

Case Report

Nonunion of Metacarpal Extraarticular Fractures in Children: Report of Two Cases and Review of the Literature

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Summary: Extraarticular metacarpal fractures are common during childhood, and osseous healing is the rule. We have treated two patients with delayed and nonunion of three metacarpal shafts. One patient sustained closed second and third metacarpal fractures, and the other sustained an open second metacarpal fracture. Both injuries were crush-type of significant force. Although initial treatment seemed appropriate, delayed union was not appreciated. The children were referred for cosmetic de-

formity. One of our patients required open reduction/internal fixation with bone grafting, whereas the other was observed. All metacarpal fractures healed. Thorough clinical examination, radiographic views, reduction, and proper immobilization are factors that may help prevent this previously unreported complication in children. **Key Words:** Delayed union—Metacarpal fractures—Nonunion.

Hand fractures in children are common. In children's fractures involving the hand, metacarpal fractures are second to phalangeal fractures in frequency (18). The fourth and fifth metacarpals are most frequently involved. Metacarpal fractures usually can be easily treated with minimal reduction and immobilization. Compared with the adult, even less anatomic reduction is required in the child (15). Fortunately, complications are quite rare.

Most articles (6,19,22) and traditional textbooks (1,15,16,20) on children's hand fractures mention potential complications without detailed case discussions. These complications include rotatory malunion, physeal damage with subsequent growth disturbance, loss of motion, and avascular necrosis of the metacarpal head. We have treated delayed and nonunion of extraarticular metacarpal fractures in two children referred months after injury for cosmetic deformity. To the best of our knowledge, nonunion of extraarticular metacarpal shaft fractures has not been reported. The purpose of this article is to present these cases, review the literature on the subject, and discuss factors that con-

tributed to the development of delayed and nonunion in these usually benign fractures.

CASE REPORTS

Metacarpal fractures

Case 1

A 10-year-old girl's dominant right hand was crushed when it was caught in a folding table. She sustained closed fractures of the shafts of the second and third metacarpals. Initial treatment consisted of a short arm cast that was worn for 1 month. Six months later, she was referred to us for the treatment of a painless, persistent nonunion accompanied by clinical deformity. Active and passive range of flexion of the proximal joints of the long and ring fingers was limited to 40°. Radiographic examination revealed ununited, angulated fractures of the shafts of the second and third metacarpals (Fig. 1). Seven months following her injury, open reduction and internal fixation with Kirschner wires and bone grafting of the fractures were performed (Fig. 2). She was immobilized in a short arm cast for 6 weeks postoperatively. Both nonunions went on to heal (Fig. 3). The final functional and cosmetic result was excellent.

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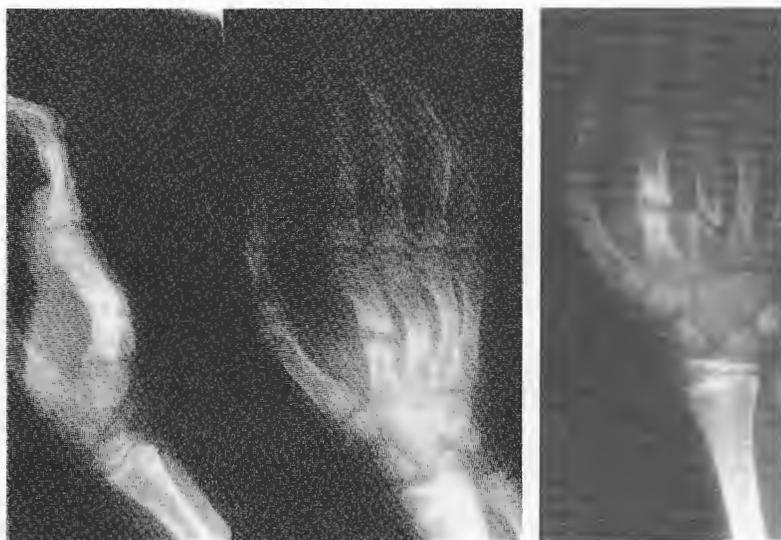


FIG. 1. Case 1. Radiographs of a 10-year-old girl with nonunion of the second and third metacarpals.

