10 Evaluation and Management of Posterolateral Rotatory Instability (PLRI)

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Background

The first reports of lateral elbow instability focused on the repair of the lateral elbow ligaments by Osborne and Cotterill [1]. These authors reported on a direct repair of the lateral elbow ligamentous structures in 1966 [1]. They performed a plication of the ligaments in cases with ligament laxity or avulsion of the lateral collateral ligament. They also described an intermittent subluxation of the lateral head into a capsular pocket or capitellar defect (Osbourne-Cotteril lesion), which could easily be reduced by the patient. In retrospect, these signs are consistent with posterolateral instability, now recognized as the most common type of symptomatic chronic instability of the elbow [2]. Laxity of the posterolateral capsule was considered to be the origin of the posterior instability.

Both Hassman et al. and Simeonides et al. reported on recurrent instability of the elbow in 1975 [3, 4]. The former described a patient with a stable ulnohumeral joint despite having required 12 closed reductions of the elbow. Burgess and Sprague reported two cases with posttraumatic radial head subluxation. Post-operative evaluation showed persistent posterior radial head subluxation after annular ligament tightening [5]. Good results were seen in the last three reports using the Osborne and Cotterill technique, which probably involved repair of the insufficient lateral ulnar collateral ligament (LUCL). PLRI, as a formal entity, was not clearly described until 1991 by O'Driscoll et al. who published a case series of five patients, with persistent elbow instability [6]. In general, O'Driscoll's description of PLRI focusing on the LUCL as the primary restraint to PLRI has remained constant with an understanding that the other components of the lateral ligamentous complex (radial collateral ligament, annular ligament) and extensor tendons probably also have secondary stabilizing role.

The lateral collateral ligament complex is comprised of the radial collateral ligament (RCL), the lateral ulnar collateral ligament

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Fig. 10.1 Schematic overview of the lateral ligamentous anatomy of the elbow. *Purple*: RCL; *Green*: LUCL; *Yellow*: annular ligament (Courtesy of MoRe Foundation)

(LUCL) (Fig. 10.1), the annular ligament, and the accessory lateral collateral ligament. The RCL and LUCL share their origin on the lateral epicondyle and are not individually identifiable at this level [7]. The LUCL arches over the annular ligament and insert on the tubercle of the supinator crest. The insertion has been described as bilobed. The extensor digiti quinti, the extensor carpi ulnaris, and the anconeus muscle cover various portions of the ligament [8].

The LUCL resists external rotation stresses to the elbow [7], but sectioning of the LUCL alone does not induce PLRI. For this to happen, both the RCL and LUCL need to be ruptured [7, 9, 10]. The annular ligament remains intact [11]. Resection of the radial head or coronoid increases the magnitude of PLRI [12]. Muscular constraints play a role maintaining stability of the elbow. Contraction of the extensor muscles has been shown to decrease laxity in LCL deficient elbows [13] and sectioning of the muscles increases laxity [9]. The anconeus muscle has been shown to create a valgus moment and may also play a role in increasing stability of the elbow [14].

The pathoanatomy of an injury leading to lateral elbow instability can be described as a circle with the disruption of soft tissue going from lateral to medial. The soft tissue disruptions are classically described in three stages [6, 15]. Stage 1 encompasses a LUCL disruption. In stage 2, the remainder of the LCL and the anterior and posterior capsules are disrupted. In stage 3A, the posterior bundle of the MCL fails and in stage 3B the anterior bundle of the MCL is also disrupted. The term posterolateral instability characterizes the mechanism of injury in which the ulna externally rotates on the humerus coupled with posterolateral radiohumeral subluxation.

PLRI is the most common cause of residual instability following a simple elbow dislocation. Different mechanisms of injury may lead to chronic PLRI. The LCL complex has a tendency not to heal following injury [16]. Some patients will have a history of one or more simple dislocations. Others may not have had a documented dislocation but a relatively minor trauma, leading to persistent and symptomatic subluxation of the elbow [17]. Some may have a history of repetitive cortisone injections leading to attrition of the lateral ligament complex. PLRI has been described in the setting of cubitus varus deformity of the distal humerus from prior distal humeral malunions with chronic attrition of the LCL. Finally, PLRI can occur following surgery to the lateral side of the elbow, when the LCL is released unintentionally, for example with lateral epicondylitis debridement [18].

Evaluation

The diagnosis of chronic PLRI is predominantly clinical. Patients will come in complaining of recurrent episodes of elbow dislocations, or more commonly, a sensation of instability, pain, and mechanical symptoms like clicking or catching. Several specific clinical tests have been described to diagnose PLRI.

