Postburn Contractures of the Hand

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KEYWORDS

• Postburn • Contracture • Hand • Finger • Flexion • Claw • Boutonniere

KEY POINTS

- Burn contractures present as a spectrum of deformities that significantly limit hand function.
- Appropriate care during the acute burn phase can help limit the incidence or severity of postburn contracture.
- Surgical release with graft or flap coverage is the primary treatment modality.
- Postoperative splinting, hand therapy, and scar care are vital to a successful outcome.

INTRODUCTION

Burns are among the most common causes of hand contractures. Failure to seek timely medical attention, inadequate treatment, and healing by secondary intention are common causes of burn contractures. Postburn deformities of the hand are functionally limiting and serve as constant visual stigma to the patient and will occur at a certain rate regardless of the initial treatment method. Sheridan and colleagues[1] reported their experience with 698 hand burns in children. Children treated with dressing changes during the initial burn went on to develop contractures that required operative correction in 4.4% of cases. Of patients requiring grafting during their initial burn care, 32% developed contractures requiring subsequent surgery. The severity of a burn contracture depends on several factors: the location of the burn, the depth of the burn, the timing of surgical or nonsurgical treatment, postinjury splinting, hand therapy and scar care during the maturation process.[2] McCauley[3,4] provided a severity rating for burn contractures of the hand, grading them I to IV (**Table 1**). Grade 1 and 2 contractures can typically be managed with therapy. Grade III and IV contractures are subcategorized as flexion, extension, or mixed deformities. More severe contractures require more complex reconstruction; however, even good functional outcomes have been achieved in grade IV contractures.[4]

Care of these deformities is more appropriately termed postburn hand reconstruction rather than treatment of burn scar contracture. In addition to release of the contracted skin and coverage of the soft-tissue defect, the surgeon must address the secondary changes to the musculotendinous unit, ligaments, and joints.[5,6] The appropriate procedures must be selected to provide a patient with the best functional outcome. For example, arthrodesis of a finger proximal interphalangeal (PIP) joint may provide a better functional outcome than complex soft tissue repair of a boutonniere deformity for some patients because of the unpredictable outcomes in boutonniere deformity, especially in the setting of postburn scar contracture,

M. Brown has no commercial or financial conflicts of interest or any funding sources to disclose. K. Chung has no commercial or financial conflicts of interest and is funded in part by Midcareer Investigator Award (2K24 AR053120-06). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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Hand Clin ■ (2017) ■–■

http://dx.doi.org/10.1016/j.hcl.2016.12.005

Table 1
Severity ratings for burn contractures of the hand

Grade	Description
I	Reports symptomatic tightness, no visible changes
II	Mild decrease in range of motion
III	Functional deficit with mild changes to hand architecture
IV	Severe functional deficit with dramatic changes to hand architecture

Adapted from McCauley RL. Reconstruction of the pediatric burned hand. Hand Clin 2009;25(4):545; with permission.

which often overpowers soft tissue reconstructions. In severely burned hands, creating stable key pinch or tripod grasp may provide the functional improvement necessary for performance of daily activities. Finally, postoperative hand therapy must be tailored to the individual contracture and surgery. For example, patients with joint release need earlier mobilization in comparison with those undergoing skin contracture release and grafting. Surgical treatment presents unique challenges but functional improvement and patient satisfaction remain high after these operations.

CONDITIONS AND PRESENTATION OF BURN CONTRACTURES IN THE HAND

The acute treatment of a burn depends on the depth of the injury. Surgery is indicated for deep or full-thickness burns that are not expected to heal within 3 weeks. Healing potential cannot always be determined at the time of injury and often requires serial assessment. Early excision and grafting is the mainstay of surgical treatment.[1,7] If the surgeon believes the burn will progress or if the burn is too large cover the hands immediately, allograft can be used for temporary coverage. Burns with deep dermal or full-thickness injury that are left to heal by secondary intention have fibroblast deposition and scar formation resulting in contracture. The distinct anatomic differences between the dorsal and volar skin also change the outcome after burn injury. The thinner more pliable dorsal skin is more easily destroyed by contracture and the relatively superficial extensor tendons are at increased risk of exposure or injury. Burns of the thicker glabrous skin of the palm and volar fingers are less commonly full-thickness dermal injuries. The palmar fascia and fibrous septae provide additional layers that protect flexor tendons and digital neurovascular bundles. Deep palmar burns take more than 3 weeks to epithelize but still have comparatively mild scarring and contracture.[8,9] Soft tissue reconstruction either with skin grafting or flaps are commonly done for dorsal hand burns but are not commonly performed for palmar burns that often can heal completely.

Untreated or severe burns of the hand result in a characteristic appearance of wrist extension, metacarpophalangeal (MCP) joint hyperextension, and interphalangeal (IP) joint flexion commonly referred to as the burn claw deformity (**Fig. 1**A, B). This is primarily a result of direct thermal injury to the dorsal skin and extensor apparatus but is potentiated by immobility, edema, and joint distension. In a patient with a large surface area burn, aggressive fluid management is initiated to fight against evaporative losses and maintain intravascular volume. Burn injuries result in third spacing with severe edema of extracellular spaces of the body. Edema and swelling of the joints encourage extension at the MCP because more joint space exists in this position versus flexion. The collateral ligaments of the MCP are lax in extension but with prolonged periods of extension they will shorten, which prevents passive MCP flexion. Extension at the MCP increases the relative flexion forces at the IP joints, leading to a

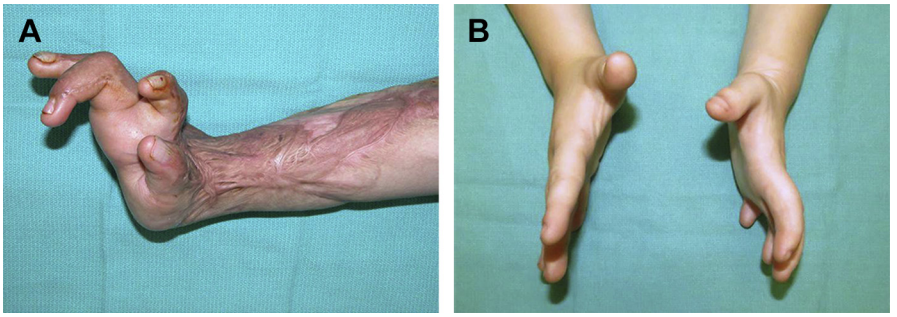

Fig. 1. Burn claw deformity. (*A*) Severe burn claw deformity with wrist and MCP extension and PIP flexion. (*B*) Mild claw deformity with MCP hypertension and slight PIP flexion.