

Surgical treatment for persistent second carpometacarpal joint pain

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Abstract

The purposes of this study were to demonstrate the clinical characteristics of patients with persistent second carpometacarpal (CMC) joint pain without bony abnormalities known as the carpal boss, and to assess the clinical efficacy of surgical stabilization of the second CMC joint. Eleven patients had persistent wrist pain with characteristic symptoms, including tenderness over the second CMC joint, increased symptoms when the involved hand was placed on the ground or gripped strongly with the involved hand, a positive metacarpal stress test and temporary pain relief with the intra-articular injection of the lidocaine. The patients underwent arthrodesis of the second CMC joint. All cases showed radiologically confirmed fusion of the second CMC joint. At the final follow-up examination, 10 of 11 patients resulted in satisfactory clinical outcomes, excepting one patient with remnant pain and restricted range of wrist motions. This report highlights the importance of conducting a careful assessment of patients who present with persistent second CMC joint pain without the bony abnormalities, such as carpal bossing. Surgery to stabilize the second CMC joint may be an option to improve their symptoms when conservative treatment fails.

Introduction

Atraumatic pain distal to the wrist joint occasionally occurs in individuals in all ages in association with repetitive hand activities in sport, work or daily living. Persistent pain can subsequently present with pathologies such as instability and/or osteoarthritis; these pathologies are mainly located at the thumb carpometacarpal

(CMC) joint or the scaphoid-trapezium-trapezoid joints.

A carpal boss is an uncommon painful pathology characterized as the presence of a bony protrusion at the second and/or third CMC joints.¹ Anatomically, the second and third CMC joints form rigid structures that consist of a solid bony configuration and several ligaments.² Although the exact pathogenesis of carpal boss remains unclear, degenerative alteration secondary to instability or conflicting mobility at the second and/or third CMC joints may correspond to symptomatic carpal boss.³ Previous studies have demonstrated the prevalence of bony pathologies at the second or third CMC joints may be approximately 1–19% in the elderly population.^{4,5} In addition, bony pathologies in the second/third CMC joints can sometimes be observed in younger individuals. A recent study reported the appearance of bony abnormalities in the joints in 13 of 16 professional ice hockey players, and indicated a potential mechanism of the occurrence: repetitive loading at the originally rigid CMC joints might cause the pathology.⁶

Based on these reports on carpal boss, we hypothesized that the second CMC joint could cause persistent pain not only in patients with bony pathologies such as carpal boss, but also in those without obvious radiographic abnormalities, which might result from mechanical stresses due to repetitive hand activities. We therefore focused on the patients with persistent, localized pain at the second CMC joint and their characteristic clinical findings. In addition, we performed surgical treatment to stabilize the joint in patients who were diagnosed with second CMC joint pain without the appearance of carpal boss and in whom conservative treatment had failed.

The purposes of this study were to demonstrate the characteristics of clinical symptoms in patients with persistent second CMC joint pain but without carpal bossing, and to investigate the clinical efficacy of arthrodesis of the second CMC joint in these patients.

Materials and methods

A retrospective study was approved by the institutional review board of our institute. Among outpatients who visited a single hand clinic from 2010 to 2018, eleven patients with a diagnosis of persistent painful second CMC joint were treated surgically (Table 1). At the first visit to the clinic, patients had experienced wrist pain that had persisted for a mean period of 6.4 months (range, 2 weeks to 14 months). Nine

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of 11 patients had visited other clinics and had been treated with oral non-steroid anti-inflammatory drugs, without a definitive diagnosis. All patients had the following characteristics: 1) tenderness over the second CMC joint, 2) increased symptoms when the involved hand was placed on the ground or gripped strongly with the involved hand, 3) a positive metacarpal stress test,⁷ and 4) temporary pain relief by intra-articular injection of the lidocaine into the second CMC joint. Imaging, including plain radiography, ultrasonography and CT and/or MRI, showed no signs of bony prominence on the second or third CMC joints or the os styloideum. In 4 patients, narrowing of the joint space less than 1 mm without bony abnormalities was identified at the second CMC joint on radiography.

