



## Degenerative lesion of the extensor tendon V finger: Ultrasound imaging in diagnosis and therapeutic possibilities

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### ABSTRACT

Traumatic injuries of the extensor tendons of the hand are common and are more frequent predisposed to tendon injuries due to the presence of chronic tendon damage. We present the case of a 61-year-old woman, tailor by profession, who showed acute rupture (80 %) with degenerative etiology of the extensor tendon of the V finger of the fifth level according to Kleinert and Verdan classification.

### 1. Introduction

Traumatic injuries of the extensor tendons of the hand are common and are more frequent than those of the flexors due to their more superficial location [1]. They are not protected by subcutaneous tissue and therefore are more prone to traumatic injuries [1]. Patients over the age of 60 are predisposed to tendon injuries due to the presence of chronic tendon damage. Young people may be at increased risk for sporting or occupational activities [2]. Spontaneous rupture is a less frequent occurrence and has been described in the presence of predisposing factors that weaken the tendon such as rheumatoid arthritis, systemic steroids, or particular occupational occupations that expose the tendons to repetitive movements [2,3]. We present the case of a 61-year-old woman, tailor by profession, who showed acute rupture (80 %) with degenerative etiology of the extensor tendon of the V finger of the fifth level according to Kleinert and Verdan classification.

#### 1.1. Case

A 61-year-old female patient, tailor by profession, came to our observation with a deficit of active extension and counter-resistance of the right fifth finger which arose in an acute way. For the past seven months, the patient reported difficulty and considerable pain during the active extension movement of the fifth finger. An ultrasound

examination, performed in the same period, revealed the presence of a degenerative tendinopathy of the extensor tendon of the little finger at the level of the V-IV-III level according to the classification of Kleinert and Verdan. The disorder has increased in intensity over the past two months. In the last week the patient, during work activity, experienced sudden pain followed by active functional impotence and against resistance during the extension movement of the entire fifth right finger. The passive extension movement was preserved. On physical examination, a voluminous painful swelling was found along the course of the tendon at the level of the III-IV-V-level up to the retinaculum. Palpation revealed the presence of a tendon gap at the V level. There was no hammer-like attitude of the fifth finger. The Elsons test was negative. Blood pressure was 120/70 mm. The blood tests were normal. The ultrasound examination performed with a high-frequency linear probe revealed a lesion of about 80 % of the extensor tendon of the little finger at the 5th level with ascent of the common extensor band at the level of the retinaculum. The residual tendon was totally subverted and hypoechoic. The P. Doppler signal showed hyperemia of the residual tendon. A noticeable fluid distension of the synovial sheath was observed. X-rays didn't show any bone lesions. Therefore, reconstruction surgery and a subsequent rehabilitation program were performed with a moderate functional recovery after three months of treatment. She is currently in excellent clinical condition and performs clinical and ultrasound follow-up every twelve months.

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## 2. Discussion

### 2.1. Clinical presentation

Any injury to the extensor apparatus of the hand requires in-depth knowledge of the complex anatomy of this district and its functioning. According to Kleinert and Verdan (1983), there are 8 anatomical areas relating to the functional division of the extensor tendons of the hand:

- Zone I: distal interphalangeal joints
- Zone II: intermediate phalanx
- Zone III: proximal interphalangeal joints
- Zone IV: proximal phalanx
- Zone V: metacarpophalangeal joints
- Zone VI: metacarpal bones
- Zone VII: wrist (carpus)
- Zone VIII: distal third forearm

