Rate of Clinically Significant Posttraumatic Arthritis After Small Finger Intra-articular Carpometacarpal Fractures

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Abstract

Although small finger intra-articular carpometacarpal joint fractures are relatively common hand injuries, few studies in the orthopedic literature report their clinical outcomes. The goal of this study was to analyze the rate of symptomatic posttraumatic arthritis following small finger intra-articular carpometacarpal joint fractures.

The authors performed a chart review of 82 consecutive patients with a small finger intra-articular carpometacarpal fractures treated at their institution over a 5-year period. Operative indications included irreducible small finger intra-articular carpometacarpal fractures and recurrent small finger carpometacarpal joint instability after attempted reduction. Group 1 included 66 patients with small finger intra-articular carpometacarpal fractures who were treated with cast immobilization alone for 6 weeks, whereas group 2 included 16 patients treated surgically followed by 6 weeks of cast immobilization. Clinical outcome parameters included posttreatment serial radiographs, a visual scale based on subjective pain scores (0-10) as part of a routine clinic intake form, and the need for subsequent small finger carpometacarpal arthrodesis. All patients included in the study had a minimum 12-month follow-up. In group 1, 6 (9.1%) of 66 patients developed symptomatic posttraumatic arthritis and required a subsequent small finger carpometacarpal arthrodesis. In group 2, none of the patients developed symptomatic posttraumatic arthritis or required arthrodesis. This study reports a relatively higher rate of small finger carpometacarpal arthrodesis after closed treatment alone for intra-articular small finger carpometacarpal fractures compared with open treatment, suggesting that anatomic alignment is important in this injury pattern.

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Small finger intra-articular carpometacarpal joint fractures and associated joint subluxation/dislocation are relatively common hand injuries typically resulting from an axial load to a clenched fist.\(^1\)\(^2\) They can be easily missed in the emergency room setting with inadequate imaging, namely the absence of a true lateral or oblique view of the hand or wrist. When missed or insufficiently treated, these injuries can result in persistent hand pain and dysfunction, often as a result of chronic instability or secondary joint degeneration.\(^3\)

Despite the frequency of small finger intra-articular carpometacarpal fractures, a paucity of published data exists on the natural history of these injuries. The percentage of patients who develop posttraumatic arthritis and whether such patients become symptomatic is relatively unknown. Moreover, controversy exists as to when surgical fixation is appropriate.\(^2\)\(^4\)\(^5\) Surgical treatment is often recommended for small finger intra-articular carpometacarpal joint fractures that are irreducible or demonstrate recurrent instability, but those injuries that simply display intra-articular comminution or 1 to 2 mm of stepoff fall into a grey area. These injury patterns are often treated with closed reduction with presumed anatomic reduction, but it is unclear whether this minimal stepoff or comminution contributes to the development of symptomatic degenerative changes postoperatively.

The goal of this study was to analyze the rate of symptomatic posttraumatic arthritis following small finger carpometacarpal joint fractures treated with either cast immobilization alone or open reduction and pinning. The hypothesis was that patients would achieve good clinical outcomes with either treatment method.

**Materials and Methods**

After the institutional review board approved the study protocol, the authors performed a chart review of all patients with acute small finger intra-articular carpometacarpal fractures who presented within 1 week of the injury over a 5-year period. After initial identification and inclusion into the study groups, some patients had follow-up beyond the initial 5-year identification period. Based on the diagnosis and treatment criteria, 91 patients were identified. Eighty-two patients were included in the study based on minimum 12-month follow-up data.

All 9 patients excluded due to lack of adequate follow-up did not undergo surgical treatment. An initial attempt at closed reduction was performed in all patients in the study population, and postreduction joint stability and quality of the reduction were assessed by the senior author (D.B.). Operative indications included displaced irreducible small finger intra-articular carpometacarpal fractures and recurrent small finger carpometacarpal joint instability after attempted reduction at the time of presentation. Patients who demonstrated radiographic joint congruency and clinical stability after reduction were treated with cast immobilization.