Varus laxity is present due to rupture of the lateral sided stabilizers but is difficult to quantify clinically. The pivot shift test [19] was originally described by O'Driscoll to detect PLRI and is sensitive but, due to apprehension, the specificity is low in the awake patient. The simplest way to perform this test is with the patient in supine position. The examiner takes the forearm of the patient with both hands, while the shoulder is elevated. The forearm is hypersupinated and a valgus stress and axial load are applied to the elbow. The elbow is then moved from extension to flexion and vice versa. Apprehension or pain is considered to be a positive sign in a patient who is awake. When a patient is placed under general or regional anaesthesia, subluxation or dislocation is considered a positive test [19]. The radial head subluxation usually occurs during extension with the elbow at around 30–45° of flexion (Fig. 10.2). The elbow reduces with further flexion beyond 30° and dislocates with extension beyond 30°.

O'Driscoll has also described the posterolateral rotatory drawer test, similar to the Lachman test of the knee, and has found to be more sensitive and specific than the pivot shift test to detect PLRI [19]. The radiohumeral joint is palpated and the forearm as a whole is externally rotated. In a positive test, the radial head can be felt to rotate posteriorly, relative to the humerus. It is very important not to supinate the forearm during the posterior drawer test as this will result in a false positive test. The cam shape of the radial head will push the finger out of the radiohumeral joint, resembling actual posterior translation of the radial head.

The tabletop test and tabletop relocation tests are carried out with the hand of the patient supported on a table. The forearm is supinated and the patient is asked to support their weight on the arm while flexing the elbow. Pain and apprehension may occur with the elbow at about 40° of flexion. The test is then repeated but the examiner now supports (relocates) the radial head. Pain and apprehension should not occur in a positive test [20] but often the relocation does not completely obliterate the apprehension.

Fig. 10.2 A positive pivot shift test results in a posterior (sub)luxation of the radial head relative to the humerus. This is apparent by a depression in the skin, proximal to the radial head (Courtesy of MoRe Foundation)

Both the push-up and chair signs have been shown to be sensitive to detect PLRI as well. The patient is asked to perform an active push-up, with the forearm in supination. If the tests are positive, the patient is unable to fully extend the elbow or the patient shows apprehension and guarding while attempting to finish the push-up [21]. It is important to use more than one test. In gross instability, the diagnosis will be clear, but in more subtle cases, some of the tests may be falsely negative. In patients with underlying hyperlaxity, some of the tests may also be falsely positive so one must test for this as well during the physical exam. The diagnosis can only be made if more than one test are considered to be positive. Repeating the tests after an intra-articular injection of local anaesthetic may be considered if the clinical exam is inconclusive.

Imaging

Radiographs (Fig. 10.3) and CT scans may show indirect signs of ligamentous injury such as calcification of the ligament or subluxation of the joint. In most cases, however, radiographs and CTs will be negative, although in some cases an Osbourne-Cotterill lesion may be visible [1]. MRI scanning is helpful in patients presenting with chronic instability [22]. A ruptured LCL can often be visualized (Fig. 10.4). Scar tissue will be present in most chronic cases. Cartilage lesions are common and these will have a negative effect on the final outcome of treatment.

Treatment Algorithm

Nonoperative treatment with physical therapy is a reasonable initial treatment for patients with PLRI. It usually includes strengthening of the dynamic stabilizers and activity modification to

Fig. 10.3 Anteroposterior radiograph showing a discrete bony avulsion of the lateral collateral ligament complex (Courtesy of MoRe Foundation)

Fig. 10.4 Magnetic resonance image of the elbow, showing a lateral collateral ligament avulsion (Courtesy of MoRe Foundation)

try to avoid activities with the elbow flexed to prevent subluxation. Bracing is an option and should be discussed with the patient; however, the efficacy of bracing is unknown in cases of chronic instability. Once nonoperative options fail, surgical intervention is indicated.

Surgery is indicated in patients with persistent symptomatic instability of the elbow with pain. Ligament reconstruction has a higher chance of failure if patients have pain only, without symptoms of instability and, in general, should be avoided in these cases. There are several surgical techniques to treat PLRI and, in general, the results are good to excellent in a majority of patients [23]. Primary repair of the chronically ruptured LCL complex depends on the integrity and quality of the remaining tissue. A full arthroscopic repair has been described with good results [24]. Preoperative screening of patients is essential if an arthroscopic technique is contemplated. No comparative data is available on when to imbricate the LCL, when to repair, or when to reconstruct. There is some weak evidence suggesting that reconstruction may be better than repair, in a large group of patients with mixed pathology [17]. Based on the available literature and our personal experiences, we have developed an algorithm (Fig. 10.5).

Surgical Management

Arthroscopic Technique

An all-arthroscopic technique has been described for both acute and chronic cases (Video 10.1). We use an adaptation of the original technique that was described by Savoie et al. [24]. It is important to test stability and range of motion of the elbow under anaesthesia. The procedure starts with a standard diagnostic elbow arthroscopy. In order to avoid disastrous complications such as permanent nerve damage, the same standard precautions are followed. We do not recommend an all-arthroscopic technique if the surgeon is not experienced in elbow arthroscopy. The ulnar nerve is palpated and marked and the joint is insufflated.