A careful anamnesis is important in order to explore the traumatic mechanism, the presence of possible degenerative or inflammatory pathologies, the professional activity carried out by the subject, often direct cause of the injury: tailors, wood carvers, shoemakers, housewives are just some of the professionals more exposed to extensor tendon injuries. Let us briefly recall that the common extensor controls the movement of the metacarpophalangeal joints of the third and fourth fingers, a movement that can be elicited and made more evident with the wrist in flexion. In the case of the second and fifth fingers, the extension of the metacarpophalangeal joints is due respectively to the extensor tendons of the index and the extensor of the little finger, which replace the function of the lateral bands of the common extensor, inserting themselves on the distal phalanx. Therefore, when we are faced with a deficit in extension of the fifth finger, we must always think of two possible tendons that can be injured at different levels based on the causes and the clinic detected [4,5]. A traumatic injury can occur in the form of an open wound or a closed rupture. An initial inspection assessment is therefore essential and must include, if chronic degenerative lesions and / or inflammatory based lesions are suspected, the search for areas of skin redness, areas with an edematous appearance or dyskeratotic areas. Closed ruptures lead to conditions that over time have weakened the structure of one or more tendons, such as rheumatoid arthritis or crystal deposition diseases. The presence of muscular hypotrophies localized in the hand must always be sought by comparing the two limbs; hypotrophies are a sign of hypofunction and lead to a degenerative cause or a dated trauma. Upon inspection and palpation of the tendon with suspected injury, a possible retraction of the same should be evaluated, a common occurrence in older injuries. It is important to remember that the extensor tendons have a low tendency to retract in acute form due to the presence of the sheaths, lateral bands and the links with other muscles to which they are bound, such as the case of lumbrical muscles [4-6].

We proceed with the examination of the V ray, we evaluate the first active extension of the same, against resistance and not. In general, in a partial injury, active extension can be highlighted through the active extension movement, but the extension against resistance may be missing, in the total the fifth finger is blocked in flexion with no movements that are only passive (Figs. 1-3). Painfulness is associated with movements and palpation of the tendon course. Furthermore, the presence of a gap on palpation must always be sought, especially evident in total, dated lesions. An absence of extension only of the distal interphalangeal with a hammer-like attitude of the fifth finger must lead to a lesion of the extensor of the little finger. With the Elsons test the presence of a rupture of the common extensor tendon on its insertion can be assessed, by having only the proximal interphalangeal extended against resistance and keeping the metacarpophalangeal of the same finger blocked, in such cases it must always be suspected if on traumatic, an avulsion of a small bone bract with in the most severe cases subluxation of the proximal interphalangeal joints. The absence of extension of the metacarpophalangeal should suggest a more proximal lesion of the

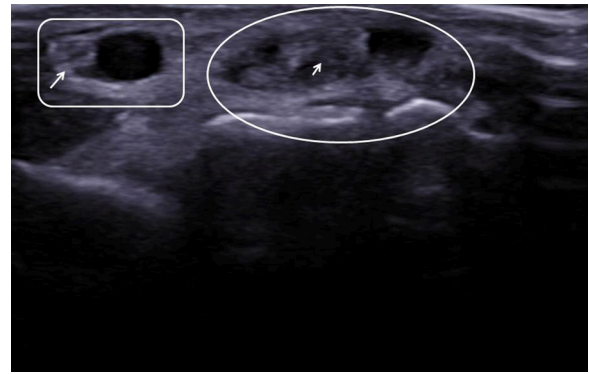


Fig. 1. Short axis ultrasound examination showing the ascent of the tendon part of the common extensor of the fingers (arrow) into the retinaculum with synovial fluid (circle) and the extensor tendon of the little finger (arrow) in place with share of synovial fluid (rectangle).

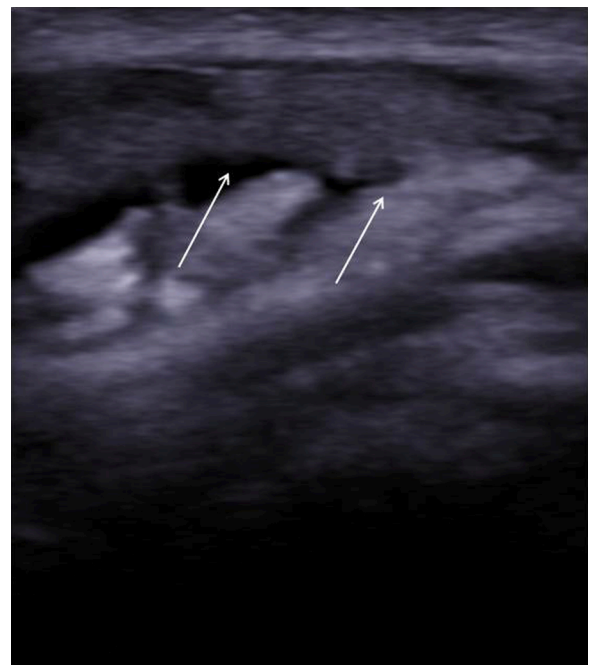
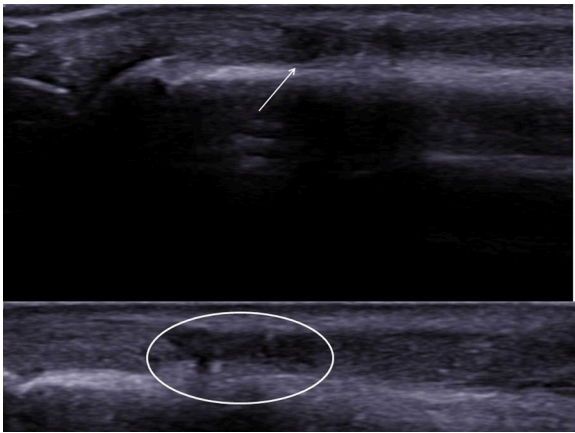


