



Lateral elbow ligament reconstruction for posterolateral rotatory instability: 10 years follow-up in 32 patients

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Background: Posterolateral rotatory instability (PLRI) is the most frequent form of both acute and chronic elbow instability. It is due to mechanical incompetence of the lateral collateral ligament. O'Driscoll et al described treatment of this instability by autologous reconstruction of the lateral ulnar collateral ligament. The aim of our study was to evaluate the medium and long-term clinical, functional and radiological results of patients who were surgically treated for PLRI by this technique. We hypothesized that such ligament reconstruction restores a functional joint complex and durably stabilizes the elbow and limits the long-term risk of osteoarthritis.

Methods: All patients treated for symptomatic PLRI by ligament reconstruction since January 1995 and who had a minimum follow-up of 36 months were retrospectively included.

Results: Thirty-two patients (32 elbows) underwent clinical and radiological evaluation with a mean follow-up of 112 months (range, 36–265 months). The success rate of the procedure was 97% with one patient requiring revision reconstruction. Twenty-four patients (75%) were free from pain. Pain was significantly greater in patients with associated lesions ($P = .03$) and those with morbid obesity (body mass index ≥ 40) ($P = .03$). Twenty-nine (91%) patients had resumed their previous activities. Twenty-eight patients (87%) were satisfied or very satisfied. The mean Mayo Clinic score was 96/100 and the QuickDash 14.7/100. Two patients (6%) with accompanying lesions developed severe osteoarthritis.

Conclusion: Elbow ligament reconstruction by the technique of O'Driscoll et al effectively restores stability and limits progression to osteoarthritis in the long term. The only failure in our series was due to several technical errors. Patients who had dislocation with associated lesions or morbid obesity are at risk of poorer functional results.

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The nosological entity of posterolateral rotatory instability (PLRI) of the elbow was described by O'Driscoll et al in 1991 in a series of 5 patients.²⁹ These authors drew attention to the mechanical incompetence of the ulnar part of the lateral collateral ligament (LCL) or lateral ulnar collateral ligament (LUCL). Mechanical failure of this ligament allows posterolateral rotatory subluxation of the humeroulnar joint, with associated dislocation

of the humeroradial joint by unlocking of the posterolateral complex.^{7,28}

These injuries are caused by a fall on the hand with the elbow in extension, forcing the joint into a combination of external rotation, flexion, and supination. The injuries of the joint capsule and ligaments progress in a lateral to medial direction.^{25,28} This mechanism causes a wide range of injuries, ranging from a simple sprain to posterolateral dislocation or even to terrible triad injury, in all of which LCL injury is the common element.³²

Healing or reconstruction of the LCL averts the risk of instability or recurrence of dislocation. If there is mechanical failure of the LCL, O'Driscoll et al²⁹ proposed reconstruction of the LUCL by autologous reconstruction using the palmaris longus tendon²⁶ or part of the triceps tendon.^{12,31} The literature reports good short-term clinical results, but as far as we are aware there has been no

The Institutional Review Board of Trousseau University Hospital, Tours, France, approved this study in advance: No. 2020 029. All patients provided their written informed consent.

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published report on medium and long-term clinical and/or functional results and no radiological investigation of the development of secondary osteoarthritis.^{2,12,17,21,22,29,31,34,35,38}

The aim of our study was to evaluate the medium and long-term clinical, functional and radiological results of patients who had been surgically treated for acute or chronic posterolateral rotatory instability of the elbow by LUCL reconstruction. Our hypothesis was that ligament reconstruction by the technique of O'Driscoll et al durably stabilizes the elbow and limits the risk of osteoarthritis in the long term.

Materials and methods

The research protocol was approved by the ethics committee of our institution prior to patient inclusion (n° IRB: ERERC 2020_029). All consecutive patients treated by LUCL reconstruction by the technique of O'Driscoll et al from January 1995 to December 2018 were identified retrospectively. The inclusion criteria were symptomatic acute or chronic PLRI of the elbow documented by preoperative clinical and radiological investigation and evaluated postoperatively with a follow-up of at least 36 months.