The arthroscopy starts in the anterior compartment. Some synovitis is almost always present. The elbow is inspected for signs of degenerative changes and cartilage lesions. A distal posterolateral portal is then made at the lateral tip of the olecranon. This portal is slightly more distal than

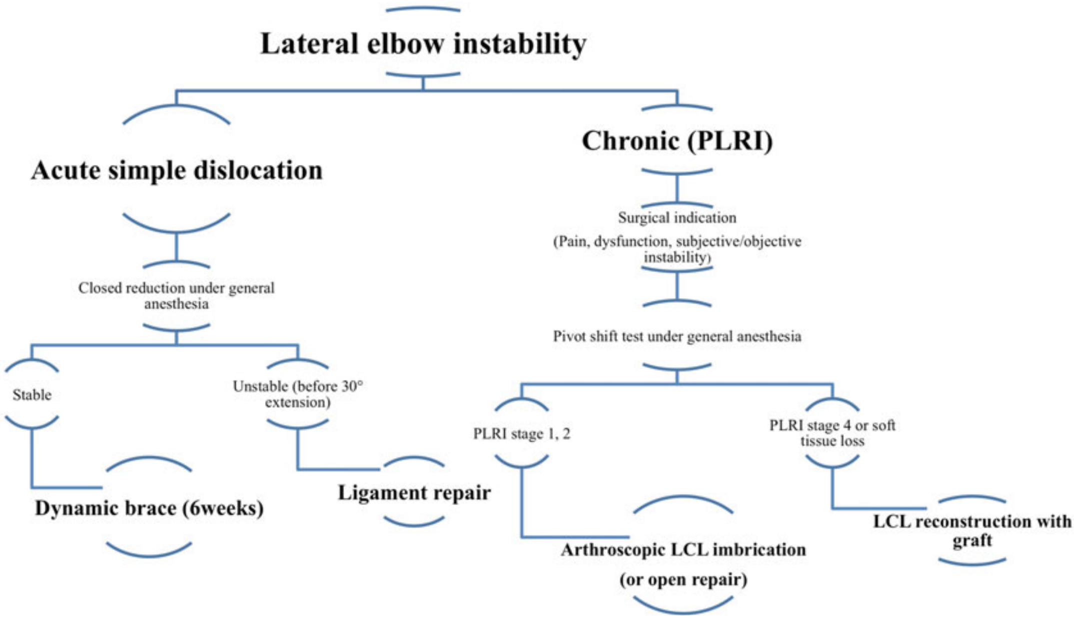

Fig. 10.5 Treatment algorithm for patients with symptomatic posterolateral rotatory instability (Courtesy of MoRe Foundation)

the classic posterolateral portal, in order to improve the access to the radiohumeral gutter. The scope is first directed to the ulnar gutter, where the posterior band and part of the anterior band of the MCL can be visualized. A valgus stress is applied to the elbow to evaluate the MCL. There should be little or no opening of the medial joint. The olecranon fossa and olecranon tip are inspected. If necessary, a central posterior portal can be made to address posterior pathology. The scope is then brought into the radiohumeral gutter. Typically, there is a synovial fringe that may block a direct view to the radial head. A needle is used to determine the perfect position of the soft spot portal and the portal is made. A shaver is used to remove the synovial fringe and any synovitis. The ulnohumeral joint is inspected and the 'drive through sign' [24] is evaluated. In patients with a clear lateral instability, the scope can be brought from the lateral side to the ulnar gutter. We further evaluate lateral stability by performing a pivot shift test under a direct arthroscopic view. We have found that it is very difficult to perform the actual pivot shift, as the scope prevents a true subluxation/relocation click. We have therefore adapted this test and now perform the pivot shift test with varus stress instead of valgus stress. This frees the radius from the humerus and the posterior translation of the radial head can easily be quantified arthroscopically.

The arthroscopic imbrication of the LCL is then performed. The scope remains in the radiohumeral gutter. A wide lumen spinal needle is loaded with a no. 2 PDS suture. The lateral epicondyle is palpated and the needle punctures the skin at the isometric point of the LCL complex [25]. From there, the needle is directed to the radiohumeral gutter and the suture is shuttled into the joint under a direct arthroscopic view. The PDS suture is brought outside the skin through the soft spot portal and the needle is removed (Fig. 10.6). The suture now runs from the lateral epicondyle to the soft spot. The needle is reloaded with a new strand of PDS suture. The subcutaneous border of the ulna is palpated and the needle punctures the skin on the subcutaneous border, just distal to the radial head. Care is taken to stay on the ulnar bone as the needle is again brought into view in the radiohumeral gutter (Fig. 10.7). The suture is shuttled and again taken out of the soft spot portal,

Fig. 10.6 Image of the lateral side of the elbow. Radial head and capitellum are marked on the skin. A PDS suture enters the joint at the insertion of the LUCL on the lateral epicondyle and exits the skin from the soft spot portal (Courtesy of MoRe Foundation)

