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Clinical case

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Sequelae of an acute Essex Lopresti lesion: a case report

Secuelas de una lesión aguda de Essex Lopresti: a propósito de un caso

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ABSTRACT. **Introduction:** the forearm is considered a joint in itself where the ulna and radius interact. It is composed of the proximal radioulnar joint (PRUJ), the interosseous membrane (IOM), with the central band as the main component, and the distal radioulnar joint (DRUJ), which includes the triangular fibrocartilage complex (TFCC). Essex-Lopresti lesion (ELL) is a complex injury caused by axial forearm loading, leading to longitudinal radioulnar dissociation and stability loss due to IOM rupture, PRUJ injury with radial head involvement, and DRUJ injury with TFCC involvement. Early diagnosis is crucial as treating chronic injuries poses a significant challenge. **Objective:** to describe chronic ELL, review the literature, and share treatment experience. **Case presentation:** we describe the case of a 30-year-old male patient with a history of a motorcycle accident in 2019, initially diagnosed as a comminuted radial head fracture and treated with its resection at another center. He presented to our center in June 2023, complaining of wrist pain and a reducible but unstable dorsal ulnar protrusion. He had no elbow or forearm pain and had a full range of motion. Complementary tests (X-rays, CT scans, and MRI) showed a positive ulnar variance, a dorsal ulnar subluxation at the wrist and a TFCC lesion, without evidence of acute rupture of the IOM. An examination under anesthesia and fluoroscopic evaluation was performed to examine the stability and range of motion of the elbow and ARCD, as well as longitudinal stability of the forearm by traction, with no longitudinal instability observed. After considering

RESUMEN. Introducción: el antebrazo puede considerarse como una articulación en sí misma donde interactúan el cúbito y el radio. Está constituida por la articulación radiocubital proximal (ARCP), la membrana interósea (MIO) con la banda medial como componente principal, y la articulación radiocubital distal (ARCD), que incluye el complejo fibrocartílago triangular (CFCT). La lesión de Essex-Lopresti (LEL) es una lesión compleja causada por una carga axial del antebrazo, que conlleva la disociación radiocubital longitudinal y la pérdida de estabilidad debido a la rotura de la MIO, la lesión de la ARCP con la cabeza del radio y lesión de la ARCD por afectación del CFCT. El diagnóstico precoz es crucial ya que el tratamiento de las lesiones crónicas plantea un importante desafío. **Objetivo:** describir la LEL crónica, revisar la literatura y compartir la experiencia de su tratamiento. **Caso clínico:** se describe el caso de un varón de 30 años que sufrió un accidente de moto en 2019. Diagnosticado inicialmente de fractura conminuta de cabeza radial derecha, fue tratado inicialmente mediante resección de la misma. El paciente visitó nuestro centro en 2023, la exploración clínica mostró dolor en muñeca y una protrusión dorsal de cúbito reductible pero inestable, sin dolor ni limitación de movimiento en el codo y antebrazo. Las pruebas complementarias, radiología simple y RMN, mostraron una varianza cubital positiva, una subluxación dorsal del cúbito a nivel de la muñeca y una lesión del CFCT, sin evidencia de ruptura aguda de la MIO. Se llevó a cabo un examen bajo anestesia y una evaluación fluoroscópica para examinar la estabilidad y el rango de movimiento del codo y la ARCD, así como la estabilidad longitudinal del antebrazo

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the longitudinal stability of the forearm A 10 mm ulnar shortening osteotomy was performed and fixed with a plate and screws (FreeFix® SKDynamics). Arthroscopically, the TFCC was disinserted and reinserted using a modification of the Mantovani technique. It was immobilized with a Münster splint. At six-month follow-up, he has a VAS of 0 at the elbow and wrist, and a dorsal flexion/ volar flexion of 80o/80o, and a supination/pronation deficit of 10o/10o. **Conclusion:** ELL is a rare but challenging pathology for orthopaedic surgeons. Therapeutic options include various surgical interventions, with ulnar shortening with TFCC repair being a viable option in chronic cases without longitudinal instability.