After the diagnosis of persistent pain due to the second CMC joint at the clinic, all patients underwent conservative treatment, such as intra-articular injection and instruction to rest and wear a wrist orthosis, for a mean period of 7.7 months (ranged from 2 to 13 months), and consequently underwent surgical treatment because of their persistent pain.

Surgical treatment

Surgery was performed under local anesthesia with brachial plexus nerve block. A tourniquet was placed on the upper arm. A short transverse incision was created over the second CMC joint. The articular cartilage of the second CMC joint was resected. Using a surgical airtome, a rectangular trough measuring 5 mm in width and 10 mm in length was created on the dorsal cortex of the second metacarpal and trapezoid, passing through the second CMC joint. A cortico-cancellous bone graft was harvested from the distal radius or the ilium to be placed onto the trough. Osteosynthesis was then performed with cross-pinning or locking plate fixation. Postoperatively, the wrist was immobilized with a wrist orthosis for 4 weeks. Then, patients underwent range of motion (ROM) exercises, as well as grip and pinch strengthening exercises that were taught by hand therapists. The use of the involved hand for daily activities was encouraged at 8 weeks after surgery.

Assessments

Patients underwent postoperative follow-up for a minimum of 12 months. Their clinical findings, including the presence/absence of residual pain and the wrist ROM, were assessed. Postoperative clinical symptoms were assessed according to the Futenma classification, as follows: excellent (no symptoms), good (occasionally symptomatic without disturbance in activities of daily living), fair (some disturbance in activities of daily living, but an improved function in comparison to the preoperative condition) and poor (similar or worse function in comparison to the preoperative condition).⁸ To assess the subjective changes of the upper extremity function, the subjects' Hand10 scores⁹ were assessed before and after surgery. Plain radiographs (antero-posterior, and lateral views) were

examined during follow-up to identify fusion of the second CMC joint. In addition, CT or MRI was examined to identify pathological changes, such as arthritic changes or heterotopic ossification.

Statistical analysis

All statistical analyses were performed using the GraphPad Prism software program (version 5.0, San Diego, CA, USA). The Wilcoxon rank-sum test was used to compare the preoperative and postoperative Hand10 scores. P values of <0.05 were considered to indicate statistical significance.

Results

Postoperatively, rigid fusion at the second CMC joint was achieved in all cases. At the final follow-up (mean, 17 months; range, 12 to 36 months), the mean arc of wrist ROM was 129 degrees (standard deviation [SD], 29). Eight cases achieved excellent clinical outcomes without symptoms and 2 showed good outcomes; in one patient, however, residual pain on gripping strongly in daily activities and decreased range of wrist motions remained at the final follow-up examination at 12 months. Regarding the functional recovery after surgery, the Hand10 scores at the final follow-up examination were significantly improved in comparison to the preoperative Hand10 scores (mean [SD], 55.3 [11.4] to 6.5 [9.4], $P = 0.004$, Figure 1).

Case report #1

An 18-year-old male who was a college baseball player, experienced persistent pain in his non-dominant side wrist on batting. Temporary pain relief was obtained with an

intra-articular injection into the second CMC joint, and a metacarpal stress test was positive. Radiological imaging showed no signs of a bony prominence or os styloideum; however, fluid collection was observed in the second CMC joint (Figure 2A, 2B, 2C). Surgical treatment to stabilize the second CMC joint with cross-pinning was successfully performed (Figure 2D, 2E). The pins were removed at 3 months, and he returned to sports activities without symptoms at 6 months after surgery (Figure 2F, 2G).

Case report #2

A 44-year-old female who was a nurse experienced severe pain in her dominant side wrist during her daily work. No obvious abnormalities were observed on radiological imaging (Figure 3A, 3B, 3C). After receiving conservative treatment for 13 months, she decided to undergo surgical treatment (Figure 3D, 3E). At 5 months

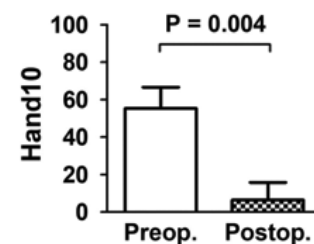


Figure 1. The changes of Hand10 scores assessed between pre- and postoperatively. The scores at the final follow-up were significantly improved in comparison to the preoperative scores ($P=0.004$).