Group 1 included 66 patients with small finger intra-articular carpometacarpal fractures who were treated with cast immobilization alone for 6 weeks, whereas group 2 included 16 patients treated surgically. Cast immobilization was continued for 6 weeks to limit the risk of fracture displacement and nonunion. Clinical outcome parameters included posttreatment serial radiographs, a visual scale based on subjective pain scores (0-10) as part of a routine clinic intake form, and the need for subsequent small finger carpometacarpal arthrodesis. Radiographs at final follow-up were evaluated by a fellowship-trained musculoskeletal radiologist (J.K.). The radiologist graded the degree of carpometacarpal joint arthritis based on the following previously published scale: grade 0 is a normal joint, grade 1 is slight joint space narrowing, grade 2 is marked joint space narrowing with osteophytes, and grade 3 is an obliterated joint space with marked osteophyte and cyst formation.\(^6\) The other joints in the hand were evaluated for any baseline degenerative joint disease. Subjective evaluation of the ability to make a full fist was used as the measure of functional disability at final follow-up. Pain was considered symptomatic if patients complained of it and felt it hindered their activities of daily living.

**Surgical Technique**

All patients acutely taken to the operating room (group 2) were treated with open reduction through a dorsal approach with fixation using 3 to 4 Kirschner wires for fracture fixation, after visual and radiographic confirmation of anatomic reduction. The patients were placed in a short arm cast for 6 weeks, followed by pin removal (Figures 1, 2).

A dorsal approach to the small finger carpometacarpal joint was used for open fusion procedures. Fixation was performed using a mini-fragment plate and screws. All patients were immobilized for 6 weeks (a splint for 1 week followed by a short arm cast). After radiographic union was confirmed, all patients underwent a short course of supervised occupational therapy.

The results of the 2 groups of patients were analyzed via the Student’s \(t\) test for continuous variables and the Fisher exact test for categorical variables. Statistical significance was set at a \(P\) value less than \(0.05\). Based on the results and power analysis, 373 patients were needed to detect a large difference in fusion rate between the 2 groups.

**Results**

All 82 patients included in this study had at least 12-month follow-up (group 1: average, 14 months [range, 12-36 months]; group 2: average, 62 months [range, 28-113 months]). In group 1, 6 (9.1%) of 66 patients developed symptomatic posttraumatic arthritis and required a subsequent small finger carpometacarpal arthrodesis (Table). None of the patients in the study was involved in workers’ compensation. Average patient age was 34.1 years in group 1 and 32.8...
years in group 2 ($P=.73$). Group 1 comprised 10 women and 55 men, and group 2 comprised 2 women and 14 men ($P=1$). One of 6 patients from group 1 who underwent fusion was a woman. All 6 patients who underwent arthrodesis due to clinical criteria, notably pain reported 7 or higher on a 0 to 10 visual scale, also demonstrated grade 3 changes on their preoperative radiographs. The 6 patients who underwent subsequent arthrodesis had the surgery at an average of 24.6 months following the initial injury and had an average postoperative follow up of 75.9 months (minimum, 25.3 months). These patients worked full-time at their preinjury occupations at the time of their arthrodesis and returned to the same occupations postoperatively.

Of the patients who did not undergo arthrodesis in group 1, thirty-two demonstrated grade 1 changes, 18 demonstrated grade 2 changes, and 10 demonstrated grade 3 changes. At final follow-up, all patients were asymptomatic and were able to make a full fist. In group 2, no patient developed symptomatic posttraumatic arthritis or required arthrodesis. Of the 16 patients, 12 demonstrated grade 1 changes and 4 demonstrated grade 2 changes; no patient demonstrated grade 3 changes. All patients in both groups achieved union documented on their last available follow-up radiographs.

In terms of pain score comparison between the groups with specific arthritis grading, average pain scores in patients with grade 1 changes were 1.28 and 0.83 in groups I and II, respectively ($P=.27$) (Figure 3). Average pain scores in patients with grade 2 changes were 2.11 and 2.01 for groups I and II, respectively ($P=.93$). For the 16 patients in group 1 who had grade 3 changes, average pain score was 9.31. No patient in group 2 had grade 3 changes.