Keywords: acute injury, sequelae, forearm, Essex-Lopresti injury, surgical intervention.

mediante tracción. Al no observarse inestabilidad longitudinal, se realizó una osteotomía de acortamiento del cúbito de 10 mm y se fijó con una placa y tornillos. De forma artroscópica, se observó la desinserción del CFCT y se reinsertó mediante una modificación de la técnica de Mantovani. Se inmovilizó con una férula de Münster. A los seis meses de seguimiento, tiene un EVA de 0 en codo y muñeca, y una flexión dorso/volar de 80º/80º, y un déficit de supinación/pronación de 10o/10o. **Conclusiones:** la LEL es una patología infrecuente pero desafiante para el cirujano. Las opciones terapéuticas incluyen diversas intervenciones quirúrgicas, siendo el acortamiento del cúbito con reparación del CFCT una opción viable en casos crónicos sin inestabilidad longitudinal.

Palabras clave: lesión aguda, secuelas, antebrazo, lesión de Essex-Lopresti, intervención quirúrgica.

Abbreviations:
CB = central band
CT = computed tomography
DRUJ = distal radioulnar joint
ECU = extensor carpi ulnaris
ELL = Essex-Lopresti lesion
IOM = interosseous membrane
MRI = magnetic resonance imaging
PRUJ = proximal radioulnar joint
TFCC = triangular fibrocartilage complex

Introduction

The forearm can be considered a joint because of the relationship between the radius and ulna at the elbow and wrist.[1] It is composed of the proximal radioulnar joint (PRUJ), which includes the radial head, lesser sigmoid cavity, and interosseous membrane (IOM), and the distal radioulnar joint (DRUJ), with the triangular fibrocartilage complex (TFCC) as the connecting element.

The radial head is the primary longitudinal stabilizer of the forearm while the IOM and TFCC act as secondary stabilizers. Other factors that have an important role in the forearm stability are: ulnar variance, degree of forearm rotation, wrist position, elbow varus/valgus position and the pattern of load applied.16-19.[2]

The IOM is made up of five ligaments.[2,3] The central band (CB) is the strongest and most critical for longitudinal stability. It is the widest (9.7 ± 3 mm) and thickest part of the IOM (1.3 ± 0.2 mm). It originates on the radius approximately 60% of the distance from the radial styloid to the radial head and runs distally, inserting at a 21-24º angle on the ulna in the mid-distal third of its length.

The remaining ligaments are: the accessory band, the distal oblique bundle or distal membranous portion, the proximal oblique cord on the anterior aspect and the accessory dorsal oblique cord.[3]

In 1951, Peter Essex-Lopresti described proximal migration of the radius following surgical excision of the radial head.[1,4] This longitudinal migration of the radius can occur when a traumatic axial load is transmitted from the wrist to the elbow, resulting in the combination of distal radioulnar joint disruption, rupture of the IOM and fracture of the radial head.[5]

This constellation of injuries results in axial radioulnar longitudinal instability. It may manifest itself acutely or chronically after excision of the radial head. According to some series, the median time of presentation of ulnar wrist symptoms was nine months after excision of the radial head.[3,5]

This pattern of injury can be included in the group of unstable forearm fractures, characterized by fracture of one or both forearm bones associated with injury to some of the main stabilizers of the forearm. The absence of at least two of these may result in an ELL as previously discussed.

The true extent of injury is often underestimated, with misdiagnosis rates exceeding 60% in most series.[5] In the acute setting, signs of instability[6] can be subtle and require a high index of clinical suspicion, especially in the presence of radial head fractures.[2] An initial misdiagnosis can lead to chronic ELL, a condition that is difficult to manage for satisfactory outcomes.[1]

Edwards and Jupiter classified[7,8] ELLs into three types *(Table 1)*.

Early treatment of these lesions usually achieves satisfactory results with radial head fixation (in type I) or radial head replacement (in type II) in combination with TFCC repair and DRUJ stabilization. In contrast, type III injuries (chronic cases) represent a major challenge, with unpredictable surgical outcomes.

Objectives. The aim of our work is to describe the diagnosis of a chronic Essex Lopresti lesion, review the literature and propose a possible treatment for this lesion based on a clinical case.

Case report

We present the case of a 30-year-old male who suffered a traffic accident on a motorbike in 2019, complaining of

pain in the right elbow and wrist. At another centre, he was diagnosed with a comminuted fracture of the radial head, and the radial head was excised.

In 2023, he visited our centre, reporting pain in the wrist. Physical examination showed: a dorsal deformity at the wrist corresponding to the distal ulna, which could be reduced manually but was unstable *(Figure 1)*. This pain increased with elbow extension and counter-resistance in pronation.

