ACUTE ULNAR COLLATERAL LIGAMENT INJURIES OF THE THUMB METACARPOPHALANGEAL JOINT : AN ANATOMICAL AND CLINICAL STUDY

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Treatment of acute injuries of the ulnar collateral ligament of the metacarpophalangeal joint of the thumb remains controversial owing to the difficulty involved in establishing an accurate diagnosis. Conservative treatment may be successful in sprains, but surgical repair has been advocated when the ligament is completely torn. The authors performed a comparative study of the anatomical lesions of the metacarpophalangeal joint of the thumb with respect to degrees of instability. The study was conducted on fresh specimens and retrospectively in surgically treated patients. Instabilities greater than 30° were found to correspond to complete rupture of the ulnar collateral ligament of the metacarpophalangeal joint of the thumb, and the stump of the ligament was found on the adductor aponeurosis in 5 out of 20 cases. In 2 out of 9 cases of avulsion-fractures, the fragments were rotated 90° although on xrays they appeared slightly displaced. It is concluded that surgical repair is the treatment of choice for instabilities greater than 30° and for avulsion-fractures.

Keywords : thumb ; instability ; collateral ligament ; metacarpophalangeal joint.
Mots-clés : pouce ; instabilité ; ligament collatéral ; articulation métacarpo-phalangienne.

INTRODUCTION

The original description of injuries of the ulnar collateral ligament (UCL) of the metacarpophalangeal joint (MCP) of the thumb by Campbell (4) in 1955 led to further studies on the diagnosis and treatment of such lesions. However, treatment of the UCL of the MCP joint of acute thumb tears remains controversial. While some authors originally recommended casting (4, 15), others recommended surgical repair of the injured elements (11, 17). Retraction of the avulsed collateral ligament proximal to the dorsal expansion of the adductor aponeurosis or its complete rupture are factors that contribute to failure to heal with conservative treatment, whereas if the ligament is only partially ruptured a plaster cast may afford successful treatment (17).

Incorrect treatment may lead to severe sequelae, and hence if suitable management is to be implemented it must be based on a correct diagnosis. Although recent studies have shown that ultrasonography and magnetic resonance imaging may be helpful in evaluating injuries to the UCL of the MCP joint of the thumb, there is insufficient experience in analyzing the images thus obtained. Additionally, such techniques are too costly for routine use (8). Clinical and radiographic examination therefore continues to be used as the method of diagnosis in general practice. However, the problem remains of how to evaluate such features with respect to the lesions of the elements that stabilize the MCP joint of the thumb. With this in mind, we have performed a comparative study with respect to clinical features of the anatomical lesions of the MCP joints of thumbs

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from specimens and from patients undergoing surgery. From this we hope to gain further insight into appropriate treatment.

MATERIAL AND METHODS

Anatomical study

Eight fresh postmortem or amputated specimens were used to test the anatomical elements that stabilize the MCP joint of the thumb. The following structures were sectioned partially and then completely, and the resulting degrees of instability were measured : dorsal aponeurosis of the adductor pollicis (fig. 1), ulnar collateral ligament (fig. 2), dorsal joint capsule and volar plate.

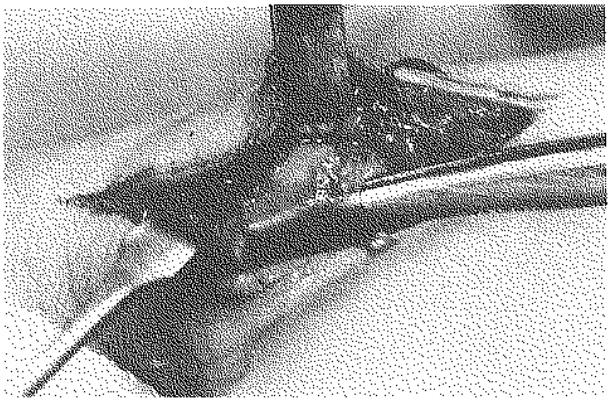

Fig. 1. — The adductor aponeurosis is held with scissors.