Fig. 10.8 Both strands of the PDS suture are tunnelled subcutaneously to the soft spot portal. This forms a loop of suture, running from the soft spot portal, subcutaneously to the lateral epicondyle, intra-articularly to the supinator crest and again subcutaneous to the soft spot portal (Courtesy of MoRe Foundation)

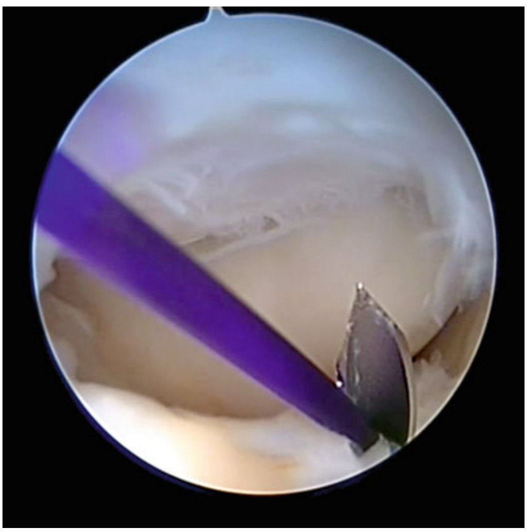

Fig. 10.7 Arthroscopic view from the radiohumeral gutter. A needle is brought into the gutter from the origin of the LUCL at the supinator crest. A PDS suture is shuttled through the needle, to form the distal half of the imbrication. This suture is then tied to the distal end, to form a single strand of suture (Courtesy of MoRe Foundation)

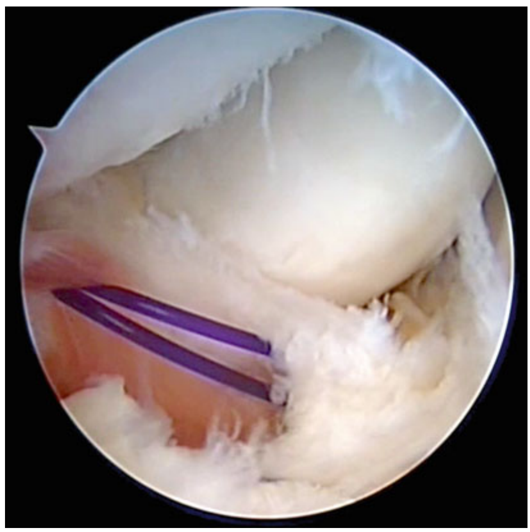

Fig. 10.9 Arthroscopic view from the radiohumeral gutter, showing the intra-articular portion of the imbrication (Courtesy of MoRe Foundation)

as the needle is removed. We now have two strands of PDS that both represent half of the LUCL. The suture ends, which were taken out of the soft spot portal, are connected and pulled distally. At this moment, there is a single strand of PDS deep to the capsule, exiting the skin at both the origin and the insertion of the LUCL. This suture is used to shuttle a second PDS from distal to proximal, essentially doubling the construction, to a two-strand suture. A mosquito is then brought through the soft spot portal into the subcutaneous tissue and both the proximal and distal ends of the sutures are pulled subcutaneously (Fig. 10.8). This creates a loop with two sutures from the soft spot, superficial to the LCL complex to the lateral epicondyle, then deep to the LCL (Fig. 10.9) towards the origin on the ulna and again out of the soft spot portal superficially to the LCL. Both sutures are then tightened and the arthroscopic adaptation of the pivot shift is repeated with the sutures relaxed and tightened. The scope is removed if adequate stability is obtained and both sutures are tied individually. The knots are buried away from the portal. Besides irritation of the knot and stiffness requiring a manipulation under anaesthesia, we have not had any complications related to this technique.

The first 20 patients who were treated with this technique were followed for an average of 21 months (12–30 months). A traumatic incident was the cause of instability in 16 patients. Tennis elbow surgery was the cause of instability in three patients. One patient had multiple prior surgeries due to an OCD lesion. The delay between the onset and the arthroscopic imbrication was 48 months on average (range 3–386 months). The pivot shift, posterior drawer, and table-top tests were used to clinically evaluate the stability of the elbow. Two out three tests were positive in all patients, with the posterior drawer test being the most sensitive test. This was positive in 18 patients. Range of motion was preserved in most with an average extension deficit of 5° (range 0–40°). Average flexion was 140° (range 120–145). Preoperative Mayo Elbow Performance score (MEPS) was 48 (range 20–75). The Quick DASH score was 54 (range 25–82). At the final follow-up there was a significant improvement in Quick DASH and MEPS scores. The average post-operative MEPS was 91 with average improvement of 43 points. Average post-operative QuickDQSH was 10, with an average improvement of 43 points. Average extension improved to 2° (range −5° to 20°) and flexion remained 140° (120–145°). A revision to an open reconstruction was performed 7 months following the arthroscopic procedure in one patient, due to persistent pain. No subjective or objective signs of instability were found in any of the other patients.

