Surgical Techniques for the Management of Midcarpal Instability

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Abstract

Keywords

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- carpus
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Palmar midcarpal instability (PMCI) is an uncommon and poorly understood disorder. Its etiology is believed to be due to traumatic or congenital laxity of the ligaments (volar and dorsal) that stabilize the proximal row. This laxity results in hypermobility of the proximal carpal row and unphysiologic coupling of the midcarpal joint. Clinically, the condition is manifested by a painful clunk with ulnar and radial wrist deviation. The purpose of this article is to chronicle our personal experience with this condition and to review our current treatment recommendations and outcomes.

PMCI is characterized by kinematic dysfunction of the proximal carpal row and is often associated with a painful ulnar catch-up “clunk” as the wrist moves from radial to ulnar deviation. Clinical and laboratory findings suggest that palmar midcarpal instability is caused by a functional loss of midcarpal constraints, primarily the dorsal radiocarpal (dorsal radiocarpal) ligament and the ulnar arm of the palmar arcuate ligament, which permits hypermobility of the proximal carpal row.

Management of PMCI should always begin with a trial of non-operative management. This includes the use of activity modification, non-steroidal anti-inflammatory medications, proprioceptive retraining, and splinting. In our experience, non-operative management has proven effective in the management of most symptomatic PMCI patients. However, surgical management is an option for those that do not respond to non-operative treatment.

Surgical management of PMCI has been limited in the past with small numbers and limited follow-up available. Here we present multiple surgical techniques preferred by the authors for the management of PMCI that has not responded to non-operative management.

Surgical Techniques

Extensor Carpi Ulnaris Ligament Reconstruction

Between 1981 and 1989, we performed 15 surgical procedures in 13 patients with symptomatic palmar midcarpal instability that had failed non-operative management.¹ Nine of the 15 procedures performed were to address the PMCI with soft-tissue procedures, including rerouting of the ECU tendon to stabilize the triquetrohamate joint. The remaining 6 procedures consisted of limited midcarpal arthrodesis.

All of the extensor carpi ulnaris (ECU) rerouting soft-tissue procedures failed at an average of 48 months of follow-up, leading the authors to believe that perhaps limited midcarpal arthrodesis might be a more definitive surgical procedure.

Dorsal Reefing

In patients with mild to moderate PMCI (symptomatic clunking that can be prevented with dorsally directed pressure on the pisiform or trapezoid ridge), reefing of the dorsal radiocarpal ligament is our preferred method of surgical treatment. The dorsal radiocarpal ligament is one

of the primary stabilizers of the midcarpal joint, and reefing has been shown to provide enough stability intraoperatively to eliminate positive findings on examination for midcarpal shift.

Technique

The patient is placed in the supine position with the affected upper extremity on an arm table, with all soft-tissue and bony prominences well-padded in standard fashion. An 8 to 10 cm longitudinal skin incision is made, centered over Lister's tubercle, and full-thickness skin flaps are created over the extensor retinaculum. The extensor pollicis longus is retracted from the third dorsal compartment and the retinaculum of the fourth compartment is divided for 1 cm proximal to its distal edge. The extensor pollicis longus and dorsal wrist extensors are retracted radially, and the common finger

extensors are retracted ulnarly to expose the dorsal wrist capsule. The dorsal radiocarpal ligament is identified originating from the ulnar one-third of the radius and inserting on the dorsal aspect of the triquetrum. The ligament is divided transversely by making a 3-cm incision in the dorsal wrist capsule 1 cm distal to the end of the radius, with the patient's wrist distracted. The distal capsular flap is pulled proximally to correct the VISI alignment of the lunate and proximal row. (**►Fig. 1**)

Next, neutral alignment of the proximal row and collinear alignment of the capitate, lunate, and radius are confirmed using fluoroscopy. At least one 0.045-in Kirschner wire is placed subcutaneously from the triquetrum to the capitate to maintain midcarpal alignment during suturing. Two rows of sutures are placed in "pants-over-vest" style to shorten the dorsal capsule and maintain tension on the

Fig. 1 Dorsal capsular reefing. (a,b) An incision is made in the dorsal capsule. (c) The VISI deformity is corrected by pulling the distal flap of the capsule and the DRTL proximally. This rotates the proximal carpal row around its axis. (d) Two rows of sutures are placed in "pants-over-vest" fashion to maintain capsular tightening.

proximal row. Lateral fluoroscopic views are checked again to confirm collinear alignment of the capitate, lunate, and radius. The skin is closed, and a well-padded short arm cast is placed with the patient's wrist in neutral position. The pin(s) is/are removed at 8 weeks, and gentle active range-of-motion exercise is begun at 12 weeks postoperatively.

