LESIONS OF THE TRIANGULAR FIBROCARTILAGINOUS COMPLEX

B. ZACHEE[1], L. DE SMET[1], G. FABRY[1]

The authors present a retrospective study of 14 triangular fibrocartilaginous lesions in 13 patients. Based on their radiographic and clinical observations a new classification is presented taking into account associated lesions in the wrist.

Keywords : ulnar wrist ; triangular fibrocartilaginous complex ; clinical diagnosis.
Mots-clés : région cubitale du poignet ; ligament triangulaire du carpe ; diagnostic clinique.

INTRODUCTION

The triangular fibrocartilaginous complex (TFCC) is formed by different ligamentous and cartilaginous structures (fig. 1) (4, 8, 11, 15). On the outer part we see the difficult-to-identify dorsal and volar radioulnar ligament and the ulnar collateral ligament. They stabilize the disc between the ulnar collateral ligament and radius.

The articular disc between the ulnar head and the triquetrum goes into the meniscus homologue on the ulnar side of the wrist and the collateral ligament.

The ulnolunar and ulnotriquetral ligaments originate from the ulna and insert into the lunate, triquetrum, hamate and base of the fifth metacarpal (volar side). The ulnar head is underneath the TFCC and is covered over 370° by cartilage (15). It articulates in the notch of the radius where 160° of rotation is allowed. The ulna moves in the palmar direction in the radial notch during supination and in the dorsal direction in pronation (6). Palmer described the ulnar head going distally in pronation and proximally in supination, which is important for x ray interpretation (15).

About 500 kg load can be transmitted from the forearm to the wrist : 82% through the radius and 18% through the ulna. Removing the TFCC reduces the force transmission on the ulnar side from 18% to 12% and with a Darrach 0%. Removing less than one-third of the TFCC does not change the force transmission in the wrist. This explains the importance of preserving the TFCC as much as possible (16).
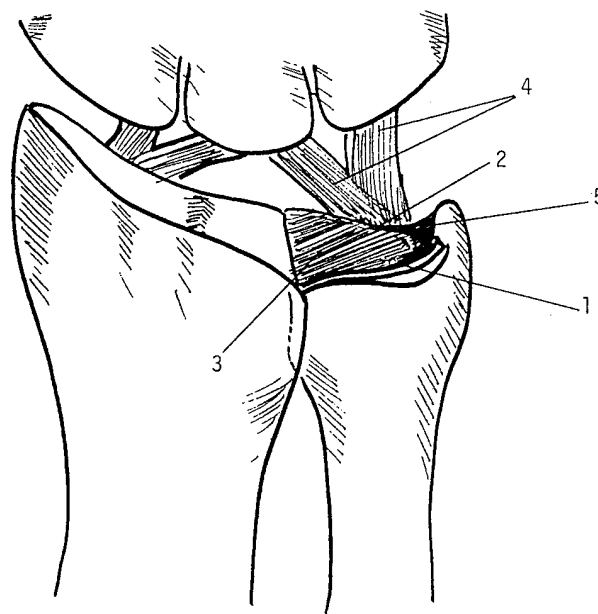

Fig. 1. — Anatomical drawing of the TFCC.
1. Dorsal radioulnar ligament ; 2. Volar radioulnar ligament ; 3. Articular disc ; 4. Ulnotriquetral + ulnolunate ligaments ; 5. Meniscus homologue.

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ALGORYTHM OF ULNAR WRIST PAIN

In the past, ulnar wrist pain was considered all too often as a symptom of psychogenic wrist complaints. The increasing interest in wrist pathology during the last 10 years, as well as the availability of arthroscopy allowed us to reconsider this statement. Ulnar wrist pain may in fact be very accurately diagnosed. The diagnosis is based on clinical examination, and we present the algorithm used in our department (fig. 2). A distinction must be made between intra- and extra-articular wrist pain. After ruling out intra-articular pathology the flexor carpi ulnaris must be examined. It may be swollen and painful at its origin, giving an inflammatory type of pain. An x ray may reveal a calcification in the tendon. This is a pathognomonic sign of a *flexor carpi ulnaris tendinitis* (18), which is treated by splinting or release. Sometimes a snap can be seen by moving the wrist actively in ulnar deviation and supination, demonstrating *extensor carpi ulnaris subluxation* (18). This condition may be acute, necessitating a plastercast, or long-standing, in which case treatment is the reconstruction of the extensor carpi ulnaris retinaculum. In intra-articular pain the first joint to examine is the pisotriquetral joint. This is done with the wrist in palmar flexion, relaxing the flexor carpi ulnaris and allowing lateral translation of the pisiform.

