A New Technique for the Treatment of Midcarpal Instability

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Abstract

Extensor carpi radialis brevis (ECRB) transfer to the hamate bone is a novel procedure that offers a new surgical treatment option for select patients with midcarpal instability (MCI) who do not respond to conservative treatment. We present our early experience with this procedure. In total, 12 patients (13 wrists) were reviewed with a follow-up duration ranging from 1 to 6 years. Complications and changes in active range of motion (AROM) were noted. Patient related outcome was measured using the Patient Rated Wrist/Hand Evaluation (PRWHE) questionnaire, amongst others. Two patients failed to show a positive response to the surgery. ECRB transfer to the ulnar side of the wrist is a new procedure that offers a potential option for the surgical treatment of MCI in select patients; however, further biomechanical and clinical studies are required. The level of evidence for this study is IV (therapeutic).

Keywords

- midcarpal instability
- wrist
- tendon transfer
- treatment

Midcarpal instability (MCI) remains a challenging clinical entity and can be subdivided into extrinsic MCI and intrinsic MCI. The former type results from injury outside the carpus, and the latter is caused by insufficiency or injury of one or more radiocarpal or midcarpal ligaments. Intrinsic MCI can further be classified into anterior, posterior, or combined anterior and posterior MCI. Although Garcia-Elias published an elegant overview of the several tests that can be of help in the diagnosis and subclassification of intrinsic MCI, it is often difficult to distinguish reliably between these categories in the clinical situation.¹ MCI is not uncommon and usually presents in young patients with hypermobile joints and rarely result from a specific injury; however, a trivial trauma, overuse, or repetitive stress may play a role in eliciting symptoms.

There is general agreement that these patients should initially be treated nonoperatively; most importantly, re-establishing adequate proprioceptive control of the proximal row should be strived for. Additionally, activity modification to avoid painful clunking of the wrist, nonsteroidal anti-inflammatory drugs (NSAIDs), and splinting using a three-point pisiform support splint are indicated. Most cases respond

well to this conservative treatment. Ultimately, in the occasional patient, operative treatment can be indicated. Suggested surgical treatments vary greatly in literature and include electrothermal capsular shrinkage,^{2,3} open or arthroscopic repair or reefing of midcarpal soft tissue,⁴ ligament reconstruction,^{1,5–7} limited arthrodesis,^{4,8} and, in severe cases, midcarpal fusion.⁹ Some of these options are specifically meant for one of the three clinical forms of intrinsic MCI, but, as mentioned before, the distinction between these forms can be difficult. Most importantly, all of these reported options have in common that they either suffer from limited experience, lack adequate follow-up, or show mixed results.

Some of these, in part experimental, options require extensive surgery with permanent limitation of wrist motion. Others provide a static solution for a dynamic problem of the wrist. This is why we proposed a new and easy surgical technique that in theory addresses the symptomatic MCI in a dynamic way but also has the advantage that it does not limit wrist motion postoperatively.¹⁰ In this paper we describe the surgical technique and present our preliminary experience in 12 patients.

Patients and Methods

Study Design

Twelve patients (13 wrists) with intrinsic MCI were treated with a new surgical technique utilizing an extensor carpi radialis brevis (ECRB) transposition performed by the first author (M.J.P.F.R.) from 2008 to 2013 in two institutions. In both institutions, by means of the written informed consent, patients agree to the use of clinical data, which is part of the routine follow-up for research purposes. This is authorized by the local Institutional Review Board of both institutions. Unfortunately, both institutions started using routine prospective patient reported outcome measurements only in 2012. Therefore, in the first eight patients we performed a retrospective chart review with a follow-up ranging from 2 to 6 years. Complications and changes in active range of motion (AROM) were noted. Additionally, patients were asked whether they would undergo the procedure again, whether they had any complaints during activities of daily living (ADL), whether they experienced pain, and whether the wrist felt more stable. In four patients, operated in 2012, prospective data could be gathered and compared with the outcome one year after operation. In this group, in addition to the aforementioned measurements and questions, grip strength was measured, and the Patient-Rated Wrist/Hand Evaluation (PRWHE; Dutch language version) and one visual analog scale (VAS) for measuring pain at rest and a separate VAS for pain during activity were administered pre- and postoperatively. Patients were considered surgical candidates when they still had significant pain and functional impairment during ADL after failing a period of adequate conservative treatment of at least one year. All patients had bilateral congenital laxity of the wrist of some degree and demonstrated a typical sag of the wrist in palmar direction. However, they became symptomatic on only one side after a relatively mild or trivial trauma. None of the candidates had previous surgery.

