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Case Report

Management of a Case Surviving Extensive Burns: A Case Report

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Abstract

Over the last century, advances in burn patient treatment have contributed to considerable reductions in morbidity and death. The physiologic insult caused by this damage pattern, on the other hand, necessitates substantial surgical intervention, resuscitation and multidisciplinary treatment. The standard of care for these patients will be reviewed in the context of a recent case study from our institution in this paper.

Keywords: *Burn; Plastic Surgery; Management*

Introduction

Despite a decrease in the prevalence of burn-related injuries in the twenty-first century owing to improved industrial output of commercial items, thermal injury remains a prominent injury pattern in the United States. Between 2005 and 2016, over 200,000 patients were burnt in the United States alone, resulting in over 6000 fatalities [1]. Although humans have been coping with thermal burns for thousands of years, "modern" burn treatment has advanced at an exponential rate in the last 50 - 60 years. Resuscitation, operational care and grafting procedures, infection prevention and therapy, and hypermetabolism mitigation have all improved survival and recovery. Despite these breakthroughs, issues and disagreements about optimal practices persist, and multiple burn centers and laboratories around the United States continue to explore various areas of burn treatment, from the resuscitative phase to the reconstructive and healing phase.

These breakthroughs in burn care have improved burn survival from near-100 percent death with a burn size of 30% in the early 1900s [2] to survival estimates of over 50% in young, healthy patients with burn sizes up to 95% [3]. Nonetheless, the acute phase of resuscitation is still fraught with debate and is not a standardized procedure. One may search the resuscitation protocols of various burn units around the country and discover numerous differences, from the use of crystalloid-only formulas to the addition of colloid at various time periods during the acute phase, to the use of "rescue treatments" and what they are and when to employ them. While we will not go into great length about the variances in this review, we will explain our first burn evaluation, following resuscitation, and overall care

approach in caring for a badly thermally-injured patient. This study aimed to spot light on a burn case that survived over 15% extensive burn after ICU admission demonstrating the management of this case.

Case Presentation

A 36-year-old male patient was admitted to the intensive care unit after experiencing 15% extensive burns after a fire explosion over face and chest. Upon arrival patient had a Glasgow Coma Scale of 15/15, blood pressure of 140/80 mm Hg and a pulse rate over 100 beats per minute. The patient was also found to have inhalational burn injury. Patient was immediately intubated to secure his airway and rapid sequence induction was performed. Figure 1 demonstrate patient condition prior to the debridement and skin grafting.

Figure 1: *Distribution of burn areas over posterior upper neck and upper chest (A) and Anterior upper parts of upper limb and anterior chest (B).*

The patient was immediately taken to our specialized Burn Operating Room once other injuries were ruled out and both non- and -excisional debridement of patient's burn wounds occurred, with resultant wound dressing application and skin grafting. His upper body burns were debrided and dressed with antimicrobial dressings. He then resuscitated for the next 48 hours, ultimately receiving approximately 3.3 mL/kg/%TBSA in the first 24 hours post-injury based on a TBSA of 15%, primarily full-thickness (third degree). Resuscitation continued over the first 48 hours, and the patient underwent serial excisional debridement and wound preparation procedures over the next few weeks. Given the size of her burns, we opted to utilize cultured epidermal autografts for assistance with skin/wound coverage. It is important to note that during the entirety of our patient's hospitalization duration (15 days in ICU and 10 days in the department) he received attentive multidisciplinary care including efforts from nutrition services, therapy services, social work, as well as the nursing and physician teams. After continued local wound and graft care the patient was discharged to a rehabilitation facility. Figure 2 illustrates patient's condition after debridement and skin grafting.

