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SYSTEMATIC REVIEW

Reconstruction Surgeries for Management of Posterolateral Rotatory Instability of The Elbow: A Systematic Review

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ABSTRACT

We aimed to investigate the indications, techniques, and results of lateral ulnar collateral ligament reconstruction (LUCLR) for posterolateral rotatory instability of the elbow (PLRI) by collecting currently available data. Several databases (PUBMED & EMBASE) were explored for articles published between 2010 and 2020. A search strategy was applied. Altogether, 2,583 studies were recovered for possible inclusion. After adjusting for duplicates, revision of methodology, exclusion of non-full text studies, and those in languages other than English, only four studies remained, which included 51 patients, with more males than females (56.9% and 43.1%, respectively). The patients' mean age was 35.1 years. Eight patients (15.7%) were managed by the Docking technique in one retrospective study, while 43 patients (84.3%) were managed by the trans-osseous technique. Both trans-osseous and Docking techniques are safe and efficient in the management of PLRI cases. The trans-osseous technique has better functional and postoperative results and lesser complications.

Mesh Words: posterolateral rotatory instability of the elbow; lateral ulnar collateral ligament reconstruction surgery; systematic review; meta-analysis

INTRODUCTION

Posterolateral rotatory instability of the elbow (PLRI) is associated with numerous symptoms, e.g., pain, sensation of clicking, and instability. Treatment delay could result in posttraumatic arthritis due to incongruency of the joint and damage of the cartilage.[1,2]

The main lesion of PLRI is due to injury to the lateral ulnar collateral ligament (LUCL), which is the essential component of the lateral collateral ligament of the elbow, and it resists varus tension and external rotating forces at the ulnohumeral joint.[3] Most frequently LUCL occurs due to trauma.[4] Moreover, its dysfunction may occur as a result of iatrogenic injuries, e.g., surgery of the lateral side of elbow; repeated steroid injections for lateral epicondylitis; or in chronic varus deformity as a complication of a supracondylar fracture of children. Insufficient LUCL will lead to symptomatic PLRI with time.[5]

Management of LUCL injury is dependent upon the aetiology of injury and the preference of the surgeon. Surgical repair can be done under acute conditions, while chronic PLRI may be better treated with lateral ulnar collateral ligament reconstruction (LUCLR) to restore stability and function.[5]

Several surgical reconstruction techniques have been described for LUCL insufficiency.[6] Multiple fixation methods have been reported to be performed to secure the graft at the LUCL footprint, e.g., trans-osseous fixation at which the sutures of the graft limbs are secured into the bone, suture anchors, and interference screws.[7] The Docking procedure is the most commonly applied technique.[8,9] In this technique, the graft is passed through a tunnel in the proximal ulna and the two free limbs of the graft are docked into the lateral condyle of the humerus at the isometric point. Nevertheless, there is no agreement as regards which technique leads to the most favourable functional outcome, with least complications for management of PLRI.

This systematic review aimed to analyse the currently available data to develop a better understanding of the indications, techniques, and results of LUCLR for PLRI. The meta-analysis intends to make evidence-based recommendations to clinicians treating patients with chronic PLRI.

Methodology

The ethical approval for conducting this systematic review (#H-06-B-091) was obtained on October 14th, 2020 from the Directorate of Health Affairs – Aseer Region. To retrieve relevant articles for this systematic review, several medically related databases were analysed for studies published between January 2010 and December 2020, i.e., EMBASE, and PubMed. The references of included articles were assessed by the researchers to identify any relevant literature. The following summarises the search strategy followed and used for literature review:

1. (elbow* OR radius* OR humeroradial OR radiocapitellar)
2. (lateral collateral ligament OR lateral ligament complex OR annular ligament OR radial collateral ligament OR lateral ulnar collateral ligament OR ulnar collateral ligament reconstruction* OR ligament surgery* OR posterolateral rotatory instability OR posterolateral rotatory stability OR posterolateral rotatory instability)
3. (reconstruct* OR docking procedure OR allograft* OR autograft* OR surgery* OR procedure* OR repair*)
4. (1 AND 2 AND 3)
5. (4 NOT knee*.Ti. AND NOT thumb*.Ti. AND NOT metacarpal*.Ti.)

