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Peripheral tears of triangular fibrocartilage complex: results of primary repair

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Abstract In 16 patients with ulnar wrist pain, we performed primary arthroscopic or open repair of the peripheral rim tears of the triangular fibrocartilage complex (TFCC) (14 ulnar, 4 volar, and 3 radial tears). The wrist function was assessed before and 1 year after the repair using the Mayo-modified wrist score. The average pain score improved from 9.1 ± 8.0 to 21.2 ± 6.5 , the average functional score from 5.0 ± 8.1 to 20.6 ± 6.3 , the average motion score from 4.7 ± 2.8 to 15.6 ± 7.3 , and the average grip point from 4.4 ± 3.5 to 15.6 ± 7.7 , all with significant differences ($P < 0.01$). Ten of the 17 cases had instability of the distal radioulnar joint and five had recurrent instability after repair.

Résumé Chez 16 patients souffrant de douleurs ulnaires du poignet nous avons exécuté par voie endoscopique ou à ciel ouvert une réparation de déchirures périphériques du complexe fibrocartilagineux triangulaire (14 lésions ulnaires, 4 palmaires, 3 radiales). La fonction du poignet a été étudiée avant l'intervention et 1 année après en utilisant le Score du poignet modifié de Mayo. La cotation de la douleur a été améliorée de 9.1 ± 8.0 à 21.2 ± 6.5 , la cotation de la fonction de 5.0 ± 8.1 à 20.6 ± 6.3 , la cotation de la mobilité de 4.7 ± 2.8 à 15.6 ± 7.3 , et la cotation de la préhension de 4.4 ± 3.5 à 15.6 ± 7.7 , avec, à chaque fois, une différence significative ($P < 0.01$). Dix des dix-sept cas avaient une instabilité de l'articulation radioulnaire distale, et 5 instabilités ont persisté après la réparation.

Introduction

Treatment of disruption of the triangular fibrocartilage complex (TFCC) includes a number of operative and

nonoperative options [1,3]. Choice of treatment is based on the duration and severity of the patient's symptoms, as well as findings of clinical and radiological examination and wrist arthroscopy.

Surgical treatment of disruption of the TFCC includes partial or total excision [8,11], ulnar recession [6], and either tenodesis or arthrodesis of the distal radioulnar joint [9,16]. Débridement or partial excision of a central tear of the TFCC (Palmer Class IA) has been accepted as the best means of eliminating painful dysfunction without jeopardizing wrist stability [15]. Repair of the peripheral disruption (ulnar, distal, or radial avulsion) of the TFCC (Palmer Class IB, IC, or ID) has been advocated as a treatment alternative because of the peripheral vascularity of the ulnar, volar and radial margins and their important roles in wrist stability [13, 14,17]. Although there have been some reports of encouraging results following repair of peripheral tears of the TFCC [4, 7,18], techniques and methods of repair varied. None of the reports mentioned an association with instability of the distal radioulnar joint. To evaluate the results of primary repair, we retrospectively reviewed a group of patients with peripheral tears of the triangular fibrocartilage.

Material and methods

The pertinent information on each one of the reported patients is shown in Table 1. Arthroscopy-assisted repair of radial tears of the TFCC was performed at the same sitting as diagnostic wrist arthroscopy. Ulnar tears were approached via a curved dorsoulnar wrist incision. The ulnocarpal joint was entered and the granulation tissue between the torn edge and the insertion site (ulnar fovea) was debrided and freshened to rough subchondral bone. Two double-ended, nonabsorbable sutures were inserted 2 mm radial to the torn edge of the TFCC and drawn over the ulna to the ulnar side of the extensor carpi ulnaris. Before tying the sutures, manual reduction of dorsal subluxation of the ulnar head was performed in forearm supination, followed by transradioulnar K-wire fixation if needed. Volar tears were repaired via a zigzag volar incision over the ulnocarpal joint. After débridement and freshening of the torn edge, the ulnocarpal ligament was looped and fixed to the carpal bones with a pullout suture.