The preoperative parameters collected were sex, age, dominant side, injured side, occupational category (heavy manual work, light manual work, and sedentary occupation), type of initial injury (isolated dislocation and fracture dislocation), associated osteo-articular, cutaneous, vascular or neurological lesions (if any), and initial emergency management. Body mass index (BMI) was classified in 3 groups: normal <25, overweight and moderate obesity 25–39.9, and morbid obesity ≥40.

Instability was considered as chronic if there was persistent subluxation or recurrent dislocation of more than 21 days duration.^{1,10} Instability of shorter duration was considered as acute. The associated injuries were fractures (radial head, coronoid process, olecranon, and ulnar shaft), vascular and nerve injury, or a cutaneous lesion associated with dislocation. For patients with chronic instability, time between the first consultation and the first symptoms of instability, number of dislocations, and pain experienced were recorded. Patients completed the self-administered QuickDASH functional evaluation questionnaire preoperatively or retrospectively. We used data from medical records for patients treated before 2002.¹¹

Clinical examination included the posterolateral drawer test^{8,28} with a possible posterior protrusion of the radial head and the lateral pivot shift test or PLRI test as described by O'Driscoll et al.²⁷ The test is positive if it elicits subluxation or simple apprehension. Subluxation is reduced with the elbow in flexion with a characteristic snap.²⁸

Preoperative radiological investigation systematically included anterior radiographs of the elbow in extension and lateral radiographs of the elbow in 90° flexion in neutral pronation/supination. The parameters examined were joint relationships, the position of the axis passing through the middle of the radial head in relation to the center of the capitellum on a lateral radiograph with the elbow flexed at 90° (Støren's line),³⁷ the presence of associated lesions (fractures or bony ligament avulsions), and humeroradial, humeroulnar and/or proximal radioulnar osteoarthritis. Because of better agreement, osteoarthritis was classified as absent to moderate vs. severe according to the binary system validated by Lindenhovius et al. It was considered as severe if the joint space was decreased by more than 50% with osteophyte formation.²³

The surgical procedures (video 1) were carried out under general anesthesia or axillary block with a pneumatic tourniquet placed at the root of the arm and inflated to 250 mm Hg. The lateral pivot shift test was systematically carried out and assessed under anesthesia before cutaneous incision. Kocher's posterolateral

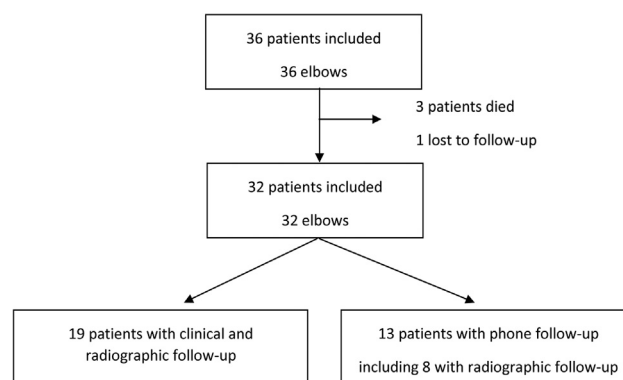


Figure 1 Flow chart.

approach was used.²⁰ The LCL was identified and exposed progressively. Its mechanical quality and tension were assessed subjectively. In all cases, its structure was markedly disorganized and repair was not possible.

The tendon graft used for ligament reconstruction was the tendon of the palmaris longus muscle or, in its absence, a half-tendon of the flexor carpi radialis muscle or part of the triceps tendon. When the palmaris longus tendon was used, its length generally allowed two-bundle reconstruction of the free part of the ligament.

The elbow was immobilized using a brachiopalmar splint that maintained the elbow at 90° flexion and the forearm in pronation for 3 weeks. It was then replaced by a splint at 90° flexion in neutral pronation/supination for further 3 weeks. Rehabilitation was started 3 weeks postoperatively in flexion extension without supination or varus constraint and without seeking to obtain full extension. Movements of pronation/supination were rehabilitated at 90° flexion. Full extension was permitted after 45 days.

