



Management of Metacarpal Nonunion in a Two-Year-Old Child

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Abstract

Introduction: Metacarpal fractures are common in childhood and adolescence and bone healing is the rule.

Case Presentation: We present a two-year-old boy with an established nonunion of the fourth and fifth metacarpal fractures, treated successfully without any complications. Both fractures resulted from a high-energy trauma; although initial treatment seemed appropriate, nonunion occurred. The child was referred to our center for nonunion and humpback deformity. The patient was treated with open reduction/internal fixation and bone graft. All metacarpal fractures healed radiographically and clinically without any problem. The final functional and cosmetic result was excellent.

Conclusions: Although the occurrence of metacarpal nonunion is rare in children, careful follow-up must be done to achieve osseous union.

Keywords: Metacarp, Nonunion, Pediatric

1. Introduction

Extraarticular metacarpal fractures are common during childhood and adolescence and the rule for that is osseous healing and delayed union or nonunion of it is very rare. It is not mentioned anything in textbooks about this rare complication.

2. Case Presentation

We treated a two-year-old boy with nonunion of the fourth and fifth metacarpal shafts due to crush-type of significant force (wringer injury) and fasciotomy after compartment syndrome. After fasciotomy, the fourth and fifth undisplaced transverse metacarpal fractures were undergone treatment by a splint for four weeks. Seven months later, he referred to our center for the treatment of atrophic nonunion and humpback deformity (Figure 1). In the clinical examination, tenderness in fracture sites was elicited. Radiographic examinations showed established nonunion in both metacarpal bones. In the clinical examination, the motion of fragment fractures and humpback deformity were also observed. He had not any condition (such as associated injury or systemic disease, especially systemic bone and collagen disease) leading to osseous nonunion and he not used any medications, and all of the

laboratory investigations were in the normal limit. To prevent bone shortening, the patient was treated with open reduction/internal fixation by intramedullary K-wires with iliac crest intercalary bone graft and short arm cast immobilization (Figure 2). Six weeks after the operative treatment, K-wires were removed. In the clinical examination, tenderness disappeared and under fluoroscopic examination, fracture fragment motion was not observed. Active motion exercise and physical therapy started as soon as possible. All metacarpal fractures were healed radiographically six months after treatment without any problem. The final functional and cosmetic result was excellent (Figure 3).

3. Discussion

Soft tissue injuries and fractures involving the hand are very common during childhood, but complications are rarely reported. The reported incidences of hand fractures in children are varying. According to Godfrey and Cornwall, metacarpal fractures comprise 10% to 35% of all hand fractures in children (1).

Ireland and Taleisnik reported two patients with nonunion of metacarpal bone treated by open reduction and internal fixation and bone graft. This is similar to



Figure 1. Radiographs of a two-year-old boy with atrophic nonunion of the fourth and fifth metacarpal bones



Figure 2. Photograph during intraoperative correction of metacarpal nonunion with open reduction/internal fixation by intramedullary K-wires with iliac crest intercalary bone graft



Figure 3. Radiographs of six months after treatment revealing the complete healing of the fourth and fifth metacarpal bones

our case and their treatment method and mechanism of nonunion are as same as those in our case (2).

Hastings and Simmons reported 354 hand fractures in children, exclusive of massive crush and amputation injuries. Poor results were rare but comprised several cases of angulation, malrotation, growth disturbance, decreased range of motion, premature physal closure, and one nonunion in an open distal phalanx fracture due to a wringer injury, which later was treated by bone grafting.

Nonunions or delayed unions are unusual in children's fractures (3). In a series of 30 nonunions in children pre-

sented by Lewallen and Peterson, none included the hand or metacarpal nonunion (4).

In two large series studies of nonunion from the Mayo Clinic, the tibia was the most common diaphyseal nonunion, and fractures about the elbow comprised the largest number of metaphyseal and epiphyseal nonunions in children (4, 5). Exclusive of the individual condition, nonunion is associated with high-energy trauma and open fractures with extensive soft tissue damage and infection (4, 6-8). Cullen et al. found that comminution and segmental injuries were the most significant predictors of delayed union. Deep infection increases the rate of nonunion (7). Our patient did not have any mentioned risk factors other than high-energy trauma.

In adults, nonunion is a rare complication in hand fractures that requires internal fixation with or without a bone graft (9). We were unable to find any report of metacarpal delayed union or nonunion in children exclusive of Ireland and Taleisnik study (2, 3, 5, 10-15).

Our opinion is that metacarpal delayed union or nonunion in children is preventable by the application of

orthopedic basic principles; soft tissue injury should be diagnosed accurately and documented initially. A standard clinical examination and radiographs, including Anteroposterior, lateral, and sometimes oblique views of the hand, should be taken (9, 16). The reduction of the fourth and fifth metacarpal fractures is less important than that of the first, second, and third ones because of the chances of improved function, cosmesis, and bone healing that are especially more important in the two latter metacarpal bones. Although metacarpal fractures in the pediatric population tend to heal without complications, they should not be neglected, especially if they have been open crushing injuries.

Buckley et al. (6), Cullen et al. (7), Haasbeek and Cole (8), and Lewallen and Peterson (4) showed that high-energy trauma and open fractures with extensive soft tissue injuries, infection, comminution, and segmental fractures are the most significant predisposing factors and predictors of delayed union and nonunion that is similar to the situation of our case (4, 6-8).

Closed or open crush-type injuries due to great load resulting in displaced or multiple fractures can lead to the development of delayed union or nonunion (2, 4, 6), as was in the case of our study. Factors such as open fractures or mechanisms involving significant forces with the loss of soft tissue support should alert the physician to the occurrence of possible complications. More accurate reduction and longer immobilization are required under these circumstances and patients should be followed up carefully for evidence of final union.

3.1. Conclusion

We were unable to find similar published cases of metacarpal nonunions in children exclusive of Ireland and Taleisnik study. When the primary injury is extensive, careful follow-up should be by clinical examinations and high-quality appropriate radiographic views; acceptable reduction and proper immobilization are the factors that may help with diagnosis, prevention, and treatment of this previously rarely reported complication in children. The pediatric orthopedic surgeon should inform the family and if possible the child that these functional and cosmetic problems may develop. In children, the complications of metacarpal shaft fractures, including delayed union and nonunion, although rare, could indeed occur.

Footnotes

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