Case 2

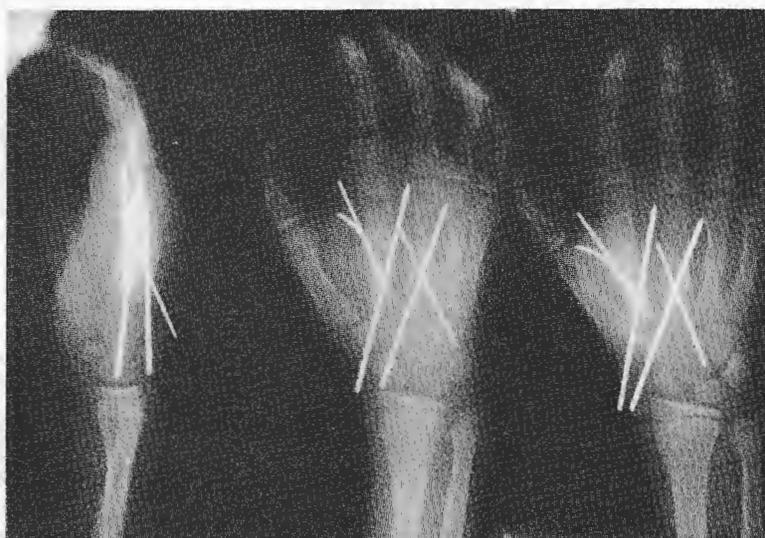
A 3-year-old boy sustained an open fracture of his dominant right second metacarpal when it was accidentally struck by a very heavy metal pipe. Initial management included primary repair of lacerated extensor tendons to the index and long fingers and immobilization, including the fingers, for 5 weeks in a short arm cast. There was no evidence of infection. Return of function was excellent, although delayed union was evident radiographically. When first examined by us 3 months following the injury, this patient had only minimal pain and stiffness accompanying his index finger motion. Radiographically, 5 months after injury, there was little progress toward union (Fig. 4). Because the delayed union was painless, no immobilization or specific treatment was initiated. He used his right hand actively during play activity. Almost 2 years after the

injury, follow-up radiographs and clinical examination showed union and normal function (Fig. 5).

REVIEW OF THE LITERATURE

Soft tissue injuries and fractures involving the hand are very common during childhood, but complications are rarely reported. The reported incidence of hand fractures in children varies. In Reed's series (18) of 410 fractures in 398 children, 85 (20%) involved the tubular bones of the hand, with 25 (6%) metacarpal and 60 (15%) phalangeal fractures. No complications were mentioned. Hanlon and Estes (8), in 1954, reported 698 children's fractures; only 7.3% involved the hand, which was the fifth most common site. O'Brien (15) stated that hand fractures are much more uncommon in children than in adults. However, Blount (1) believed that the incidence of hand frac-

FIG. 2. Case 1. Radiographs 2 weeks after open reduction/internal fixation with bone graft of the second and third metacarpals.



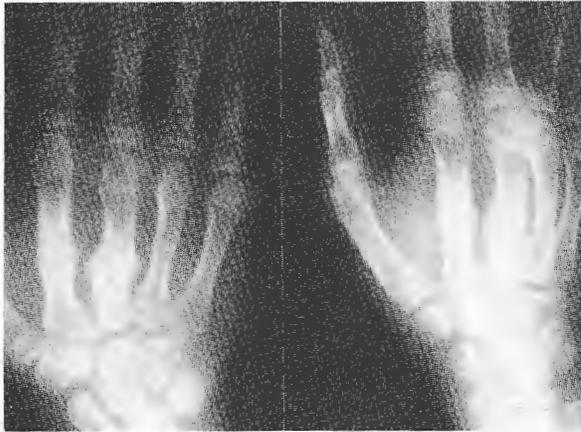


FIG. 3. Case 1. Radiographs of a 10-year-old girl show the nonunion healed 3 months after surgery.

tures in children, reported to be anywhere from 7 to 10%, was too low because of the omission of the "most frequent fracture of all—the distal phalanx in the crushed fingertip." Hastings and Simmons (9) reported on 354 hand fractures in 313 children, exclusive of massive crush and amputation injuries. Poor results were not common, but included several cases of malrotation, angulation, decreased range of motion, growth disturbance, premature physal closure, and one nonunion in an open distal phalanx fracture due to a wringer injury, which later required bone grafting.