Fig. 2. Short axis ultrasound detail of the ascent of the tendon part of the common extensor of the fingers in the retinaculum with synovial fluid (arrows).

common extensor isolated or associated with that of the little finger but located distal to the juncturae tendinum. Any injury instead that occurs from the juncturae tendinum to rise can be clinically recognized by the fact that it also affects the IV or the other fingers, as it breaks the tendon bonds with the bands that reach the other rays [5-7].

## 3. Imaging

Imaging is important in diagnosis [8,9], x-ray plays its role in the evaluation of bone injuries such as fractures possibly associated with the tendon injury and in the detection of radiopaque foreign bodies [10]. In addition, it may highlight predisposing factors for chronic hand tendon injuries such as maladjustment consolidated fractures. Like x-ray, CT is also not adequate for direct evaluation of tendons and its application is limited to the suspicion of bone lesions to be investigated [9,10]. The most accurate methods for direct assessment of tendon structures of the extensor of the little finger are MRI and high resolution ultrasound. MRI allows the study of lesions of the tendons of the hand with the use of



**Fig. 3.** Long axis ultrasound examination showing the lesion of the extensor tendon of the little finger at V level (arrow) and the corresponding residual portion (circle).

specific coils for the extremities, but has as disadvantages a relatively long examination time, the exclusively static study of the tendons and artifacts in orthopedic patients in addition to general contraindications of the method [10,11]. However, it must be considered that MRI compared to the US, provides a panoramic assessment of the surrounding soft tissues, bone and cartilage structures that could escape the US. In general, normal tendons have low signal strength on MR images, while disruption manifests itself as higher signal strength. In the presence of partial injury, areas of greater intensity are evident in the context of the tendon in the T1-weighted (and sometimes T2-weighted) sequences. In the presence of complete rupture there will be a discontinuity with fraying of the tendon stumps. In the tendon gap in the presence of acute injury, the signal intensity is intermediate in the T1 sequences and high in T2 due to the presence of blood and edema [11]. Furthermore, with MR images the phenomenon of the "magic angle" is possible when the orientation of the extensor tendons (especially of the long extensor of the thumb) is around  $55^\circ$  with respect to the direction of the magnetic field. The effect is a false increase in intratendinous signal intensity, which can mimic lesions [12]. High-resolution ultrasound with high-frequency probes (10–15 MHz) is largely proving to be the method of first choice, not invasive, rapid and economical for the study of tendon lesions of the hand [13]. The use of dedicated high frequency probes allows to obtain high spatial resolution and anatomical detail [12,13]. Therefore, when there is the clinical suspicion of a hand tendon injury, ultrasound is a valid support for early diagnosis. The latter is necessary for an equally early treatment of the injury to avoid chronic complications such as failure to recover movement and the resulting deformity. Ultrasound allows an optimal assessment of the state of the tendon, allowing to confirm the presence of a clinically suspected lesion and to evaluate the degree of the lesion by differentiating between partial or complete lesion, the gap existing between the two lacerated extremities, the degree of retraction and associated injuries. The partial lesion appears as a partial loss of the fibrillar pattern of the tendon with a hypo-echogenic discontinuity at the level of the lesion. In the event of a complete rupture, the fibrillar pattern is completely lost with tendon discontinuity [1]. The gap between the torn tendon ends can be occupied by acute fluid or later by granulation tissue. Ultrasound also allows the evaluation of the cortical bone profile and the presence of an avulsed bone fragment associated with the tendon, distinguishing it from intra-tendon calcification [14]. In addition, it allows the identification of radiolucent foreign bodies. An undisputed advantage is the possibility of performing a real-time dynamic evaluation which allows to evaluate the limitation of both active and passive tendon movement. This can help in determining the position and extent of the rupture as well as the presence of peri-tendon adhesions. Another possibility is the quick