Operative Technique

Regional axillary anesthesia was utilized in most cases; however, sometimes, based on the patient's preference, the procedure was performed under general anesthesia. No prophylactic antibiotics were administered. An upper arm tourniquet was used to improve visualization. The patient was positioned supine on an operating table with the arm abducted 90° on a hand table. The wrist was prepped and draped to the level of the elbow.

This new technique uses only a dorsal approach. A 4-cm longitudinal middorsal incision centered over the distal carpal row (►Fig. 1) usually suffices to reach both the insertion of the ECRB on the base of the third metacarpal as well as its new insertion, i.e., the central, dorsal region of the hamate bone. The incision is carried down to the extensor retinaculum of the fourth compartment, taking care not to damage branches of the dorsal sensory nerves and major veins. Distal of the extensor retinaculum, the insertion of the ECRB is identified. Next, the central, dorsal region of the hamate bone is identified, using a slit in the dorsal capsule covering the hamate bone. The capsule here consists largely of

Fig. 1 Incision through which the whole procedure can be performed. Here, first the extensor carpi radialis brevis insertion is identified.

the dorsal intercarpal ligament or dorsal radiocarpal ligament, and the slit runs parallel with the course of the fibers of this ligament. It is not necessary to use fluoroscopy, as one can orient oneself easily looking through this slit and using the joint edges between hamate and triquetrum and hamate and capitate as reference points. A sturdy bone anchor is inserted in the center of the hamate bone, preferably armed with two nonresorbable sutures. The ECRB is then detached from the base of the third metacarpal and transposed (►Figs. 2a, b), staying palmar to the extensor digitorum communis (EDC) tendons, to the dorsal aspect of the hamate, where it is firmly attached under near maximum tension using the two sutures of the bone anchor. Alternatively, a bone interference screw can be used to attach the transposed tendon onto the hamate bone. Care should be taken that there is a gradual and unhampered course of the ECRB exiting the second extensor compartment all the way toward its new insertion point onto the hamate. Finally, the slit in the capsule is repaired and imbricated using nonabsorbable sutures to cover the ECRB insertion (►Fig. 3). The tourniquet is deflated and hemostasis is achieved with bipolar cautery. The skin is closed according to surgeon preference, followed by a bulky dressing. A protective volar splint is applied.

Postoperative Management

Immediately postoperatively, early AROM exercise of the fingers, including the metacarpophalangeal joints, is encouraged. Two weeks postoperatively, the splint is removed and a vigorous rehabilitation program is initiated. Besides AROM exercises of the wrist and (isometric) muscle strengthening, this program includes exercises that improve proprioceptive stability of the wrist through neuromuscular control. From that point on, a removable splint or brace is used only during

Fig. 2a, b (a) Cadaver specimen and (b) artist impression in which the transposition of the ECRB is depicted. The ECRB should course palmarly to the extensor digitorum communis tendons toward the hamate.

heavy activities and is weaned as soon as possible during the weeks that follow.

Results

Records of all consecutive patients who were operated were available for review. There were seven male and five female patients with an average age of 23 years (17 to 46 years). In these 12 patients, seven left wrists and six right wrists were operated. Nine of the 12 patients were right hand dominant. Although there were no complications, there were two frank failures. One male patient reported no improvement at all 7 months postoperatively and demanded a midcarpal fusion, which he had undergone with a very satisfying outcome on

the contralateral side for the treatment of a severe MCI. One young female patient remained symptomatic and was not satisfied with the result of the operative treatment. In the remaining 10 patients (11 wrists), results overall were quite consistent and good. All of the 10 patients reported a more stable wrist with significantly less pain. There were no or considerably fewer complaints during ADL, and all would undergo the procedure again. One year postoperatively, there was no noticeable change in AROM. In the four patients who were followed prospectively, grip strength did improve postoperatively and approached that of the contralateral side but stayed somewhat lower than the age- and gender-corrected reference values. The results for PRWHE, pain at rest, and pain during activity are presented in ►Table 1.

