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Case Report
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Severe Thermal Injury Due to Alcohol Exposure Resulting in Upper Extremity Amputation: Case Report

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Abstract

Aim: *The aim of presented case is to showcase a rare and life-threatening instance of a burn injury that is indirectly caused by alcohol consumption.*

Case Report: *We present the case of a 75-year-old man who fell asleep on a stove while distilling alcohol. He was transported by ambulance to Cho Ray Hospital. The patient was admitted with impaired consciousness, and all history was obtained heteroanamnestically from family members. He had sustained fourth-degree burns of the torso, back, and an arm that was completely covered with eschars. He was promptly admitted to the Department of Plastic Surgery, where the affected arm was amputated and a debridement of the surrounding area was performed. After 10 days of hospitalization with supportive care, the patient underwent a repeat debridement, and after 7 more days he was discharged home.*

Conclusion: *Lower-degree burns are very painful; however, in the presence of altered consciousness, if the source of the burn is not removed the injury can rapidly progress to deeper degrees and cause irreversible damage that may be life-threatening. Proper management of such burns requires a multidisciplinary team providing extensive debridement and supportive therapy.*

Keywords: Alcohol Intake, Amputation, Burns, Debridement.

Introduction

Burn injuries represent a serious and potentially life-threatening condition which, depending on their extent, depth, and the anatomical regions involved, may result in severe local as well as systemic complications. In addition to direct damage to the skin and subcutaneous tissues, severe burns lead to disturbances in thermoregulation, significant fluid and electrolyte loss, profound metabolic stress, increased susceptibility to infection, and the development of multiorgan failure. The risk of death is higher in elderly patients and those with health issues like heart disease, diabetes, and chronic kidney disease. Data from the United States in 2020 show that burn injuries accounted for about 440,000 visits to emergency departments. Around 30,000 of these patients were hospitalized due to the severity of their injuries. Despite improvements in critical care and surgery, an estimated 3,000 to 4,000 people die each year from burn-related causes. Advanced age and deep, extensive burns are major factors linked to poor outcomes [1].

Burns are clinically classified according to depth and total body surface area (TBSA) involved. Based on depth, burns are traditionally categorized into three degrees. First-degree burns involve only the epidermis and clinically present as erythematous, edematous, dry skin with significant pain, typically healing spontaneously without scarring within several days. Second-degree burns involve the dermis and, depending on whether only the papillary dermis or both papillary and reticular dermis are affected, are subdivided into superficial and deep partial-thickness burns. Despite relatively small anatomical differences, these two subtypes demonstrate marked clinical distinctions. A characteristic feature of second-degree burns is the formation of blisters (bullae), which arise from edema at the epidermodermal junction due to subepidermal separation. Superficial partial-thickness burns generally present with intact blisters, heal within approximately two weeks, and result in minimal or no scarring. In contrast, deep partial-thickness burns typically heal over three to four weeks and present with a pale, dry wound surface, with or without ruptured blisters. These subtypes also differ in pain perception; due to damage to sensory nerve fibers within the reticular dermis, deeper burns are associated with reduced pain. Clinically, they may also be distinguished by capillary refill: superficial burns demonstrate rapid capillary refill and blanching with pressure, whereas deeper burns exhibit delayed or absent blanching.

Third-degree burns extend through the entire dermis and may involve deeper structures. The affected skin appears dark or brown due to tissue necrosis, pain is absent owing to destruction of nociceptors, vascularization is severely compromised, and spontaneous healing is not possible, necessitating surgical intervention. A fourth-degree classification is also described in the literature, denoting complete destruction and carbonization of underlying muscles, tendons, and bone. Although rare, delayed removal of the heat source can result in such injuries, leading to severe systemic complications, amputations, and high mortality rates [2].

Severe burns require hospital treatment to lower the risk of lasting functional and structural damage or death. They are identified by a mix of burn depth, TBSA, location, and the patient's health condition. The initial emergency assessment uses the "rule of nines" to estimate burn size. This rule states that the head and neck make up 9% of TBSA, each arm 9%, the front and back of the torso 18% each, each leg 18%, and the perineum 1%. The Parkland formula is closely linked to this rule and helps calculate the initial fluid needs of patients with severe burns. It is essential for early resuscitation within the first 24 hours after injury. Alcohol significantly contributed to this burn injury. It reduces pain sensitivity, slows reaction time, and affects consciousness. This prolongs exposure to heat and increases the chances of severe burns. Initially minor injuries can quickly worsen to significant tissue death, leading to the need for aggressive treatments like amputation, which carry a high risk of mortality and long-term functional issues. This case report presents an unusual but very serious thermal injury linked to alcohol use. The aim of this case is to highlite the need for quick assessment and prompt emergency care for burns in patients with high stage burns.

Case Report

We present the case of a 75-year-old man who was found by family members leaning against a stove while distilling homemade alcohol. Emergency medical services were contacted and transported the patient to the nearest hospital. Upon arrival at the emergency department, the patient was confused with impaired consciousness (Glasgow Coma Scale score of 11). A heteroanamnestic history was obtained from family members via telephone.

