

Bromelain-based enzymatic debridement in hand burns – an easier way to manage a difficult patient: case report

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ABSTRACT

Introduction. Bromelain-based enzymatic debridement may be considered the standard in patients with upper extremity burns management, regarding the low risk of bleeding, wound infections, reduction of surgical timing, and the decreased risk of compartment syndrome development.

Case presentation. We present the case of hand and face burns in a patient presenting deep venous thrombosis of the lower limb extended to the level of the vena cava, and bilateral pulmonary embolism. The enzymatic debridement reduced periprocedural bleeding and allowed a faster recovery and therefore the resumption of oral anticoagulation and antiplatelet medication in a patient with important cardiac, arterial, and renal comorbidities.

Conclusion. Bromelain-based enzymatic debridement use is recommended in patients presenting upper limb deep burns, especially in anatomically challenging areas, like hand fingers, and especially in those with a previous medical history that predisposes them to periprocedural bleeding and increased risk of poor healing.

Keywords: hand burns, pulmonary embolism, deep venous thrombosis, enzymatic debridement

INTRODUCTION

Bromelain-based enzymatic debridement using the concentrate of proteolytic enzymes enriched in bromelain was approved to be used in Europe starting with 2013 [1], and, since then, there is perpetual evidence regarding its use in various Burn Units. In comparison with the actual standard of care (tangential necrosectomy), it appears to reduce the periprocedural blood loss, to decrease the need for surgical interventions, reduces the incidence of wound infection, decreases the need for skin grafting due to the ability to preserve more viable dermis and appears to reduce the length of hospital stay [2,3].

European consensus guidelines state that enzymatic debridement is best indicated for patients

presenting mid-to-deep dermal burns and mixed patterns but can be also used in selected patients with full-thickness burns [2]. A newly published Spanish consensus affirms that this method is safe for eschar (deeper dermal burns) removal in adult patients, being very useful in those with face, hand, neck, and neckline burns, and can be safely used in areas up to 15% total body surface area (%TBSA) [4]. In addition, the European consensus considers that feet may also benefit from enzymatic debridement, with perineal and genital burns being under study [2,5]. Italian recommendation is against the use of this method in epidermic and superficial dermal burns, and, in conjunction with the above-mentioned areas, it may be considered in chest and abdomen burns [6].

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There are some aspects that should be taken into consideration regarding critically ill patients who will benefit from enzymatic debridement, considering that this technique increases the systemic inflammatory response and may aggravate a persistent hemodynamic instability. Consequently, it is important to be initiated after hypovolemia correction, in hemodynamic stable patients, except for patients in which the risk of compartment syndrome development is high [4].

The application time is about 4 hours [4,6], and wet dressing should be used for 2-18 hours after the procedure [6]. This is an extremely painful procedure, therefore anesthesia, deep sedation, analgo-sedation, or multimodal pain control are indicated [2,6].

The use of enzymatic debridement has some limitations, apart from chemical and electrical burns, like diabetic foot disease, the early phase of scald burns, and patients with large-surface burn injuries [2,4,6,7]. Taping et al. showed that this method has no superior result in patients with scald injury, and this can lead to more frequent surgical intervention and longer hospital stay according to the %TBSA burned [8].

We present the case of hand and face burns in a patient presenting deep venous thrombosis of the lower limb and extended to the level of the vena cava, and bilateral pulmonary embolism.

CASE PRESENTATION

A 68-year-old male patient was referred to our hospital after an explosion in a closed space, sustaining deep dermal burns on the face, neck, hands, and a small area of the lower limb (Figure 1) covering almost 12%TBSA. Due to the high suspicion of inhalational injury and progressive facial edema, he was intubated on the scene. At admission into the Burn Intensive Care Unit, the patient presented clinical signs of deep venous thrombosis of the lower left extremity. Doppler scanning and computed tomography revealed a left femoral vein with thrombotic material extending up to the proximal and middle level of the inferior vena cava, an advanced form of chronic arteriopathy and bilateral pulmonary embolism. His medical history included: venous and pulmonary thromboembolism in the last six months, congestive heart failure class IV (New York Heart Association classification), ischemic cardiomyopathy, previous myocardial infarction, atrial fibrillation, grade II hypertension, peripheral artery disease stage IV, dyslipidemia, stage II chronic kidney disease, obesity grade I, active smoking, and chronic alcoholism. He had chronic (inconstant) treatment with rivaroxaban and clopidogrel. Bronchoscopy ruled out the presence of inhalational in-