Fig. 3 Finally, the slit in the capsule is repaired and imbricated using nonabsorbable sutures to cover the ECRB brevis insertion.

Discussion

Establishing the exact subtype of intrinsic MCI in symptomatic patients remains difficult, although much new insight has been gained during recent years. With the possible exception of anterolateral midcarpal instability, the remaining types of intrinsic MCI still are somehow aggregated with regard to treatment strategies. There is consensus that the vast majority of these patients respond well to conservative treatment.¹ However, when it comes to surgical options, in case nonoperative treatment fails, there is a plethora of possibilities available in the literature: electrothermal capsular shrinkage,^{2,3} open or arthroscopic repair or reefing of midcarpal soft tissue,⁴ ligament reconstruction,^{1,5-7} limited arthrodesis,^{4,8} and, in severe cases, midcarpal fusion.⁹ Many of the soft tissue repairs aim toward repairing, reconstructing, or augmenting the ligaments that fail to support the ulnar side of the wrist. Moreover, some of these options have the disadvantage that they require quite extensive surgery with permanent limitation of wrist motion. Recently, a surgical technique was described using also a (hemi) ECRB to correct a recurrent MCI in the hypermobility type of Ehlers-Danlos syndrome.⁷ This technique leaves the insertion of the tendon intact, requires both a dorsal as well as a volar approach, and

Table 1 Results of the four patients who were followed prospectively (1-year follow-up)

	PRWHE		VAS Rest		VAS Activity		TAROM Flexion-Extension	
Patient (M/F)	Preop	Post-op	Preop	Postop	Preop	Postop	Preop	Postop
Aer (M)	77	11	6	0	10	3	160	160
Sal (M)	67	13	4	0	9	2	160	150
Vel (F)	70	17	4	2	9	3	180	175
Alo (F)	79	15	4	1	8	3	180	180

Abbreviations: F, female; M, male; PRWHE, Patient Related Wrist/Hand Evaluation (only part 2 and 3, functionality and cosmesis respectively, of the Dutch Language Version was used, where 0 is the best possible score and 110 the worst possible score; TAROM, Total Active Range of Motion; VAS, visual analog scale (0 is the best possible score, 10 the worst possible score).

concentrates more on realignment of the lunocapitate joint. The authors concluded that their technique may provide a solution for recurrent MCI and that the use of an autologous tendon seems feasible despite a background of abnormal collagen metabolism.

In one male patient of our series the technique failed, but in hindsight, we believe that this patient was wrongly indicated for this treatment. He was a heavy manual laborer and extremely hypermobile and was much more satisfied with a midcarpal fusion that he had earlier undergone contralaterally. Seven months after the initial surgery he demanded conversion into a midcarpal fusion, which was performed shortly thereafter with good outcome. The other dissatisfied patient continued to experience complaints, and she reported that except for the scar, nothing had changed for her.

This study has many limitations. First, in this small series the data of only four patients were prospectively collected. All other patients were retrospectively reviewed. Second, we did not perform any statistical analysis because of the small sample size in each of these groups. Third, and perhaps most importantly: the positive outcome could be the result of more than one reason. Indeed, the ECRB could in theory actively balance the ulnar side of the wrist, but to date we do not have any proof for this. On the other hand, our findings could be the result of the reefing or imbrication of the dorsal capsule over the hamate. Finally, the vigorous training program based on re-establishing adequate proprioceptive control of the proximal row could be responsible for the results. To assess this new procedure fully, biomechanical studies are required as well as prospective clinical studies with a larger cohort of patients and adequate follow-up.

Conflict of Interest
None

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