The patients were seen again in consultation by an independent assessor. Patients who were unable to attend or who declined to do so were assessed by telephone, and all provided photographs for evaluation of maximum joint mobility in flexion, extension, and pronation/supination.²⁴ In patients who were not examined in person, the lateral pivot shift test and grip strength measurement by dynamometer were unavailable. The self-evaluation questionnaires and the anterior and lateral radiographs obtained at last follow-up were returned by post.

The postoperative functional and clinical parameters collected were complications (infection, hematoma, complex regional pain syndrome [CRPS]), average pain assessed on a visual analog scale (VAS), patient satisfaction graded in 4 levels (very satisfied, satisfied, moderately satisfied, and dissatisfied), the QuickDASH,^{11,15} the Mayo Clinic questionnaire (Mayo elbow performance score [MEPS]),⁹ development of clinical signs of recurrent or persistent instability with apprehension, snapping sensation, pseudo-locking or true dislocation, abnormal lateral pivot shift test, range of joint movement in flexion/extension and pronation/supination measured by a goniometer, grip strength measured by a Jamar dynamometer (Sammons Preston, Bolingbrook, IL, USA) and compared with the contralateral side, ability to lift a 10 kg weight, change in activities of daily living, return to work in the same employment or need for adaptation, or change of employment related to the functional status of the operated elbow.

The postoperative radiological parameters assessed at the last follow-up were centering of the radial head on the capitellum (Støren's line)³⁷ and the presence of secondary ossification and/or humeroradial, humeroulnar, and/or proximal radioulnar osteoarthritis.

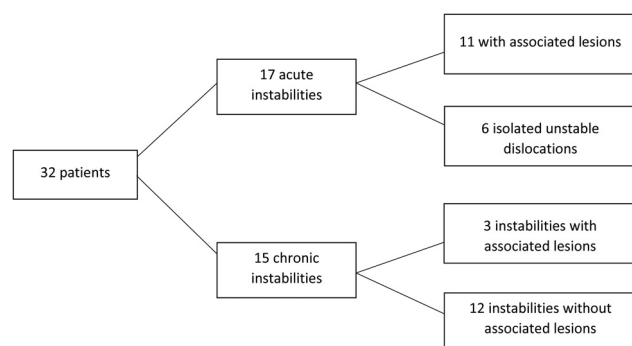


Figure 2 Distribution of patients according to type of instability.

Revision reconstruction and episodes of subluxation or objective clinical signs of instability were considered as failures.

Statistical analysis was performed using PRISM™ software (GraphPad®, San Diego, CA, USA). Quantitative variables were compared with the Wilcoxon Mann-Whitney U test. A potential association between a categorical study variable and a nominal response variable was sought using Fisher's exact test. A *P* value < .05 was considered significant.

Results

Thirty-six ligament reconstructions (36 patients) were included. During follow-up, 3 patients died and one was lost to follow-up (Fig. 1). Nineteen patients were seen again in consultation (59%), and 13 were evaluated by telephone and photographs. Radiographs were obtained at the last follow-up in 27 patients (84%). With regard to the 3 patients who had died, one had been evaluated 9 months postoperatively, his course was unremarkable, and he had no signs of elbow instability. The families of the other 2 patients reported no elbow-related problems at 7 and 19 years follow-up.

Mean clinical follow-up in the 32 cases evaluated was 112 months (range, 36–265 months). Mean age at the time of surgery was 43.8 years (range, 18–69 years). Fifteen patients had a normal BMI, 14 were overweight or moderately obese, and 3 (9%) were morbidly obese. Seventeen patients had acute instability and 15 had chronic instability (Fig. 2). Trauma was the cause of instability in all cases. The preoperative epidemiological, morphological, and clinical characteristics of the patients included are given in Table 1.

