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#### EVALUATION AND MANAGEMENT OF CHRONIC POSTEROLATERAL ROTATORY INSTABILITY (PLRI)

Roger van Riet<sup>1,2</sup>

<sup>1</sup>AZ Monica Hospital, Orthopaedic Centre Antwerp and Monica Orthopaedic Research (MoRe) Foundation, Antwerp, Belgium

<sup>2</sup>University of Antwerp, Wilrijkstraat 10, Edegem, Belgium

#### SUMMARY

The lateral ulnar collateral ligament (LUCL) is the main static stabilizer to prevent posterolateral rotatory instability (PLRI). Symptomatic PLRI can range from subtle instability to recurrent dislocations in which the ulna and radius rotate around the humerus in a posterolateral direction. The LUCL shares a common insertion with the radial collateral ligament (RCL) on the lateral condyle of the humerus and inserts distally on the proximal part of the supinator crest of the ulna. The most common mechanism of injury is a fall on the outstretched hand. If initial treatment fails, chronic instability may develop. Direct repair may no longer be possible and augmentation of the reconstruction can be necessary in chronic cases. The diagnosis is mainly clinical with several specific tests. Imaging may be helpful. In patients with grade I instability arthroscopic imbrication of the LCL complex has been shown to yield excellent results. A tendon graft is often used in more severe grades of instability.

**Keywords:** PLRI, instability, elbow, ligament, LUCL

#### OCENA I LECZENIE PRZEWLEKŁEJ TYLNO-BOCZNEJ NIESTABILNOŚCI ROTACYJNEJ STAWU ŁOKCIOWEGO (PLRI)

Roger van Riet<sup>1,2</sup>

<sup>1</sup>AZ Monica Hospital, Orthopaedic Centre Antwerp and Monica Orthopaedic Research (MoRe) Foundation, Antwerp, Belgium

<sup>2</sup>University of Antwerp, Wilrijkstraat 10, Edegem, Belgium

#### STRESZCZENIE

Wiązadło poboczne boczne łokciowe (LUCL) jest głównym statycznym stabilizatorem, które zapobiega niestabilności tylnobocznej rotacyjnej (PLRI) stawu łokciowego. Objawowe PLRI może wahać się od subtelnej niestabilności do nawracających dyslokacji, w których kość łokciowa i kość promieniowa obracają się wokół kości ramiennej w kierunku tylnobocznym. LUCL ma wspólny przyczep z więzadłem promieniowym bocznym (RCL) na nadkłykcii bocznej kości ramiennej oraz w dalszym końcu proksymalnej części grzebienia kości łokciowej. Najczęstszym mechanizmem obrażeń jest upadek na wyciągniętą rękę. Jeśli leczenie zachowawcze zakończy się niepowodzeniem, może dojść do przewlekłej niestabilności. W takich przypadkach naprawa bezpośrednia więzadła może nie być już, dlatego wskazane jest wzmocnienie rekonstrukcji. Rozpoznanie opiera się głównie na badaniu klinicznym po przeprowadzaniu z specyficznych testów. Badania obrazowe może być pomocne. U pacjentów z niestabilnością I stopnia wykazano, że artroskopowa rekonstrukcja kompleksu LCL daje doskonałe wyniki. Przeszczep ścięgna jest często stosowany w wyższych stopniach niestabilności.

**Słowa kluczowe:** PLRI, LUCL, więzadło promieniowe poboczne, więzadło boczne łokciowe

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## Introduction

Posterolateral rotatory instability (PLRI) was first described by O'Driscoll *et al.* in 1991 (O'Driscoll *et al.*, 1991) as an injury to the Lateral Ulnar Collateral Ligament (LUCL) of the elbow. The radius and ulna rotate posteriorly relative to the humerus. The LUCL and radial collateral ligament (RCL) share a common insertion on the lateral condyle of the humerus. The LUCL is the major stabilizer to posterolateral rotatory stresses, whereas the RCL resists varus stress. Both the LUCL and RCL need to be avulsed from the lateral condyle for a clear PLRI pattern to occur (Dunning *et al.*, 2001).

The most common mechanism of injury is a fall on the outstretched hand but different mechanisms of injury may lead to chronic PLRI. Some patients may have had a minor fall, while others would have had recurrent dislocations of the elbow. Unfortunately, iatrogenic injuries to the LCL complex are a relatively common mechanism, for example following tennis elbow surgery. The LCL complex has a tendency not to heal following injury and repair or reconstruction may be indicated in chronic symptomatic cases.

