

The October 7th Terrorist Attack on Israel: Complexity of Burn Care

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Burn injuries pose a significant challenge in mass casualty scenarios. They require rapid and effective intervention to optimize patient outcomes. In this case report, we present the management of three severely burned patients following the October 7th terrorist attack in Israel. Our objective is to highlight the role of NexoBrid® (MediWound Ltd, Yavne, Israel) enzymatic debridement [1] as a primary intervention and discuss the challenges encountered in a mass casualty setting.

PATIENT DESCRIPTION

On 7 October 2023, Hamas initiated the Iron Swords War. More than 1200 people were killed and 253 kidnapped. The G family from Kibbutz Kfar Aza, including E, a physician; her husband A; and their baby Y, hid in their home shelter as terrorists attacked at 6:30, later invading their home at 13:15. The attackers tried to burn the family alive by setting the house on fire using gas stove tanks.

The family escaped to a bathroom to cool burns and later fled through a window into a hidden path. They went through an agricultural area and evaded the terrorists. They hid in a metal tractor for 90 minutes, during which Y's condition worsened. They eventually reached the Israeli Defense Forces (IDF) at the Kibbutz gate and were evacuated by helicopter. The family arrived at the hospital's intensive care unit (ICU) at 16:05, presenting with severe injuries.

CASE 1

Y, a previously healthy 18-month-old girl, was admitted to the ICU with extensive burns covering 30% total body surface area (TBSA), involving the face/neck (7%) and all extremities (lower 18%, upper 5%). She had an inhalation injury as well and was intubated, ventilated while initiating fluid resuscitation using the modified Parkland formula with Hartmann solution. Initial imaging screenings ruled out other immediate traumatic injuries.

Enzymatic debridement with Nexobrid® was performed to assess burn depth, revealing partial to deep-thickness burns with intact dermis. Post-admission, the patient was

diagnosed with coronavirus disease 2019 (COVID-19). Her mother also tested positive, necessitating treatment with steroids and remdesivir. Further complicating the patient's recovery, *Moraxella catarrhalis* was identified in tracheal aspirate, leading to sepsis and requiring inotropic support.

One-week post-admission, a Carbapenem-resistant enterobacteriaceae (CPE) infection developed, causing recurrent fever, which ultimately resolved after a week of tailored antibiotic therapy. On 13 October, Y was extubated but experienced severe upper airway obstruction, managed with inhalations and intravenous steroids. Demonstrating a notable recovery, Y was discharged home on 5 November.

CASE 2

E, a 34-year-old woman, presented with 62% TBSA burns, including bilateral circumferential burns to the legs (36%), non-circumferential burns on both hands (14%), and burns to the face/neck (6%) and anterior trunk (6%). Initial assessment revealed no significant hoarseness, with only mild dyspnea; carboxyhemoglobin was 5.4% (non-smoker). Given the extent of the burn injury,

ries, Nexobrid® was applied to all burn areas to assess depth, revealing partial- to deep-thickness burns. The patient's cardiovascular status was compromised, requiring vasopressor support and central venous line placement. Bronchoalveolar lavage (BAL) revealed evidence of mild smoke inhalation injury. The patient was subsequently intubated and ventilated, with fluid resuscitation initiated. In addition, the patient developed several infections, including *Aspergillus* (from tissue), *Klebsiella* (in sputum), *Staphylococcus pneumoniae*, and *Clostridium difficile* toxin, necessitating targeted antibiotic therapy.

The patient's respiratory status deteriorated, leading to respiratory acidosis, fever, leukocytosis, and hypoxemia, with subsequent transfer to ICU. The patient was found positive for COVID-19, progressing to acute respiratory distress syndrome (ARDS). Due to difficulties in ventilator weaning, a tracheostomy was performed 2 weeks post-injury. Despite maximal respiratory support, her condition continued to decline, requiring transfer to thoracic surgery for veno-venous extracorporeal membrane oxygenation for 7 days (VV-ECMO). Following improvement and return from the ICU, computed tomography (CT) imaging revealed a saddle pulmonary embolism without right ventricular strain, as well as a superior vena cava (SVC) syndrome. Anticoagulation was initiated with apixaban. During hospitalization, *Fusobacterium* colonies were detected within the burn wounds, likely secondary to the circumstances of the injury, requiring frequent debridement, and antibiotic coverage. The patient was discharged to rehabilitation on 26 December 2023, with appropriate

Figure 1. Before and after treatment with Nexobrid® (MediWound Ltd, Yavne, Israel)

[A] A deep partial thickness burn before treatment with Nexobrid®; escharotomies were performed prior to the patient's transfer into our burn center



[B] After debridement with Nexobrid®, the dermis is left, and conservative treatment was applied



pharmacological treatment, anticoagulation, and plans for future scar laser surgery.