Open Technique

Primary Repair

Acute ligament repairs are indicated in patients in whom a closed reduction is not possible or if the elbow remains unstable after a successful closed reduction. The elbow is moved from flexion to extension following the reduction. If the elbow dislocates before 30° of extension can be reached, we feel that an acute repair is indicated. Finally, surgical repair may also be indicated for active patients in certain professions or sports.

An open ligament repair can be performed under general or regional anaesthesia. An ultrasound-guided supraclavicular block is the preferred technique in our institution. The patient is placed in a supine position with the arm on a hand table since a lateral approach is preferred. A pivot shift test is performed under anaesthesia. PLRI is often difficult to determine in an awake patient, due to pain and apprehension but may become apparent once the arm is anaesthetized (Fig. 10.10). Alternatively, the patient can be placed in lateral decubitus or prone position if the surgeon prefers to approach the elbow through a posterior incision [26]. We prefer to use a 2 cm lateral incision and an extensor tendon split anterior to the remnant of the

Fig. 10.10 A lateral incision is used. The incision is centred on the lateral condyle and directed, over the posterior one-third of the radial head, to the supinator crest of the ulna (Courtesy of MoRe Foundation)

LCL (Fig. 10.11). Most commonly, it is avulsed from the humerus [27]. In the acute situation, it is not uncommon to have an avulsion of the common extensor tendon mass [27], allowing for direct access to the joint once the fascia is incised.

The isometric point on the capitellum is determined. It is situated just anterior to the circle made by the articular surface of the capitellum [25]. The exact location of the avulsion can often be identified in acute cases. The LCL can be reattached using bone tunnels or a bone anchor, depending on the preference of the surgeon. As subcutaneous knots often cause irritation due to their subcutaneous location, the extensor tendon split is closed with running sutures, so that there is only one single knot distally. The knot is buried in the extensor tendon mass.

Post-operative Protocol

The arm is placed in a removable splint for 24 h, with the elbow in 90°. On the first post-operative day, the arm is protected with a dynamic elbow brace and both passive and active motion is started. Unlimited flexion of the elbow is allowed immediately. Extension is blocked at 60° for the first 2 weeks, to 30° for the following 2 weeks and full extension in the brace is allowed from weeks 4 to 6. The dynamic brace is worn for a total of 6 weeks after which strengthening exercises of the arm are started. Unrestricted activity is permitted at 3 months.

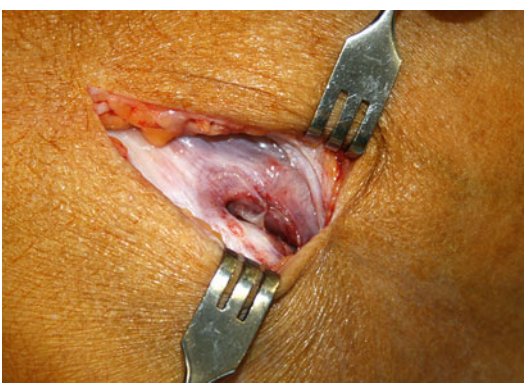

Fig. 10.11 Intraoperative view of the lateral elbow. After incision of the skin only, both an avulsion of the LCL complex, together with an avulsion of the extensor tendons became apparent (Courtesy of MoRe Foundation)

LCL Reconstruction

A formal reconstruction is indicated in patients with severe chronic instability. This can occur after a single or multiple elbow dislocations or when the instability occurs following surgery to the lateral elbow.

In 1992, Nestor, O'Driscoll and Morrey first described reconstructing the LUCL with a series of 11 patients using a modified Kocher and elevating the common extensor origin, along with the anconeus and extensor carpi ulnaris [28]. If the LUCL was identified to be insufficient, reconstruction with autologous tendon graft consisting of the palmaris longus was performed. The supinator crest is palpated and the origin of the LUCL is identified. Two converging bone tunnels based off the supinator crest of the ulna are created and the graft is passed through the tunnel. The isometric point of the lateral epicondyle is identified and two tunnels are made diverging from the insertion on the lateral epicondyle. The graft is passed through the tunnels, reflected back across the joint and sutured back onto itself [28].

Various techniques have since been published. Jones et al. described an adaptation of the original technique, using a similar ulnar tunnel with a proximal docking technique through the humerus [29]. Using a autologous palmaris longus looped through the ulna at the level of the supinator crest, it is then tunnelled through the isometric point. Two small drill holes exit the humerus for two sutures attached to both graft limbs. These are used to dock the graft in the tunnel [29].

Beyond the configuration of tunnels, the number of strands of the LUCL reconstructed has been explored, with single strand reconstruction versus double stranded showing equal outcomes [6, 11, 15, 28]. Different grafts, both auto and allografts, including Achilles, triceps fascia, gracilis and Palmaris longus have been used. All grafts have been shown to be of sufficient strength [30] and no clear differences have been found in clinical studies.