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Table 1 Patient characteristics. *P* pain, *F* functional status, *M* motion, *G* grip strength, *CT* computed tomography, *MRI* magnetic resonance imaging, *DRUJ* distal radioulnar joint

Case	Sex/ age (years)	Injury	Previous fracture	Delay from injury to surgery/ period of follow-up (months)	Image studies	Arthroscopic/ surgical findings*	Surgical treatment	Mayo score (P,F,M,G)		Results
								Preoperative	At follow-up	
1	M/62	Fell at home	Colles'	2/15	X-ray, ulnar styloid fracture	Ulnar tear	Open repair	15,0,5,5	25,25,25,15	Mild weakness of grip strength
2	M/52	Twisting		6/12	CT, DRUJ subluxation	Ulnar tear	Open repair	0,0,5,5	20,20,15,15	
3	M/30	Traffic accident		3/15		Radial tear	Arthroscopic repair	15,0,5,10	25,25,20,25	Back to work
4	M/41	Twisting		3/13	CT, DRUJ subluxation	Ulnar tear, volar tear	Open repair	0,0,0,5	15,15,5,5	Recurrent DRUJ subluxation
5	M/71	Fell at home	Colles'	2/15		Ulnar tear	Open repair	15,15,5,5	25,25,10,15	
6	F/72	Fell at home		2/14	MRI, DRUJ subluxation	Radial tear	Arthroscopic repair	0,0,0,0	25,25,15,15	Wrist swelling subsided
7	M/50	Traffic accident	Galeazzi'	3/15	X-ray, DRUJ subluxation	Ulnar tear	Open repair	15,0,5,0	25,25,25,25	Back to work
8	M/63	Lifting heavy object		5/15		Radial tear, volar tear	Arthroscopic repair	15,15,5,5	25,25,20,25	Back to work
9	M/20	Traffic accident	Galeazzi'	24/13	X-ray, DRUJ subluxation	Ulnar tear	Open repair	20,20,10,10	15,20,10,10	Recurrent DRUJ subluxation
10	F/23	Lifting heavy object		3/12	CT, DRUJ subluxation	Ulnar tear, volar tear	Open repair	0,0,5,0	0,0,5,0	Recurrent DRUJ subluxation
11	F/56	Traffic accident	Colles'	2/13	MRI, DRUJ subluxation	Ulnar tear	Open repair	0,0,0,0	25,20,10,15	
12	F/56	Traffic accident	Colles'	2/13		Ulnar tear	Open repair	15,0,5,5	25,25,25,15	
13	M/42	Fell at work		1/14	MRI, DRUJ subluxation	Ulnar tear, volar tear	Open repair	0,0,5,10	20,20,15,15	Recurrent DRUJ subluxation
14	F/64	Traffic accident	Colles'	10/15	X-ray, DRUJ subluxation	Ulnar tear	Open repair	15,20,5,5	25,25,20,25	Back to work
15	M/19	Traffic accident		2/14	MRI, DRUJ subluxation	Ulnar tear	Open repair	15,15,5,5	20,15,5,5	Recurrent DRUJ subluxation
16	F/28	Pushing heavy object		2/15	MRI, no DRUJ problem	Ulnar tear	Open repair	25,25,25,25	25,25,25,25	Back to work
17	F/79	Twisting		3/13		Ulnar tear	Open repair	0,0,5,0	20,20,15,15	Back to regular activities

Table 2 Mayo-modified wrist scores in 17 patients before and one year after primary repair of the triangular fibrocartilage complex

	Preoperative scores (Mean±SD)	Postoperative scores (Mean±SD)	P-value
Pain	9.1±8.0	21.2±6.5	0.001
Function	5.0±8.1	20.6±6.3	0.001
Motion	4.7±2.8	15.6±7.3	0.001
Grip strength	4.4±3.5	15.6±7.7	0.002

After primary repair of the TFCC, a long arm splint in a supinated position was applied for 6 weeks. Once the long arm splint was removed, passive movement of the wrist in both extension-flexion and supination-pronation was initiated, followed by progressive active loading of the wrist 12 weeks after repair.

For final statistical analysis, each patient's symptoms and signs were rated by the Mayo-modified wrist score [4] before surgery and 1 year after the primary repair. Grip strength was measured using a Jamar dynamometer (ASIMOW ENGR. Santa Monica, California, USA). Nonparametric data were analyzed by Wilcoxon's matched-pairs signed ranks test.