**DISCUSSION**

The goal of this study was to analyze the rate of symptomatic posttraumatic arthritis following small finger intra-articular carpometacarpal joint fractures treated with cast immobilization alone or open reduction and internal fixation. The authors compared the rate of symptomatic posttraumatic arthritis in patients treated nonoperatively vs operatively. The current literature suggests that patients in each group would have similar good outcomes.$^{2,4,5,7}$ However, the current study revealed that approximately 9.1% of the patients who were initially treated nonoperatively developed radiographic evidence of arthritis that was symptomatic within 1 year and elected to undergo subsequent carpometacarpal arthrodesis. Conversely, no patient who underwent open reduction and internal fixation initially had to undergo subsequent arthrodesis, despite having a longer follow-up period.

In addition, despite the fact that all 82 patients in this study developed some radiographic signs of arthritis (44 patients with grade 1, twenty-two with grade 2, and 16 with grade 3), only 6 (7.2%), all of whom had grade 3 changes, had significant pain and disability from this arthritis. Therefore, 92.8% (76/82) of patients with radiographic signs of arthritis of their small finger carpometacarpal joint had no or minimal complaints of pain in that joint. Only 37.5% (6/16) of those with severe grade 3 posttraumatic arthritis had clinically significant symptoms, suggesting that some other factors, such as slight malreduction, can lead to symptomatic degenerative changes. Alternatively, patients who require arthrodesis of the small finger carpometacarpal joint following...
attempted conservative management can expect to have a good postoperative result after arthrodesis based on this study’s follow-up data.

Available literature-based evidence is scarce with regard to the treatment strategy of intra-articular small finger carpometacarpal joint fractures. Inadequate reduction seems to be the culprit of suboptimal functional outcome. In a small case series of 14 patients treated nonoperatively, 1 patient developed symptomatic arthritis at 4.5-year follow-up, but in another case series, 38% of patients reported significant residual discomfort at 4.3-year follow-up, regardless of treatment method.

The main strength of the current study is that it is one of the largest series in the literature to evaluate the outcomes of small finger intra-articular carpometacarpal fractures, comparing initial treatment methods of nonoperative vs operative treatment. The study has some limitations. Despite being one of the largest series in the literature, the study is still underpowered to detect significant differences in the rate of fusion between the patients initially treated with nonoperative management vs open reduction and pinning. Furthermore, the retrospective nature of the study prevents the establishment of a causal relationship, and validated pain or disability measurements were not used. Radiographic measures and clinical documentation were relied on to assess outcomes. In terms of patient numbers, a significantly larger number of patients were treated nonoperatively than operatively. Such a discrepancy could have skewed the data. With a greater number of patients in the surgical group, an increase may been seen in the development of posttreatment arthritis and a subsequent need for arthrodesis. Lastly, the minimum follow-up period of 12 months may not have been long enough to accurately assess for the development of posttraumatic arthritis, but in the absence of prospective or longer-term retrospective studies with clinical and radiographic follow-up, the authors present clinically relevant data for patient education and further studies.

Despite these limitations, the authors believe that this study is valuable because the results confirm the high incidence of posttraumatic arthritis in patients with small finger intra-articular carpometacarpal fractures treated operatively and nonoperatively. The fact that more patients developed posttraumatic arthritis following nonoperative treatment is important for hand surgeons to understand when treating these injuries in the acute setting. This study suggests that near-anatomic articular surface reduction at the time of initial treatment may be more important in terms of preventing future symptomatic posttraumatic arthritis than was previously thought, based on the available literature. Near-anatomic reduction in this patient population can be challenging, and the quality of the reduction may be the difference between a symptomatic and asymptomatic joint in the presence of posttraumatic degenerative changes. Small finger intra-articular carpometacarpal fractures treated with casting alone may lead to a higher-than-expected rate of symptomatic posttraumatic arthritis and require subsequent arthrodesis. The quality of initial reduction may play an important role in the development of symptomatic degenerative changes.

REFERENCES
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