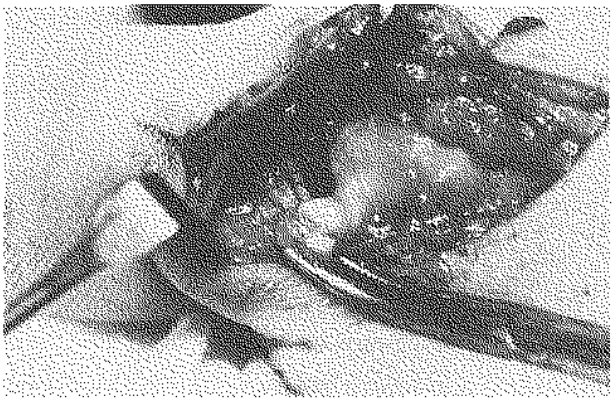

Fig. 2. — The adductor aponeurosis is cut, and the ulnar collateral ligament is cut and held with a hemostatic clamp. The MCP joint is seen open (*).

Clinical cases

Thirty-eight consecutive patients (38 thumbs) were diagnosed and treated by hand surgeons at our plastic surgery unit for lesions of the UCL from 1986 to 1996. Only cases that had occurred in the preceding 48 hours were studied. The patients' ages ranged from 14 to 66 years. There were 22 males and 16 females.

The commonest cause of lesions was falls (11 while skiing and 6 chance falls). Thirteen cases were impact lesions (6 by a ball in sports and 7 by heavy objects). Eight were caused by the thumb being pushed into abduction and extension (3 in karate practice and 5 in incidents involving aggression or while playing).

Diagnosis was based on clinical features, exploration and roentgenograms. Patients complained of pain, tenderness, local swelling and, in some cases, loss of pulp-to-pulp pinch strength. Clinical examination included palpation to induce pain with local pressure at the level of the UCL and with abduction of the proximal phalanx of the thumb while the examiner held the metacarpal immobilized. In all cases, this test was positive. Stener's sign (palpation of a mass immediately proximal to the MCP joint) was found in 7 cases. Instability tests were performed with the MCP joint at 30° of flexion. In cases where pain prevented testing, the median and radial nerves were blocked with anesthesia.

The ranges of ulnar instability of the injured thumbs were measured using a digital goniometer subtracting the degrees of physiological abduction of the opposite side (the final measurement was the result of subtracting the degrees of the uninjured thumb from the lesioned one). Three patients showed more than 45° of ulnar instability (60°, 70° and 90°) ; 12 patients, between 30° and 45° ; 16 cases less than 30°, and in 7 thumbs no instability was found.

In all cases, roentgenograms were taken in two projections : anteroposterior and latero-oblique. When the diagnosis was unclear, roentgenograms were also taken with stress. Exploration was made with both thumbs at 30° of flexion. The most frequent radiographic finding was avulsion-fracture of the ulnar side of the proximal phalanx (fig. 3). This was found in nine cases. Cases of avulsion-fracture showed different ranges of instability : in 3 it was 30° to 45° ; in the other 6 it was between 15° and 30°. A further three cases displayed volar subluxation of the proximal phalanx. No cases of metacarpal fracture were found.

Patients with ulnar instability of more than 30° and the cases of avulsion-fracture were operated under regional anesthesia (20 cases), except one patient who

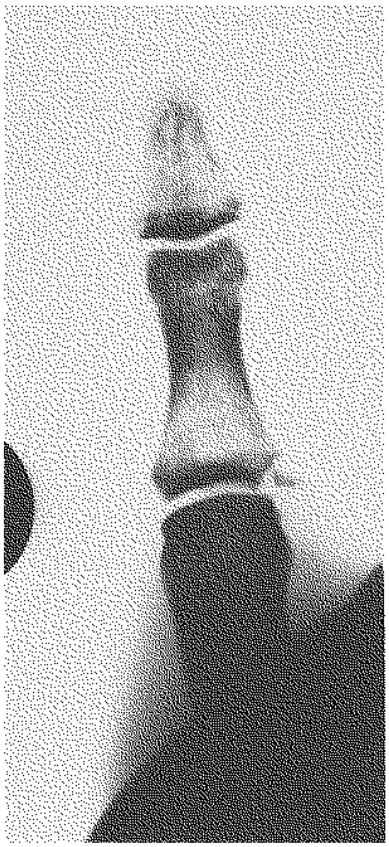

Fig. 3. - A case of avulsion-fracture of the base of the proximal phalanx.

refused surgery. Cases not operated were treated with a plaster cast for a minimum of 3 to 4 weeks and a further 2 weeks of nocturnal immobilization.