There was no pain in the forearm or elbow, where the range of motion of flexion-extension and pronation-supination was complete.

No distal neurovascular deficits were observed.

Additional tests performed were: radiographs of the wrist and elbow (X-ray) *(Figure 2A-B)*, computed tomography (CT) of the wrist *(Figure 2C)* and magnetic resonance imaging (MRI) of the wrist and forearm. At the wrist they revealed a positive ulnar variance *(Figure 2B)*, a dorsal subluxation of the ulna with respect to the radius, a lesion of the TFCC with rupture of its insertion at the ulnar level (type II of the Atzei/IWAS classification) *(Figure 2D)* and signs of extensor carpi ulnaris (ECU) tendinopathy.

MRI of the forearm showed no acute lesions of the IOM and we assumed that it was healed *(Figure 2E)*.

Given these findings, the following surgical intervention was proposed: PRUJ stability evaluation, ulnar shortening osteotomy and wrist arthroscopy for revision of the TFCC.

Surgical procedure

The procedure started with an examination under anesthesia and fluoroscopic assessment of: varus/valgus instability of the elbow, longitudinal instability of the forearm and DRUJ.

The radius longitudinal compression and radius traction tests were applied without observing any displacement *(Figure 3)*. Assuming, therefore, the integrity of the IOM, which implied longitudinal stability of the forearm, we proceeded to perform an ulnar shortening osteotomy.

A 1 cm ulnar shortening osteotomy was performed and fixed with a plate (FreeFix® SKDynamics, 7300 North Kendall Drive, Suite 400, Miami, Florida 33156, 877-753-5396 Designed and Manufactured in the USA). After a correct radiographic control, the arthroscopic procedure was performed.

Through portals 3-4 and 6R a disinsertion of the TFCC was observed in its most dorsal- foveal area *(Figure 4A)*, and a reinsertion was performed using a modification of the Mantovani technique with a PDS 3/0 suture *(Figure 4B)*. Final stability was checked and a Münster-type splint was applied with the elbow at 90° and the forearm in neutral position.

The postoperative regimen included the following specific guidelines: wrist flexion and extension from the third postoperative week, free pronation from the sixth week, and weight bearing and strength training from 7-8 weeks postoperatively.

At the third week the splint was removed, and wrist flexion and extension was started with good radiographic control. After six months, the patient reported no pain in the elbow or wrist. Radiographically, we observed signs of osteotomy consolidation. At this time, the patient had an active wrist flexion and extension of 80/80º and a 10º deficit in pronation *(Figure 5)*.

Table 1: Classification of Essex-Lopresti lesions (ELL) according to Edwards and Jupiter.

ELL type	Description
1	Fracture of the radial head with a large displaced fragment and minimal or no comminution amenable to open reduction and internal fixation
2	Comminuted fracture of the radial head that cannot be reconstructed and requires excision of the radial head and prosthetic replacement
3	Chronic cases with irreducible proximal radial migration. Consider performing ulnar shortening osteotomy and an accessory procedure (radial head arthroplasty ± arthroscopic assessment ± IOM reconstruction)

Figure 1:

Preoperative clinical examination.

Figure 2: Complementary tests. **A)** Preoperative AP and LAT view of the wrist and elbow. **B)** Ulnar variance with respect to contralateral. **C)** CT image. **D)** MRI TFCC lesion type II Atzei/IWAS classification. **E)** Forearm MRI.

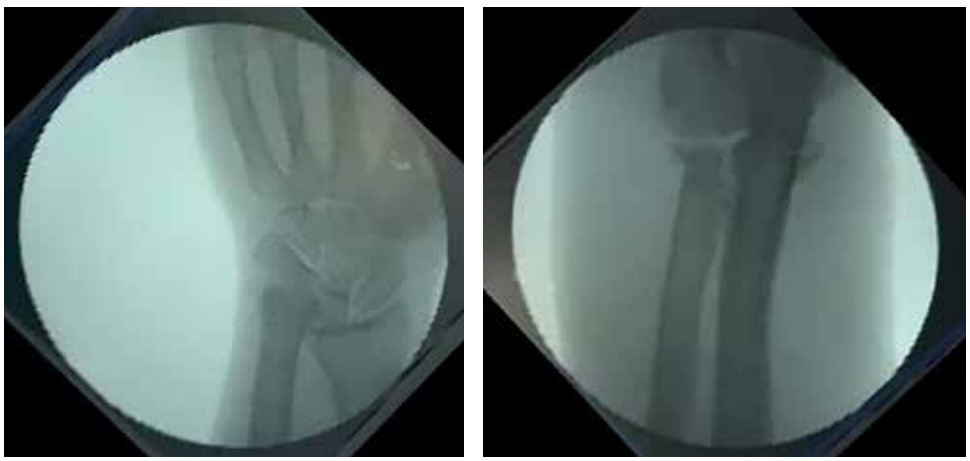

Figure 3:

Intraoperative radius traction and compression test.