## Aim

The aim of this paper is to describe the evaluation, diagnosis, imaging and treatment of patients with symptomatic PLRI.

## Material and methods

Clinical evaluation is the mainstay of diagnosis and consists of multiple specific tests. Imaging is often inconclusive and the advantages and disadvantages of different imaging modalities will be discussed. Surgical options include arthroscopic and open techniques and technical tips will be described as well as the indication.

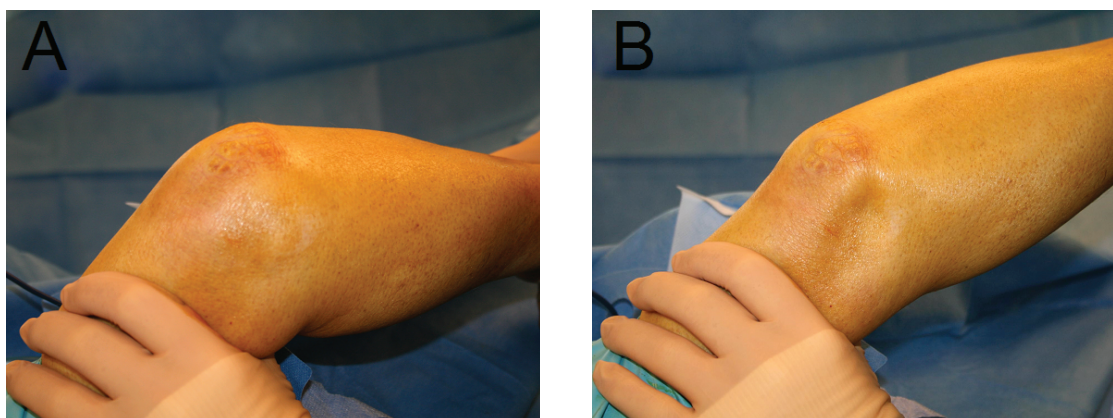
## Evaluation

Clinical evaluation is the most important

part in the diagnosis of PLRI. Often patients will complain of subtle weakness and clicking of the elbow, for example when they are trying to push up from a chair. The elbow is usually painful. Other patients may have had recurrent episodes of elbow dislocations, sometimes with only minor injuries. Multiple specific tests have been described. Most commonly used are the pivot shift, posterior drawer and table top tests (O'Driscoll 2000). In the pivot shift test, the patient is lying supine on the examination table. The shoulder is extended and externally rotated. The examiner supinates the forearm and applies valgus stress and an axial compressive load on the elbow while the elbow is flexed and extended. In a positive test, a subluxation will occur around 30–45° of flexion (Figure 1). The elbow will reduce with further extension. Often the elbow will not significantly sublux in an awake patient but the patient will be apprehensive. A frank dislocation may occur with the patient under anaesthesia. Apprehension is less common in the posterior drawer test. The forearm is externally rotated and even subtle subluxation can be palpated in the soft spot. For the table top test, the hand is placed on a table with the forearm supinated. The patient is asked to support their weight on the arm while the elbow is flexed. In a positive test, pain and apprehension occur with the elbow at about 40 degrees of flexion. Alternatives to this test include the chair and push-up tests. It is advised to perform more than one test to diagnose PLRI in an awake patient.

## Imaging

Radiographs and CT scans are often negative. Lateral calcification or subluxation can sometimes be found as indirect signs of ligamentous injury. Magnetic resonance imaging may show scarring of the ligament or a clear rupture of the ligament (Figure 2).



**Figure 1.** (A) The pivot shift is performed with the patient under general anaesthesia. The forearm is supinated and moved from flexion to extension while applying axial compression and valgus stress (Courtesy of MoRe Foundation). (B) The radial head will sublux posteriorly in a positive test, creating a skin depression between the radial head and capitellum. (Courtesy of MoRe Foundation).



**Figure 2.** Magnetic resonance image, showing an insufficient lateral collateral ligament (Courtesy of MoRe Foundation).