Nonunions or delayed unions are unusual in children's fractures (1,17). Lewallen and Peterson (12) presented a series of 30 nonunions of diaphyseal long bones in children. None included the hand. Open fractures associated with significant soft tissue injury were thought to be precursors of nonunion in these children. In this series, 20 of 30 frac-

tures were open. All were initially treated by irrigation and debridement, but eight bony and six soft tissue infections developed. In adults, nonunions (11,13) have been reported in hand fractures and require internal fixation. In our review of the literature, we were unable to find any case of open or closed metacarpal fracture leading to delayed or nonunion in children (1,3,9,12,15–17,20).

We believe that these complications were preventable by the application of time-honored orthopedic principles (2,3,5,7,10,14–17,19–22). The extent of injury must be documented initially. A thorough clinical examination and radiographs, including AP, lateral, and sometime oblique views of the hand, are useful (6). Reduction of the second and third metacarpals is more important than that of the fourth and fifth for cosmesis, function, and improved chances for osseous union. Although fractures in children tend to heal without problems, they should not be neglected, particularly if they follow open, crushing injuries.

We agree with Lewallen and Peterson (12) that open fractures with significant soft tissue injury are precursors of nonunion in children. We also believe that closed crush-type injuries of great force resulting in displaced or multiple fractures contribute to the development in delay or lack of progress toward union.

Although Blount (1) advocated reduction and percutaneous pinning of metacarpal fractures, non-operative means should initially be tried. Metacarpal fractures should be reduced and properly immobilized in short arm casts, including the digit of the injured metacarpal. A second neighboring digit may also be included in the cast for better control of rotation and angulation, particularly if the child's hand is small. We prefer the "intrinsic plus" or "safety" position of immobilization with the proximal joint in flexion and the middle and distal joints

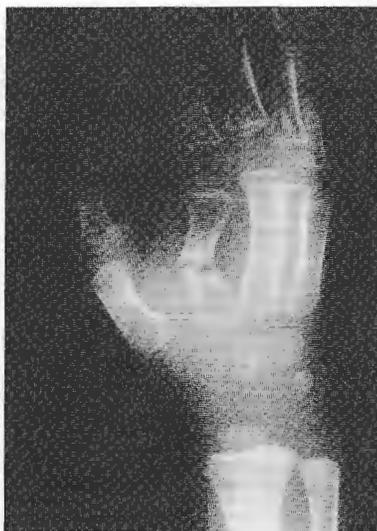


FIG. 4. Case 2. Radiograph of a 3-year-old boy 5 months following an open right second metacarpal fracture.



FIG. 5. Case 2. Radiographs of a 3-year-old boy with healed right second metacarpal fracture show union after 2 years.

extended. Factors such as open fractures or mechanisms involving significant force with loss of soft tissue support should alert the physician to possible complications. More accurate reduction and longer immobilization are required under these circumstances.

CONCLUSIONS

Complications of three metacarpal fractures in two children were presented. A forceful crush mechanism occurred in both patients. One of the three fractures was open. The second metacarpal was involved twice and the third metacarpal once. This location led to more obvious cosmetic deformity, which was the reason for referral. We were unable to find similar published cases of metacarpal nonunions in closed or open metacarpal fractures in children. When the extent of the primary injury is appreciated, the physician should inform the child and family that these functional and cosmetic problems may develop. In children, complications of metacarpal shaft fractures, including delayed union and nonunion, although rare, can indeed occur.

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