The patient was able to return to his usual work as a cook and to his usual sporting activity.

Discussion

A fracture of the radial head alone should be considered a warning sign as it may be associated with more serious and complex injuries such as a Hotchkiss terrible triad or an Essex Lopresti injury. The tools at our disposal are a proper physical examination and understanding the forearm as a joint, ascertaining, as far as possible, the mechanism of injury. A varus/valgus and/or rotational component would suggest a triad and axial trauma to the forearm would suggest an ELL as was the case in our patient.

If we focus on the ELL, a correct assessment of the interosseous membrane and the stability of the distal radioulnar joint must be performed. Early recognition of IOM lesions is the key to avoiding complications and obtaining favourable outcomes: in the acute setting, there may be only subtle findings indicative of instability,[5,9] therefore a high index of clinical suspicion is required.

Elbow, forearm and wrist radiographs and bilateral radiographs are necessary especially in Mason fracture type 2 or higher. Bilateral radiographs in pronation will allow comparison of ulnar variance with the uninjured wrist; it should also be noted that wrist radiographs may be normal on initial presentation[2] and it has been reported that only 20% of these injuries are fully recognised on initial presentation.[3,9]

MRI and ultrasound have become valuable diagnostic tools for IOM tears, with sensitivity rates of over 88% in most series.[5] The «muscle herniation sign» can be detected in the presence of an IOM tear by applying an anterior-to-posterior force, with the herniated musculature also easily visible by ultrasound on the posterior aspect of the forearm.

Longitudinal stability should always be assessed intraoperatively using the radius compression and traction test. A distal migration of the radius greater than 3 mm after applying manual traction to the radius suggests an IOM tear, while a proximal migration greater than 6 mm indicates injury to both the TFCC and the IOM, strongly suggesting longitudinal instability.[2]

However, all these tests may be negative in case of a partial lesion of the IOM.[3]

As for treatment, there is no gold standard. What we do know is that most of these cases require an ulnar shortening osteotomy.[3] If the patient reports elbow pain or intraoperatively a longitudinal instability is observed, some action at the proximal radioulnar joint, such as radial head arthroplasty, may be required.[8,10]

Subsequently, if the patient reports pain in the evaluation of the distal radioulnar joint, or instability at this level, we should suspect a TFCC injury. We will use arthroscopy for proper assessment and treatment.[3]

Ulnar shortening osteotomy, combined with TFCC repair, plays a critical role in the management of chronic Essex-

