



Functional Outcomes of Patients with Ankylosed Elbow Managed with Fascia Lata Interposition Arthroplasty and Early Post-operative Active Motion Protocol: A Retrospective Study

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ABSTRACT

Background. Interposition arthroplasty is a non-prosthetic-requiring surgery that restores motion in young patients with ankylosed elbows who are not amenable to total elbow arthroplasty, elbow arthrodesis, or resection arthroplasty. This procedure usually requires extensive soft tissue stripping to free the elbow joint, an interposition graft, and post-operative immobilization.

Objective. This study determined the functional outcomes of patients who underwent interposition arthroplasty of the elbow with early post-operative active motion exercise protocol, foregoing external fixation.

Methodology. The study retrospectively reviewed charts of patients treated by a single surgeon for ankylosed elbows from 2017 to 2023 in a tertiary institution. All patients initiated early overhead active motion exercises as early as 24–48 hours post-surgery without any external fixation. Pre-operative and last follow-up functional outcomes were determined using the Mayo Elbow Performance and Fil-DASH scores.

Results. The study included six patients with a mean age of 44 (24–61). Mayo Elbow Performance improved by a mean of 23% and Fil-DASH scores improved by a mean of 92%. Patients' average arc of motion was 65° at a mean follow-up of 20 months. All elbows were stable and painless throughout the arc of motion.

Conclusion. Interposition arthroplasty using tensor fascia lata graft combined with early overhead active motion is a viable surgical option for pain relief and improvement of motion in patients with elbow ankylosis who are candidates for either total elbow arthroplasty or arthrodesis.

Keywords. arthritis, elbow, post-traumatic, interposition, arthroplasty, ankylosis

INTRODUCTION

Interposition arthroplasty is a non-prosthetic-requiring surgery that restores motion in young patients with ankylosed elbows who are not amenable to total elbow arthroplasty, elbow arthrodesis, or resection arthroplasty.

This usually requires extensive soft tissue stripping to free the elbow joint, and an interposition graft coupled with post-operative contractions in the form of a hinged external fixator,¹ or dynamic joint distractor.²

Despite knowing that early motion aids in improving function, motion is usually delayed depending on the surgeon's preference, the patient's specific condition, and the type of post-operative immobilization used.

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This study determined the functional outcome of patients who underwent interposition arthroplasty of the elbow without post-operative external fixation, combined with early (24–48 hours) post-operative overhead active motion exercise protocol.

Rationale and review of related literature

Most activities performed with the arm depend on a 100° functional arc of motion of elbow extension and flexion (30–130°), and another 100° arc of motion for pronation and supination.¹ A 50° loss in the arc of motion can lead to an 80% loss of function.² This is most especially true for the ankylosed elbow with little to no arc of motion.

Surgical management options for elbow ankylosis include open or arthroscopic releases, interposition arthroplasty, elbow arthrodesis, and elbow arthroplasty.²

Arthrodesis is mainly performed for severe joint destruction, most commonly due to post-traumatic arthritis, instability, or infection.³ Arthrodesis becomes problematic in older patients or those being treated for chronic infection since fusion is difficult to achieve when the bone stock is deficient. More importantly, fusion has a high complication rate and is functionally disabling.^{4–6}

Total elbow arthroplasty longevity has yet to be proven and is primarily indicated for inflammatory elbow arthritis or conversion of a failed interposition arthroplasty in elderly patients.⁷ Some drawbacks are the infection rate and the inability to bear weight on this implant system.

Interposition arthroplasty, introduced by Murphy in 1905,⁸ is a viable option for patients with severe elbow arthritis or ankylosis. The triceps aponeuroses are detached, and the ulno-humeral joint dislocated and cleared of osteophytes before interposing biologic tissue such as autologous tensor fascia lata or an Achilles tendon allograft to cover the bone ends.^{9,10} Extensive soft tissue stripping will allow the surgeon to perform this procedure with ease while compromising stability, hence the need to reinforce with an external fixation post-operatively. This procedure relieves pain and improves the total arc of motion while maintaining the native elbow joint.^{1,2}

Positioning the arms overhead converts gravity from a distracting to a stabilizing force.^{11,12} The overhead and supine position minimizes the effect of gravity, decreases posteriorly directed forces, and allows the triceps to function as an elbow stabilizer by avoiding abduction and internal rotation. This position eliminates the gravitational varus and extension-distraction force without affecting the integrity of the lateral ulnar collateral ligament (LUCL), allowing the surgeon to move the elbow without fear of dislocation.