Initial management included standard ABC assessment, documentation of vital signs, and an urgent evaluation of burn wounds. On physical examination, extensive thermal injuries of third- and fourth-degree severity were identified, involving the anterior surface of the left torso, the back, and the entire left upper arm and forearm; the left upper extremity was completely carbonized. Additionally, third-degree burns were noted on the neck and left auricular region at sites where the patient's head had been resting against the arm. At the time of admission, no radiological (X-ray) or laboratory investigations were available. Medical records revealed a history of chronic alcohol consumption. The estimated total body surface area (TBSA) affected was approximately 20%.

Intravenous analgesia and a proton pump inhibitor were administered, and fluid resuscitation was initiated. The patient received 500 mL of lactated Ringer's solution during the early phase of management, with a total of 2,000 mL administered within the first 8 hours. Due to the extent of the burns and the presence of circumferential necrotic tissue, the patient was urgently transferred to the Department of Plastic and Reconstructive Surgery. Surgical management included emergency amputation of the affected left upper extremity with radical debridement of adjacent necrotic tissue during the initial operative procedure.

During hospitalization, the patient underwent a total of two surgical debridements, with the second procedure performed ten days after admission. No autologous skin grafts were applied during the first two debridement procedures. Following each operation, the wounds were covered exclusively with sterile vaseline-impregnated gauze dressings and cold bandages. Throughout the hospital stay, the patient did not develop clinically evident local or systemic infection.

After the second debridement, the patient remained hospitalized for an additional seven days, receiving supportive care and physiotherapy, with a structured plan for outpatient follow-up. He was subsequently discharged home with instructions for rehabilitation and scheduled follow-up visits at the outpatient clinic.

Discussion

The burn injury this patient experienced met almost all criteria for a major burn. This includes burns covering more than 20% of total body surface area (TBSA), the presence of third- and fourth-degree burns, risk of inhalation injury, burns impacting critical areas such as the face, hands, or major joints, circumferential extremity burns, and occurrence in a patient with serious preexisting health issues. Normally, such an injury profile would suggest a very poor prognosis. Severe burns trigger a strong hypermetabolic and inflammatory response, marked by prolonged increases in catecholamines, cortisol, and glucagon, along with higher levels of pro-inflammatory cytokines. This chain of events leads to high blood sugar and significant breakdown of body tissues. Catabolic hormones and inflammatory substances heavily suppress protein and fatty acid production, resulting in a constant negative nitrogen balance. In severe burns, skeletal muscle becomes the main energy source, causing rapid muscle breakdown, loss of lean body mass (LBM), and significant muscle wasting. Studies show that losing even 20% of LBM can impair immune function, increase infection risk, and delay wound healing. Losses of 30% or more can harm respiratory function, leading to ineffective coughing and longer need for mechanical ventilation, while a loss of 40% or more correlates with death rates above 50%. These biological changes highlight the urgent need for aggressive nutritional support. This support includes high-protein, high-calorie diets and early enteral feeding, for patients with serious burn injuries. Notably, significant hormonal changes happen soon after a burn injury. Even before hypovolemia starts, cardiac output may decrease as part of the early neurogenic response. The combination of burn shock, persistent capillary leakage, and a lasting hypermetabolic state puts various organ systems at risk. If this situation isn't detected and treated quickly, it can lead to organ failure affecting the cardiovascular, respiratory, and renal systems, which carries a high death rate. Current data show that overall, in-hospital death rates among burn patients vary from about 3% to 8%, but they rise quickly with injury severity. Inhalation injuries nearly triple the risk of death, reaching around 30%. Meanwhile, major burns affecting 40% to 70% of TBSA are linked to death rates of about 30% to 70% [4]. Given this grim background, the survival in this case emphasizes the vital role of prompt, multidisciplinary burn care. A key part of modern burn treatment is quick fluid resuscitation and early surgery for wound coverage. The Parkland (Baxter) formula, which calculates fluid needs as 4 mL times body weight (kg) times percentage of TBSA burned, using lactated Ringer's solution, is the standard guideline for initial resuscitation. The amount computed is given over the first 24 hours after the injury, with half given in the first 8 hours and the rest over the next 16 hours. This formula is usually applied to adults with burns affecting more than 10% to 15% of TBSA. Its goal is not only to restore blood volume but also to ensure adequate organ blood flow. In practice, the effectiveness of resuscitation is checked by monitoring urine output (with a target of at least 0.5 mL/kg/h in adults), blood flow measurements, and lab results. Both too little and too much fluid resuscitation can lead to bad results. Not enough fluids worsen the depth of burns and organ damage, while too much can cause "fluid creep," compartment syndromes, and acute respiratory distress syndrome (ARDS) [5]. Lactated Ringer's solution is preferred in the early stage because capillary leakage is greatest in the first 24 hours. Colloid solutions, like albumin or plasma, are usually avoided early due to the risk of leaking and worsening swelling but may be used after 24 hours or for rescue when large amounts of crystalloid fluids are needed. While colloids can help reduce total fluid volume by raising oncotic pressure, they haven't shown definitive benefits for survival. Fresh frozen plasma and albumin are typically saved for later stages, once capillary health improves.

