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Management of Pediatric Minor Burn Using Hydroactive Wound Dressing: A Case Report

Dinar Alifia Yudiasti[1*], Iswinarno Doso Saputro[2]

[1]Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

[2]Department of Plastic Reconstructive and Aesthetic Surgery, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

*Corresponding author details: Dinar Alifia Yudiasti; dinaralf@yahoo.com

ABSTRACT

Background: Pediatric burn injuries are common in clinical practice and pose unique challenges due to children's physiological differences, higher infection risk, and psychological vulnerability. Effective outpatient strategies using modern wound care can offer safe, cost-effective solutions. ***Case:*** A 4-year-old girl presented with a 1.5% TBSA partial-thickness burn on her right foot from accidental hot water scalding. The burn was characterized by erythema, bullae, and significant pain. Mechanical debridement under general anesthesia was performed to remove necrotic tissue and reduce infection risk. A hydroactive wound dressing was applied post-debridement to promote moist healing, reduce pain, and enhance epithelialization. The patient was discharged with wound care instructions and nutritional support for outpatient follow-up. ***Results:*** Within four weeks, the wound showed rapid healing with no infection, minimal scarring, and excellent cosmetic and functional recovery. The child resumed normal activities without complications or psychological distress. ***Conclusion:*** This case demonstrates that pediatric second-degree burns can be safely and effectively managed on an outpatient basis using hydroactive dressings following appropriate debridement and pain control. Such an approach promotes healing, reduces healthcare burden, and minimizes psychological impact on both the patient and family.

Keywords: burn; pediatric; wound healing; hydroactive dressing; ambulatory care.

INTRODUCTION

Burn injuries are a leading cause of morbidity and mortality among children worldwide. Among pediatric patients, burns frequently result from scalding with hot liquids, contact with hot surfaces, or exposure to flames [1]. Blistering burns are the most common in children under five years old. Globally, the World Health Organization (WHO) identifies burns as the fourth leading cause of death from unintentional injuries in children [1,2]. In addition to physical trauma, pediatric burns have significant psychosocial impacts due to the pain associated with treatment, prolonged recovery periods, and the potential for visible scarring, which can lead to lasting psychological effects [3].

Pediatric burn management presents unique challenges due to physiological differences between children and adults. These differences include thinner skin, a higher body surface area-to-mass ratio, and distinct metabolic and immune responses. Such factors contribute to higher risks of infection, fluid loss, and complications, even in relatively minor burns [3, 4]. The psychological stress on the child and their family further complicates care. Recent advances in burn management emphasize using advanced wound dressings, such as hydroactive dressings and silver foam dressings, to accelerate healing, reduce infection risk, and enhance patient comfort. These dressings also minimize the frequency of painful dressing changes, improving the overall care experience for pediatric patients [5].

Burn injuries also impose a significant socioeconomic burden due to prolonged hospital stays, surgical interventions, and substantial rehabilitation costs. Developing cost-effective outpatient management strategies for minor burns has become a critical advancement, enabling patients to recover in their home environments while reducing healthcare expenses [6]. Pediatric burns, which constitute approximately 24% of all burn cases, require specialized care due to higher metabolic demands and the unique risks of infection in this age group [4]. This report discusses the application of hydroactive wound dressings in managing minor pediatric burns, emphasizing their efficacy based on case presentations and supporting literature.

CASE DESCRIPTION

A 4-year-old girl was brought to the Emergency Department by her parents after sustaining a burn injury to the right foot (pedis) caused by accidental exposure to hot water. The incident occurred at home

while the child was playing. Immediately after the injury, the affected area developed redness and blisters, accompanied by significant pain and chills. As a form of first aid, the parents rinsed the burn area under cool running water for approximately 10 minutes. Despite this effort, the child's symptoms persisted, prompting her parents to seek medical attention. Upon arrival at the Emergency Department, the child appeared alert but visibly distressed due to the pain.

FIGURE 1: Clinical progression of a hot water burn injury on a 4-year-old girl's right foot. *(A)* Acute phase: Photograph taken approximately 10 minutes post-injury, showing redness and the initial formation of blisters after the burn. *(B)* Semi-acute phase: Photograph taken approximately 1-hour post-injury at the Emergency Department, showing increased redness, blistering, and tissue damage.

The medical team promptly assessed the burn, noting erythema, bullae, and signs of superficial partial-thickness tissue damage consistent with a second-degree burn. Using the Lund and Browder chart, the total body surface area (TBSA) affected was calculated at 1.5%. The patient's weight was recorded as 22 kg, which informed the subsequent fluid resuscitation plan and anesthetic considerations. Given the clinical findings, a multidisciplinary team decided to perform debridement under general anesthesia to facilitate proper wound cleaning and minimize the risk of infection.