No other study initiated early active motion within 24–48 hours after interposition arthroplasty of the elbow. The

surgeon in this study minimized soft tissue releases while interposing soft tissue in the ulno-humeral joint, eliminating the need for post-operative external fixation, and allowing overhead active elbow motion exercise as early as 24–48 hours after surgery.

METHODOLOGY

Study design and participants

This study was approved by the Ethics Review Board of V. Luna Medical Center and conducted according to the Declaration of Helsinki. The medical records of patients diagnosed with ankylosed elbows who were surgically managed with interposition arthroplasty with early post-operative active motion protocol over five years were reviewed.

Surgical technique

A single orthopedic surgeon with subspecialty training in hand and reconstructive microsurgery performed the surgeries. Each patient was positioned in lateral decubitus with the affected side up. A bump was placed anterior to the arm with the forearm hanging off the edge of the bed (Figure 1). The distal humerus was exposed using the posterior triceps-sparing approach. The lateral ulnar collateral ligament (LUCL) and capsule were released to posteromedially dislocate the elbow (Figure 2). The medial collateral ligament (MCL) and the ulnar nerve were isolated and protected.

Attention was then focused on the lateral thigh, where an incision was made to harvest the full-thickness central portion of the tensor fascia lata graft, ensuring a sufficient graft size of at least 8 x 5 cm (Figure 3A and B). After careful hemostasis, the dermis was closed directly over the gap without a drain using thick 1-0 absorbable sutures. The fascia lata graft was folded over the eburnated surface of the distal humerus and anchored to the intact remnant periosteum on the lateral and medial sides of the distal humerus using 4-0 absorbable sutures (Figure 4).

The elbow was then surgically reduced and the LUCL was repaired using a 4.5mm suture anchor (Figures 5A and B). The wound was closed over a drain. An arm sling was used to immobilize the elbow. No external fixation was used for all patients.

Postoperative care and rehabilitation

As early as 24–48 hours after surgery, each patient performed overhead active elbow range of motion exercises while reclining at a 45° angle. The shoulder was flexed forward to 90° in adduction and neutral rotation. The elbow was allowed to flex with gravity. Active-assisted forearm pronation and supination, and flexion and extension were performed as tolerated (Figures 6A and B). Shoulder internal rotation and abduction were avoided to minimize gravitational varus strain.¹²



Figure 1. Patient position in lateral decubitus with the affected side up.

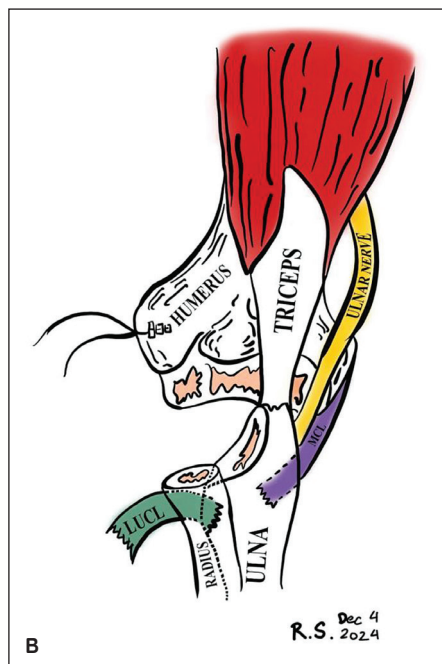
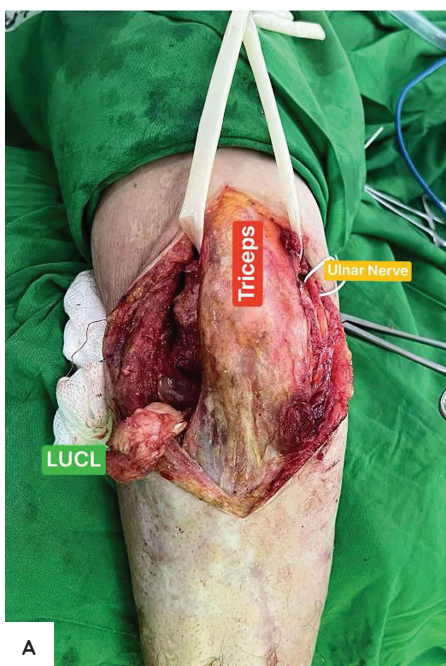


Figure 2. (A) Posterior Triceps sparing approach showing the release of LUCL to allow capsulectomy and Ulna-Humeral joint release and posteromedial dislocation. The MCL is retained. (B) Schematic representation of the surgical technique used by the authors showing the eburnated articulating surfaces of the elbow joint after posteromedial surgical dislocation of the of the ulna with retention of the anterior bundle of the MCL. Also shown are the ulnar nerve protected and isolated after release, and the suture anchor in place for later repair of the LUCL.