Pain with this maneuver may result from *avascular necrosis* of the pisiform, *fracture* or *arthritis of the joint* (fig. 3). These patients may have pain on the dorsal side of the wrist. A tunnel view is helpful, and the lesion is treated by excision of the pisiform. Sometimes there is pain on the dorsal side of the wrist after a direct blow playing golf or flipper. Palpation of the hamate is also painful. A tunnel view or CT scan may reveal a *fracture of the hook of the hamate* (fig. 4). Excision is the best solution. The next step is the Lichtman test. Bringing the wrist from a radial to ulnar position while maintaining palmar flexion will narrow the space for the triquetrum between the hamate and the ulnar head. With a *triquetrohamate* dissociation the triquetrum appears dorsally on the wrist. The diagnosis can be confirmed on radiocinema-

tography. These lesions are treated with a triquetrohamate fusion (9). A trial fixation with an external fixator can be done before the definitive arthrodesis.

Pathology in the distal radioulnar joint gives pain with pronation and supination (2, 8, 13, 15, 18).

Trauma can cause subluxation and instability of the joint, resulting in *posttraumatic arthritis* of the *distal radioulnar joint*, while *rheumatoid lesions* cause arthritis of this joint. CT scan and x rays confirm the diagnosis. The Sauvé-Kapandji procedure is the procedure of choice (fig. 5). The next step is the Reagan test : pain on moving the triquetrum and lunate toward each other indicates a *lesion at the lunatotriquetral joint* (18). Posttraumatically it may be a part of a Mayfield lesion, and arthrography (3) provides confirmation. Fusion can be performed, although the results are not always predictable. Without trauma the ulna "plus" component can cause the *ulnar impaction syndrome* (15, 7, 10, 12, 18). There are different types of this syndrome starting with chondromalacia of the triquetrum or lunate, perforation of the TFCC and chondromalacia of ulnar head and rupture of the lunatotriquetral ligament. On plain x ray an ulna "plus" and sometimes cysts in the ulna or the lunate can be seen (fig. 6).

Arthrography will demonstrate a TFCC perforation with or without a triquetrolunate ligament perforation (3). A Sauvé-Kapandji procedure or a triquetrolunate fusion with ulnar shortening can be performed.

