

Comprehensive Management of Deep Second- And Third-Degree Gasoline Burns in a High-Specialty Burn Unit

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ABSTRACT

Burns are traumatic injuries that affect the skin and underlying tissues, potentially causing significant systemic, functional, and aesthetic complications, especially when critical areas such as the face and neck are involved. Among causative agents, flammable liquids like gasoline are associated with rapidly progressing and deep burns. We present the case of a 57-year-old male patient who suffered direct exposure to gasoline, developing superficial second-degree, deep second-degree, and third-degree burns, affecting approximately 6–7% of total body surface area. He was admitted to a high-specialty burn unit, where he received comprehensive management including hemodynamic stabilization through guided fluid resuscitation, multimodal analgesia, hypercaloric and hyperproteic nutritional support, scheduled surgical debridements, and application of Suprathel® as a temporary dermal substitute. During his clinical course, severe facial edema and risk of functional and aesthetic complications were documented; however, the multidisciplinary approach allowed airway preservation, pain control, wound bed protection, and promotion of re-epithelialization. Follow-up included early rehabilitation to maintain cervical mobility and oral opening, as well as evaluation by plastic surgery and ophthalmology to prevent sequelae. This case demonstrates that structured, protocolized comprehensive management with advanced dermal coverage technologies, such as Suprathel®, is an effective strategy to optimize clinical, functional, and aesthetic recovery in patients with deep burns caused by flammable liquids in critical areas, highlighting the importance of specialized units and a multidisciplinary approach in the treatment of complex injuries.

KEYWORDS: Flammable liquid burns, facial and cervical burns, second- and third-degree burns, multidisciplinary burn management, Suprathel®, high-specialty burn unit

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INTRODUCTION

Burns are among the most complex traumatic injuries in medical practice, not only due to local damage to the skin and underlying tissues but also because of systemic repercussions and the risk of short- and long-term complications. The World Health Organization (WHO) estimates that over 11 million cases requiring medical attention occur annually, with thermal burns from flammable liquids, such as gasoline, being one of the most frequent causes in adults (WHO, 2018).^{1,2}

Management of patients with second- and third-degree burns requires comprehensive care in specialized units, which have the human and technological resources to ensure proper initial stabilization, timely surgical treatment, pain control, nutritional support, and functional rehabilitation.²

Involvement of critical anatomical regions, such as the face and neck, presents an additional challenge due to the risk of airway compromise, significant aesthetic and functional alterations,

and considerable psychological impact on the patient's quality of life. This article presents the case of a 57-year-old male patient with deep second- and third-degree burns to the face and neck secondary to gasoline exposure, managed in a high-specialty burn unit, highlighting the importance of a

multidisciplinary and protocolized approach to optimize clinical outcomes.³

CLINICAL CASE

A 57-year-old previously healthy male patient, with no significant medical history and non-contributory family history, suffered an accident caused by sudden ignition of gasoline during domestic activities while attempting to start a fire. The combustion produced a direct flame that immediately reached the cervicofacial region, causing skin lesions of varying depth. The patient reported sudden, severe pain with a burning sensation, inability to fully open his eyes due to palpebral edema, and limited cervical mobility. He was immediately transported by family members, arriving at the emergency department approximately forty minutes after the incident. Upon admission, he was conscious, cooperative, and oriented in all spheres, with evident anxiety, pain-related facial expression, and reflex tachycardia secondary to pain. Initial vital signs showed blood pressure of 135/85 mmHg, heart rate of 110 bpm, respiratory rate of 24 breaths per minute, oxygen saturation of 94% on room air, and temperature of 36.7 °C. There were no neurological alterations or immediate hemodynamic compromise.