Surgery began with an incision on the ulnar side of the MCP joint. Dissection of the subcutaneous tissue was carried out carefully to avoid cutting the sensory branches of the radial nerve. Following this, the aponeurosis of the adductor was located and transected if it was not damaged to visualize the joint. The torn elements were repaired with nylon monofilament suture or reattached to the bone with a pull-out suture. The nine cases of avulsion-fractures were treated by reduction of the fragment and fixing with Kirschner wires. If the fragment was too small, it was attached to the phalanx with a pull-out suture.

Mean follow-up after surgery was 5 years (range 1 to 11 years). Patients gave subjective answers to items on a questionnaire that included pain and hand function for professional or recreational activities, and they were seen by one of the authors (JLA) for clinical evaluation : measurement of joint stability, assessment of pulp-to-pulp pinch to fifth finger and key pinch.

RESULTS

Cadaver studies

When the aponeurosis of the adductor muscle was released, the MCP joint of thumb did not show any degree of joint laxity and therefore no instability was noted. Partial section of the UCL resulted in a slight joint aperture of less than 10°, but the joint was still stable. Complete disruption of the UCL including the accessory UCL revealed gross instability of the joint, and radial stress was between 25° and 40°. Transection of the dorsal capsule, UCL and volar plate afforded great instability, close to 90° of radial deviation ; and volar subluxation of the proximal phalanx was observed.

Surgical findings

Different lesions were found in the surgically-treated patients. They were divided into three groups according to their clinical and radiographic features :

a) Avulsion-fractures. In the six cases with less than 30° of instability, the UCL lesion was incomplete ; the adductor pollicis aponeurosis, volar plate and dorsal joint capsule did not show lesions. The three avulsion-fractures with 30° to 45° of instability had completely avulsed UCL's, and these were fixed to the bone fragment. Furthermore, in two cases the dorsal joint capsule was partially torn. The volar plate and accessory UCL were not damaged in any case. The bone fragment was found with different degrees of displacement but was not found on the adductor aponeurosis. In two cases, the bone fragment appeared slightly displaced in roentgenograms, while at surgery it was seen to be rotated 90°.

b) Patients with 30° to 45° instability (11 cases operated). In all 11 cases, the UCL was found to be completely torn in the midsubstance or at the distal portion. The dorsal joint capsule was

partially torn and in two cases this was associated with a lesion of the adductor aponeurosis. The UCL appeared displaced proximally and on the adductor aponeurosis (Stener's lesion) in five cases, corresponding to the preoperative clinical findings (Stener sign), while the rest were negative. c) Patients with more than 45° of instability (three cases). The lesion affected the UCL, the dorsal joint capsule, and the adductor aponeurosis. In the only case with 90° of instability, the volar plate was torn.

Results of treatment

Nineteen of the 20 surgically-treated patients were satisfied with the results. At clinical examination, in 17 patients the results were assessed as very good (joint stability, key pinch and pulp pinch to fifth finger were normal and free of pain). In three patients, the results were considered good when one of the following features was present : occasional pain, some limitation in key pinch or pulp-to-pulp pinch or laxity. However, none of the patients had laxity in the injured thumb greater than 10° relative to the uninjured one. No patients in this group reported pain requiring any medication or limiting their professional activities. The results in the 9 cases of avulsion-fractures were very good.

The results of the conservatively-treated cases were assessed as very good (13 cases), good (3) and unsatisfactory (2 cases). The latter corresponded to one patient with 45° of laxity who had refused surgery and another with 25° of laxity. These subjects complained of pain on pinching, a laxity greater than 10° (one case) and impediment to pulp-to-pulp pinch of thumb to fifth finger.