### Treatment

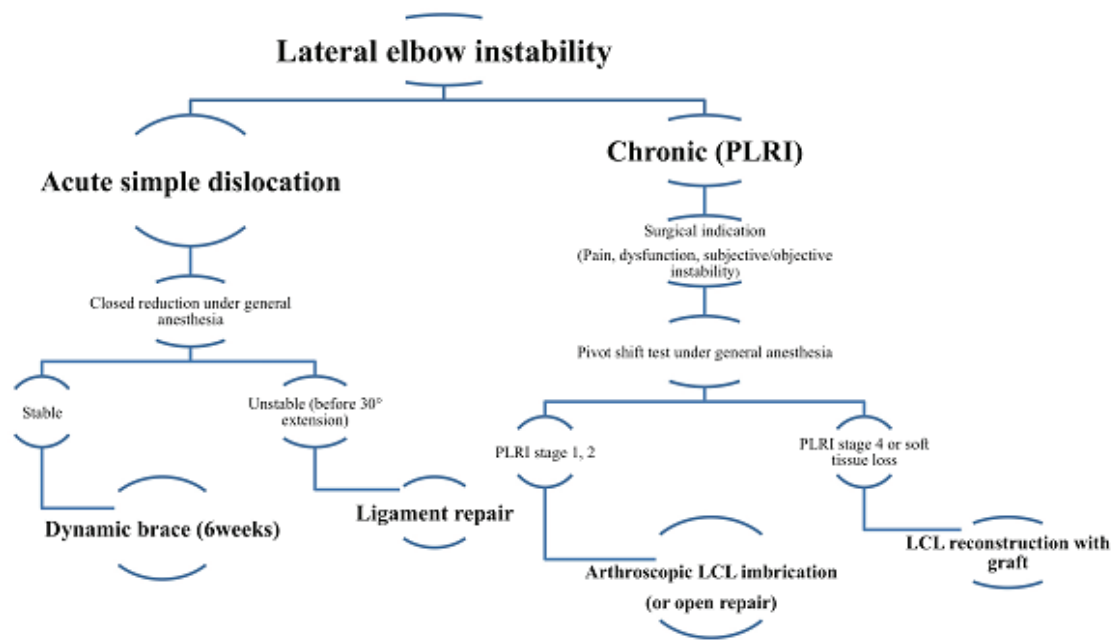
Surgical treatment is indicated in patients with chronic symptomatic PLRI. This can be performed arthroscopically or with open techniques. The decision between the two is based on an algorithm developed at Monica Hospital (Figure 3).

## Results

### Arthroscopy

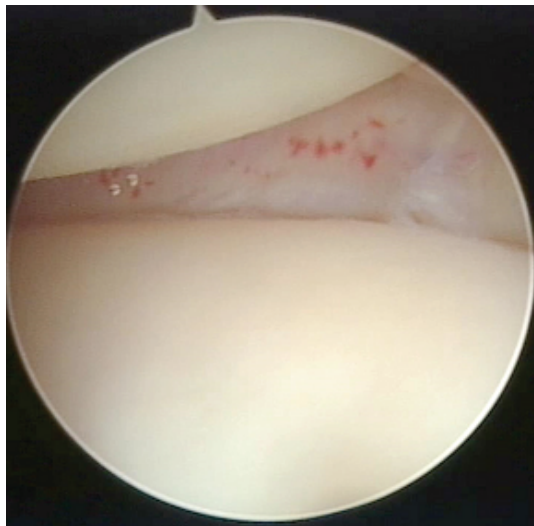
The patient is placed in lateral decubitus. A standard diagnostic arthroscopy is performed. In an acute ACL avulsion, a bone anchor can be placed in the lateral epicondyle. The sutures are shuttled through the LCL complex and the LCL is fixed under direct arthroscopic view. Repair is usually not possible in chronic cases. For these patients, we use an arthroscopic imbrication technique (Conti Mica *et al.*, 2016; Tashjian *et al.*, 2016). The scope is placed in the posterolateral gutter. PLRI is assessed using the drive through sign and arthroscopic rotation test where an uncovered view of most of the radial head (Figure 4) can be visualized with supination of the forearm and traction on the radius (Conti Mica *et al.*, 2016). A spinal needle is loaded with a no.2 PDS suture. The needle is placed through the insertion of the LCL at the lateral epicondyle. The PDS is then shuttled into the radiohumeral gutter and pulled through the soft spot portal (Figure 5). A second PDS suture is shuttled from the subcutaneous border of the ulna, over the origin of the LCL on the supinator crest into the radiohumeral gutter (Figure 6). This is then also pulled through the soft spot portal where both ends are tied together. The suture is then doubled. A mosquito is used to pull both the distal and proximal ends