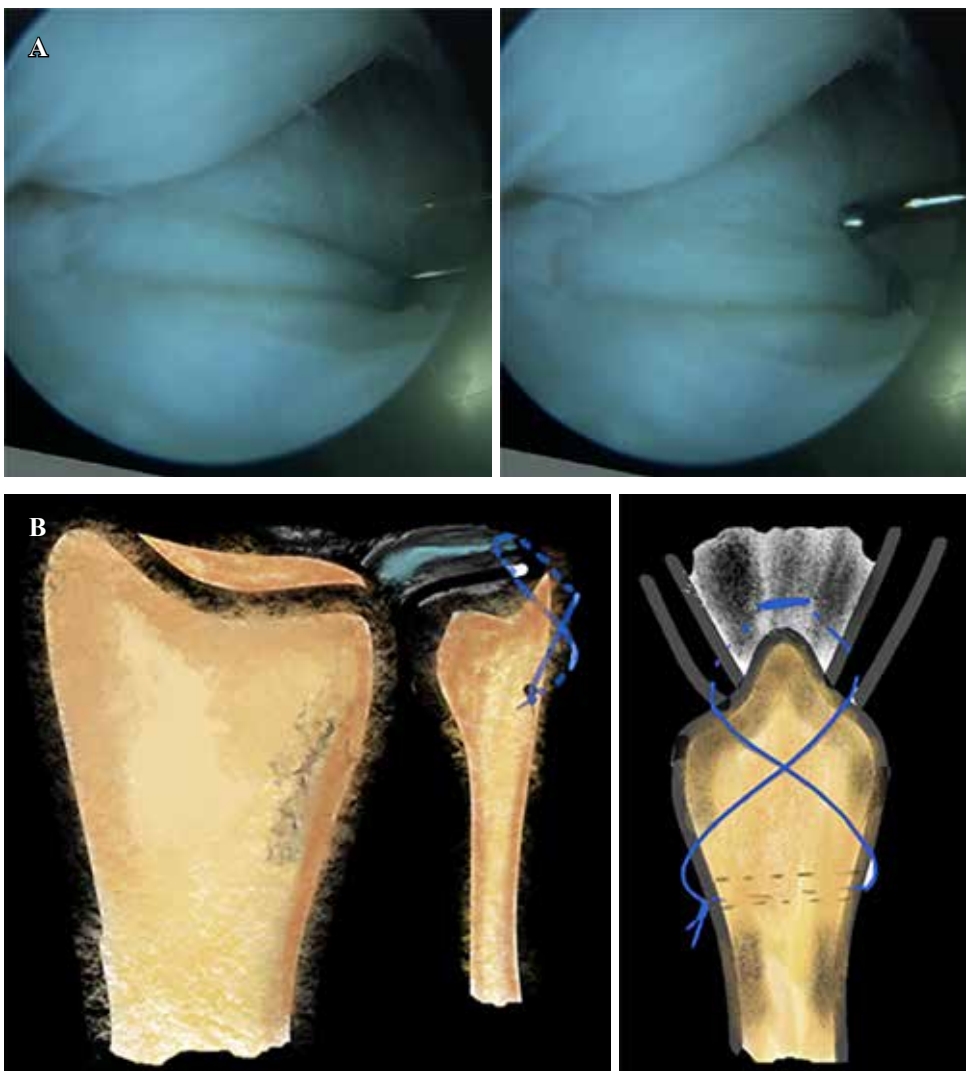

Figure 4:

TFCC. **A)** Arthroscopic view of TFCC lesion. **B)** TFCC repair by Mantovani technique modification. Original illustration by Raquel Maroto-Rodríguez.

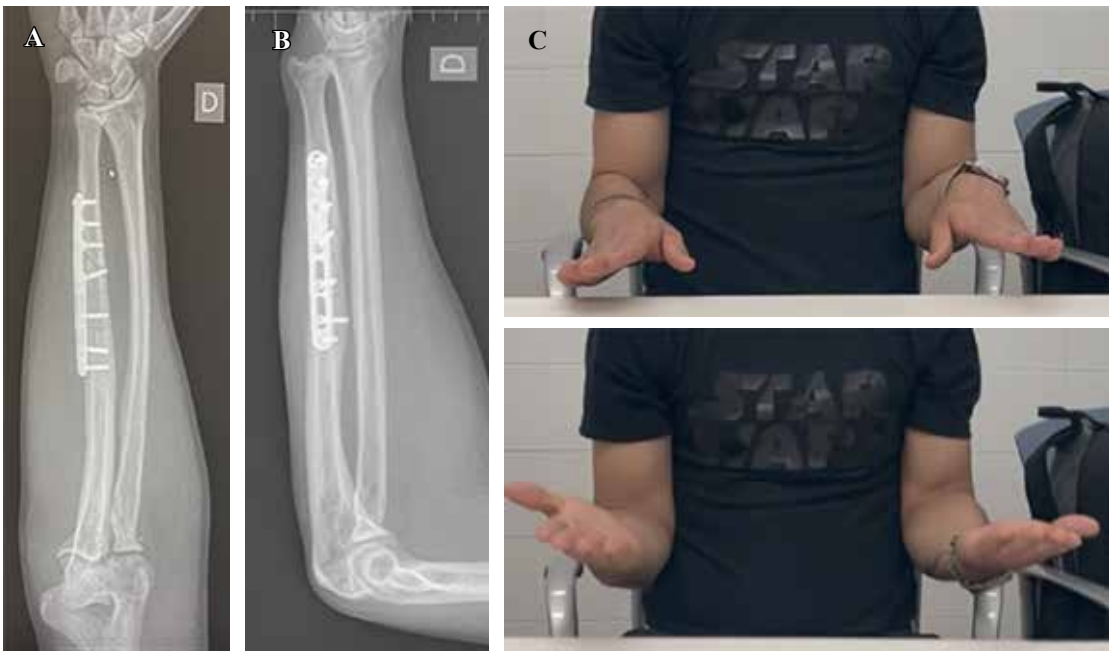

Figure 5:

A) Six months postoperative. **B)** Postoperative radiological control at six months. **C)** Patient's ROM at six months.

