SONOGRAPHY OF THE INJURED ULNAR COLLATERAL LIGAMENT OF THE THUMB

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We used high-resolution ultrasonography to image the ulnar collateral ligament in 39 patients who had sustained recent injuries of the metacarpophalangeal joint of the thumb. All the patients were subsequently operated on and the lesions of the ligament were recorded.

In 36 patients the preoperative ultrasonographic diagnosis was correct. Five of these showed no rupture of the ligament. In the other 31, ultrasonography correctly distinguished between rupture in situ (15) and rupture with dislocation of the ligament (16). Misdiagnosis by ultrasonography in three cases was due to delay of the investigation (three weeks after injury) in one, to technical error in one and to misinterpretation of the image in one.

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Injuries of the ulnar collateral ligament of the thumb (UCL) have been reported many times since the first description by Bunnell in 1948. Campbell (1955) invented the term 'gamekeeper's thumb' to describe the laxity of this ligament which results from the repetitive trauma of killing rabbits. When skiing became a popular winter activity, injuries of the UCL increased dramatically and the term 'skier's thumb' is now in common use (Schultz and Fox 1973; Gerber, Senn and Matter 1981; Massart and Bèzes 1984; Primiano 1985; Fairclough and Mintowt-Czyz 1986).

The metacarpophalangeal joint of the thumb is a hinge joint stabilised by its strong collateral ligaments. The UCL consists of the ulnar collateral ligament proper which lies in the longitudinal axis and of the accessory ulnar collateral ligament which inserts into the volar joint capsule and aponeurosis (Fig. 1). Because of the differential tightness of the two parts during movement, the joint is stable in all positions (Mitzscherling, Pätzolt and Stock 1988; Williams et al 1989; Obiltschnig and Klestil 1991; Shaw and Morris 1992).

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A particular feature of the joint is the anatomy of the tendon of the adductor pollicis muscle which is also called the adductor aponeurosis. The three sites of insertion of the aponeurosis into the ulnar sesamoid, the base of the proximal phalanx and the extensor aponeurosis counterbalance the pull of the abductors on the proximal phalanx. The UCL is largely covered by this aponeurosis which plays a key part in determining how injuries of the UCL should be treated (Moberg and Stener 1954; Stener 1962; Gerber et al 1981; Hollenburger, Holt and Dax 1982; Pechlaner 1982).

Rupture of the UCL results from an abduction force applied to an already maximally abducted thumb, which can be in the flexed or the extended position (Schultz and

Fig. 1

Anatomy of the metacarpophalangeal joint of the thumb viewed from the ulnar side. 1, proximal phalanx; 2, first metacarpal; 3, ulnar collateral ligament proper; 4, accessory ulnar collateral ligament; 5, proximal palmar ligament; 6, fibrocartilaginous plate; 7, adductor aponeurosis; 8, adductor pollicis; 9, ulnar sesamoid bone; 10, extensor tendon; 11, tendon of adductor pollicis.

Fox 1973; Resnick and Niwayama 1988a,b; Obiltschnig and Klestil 1991) and usually occurs at the distal insertion. Dislocation of the ruptured ligament from beneath the adductor aponeurosis can occur as shown in Figure 2 (Stener 1962; Neviasser, Wilson and Lievano 1971; Bowers and Hurst 1977). This so-called 'Stener lesion' results in chronic instability and later osteoarthritis of the joint.

Some authors have favoured early operation for all ruptures (Moberg and Stener 1954; Cantero, Cruz and Perrenoud 1980; Stothard and Caird 1981; Hollenburger et al

Fig. 2

The dorsal aspect of the right first metacarpo-phalangeal joint. A: in the anatomical position the ulnar collateral ligament is hidden by the adductor aponeurosis. B: at the instant of rupture the adductor aponeurosis holds the torn ligament in situ. C: if abduction continues the torn end of the ligament can pass below the proximal edge of the aponeurosis. D: when the phalanx resumes its normal alignment the ligament is caught by the aponeurosis and folded over to point proximally (Stener 1962).

1982; Brückner 1985; Helm 1987) although conservative therapy can give good results for partial tears and for complete tears without dislocation of the ligament (Pechlauer 1982; Paar and Rubach 1983; Louis, Huebner and Hankin 1986; Mitzscherling et al 1988; Abrahamsson et al 1990). The choice of the correct treatment depends on the position of the torn UCL. Since there is no clinical or non-invasive radiological method to differentiate between a lesion in situ and a Stener lesion we used ultrasonography to try to distinguish between them.

PATIENTS AND METHODS

We performed ultrasonography on 39 patients. There were 25 men and 14 women aged from 16 to 61 years (mean 37.2) of whom 37 had had a recent injury; in two patients the injury had occurred two and three weeks before. The

cause of injury was a skiing accident (36), a fall while playing football (1), a fall while mountain climbing (1) and an occupational accident in the forest (1). All the injuries were of the typical extension/abduction type. Radiographs were taken, with and without radial stress, before ultrasonography but the radiographic diagnosis was unknown to the ultrasonographer. All the patients were operated on and a correlation between the ultrasonographic and intraoperative findings was made.