At the end of the third week, active-assisted elbow and forearm rotation exercises were allowed in gravity-dependent sitting or standing positions.

At six weeks post-surgery, patients were allowed to do range-of-motion exercises with the elbow independent of gravity.

Outcome analysis

At each patient's last follow-up, functional outcomes were determined using the Mayo Elbow Performance Score (MEPS) and the Filipino Disabilities of the Arm, Shoulder and Hand (DASH) scores.

The maximum MEPS is 100 points: 45 points for no pain, 20 points for $>100^\circ$ of motion, 10 points for joint stability, and 25 points for the capacity to perform selected daily activities. The results are categorized as excellent (90–100 points), good (75–89 points), fair (60–74 points), or poor (<60 points).¹³

The DASH score was originally published in the *American Journal of Industrial Medicine* in 1996 by Hudak and later translated to Filipino (Fil-DASH) by Estrella. It is a standardized assessment of the impact on the function of a variety of musculoskeletal diseases and injuries of the upper extremities. It is a validated 30-item subjective questionnaire in which the response options are presented as 5-point Likert scales. A higher numerical result directly correlates with difficulty and limitation in performing activities of daily living, work, and sports.^{14,15}

RESULTS

The study identified six patients with elbow ankylosis who underwent fascia lata interposition arthroplasty in a tertiary medical center over five years. The mean age of the participants was 44 years (range: 24–61), with an average follow-up period of 20 months (Table 1). Most were post-traumatic in etiology (83.3%).

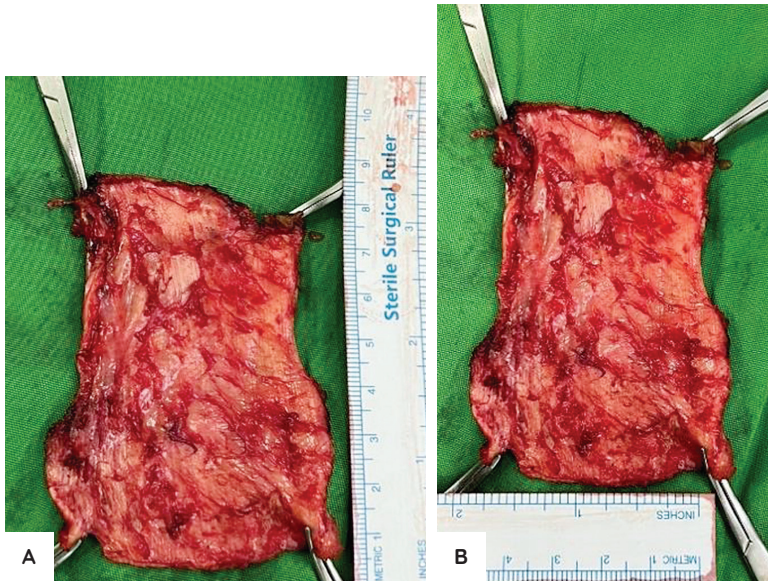


Figure 3. (A) Tensor fascia lata graft harvested 8 cm in length, based on the eburnated surface of the distal humerus. **(B)** Tensor fascia lata graft harvested measuring 5 cm in width.

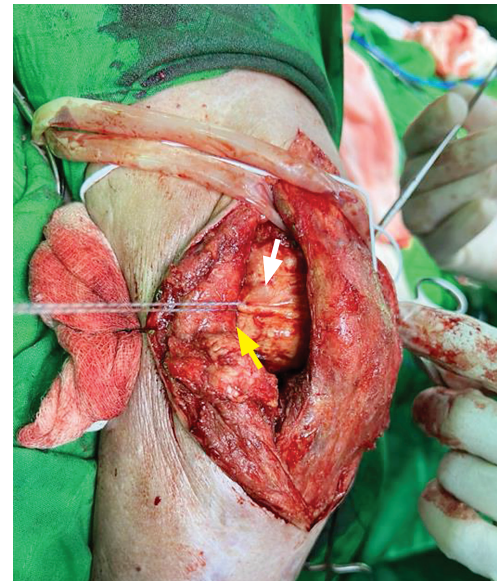


Figure 4. Fascia lata graft (white arrow) anchored to retained periosteal remnants of the eburnated surface of the distal humerus on both lateral and medial sides. Yellow arrow shows suture anchor in place for repair.