Results

Lichtman et al¹ performed a retroactive comparison of volar soft-tissue reconstruction (advancement of the arcuate ligament) and midcarpal fusion in 1993.¹ The results confirmed that midcarpal arthrodesis was a more reliable procedure, and the volar ligament procedure was abandoned. More recently, however, Lichtman has been performing dorsal capsular reefing for mild to moderate cases. Although long term outcome studies are unavailable, the authors feel that this procedure has provided good results (return to work, no further clunking) in the short term.

Limited Midcarpal Arthrodesis (Triquetrohamate or Capitollunate-Triquetrohamate)

Midcarpal arthrodesis is indicated for patients with severe PMCI (a painful clunk that cannot be prevented by dorsally directed pressure on the pisiform) or those in whom clunking has recurred despite soft-tissue reconstruction. Triquetrohamate or capitollunate-triquetrohamate (four-corner) fusion may be used, but we think that four-corner fusion creates a more solid fusion mass. Both procedures may result in radial-sided wrist pain, perhaps because of secondary hypermobility at the scapholunate joint.

Technique

To begin, a dorsal approach to the wrist capsule is made as described above, or a ligament-sparing incision may be used, if preferred. A longitudinal 6-cm incision is made in the wrist capsule to expose the midcarpus. The joint spaces between the carpal bones to be fused are identified, and a high-speed burr is used to denude articular cartilage and any ligamentous material from the appropriate joint spaces. Care is taken to leave approximately one-third of the palmar articular cartilage intact to maintain the external carpal architecture. Proper alignment of the capitate on the lunate is essential and confirmed by fluoroscopy.

For four-corner fusion, 0.045-in Kirschner wires are advanced percutaneously from the triquetrum into the lunate, from the hamate and the capitate into the lunate, and from the triquetrum into the capitate. Alternatively, headless compression screws, surgical staples, or circular plates may be used. The intercarpal spaces are packed with cancellous autograft from the radial styloid or iliac crest, with care taken to maintain the normal spatial relationships of the carpals. We do not perform scaphoidectomy as part of the four-corner fusion, although theoretically it might prevent future pain because of secondary scapholunate instability. A well-padded short arm wrist splint is applied postoperatively and changed

to a short-arm cast after suture removal. The cast is worn until radiographic healing is evident.

Outcomes

Four-corner fusion combined with scaphoid excision has shown success in the treatment of scapholunate advanced collapse (SLAC) wrist, with low rates of nonunion and high patient satisfaction scores. The procedure has not been as widely used in the management of PMCI, but limited results indicate that it can provide good results for patients with severe symptoms. In addition to our series reported above, several other authors have reported results from midcarpal fusion. Goldfarb et al² reported that 7 of 8 patients (88%) who underwent four-corner arthrodesis for PMCI were satisfied with the surgery, and 6 of 8 patients (75%) had no pain or mild pain. Rao and Culver³ had less success in treating PMCI with midcarpal fusion, with only 6 of 11 wrists (55%) in 10 patients having good or excellent results. However, they used a limited triquetrohamate arthrodesis rather than a four-corner fusion.

Discussion

PMCI is a complex kinematic dysfunction of the proximal carpal row. While significant advances in the understanding of midcarpal instability have occurred in the past 30 years, there continues to be a lack of information regarding definitive surgical management of this condition.

Early operative management by Lichtman et al¹ used multiple operative procedures, including tendon rerouting, volar soft tissue reefing, and limited midcarpal arthrodesis. Results from this early experience showed a significant failure rate associated with tendon rerouting and volar soft tissue reefing, but limited midcarpal arthrodesis showed good results at long-term follow-up. Later studies performed by Goldfarb et al and Rao et al confirmed Lichtman et al's operative experience with limited midcarpal fusions by demonstrating improved patient satisfaction and outcomes in extremely symptomatic patients. In recent years, we have been performing dorsal capsular reefing in mild to moderate cases, with anecdotal results indicating reliable relief from clunking and pain.

Based on our experience and the published results of others, we suggest stratifying patients with symptomatic midcarpal instability and always undergoing a trial of nonoperative management after diagnosis. For patients with mild to moderate symptoms that have failed nonoperative management, we advocate soft tissue procedures alone, such as dorsal reefing as described above. For patients with severe symptoms that have failed nonoperative management, we recommend limited midcarpal fusion. The studies supporting these recommendations are limited with small numbers, and, therefore, there remains a significant opportunity for further research in the operative management of midcarpal instability.

Conflict of Interest

None

References

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