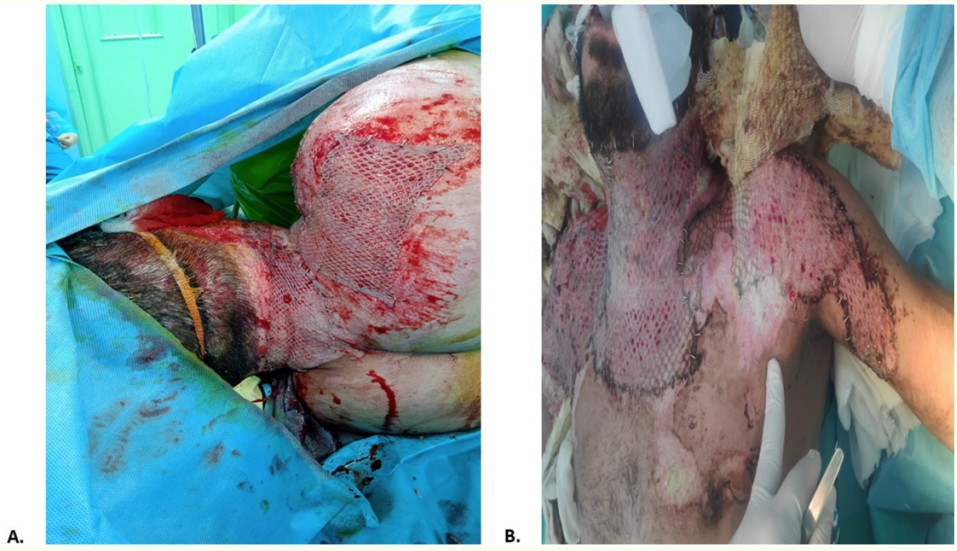

Figure 2: *Burn patient after debridement and skin grafting.*

Discussion and Literature Review

Evaluating overall burn size might be challenging for the inexperienced as well. While we assume many in the medical industry to have heard of "the rule of 9s," putting the concept into practice is more difficult. Many studies have been conducted to assess the general accuracy of pre-burn center size estimations provided by both EMS and referral hospitals, the majority of which are wrong. What is probably more concerning is that mistakes occur in both directions, i.e. overestimation is as often as underestimation. On their primary website, the American Burn Association (ABA) includes a list of Burn Center Referral Criteria as well as a handy guide to the "Rule of 9s for public usage," which is repeated in this overview.

Historically, "burn surgery" consisted of scar removal and repair if the patient survived. Lieutenant Colonel C.P. Artz discussed "exposing" burn wounds to air until eschar forms in 1955, stating that "[i]n full-thickness burns, there is dehydration of the pearly white or charred dead skin, and it is converted into a protective eschar.... This eschar serves as a temporary physiological cover until liquefaction occurs beneath it in 14 to 21 days" [4]. It wasn't until the 1970s, when Zora Janzekovic, a Yugoslavian surgeon, published her experience of excising severe partial- and full-thickness burn lesions in over 1,600 patients, that "burn surgery" became a surgical specialism [5]. Most contemporary burn units remove severe, partial, and full-thickness burn wounds "early," usually within 24 - 72 hours of damage. In our experience, "early" implies at or around admission, because burnt tissue is a nidus of the inflammatory cascade that might result in "burn shock" [6].

Fluid resuscitation of the thermally damaged patient is, in many respects, the most critical early element of burn therapy, and it is likely that it contributes the most to overall improvements in burn survival. The requirement for fluid resuscitation was acknowledged for the first time in contemporary times in the 1920s. Dr. Frank Underhill, a physiologist at Yale Hospital, observed that burn-blister fluid had a composition very similar to plasma while caring for 20 burn-injured patients. He accurately hypothesized that "burn shock," or the

hemodynamic instability that follows a significant burn injury, constituted a hypovolemic condition that required intravascular volume-based therapy [7]. The "Cocoanut Grove" nightclub in Boston, Massachusetts, a prominent Pacific-Island themed club, caught fire in 1942. F. D. Cope and O. Cope Moore treated for the bulk of patients between Boston City and Massachusetts General Hospitals, contributing to the codification of the link between patient size and total burn size as it pertained to fluid resuscitation. C. Baxter and T. Shires at Parkland Hospital in Dallas, Texas, advanced this resuscitation work in the 1960s and 1970s, eventually leading to the ParklandTM formula, or 4 mL/kg/percent TBSA of Lactated Ringers solution, which is the most commonly used burn resuscitation formula in the United States [8].