Of the 15 patients with chronic instability, all had preoperative lateral elbow pain, 8 had episodes of recurrent dislocation, and 7 had episodes of subluxation. All patients had a positive lateral pivot shift test.

Three patients had preoperative moderate osteoarthritis: 2 cases of humeroulnar osteoarthritis (one acute case in a woman aged 69 and one chronic case of recurrent dislocation) and one patient with proximal radioulnar osteoarthritis and chronic recurrent dislocation.

Ligament reconstruction was performed at a mean of 12 days (range, 1–21 days) in acute cases and 52 months (range, 2 months–30 years) in chronic cases. In 21 patients, the tendon of the palmaris longus muscle was used for reconstruction, in 10, a half-tendon of the flexor carpi radialis muscle, and in one patient, part of the triceps tendon. There was no difference in mobility (*P* = .17), strength (*P* = .35), or elbow arthrosis (*P* = .3) according to the graft used. Four patients were immobilized by humeroulnar external fixator, one patient with recurrent dislocation who was not compliant with splint wearing, one patient with open dislocation and stretching of the brachial artery and the median nerve, one patient with a

Table 1

Characteristics of 32 patients (32 elbows) who underwent autologous ligament reconstruction for posterolateral instability.

Characteristics	N (%) [range]
Age (years)	43.8 [18–69]
Male sex	18 (56)
Class III obesity (BMI ≥ 40)	3 (9)
Occupation	
Heavy manual work	12 (38)
Light manual work	3 (9)
Sedentary	17 (53)
Dominant elbow operated	13 (41)
Follow-up (months)	112.1 [36–265]
Instability	
Acute	17 (53)
Chronic	15 (47)
Associated lesions	14 (44)

BMI, body mass index.

7-month-old terrible triad injury, and one patient with well-established dislocation of 17 days duration.

There were no surgical complications (infection or hematoma). Three patients (9%) developed a CRPS, one of whom had chronic instability. We experienced 1 technical failure with ligament rupture and persistent instability 60 days postoperatively. Revision surgery was carried out with incorrect positioning of the humeral isometric point. Two other patients underwent further surgery, one for cubital tunnel syndrome and the other for pseudarthrosis of the radial head.

At last follow-up, the mean VAS score was 7/100 (range, 0–70). Twenty-four patients (75%) were pain-free, 6 (19%) had a VAS score of 30 or lower, one had a VAS score of 50, and the last patient, whose initial injury was an open terrible triad with neurological and vascular involvement complicated by pseudarthrosis of the radial head that had twice required surgical revision, had daily pain with a VAS score of 70. The VAS score was significantly higher when there were other associated injuries (*P* = .03) and in obese patients (*P* = .03).

With the exception of the technical failure, no episode of dislocation or subluxation was reported during the period between the initial surgical procedure and last follow-up. Eight patients (25%) still had apprehension of the elbow, one of whom described snapping and 2 experienced sensations of pseudolocking. Eighteen patients (56%) were very satisfied with the procedure, 10 (31%) were satisfied, and 4 (13%) moderately satisfied. No patient was disappointed or dissatisfied (Table II). Satisfaction was not dependent on age (*P* = .95) or BMI (*P* = .74). There were significantly more satisfied patients among those who did heavy manual work (*P* = .01) and those who were treated for chronic instability (*P* = .006). Twenty-four patients (75%) considered themselves as cured and 8 (25%) as improved. In patients with chronic instability the QuickDASH score was always significantly improved (*P* = .003). There was no significant difference between acute and chronic instability for the QuickDASH (*P* = .47) and Mayo Clinic scores (*P* = .83). The Mayo Clinic score was significantly poorer in the case of associated lesions (*P* = .007) and in patients with morbid obesity (*P* = .0006). Three patients (9%) were classified as disabled, of whom 2 had adapted their daily activities. Six patients (19%) were unable to carry weights of more than 10 kg. One professional rugby player was able to resume his sport at the same level as before (Fig. 3).