DISCUSSION

The mechanism responsible for the injury in all our patients was abduction trauma of the thumb. Within the sphere of influence of our hospitals, ski falls represent less than 50%, although this may be higher in other areas. When skiers fall, the ski-pole strap may push the thumb into extension and radial deviation, thus injuring the supporting structures of the MCP joint (17).

The anatomical elements that stabilize the MCP joint of the thumb are well documented (5, 15). The UCL's and accessory collateral ligaments are the main elements involved. The dorsal capsule, volar plate and the attachment of the adductor brevis on the expansion of the dorsal aponeurosis also provide support to the joint. The adductor muscle and the extensor pollicis longus contribute to stabilizing the distal phalanx for pulp-to-pulp pinch (9).

Diagnosis of what is known as skier's thumb is based on clinical examination : local tenderness, swelling, pain with abduction of thumb. These signs were present in our series. However, a more accurate diagnosis is required to evaluate the integrity of the UCL. In cases of total rupture, surgical repair may be indicated since although the ligament itself is not retracted, a gap between the ends of the ligament may prevent healing (10, 19). We performed serial surgical sections on amputated and cadaver specimens of the anatomical structures of the MCP joint of the thumb to relate the lesions observed to degrees of instability. Partial injury of the UCL caused only some degrees of radial stress but not gross instability. In this case, Stener's lesion was not consistent. The good results of conservative treatment of patients with less than 30° of instability confirmed our hypothesis. By contrast, total injury of the UCL, including the accessory UCL, elicited gross instability of the MCP joint of the thumb. This was confirmed at operation, as all of them were treated surgically. Coonrad and Goldner (5) observed no instability when only the adductor aponeurosis was released, and partial instability with sectioning of the UCL ; however, they failed to measure radial stress. On testing thumbs in full MCP flexion, Palmer and Louis (13) found at least 35° of instability when the adductor aponeurosis, dorsal capsule and UCL were cut. When the volar plate and UCL were cut, the joint angulated more than 90°. Similar results were found by us in specimens and in surgical patients.

A caveat should be invoked as regards our measurements of radial stress. Considerable variations exist in thumb motion among individuals

(7). Thus, our measurements were made subtracting the degrees of stress of the uninjured thumb. Additionally, the angulation increases with neutral extension of the MCP joint and decreases with full flexion (13, 14). In some circumstances, explorations were made under regional anesthesia since pain may hinder examination, affording incorrect measurements.

Avulsion-fractures should be considered as a type of UCL injury. In 1977 Palmer and Louis (13), and later Louis *et al.* (11), divided UCL lesions into 5 patterns. In type I, there is an undisplaced fracture and in type II a displaced fracture on the ulnar side of the base of the proximal phalanx. In the former case, patients were treated with a plaster cast and in the latter with surgery. Although Pichora *et al.* (16) found 85% of ulnar instability in their series, only 12% corresponded to avulsion-fractures and 40% of these presented true instability. The rarity of avulsion-fractures in association with dorsal dislocation injuries suggested to Coonrad and Goldner (5) that the UCL was stretched without complete rupture. In our series, we found no great instability (i. e. with more than 45°) in cases with avulsion-fractures. The UCL's were not stretched ; rather, the accessory UCL and volar plate maintained some degrees of stability. Moreover, we observed no true undisplaced fractures, although some of them were slightly displaced. Among the latter cases, at surgery we found two cases with the bone fragment rotated 90° that had not been suspected from the radiological explorations. In conclusion, correct management of UCL injuries may require the use of roentgenograms, even in cases without gross instability, to observe a possible avulsion-fracture. In our opinion, these cases require surgical exploration even though the avulsed fragment appears only slightly rotated in roentgenograms.

