Metacarpal and Phalangeal Fractures in Athletes

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KEYWORDS

• Athlete • Hand injuries • Metacarpal fractures • Phalangeal fractures

KEY POINTS

- Most metacarpal and phalangeal fractures resulting from athletic injuries occur by a low-energy mechanism and are usually extra-articular and minimally displaced.
- Football injuries account for most metacarpal and phalanx fractures.
- Sport, player position, time of season, and level of play should be taken into consideration when determining treatment options.
- Early range of motion is a key aspect in the recovery process.

EPIDEMIOLOGY

Metacarpal and phalangeal fractures are among the most common skeletal injuries in the general population, accounting for 10% of all fractures and 1% of emergency department visits in the United States.[1–3] Nearly half (41%) of all injuries to the hand warranting an emergency room or urgent care facility visit involve a fracture to the metacarpal or phalanx. These injuries occur most commonly in young adult men and nearly a quarter (22.4%) are sustained during athletic events.[3–5]

Organized sporting events are becoming increasingly popular among children and adolescents, with 45 million active participants in the United States.[6] High school participation has also been growing annually for the past 20 years to more than 7 million athletes.[7] With this increase in participation, both acute and chronic overuse injuries are increasing as well.[8,9]

Metacarpal fractures sustained from a direct blow are the most commonly occurring fracture (2 in 3) in the young male athlete population, especially those participating in contact sports such as football, lacrosse, or hockey.[10–13] Fifty percent of all hand fractures occur during football events.[14]

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Although the number of injuries sustained is higher during practice, the injury rate is higher during competitive games. The reason for this is that more time is spent at practice as opposed to games, but competition typically increases the intensity level.[14–17]

Because women's sporting events typically do not involve forced contact, lower extremity injuries in general are more common in young female athletes.[18,19]

MECHANISM OF INJURY

Most hand fractures result from a direct blow, fall, or crush. In athletic events, these are most commonly caused by low-energy forces and therefore result in minimal soft tissue injury. Common fracture patterns exist secondary to the relative anatomy and deforming forces on susceptible areas of the bone. Torsion, compression, shear, bending, and tension can all result in specific fracture patterns. These patterns are discussed in greater detail later in the article. Sport-specific injuries occur and the specific protective gear may uniquely protect from or predispose to particular injuries.[5,12,18,20,21] It is incumbent on the physician caring for the athlete to understand these patterns and to assist in both the prevention and treatment of these injuries.

Stress fractures in the upper extremity, specifically in metacarpals or phalanges, are rare compared with lower extremity stress fractures.[18,22] There have been reports of metacarpal stress fractures in the dominant hand of racquet-playing athletes, such as golfers, batters, or tennis players.[22] These injuries are managed similarly to lower extremity stress fractures and are primarily treated by rest, activity modification, and immobilization.

Fractures of the metacarpals or phalanges can significantly affect an athlete's training program, season, or career, depending on the timing and severity of injury. Regardless of the type of injury, the well-established principles of stable anatomic reduction and early functional motion are the keystones of treatment.

ANATOMY AND CLASSIFICATION

The anatomy of the metacarpals is unique in that all 4 nonthumb metacarpal bones are connected via strong interosseous ligaments and distally by the deep transverse metacarpal ligament, which maintains the stability of the metacarpal arch.[23–25] Therefore, isolated metacarpal shaft fractures, especially those in the central 2 digits, tend to be stable (**Fig. 1**).

The index metacarpal is typically the longest metacarpal bone with the broadest base, whereas the ring finger metacarpal is usually the narrowest in diameter, with the small finger metacarpal being the shortest.[24] These subtle changes in bony anatomy can be important for evaluation of imaging studies as well as for implant selection, such as intramedullary devices or plates.

The carpometacarpal (CMC) joints of the index and long fingers have an inherent stability because of their bony morphology and soft tissue support, thereby permitting only minimal range of motion. In comparison, the articulations of the ring and small finger metacarpal bases with the hamate allow a larger degree of motion, especially in flexion, to enable a powerful grip. For this reason, more displacement can be permitted in fractures of the ulnar metacarpals because the deformity can more easily be compensated.

Because of the anatomy, border metacarpals are more susceptible to shortening, because they have less soft tissue support (see **Fig. 1**); however, they can tolerate more angulation in the coronal plane away from the center, because a slight malrotation deformity does not lead to impingement on the other digits.