The mean elbow flexion of patients at re-evaluation was 126° (range, 100–140°), mean residual flexum 16° (range, 0–60°), mean pronation 84° (range, 70–90°), and mean supination 75° (range, 0–90°). Mobility in pronation and supination was significantly poorer in obese patients (*P* = .03 and *P* = .01, respectively). Residual

Table II

Clinical results of 32 patients (32 elbows) who underwent autologous ligament reconstruction for posterolateral instability.

Case	Sex	Age (ys)	BMI	Type of instability	Associated lesions	Graft	Dominant side operated	Follow-up (months)	Mobility E-F, P-S	Grip strength (%)	Osteo arthritis	QDASH preop	QDASH	Mayo clinic	VAS	Opinion	Satisfaction
1	M	30	20.3	Acute	-	FCR	yes	54	10-120, 85-80	-	-	-	0	100	0	cured	S
2	F	64	23.9	Acute	-	PL	no	65	0-110, 85-80	-	0	-	22.73	100	0	cured	VS
3	M	43	21.9	Acute	Triad	PL	yes	49	0-130, 85-80	-	-	-	0	100	0	cured	VS
4	F	62	29.2	Chronic	-	FCR	yes	83	0-110, 85-80	-	0	25	4.55	100	0	cured	VS
5	M	44	21	Chronic	-	FCR	no	52	0-130, 85-80	100	0	86.36	0	100	0	cured	VS
6	M	45	27	Chronic	-	PL	no	120	0-110, 85-80	-	0	0	0	100	0	cured	VS
7	F	32	40.5	Chronic	RH	PL	no	49	45-100 80-50	46	0	90.91	84.09	45	50	improved	S
8	F	53	25.7	Acute	RH	PL	no	173	30-130, 85-80	80	0	-	13.64	100	0	cured	S
9	F	55	26.4	Acute	-	FCR	yes	66	0-140, 85-80	100	PRU	-	15.91	100	0	cured	VS
10	F	27	26	Chronic	-	PL	yes	183	-10-140, 85-80	113	0	54.55	2.27	100	0	cured	VS
11	M	22	23.8	Chronic	Neglected triad	FCR	no	36	10-130, 85-80	-	-	-	47.73	85	10	cured	VS
12	M	31	20.9	Chronic	-	PL	no	250	10-140, 85-80	-	0	93.18	11.36	100	0	improved	MS
13	M	41	31	Acute	-	PL	yes	64	10-130, 85-80	-	-	-	27.27	100	10	improved	S
14	F	35	25.5	Chronic	-	T	no	265	0-130, 85-80	93	PRU	18.18	22.73	100	0	cured	VS
15	F	69	22	Acute	Triad	FCR	yes	171	50-140, 85-80	129	HU	-	18.18	100	0	improved	S
16	M	44	24	Chronic	-	FCR	no	130	-10-140, 85-80	100	HU	47.73	2.27	100	0	cured	VS
17	F	61	24.6	Acute	RH	FCR	no	45	30-110, 85-80	-	0	-	0	100	0	cured	S
18	M	18	26.5	Chronic	-	FCR	yes	38	-10-130, 85-80	120	0	11.36	0	100	0	cured	VS
19	M	61	24.3	Acute	Triad	PL	yes	41	60-130, 85-80	110	0	100	4.55	100	0	cured	MS
20	M	45	30.8	Chronic	RH	PL	yes	197	20-130, 85-80	111	0	77.27	11.36	100	0	cured	VS
21	F	27	21	Chronic	-	PL	no	115	20-120, 70-80	-	0	34.09	20.45	100	25	improved	MS
22	F	43	24.8	Acute	Coronoid	PL	no	193	0-130, 85-80	-	Tri severe	-	0	100	0	cured	VS
23	M	57	25.6	Acute	Coronoid	PL	no	150	0-130, 85-80	106	0	40.91	0	100	0	cured	VS
24	M	63	29.4	Acute	Coronoid	PL	no	126	0-130, 85-80	-	0	4.55	0	100	15	cured	S
25	M	54	24.6	Acute	Open dislocation NV involvement	FCR	no	87	30-110, 85-80	-	0	-	63.64	85	15	improved	MS
26	M	47	43	Acute	Open triad	PL	no	166	40-110, 80-50	43	HU severe	-	47.73	65	70	improved	S
27	M	43	28	Chronic	-	PL	yes	60	-10;140 85-90	106	0	50	2.27	100	0	cured	VS
28	F	28	26.3	Acute	-	PL	yes	145	15-130, 85-80	107	0	-	4.55	100	0	cured	VS
29	F	28	26.2	Acute	Crush Injury, CS, RH, BBFF	PL	no	149	35-120, 90-5	32	0	-	34.09	95	30	improved	S
30	F	48	24.7	Acute	-	PL	no	65	40-130, 80-50	55	0	-	31.82	100	0	cured	S
31	M	20	22.6	Chronic	-	PL	yes	141	-5-140, 90-90	108	0	36.36	6.82	100	0	cured	VS
32	F	60	41.6	Chronic	-	PL	no	58	0-130, 85-80	-	-	-	0	100	0	cured	VS