Palpating the TFCC just distal to the ulnar head is the next step. With the piano-key test the dorsopalmar instability of the radioulnar joint is compared with the other side. If the test is negative, but the TFCC painful, arthrography is required. A *small central TFCC lesion* can be treated by arthroscopic debridement (14, 17). If positive, we also perform arthrography which may demonstrate a *large central lesion* (as in ulnar impaction). A Sauvé-Kapandji procedure is our treatment in such cases. Negative arthrography will be seen in either a *peripheral TFCC lesion* (treated with arthroscopic suturing) (14), or an avulsion of the *styloid process* (fig. 7) (which can
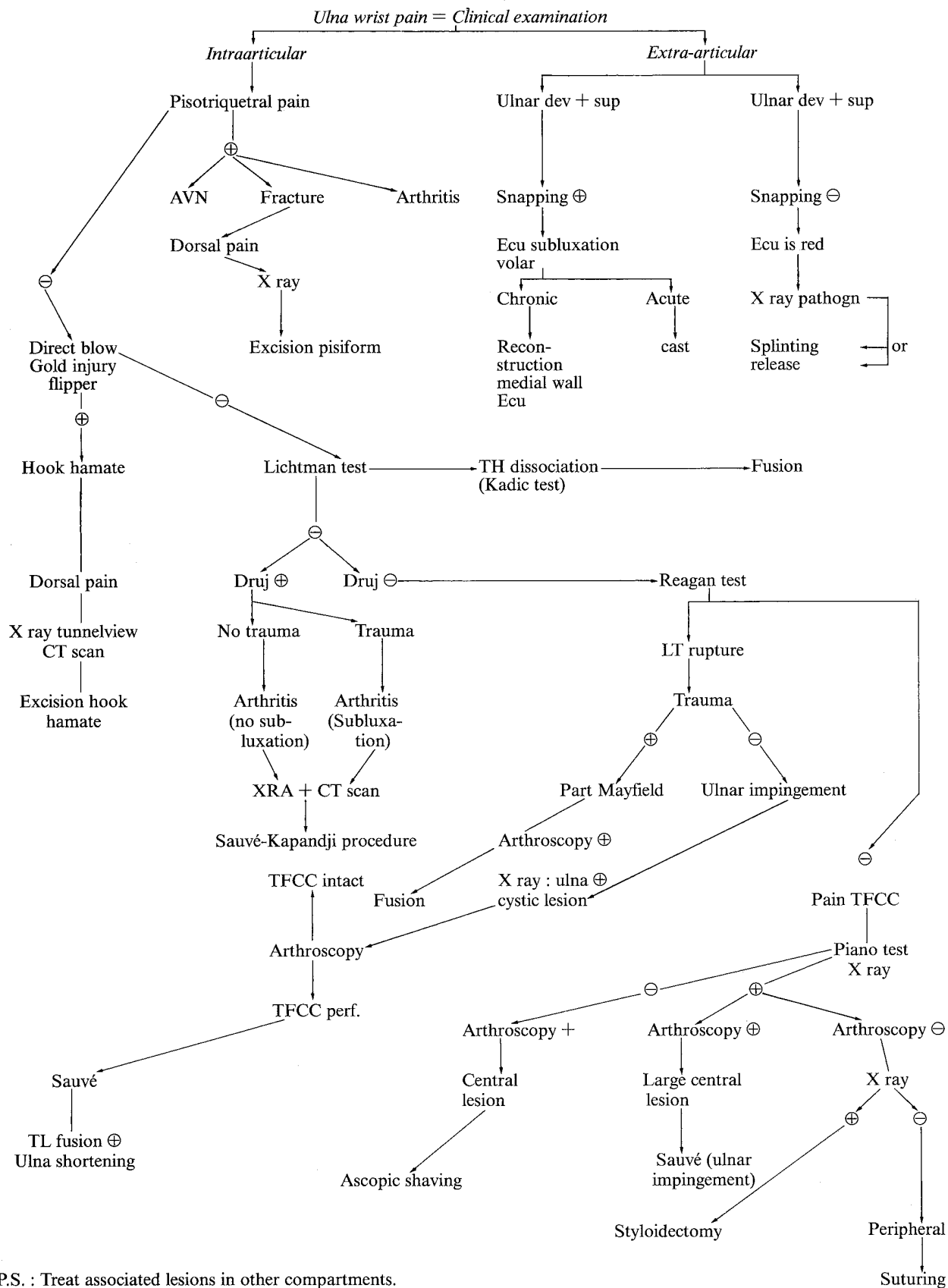
Ulna wrist pain = Clinical examination

Intraarticular

Extra-articular

Pisotriquetral pain

⊕

AVN   Fracture   Arthritis

Dorsal pain

X ray

Direct blow
Gold injury
flipper

⊖

⊕

Hook hamate

⊖

Lichtman test ⟶ TH dissociation ⟶ Fusion
(Kadic test)

Ulnar dev + sup

Snapping ⊕

Ecu subluxation
volar

Chronic   Acute

Recon-   cast
struction
medial wall
Ecu

Ulnar dev + sup

Snapping ⊖

Ecu is red

X ray pathogn

Splinting   ⟵ or
release

Dorsal pain

X ray tunnelview
CT scan

Excision hook
hamate

Excision pisiform

⊖

Druj ⊕   Druj ⊖ ⟶ Reagan test

No trauma   Trauma

Arthritis   Arthritis
(no sub-   (Subluxa-
luxation)   tion)

XRA + CT scan

Sauvé-Kapandji procedure

TFCC intact

Fusion

Arthroscopy

TFCC perf.

Sauvé

TL fusion ⊕
Ulna shortening

LT rupture

Trauma

⊕   ⊖

Part Mayfield   Ulnar impingement

Arthroscopy ⊕

X ray : ulna ⊕
cystic lesion

⊖

Pain TFCC

Piano test
X ray

⊖   ⊕

Arthroscopy +   Arthroscopy ⊕   Arthroscopy ⊖

Central   Large central   X ray
lesion   lesion
                                    ⊕   ⊖

Ascopic shaving   Sauvé (ulnar
                  impingement)

Styloidectomy   Peripheral

Suturing

P.S. : Treat associated lesions in other compartments.