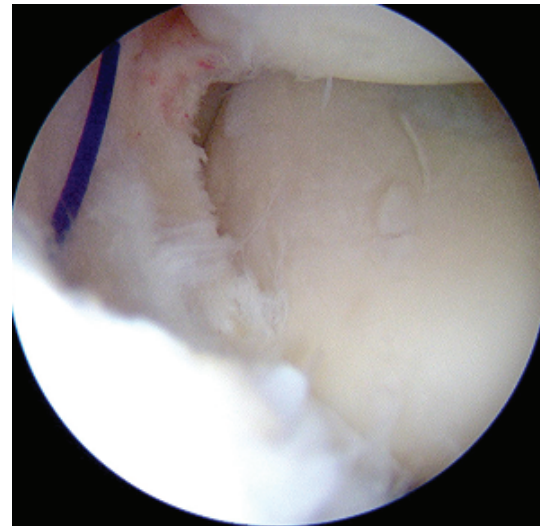


**Figure 3.** Treatment algorithm for patients with symptomatic posterolateral rotatory instability (Courtesy of MoRe Foundation).

of the sutures subcutaneously through the soft spot. The sutures are tensioned and rotatory stability is tested again. The sutures are tied once satisfactory stability has been obtained. In our cohort of patients, both DASH and MEPS significantly improved with this technique at a minimum follow-up of 2 years (Conti Mica *et al.*, 2016).



**Figure 4.** Arthroscopic posterolateral view of an unstable radiocapitellar joint. Axial traction, supination and varus stress uncover the entire surface of the radial head (Courtesy of MoRe Foundation).



**Figure 5.** Arthroscopic posterolateral view of the radio-capitellar joint showing the proximal intraarticular part of the PDS suture (Courtesy of MoRe Foundation).

#### *Open reconstruction*

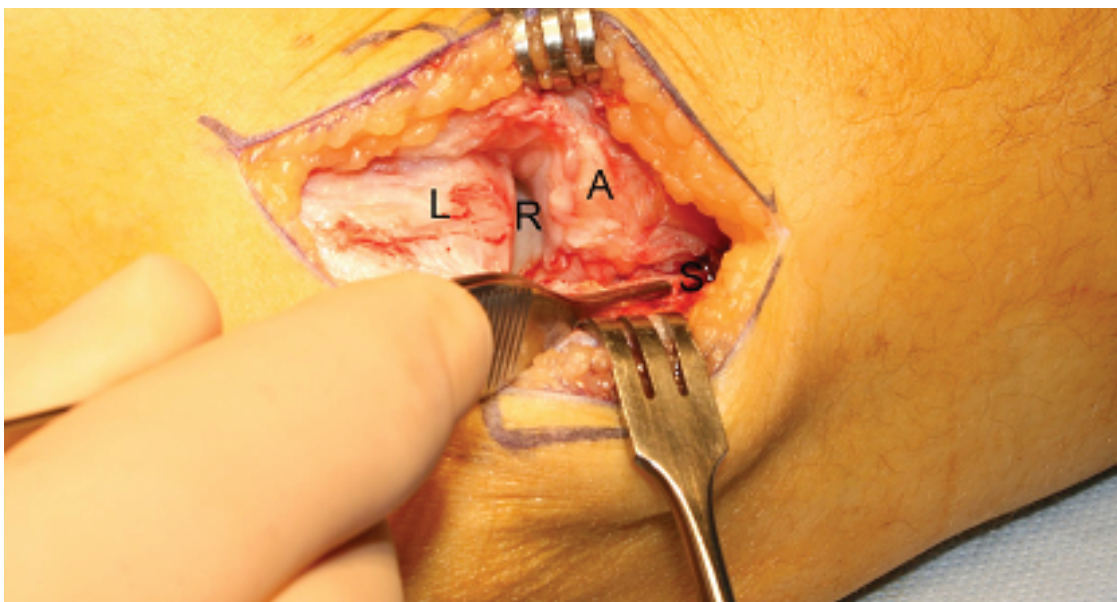
Lateral collateral ligament reconstruction is usually performed under locoregional anaesthesia from an ultrasound guided supraclavicular block but if the patient prefers it can be done under general anaesthesia.

A 4-cm direct lateral incision is made. Kocher's interval is developed between the supinator crest distally and lateral epicondyle



**Figure 6.** Lateral view onto the elbow. Radial head, capitellum and LCL complex are marked on the skin. The first PDS strand is in place running from the lateral condyle, where it enters the joint, to the soft spot portal. The second PDS will enter the joint through the spinal needle at the subcutaneous border of the ulna. (Courtesy of MoRe Foundation).