The indication for conservative or surgical repair of UCL lesions remains controversial, although some ideas have changed from the early protocols of Campbell (4) and Parikh *et al.* (15), who mainly proposed primarily conservative treatment, to new concepts of surgical treatment in certain circumstances. Abrahamsson *et al.* (1) determined treatment on the basis of palpation of the torn ligament (Stener sign). All the patients with a positive Stener sign treated by those authors were operated on with very good results (8 out of 8 cases). Patients in whom this sign was negative were treated with a plaster cast, although one case out of 16 showed 20° of instability at follow-up. Those authors, however, failed to study the anatomical lesions of these latter cases since the patients had not been operated on. They held that only displacement of the UCL proximal to the adductor aponeurosis constituted grounds for surgical repair. Significant variations in the presence of a Stener lesion have been reported by other authors, varying from 64 to 66% (11, 18) to 14 to 30% (3, 12, 17). In our study, the Stener lesion was found in only 5 out of 20 surgically-treated cases (the UCL was torn and retracted on the adductor aponeurosis). On the other hand, in two cases with a positive Stener sign the ligament was not found on the adductor aponeurosis. This could have resulted from swelling or bruising. In sum, we did not consider this sign relevant as regards indications for surgery owing to its low accuracy in diagnosing complete rupture of the UCL.

The degree of radial deviation of the MCP joint of the thumb with this joint at 30° of flexion is considered by us and other authors to be the most accurate sign for evaluating the condition of the UCL. However, different degrees of radial stress have been advocated to settle complete rupture of the UCL. Parikh *et al.* (15), Smith (17) and Derkash *et al.* (6) considered 45° ; Louis (11), 35° and Bowers and Hurst (3) and our group, 30° (although measured over the contralateral thumb). The discrepancies among the different authors are not very large. According to our anatomical and clinical experience reported here, a protocol should be followed that includes surgical treatment for cases with gross instability and for avulsion-fractures, since secondary repair may be less reliable (2).

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SAMENVATTING

J. ARRANZ LÓPEZ, F. ALZAGA, J. MOLINA. Acute letsels van het ulnair collateraal ligament van de duim : anatomische en klinische studie.

Behandeling van acute letsels van het ulnair collateraal ligament van het metacarpofalangiale gewricht van de duim blijft controversieel, meestal door de moeilijkheid om een accurate diagnose te stellen.
Bij simpele verstuikingen is een conservatieve benadering voldoende, maar een chirurgisch herstel is noodzakelijk wanneer het ligament volledig is gescheurd. De auteurs hebben een vergelijkende studie van de anatomische letsels van het metacarpofalangiale gewricht van de duim uitgevoerd.
De studie werd verricht op verse specimens en retrospectief nagekeken bij chirurgisch behandelde patiënten.
Instabiliteiten groter dan 30 graden werden gezien bij volledige ruptuur van het ulnair collateraal ligament.
In 5 van de 20 gevallen vond men eveneens een luxatie van de stomp van het ligament over de adductoraponeurose.
In 2 van de 9 gevallen met avulsiefractuur waren de fragmenten meer dan 90 graden geroteerd ondanks de lichte verplaatsing op radiografie.
Chirurgisch herstel is de eerste keuze behandeling bij instabiliteiten groter dan 30 graden en bij avulsiefracturen.

RÉSUMÉ

J. ARRANZ LÓPEZ, F. ALZAGA, J. MOLINA. Les lésions aiguës du ligament collatéral ulnaire de l'articulation métacarpo-phalangienne du pouce : étude anatomique et clinique.

Le traitement des lésions aiguës du ligament collatéral ulnaire de l'articulation métacarpo-phalangienne du

pouce reste controversé, vu la difficulté d'établir un diagnostic fiable. Le traitement orthopédique peut donner un bon résultat pour les entorses ; par contre, on a proposé le traitement chirurgical lorsque le ligament est totalement déchiré. Les auteurs ont réalisé une étude comparative des lésions anatomiques de l'articulation métacarpo-phalangienne du pouce en fonction du degré d'instabilité. L'étude a été effectuée à partir de pièces anatomiques fraîches et, rétrospectivement, sur des patients traités chirurgicalement. Des instabilités supérieures à 30° correspondaient à des ruptures complètes du ligament collatéral ulnaire de l'articulation métacarpo-phalangienne du pouce ; ce ligament a été retrouvé sur l'aponévrose de l'adducteur dans 5 cas sur 20. Dans 2 des 9 cas de fractures-avulsions, les fragments étaient déplacés de 90° alors que, sur les radiographies, ils n'apparaissaient que légèrement déplacés. Les auteurs concluent que la réparation chirurgicale est le traitement de choix pour les instabilités supérieures à 30° et pour les fractures-avulsions.