Study selection was performed independently by two researchers. Disagreements were settled by repeated revisions of full-texts and discussions with senior orthopaedic consultants. Full-text manuscripts were reviewed if the titles and abstracts of retrieved studies comprised inadequate data to determine its relevance for being included. The inclusion criteria for the articles were as follows:

1. Cohort studies;

2. Patients included in the study had undergone LUCLR surgery for PLRI
3. The article was published in the English language;
4. The full-text of the article was available; and
5. the Mayo Elbow Performance Score (MEPS)[10] was used for the assessment of the results of LUCLR surgery.

Studies describing patients who underwent LUCL repair surgery were excluded. Moreover, case reports, case series, scientific meetings, review articles, and expert opinions were not included.

Our systematic review was carried out in compliance with the protocol prescribed by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[11] Data extraction was performed by the second author and then was repeated by the first author to confirm the coherence. The following information were collected: AU (author), year published, SO (source), study population, patient characteristics, injury-related characteristics, surgical variables (i.e., surgical indication, graft type, surgical technique, return to sport and full function, complication rates, and rehab regime), ROM (range of motion), and functional arc data. Postoperative recurrent or ongoing instability is a result of concern, which was deemed positive if the patients were demonstrating elbow instability or showed evidence of recurrent instability, e.g., a positive pivot-shift test.[2]

Measurements of patient-reported outcomes have been reported. The most frequently used measure is the MEPS.[12] Our results were classified according to Morrey and An's evaluation criteria.[13] The two researchers independently evaluated all included studies for the risk of bias and methodological quality using the Methodological Index for Non-Randomised Studies.[14]

The statistical analysis was completed using the Statistical Package for Social Sciences (SPSS) (IBM Corp. Released 2017.IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.) The relative risk, 95% confidence interval, and Z-test were applied to compare the outcomes of the trans-osseous and Docking surgical techniques. P-values <0.05 were considered as statistically significant.

RESULTS

Study selection: After searching the databases, 2,583 studies could be retrieved for potential inclusion (Figure 1). After adjusting for duplicates, revision of methodology and excluding non-full text studies and those in languages other than English, only four studies remained.[9,12,15,16]

Study characteristics and clinical outcome: Table 1 shows a summary of the characteristics of the four included articles published between 2012 and 2015. All studies had levels of evidence of 2-3. The four studies included 51 patients, with more males (29, 56.9%) than females (22, 43.1%). Their mean age was 35.1 years (range 16-63 years). The indications for surgery were mainly traumatic dislocation (44 patients, 86.3%), while three patients (5.9%) had attritional degeneration. Eight patients (15.7%) were managed by the Docking technique in one retrospective study,[9] 43 patients (84.3%) were managed by the trans-osseous technique in one retrospective and two prospective studies.[12,15,16]

Follow up and complications: The average follow-up duration for all included patients was almost 6 years (54.8 months). Patients in the Docking group had the longest follow-up duration (85 months).

Among those who underwent trans-osseous reconstruction (n=43), one patient had medial collateral ligament reconstruction, and four patients underwent revision surgery, while among those who underwent Docking reconstruction (n=8), two patients had recurrent instability, one had postoperative loss of motion, but none underwent revision surgery.

Residual pain was reported in three articles (15 out of 41 patients, 36.6%). Four patients had residual pain (out of 8 patients) after undergoing Docking technique (50%), compared with 11 patients (out of 33) who underwent trans-osseous technique (33.3%).

All four articles in the present systematic review reported their patients' scores for postoperative MEPS, which ranged from 45 to 100 (mean: 89.9). The highest mean score was reported by Lin et al.[12] for patients who underwent the trans-osseous technique at 93, and that reported by Vernet et al.,[16] while the lowest score at 87.5 was reported by Jones et al.,[9] whose patients underwent the Docking technique and Tawari et al.,[15] whose patients underwent the trans-osseous technique. Almost all patients were satisfied with their postoperative outcome (92.2%, 47/51).

Comparison between surgical techniques: In the reviewed studies, residual pain and revision surgery were comparable in the two surgical techniques (Docking and trans-osseous). However, significantly more complications were present in patients who underwent the Docking technique (p=0.01), as shown in Figure 2. Patients who were managed with the trans-osseous technique had better mean MEPS scores than those managed with the Docking technique. However, this difference was not statistically significant.