CASE 3

A, a 33-year-old male, arrived at the emergency room conscious but restless and hemodynamically stable. He exhibited signs of inhalation injury, with an elevated carboxyhemoglobin level of 4.4%. He presented with 50% TBSA burns, including bilateral circumferential burns on the legs up to mid-thigh (31%), a non-circular burn on the right arm (4.5%), a small area on the left arm (3%), and burns to the back (6.5%). Mild facial burns (5%) singed facial hairs, and soot in the mouth further indicated inhalation injury. He underwent sedation, intubation, and mechanical ventilation.

BAL from the LLL confirmed smoke inhalation injury. Nexobrid® debridement was performed to remove necrotic tissue and promote healing. During hospitalization, blood and sputum cultures revealed numerous infective pathogens, which were treated with appropriate antimicrobials. He responded well to the treatment and was extubated on 15 October. He was discharged home on 5 November with continuous topical burn therapy using Dermacombin® cream.

COMMENT

These cases illustrate the high complexity of burn care during mass casualty events and highlight the need for multidisciplinary, intensive management.

METHODOLOGY

Standard local burn treatment includes initial cleansing, debridement, and conservative care with Flaminal® Forte for partial-superficial burns. When burn depth assessment is required, Nexobrid® is applied, serving both diagnostic and prognostic purposes to determine surgical necessity. All three patients were treated using the standard burn protocol: Oxandrolone®, vitamin C, zinc, multivitamins, beta blockers, analgesics, and proton pump inhibitors.

Nexobrid® is a method of enzymatic debridement based on a proteolytic enzyme called bromelain, derived from pineapple stems. The biological mechanism of Nexobrid® involves its ability to selectively and efficiently break down and remove necrotic, or dead, tissue from burn wounds [1]. Nexobrid® has been increasingly popular in its use in nonsurgical debridement of superficial, partial, and deep-thickness burns [2,3].

Seven proposed benefits associated with the use of Nexobrid® were accomplished, including reduced time to complete debridement, reduced need for surgery, excised area of burns, need for autograft, time to wound closure, improved scar quality [2], and prevention of escharotomy. An innovative approach was applied by which Nexobrid® was used to completely cover all burned BSA, overcoming the known common covering area, which stands for 15% of TBSA in one use. This therapy is broadly used as an integral part of the burn treatment protocols of the burn unit at Sheba Medical Center. The therapy has proven to be beneficial even when applied to larger

areas, with outstanding results in a short time [4].

LIMITATIONS OF NEXOBRID® IN MASS CASUALTY SETTINGS

Although Nexobrid® is typically limited to 15% TBSA per session, in this mass casualty scenario, it was applied to larger areas under close monitoring. The outcomes demonstrated the feasibility and efficiency, conserving resources for additional patients.

COMPLICATIONS AND CLINICAL CHALLENGES

Infections

All patients developed serious infections.

- Y (infant): *Moraxella catarrhalis* sepsis, followed by CPE infection, which led to recurrent fever, requiring multiple antibiotics
- E (mother): Pneumonia (*Klebsiella*, *Staphylococcus*), *C. difficile* enterocolitis, COVID-19 that complicated ARDS and delayed weaning
- A (father): Polymicrobial infections, including *Acinetobacter*, *Bacillus*, *Serratia*, *Aspergillus*, and *Enterobacter*, necessitating aggressive antimicrobial therapy

Respiratory

All sustained inhalation injuries.

- Y. required early intubation for airway protection
- E. developed ARDS, prolonged ventilation, and needed VV-ECMO
- A. showed injury on BAL and required short-term ventilation

Thromboembolic events

E. developed a saddle PE (no RV

strain) and SVC syndrome, both managed with anticoagulation.

CONCLUSIONS

The Iron Swords war forced the entire country's health system to push its boundaries to save as many lives as possible. Under the advanced and innovative therapy approach, all family members had outstanding healing and a much faster recovery time without any need for surgical procedures, paving the way to better rehabilitation and better outcomes. We emphasized the advantage of Nexobrid® in times of mass casualty, disaster, wartime events.

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Can anything be sadder than work left unfinished? Yes, work never begun.

Christina Rossetti (1830–1894), English writer and poet