Lopresti injuries, particularly in cases where longitudinal stability of the forearm is preserved. This approach addresses ulnar variance and helps restore distal radioulnar joint stability, directly impacting the patient's functional outcomes. TFCC repair is essential to stabilize the distal radioulnar joint and prevent further subluxation or instability, which can cause chronic pain and functional impairment if untreated. Studies have shown that ulnar shortening osteotomy reduces stress on the TFCC, thereby allowing a more stable and congruent alignment at the wrist, crucial for patients with symptomatic ulnar-sided wrist pain.[9,10] This dual approach, combining osteotomy and TFCC fixation, offers a targeted solution to address both structural and symptomatic needs, highlighting its importance in treatment protocols for complex forearm injuries.[5,11]

In chronic cases, if longitudinal instability is observed, the treatment should be its reconstruction.

Multiple techniques have been described for reconstruction of the membrane using palmaris longus,[12] flexor carpis radialis,[13] Achilles allograft,[11,14,15] pronator teres,[3,5,13,16,17] hamstring,[18,19] synthetic materials[20,21] and bone-patellar tendon-bone graft.[5,6,9,16,22]

Adams et al.,[5] described the use of the latter option, they report that there are no differences between the use of autograft or allograft for reconstruction except for a 19% incidence of mild knee symptoms observed in the autograft group.

Bigazzi et al,.[9] described the reconstruction of the interosseous membrane using fascia lata grafting. They reported that it has a good tendon size, larger and stronger than the palmaris longus or half of the radial carpal flexor tendon.

In addition, fascia lata graft is readily available without complications in the donor site (fascia lata allograft from allograft bone bank), compared to bone-patellar tendon-bone graft.

A common problem encountered in the literature relates to adequate graft tensioning. Laboratory studies suggest pre-tensioning the graft, but it is difficult to achieve and maintain in the operating room. To avoid this, in this article they describe anchoring one end of the graft with transosseous sutures and the other end to the ToggleLoc fixation device with ZipLoop technology, which allowed us to progressively tension the graft, approximating it as needed and checking the longitudinal stability of the forearm, as described above.

Several comparative studies have been carried out to evaluate the biomechanical performance of selected IOM reconstructive techniques.

Stabile et al.,[18] conclude that all grafts are structurally inferior to the IOM and within the multiple possibilities opt for the double-stranded FCR graft.[14]

Two cadaveric studies also demonstrated that reconstruction with FCR autograft effectively restored normal biomechanics and reduced proximal radial migration.[14] Three other cadaveric studies collectively evaluated the biomechanics of native IOM, Achilles tendon allograft, patellar tendon bone autograft, radial carpal flexor autograft and palmaris longus autograft.[12,15,18] Among these three studies, no one of the reconstructive techniques restored the same stiffness than the native IOM, with patellar tendon bone graft providing the greatest stiffness.

With regard to graft placement, one study demonstrated that, in terms of biomechanical outcomes, proximal-distal accuracy of graft significance is less important than the proper angle and tension of the graft with the forearm in supination.[23]

This 2019 meta-analysis[2] includes multiple studies describing different techniques to reconstruct it, using different types of graft and anchors. There is no superiority in any of them and the recommended technique is the one with which the surgeon is most comfortable.

Finally, radioulnar synostosis[9] is the definitive salvage procedure for longitudinal radioulnar instability. However, the result is a fixed forearm in a rotated position, which is usually chosen in neutral or mild pronation. The union rates are lower and the complication rate higher in patients with previous trauma (such as Essex-Lopresti lesions) than in patients undergoing the procedure for congenital or neoplastic conditions.

Conclusion

It is important to stress the importance of understanding the forearm as a single joint and to consider radial head fractures, especially from Mason II onwards, as an indication of a possible more serious and complex injury, hence the importance of a high degree of suspicion and correct physical examination.

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Ethical consideration: all procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The authors have granted informed consent from the patients to use the images.

Conflict of interests: the authors do not have any conflict of interest.