Our preferred method of reconstruction of the ligament begins using a 4 cm lateral incision—identical to the incision used during an acute repair but continuing slightly more distal towards the supinator crest of the ulna. The Kocher interval (Fig. 10.12) is identified between the anconeus and the extensor carpi ulnaris (ECU). There is a strip of fatty tissue between these two muscles that allows easy identification of the interval. This can usually be identified through the fascia. The fascia is incised over the interval and the plane between the anconeus and ECU is developed. Kocher's interval is followed onto the proximal ulna. There are always three small blood vessels on the ulna at the distal part of the approach. These are best coagulated, to avoid post-operative bleeding. The supinator crest on the ulna is palpated and followed proximally. A small tubercle can often be palpated on the most proximal part of the crest, just distal to the radial head, at the base of the annular ligament. This is the insertion of the LUCL. The annular ligament is typically intact, as is the lateral capsule, which may be lax. It is hard to identify the LCL, in chronic cases, as the whole of the lateral capsule and ligament complex will often be very fibrotic. The lateral epicondyle is then approached and the common extensor tendon is released from posterior to anterior. The entire LCL will no longer be attached to the lateral epicondyle most of these patients and any remnants are released sharply for later fixation to the graft. The lateral capsule is then opened. The capsule should be opened slightly anterior to allow interposition between the final graft and radial head to prevent abrasion on the graft.

The choice of graft depends on the preference of the surgeon. A variety of allograft, autograft or synthetic grafts have all been described [17]. All are of sufficient strength to reconstruct the LCL complex [30]. We use an allograft extensor hallucis longus (EHL) tendon of approximately 20 cm. There are multiple ways to fix the graft to the humerus and the ulna. Bone tunnels can be used, as well as anchors, interference screws, or cortical buttons. The graft can be placed in a yoke or docking configuration and single- or multiple strands of graft can be used. No differences between these techniques have been shown in the literature. We use a cortical bone button with a retractable loop to fix the graft (ToggleLoc, Zimmer Biomet, Warsaw, Indiana).

A unicortical drill hole with a diameter of 4.5 mm is made at the insertion of the LUCL at the supinator crest on the ulna (Fig. 10.13). The button is placed intramedullary. The button is inserted longitudinally through the tunnel. The button is then flipped in the canal and secured by pulling the button onto the intramedullary side of the lateral cortex of the ulna. The EHL graft is then placed in the retractable loop. The graft has a length of about 20 cm and is pulled halfway through the loop. This means that approximately 10 cm of graft will be at either side, once the graft

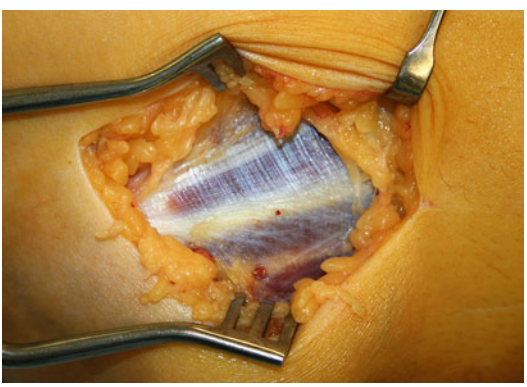

Fig. 10.12 Kocher's interval is identified between the anconeus and the extensor carpi ulnaris (Courtesy of MoRe Foundation)

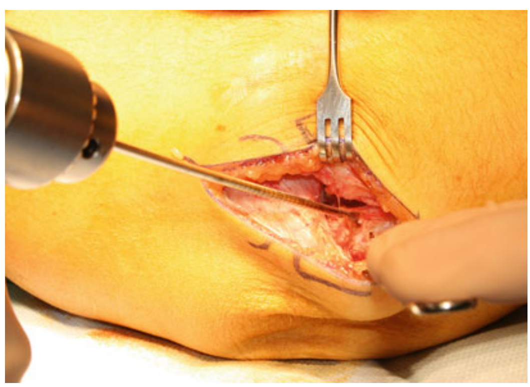

Fig. 10.13 The supinator crest can easily be palpated on the ulna. A guidewire is drilled unicortically through the lateral cortex of the ulna (Courtesy of MoRe Foundation)

is inserted in the loop. The loop is then closed and by doing this, the middle portion of the graft is pulled into the drill hole at the insertion of the LUCL. This essentially leaves two limbs of graft on either side of the tunnel.

The isometric point on the capitellum is then determined. It is situated just anterior to the circle made by the articular surface of the capitellum [25]. A small suture can be used to determine this isometric point, while the elbow is moved through flexion and extension [23]. A guidewire is drilled from the isometric point, bicortically, through the posterior cortex of the humerus (Fig. 10.14). Care should be taken not to exit in the olecranon fossa as this could later lead to impingement of the button between the ulna and the humerus. The first cortex is overdrilled up to, but not through the second cortex, with a 6 mm canulated drill. This creates a tunnel for the graft. The posterior cortex is overdrilled with a 4.5 mm drill, so that the button can exit the tunnel past the second cortex. The humeral button is then pushed through the tunnel from distal to proximal and secured on the posterior cortex. Part of the loop will remain distally, outside the tunnel. The position of the buttons can be checked with fluoroscopy or, the humeral button, can be visualized directly if necessary.