Technique. The examination was performed with a 7.5 MHz linear transducer. The hand is positioned in a water-filled basin, the water serving as an interface between the transducer and the skin to avoid distortion of the soft tissues from compression by the transducer, which is positioned with its long axis in line with the thumb 5 to 10 mm away from the surface of the skin (Fig. 3). A second plane at right angles to the first can be used to image the adductor

Fig. 3

Longitudinal direction of the transducer in the water-filled basin.

Fig. 4a

Fig. 4b

Ultrasonographic anatomy of the ulnar side of a normal first metacarpophalangeal joint. Figure 4a – Longitudinal plane. PP, proximal phalanx; OMI, first metacarpal; 1, ulnar collateral ligament; 2, subcutaneous layer; 3, skin. Figure 4b – Transverse plane. M.ADD.POL., adductor pollicis; 1, adductor aponeurosis and ulnar collateral ligament.

aponeurosis and any traumatic haematoma, but it is not essential for the diagnosis. It can also be of advantage to examine the opposite thumb since the thickness of the UCL varies from patient to patient, but is similar in both hands of the same patient. Artefacts due to hairs, air bubbles and edge phenomena are easily recognised.

With the transducer placed over the ulnar side of the joint it is easy to define the rounded head of the first metacarpal bone and the flat base of the proximal phalanx. The UCL and adductor aponeurosis are demarcated from the echogenic subcutaneous fat as an echolucent band, which runs from the neck of the metacarpal to the base of the phalanx in a convex, curved course (Fig. 4a). With the

transducer in the transverse position the echolucent muscle belly of the adductor pollicis can be seen close to the joint line merging into the adductor aponeurosis and UCL (Fig. 4b).

RESULTS

At operation the UCL was found to be dislocated from beneath the adductor aponeurosis in 18 patients and was in situ in 21. The sonographic diagnosis was the same as the intraoperative diagnosis in 36 of the 39 patients (92%). In two patients a dislocated ruptured UCL was diagnosed sonographically as a rupture in situ; in one a rupture in situ

was diagnosed sonographically as dislocated. The specificity of the examination was therefore 89% for dislocated ruptures and 95% for those in situ.

One of the wrongly diagnosed patients was not examined until three weeks after the accident when ultrasonography showed a large ill-defined echolucent area at the joint level which was misinterpreted as repair tissue around a rupture in situ. The presence of scar tissue was confirmed intraoperatively, but the ligament was found to be dislocated and already considerably shrunken (see Fig. 7).

The second wrongly diagnosed patient had been examined with the transducer pressed against the skin and the consequent distortion of the tissues caused the misinterpretation of a dislocated ligament as rupture in situ.

In the third patient the diagnosis was wrong because two echolucent zones were detected, one close to the articular space and the second at the neck of the metacarpal. This picture was interpreted as a dislocation of the ligament, but a rupture in situ was found at operation.

In one patient the ligament was torn at its proximal insertion on the metacarpal. Ultrasonography correctly diagnosed a rupture in situ but did not correctly locate the site of the tear.

In five patients the clinical picture suggested an injury of the UCL, but there was no evidence of subluxation on ultrasonography. The ligament was in its normal position, and no haematoma could be found, but the skin and subcutaneous tissues were oedematous. This appearance was interpreted as a strain and at surgery no ligament rupture was found.

DISCUSSION

Although Stener (1962) and some other authors (Gerber et al 1981; Lamb and Angarita 1985; Louis et al 1986) were of the opinion that tears of the UCL could only be defined

intraoperatively, others have developed several methods for preoperative diagnosis. Van Wetter (1986) used his rubber-band test to verify a torn ligament, and others used stressed radiographs with or without specially-developed holding devices (Schultz and Fox 1973; Heim 1982; Pechlaner 1982; Curtis and Downey 1983; Rubach and Paar 1983; Downey and Curtis 1986; Lütten, Thomas and Dihlmann 1987). None of these methods, however, allowed differentiation between dislocated ruptures and ruptures in situ. Moutet et al (1989) and Abrahamsson et al (1990) tried to determine those with the Stener lesion by palpation and advocated different treatments for the two types.

Arthrography can differentiate a simple rupture of the articular capsule from a capsuloligamentous rupture (Engel et al 1979; Stothard and Caird 1981), and Bowers and Hurst (1977) reported that it was possible to define the exact position of the torn ligament. Resnick and Danzig (1976) and Resnick and Niwayama (1988a,b) recommended radiography with and without stress complemented by arthrography. Arthroscopy is an accurate method of diagnosis (Vaupel and Andrews 1985) but it has not gained wide acceptance because of its invasiveness.

