

Surgical Treatment of Neglected Elbow Dislocation with the Box-loop Technique: A Case Report

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Learning Point of the Article:

The Box-loop technique stands out as an efficient and cost-effective alternative for treating chronic elbow instability in cases of persistent elbow dislocation.

Abstract

Introduction: The elbow is the second most common joint involved in dislocations in the human body, accounting for approximately 20% of all joint dislocations. The precariousness of some health services, in rural and less developed places, contributes to a higher rate of underdiagnosis of these injuries, resulting in a higher prevalence of persistent elbow dislocations. In the surgical management of chronic elbow dislocations, primary ligament repair is frequently not feasible, making reconstruction of the lateral and medial collateral ligament complexes of the elbow usually necessary, often with the use of grafts.

Case Report: On October 07, 2023, a 39-year-old male patient presented to the emergency department of an external health service after falling from a flight of stairs. A fracture of his left distal radius was then diagnosed, and he underwent fixation of such a fracture with Kirschner wires, which evolved with a good clinical result. Five months later, in March/2024, the patient came to our health service and was also found to have a previously undiagnosed persistent left elbow dislocation. The case was operated on 1 month after, in April/2024, 6 months after the index trauma. On April 09, 2024, a surgical procedure was performed, with capsular release by lateral and medial incisions, open reduction of the joint, and reconstruction of the lateral and medial ligament complexes with an autologous graft (semitendinosus and gracilis tendons, harvested from the left thigh), using the box-loop technique. Since the procedure, the patient remains in regular clinical follow-up, presenting total joint congruency and functional arc of movement, despite signs of moderate ulno-humeral osteoarthritis. He is now able to perform his everyday activities without pain or any other symptoms.

Conclusion: This case is a report of a previously undiagnosed chronic elbow dislocation, which required a technique to reduce it and provide further elbow stability. The use of the box-loop technique proved effective in treating this patient, with good functional results.

Keywords: Elbow, instability, box-loop, osteoarthritis.

Introduction

The elbow is the second most frequently dislocated joint in the human body, second only to the shoulder joint. It is estimated that it accounts for approximately 20% of all joint dislocations [1]. In general, elbow dislocation occurs after trauma, leading

patients to seek emergency care, where they are subjected to elbow joint reduction. In developing countries, the precariousness of some health services, mostly in rural areas and faraway places, contributes significantly to a higher rate of underdiagnosis of these injuries, resulting in a higher prevalence

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Case Report



Figure 1: 06 months post-trauma AP and Lateral X-rays, revealing a posteriorly dislocated elbow

of persistent elbow dislocations [1].

Once an acute elbow dislocation has been reduced, most cases can be managed conservatively, with surgery only indicated for those with persistent instability. In chronic cases (chronic elbow dislocations), primary ligament repair is not always feasible, making it necessary to reconstruct the lateral and medial collateral ligament complexes of the elbow, often using a graft [2, 3].

Various ligament reconstruction techniques have been developed over the years to manage this condition. Some authors have proposed methods that allow both ligament complexes to be reconstructed using a single graft, as described in the circumferential reconstruction model proposed by Van Riet et al. (2006) [4, 5].

In 2015, Finkbone and O'Driscoll presented the Box-loop technique, a less invasive procedure for the treatment of concomitant medial and lateral instability. The study consisted of a retrospective case series with 14 patients who underwent the Box-loop surgery [6]. In 2018, Vicenti et al. published a prospective controlled trial in which 12 patients were addressed with the Box-loop technique [7]. Later, Aminata et al. (2019), with a five-case series [1], and Krishna et al. (2023), with a case report, also studied the technique [8].

Despite still being relatively scarce in the current literature, the previous studies regarding the Box-loop technique showed consistent results, proving it to be a reliable alternative in the management of persistent elbow instability. This case report intends to support this statement by presenting another case in which the Box-loop was performed and the positive follow-up results.

A 39-year-old male presented to the emergency department of an external health service on October 07, 2023, after falling from a flight of stairs. At the time, he complained of pain in his left forearm, and radiographs revealed a fracture of the left distal radius. The patient underwent closed reduction and percutaneous fixation of such a fracture, with Kirschner wires. However, no X-rays of the left elbow were taken at the time.