Removing dead tissue within the first 72 hours has been shown to significantly reduce the hypermetabolic response and lead to better outcomes. For instance, patients who received complete tissue excision and wound coverage—using autologus or donor skin—within 72 hours for burns covering 50% or more of TBSA showed a resting metabolic rate that was 40% lower than similarly injured patients treated later. Early removal of dead tissue also cuts protein breakdown, lowers rates of infection and sepsis, and speeds up wound healing compared to delays in tissue removal [3]. In a study on severely burned children, tissue removal done within 24 hours nearly eliminated the hypermetabolic response and was linked to no deaths, while there were three deaths in a group managed conservatively. Therefore, early surgical removal is seen as one of the biggest advancements in burn care, significantly reducing tissue breakdown and improving survival [6].

Once a patient's blood flow is stable, focus shifts to proper wound care. Autologous split-thickness skin grafts are considered the best option since they best restore skin function. However, in cases of severe burns or limited donor sites, various temporary or permanent options are used. Cadaveric allografts, pig skin grafts, and synthetic skin substitutes—like biosynthetic collagen-glycosaminoglycan scaffolds—can provide temporary coverage and aid in healing. These act as a bridge until autografting is possible. Still, no substitutes can fully replicate all functions of natural skin, such as feeling, temperature control, and full barrier function. As shown in this case, reconstructive management usually follows a step-by-step method. This includes early debridement and excision, temporary coverage with dressings or substitutes, and later definitive autografting or flap reconstruction when the patient is stable [3].

Monitoring for systemic complications is crucial throughout treatment. Sepsis is the top cause of late deaths among burn patients. Prevention involves careful wound care with topical antibiotics, targeted treatments based on lab results, early tissue removal, and proper nutritional support. Routine use of systemic antibiotics is not recommended due to lack of evidence supporting its benefit; antibiotics should only be given for confirmed infections. Tetanus shots should be given according to standard trauma guidelines. Inhalation injuries and ARDS are serious complications. Almost half of patients with extensive burns have inhalation injuries, which greatly raise the risk of respiratory failure. Pneumonia is the most common complication, while ARDS affects up to 50% of patients with major burns, carrying death rates close to 50%. Early intubation is often necessary to protect the airway. Strategies for gentle lung ventilation—like low tidal volumes and suitable levels of positive pressure—are used, and in tough cases, extracorporeal membrane oxygenation (ECMO) can be considered [4]. Providing enough pain relief and sedation is critical due to severe pain and metabolic stress, while muscle relaxants are occasionally needed to improve oxygen levels. However, medically induced comas are not regularly used and are reserved for specific intensive care cases. Other common complications include urinary tract infections, skin infections, and wound infections. Despite improvements in care, deaths from severe burns remain a major concern. Data from the U.S. National Burn Repository shows that death rates rise from less than 1% in minor burns to around 30% when 40% or more of TBSA is affected, and rise to about 50% in burns covering more than 70% of TBSA [7]. Advances in intensive care and early surgical removal of dead tissue have greatly improved outcomes. In this case, strict adherence to these principles—prompt fluid resuscitation, early surgical intervention, and careful supportive care—likely played a significant role in survival, despite the injury meeting all criteria for a critical burn.

Conclusion

Despite significant advances in modern medicine and the development of specialized burn care centres, burn injuries remain among the most challenging local and systemic conditions in clinical practice. They are associated with prolonged, complex, and resource-intensive treatment, as well as a high risk of early and late complications, including infections, multiorgan failure, functional impairments, and permanent disability. Among numerous prognostic factors, the extent of burned total body surface area (TBSA) remains the most extensively studied and reliable predictor of mortality, with a well-established linear correlation between burn size and risk of death. The present case further highlights the complexity of managing severe burns, particularly in elderly patients. Amputation is a relatively rare complication of burn injury; however, in this instance, reduced consciousness and diminished pain perception due to alcohol consumption resulted in prolonged exposure to a heat source, progression from superficial to deep full-thickness burns, and subsequent irreversible tissue damage necessitating emergency amputation. This injury mechanism renders the case uncommon while simultaneously underscoring the hazards indirectly associated with alcohol use, especially in the elderly population.

From a therapeutic perspective, this case reinforces the fundamental principles of managing life-threatening burn injuries. Early and adequate fluid resuscitation according to the Parkland formula is essential for preventing burn shock and preserving perfusion of vital organs. Equally important is timely surgical intervention within the first 72 hours, aimed at removing devitalized tissue, attenuating the hypermetabolic and inflammatory response, and reducing the risk of infection and sepsis. Furthermore, early high-protein nutritional support represents an indispensable component of care, mitigating catabolism, preserving lean body mass, and promoting wound healing.

In conclusion, the survival of the patient presented in this case report—despite fulfilling nearly all criteria for severe and life-threatening burn injury—highlights the critical importance of a prompt, aggressive, and multidisciplinary treatment approach. Consistent application of established therapeutic principles can substantially improve outcomes, even in clinical scenarios that initially appear unsurvivable.

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