Table 1. Patients characteristics who underwent surgical stabilization for persistent second CMC joint pain.

Case number	Age (years)	Gender	Involved side	Duration from conservative treatment to surgery (months)	Bony prominence	Radiologic findings Os styloideum	Joint narrowing
1	18	M	Non-dominant	2	-	-	-
2	44	F	Dominant	13	-	-	-
3	40	F	Dominant	5	-	-	-
4	62	F	Dominant	5	-	-	-
5	36	F	Non-dominant	7	-	-	+
6	28	F	Dominant	12	-	-	+
7	40	M	Dominant	10	-	-	+
8	24	F	Dominant	12	-	-	-
9	34	F	Dominant	4	-	-	+
10	31	F	Non-dominant	7	-	-	-
11	36	M	Dominant	8	-	-	-

after arthrodesis of the second CMC joint, she had no symptoms and returned to her job without restriction.

Discussion

To our knowledge, this report is the first study to focus on the pain at the second CMC joint in patients without bony abnormalities. These patients showed similar clinical symptoms to patients with carpal boss, including tenderness of the second CMC joint, and increased pain when placing the hand on the ground or gripping strongly with the hand. It is noteworthy that a positive metacarpal stress test can be helpful for diagnosing the presence of second CMC joint pain in the clinical setting. In addition, temporary pain relief after the interarticular injection of local anesthetics might be useful for determining the location of the symptoms.

Although several studies have investigated the clinical features of carpal boss, the pathogenesis of symptomatic bony protrusion is unclear. To date, degenerative osteophyte formation, sequela of prior trauma, or chronic remodeling of the bone related to extensor carpi radialis tendon attachment have been reported as potential causes of carpal bossing.¹⁰ Roulet et al.¹¹ suggested that the occurrence of bony protrusion at the joint may result in dorsal impingement and secondary degenerative osteoarthritis without disruption at the true joint surface. Based on the evaluation of our cases of persistent second CMC joint pain without bony abnormalities, we hypothesize that the symptoms might present in patients with latent or immature carpal bossing. Thus, hand surgeons should note the existence of the current pathologies if they encounter a case with persistent pain around the wrist joint.

When conservative treatment failed, surgical treatment was performed to stabilize the second CMC joint. In the literature, symptomatic carpal bossing may require surgical treatment, such as the removal of the bony prominence or arthrodesis of the second/third CMC joints.¹² In cases of persistent pain without carpal bossing, stabilization of the second CMC joint can be an effective option for improving the clinical function and relieving symptoms. On the other hand, we should note that one patient continued to experience pain with a decreased range of motion.

The present study was associated with some limitations. First, the number of patients was relatively small and the follow-up period was 12 months. Second, it was a



Figure 2. Case 1: an 18-year-old male. Preoperative radiographs (A, B) and MRI (C) showed the second CMC joint without carpal bossing but with mild intraarticular fluid collection. Postoperative radiographs (D, E) showed stabilized second CMC joint with cross-pinning, and CT at 6 months (F, G) showed rigid fusion at the joint.



Figure 3. Case 2: a 44-year-old female. Preoperative radiographs (A, B) and MRI (C) showed the second CMC joint without carpal bossing or degenerative changes. Surgical stabilization with cross-pinning was successfully performed (D, E).

retrospective study; thus, we should note that decisions regarding surgical treatment were made at the surgeons' discretion. Third, we did not collect patients who were successfully treated with conservative treatment alone; thus, optimal protocol and the efficacy of conservative treatment remain unclear. Further studies to prospectively investigate conservative treatment and radiological progression would be important to identify patients who require surgical treatment.

Conclusions

In conclusion, we demonstrated cases of second CMC joint pain without bony abnormalities such as carpal bossing. When conservative treatment fails, surgical treatment to stabilize the second CMC joint may be an option to improve the symptoms of these patients.

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