In preparation for the procedure, the patient was stabilized with analgesics to address her pain and intravenous fluids to ensure adequate hydration. Parents were reassured about the procedural safety and the importance of early intervention to promote optimal healing. Debridement was conducted under general anesthesia using a laryngeal mask airway (LMA) to provide secure and effective airway management. The wound management procedure began with initial cleaning using a chlorhexidine solution to reduce microbial contamination. This was followed by rinsing the wound thoroughly with sterile water and drying it with sterile gauze. To further minimize the risk of infection, povidone-iodine was applied as a topical antiseptic, after which the area was rinsed again with 0.9% sodium chloride (NaCl) solution and dried. Mechanical debridement was then performed to carefully remove necrotic tissue, promoting wound healing and exposing healthy tissue for dressing. Finally, the wound underwent a second cleaning using chlorhexidine and NaCl to ensure a pristine and sterile surface before the application of the appropriate dressing.

FIGURE 2: Partial-thickness burns on the right foot of a 4-year-old girl. *(A)* Post-debridement phase: The wound appears clean, with removal of necrotic tissue and exposure of the underlying dermis. *(B)* Wound management phase: The affected area after the application of a hydroactive wound dressing, demonstrating its use in promoting a moist healing environment and protecting the wound from external contamination.

After completing the debridement, the wound was dressed with a hydroactive wound dressing. This dressing was chosen for its advanced properties, including its ability to maintain a moist wound environment conducive to epithelialization, absorb exudate effectively, and act as a barrier against secondary infections. The parents were provided with detailed instructions on home care, including wound hygiene, dietary recommendations to support tissue repair (such as protein-rich foods), and precautions to avoid scratching or further trauma to the affected area. The patient showed significant improvement during follow-up visits.

The hydroactive dressing facilitated faster epithelialization, reduced exudate accumulation, and minimized discomfort. By the second week post-debridement, the wound exhibited robust healing with no signs of infection or hypertrophic scarring. The child was able to resume normal activities with minimal restrictions by the end of the follow-up period.

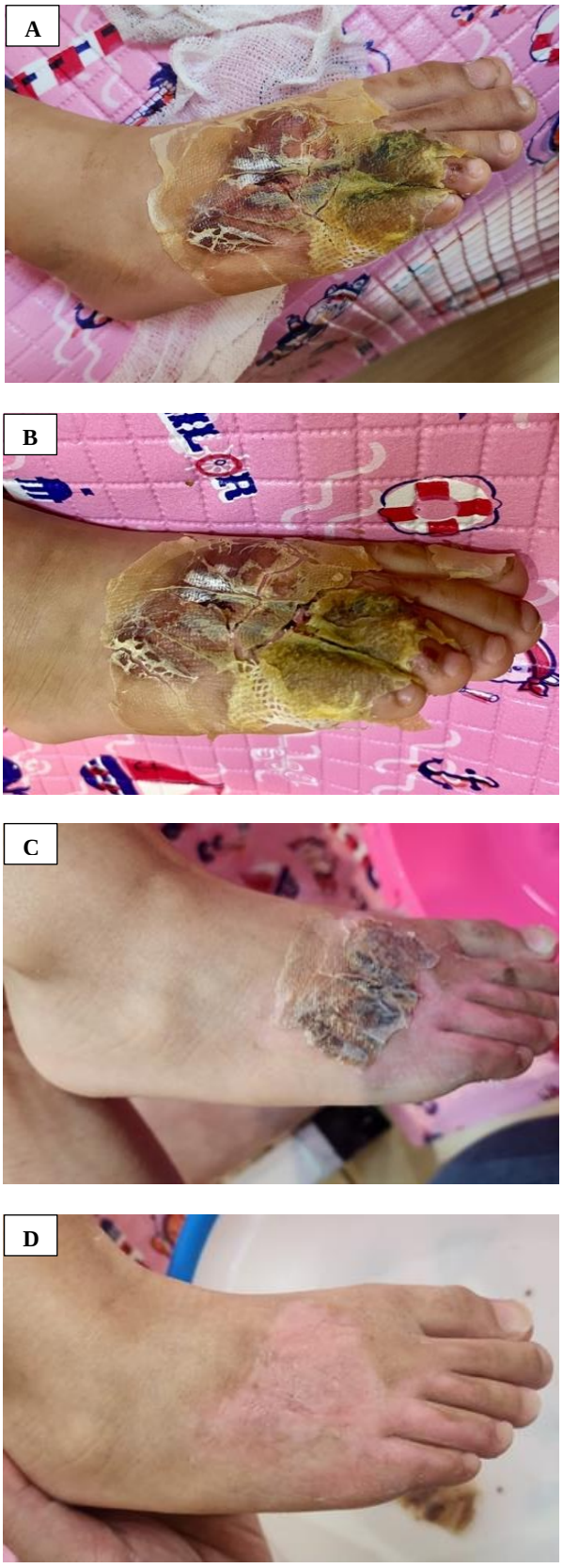

FIGURE 3: Healing progression of a partial-thickness burn on the right foot of a 4-year-old girl. *(A)* Day 10: Eschar formation with early healing. *(B)* Day 17: Eschar peeling and wound contraction. *(C)* Day 27: Advanced healing with minimal eschar. *(D)* Day 30: Complete wound closure with smooth skin regeneration.

