Metacarpal Neck Fractures: Results of Treatment with Traction Reduction and Cast Immobilization

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Abstract Although fractures of the fifth metacarpal neck (boxer's fractures) are common, their treatment can be problematic. A description of a technique utilizing traction reduction is presented in this paper. The records and radiographs of 59 patients who underwent reduction using longitudinal traction and subsequent immobilization in a specially molded cast were retrospectively reviewed. On average, 80% of initial fracture angulation in the sagittal plane was corrected, and only 1° of this correction was lost at the discontinuation of casting (3–4 weeks). We have found this technique to be highly effective in the treatment of boxer's fractures. Advantages of this treatment include its efficacy, ease, and improved patient tolerance over other casting techniques.

Keywords Boxer's fracture · Cast · Reduction

Introduction

Metacarpal neck fractures are among the most common of hand fractures with those involving the fifth metacarpal (boxer's fractures) being the most common [2]. These fractures result from a longitudinal compression force acting on a flexed metacarpophalangeal joint (MCP)—usually when a clenched fist strikes a solid object. The resultant fracture is usually unstable with volar angulation due to comminution of the volar cortex and the deforming action of the interossei.

Many methods of immobilization have been described to maintain reduction of metacarpal neck fractures. Early methods included immobilization over a roller bandage and banjo splinting [5, 9]. In the 1920s and 1930s, several authors espoused management with straight dorsal splinting, immobilizing the MCP joints in extension [5, 6]. Contemporary treatment usually relies upon reduction by the Jahss maneuver followed by cast or splint immobilization. Recent methods of immobilization have included: anterior splinting, anterior–posterior splinting, ulnar splinting, fracture braces, and immobilization with adhesive tape [1, 3, 4, 7, 8]. All typically immobilize the reduced fracture with the MCP joints in flexion. Although reduction of these fractures is usually successful using the Jahss technique, successful maintenance of the reduction has remained a vexing problem.

Over the past decade, the senior author has developed and employed a different technique for reduction and immobilization of fifth metacarpal neck fractures which we have found to be highly successful. The technique is based upon reduction by longitudinal traction only and subsequent immobilization using a three-point molded plaster cast with the interphalangeal (IP) joints free. Advantages of this treatment method include its efficacy, ease of application, freedom of IP joint motion, and improved patient tolerance. Anesthesia is not necessary with this technique. We report in this paper a description of this technique and the results of patients treated by this method by the senior author as well as other attending staff at our institution.

Materials and Methods

The records of all available patients diagnosed at our institution with a boxer's fracture or a fracture of the fifth metacarpal neck from 1988 to 2006 were retrospectively

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reviewed to determine which underwent fracture management using the techniques outlined below. The corresponding injury and immobilization radiographs were then reviewed to ensure accuracy of diagnosis and to confirm casting in accordance with this technique. Fifty-nine patients had been treated with the described technique and had sufficient radiographic follow-up (at least 3 months) for review and measurement. Additional information abstracted from the patient records included age, gender, hand dominance, and mechanism of injury.

Initial injury, postreduction, and final follow-up radiographs were reviewed. Anterior–posterior and true lateral views of the metacarpal were available for all patients. Oblique views of the hand were not consistently obtained. Fracture angulation was measured on the true lateral view using a fine goniometer centered at the fracture site on the dorsal cortex. Three sagittal angulation measurements were made: initial injury, postreduction (in cast), and final follow-up. Accepting the normal metacarpal neck–shaft angle to be 15° , the degree of correction and subsequent maintenance/loss of correction was determined [3].

On initial presentation, various modes of nonoperative treatment were employed. Regardless of initial treatment modality, all study patients subsequently underwent fracture reduction using longitudinal traction in finger traps with subsequent cast immobilization within the first week postinjury. Our technique of traction reduction and casting of boxers' fractures is described below.

Technique of Traction Reduction and Casting

The patient is positioned supine and a finger trap is placed over his small finger. The shoulder is abducted 90° with the elbow flexed to 90° . Countertraction of approximately 8 to 14 lb is placed over the distal portion of the humerus. The patient is then allowed to hang in traction for a period of 5

Figure 1 Application of cast padding with fifth digit in longitudinal traction.

Figure 2 Squares of padding are placed volarly and dorsally over the fracture.

to 10 min. Anesthesia in the form of a metacarpal block or ulnar block may be used at this point; however, in our experience, this has not been necessary. It was initially utilized when performing this technique, but we have been pleasantly surprised at how well patients tolerate traction.

Following traction reduction, web-roll cotton padding is applied. The cast padding is advanced distally past the level of the MCP joint of the small finger and the webspace of the index finger (Fig. 1). Additional squares of padding are placed volarly over the region of the fifth metacarpal head and dorsally over the fracture. This can be either cotton felt padding or multiple layers of folded web-roll (Fig. 2).