Figure 1: Admission to a Level 3 Burn Center



Figure 2: Admission to a Level 3 Burn Center

Physical examination revealed dermal injuries on the face and neck characterized by erythema, tense serous blisters, areas of exposed dermis, and zones of cutaneous necrosis. Superficial second-degree burns were identified on the cheeks, malar, and mandibular regions; deep second-degree burns in the periorbital region, lips, and lateral neck; and third-degree burns in the mental and submandibular areas with patchy carbonized areas and total loss of pain sensation. Burned

body surface area was estimated at 6–7% using the Lund-Browder chart. Airway examination showed no stridor or dysphonia, and no visible intraoral lesions; however, progressive edema of the neck and lips posed a potential risk for respiratory compromise, warranting close monitoring and continuous evaluation of the need for orotracheal intubation. Conjunctivae were hyperemic without apparent corneal lesions, prompting ophthalmology consultation



Figure 3,4: Day 3 of Admission to the Burn Unit.

Advanced management was initiated in the burn unit, including guided fluid resuscitation using Parkland formula

with intravenous Hartmann solution adjusted to weight and burned surface area, supplemental oxygen therapy, and multimodal analgesia with short-acting opioids combined

Comprehensive Management of Deep Second- And Third-Degree Gasoline Burns in a High-Specialty Burn Unit

with nonsteroidal anti-inflammatory drugs for adequate pain control. Empiric systemic antibiotic prophylaxis was prescribed due to lesion location and extent, along with early hypercaloric and hyperproteic enteral nutrition to promote wound healing and compensate for the increased energy expenditure characteristic of burn patients.

From day one, wounds underwent sterile dressings with gentle debridement of devitalized tissue, saline irrigation, and topical silver sulfadiazine for superficial and deep second-degree burns. Multiple surgical debridements were scheduled in the operating room to remove necrotic tissue, reduce bacterial load, and prepare the wound bed for advanced coverage. Suprathel®, a temporary synthetic dermal substitute, was applied during these procedures to promote re-epithelialization, decrease pain, protect exposed nerve endings, and reduce the risk of local infection. Suprathel® demonstrated good adherence and tolerance without

immediate adverse reactions.

The patient remained under close observation, with severe facial edema limiting ocular and oral opening and increased neck skin tension restricting cervical movements. Nevertheless, the airway remained patent without intubation, due to continuous monitoring and effective edema control. Early physiotherapy focused on facial and cervical mobility prevented contractures. The most relevant complications observed included high risk of hypertrophic scarring, facial aesthetic alterations, and potential functional sequelae involving the lips and neck. Short-term prognosis was considered guarded due to infection risk and airway involvement. Medium-term follow-up will require multidisciplinary evaluation by plastic and reconstructive surgery to assess the need for skin grafts or local flaps, along with prolonged rehabilitation to minimize aesthetic and functional sequelae.



Figure 5: Day 7 of Admission to the Burn Unit.



Figure 6,7: Day 7 of Admission to the Burn Unit.

DISCUSSION

Burns are among the most complex traumatic injuries in clinical practice, responsible for significant morbidity and mortality worldwide. The WHO estimates that over 11 million burn injuries require medical attention annually, with mortality rates varying according to burn depth, body surface area affected, and availability of specialized care units.^{4,5} Among adult burn causes, flammable liquids, particularly gasoline, pose a major risk due to rapid spread and high combustion temperature, causing deep tissue injury within seconds. Facial and cervical regions are particularly vulnerable due to frequent exposure and the concentration of critical structures related to the airway, sensory organs, and facial aesthetics.^{6,7}

The pathophysiology of deep burns involves direct damage to keratinocytes and extracellular dermal matrix, followed by a local and systemic inflammatory response that may compromise tissue perfusion and promote progressive necrosis. Deep second-degree and third-degree burns result in partial or complete dermal destruction, leading to barrier loss, increased infection risk, dehydration, and electrolyte imbalance. In facial regions, inflammation and edema may rapidly compromise the upper airway, constituting a medical emergency requiring continuous monitoring and respiratory support planning. In this case, initial airway evaluation and constant monitoring prevented the need for emergent intubation.⁷