In contrast to radiological methods ultrasonography can image soft tissues due to differences in their impedance. We have defined the following sonographic criteria for rupture of the UCL:

- 1) Broadening and fading of the echogenic band which represents the skin layer.
- 2) Broadening and echolucent appearance of the subcutaneous layer.
- 3) Subluxation of the metacarpophalangeal joint with radial deviation of the proximal phalanx. This is a definite sign of capsuloligamentous rupture.
- 4) If the torn UCL is in situ the normal convex course of the echolucent ligament is present (Fig. 5).
- 5) If the torn UCL is dislocated there is an echolucent bulge

Fig. 5

Rupture in situ of the ulnar collateral ligament (right thumb). PP, proximal phalanx; OMI, first metacarpal; 1, ulnar collateral ligament in situ; 2, small haematoma; 3, widened joint space; 4, subcutaneous layer; 5, skin.

Fig. 6

Dislocated rupture of the ulnar collateral ligament (right thumb). PP, proximal phalanx; OMI, first metacarpal; 1, dislocated ligament and small haematoma; 2, widened joint space; 3, subcutaneous layer; 4, skin.

at the neck of the metacarpal bone and loss of the convex echolucent image of the ligament (Fig. 6).

6) In cases of recent injury, haematoma is represented by a 5 to 10 mm thick, spherical echolucent structure in the immediate vicinity of the torn UCL, its location depending on the site of rupture.

7) If more than one week has elapsed since injury the haematoma cannot be detected and may be replaced by a diffuse echolucent, non-homogeneous image of scar tissue (Fig. 7).

The presence of the small haematoma is strong confirma-

tion of the diagnosis of a ligament rupture. We cannot explain why the haematoma is found usually at the long end of the torn ligament or why it is sometimes absent. It should not be confused with an effusion within the intact joint capsule which is always closer to the head of the metacarpal.

A radiograph of the injured thumb is always needed to exclude bone lesions (Kjaer-Petersen, Andersen and Langhoff 1991) but the need for stressed radiographs can be eliminated by ultrasonography. This avoids any risk of secondary dislocation (Obiltschnig and Klestil 1991)

Fig. 7

Ruptured ulnar collateral ligament with scar formation three weeks after injury (right thumb). PP, proximal phalanx; OMI, first metacarpal; 1, scar formation; 2, widened joint space; 3, subcutaneous layer; 4, skin.

Fig. 8a

Fig. 8b

Two patients with torn ulnar collateral ligaments in different positions. Figure 8a – Rupture in situ (right thumb). 1, ulnar collateral ligament in situ; 2, widened joint space; 3, subcutaneous layer; 4, skin. Figure 8b – Dislocated rupture. PP, proximal phalanx; OMI, first metacarpal; 1, dislocated ligament with small haematoma; 2, widened joint space; 3, subcutaneous layer; 4, skin.

although Abrahamsson et al (1990) have denied that this can happen. MRI may be an alternative to ultrasonography as it can provide accurate images of the soft tissues (Fry et al 1991; Spaeth et al 1993; Louis and Buckwalter 1989).

Several different treatments have been proposed for the various patterns of UCL rupture (Pechlaner 1982; Paar and Rubach 1983; Louis et al 1986; Vanclooster et al 1988; Bonaga, Danda and Fama 1989; Moutet et al 1989). As ultrasonography proves its worth it will be possible to classify the injuries in a high proportion of cases and to give the appropriate treatment. Ruptures in situ could be treated conservatively and those with a Stener lesion would need surgical reconstruction (Paar and Rubach 1983; Mitzscherling et al 1988; Moutet et al 1989; Abrahamsson et al 1990). Obiltschnig and Klestil (1991), however, suggested that even when the ligament is ruptured in situ there is no contact between the ends of the ligament. As healing is made impossible by constant movement, immobilisation of the metacarpophalangeal joint in a glove spica cast is thought to be mandatory even for tears in situ (Campbell et al 1992).

Dislocated torn ligaments, displaced avulsion fractures, the rare atypical dislocations and cases of epiphysiolysis all require early surgical treatment to restore full function (Winslet, Clarke and Mulligan 1986; White 1986; Onuba and Essiet 1987; Reck et al 1991; Sartorius et al 1991). Late operations have a bad prognosis because retraction and atrophy of the ligament make its reconstruction almost impossible (Neviaser et al 1971; Reikeras and Kvarnes

1982; Brückner 1985; Helm 1987; Sennwald, Segmüller and Egli 1987; Arnold, Cooney and Wood 1992).

Conclusions. The advantages of ultrasonography are its high precision in identifying ruptures of the ligament and in differentiating ruptures in situ from those with the Stener lesion (Fig. 8). The examination is quick, cheap, widely available and painless. The disadvantage is that, like all ultrasonographic examinations, its accuracy depends on the proficiency of the examiner.

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