BMI, body mass index; QDASH, quick disabilities of the arm, hand, and shoulder score; VAS, visual analog scale.

Ys, years; F, female; M, male; CS, compartment syndrome; Sd, syndrome; BBFF, both-bone forearm fracture; E, extension; F, flexion; P, pronation; S, supination; RH, radial head; NV, neurovascular; PL, palmaris longus; FCR, flexor carpi radialis; T, triceps tendon; PRU, proximal radioulnar; HU, humeroulnar; Tri, tricompartmental; MS, moderately satisfied; S, satisfied; VS, very satisfied.

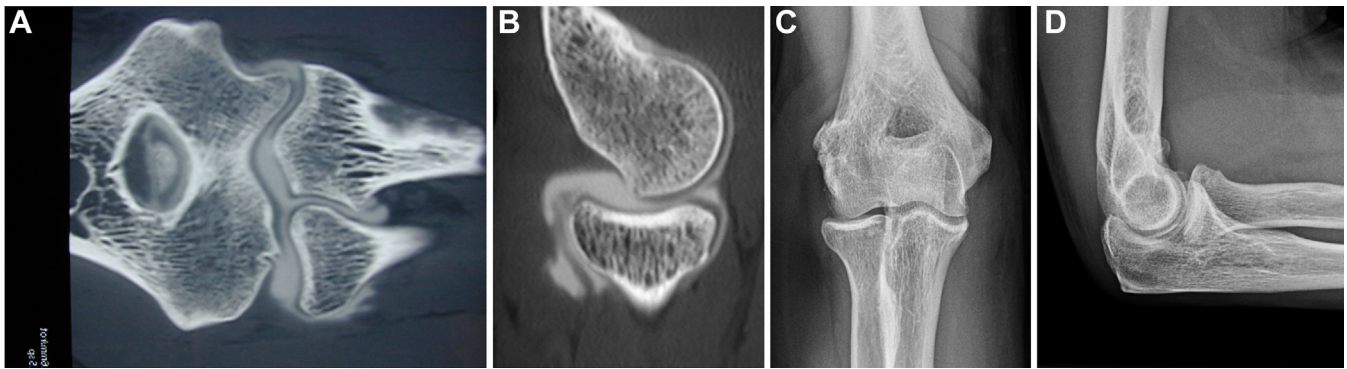


Figure 3 Preoperative CT scan (A and B) and radiographs at 15 years follow-up (C and D) in a professional sportsman. CT, computed tomography.

flessum was significantly higher when there were associated lesions ($P = .004$) and in acute instability ($P = .02$), where it was a mean of 8° greater than in chronic instability. Twenty-four patients (75%) had a range of motion of at least 100° , and 3 of these patients had been immobilized by external fixation. The lateral pivot shift test was negative in all cases except one. In the 19 patients assessed by dynamometer, mean grip strength was 93% (range, 32%–129%) compared with the uninjured side.