The capsule is closed in order to avoid friction between the radial head and lateral side of the capitellum, once the graft is placed and tensioned. Both limbs of the graft are then fixed to the button. The first limb is pulled through the loop from medial to lateral. The second limb is pulled through the loop from medial to lateral. Kocher type clamps are attached to the ends of both limbs. Both limbs are then tightened manually. The elbow is fully reduced and held with the forearm in pronation as the graft is tightened. The sliding loop is then closed, tightening the graft further and pulling a part of both limbs into the humeral tunnel (Fig. 10.15). Usually the graft is long enough, so that the ends of both limbs will remain outside the tunnel. The ends of both limbs are folded proximally and used to suture the limbs back onto the tightened part of the graft (Fig. 10.16). All lateral structures are then closed over the graft. Although the LCL is isometric, the LUCL has been shown to be lax in extension and tighten in flexion [25]. We therefore tighten the graft in approximately 30° of flexion, allowing the reconstruction to tighten even more when the elbow is flexed.

Post-operative Protocol

The post-operative regimen is identical to the primary repairs. Radiographs may be used to confirm the correct position of the buttons (Fig. 10.17). Post-operatively, patients are instructed to mobilize the elbow in a dynamic

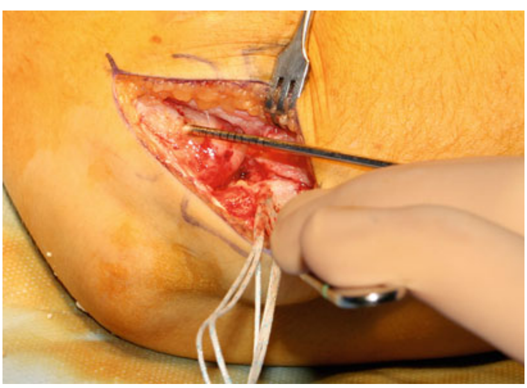

Fig. 10.14 A guidewire is drilled bicortically from the insertion of the LUCL at the lateral epicondyle, exiting on the posterior cortex of the humerus (Courtesy of MoRe Foundation)

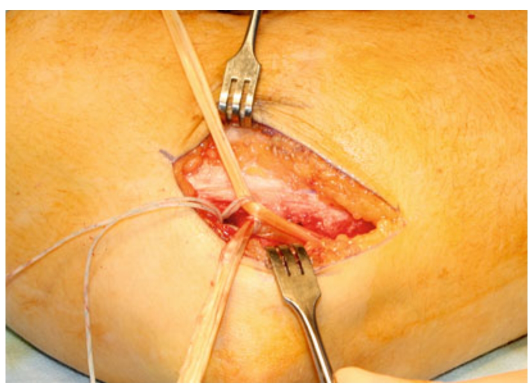

Fig. 10.15 The humeral button is secured through the humeral tunnel and the graft is tensioned (Courtesy of MoRe Foundation)

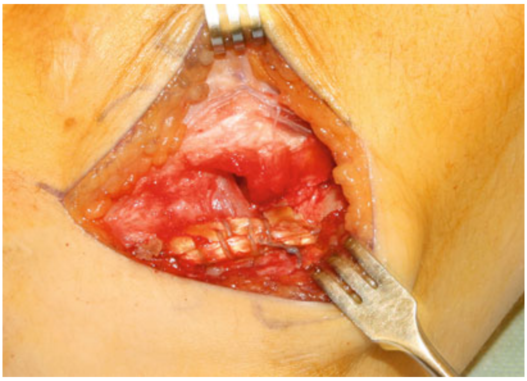

Fig. 10.16 The remaining graft is doubled back and sutured onto itself for additional fixation (Courtesy of MoRe Foundation)

elbow brace for 6 weeks. Extension is progressively allowed with increments of 30° every 2 weeks, starting with a 60° extension block.

Outcomes After Surgical Treatment of PLRI

Results after reconstruction for PLRI are overall good to excellent in about 85 % of patients. Instability is the most common complication despite accurate repair or reconstruction [17, 31]. Several authors have reported results after reconstruction with a majority of patients remaining stable with worse outcomes in patients with degenerative arthritis, pain only without symptoms of instability and prior surgery [16, 29, 30].