Large body-surface area burns are often exceedingly difficult to close quickly, owing to a shortage of donor site autograft to employ. Several tissue replacements have been developed during the last several decades to address this issue. C. P. Artz describes employing "postmortem homografts," which are "taken from the corpse of a deceased individual under aseptic circumstances shortly after death..." [4]. "Postmortem homografts" are now often referred to as allografts and are generally used cryopreserved rather than fresh. These are almost often temporary bandages used to cover wounds and prevent desiccation. The use of allografts is somewhat troublesome due to concerns about disease transmission, skin supply, and cost. For decades, bioengineered "skin replacements" have been used in extensive body surface area burns. The first, and maybe most extensively used, bilaminar product is Integra.TM It mixes bovine collagen and shark cartilage-derived chondroitin-6-sulfate, and when applied to full-thickness burns, it enables for vascularization and the creation of a neodermis. The outer layer is a Silastic silicone-based substance that functions as an epidermis and protects the underlying collagenous material. After the collagen has engrafted in a few weeks, an ultra-thin split-thickness skin graft can be placed. Similar materials, such as another bovine collagen product called PrimatrixTM and a Hyaluronic acid derivative called HyalomatrixTM, have been developed for use in burn therapy. Cultured "skin" has been used with considerable success in wound closure in very extensive burns with highly restricted donor sites. A firm in Cambridge, Massachusetts called EpicelTM grows confluent sheets into epidermis from a sample of patients' full-thickness skin in two to three weeks. These sheets, which are FDA-approved for compassionate use in major burns, can then be placed on a prepared site. As a result of the thin epidermal layer's resistance to blistering and shearing, the wound is closed but incomplete. The costs connected with its use are likewise significant. A product frequently referred to as "spray-on skin" on social media and by the general public is an outgrowth of "cultured" skin. The FDA is now evaluating ReCellTM, a real-time non-cultured skin transplant option. A doctor obtains a tiny full-thickness skin sample and uses a proprietary kit in real-time to generate a solution comprising basal keratinocytes that may be "sprayed" over an excised and prepared wound bed in an estimated 80:1 expansion, which is really donor-site sparing [9]. Thus, on HD2, a 62 cm full-thickness skin sample from our patient was submitted for the creation of epidermal sheets, which were successfully implanted roughly one month after damage.

Burn treatment is a real "team effort," and it was likely the first "team-centered" surgical specialization formed following the "Texas City Disaster" in 1947, which is still regarded America's "worst industrial tragedy" [3]. Dr. T. Blocker and the University of Texas Hospital in Galveston treated the injured, and they were cared for by a team of nurses, physicians, therapists, dietitians, and social workers during their recovery to maximize results. The staff understood the importance of prompt nourishment, movement, and rigorous wound care. These ideas are being practiced today.

Conclusion

The treatment of a patient with a substantial body-surface area burn is complicated, time-consuming, and laden with possible problems. In burn centers accustomed to the complexity of severe burn care, these problems may be predicted and managed, resulting in improved survival and functional results. Despite an expected initial death rate of about 70% on admission, the patient in this story lived to discharge with only a few manageable problems and is now home, driving and generally living independently. Outpatient scar activities such as moisturization, massage and compression are being used to treat her burn scars. This great outcome is the norm in burn centers and exemplifies why patients with severe burn injuries should be treated in these specialist facilities. Any patient with a serious burn, even if not on the ABA referral list, should meet with a burn-trained surgical team.

Author Contribution

All authors participated actively in writing the manuscript.

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Informed Consent

An oral informed consent was gained from the patient upon recovery of his condition in order to use his data in writing this case report.

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Conflict of Interest

Authors have no competing interest.

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