In March/2024, which means 5 months after the index trauma, the patient came to our service for medical evaluation. His left hand and wrist were fine, but he reported pain and functional limitation in his left elbow. After that, radiographs of his left elbow were taken, which revealed a posterior elbow dislocation (Figs. 1).

The patient was referred to the outpatient clinic of our hospital, and surgery was scheduled after a computed tomography scan was obtained (Fig. 2).

In view of that chronic left elbow posterior dislocation, on April 09, 2024 (which means 6 months after index trauma), a surgical procedure was performed, with capsular release by lateral and medial approaches, delicate reduction of the joint, and reconstruction of the lateral and medial ligament complexes with an autologous graft, using the Box-loop technique. We used both gracilis and semitendinosus tendons harvested by the surgical team during the procedure, from the left thigh.

The patient was placed in the supine position, under general anesthesia and brachial plexus block. After harvesting and preparing the graft (taken from the left thigh), a tourniquet was placed on the left upper limb. Next, a lateral incision was made in the left elbow, with careful dissection up to the extensor-supinator muscles of the forearm, which were sectioned at their

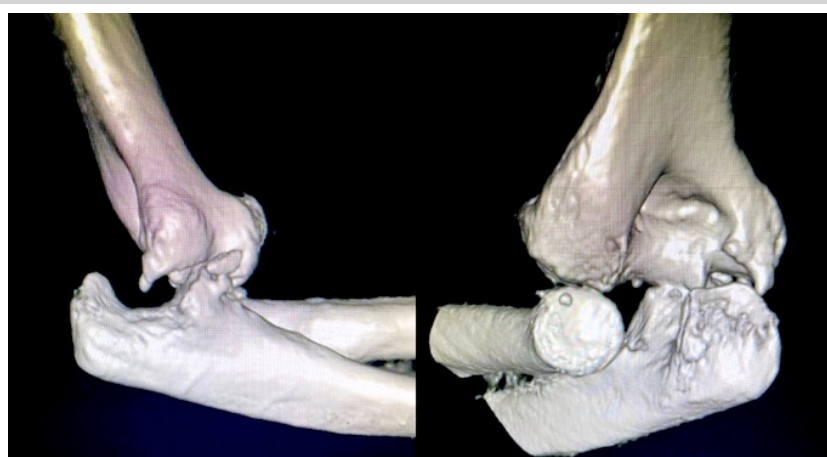


Figure 2: 06 months post-trauma 3D CT Scans, revealing a posteriorly dislocated elbow



Figure 3: articular surfaces of the radius and trochlea were still in good condition

insertion on the lateral epicondyle, allowing visualization of the dislocated radial head. Joint inspection revealed wear on the articular surface of the olecranon, while the articular surfaces of the radius and trochlea were in good condition (Fig. 3).

A second incision was then made on the medial aspect of the elbow, providing access to the flexor-pronator muscles. Using the Hotchkiss approach technique, the sublime tubercle was exposed, and the medial aspect of the trochlea was identified. The radio-capitular and humero-ulnar joints were then reduced using these two approaches, making it possible to apply the Box-loop technique.

Initially, a 6.0 mm drill was used to make a bone tunnel between the medial and lateral epicondyles, respecting the respective anatomical parameters of the ligament insertions. A new bone tunnel was then made in the proximal ulna, from the supinator crest to the sublime tubercle. The graft of the gracilis and semitendinosus tendons was then passed through the tunnels and fixed under tension, with Vycril 1.0 sutures, with the elbow at 60°. At the end of the procedure, joint stability was assessed and considered satisfactory (Fig. 4).

Postoperatively, the patient was immobilized with a dynamic axilopalmar orthosis (articulated hinged brace), allowing free flexion and extension of the elbow, but restricting varus and valgus stress, as well as preventing shoulder abduction. After 2 months, the orthosis was discontinued and the patient maintained physiotherapy to gain range of movement.

Six months after surgery, radiographs of the elbow showed total joint

Surgeons.

congruence, but signs of moderate ulno-humeral osteoarthritis (Fig. 5).

Clinically, the patient had an arc of movement of 70–140° for flexion-extension and 0–80° for pronation-supination (Fig. 6).

