

Treatment of Nonunion and Malunion Following Hand Fractures

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KEYWORDS

- Nonunion • Malunion • Phalanx • Metacarpal
- Hand fracture complication

Fractures in the upper extremity are common, accounting for about 1.5% of emergency department visits, with hand fractures comprising 40% of all upper extremity fractures.¹ Complications can and do occur, making their diagnosis and treatment an important part of caring for patients with these injuries.

Malunions are common in the metacarpals and phalanges, although not all are clinically significant. The common fifth metacarpal neck, or boxer's fracture, usually heals with an apex dorsal deformity, but this is rarely problematic. By contrast, those with rotational or angular deformities often affect hand function, and treatment is necessary. Nonunions, on the other hand, are uncommon, but when they occur are often significant and inevitably require treatment. Nonunions are often associated with other conditions such as tendon and nerve injuries, and as a result sometimes salvage procedures, such as arthrodesis or amputation, are the best treatment.²

NONUNION

Delayed unions often occur in the hand, but will eventually heal and do not require intervention, whereas nonunions are more common with infection and open fractures, and these will inevitably require operative treatment. Occasionally they may result from metabolic abnormalities, such as low calcium or vitamin D, but once the metabolic abnormality is corrected, union will typically follow. Radiographic appearance alone is not a reliable

indicator of nonunion, but with clinical instability or deformity, treatment should be considered because prolonged immobilization is poorly tolerated and permanent stiffness will occur.

Timing for the diagnosis of nonunion is variable, but generally requires consecutive radiographs without signs of progressive healing for a period of 4 to 6 months. The pathophysiology of the nonunion is hypertrophic or atrophic, with atrophic being much more common in the hand.³ Hypertrophic nonunions display callous formation, but without bridging callous between fracture segments. With rigid fixation, union will typically occur. Atrophic nonunions do not exhibit callous and often reveal resorption at the site of the fracture. Resorption may be secondary to impaired blood supply, infection, metabolic conditions such as smoking or diabetes, or soft-tissue interposition between the fracture ends. Technical difficulties from a previous operative procedure, such as overdistraction of the fracture site, devascularization from exposure, or inadequate fixation can also lead to nonunion. Preoperative blood work, including a white blood cell count, erythrocyte sedimentation rate, and C-reactive protein, can be helpful and provide a means to follow recovery in the event of an infection. Intraoperative bone cultures should be obtained to determine specific organisms and to guide antibiotic choice. Surgical principles include eradication of any residual infection, debridement of nonviable bone, and stabilization of the fracture segments. Bone graft is often required to achieve union.³

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Arthrodesis is useful for articular nonunions associated with joint stiffness. This digit is likely to remain stiff following healing of the nonunion, and arthrodesis allows for internal fixation to cross the joint, allowing for a longer implant and more stability. Both the joint and nonunion site should be debrided, bone grafted, and stabilized (**Fig. 1**).²

Nonunions commonly occur in the tuft of the distal phalanx, but are rarely symptomatic. These fractures are typically the result of crush injuries and are associated with nail bed injuries. Despite

nail bed repair some of these will fail to unite, which may result in an unstable tip of the finger and, depending on the digit, may be problematic for the patient. When a significant amount of bone is missing, amputation revision may be the best treatment, as bone grafting on the tip of the phalanx is prone to resorb.

When the nonunion is in the shaft of the distal phalanx, this can often be treated with compression across the nonunion site, either through an open approach or with percutaneous compression screw placement (**Fig. 2**).