Comprehensive burn management requires hemodynamic stabilization, pain control, wound care, and metabolic support. Fluid resuscitation guided by Parkland formula ensures adequate perfusion, while multimodal analgesia and early nutritional support reduce physiological stress, promote healing, and prevent systemic complications. Early surgical debridement is fundamental in deep burns to remove necrotic tissue, decrease bacterial load, and prepare the wound bed for advanced dermal coverage. Scheduled operative debridements reduce local and systemic infections, accelerate re-epithelialization, and minimize hypertrophic scarring.⁸ Suprathel® acts as a semipermeable barrier protecting the wound, maintaining a moist environment, reducing pain during dressing changes, and promoting re-epithelialization without immediate grafting in many deep second-degree burns. Its use is particularly indicated in facial burns due to tissue delicacy, high nerve density, and the need to preserve function and aesthetics. In this case, Suprathel® demonstrated good adherence, clinical tolerance, and pain reduction, allowing less traumatic dressing changes and maintaining wound bed protection until definitive reconstructive procedures.^{9,10}

The multidisciplinary approach, involving burn surgery, plastic surgery, anesthesiology, nutrition, physiotherapy, and ophthalmology, enabled comprehensive risk assessment and timely interventions. Early physiotherapy focused on cervical mobility and oral opening prevented contractures and

Comprehensive Management of Deep Second- And Third-Degree Gasoline Burns in a High-Specialty Burn Unit

functional loss. Ophthalmology involvement ensured ocular protection against edema and dermal exposure, reducing corneal complication risk.¹¹

The patient's short-term prognosis was guarded due to burn depth and risk of infection, but favorable evolution with operative debridements and Suprathel® application highlights the effectiveness of structured, protocolized management in high-specialty units. This case underscores the importance of individualized planning, early intervention, and advanced wound care technologies to minimize aesthetic and functional sequelae and optimize recovery.¹¹

CONCLUSION

The management of deep second- and third-degree burns caused by flammable liquids, such as gasoline, in facial and cervical regions represents a significant clinical challenge due to anatomical complexity, airway compromise risk, high likelihood of infection, and potential permanent functional and aesthetic sequelae. This case demonstrates that early, comprehensive, and multidisciplinary care in specialized burn units is critical to optimize clinical outcomes and reduce morbidity.¹²

Initial hemodynamic stabilization using standardized formulas like Parkland, combined with multimodal analgesia and hypercaloric, hyperproteic nutritional support, preserves organ function, promotes healing, and prevents systemic complications. Close coordination among burn surgery, plastic surgery, anesthesiology, physiotherapy, nutrition, and ophthalmology addressed edema control, airway preservation, ocular protection, and prevention of contractures and functional limitations.¹³

Scheduled surgical debridement and operative wound care were essential for removing devitalized tissue, reducing bacterial load, and preparing the wound bed for advanced dermal coverage. Suprathel® served as a key therapeutic component, providing a protective barrier, maintaining wound moisture, reducing dressing change pain, promoting re-epithelialization, and minimizing infection and hypertrophic scarring risk. Early rehabilitation and close follow-up effectively controlled facial edema, maintained cervical mobility and oral opening, and prevented contractures and functional alterations.¹³

This case highlights the necessity of standardized protocols in high-specialty units, integrating continuous assessment, systemic support, advanced dermal therapies, and multidisciplinary participation to optimize outcomes. Long-term planning, including reconstructive evaluation and management of potential aesthetic and functional sequelae, is essential for comprehensive recovery. In summary, management of deep burns from flammable liquids in critical areas requires a holistic approach combining stabilization, pain control, surgical debridement, advanced dermal substitutes, nutritional support, and early rehabilitation under a multidisciplinary team. This case supports the clinical efficacy of these strategies, demonstrating their applicability

and providing evidence to guide management of similar injuries, improving short- and long-term functional, aesthetic, and clinical outcomes.^{14,15}

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