The patient was now able to touch his mouth and feed himself with his left hand, and also to hold objects, in spite of the considerable limitation of elbow extension. The patient had no pain and was able to work again. When applying functional scores, the patient scored 6.8/100 on the Quick DASH and 87% on the American Shoulder and Elbow

Discussion

Chronic elbow dislocation is a challenging condition in orthopedics, mainly due to the complications generated by joint incongruity. Reconstruction of the lateral and medial elbow ligament complexes is necessary to restore joint stability and allow the limb to recover functionally [9, 10]. Various surgical techniques have been described, including isolated reconstruction of the ulnar collateral ligament (UCL) and lateral UCL (LUCL). However, the “Box-Loop” reconstruction technique has been gaining prominence in recent years [1, 6, 7, 8] (Table 1).

The circumferential graft technique, as described by Van Riet et al. (2006) and Finkbone and O’Driscoll (2015), allows simultaneous reconstruction of the medial and lateral ligament complexes using only a single tendon graft. This technique



Figure 4: final construction, with lateral incision (left) and medial incision (right)



Figure 5: AP and Lateral X-rays, 06 months after surgery, with signs of moderate ulno-humeral osteoarthritis

proved to be biomechanically similar to conventional reconstruction of the UCL and LUCL, as demonstrated by Hackl et al. (2015) in a biomechanical study, comparing both approaches. That study concluded that the Box-loop technique provided better resistance of the graft after cyclic stress, even though it did not reproduce the identical anatomy of the ligaments, suggesting that it may be beneficial due to the maintenance of resistance to cyclic stress [2,4].

Aminata et al. (2019) showed that the effectiveness of the Box-loop technique, in cases of chronic elbow instability, was evidenced by a case series of six patients. All such patients referred clinical improvement, with no complications reported [1]. Finkbone and O'Driscoll (2015) also observed favorable results for joint stability and functional return after ligament reconstruction with the "Box-Loop" technique [2].

Autologous grafts, such as gracilis and semitendinosus tendons, are reliable for elbow ligament reconstruction, enabling early return to mobility [1].

To date, few studies on the surgical management of persistent elbow dislocation have been published. Chronic elbow dislocation is an uncommon pathology, and is often related to medical negligence at the time of first medical evaluation, or in patients with poor cooperation. This study describes a case that clearly demands complex surgical management, with quite a few previously

described surgical options in the literature. Progression to osteoarthritis, in such cases, is common; in Finkbone and O'Driscoll's 2019 study, among the 14 patients who underwent the Box-loop treatment, only nine had post-operative radiographies during follow-up, and seven of them revealed some degree of post-traumatic radiographic osteoarthritis, just like the patient presented in our study.

The aim of the indication of the Box-loop technique, for this patient, was to maintain joint reduction, restore elbow stability, and allow elbow function to return, preventing the progression of severe elbow functional limitation. After 6 months of follow-up, there were no complications, such as recurrence of instability or ulnar neuritis, as described in other studies.

Still, the elbow joint, just like the shoulder joint, is not a load-bearing joint, such as the hip, knee, and ankle. In this sense, shoulder and elbow specialists are used to witness clinical-radiological dissociations between the degree of glenohumeral osteoarthritis, radiographically, and the patient's symptoms. This means that, in daily clinical practice, it is relatively usual to see patients with moderate (or even severe) gleno-humeral arthritis, on radiographs, but with minimal clinical symptoms. Joyce et al. (2021) and Kircher et al. (2009) analyzed the clinical-radiological dissociation in patients with glenohumeral osteoarthritis and demonstrated that patients with advanced degrees of glenohumeral osteoarthritis may have few clinical symptoms [11,12].

Unlike in the shoulder, there is a scarcity of studies demonstrating this same clinical-radiological dissociation in



Figure 6: Elbow range of motion at 06 months after surgery

Table 1: Box-loop results comparison

Authors	Year of publication	Patients involved	Chronic instability diagnosis	Follow up (mean-months)	ASES score (mean)	QuickDASH score	Range of motion (mean)	Radiographs (findings)
Finkbone and O'Driscoll	2015	14	12	64 (19–109)	81,07 (36–100)	12,71 (0–64)	F/E 139/11 (105–155/0–35)	7 UO
							P/S 80/75 (45–90/30–90)	2 HO
Vicenti et al	2018	12	12	12 (12–12)	-	-	FE 147/0	1 UO
							P/S 87/86	
Aminata et al	2019	5	5	20,8 (12–31)	-	19,4 (9–27)	F/E 145/30 (140–150/0–45)	N
Krishna et al	2023	1	1	12	-	-	F/E 10/130	N
P/S: Pronation/supination, F/E: Flexion/extension, UO:Ulnohumeral osteoarthritis, HO: Heterotopic ossification, N: Normal.								
*Finkbone and O'Driscoll did not evaluate in clinic 4 of the cases								
**Vicenti et al., Aminata et al., and Krishna et al. did not utilize the ASES score								
***Vicenti et al., Krishna et al. did not utilize the Quick DASH score								

the elbow. However, we consider it plausible that such dissociation may occur in the elbow, since the elbow, just like the shoulder, is not a load-bearing joint.