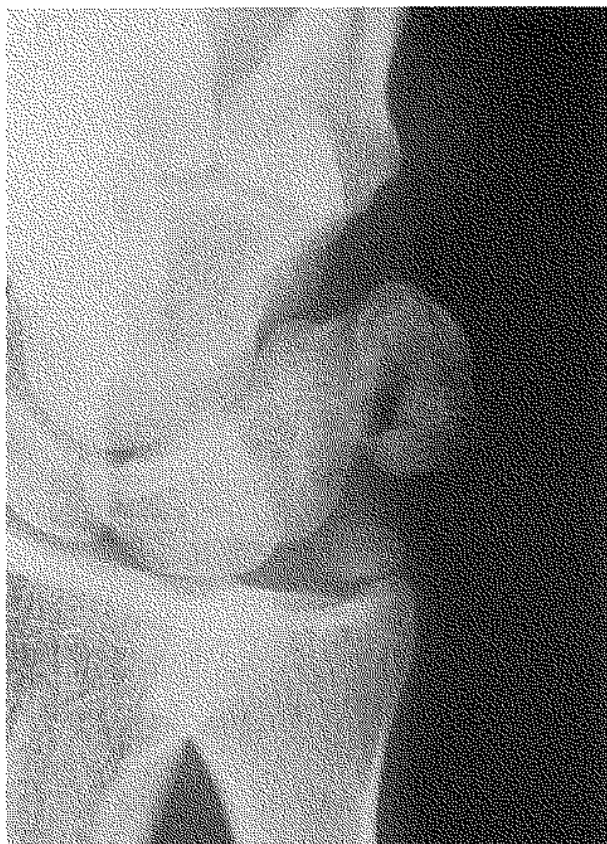*Fig. 2*. — Algorithm of ulnar wrist pain.

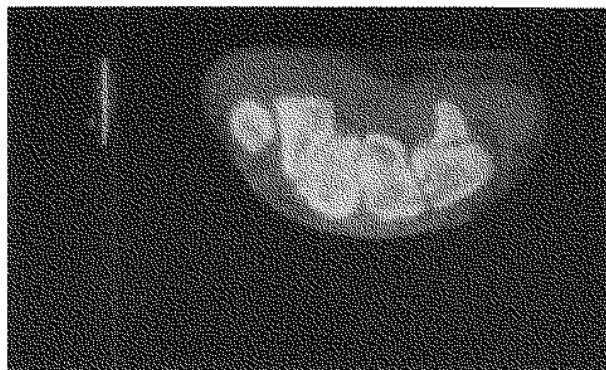Fig. 3. — Fracture of the pisiform seen on oblique radiograph.

Fig. 4. — Fracture of the hook of the hamate seen on CT-scan.

be treated by styloidectomy and resuturing of the TCFF). Associated lesions on the radial side of the wrist must of course be explored and treated.

MATERIALS AND METHODS

We reviewed the files of 13 patients with 14 TFCC lesions. All patients were seen as outpatients and were assessed as to the type of lesion, treatment and results.

RESULTS

Thirteen patients were examined : 8 had a lesion on the dominant side, 4 on the nondominant and one bilaterally. The male/female ratio was 6/7. The mean age was 32.4 years (ranging from 17 to 43 years). The follow-up after surgical treatment ranged between 3 and 10 months. Two lesions

were work-related, 2 domestic accidents, 2 sports accidents, and 7 did not recall any trauma.

The complaints were present for a mean of 1.6 years, ranging from 4 months to 4 years. There was no locking, 3 patients had crepitus and 5 synovitis. Ten patients had specific pain on the ulnar side of the wrist, and those who did not had a TFCC lesion associated with a scapholunate ligament rupture. The Reagan test was never positive, even with patients having a triquetrolunate ligament rupture. The Watson test was positive in 6 wrists. Four had a scapholunate ligament rupture ; 2 did not. All patients had pressure pain on the TFCC. The piano-key test was positive in 6 wrists. Two had a rupture of the styloid process, two a peripheral TFCC rupture and two a large central TFCC lesion. On radiographs an avulsion of the styloid process was seen on 3 occasions..
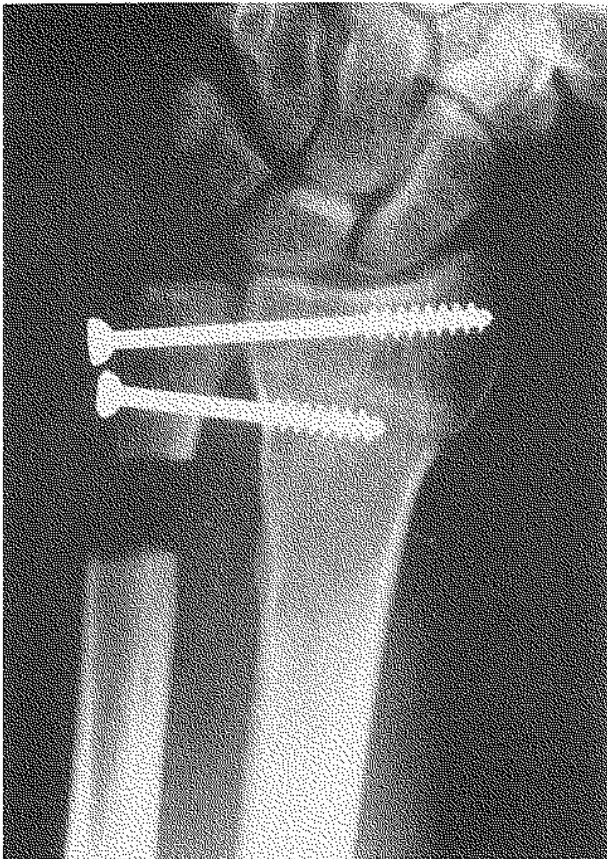
Fig. 5. — Radiograph of a Sauvé Kapandji procedure.