On postoperative radiographs, the radial head was centered in 30 patients (94%). Of the remaining two patients, one was the case of technical failure and the second still showed posterior translation of the radial head of 3 mm with no sign of clinical instability.

Radiographs were obtained in 27 patients at more than 3 years follow-up, at a mean of 118 months (range, 38–265 months). Four patients had moderate osteoarthritis; one case of proximal radioulnar osteoarthritis and 3 cases of preexisting osteoarthritis which remained stable. Severe osteoarthritis developed in 2 patients; tricompartmental osteoarthritis at 16 years follow-up in the patient whose radial head was not recentered, and humeroulnar osteoarthritis after an open terrible triad injury in the only patient who experienced daily pain. At 4 years follow-up, the single patient with technical failure did not have osteoarthritis. Twenty-one patients (66%) had secondary ossification which was not associated with significantly greater pain ($P = .73$) or loss of mobility ($P = .67$) and was not a criterion of dissatisfaction ($P = .65$). Osteoarthritis or secondary ossification were not related to the presence of associated lesions ($P = 1$, $P = .64$, respectively) or to the duration of instability ($P = .64$, $P = .27$, respectively).

Of the 12 patients with chronic instability without associated lesions, only one (8%) reported pain during major effort and all were able to resume their previous professional occupations and leisure activities. Ten patients (83%) were able to lift weights of more than 10 kg. Two patients (17%) had persistent apprehension and one, (8%) a snapping sensation. At last follow-up, all had a Mayo Clinic score of 100, and their postoperative QuickDASH score was significantly improved compared with their preoperative score ($P = .002$). Two patients (17%) had moderate osteoarthritis with no clinical impact.

With regard to 7 of the 8 cases with range of motion less than 100° , these concerned the patient with failed ligament reconstruction, one patient with crush injury and compartment syndrome, 2 patients with humeroulnar osteoarthritis, one patient with numerous secondary ossifications, and 2 patients with CRPS. No cause for the limited range of movement could be identified in the last patient.

The patient who experienced snapping sensations initially presented with recurrent dislocation. At the last follow-up, the

clinical results were very good (VAS score 0, full range of motion, QuickDASH score 22.73 unrelated to the elbow, and Mayo Clinic score 100). Radiological examination at the last follow-up showed moderate proximal radioulnar osteoarthritis and increase in the ossification that were present preoperatively. The two patients with pseudolocking had morbid obesity and associated lesions (radial head fracture and open terrible triad).

Of the 4 patients (12.5%) who were moderately satisfied, 3 had incomplete extension (20° , 30° and 60°) and 1 had a persistent sensation of apprehension.

Discussion

Ligament reconstruction of the LUCL with the technique of O'Driscoll et al effectively achieves posterolateral stabilization and appears to preserve the elbow from osteoarthritis in the long term. With a mean follow-up of nearly 10 years, 97% of patients had a negative lateral pivot shift test and none reported a new episode of subluxation or dislocation. More than 90% were able to resume their previous activities. Three-quarters of patients were free of pain. Marked pain was related to associated lesions and morbid obesity.

Anakwenze et al² carried out a meta-analysis of the clinical results of chronic instability without associated lesions, whatever the technique that had been used for LUCL reconstruction.^{12,17,21,22,29,31,34,35} They reported similar ranges of motion but a mean Mayo Clinic score of 91 compared with 100 in this subgroup in our series. Also, they observed recurrent instability in 8% of cases, which raises the issue of the reconstruction technique used.

