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Case report

Transposition of the Extensor Indicis Proprius (EIP) for inveterate post-traumatic rupture of the Extensor Pollicis Longus (EPL) of the hand. 12 clinical cases

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Summary. *Background and aim of work*: Subcutaneous tendon rupture of the Extensor Pollicis Longus (EPL) is one of the most frequent injuries of the extensor tendons of the hand. In this paper, we report our experience on 12 cases of atraumatic subcutaneous EPL lesions treated in our hospital with Extensor Indicis Proprius (EIP) transposition. *Methods*: This observational study was conducted between January 2015 and December 2018 in the Casa di Cura "Prof. Nobili", Castiglione dei Pepoli (Bologna). Twelve patients were included in the study, nine of whom were females and three were males, with an average age of 72 years (range: 40-84 aa). The average follow-up was 32.4 months. The preoperative diagnosis was subcutaneous atraumatic rupture of the EPL tendon in all cases. *Results*: The clinical outcome was excellent in all the patients at the end of follow-up. At the second clinical control, all patients achieved complete active extension of the distal phalanx of the first finger. We did not notice any intra- or extra-operative complications, and the post-operative course was regular in all cases. *Conclusion*: EIP transposition has allowed an almost complete recovery of the ability to extend the first finger in patients treated in our hospital, in line with what is described in the literature. In addition, patients' satisfaction rate was excellent in all cases. Based on the good results and the low rate of complications affecting the donor area, we consider EIP transposition surgery to be a valid option for inveterate EPL ruptures. (www.actabiomedica.it)

Key words: extensor tendon, rupture, transposition, hand injuries

Background

Subcutaneous tendon rupture of Extensor Pollicis Longus (EPL) is one of the most frequent injuries of the extensor tendons of the hand. This type of lesion can be the direct consequence of violent traumas to the wrist, but more frequently occurs secondary to degenerative or inflammatory diseases, rheumatism, or after consolidation processes involving distal fractures of the radius. Sometimes, this happens without a predisposing condition, simply due to continuous use of the I finger in flexo-extension movements.

The rupture of the EPL usually occurs at its point of reflection on Lister's tubercle, where frictions are greatest and vascularisation is less represented (1). The continuous repetition of microtraumas in the area of reflection of the tendon on Lister's tubercle can over time lead to its subcutaneous rupture.

Some authors have hypothesised the pathogenetic mechanisms behind this lesion. Among these, Engkvist and Lundborg (2) considered that the appearance of a hematoma formed inside the tendon sheath as a result of trauma or inflammation of the wrist usually led to an increase in pressure in an inelastic compartment. Increases in pressure can cause alterations in blood supply and can result in necrosis and rupture of the tendon structure (2). In the period following tearing of the EPL tendon, a retraction of the proximal stump is generally observed, accompanied by degenerative processes that compromise the direct repair.

Clinically, it is characterised by the impossibility of active extension of the first ray interphalangeal joint. Rarely the patient could experience a sensation of detachment accompanied with discomfort coming from the dorsal zone of the first ray during a particular hand action. Usually, however, the patient does not feel any pain and often realises after a few days that he has limitations in the use of the first finger.

The diagnosis is clinical and the most appropriate first-level examination is ultrasound of the extensor apparatus of the first ray. Radiography and MRI of the wrist, however, can help detect osteophytosis secondary to vicious consolidations which may be responsible for tendon rupture.

Many treatments have been suggested, including tendon grafting using Palmaris Longus (3), arthrodesis of the IF of the thumb, or a tendon transposition technique using the Extensor Indicis Proprius (EIP) developed by Mensch in 1925 and then used by many authors also utilising the Extensor Carpi Radialis Longus (ECRL), the Extensor Proprius of the V finger, or the II tendon of the Extensor Digitorum Communis (EDC II). In this paper we report our experience on 12 cases of atraumatic subcutaneous EPL lesions treated in our structure with transposition of the EIP.