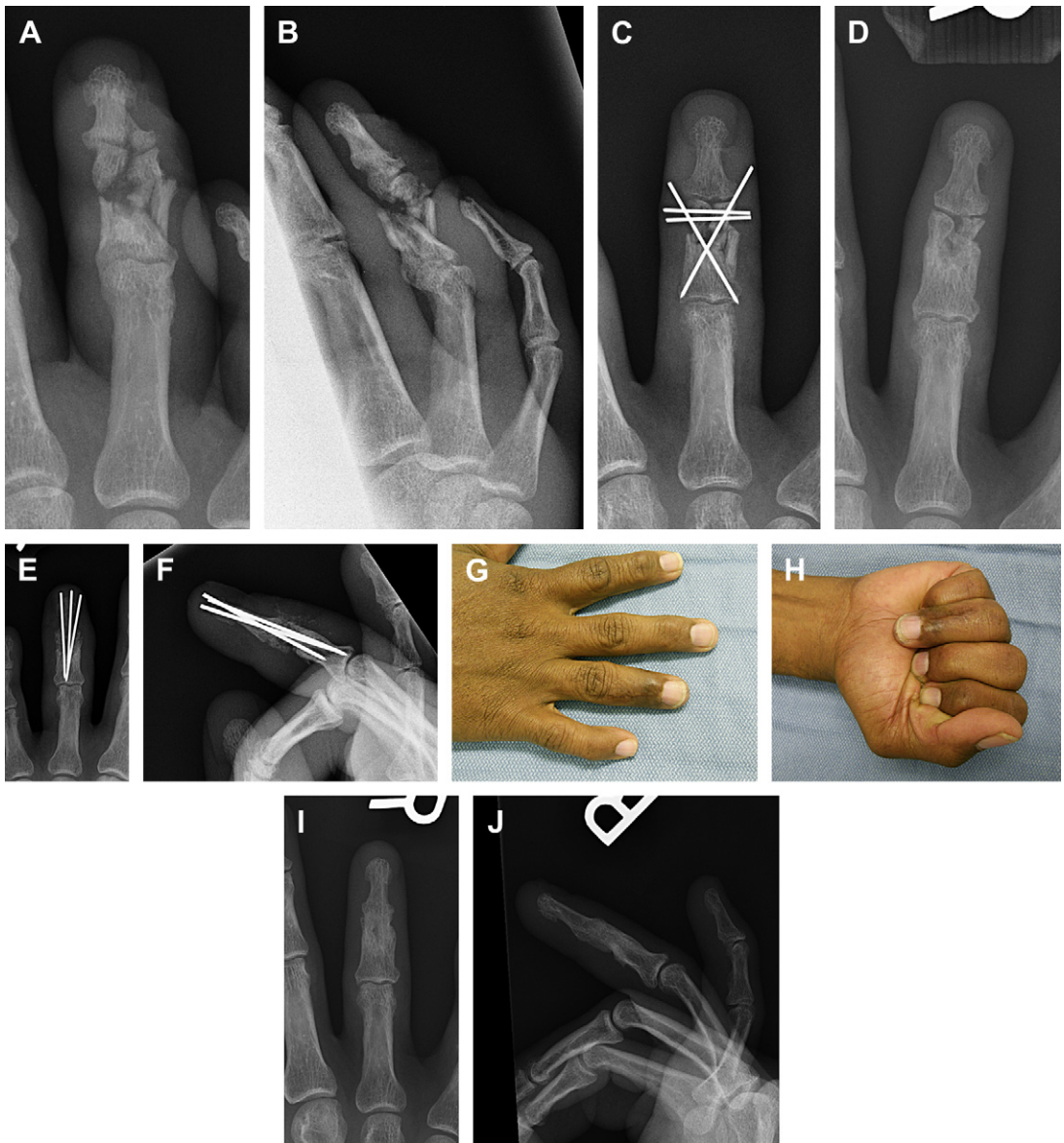


Fig. 1. Clinical example of patient with comminuted open fracture of middle phalanx. Preoperative posterior-anterior (A) and oblique (B) radiographs. Initial stabilization was with Kirschner (k)-wires (C). Persistent painful nonunion 8 months following injury (D) treated with correction of nonunion with bone graft and arthrodesis or arthritic distal interphalangeal (DIP) joint (E, F). Final clinical (G, H) and radiographic (I, J) appearance.

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