Operative Fixation of Metacarpal and Phalangeal Fractures in Athletes

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KEYWORDS

• Hand fractures • Metacarpal fractures
• Phalangeal fractures

Metacarpal and phalangeal fractures are the most common injuries in the upper extremity.[1–3] Emmett and Breck noted that fractures of the metacarpal and phalanges accounted for approximately 10% of nearly 11,000 upper extremity fractures.[4] Metacarpal and phalangeal fractures usually occur between the ages of 10 and 40 years, are more common in men, and are a common injury in athletes.[5]

Fractures of the metacarpal and phalanges have significant economic consequences for the worker and the athlete. In 1997, Kelsey and colleagues[2] reported there were more than 17.6 million upper extremity injuries resulting in 32.5 million days of restricted activity and more than 90.5 million days off work. The cost of the injuries was approximately 18.5 million dollars.[2] Chung and Spilson estimated there were approximately 1.5 million hand and forearm fractures and that more than 600,000 of these were metacarpal and phalangeal fractures in 1998.[6]

Stable anatomic fracture restoration and early functional recovery are the goals of internal fixation of hand fractures. Open reduction and internal fixation of hand fractures has become more popular over the past 3 decades secondary to improved implant materials and designs, surgical technique, radiographic availability, and the demand for anatomic fracture restoration by the general public and athletes.[7–9] However, open reduction and internal fixation of hand fractures presents a new challenge to a hand surgeon because of the difficulty in management of small fracture fragments without devascularization. Open reduction without stable fixation increases the risk of tendon or joint adhesions adjacent to the fracture. Percutaneous techniques may offer the advantage of stable fracture fixation and early digital rehabilitation while minimizing the risks of fragment devascularization and postoperative fibroplasia.

Metacarpal and phalangeal fractures are common athletic injuries that can significantly affect the athlete's career when they occur during the season and affect the athlete's training when they occur in the off season. This situation is particularly relevant if there are complications or if fixation is not stable enough to permit early range of motion and rehabilitation. This article discusses percutaneous and open reduction techniques of hand fractures as these injuries pertain to athletes. The goal is stable fixation to allow early return to competition and rehabilitation.

UNICONDYLAR FRACTURES

London initially classified phalangeal condylar fractures in 1971.[10] Type I fractures were stable

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and nondisplaced. Type II fractures were considered unstable. Type III fractures were comminuted or bicondylar. London noted that bicondylar fractures were common athletic injuries. Stark noted that unicondylar fractures of the proximal phalanx were common athletic injuries and often were missed because the athlete can often bend the finger after the initial injury.[11] Athletes frequently have a history of a finger dislocation reduced by a trainer and present to the clinic in a semi-acute state if they continue to experience pain and deformity as the fracture starts to displace.

Weiss and Hastings describe their results in a series of 38 consecutive patients who had unicondylar fractures of the proximal phalanx.[12] Nineteen patients involved in the study sustained a fracture from a ball sport. The investigators noted that unicondylar fractures tended to be more common after sports injuries when the ball came between two slightly flexed outstretched digits with high velocity, which spread the digits resulting in an oblique volar Type I fracture pattern caused by tension and rotation transmitted through the collateral ligament to the condyle involved. They described that the avulsed condyle tends to be on the outermost fingers of the hand and that the condylar toward the midline of the hand is the one that is most frequently fractured. Weiss and Hastings noted that, in their series, in those cases in which the condyle away from the midline was fractured, either a compression mechanism with the finger giving away from the midline or a tension mechanism with the finger deviating toward the midline was most likely involved. McCue and colleagues[13] concurred with those findings by Weiss and Hastings in their study of phalangeal fractures.

Unicondylar fractures of the phalanges are inherently unstable. Weiss and Hastings reported that 5 of 7 nondisplaced condylar fractures of the phalanges that were managed nonoperatively displaced during treatment. They noted that nonoperative treatment of these fractures requires extremely close follow-up due to the high likelihood of displacement.

A single Kirschner wire does not provide adequate stability of unicondylar fractures of the proximal phalanx. At least two Kirschner wires are needed for reliable fixation if this mode of stabilization is selected. Kirschner wires splint but do not compress the fracture site compared with screw fixation. Conversely, mini screws provide compression at the fracture site and a single screw centered in the condylar fragment may impart sufficient stability. Kirschner wires and mini screws may be used in combination, and two mini screws may be inserted into larger fragments. Stable fixation seems to correlate with recovery of motion at the proximal interphalangeal (PIP) joint. However, full recovery of the PIP joint motion is an exception rather than the rule following condylar fractures, usually because of some residual extension lag or flexion contracture.

Recently, Geissler introduced the technique of headless cannulated mini screw fixation as an excellent option for intraarticular unicondylar and selected bicondylar fractures of the proximal phalanx.[14] Headless mini screws fit entirely within the bone fragment minimizing collateral ligament obstruction and irritation compared with mini screws with conventional heads. In addition, percutaneous insertion minimizes soft tissue dissection and scarring compared with a mini open procedure. Motion-restricting joint and tendon adhesions are less likely to occur. Insertion of cannulated screws allows for precise placement and simplifies the procedure significantly.

SURGICAL TECHNIQUE

Condylar fractures can usually be manually reduced within 7 to 10 days following injury (**Fig. 1**). Manipulative reduction is performed under fluoroscopic control. A dental pick, Kirschner wire, or hypodermic needle may be useful to assist reduction when closed manipulation fails to anatomically reduce the articular surface. A pointed reduction clamp or specialized fracture reduction jig may be applied to provide provisional fixation (**Fig. 2**). Adequate reduction of the condylar fracture is confirmed under fluoroscopic control both by posteroanterior (PA) and lateral radiographs. The condyle should align concentrically on lateral radiographs. A displaced condylar fracture displays a double convexity (Tushie sign) as viewed laterally if it is not fully reduced.

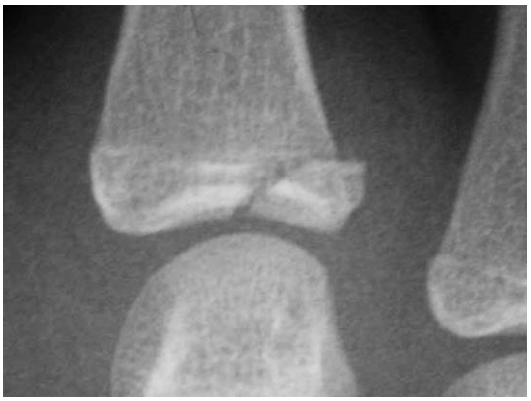

Fig. 1. Posteroanterior radiograph of a displaced intraarticular fracture of the base of the proximal phalanx to the index finger.