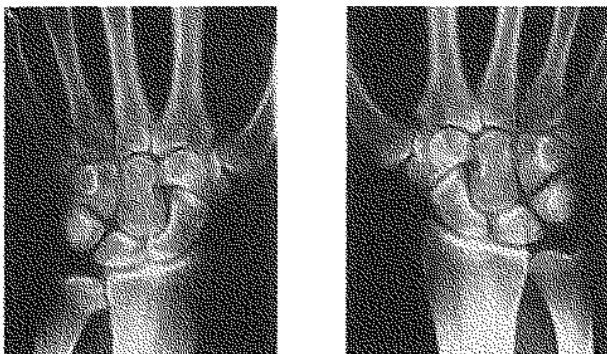*Fig. 7.* — Plain radiograph of a styloid avulsion.

Fig. 6. — Example of an ulnar impaction syndrome with cystic degeneration of ulna and lunatum.

One of the four patients with scapholunate dissociations had a DISI (Dorsal Intercalated Segment Instability). No VISI (Volar Intercalated Segment Instability) was seen. Bone scintigraphy was performed in one patient, revealing diffuse uptake in longstanding synovitis. Arthrography was performed in 11 of the 14 wrists. Five demonstrated a TFCC lesion. A central lesion was confirmed during arthroscopic exploration. Six had normal arthrography, although one of these had a central TFCC lesion. Two were peripheral lesions, and 3 were styloid process avulsions. Three of the 11 arthrographies had a midcarpal inflow. One had a triquetrolunate dissociation, two had scapholunate dissociations. Eight did not show inflow midcarpally, although 3 of them had an intercarpal ligament rupture on arthroscopy.

CT scan was never done. MRI twice revealed a lesion of the TFCC, confirmed on arthroscopy. We could classify our TFCC lesions according to type (table I).

The first is a central perforation without an associated lesion (one patient). Arthrography was positive, and synovitis was present, although no

Table I. — Classification of TFCC lesions

– Central TFCC lesion	
Without associated lesion :	1
With associated lesion :	7
– Peripheral TFCC lesion	
Without associated lesion :	1
With associated lesion :	2
– Avulsion styloid process :	3

injury was recalled. An arthroscopic debridement of the lesion was performed with immediate relief, and the patient returned to work, very satisfied at 6 weeks.

The second group included patients with a TFCC lesion with associated lesions (7 patients). Three had a scapholunate dissociation, and all three had been injured. Two had a positive Watson test, and two synovitis. Arthrography was positive for scapholunate rupture in two cases. All three patients had only a shaving of the TFCC arthroscopically. One was very satisfied, and started work at 6 weeks. One was indifferent in his subjective evaluation, and returned to work at 2 months. One was not satisfied and still does not work. All three were heavy laborers. Four had an associated triquetrolunate ligament dissociation. None had an injury. Most had physically demanding jobs, or participated in intensive sports (squash, etc.). The Reagan test was never positive. The piano-key test was positive on two occasions (with very large TFCC lesions). One had synovitis. Only one arthrography was positive for both TFCC and a triquetrolunate ligament lesion. Ulna "plus" was seen on plain x ray. All four could be classified as an ulnar impaction syndrome. Two had a complete abrasion of the TFCC, with a triquetrolunate lesion. A Sauvé-Kapandji procedure with shortening of the ulna was performed in one case, and the patient was very satisfied. Another patient had an arthroscopic shaving of the TFCC and cartilage lesion of the triquetrum. He was very satisfied and returned to work and sports in 6 weeks. The one with an open debridement of the TFCC was also very satisfied.