Jones et al. reported on eight patients at a mean of 7 years post-operative from LUCL reconstruction using a palmaris autograft with two distal ulnar tunnels and a proximal docking technique [29]. The authors reported complete resolution of instability in six patients and recurrence in two of eight (25 %). Despite recurrence, all the patients were reported to be satisfied at final follow-up. Nestor et al. evaluated 11 patients (three repairs and eight reconstructions) who underwent surgery for PLRI [28]. The reconstructions were performed using a 5-tunnel technique (three in the humerus and two in the ulna) and a palmaris autograft. They noted three patients with fair outcomes and one with a poor outcome according to their classification. The patients who underwent repair had good results; however, they had less severe disease than the patients who underwent reconstruction. Prior surgery and the presence of radiocapitellar arthrosis were noted to be risk factors for poor outcomes. They suggest that all patients are counselled regarding these risks and that the quality of the joint is assessed preoperatively and during surgery.

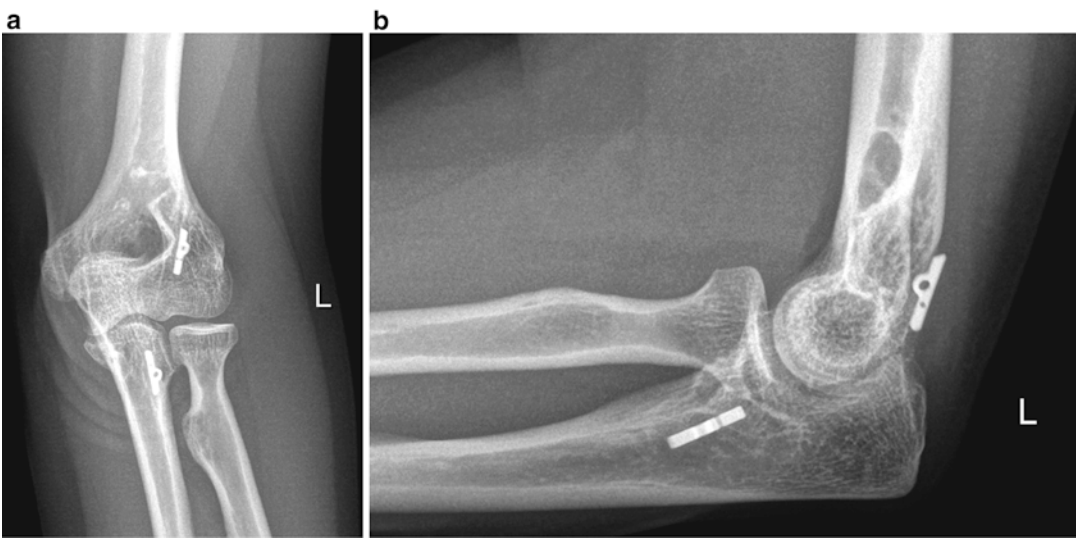

Fig. 10.17 (**a**, **b**) Post-operative anteroposterior and lateral radiographic view of the elbow, showing correct placement of the buttons (Courtesy of MoRe Foundation)

Sanchez-Sotelo et al. reported their outcomes in 44 (12 repairs and 33 reconstructions) patients who underwent surgery for PLRI. Five patients (11 %) noted further instability, and 27 % of patients described fair or poor results [17]. Better results were noted in patients with a post-traumatic etiology, subjective instability and in those patients in whom a graft was utilized. Most recently, Baghdadi et al. reported on 11 patients who had a revision LUCL reconstruction for a failed prior reconstruction utilizing an allograft tendon [30]. The revision reconstructions were performed at a mean of 3 years after the initial LUCL reconstruction. Osseous deficiency was identified at some level in 8 of 11 patients. At an average of 5 years status post-revision reconstruction, 8 of 11 elbows remained stable. All patients who remained stable had a good or excellent result whereas all patients who had persistent instability were noted to have some degree of bone loss. The authors concluded that revision LUCL reconstruction is an option for persistent instability although it must be recognized that almost half of the patients either had persistent instability after revision or a fair or poor outcome.

Conclusions

Posterolateral rotatory instability is caused by an insufficiency of both the lateral collateral ligament and the lateral ulnar collateral ligament of the elbow. The proximal ulna and radial head externally rotate about the distal humerus when the forearm is positioned in supination and slight flexion and when axial compression is applied to the forearm. It typically occurs from a fall on the outstretched hand causing a subluxation or dislocation, rupturing the stabilizers of the elbow. Failure to heal may lead to symptomatic PLRI. Surgery to the lateral elbow may also injure the lateral structures and is a relatively common cause of PLRI.

Four stages of PLRI exist and treatment may be tailored to severity of instability. The diagnosis of PLRI is mainly clinical. Several specific tests are used to evaluate the stability of the lateral elbow. Further evaluation usually includes MRI scanning.

Once the diagnosis is made, surgery is often indicated in chronic cases. Several surgical options exist, depending on the stage of instability. Arthroscopic imbrication of the lateral ligaments can yield excellent results in milder cases. A formal reconstruction is usually indicated in more severe stages of instability. Depending on the severity of instability and the preoperative status of the elbow, surgery usually leads to good or excellent results with a very small chance of recurrence.

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