Results

Sixteen patients (17 cases – one patient had bilateral TFCC injuries) were assessed. The results are summarized in Table 2. In this small group of patients, we observed that instability of the distal radioulnar joint with subsequent dorsal subluxation of the ulnar head (five cases) after repair was the common denominator underlying any poor results (either a low wrist score both before and after surgery or the same wrist score despite surgery). Two of these patients underwent a second operation for subluxation; three declined further intervention. The results for the two reoperated patients were good at follow-up after a minimum of 3 months.

Discussion

Derangement of the TFCC in a patient with chronic ulnar wrist pain was once a diagnosis of exclusion [11]. Physical examination helps in localizing the injury to the area adjacent to the ulnar head, especially in relation to ulnar wrist pain on forearm supination. However, there is no physical finding that specifically identifies or defines injury to the TFCC. Although plain radiographs may be useful in determining ulnar variance and demonstrating concomitant injury to the carpus, positive correlation between peripheral TFCC injury and positive ulnar variance does not exist [7]. Moore [12] described four reliable radiographic signs of rupture of the distal radioulnar joint capsule and triangular fibrocartilage complex. However, the changes in the plain radiographs of the wrist in most of our patients were subtle. Except for clearly defining the occult subluxation of the distal radioulnar joint, a CT scan of the wrist did little to help in identifying a derangement of the TFCC. MRI study, although distinguished for its specificity for soft tissue

lesions [2], needs special coils for wrist joints and high-resolution power to detect these tiny, complex lesions. Arthroscopy appears to be the most consistent diagnostic technique available, allowing direct visualization of the TFCC pathology and differentiation between central attritional tears and peripheral avulsion tears. It also allows scrutiny of the associate radiocarpal and proximal carpal row pathology.

The TFCC has been shown to have three major functions: (1) It acts as a cushion for the ulnar carpus, carrying appropriately 20% of the axial load of the forearm in a cadaver specimen. (2) It is the major stabilizer of the distal radioulnar joint. (3) It is a stabilizer of the ulnar carpus [14, 17]. Conforming to these dissimilar functions, the structures of the TFCC also differ considerably. Whereas the load-bearing central portion is cartilaginous and poorly vascularized, the peripheral attachment functioning as a key ligamentous support is relatively stout, fibrous, and vascularized. Because of these important functions, traumatic derangement of TFCC may cause enough symptoms to limit employment and require treatment.

Symptomatic tears of the hypovascular central cartilaginous portion of the TFCC (Palmer Class IA), with both the continuity and stability of TFCC remaining intact, have responded favorably to open or arthroscopic débridement and ulnar recession osteotomy [11, 14, 19,20]. Treatment of symptomatic peripheral tears of the TFCC, however, deserves special consideration. Dameron [5] recommended surgical repair of peripheral tears during the first 2 months following injury, but suggested resection of the distal ulna and the damaged portion of the triangular fibrocartilage if surgery was carried out more than 2 months after the initial injury. Imbriglia and Boland [8] reported that excision of the torn articular disc portion of the TFCC achieved good results in 14 out of 16 patients.

Cooney [4] reported on 33 patients with peripheral tears (23 radial tears, five ulnar tears, and five volar tears) not associated with instability of the distal radioulnar joint, with 26 patients having good to excellent results. Hermansdorfer [12] recommended surgical repair of the avulsed TFCC to the fovea at the base of the distal ulna, and Trumble [18] reported good results using arthroscopic repair of isolated peripheral tears of the triangular fibrocartilage.

In contrast to Cooney's report [4], the site of the peripheral tears of the TFCC in most of our patients (14 in 17 cases) was on the ulnar side (Palmer Class IB). In ten patients, instability (either subluxation or dislocation) of the distal radioulnar joint was found. Recurrent instability of the distal radioulnar joint was noted in five patients. We surmise the causes of recurrent instability in these cases to be the following: (1) the injury sustained was at the severe extreme of the instability scale according to the concept proposed by Melone [10]; (2) associated insufficiency of the dorsal radioulnar ligament and capsule of the distal radioulnar joint; and (3) incomplete healing of the tissue because of poor reserve of damaged tissue or inadequate freshening of torn edges.

This study shows that peripheral tears of the TFCC in a subacute or chronic stage can be accurately diagnosed by arthroscopy of the wrist and successfully repaired. Distal radioulnar joint instability, which is not infrequently associated with a peripheral tear of the triangular fibrocartilage, should be addressed concomitantly to improve the functional result.

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