Methods

This observational study was conducted between January 2015 and December 2018 in the Casa di Cura "Prof. Nobili", a private hospital accredited to the National Health System and located in Castiglione dei Pepoli (Bologna). Twelve patients were included with an average age of 72 years (range: 40-84 aa); nine patients were females and three were males. The intervention was conducted on the right hand in eight patients and on the left hand in four patients. The dominant limb was the right in 10 patients and the left in two. The study was approved by the ethical committee of the Institute in which the research was carried out and the patients gave their informed consent.

All the patients were evaluated in the 30th, 75th, and 150th day with clinical control, followed each subsequent year with a telephone interview, per the follow-up protocol adopted in our facility. The average follow-up was 32.4 months.

The preoperative diagnosis was subcutaneous atraumatic rupture of the EPL tendon in all cases. For all cases, a wrist trauma (distortion or fracture) had occurred and no rheumatic or inflammatory pathologies were recorded in the patient's history.

On clinical examination, all the patients presented the inability to extend the distal phalanx of the first finger with the palm of the hand resting on a plane; the absence of retropulsion is a distinctive sign of EPL lesion. In order to examine the quality of the extensor apparatus of the second finger, the isolated amount of extension was measured starting from the maximum active flexion. We then evaluated the ability to lift the second finger with the palm of the hand placed on a plane.

For the assessment of post-operative results, we analysed the strength and the articular extension of the first finger, the degrees of movement on the various planes, the ability to regain normal daily activities, and patient satisfaction. All values were compared with the healthy contralateral limb before and after surgery.

In relation to individual parameters, we considered the result to be excellent if the strength and articulation of the first finger were comparable to the opposite side, good if only modest limitations against passive resistance were present, mediocre when these limitations occurred with little or no resistance, and very bad in case of complete deficit.

Surgical technique

Under plexus anaesthesia, a dorsal incision at the first ray of the affected hand was made. Proceeding in-depth through the tissue planes, the distal stump of the EPL was found and isolated from the surrounding soft tissues, highlighting its complete detachment from the proximal portion. A dorsal incision was then made in correspondence of the second ray of the same hand to identify the EIP tendon, which was isolated and dissected at the level of the metacarpal head. The distal stump was sutured to the EDC at the second ray, while the proximal stump, after being freed from the surrounding soft tissues, was transported through a subcutaneous tunnel at the level of the first ray and then sutured to the distal abutment of the EPL (Fig. 1-4). During tenorrhaphy, it is very important to test

the tension of the construct. After careful haemostasis, the planes were sutured and an extension position splint was put in place and maintained for 30 days.

After this period, the splint was removed and the active extension of the distal phalanx was directly evaluated. In addition, a static and dynamic ultrasound was performed. Following these evaluations, physical and re-educational therapies were performed in order to achieve the recovery of the complete extension of the first ray, the force of gripping, and the opposition of the thumb.

Results

The clinical outcome was excellent in all the patients. Immediately after the removal of the splint, all 12 patients were able to extend the last phalanx of the first finger a few degrees and could actively extend the index without any deficit (Fig. 5-6). The ultrasound evaluations showed the proper continuity of the tenorrhaphy and its correct sliding through soft tissue.

At the second clinical control, all the patients achieved complete active extension of the distal phalanx of the first finger.

We did not notice any intra- or extra-operative complications and the post-operative course was regular in all cases. At the strength tests administered during follow-up, all 12 patients showed a clinical picture comparable to the healthy contralateral limb.