Jones et al,¹⁷ who performed LUCL reconstruction by proximal fixation of the graft in a blind-ended tunnel using the docking technique,⁶ reported poorer results. At a 7-year follow-up of 8 patients, 2 patients (25%) had residual instability with a Mayo Clinic score of 87.5. More recently, Jung et al¹⁹ also described a technique of dual reconstruction of the LUCL. With this technique, ulnar tunnels are no longer needed, and so an alternative is possible if the tunnels fail. These authors reported results in only 10 patients, with mean ranges of motion of 130° , but with poorer Mayo Clinic and QuickDASH scores than in our study. Arthroscopic techniques are developing and are becoming a diagnostic and therapeutic alternative,^{3,14,36} although current results cannot as yet be predictive of the long-term outcome. Using the open technique of O'Driscoll et al with tunnels drilled in bone, the tension of the tendon graft can be controlled and so accordingly it appears to us a safer technique than arthroscopy or blind-ended tunnels for effective treatment of PLRI.

The only failure in our series can be attributed both to late secondary management and to technical errors due to

malpositioning of the ulnar tunnels and of the humeral point of isometry after revision reconstruction in a patient with morbid obesity (BMI 40.5). This case underlines the importance of correct creation of the various tunnels. Badhrinarayanan et al,⁴ in their review of the literature, found a statistically significantly higher rate of persistent instability in revision reconstruction (40%) than in primary reconstruction (12.2%). Baghdadi et al⁵ stressed the multifactorial nature of persistent instability after ligament reconstruction, where failure of revision reconstruction in their cohort related only to instability with associated bone lesions.

Involvement of the coronoid process is an additional factor of instability, and if it is neglected, the lack of recentring of the radial head tends to be more likely.^{16,30} In our study, one patient with an untreated fracture of the coronoid process still had faulty recentring of the radial head on immediate postoperative radiographs. While the clinical results were always very satisfactory, radiographs at 16 years follow-up showed severe tricompartamental osteoarthritis.

Osteoarthritis was evaluated in 84% of our patients with a mean follow-up of nearly 10 years. Four of the 6 cases of osteoarthritis had no clinical impact (absence of pain and full mobility), while one was painful (VAS 70/100) and another had flexum of 50°. In the 3 patients with preoperative osteoarthritis, the condition remained stable. Severe osteoarthritis developed in only 2 cases (6%) with associated joint lesions.

In elbow dislocation associated with intra-articular fracture that was not stabilized by ligament reconstruction, Forthman et al¹³ reported osteoarthritic changes in 33% of cases at only 5 years follow-up. Simple elbow dislocation also carries a risk of osteoarthritis. Josefsson et al¹⁸ reported 38% of osteoarthritis and 74% of secondary calcification at 24 years of follow-up after such injury. Reconstruction of the LUCL alone thus appears to offer long-lasting stabilization that generally prevents the development of degenerative lesions in the long term. Patients with morbid obesity (BMI ≥40) had reduced range of motion, particularly in pronation/supination, and lower grip strength and Mayo Clinic functional scores. They also reported sensations of pseudolocking with increased pain. Rao et al³³ analyzed the use of external fixation for treatment of elbow instability in a population, where 95% of patients were obese or overweight. Reconstruction of the LUCL was performed in only 4 of their 27 patients (15%). They reported 40% of surgical revision with a mean reduction of extension of 20° and development of osteoarthritis in 55% of cases at 5.8 years of follow-up. Although obesity appears to be a negative factor, it must not be a contraindication to ligament reconstruction.

This study has some limitations. Firstly, it is a retrospective study with a limited series of patients. Although PLRI is the most frequent form of instability, its incidence remains low and restricts the number of patients included. Data on preoperative mobility were incomplete and preoperative dynamometer grip strength measurements to analyze the lack of strength reported by some patients were not available. The population was a heterogeneous one with a variable follow-up of a mean of 10 years but ranging from 36 months to 22 years. However, this study presents a larger patient series and a longer follow-up than other published studies, and only one patient was lost to follow-up.

Conclusion

Elbow ligament reconstruction using O'Driscoll's technique effectively restores posterolateral stability and limits the development of osteoarthritis in the long term, even when there are associated lesions. The only failure in our series was due to several technical errors. Patients with dislocations and associated lesions or morbid obesity are at risk of poorer functional results.

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