DISCUSSION

This case illustrates the efficacy of hydroactive dressings in managing minor pediatric burns, reinforcing evidence from the literature. Using these dressings, the patient achieved faster healing with minimal pain and discomfort, consistent with research highlighting their benefits in reducing pain and the need for frequent dressing changes. Additionally, the outpatient setting provided an optimal environment for recovery, alleviating the psychological stress often associated with hospital stays and frequent interventions. This case underscores the practicality and efficiency of hydroactive dressings, particularly in resource-limited settings, where they offer a balance of cost-effectiveness and superior clinical outcomes. By integrating advanced wound care strategies with holistic outpatient management, this approach sets a benchmark for improving pediatric burn care standards.

Burn injuries in children are common and present unique challenges for clinicians and caregivers. Epidemiological data indicate that blistering burns are the leading cause of minor burns in children under five years old, comprising the majority of cases. Even minor burns in children can have significant psychological and physical impacts [3,7, 8]. Early management prioritizes burn cooling, pain control, and infection prevention. If left untreated, even minor burns can progress to more severe or infected wounds, underscoring the importance of timely and effective interventions [4,9].

The psychological impact of burns on children is considerable. Pain associated with burns often leads to anxiety and fear, which, if unaddressed, can result in post-traumatic stress disorder (PTSD) or other long-term behavioral issues. Parents and caregivers are also affected, as the burden of care can lead to emotional and financial stress [10,11]. Outpatient care has emerged as a viable option for managing minor pediatric burns. Treating burns in an outpatient setting offers several advantages, including reduced healthcare costs and increased patient comfort [12]. Recovering in a familiar home environment can improve psychological well-being and overall satisfaction with care, particularly for children. Outpatient care also reduces hospital-acquired infection risks and alleviates the demand on inpatient resources, making it a practical option for healthcare systems with limited capacity [6,9].

Hydroactive wound dressings are a modern and advanced approach to burn management, particularly for minor burns. These dressings maintain a moist wound environment crucial for optimal healing, while reducing dressing change frequency [13]. Studies have shown that hydroactive dressings significantly enhance patient comfort and reduce procedural pain. Unlike traditional methods

requiring frequent changes, hydroactive dressings can remain in place for several days, minimizing patient discomfort and improving compliance. Additionally, hydroactive dressings are associated with fewer complications, such as infections or delayed healing, compared to traditional dressings [14].

Pain management is a critical aspect of pediatric burn care. Hydroactive dressings have been proven to reduce pain during dressing changes, decreasing the reliance on analgesics and sedatives. Non-pharmacological approaches, such as distraction techniques or virtual reality, can further enhance the child's experience during treatment [9, 13, 15]. Aesthetic outcomes are another crucial consideration. Hydroactive dressings promote faster re-epithelialization, reducing the risk of hypertrophic scarring. For pediatric patients, minimizing scarring is essential as it impacts their physical appearance, self-esteem, and social interactions later in life. Proper scar management, combined with hydroactive dressings, ensures better functional and cosmetic outcomes, reducing the likelihood of contractures that may require surgical correction [5, 10, 11].

The long-term outcomes of pediatric burn management rely heavily on early intervention [3, 16]. Hydroactive dressings not only reduce healing time but also enhance skin regeneration, leading to better functional and cosmetic results. Comparative studies have shown that hydroactive dressings outperform traditional gauze-based dressings in preventing infections and accelerating healing [12]. Moreover, their role in outpatient settings highlights their practicality, particularly in resource-limited healthcare systems. Although alternative treatments, such as biological dressings or modern gel preparations, are also promising, hydroactive dressings remain a cost-effective and widely accessible choice. Future research should explore their role in managing complex burns and integrating them with adjunctive therapies, such as laser treatments or growth factor applications, to optimize outcomes further [9].

CONCLUSION

This case highlights the successful management of a pediatric second-degree burn using hydroactive wound dressing following meticulous debridement under general anesthesia. The favorable outcome reflects the importance of early intervention, multidisciplinary collaboration, and advanced wound care techniques in managing pediatric burns. Future research should continue to explore the role of innovative dressings and treatment protocols in improving long-term outcomes for burn patients.

Conflict of interest

The authors declared no conflict of interest. Informed consent was obtained from the patient's legal guardian (parents) for publication of this case.

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Data Availability Statement

Data supporting the findings of this case report are not publicly available. Any inquiries regarding the case details may be directed to the corresponding author via the provided email address.

Authors Contributions

All authors contribute equally in the process of preparing, reviewing, and finishing the manuscript. All authors agreed to this final version of the manuscript to be submitted to this journal.

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