care to minimize infection risk, including the use of topical antimicrobial agents to control microbial colonization.[1-2] However, routine prophylactic systemic antibiotics are not recommended for outpatient management, as they may contribute to antibiotic resistance.[7-8]
2. **Hypertrophic Scarring:**
   Hypertrophic scarring is another common complication, particularly in deep partial-thickness burns. This can result in functional and cosmetic issues, necessitating interventions such as pressure therapy or silicone gel sheeting to manage scar formation.[9]
3. **Pigmentation Changes:**
   Pigmentation changes, such as hyperpigmentation or hypopigmentation, can occur as the burn heals, potentially leading to long-term cosmetic concerns.[7]

Deep second-degree burns in the posterior region of the pelvic limbs, treatment requiring tangential excision.

Proper wound management, including maintaining a moist wound environment and using advanced dressings, is crucial to promote healing and minimize these complications.[7][9] Early referral to a burn specialist is advised for deep partial-thickness burns or if complications arise, to ensure optimal outcomes.

Mixed second degree burn, predominantly superficial, allografts (epifast) are applied

Typical Patient Demographics Affected by Second-Degree Burns

Second-degree burns, also known as partial-thickness burns, affect a diverse range of patient demographics, with certain patterns observed in different age groups and settings.

1. **Pediatric Populations:**

In children aged 0-6 years, second-degree burns are frequently caused by scalds, often occurring in domestic settings. This age group is particularly vulnerable due to their limited understanding of danger and their increased exposure to hot liquids and surfaces in the home environment.[10-12] Scald burns are the predominant cause of burn injuries in young children, with a significant proportion occurring at home.[12]

2. **Adult Populations:**

In adults, second-degree burns are also common, with a notable incidence in males. The age group most affected tends to be young adults, particularly those aged 16-35 years, as

seen in studies focusing on facial burns.[13] In these cases, accidental scalding and flame burns are common etiologies.[13-14] Adult burn injuries often occur in occupational settings or during activities involving open flames or hot surfaces.[14]

Overall, second-degree burns are more prevalent in males across all age groups, with scalds being a leading cause in both children and adults. The demographic patterns underscore the importance of targeted prevention strategies, such as educating caregivers about burn risks in children and implementing safety measures in workplaces for adults.[13-14]

Deep second-degree burns + bilateral compartment syndrome of the hands. Initial surgical treatment: dermofasciotomies of the back of both hands

CONCLUSION

Second-degree burns, or partial-thickness burns, represent a significant clinical challenge due to their potential for complications such as infection, hypertrophic scarring, and pigmentation changes. Effective management of these burns requires a multifaceted approach, including the use of topical antimicrobial agents like silver sulfadiazine, advanced dressings such as bio-degradable synthetic membranes, and innovative treatments like allogeneic cord blood platelet gel and cultured keratinocytes. These modalities aim to promote healing, prevent infection, and minimize long-term cosmetic and functional impairments.

The demographic patterns of second-degree burns highlight the vulnerability of specific populations, such as young children and young adult males, to scald and flame injuries. This underscores the importance of targeted prevention strategies, including public education on burn risks and safety measures in both domestic and occupational settings. Furthermore, the literature emphasizes the need for individualized treatment plans based on the burn's depth, location, and the patient's overall health status.

Recent advancements in burn care, such as the use of combination dressings and immunomodulatory therapies, offer promising avenues for improving outcomes in second-degree burns. However, challenges remain, particularly in resource-limited settings where access to advanced treatments may be limited. Early referral to burn specialists and adherence to evidence-based wound care practices are critical to optimizing patient outcomes.

Mixed second-degree burns with a predominant deep lesion. QX treatment: harvesting and application of a meshed partial-thickness skin graft

In conclusion, while significant progress has been made in the treatment and management of second-degree burns, ongoing research and innovation are essential to address the persistent challenges associated with these injuries. By integrating advanced therapies, improving access to care, and prioritizing prevention, healthcare providers can enhance the quality of life for burn patients and reduce the burden of second-degree burns globally.

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