A base layer of elastic plaster (if available) is placed on the hand and forearm. Elastic plaster is preferred as it gives excellent contour, minimizes pressure points, and facilitates molding. After this has been placed, 3 × 15-in. plaster struts, five to eight layers thick, are placed both volarly and dorsally, longitudinally in line with the fifth ray. These are extended distally to a point at or just past the proximal one-third of the proximal phalanx of the fifth finger (Fig. 3). While the small finger is still in traction, three-point molding is performed to create appropriate three-point support for the reduced fracture. The dorsal point of contact overlies the fracture site with the volar contact points over the metacarpal head distally and the proximal metacarpal shaft proximally (Fig. 4). Firm pressure is applied to assure fracture support but with a smoothed contour to avoid pressure spots. Care is taken to maintain the distal transverse metacarpal arch in the palm. After the plaster

Figure 3 a and b AP and lateral radiographs showing the distal extent of casting.

has hardened sufficiently in the molded position, an additional layer of regular 3- or 4-in. plaster is applied over the top of the previous construct.

A cast saw or cast knife is used to trim away excess plaster around the thumb and at the distal transverse flexion crease on the radial side of the hand to allow for unimpeded motion

of the thumb as well as the index and long fingers. The height of the cast should slope distally in the region of the ring finger and extend to the midthird of the proximal phalanx over the small finger. Adequate cast padding should be available at this time to turn down over the cut plaster edges. If desired, a thin shell of fiberglass may be applied over the initial well-

Figure 4 Three-point molding is performed to support the reduced fracture.

Figure 5 Final cast with ring and small fingers buddy-taped.

molded plaster cast to improve durability. The final step involves buddy taping the small finger to the ring finger using half-inch cotton tape for rotational control (Fig. 5).

The final construct allows nearly unimpeded motion of the thumb, index, and long fingers at the IP and MCP joints. Active and passive motion of the distal interphalangeal and proximal interphalangeal joints of the ring and small fingers is allowed, however, MCP motion of the small finger is restricted. Postreduction films are obtained to assess reduction. Elevation and anti-edema exercises are begun immediately after casting.

Normal use of the thumb, index, and long fingers is encouraged. The duration of casting is usually 3 to 4 weeks at which time the cast is removed and repeat X-rays are obtained. The patients are then allowed unrestricted motion of the hand with the small finger buddy-taped for a period of an additional 3 weeks.

Results

Most of the patients in this investigation were young males who sustained their boxers' fracture by striking an object with a clenched fist. Of the 59 patients, 53 were male (90%). Patient age averaged 28 years (range, 12 to 86 years). Five patients were less than 18 years of age. With respect to hand dominance, 51 of the 59 patients had injured their dominant hand (86%).

Of the 59 patients, 44 sustained their fracture by striking an object with a clenched fist. A fall directly onto the hand produced the boxers' fracture in another eight patients. For the remaining patients, four patients were injured in a motor vehicle accident, two were involved in industrial accidents, and one sustained his injury when his hand was caught in a metal gate.

All fractures were reduced and immobilized using the aforementioned techniques within 7 days of injury. Initial fracture angulation measured on the lateral radiographs averaged 32° (range, 13–54°) in excess of the normal head–shaft angle. Following traction reduction, fracture angulation averaged 6° (range, 0–20°), designating an average 81% correction of the initial angulation. At final follow-up, fracture angulation averaged 6.9° (range, 0–20°), indicating an average loss of less than 1° from the initial correction. In all 59 patients, the difference between the initial postreduction angulation and that at final follow-up was 4° or less. The average MCP arc of motion at most recent follow-up was 88° (range, 76–105°).

Discussion

Numerous treatment measures have been described for the treatment of boxer's fractures, yet their management

remains a controversial problem. While the indications for the reduction and immobilization of these fractures are less than clear, we believe that acceptance of significant angulation of fifth metacarpal neck fractures does not uniformly lead to fully functional results.

We have found that the use of longitudinal traction (finger traps) for fracture reduction corrects an average of nearly 80% of initial fracture angulation in the sagittal plane. For most patients, the result is near-anatomic. For no patient was a correction of less than 50% achieved. We have also found that the maintenance of this reduction is reliably achieved using the three-point molded plaster cast we describe in this paper. For all patients in this study, the final angulation measurement differed by 4° or less from the initial correction measurement.

In addition to producing consistent results, this method affords further advantages in that no special materials are required and that anesthesia is generally not needed. Also, this method may be performed on an elective basis up to 1 week following injury. The special cast allows nearly full motion of the MCP and IP joints of the thumb, index, and long finger as well as IP motion of the ring and small fingers. This regimen has been highly successful in maintaining digital mobility while effectively holding fracture reduction. Furthermore, we have found that this technique obviates the need to consider open or closed reduction with internal fixation in the majority of patients.

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