The third type of lesion is a peripheral TFCC lesion, without associated lesions (one patient). There was no injury. The piano-key test was

positive, as stability was lost in the radioulnar joint ; the ulna is dorsally subluxed as seen on plain x ray (fig. 15). Arthrography was negative. An open debridement resulted in patient satisfaction and resumption of work in 2 months.

The fourth type of lesion is a peripheral lesion with associated lesions (2 patients). The piano-key test was again positive, with a prominent ulna and a positive Watson test. Arthrography was not performed. In the 2 patients arthroscopic suturing was performed. Although their ulnar pain disappeared, the patients were not satisfied (probably due to their associated lesions).

The fifth type of lesion is ulnar styloid avulsion (3 patients). All 3 had had trauma in the past. The piano-key test was positive. Pronation and supination were decreased because of radioulnar joint discongruity. A styloid resection and reinsertion of the TFCC gave satisfaction in all 3 patients, who also resumed work within 3 months.

DISCUSSION

Ulnar wrist pain has long been considered as the "low back pain" of the wrist. Arthrography and arthroscopy have enabled us to differentiate different types of lesions (see algorithm) (3, 14). The lesions of the TFCC are among them. Even in the TFCC lesions we see different types of lesions, with different etiology (17). First is the ulnar impaction syndrome, which is seen in a wrist with ulna "plus" (7). Repetitive movements rather than acute trauma are the cause of the lesion. The condition always includes a central lesion associated with chondromlacia of the ulnar head, lunate and/or triquetrum. In a longstanding lesion there can be a rupture of the lunatotriquetral ligament. On roentgenogram, the ulna "plus" and some cystic lesions in the ulna and lunate are obvious. As it is a central lesion, arthrography is usually positive.

Trauma can cause three different lesions.

An avulsion of the styloid process leads to instability of the distal radioulnar joint, with a positive piano-key test and dorsal subluxation of the ulnar head. Arthrography is negative, as the TFCC is disrupted as a whole. Plain x ray reveals an avulsion of the ulnar styloid.

The second lesion is an avulsion at the ulnar insertion, and this also leads to radioulnar joint instability. As the TFCC is disrupted as a whole, arthrography will be negative.

The third is a central lesion, or a lesion in the meniscal part of the TFCC. Instability occurs only with a very large lesion. In this case, arthrography will be positive. The overall result was satisfactory or very satisfactory in 10 cases. The dissatisfied patients were the ones with an untreated associated lesion. A difficult lesion is a TFCC associated with a scapholunate dissociation, as the forces passing to the ulnar as well as to the radial column are disturbed, leading to an unstable wrist. Leaving the scapholunate dissociation untreated gave bad results. For avulsions of the ulnar styloid, we advocate removal and reinsertion of the TFCC on the ulnar head. For peripheral lesions, arthroscopic suturing and for central lesions shaving is recommended (14). Associated lesions should be treated.

CONCLUSION

In the last decade TFCC lesions became a well-known entity. Differentiation between the different possibilities and associations is necessary since specific treatment is possible. We need to treat associated lesions as well, if we want to obtain good results.

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SAMENVATTING

B. ZACHEE, L. DE SMET en G. FABRY. Letsels van het triangulair fibrocartilagineus complex.

Het triangulair fibrocartilagineus complex is, volgens Palmer en Werner, de ligamentaire en cartilagineuze structuren die de distale radius en ulnaire carpus aan de distale ulna ophangen. De auteurs stellen een studie voor van 13 patiënten met 14 letsels van het triangulaire fibrocartilagineuze complex. Tien van de 13 patiënten behaalden een bevredigend resultaat.

RÉSUMÉ

B. ZACHEE, L. DE SMET et G. FABRY. Les lésions du ligament triangulaire du carpe.

Le ligament triangulaire du carpe est défini par Palmer et Werner comme les ligaments et structures cartilagineuses qui unissent le radius et le carpe cubital à la partie distale du cubitus. Les auteurs présentent une étude de 13 patients présentant 14 lésions du ligament triangulaire. Dix des 13 patients obtinrent un résultat satisfaisant.