Discussion

In case of inveterate rupture of the EPL, direct suturing of the proximal stump to the distal abutment

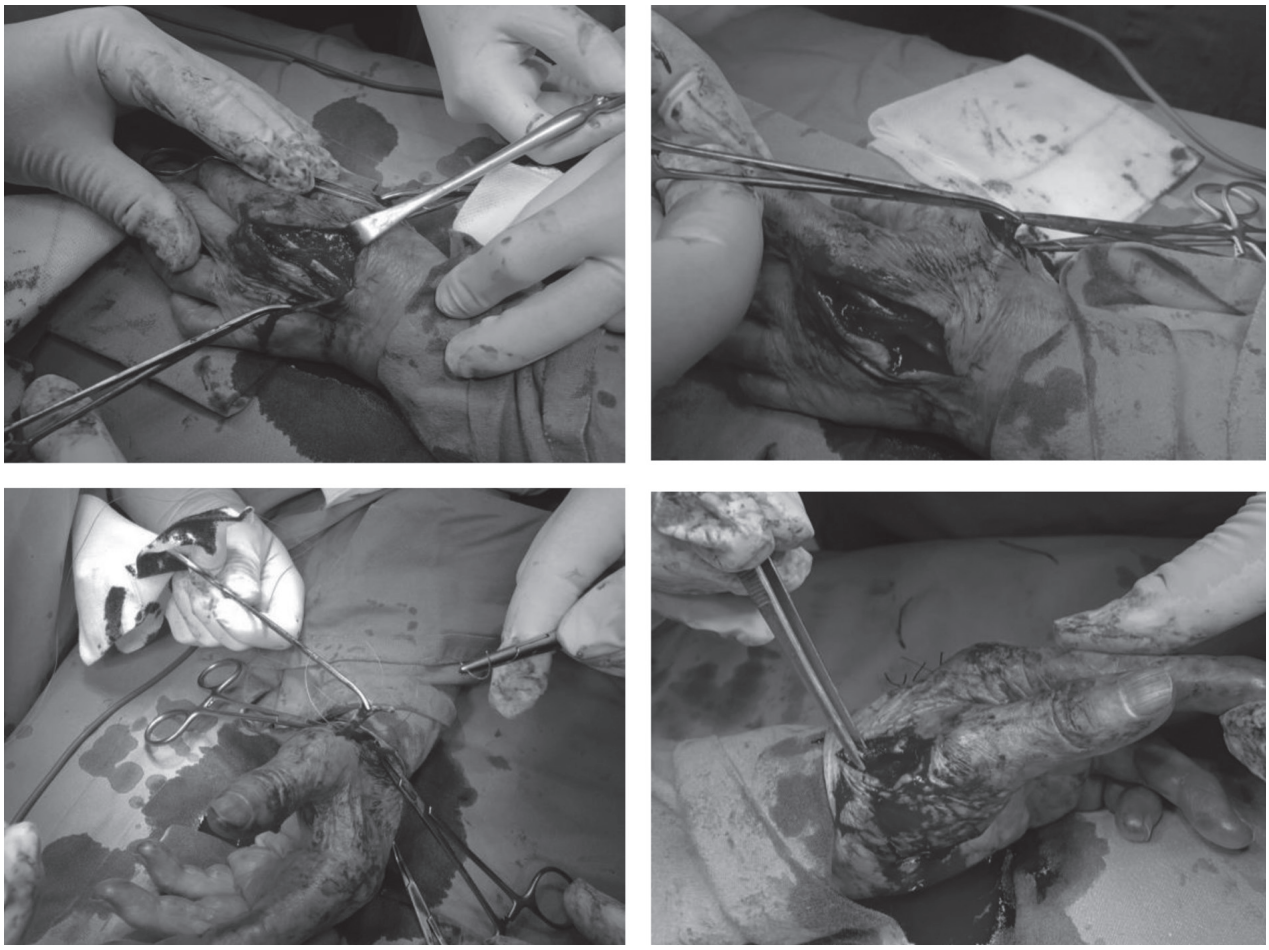

Figure 1-4. Procedure of transposition of EIP pro EPL. The details are set out in the text