jury. Systemic anticoagulation with unfractionated heparin was rapidly initiated. In addition, the patient presented an episode of acute-on-chronic kidney disease, nevertheless, with rapid and adequate treatment initiation, a clear improvement of renal function was noticed. 24 hours after the admission, when hemodynamic stabilization was obtained, enzymatic debridement with bromelain was applied according to the manufacturer's recommendations on the upper extremities, with optimal results. For the facial burns, topical treatment with oxytetracycline spray and silver sulphadiazine cream were used. Afterward, autologous skin grafting was performed (Figure 2). Antiplatelet therapy was resumed after surgery. After seven days, the respiratory dysfunction has improved, the patient was extubated and received high-flow nasal cannula (HFNC) oxygen therapy until he was stable enough to tolerate a spontaneous breathing trial (SBT). Subsequently, computed tomography evaluation showed a decreased diameter of the femoral and pulmonary thrombotic materials. Postoperative evolution of the skin grafts was favorable. Intravenous heparin administration was discontinued and anticoagulation therapy with rivaroxaban was restarted, with doses adjusted according to the patient's renal function. Frequent physical rehabilitation allowed the patient to become autonomous, and to be able to use his hands in daily activities. After three weeks, the patient was discharged home, not only with favorable evolution of the upper extremities skin grafts (Figure 3), but with all his chronic conditions in acceptable parameters.

DISCUSSION

In accordance with current guidelines, enzymatic debridement can be classified according to the timing of application, as immediate or very early (first 12 hours), early (between 12 and 72 hours) and delayed (after 72 hours). The early phase is considered the gold standard [2]. We have chosen to apply it early, 24 hours after the admission, when hemodynamic and renal function stabilization were obtained, and facial edema controlled.

Fisher and al. reported the feasibility and usefulness of enzymatic debridement in patients with circumferential deep burns of the upper extremities, as in our case, especially in preventing compartment syndrome development, reducing blood loss, and the need for secondary skin grafting [9]. Current recommendation state that enzymatic debridement cannot be used in case of established compartment syndrome and in high voltage burns. Considering the thromboembolic complications and previous cardiac pathological history of our patient, along with the need for anticoagulation and rapid



FIGURE 1. Second and third degree burns of the hands and leg area burns



FIGURE 2. Autologous skin grafting – immediate postoperative appearance



FIGURE 3. Postoperative evolution of the skin grafts

resuming of antiplatelet medication, the use of bromelain-based enzymatic debridement reduced not only the risk of bleeding, but also the time between admission and surgery, and therefore the length of hospitalization.

It is well known that hand burns are common (80% of severe cases) due to the protective reflexes in face of flames [10]. A study by Schulz et al. emphasized that enzymatic debridement is preferable in patients with severely burned hands, offering a safe method to rapidly remove burn eschar and it is superior to traditional tangential necrosectomy. It induces faster healing, satisfactory early wound scars, permit early mobilization [11], and reduces skin-graft use [12]. We also obtain rapid and proper wound healing, even if the patients presented a severe form of peripheral artery disease, and the pulmonary embolism induced important respiratory dysfunctions in need of mechanical ventilation for almost a week, having therefore scarce condition for proper tissues healing.

There is a record of potential adverse events after the use of the concentrate of proteolytic enzymes enriched in bromelain, like acute coagulation abnormalities and hyperthermia [14]. No other study or case report presented treatment-related adverse events [1,14,15]. Neither is the case with our patient.

A study by Corrales-Benítez et al. targeted the evaluation of burn hand function in patients treated with enzymatic debridement. They showed that patients presenting deep partial-thickness hand burns showed normal values at 3 months and 1 year of follow-up, having complete restoration of function, quality of life, and scar results [16]. As for our pa-

tient, during the three-week hospitalization, with daily physical rehabilitation, we obtained good hand movements for all current activities.

CONCLUSION

Enzymatic debridement with the specific concentrate of proteolytic enzymes enriched in bromelain is recommended in patients with cardiac and arterial comorbidities presenting upper extremity deep burns, due to the decreased risk of bleeding, wound infection, compartment syndrome development, and difficult tangential necrosectomy in anatomically challenging areas, like fingers.

Ethical approval and informed consent

All the procedures of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008(5), as well as the national law. Written informed consent was obtained from the patient for publication of this case report and accompanying images. Case reports are exempt from ethical approval in our institution.

Declaration of competing interest

The authors declare no conflict of interest regarding this article.

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