This study has limitations that must be taken into consideration.

This article reports only one patient, and hence does not allow comparative or statistical analysis.

This patient was evaluated for 6 months postoperatively, and it has to be considered that future complications, such as recurrence of instability and development of ulno-humeral advanced osteoarthritis, may occur. Nevertheless, the existing literature on the subject, although limited to a few publications, does not report late instability following this surgical procedure. This study also does not compare the Box-loop technique with other techniques previously described in the literature, such as traditional ligament reconstructions and techniques with assisted use of external fixators, which may make it burdensome to analyze the relative effectiveness of the technique presented in this article.

Despite the fact that the clinical improvement that this patient obtained, with the surgery presented here, was indeed remarkable (allowing him to return to work and to perform elementary activities of daily living without pain, such as dressing, eating with his left hand and taking care of his personal hygiene with left upper limb), the pre- and post-operative left elbow range of motion was not evaluated with a score (such as the Mayo Elbow Performance Score, for example), which is also a limitation of this study.

This article did not involve more advanced post-operative imaging studies (such as computed tomography and magnetic

resonance imaging) and was based on the clinical and radiographic evaluation of the case, during the first 6 months postoperatively. In this sense, it is relevant to say that post-operative radiographs revealed the presence of a congruent elbow joint, and that the patient's marked clinical improvement was clearly due to the restoration of the elbow joint's congruence.

However, in the future, once the patient develops pain and osteoarthritis

progression, studies such as computed tomography and magnetic resonance imaging will undoubtedly contribute to a more in-depth radiological evaluation of the elbow joint, and add to an eventual decision-making process for other future surgical procedures (such as elbow arthroplasty, for example).

The Box-loop surgical technique is reproducible, but it has a steep learning curve. Not only must the surgeon have a deep and solid understanding of the elbow's anatomy, but it is also crucial to understand that elbows subjected to this surgical technique have substantially distorted anatomy. Furthermore, considering that chronic elbow dislocation cases are in fact not common, the learning curve becomes even more difficult and, in our view, feasible for orthopedic surgeons working in centers that actually receive this type of medical demand.

Potential complications inherent to the Box-loop surgical technique include tunnel malpositioning and intraoperative ulnar nerve injury. However, such complications appear to be clearly avoidable with appropriate surgical technique. Furthermore, we emphasize that the remarkable clinical improvement presented in this case report demonstrates clear integration of the tendon graft, harvested from the patient's left knee and placed in his left elbow.

The Box-loop technique is highly cost-effective, as it does not require any orthopedic implants (such as anchors, screws, or buttons). The tendon graft is sutured to itself using 1.0 Vicryl sutures, in a way that this technique aims to treat a complex orthopedic problem at a low cost.

The progression of elbow osteoarthritis, in this case presented here, is indeed expected to happen, but there is no way to predict how quickly this progression will advance over time. Hence, the

patient remains clinically satisfied for now, but aware that other surgical approaches may eventually be considered in the future, depending on his clinical picture.

As previously mentioned, literature on the Box-loop technique is limited. However, published studies reinforce the technique's reproducibility and reiterate that good clinical results can indeed be obtained.

Conclusion

The "Box-Loop" represents an efficient technique for the treatment of chronic elbow dislocations, offering a safe surgical solution, with satisfactory functional results, but with an unpredictable long-term prognosis. Additional studies, with

larger samples and long-term follow-ups, are necessary to highlight more clearly the benefits of this technique in comparison with anatomical reconstructions of the lateral and medial ligament complexes.

Clinical Message

The Box-loop technique used in this case is an excellent indication for the surgical management of chronic elbow dislocations. The technique is cost-effective and reproducible, but in-depth anatomical knowledge of the elbow is necessary. Elbow post-traumatic radiographic arthritis is expected to happen, but still, good clinical results can be achieved.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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