Table (1): Main findings of the studies included in the systematic review

Reference	Country	Gender n (M:F)	Age Mean (range) years	Follow up Mean (range) months	Indication for surgery	Technique	Clinical score Mean (range)	Complications	Revision surgery
Jones et al. 2012	USA	8 (4:4)	40 (17-57)	85 (62-112) months	4 traumatic dislocation; 3 attritional degeneration	docking technique	MEPS: 87.5 (75-100)	2 recurrent instability 1 had postoperative loss of motion	None
Lin et al. 2012	Taiwan	14 (10:4)	31.6 (18–60)	49 (24-77)	14 traumatic dislocation	Transosseous	MEPS: 93 (65-100)	1 medial collateral ligament reconstruction	1 re-operation for persistent instability
Tawari et al. 2013	UK	10 (4:6)	31 (16-50)	27 (11-76)	7 traumatic dislocation 3 unknown	Transosseous	MEPS: 87.5 (45-100)	None	3

Vernet et al. 2015	France	19 (11:8)	37.8 (20–63)	61 (12-145)	19 traumatic dislocation	Transosseous	MEPS: 90 (60–100) QuickDASH 21 (0–63)	None	None
Zale and Kim 2019	USA	20 (10:10)	49 (21-83)	27 (12-36)	All patients had elbow dislocation	docking technique (Not Applicable)	MEPS: 90 (55-100) Quick DASH 22.4 (0- 59.1)	1 Limited forearm rotation	None
Seo et al. 2020	Korea	18 (11:7)	40 (19-64)	≥12	18 Unstable elbow dislocation	Arthroscopic repair (Not Applicable)	MEPS: 97.7 ± 3.9	None	None
Overall		89 (50:39)	39.2 (16-83)	39.9 (11-145)			MEPS: 91.5 (45-100) Quick DASH 21.7 (0-63)		4

MEPS: Mayo Elbow Performance Score
ORIF: Open reduction and internal fixation
MUCL: medial ulnar collateral ligament
RHR: radial head replacement
Quick DASH: Disabilities of the Arm Shoulder and Hand

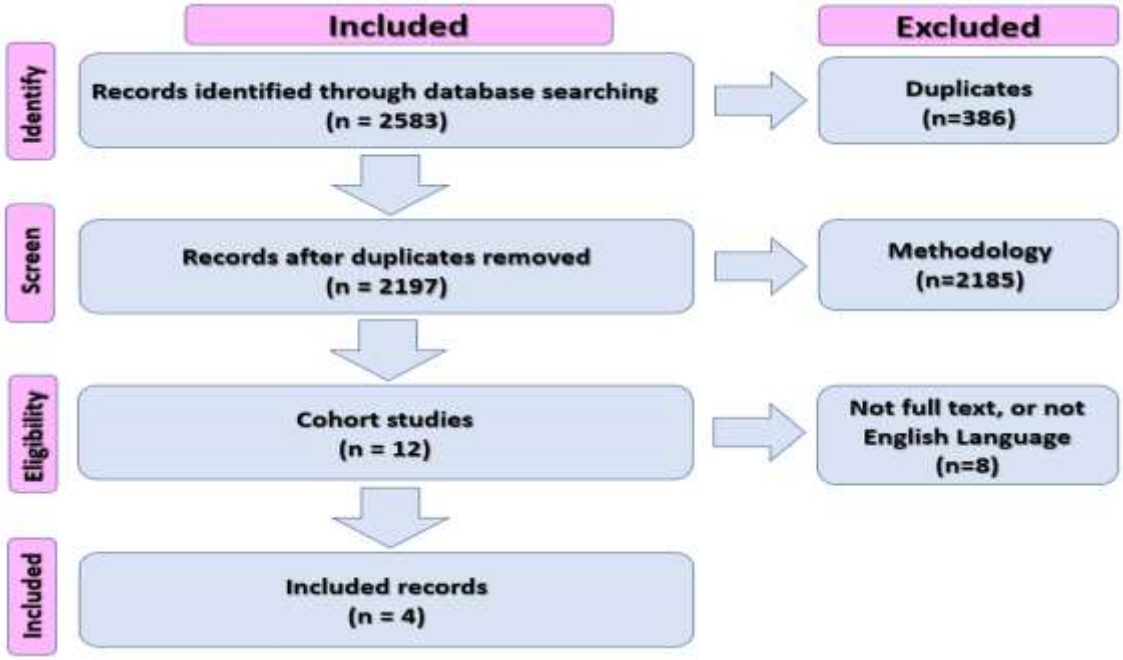

Figure (1): Flow diagram for stages of study selection and exclusion

	Trans-osseous (n/N)	Docking (n/N)	RR	95% CI	P value
Pain	4/8	11/33	1.5	0.64-3.49	0.3466
Complications	3/8	1/43	16.13	1.91-136.19	0.0106
Reoperation	0/8	4/43	0.54	0.03-9.23	0.6728