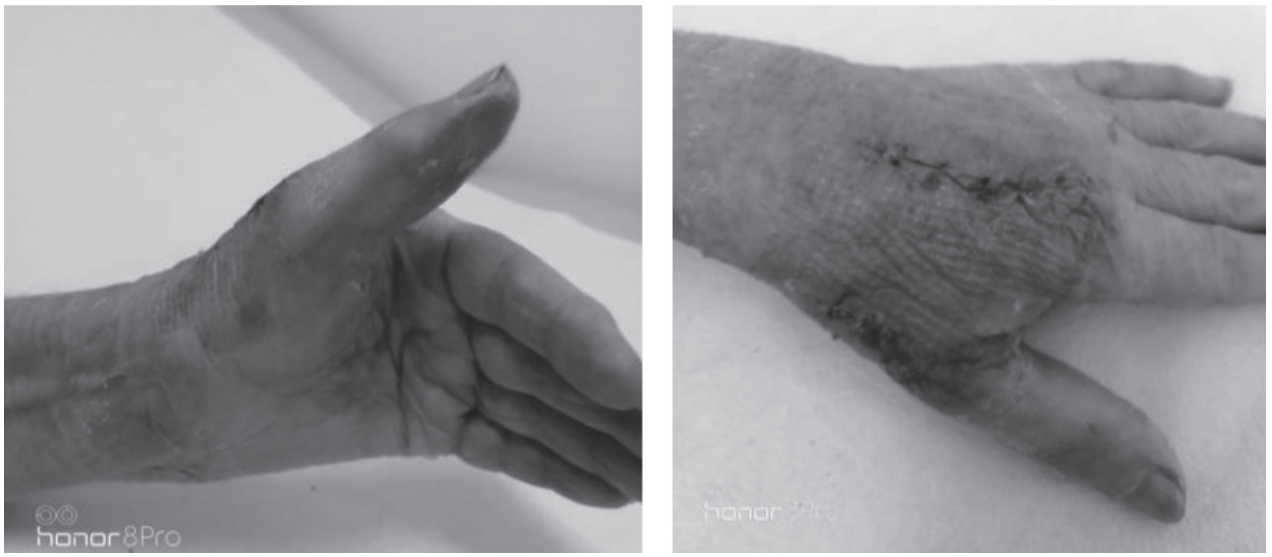

Figure 5-6. Clinical check 30 days after surgery

is not a viable and reproducible option, due to the degenerative processes that are often observed following such rupture (4-5). In addition, it should be noted that any suture would occur at the point of reflection of the tendon on the radial tubercle, possibly compromising the mechanical seal. Lesion repair using tendon grafts, such as the Palmaris Longus (6,7), has been progressively abandoned because of the need to perform multiple skin incisions and a double tendon suture.

For these reasons, tendon transposition surgery is currently providing the best results and is supported by a higher number of good results. In the past, several variants of tendon transfer have been tested, but most have shown important limitations. The transposition of the Extensor Proprius of the V finger proposed by Verdan did not allow a good sliding of the transposed tendon and a sufficient extension force of the first ray (8). The procedure using the Extensor Carpi Radialis Longus (ECRL) gave good results (9, 10), even if it was supported by a smaller number of cases.

According to most authors, the tendon that provides the best outcome in terms of distal phalanx extension in the EPL repairing is the Extensor Indicis Proprius (EIP) (11-15). This method has favoured an almost complete recovery of the ability to extend the first finger in patients treated in our hospital, in line with what is described in the literature (11-13). Moreover, patients' satisfaction rate was excellent in all cases.

Since this tendon had to be transposed to improve the extension function of the first finger, it was discussed whether this intervention could reduce the extension capacity of the second ray (17,18). Matter-Parrat showed a certain decrease of the independent extension force of the second finger and a reduction of the ROM in active extension of the II MCP following the transposition (17). Despite these findings, any deficit in the performance of normal daily activities was considered derisory (17). On the contrary, in the series of Russel Moore et al. (16) and Kitano et al. (19), no deficit in strength or ability to separately extend the index was observed. In our case study we did not find any alterations involving independent extension and extension force of the second ray.

Conclusions

Based on the quality of the obtained results and the low rate of complications affecting the donor area, we consider EIP transposition surgery a valid option for inveterate EPL ruptures.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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