comparison with the unaffected counter-side and to identify the exact site of the pain or symptoms [13,14]. All this information provided by the ultrasound is important for the surgical planning allowing to choose the direct repair or the graft of the tendon [15]. In addition, in case of rupture, the demarcation of the exact position of the retracted extremity by ultrasound provides the surgical incision point allowing to minimize its length for aesthetic reasons [15]. High resolution ultrasound is also used in follow-up -up post-operative to evaluate the integrity of the repaired tendons and post-operative complications such as tendon callus or peritendinous adhesions and re-rupture which are the cause of active and/or passive tendon motor limitation that can be evaluated with dynamic tests [15]. In conclusion, high-resolution ultrasound has high potential in the accurate, rapid, and cost-effective diagnosis of tendon injuries but no. In addition, it represents a valid tool for surgery and for post-operative follow-up.

### 3.1. Treatment

The treatment of injuries of the extensor tendons of the fifth finger clearly depends on the site of the injury, which must therefore be evaluated carefully and with the necessary instrumental examinations before being able to talk about management of the same. In Zone I injuries, we are first going to evaluate the time elapsed from the traumatic event or in any case the scarring aspect of the tendon. Acute injuries can be treated with a brace for at least 40 days. However, in the presence of very old lesions or lesions associated with avulsion of part of the distal phalanx or even with loss of substance of the tendon or soft tissues, bloody reduction and internal fixation with K-wires and / or in the case of tendon suture injuries of the tendon. Some authors consider conservative treatment valid even in simple chronic lesions in the first instance and surgical treatment only in case of failure. The reasoning is the same in lesions of Zone II, where only in cases with more than 50 % of tendon involvement can a tendon suture be attempted in the first instance. As for zone III, it must always be assessed whether the lesion affects only the insertion of the common extensor or if in the case of more serious or open lesions there has also been the rupture of the extensor of the little finger in which case the fifth finger will be totally flexed at the proximal interphalangeal [5–7]. Surgery helps us in the presence of avulsions or severe volar subluxations of the intermediate phalanx. In these cases, two K-wires are used under fluoroscopy, one inclined with respect to the phalangeal axis that keeps the avulsed bone bract in reduction and the other that crosses the axis of the 5th finger while preserving the reduction of the intermediate subluxated phalanx. In all other cases it is generally possible to attempt a conservative treatment as a first step by having you follow an accurate motor rehabilitation. Injuries of the proximal phalanx, ie zone IV, can involve both the common extensor and the own of the little finger. They are often detectable already at a first clinical evaluation and can be treated with an extension brace for four weeks, which has shown good results in closed partial lesions. In open or complete ruptures, a surgical suture must be performed after exploration of the surrounding soft tissues and cleaning of the region [16,17]. Proximal lesions of Zone V or VI usually result from trauma from blunt or sharp objects or from degenerative diseases. In these cases, especially if there is the involvement of more tendons or the "juncturae tendinum", a surgical exploration must be performed with evaluation of the tissues involved and, in the case of significant functional deficits, the suture of the structures involved. In the post-operative period, immobilization in brace with extended wrist and flexed metacarpophalangeal for 3–4 weeks is recommended. Rehabilitation therapy is a fundamental step both if you opt for a conservative treatment and in the case of surgery. The function is not only that of an optimal and early functional recovery but above all that of preventing the appearance of adherent lesions and promoting healing even of minimal gaps. Rehabilitation treatment after surgery initially involves passive movements after 7–14 days while active movements after 20 days. Both in the case of surgery and non-operative treatments, sequelae are possible such as: flexion or

extension deficit, re-ruptures, loss of grip strength or even adhesion formations that require tenolysis [7,16,17].

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### Declaration of Competing Interest

The authors have no conflicts of interest.

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