

Emergency Department Management of Burn Blisters

Opposing authors provide succinct, authoritative discussions of controversial issues in emergency medicine. Authors are provided the opportunity to review and comment on opposing presentations. Each topic is accompanied by an Editor's Note that summarizes important concepts. Participation as at authoritative discussant is by invitation only, but suggestions for topics and potential authors can be submitted to the section editors.

Editor's Note: *In managing burn blisters, clinicians are forced to choose between removing blisters, including devitalized tissues and blister fluid that contains inflammatory agents, or leaving them intact, thereby providing a sterile and protective covering of the wound that helps retain fluid that has regenerative properties. In this installment of Clinical Controversies, pro and con advocates present evidence and arguments relating to the management of burn blisters and discuss opposing perspectives that should be considered in deciding whether to debride burn blisters or leave them intact.*

BURN-RELATED BLISTERS SHOULD NOT BE REMOVED IN THE EMERGENCY DEPARTMENT



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Consideration of the biochemical, physiologic, and anatomic features of burn blisters has led to strong opinions about their management. Blisters contain multiple chemicals that lead to increased inflammation and vasoconstriction, which could impair healing. However, blisters also contain numerous molecules that may improve wound healing. For example, prostaglandin E2 and calmodulin can vasodilate, stimulate endothelial cells, and encourage the proliferation of keratinocytes and fibroblasts, which would be beneficial for wound healing.^{1,2} Ultimately, equally good physiologic arguments can be made for both removing and leaving blisters intact. Therefore, it is important to make decisions based on clinical

evidence with consideration of the potential harms associated with deroofting blisters.

Although the current evidence is relatively limited, it generally supports leaving burn blisters intact. In a study that would likely be considered unethical today, Gimbel et al³ purposefully created a row of burns across the abdomens of healthy volunteers and then left the blisters intact, deroofted them with scissors, or aspirated them. The intact group healed faster compared with the aspirated and deroofted groups, and was the only group with completely healed wounds at 14 days.³ Forage⁴ presented a case report in which a young girl presented with extensive burns to both of her legs. He left the blisters intact on one leg and debrided the other. The leg with intact blisters had less pain, faster healing, and better cosmetic results at 1 year. Swain et al⁵ performed a nonrandomized, open-label trial in which 316 blisters were left intact, aspirated, or debrided. All patients healed well, but those who had their blisters deroofted experienced significantly more pain. Finally, Ro et al⁶ performed a single-blind randomized controlled trial comparing aspiration with deroofting in 40 patients with burn blisters. Although neither was left intact, the deroofted group had worse scarring than the aspiration group when assessed with a validated scale. These human data are consistent with animal data, which have shown that debriding burns results in slower healing and much higher rates of infection and scarring, although the animal models are imperfect because pigs do not actually form burn blisters.⁷ To our knowledge, there is not a single study that demonstrates improved outcomes from burn blister debridement in human patients.

One must also consider the harms associated with deroofting blisters. The most obvious harm is pain. Debridement itself is a painful procedure and the subsequent open wounds require more frequent, painful dressing changes.^{5,6} As a result, many patients may require significant intravenous opioids or procedural sedation, posing additional risks for the patient, as well as prolonging length of stay and consuming resources that may be

required by other emergency department (ED) patients. Poor pain control and frequent dressing changes are risk factors for posttraumatic stress disorder among burn patients, which can lead to significant long-term harms.⁸ Finally, deroofting blisters may increase the rate of infection by removing the protective membrane of the skin. Although to our knowledge there are no direct data on rates of infection between groups in humans, one study found that deroofting blisters was associated with a 5-fold increase in colonization by bacteria (particularly *Staphylococcus aureus*) compared with leaving blisters intact.⁵ Furthermore, infection rates were significantly higher after debridement in the pig model by Singer et al⁷ discussed earlier.

Although some guidelines recommend different treatment approaches for different-sized burns, this is often based on opinion, without clear evidence supporting such an approach.⁹ Similarly, although novel biosynthetic burn dressings may prove useful, a recent systematic review found insufficient evidence to support their use.¹⁰ To our knowledge, there has never been a study comparing such dressings with an approach of leaving blisters intact. Considering the lack of evidence, debriding blisters simply to allow an expensive new dressing to be applied does not seem justified.

Clinical judgment and shared **decisionmaking** are always important. For example, one might decide to manage blisters on the soles of the feet (which are more likely to rupture spontaneously) differently than blisters elsewhere on the body. However, although further studies are clearly needed, the currently available evidence suggests that leaving blisters intact may be better than deroofting them. When considering the potential harms in regard to pain and flow of patients through the ED, we believe the burden of proof lies with individuals suggesting the more aggressive intervention. In the meantime, we focus our attention on high-quality first aid, assessment for other injuries, and excellent analgesia, and will leave our patients' burn blisters intact.

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SELECT BURN BLISTERS SHOULD NOT BE LEFT INTACT



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Burn damage can cause blisters because of separation of the epidermis from the underlying dermis.¹ Such wounds generally represent either superficial or deep partial-thickness injuries.² In the absence of clinical data, existing expert opinion as articulated in guidelines and reviews generally recommends debridement of ruptured blisters.^{3,4} More controversial is whether to intervene when blisters are intact. Such interventions may include full debridement of all overlying devitalized tissue or a less invasive approach of blister aspiration. Given the limitations of the existing literature, we argue that emergency physicians should aspirate or debride select burn blisters, an approach supported by many burn centers and guidelines.³

Burn blisters result from the increase in capillary permeability after thermal injury, which allows fluid