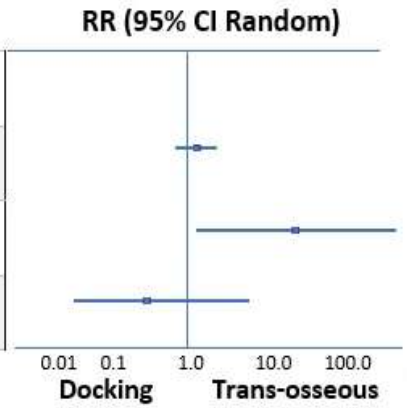

Figure (2): Forest plot comparing outcomes of trans-osseous surgical technique with those of Docking (pain, complications and reoperation)

DISCUSSION

Chronic instability of the elbow is a disabling pathology. It is associated with chronic pain, joint instability, recurrent subluxation/dislocation, and limited range of movement, thus affecting patients' daily lives.[17] This systematic review focused on cases with PLRI managed by LUCLR. It is to be noted that results of articles on LUCLR for PLRIE were mainly published in case reports or series,[18,19] which were excluded from the present systematic review. This depicts the rarity of this clinical condition and the difficulties we face in diagnosing and managing it, resulting in a literature shortage to describe those specific characteristics and the effectiveness of management strategies.[4] Our systematic review included four articles that underlined the clinical outcomes in 51 patients with PLRI managed by the Docking or interosseous techniques. In spite of differences in the adopted surgical techniques, the reported outcomes by all included studies indicated that LUCLR is effective in achieving lateral elbow stability.

Slight activity-related pain occurred in nearly one-third of patients included in our systematic review (36.6%, 15/41). Nevertheless, almost all patients (92.2%, 47/51) were satisfied with their postoperative outcome. Sanchez-Sotelo et al.[2] stressed that persistent pain is a common complication following reconstruction. Several studies emphasised that LUCLR is the preferred choice to restore stability of the elbow in patients presenting with sub-acute-to-chronic PLRI.[20-22] In spite of the fact that the diagnosis is generally late, surgical results of LUCLR are mainly excellent, with approximately 90% of patients achieving postoperative elbow stability on physical examination and nearly 90% MEPS on long-term follow-up (about 5 years).

It is to be noted that PLRI occurred more among males than among females, and at a relatively young age (mean: 35.1 years). Similarly, most studies on LUCLR for chronic PLRIE included more males than females,[19,23,24] and their patients' mean age was also comparable to that of our patients (31.3 years), such as those included in the studies of Williams et al.[18] (27 years), Gong et al.[25] (29 years), Rodriguez et al.[19] (31.2 years), and Baghdadi et al.[26] (33.2 years).

In our systematic review, only four patients underwent revision surgeries (7.8%). Lin et al.[12] reported one instance of residual postoperative instability due to a concomitant medial collateral ligament injury that was not diagnosed before doing LUCLR. Fares et al.[27] reported that 2.7% of the patients underwent revision surgery. They added that careful preoperative assessment is necessary to identify any concomitant injuries. The low reoperation rate may be explained by the relatively young population, who had better healing potential and less comorbidity complicating their condition. Moreover, most of the patients included in this systematic review had nearly full range of elbow movements following surgical reconstruction, as indicated by the mean MEPS. O'Driscoll et al.[28] noted that residual postoperative pain affects about one third of the patients. However, all patients had stable elbows and all patients were either satisfied or very satisfied with their post-surgical outcome. These findings confirm a higher predilection among active or athletic populations, who are more vulnerable to traumatic dislocation, and possibly indicate a greater potential for cure with a less associated comorbidity complicating the condition. Potential limitation of this systematic review could have occurred in our selected studies because of the discrepancy in the sample sizes size between the two surgical techniques (43 patients managed with trans-osseous technique compared with 8 patients managed with the Docking technique) and differences in follow-up lengths. Another limitation is that we did not includ the studies published before 2010.

CONCLUSION

This systematic review shows that both the trans-osseous and Docking techniques are safe and efficient in the management of PLRI. The trans-osseous technique has better postoperative functional and clinical outcomes and lesser complications than the Docking technique. However, the two techniques do not differ in terms of residual pain and revision surgery rates. Further systematic reviews and meta-analyses involving more studies are required to better understand the limitations and potentials of these two surgical techniques for LUCLR.

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