proximally. The supinator crest is palpated and followed proximally. The LUCL inserts on a small proximal tubercle proximal on the supinator crest. The capsule is opened posterior to any remnants of the LCL complex and followed on to the lateral epicondyle (Figure 7). Synovitis is common. Extensor tendon and LCL remnant are sharply dissected from the lateral condyle, so that they can be fixed to bone or in bone tunnels. Anchors, cortical buttons, screws or bone tunnels can be used to fix the graft. In our practice an allograft extensor research longus tendon of approximately 20 cm is used as a ligamentous graft but other allograft, autograft and synthetic grafts can be used. We prefer to perform a cortical bone button fixation. One button is placed unicortically at the ulnar insertion of the LUCL. A second button is placed bicortically at the isometric humeral insertion and fixed behind the posterior cortex. Care is taken not to place the button in the olecranon fossa, as this may interfere with extension. The capsule is closed under the graft and the graft is fixed with both buttons and sutured to itself for further fixation (Figure 8). While tightening the graft, the elbow is held in 30° of flexion with the forearm in pronation.



**Figure 7.** Intraoperative photograph showing the lateral epicondyle (L), radial head (R), anular ligament (A) and supinator crest (S). The forceps point towards the insertion of the LUCL (Courtesy of MoRe Foundation).





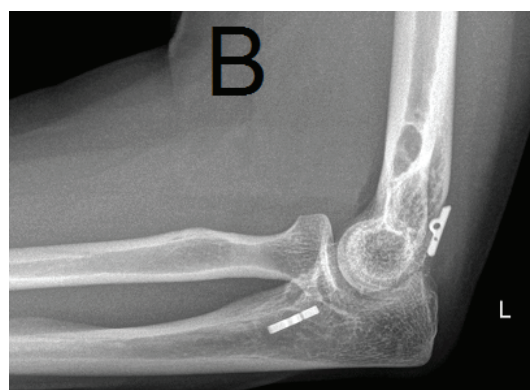
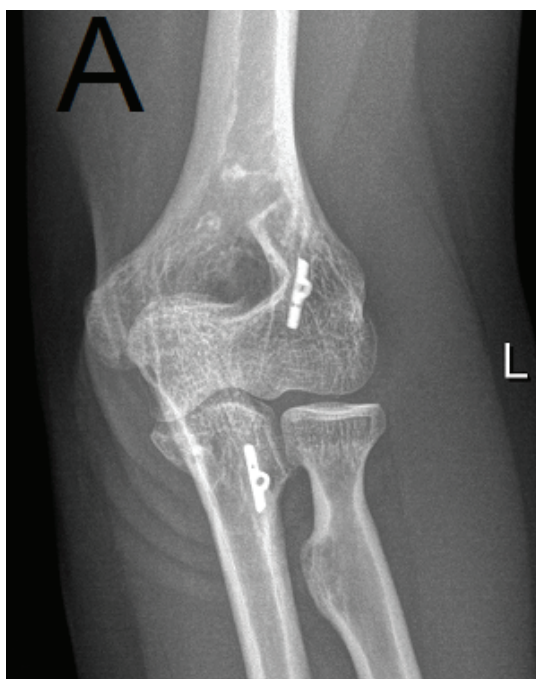
**Figure 8.** An extensor research longus graft (\*) is tensioned and fixed between two cortical buttons. The remaining graft limbs (1 and 2) is doubled back and sutured onto itself for additional fixation (Courtesy of MoRe Foundation).

#### *Postoperative protocol*

Position of the buttons can be confirmed on plain radiographs (Figure 9). The elbow is protected by a dynamic splint. Flexion is allowed freely in the brace. Extension is blocked at 60° for the first two weeks and increased with 30° increments at two and four weeks.

#### **Discussion and conclusions**

In general, results are good, after LCL reconstruction (Olsen and Sojbjerg 2003; Sanchez-Sotelo *et al.*, 2005). Recurrence at long-term follow-up has been reported between 10 and 25% (Jones *et al.*, 2012; Sanchez-Sotelo *et al.*, 2005). Preoperative degenerative changes and prior surgery to the elbow are negative predictive factors.



**Figure 9.** (A, B) Postoperative anteroposterior and lateral radiographic view of the elbow, showing correct placement of the buttons (Courtesy of MoRe Foundation).

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*Author responsible for correspondence:  
Roger P. van Riet  
AZ Monica Hospital and Monica Orthopaedic  
Research (MoRe) Foundation,  
Stevenslei 20, 2100 Antwerp, Belgium  
drrogervanriet@azmonica.be*

*Autor nie zgłosił źródła finansowania.  
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*Autor odpowiedzialny za korespondencję:  
Roger P. van Riet  
AZ Monica Hospital and Monica Orthopaedic  
Research (MoRe) Foundation,  
Stevenslei 20, 2100 Antwerp, Belgia  
drrogervanriet@azmonica.be*