Figure 5. (A) The LUCL was repaired (white arrow) at its origin using 4.5 mm suture anchor. The ulnar nerve transposed superficial to the fascia lata graft (blue arrow). **(B)** Post-operative radiograph with suture anchor in place for LUCL repair (white arrow).

There was a 23% improvement in mean MEPS from 21.67° pre-operatively to 92.5° (Figure 7 and Table 2) with an average arc of motion at 65°.

The mean Fil-DASH scores improved by 92% from 69.34 pre-operatively to 4.9 at 24 months follow-up (Figure 8).

At the last follow-up, pain scores were rated as mild to none. All patients report subjective satisfactory outcomes. There were no post-surgical complications, such as surgical site infection, heterotrophic ossification, or residual instability.

Although a painless crepitus was noted during the range of motion, this gradually disappeared after two years.

DISCUSSION

This study describes a surgical approach for elbow ankylosis that involves minimal soft tissue releases, allowing for soft tissue interposition in the ulno-humeral joint. This technique eliminates the need for post-operative external fixation and enables overhead active elbow motion exercises as early as 24–48 hours after surgery.

Table 1. Patient demographics

Patient Number	Patient Initials	Sex	Age (years)	Handedness	Etiology	Follow-up (months)
1	RA	Male	61	Right	Post-traumatic	24
2	ADV	Male	32	Right	Post-traumatic	30
3	DA	Male	29	Right	Post-traumatic	24
4	LT	Female	24	Right	Post-traumatic	24
5	GF	Male	61	Right	Post-traumatic	6
6	DB	Male	56	Right	Tuberculous	12
Mean			44			20

Table 2. Mean Mayo Elbow Performance Score (MEPS)

MEPS	Pre-op	3 months post-op	6 months post-op	12 months post-op	24 months
Pain	2.50	22.5	32.5	40	41.25
Motion	5.00	13.3	15.8	15	16.25
Stability	7.50	8.3	10.0	10	10.00
Daily Function	6.67	13.3	25.0	25	25.00
Total	21.67	57.4	83.3	85	92.50



Figure 6. (A) Early overhead exercises initiated within 48 hours post-surgery showing gravity dependent position of elbow flexion. (B) Active-assisted range of motion exercises is performed from gravity dependent elbow flexion to elbow extension.

The following techniques helped us achieve an early active range of motion: first, the triceps was spared so that active elbow extension could be initiated immediately, in contrast to a study by Charalambous and Morrey where the triceps aponeurosis was detached and reattached after clearing out the ulno-humeral joint of osteophytes.³ Second, only the LUCL was detached to dislocate the joint postero-medially and insert the fascia lata graft. The anterior bundle of the MCL was retained, in contrast to Chen’s study which removed and then reconstructed all soft tissue attachments.⁹ Third, no external fixation or dynamic distractor was applied, in contrast to studies by Miyazaki et al. and Cheng.^{1,2} Fourth, active overhead motion protocol for elbow dislocations as described by Schreiber was initiated 1–2 days post-operatively.¹² This maneuver utilizes the dynamic stability to the elbow provided by the actively contracting triceps against gravity. Retaining the MCL with a repaired LUCL can allow early overhead motion without strain, like starting a dart thrower motion exercise after a scapholunate ligament repair.¹⁶

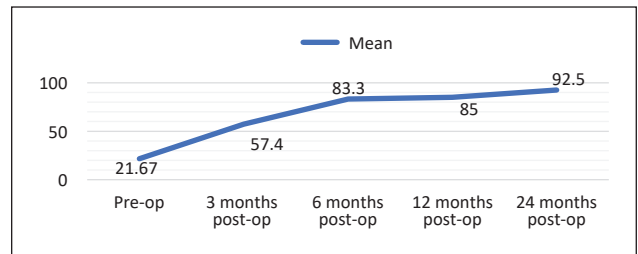


Figure 7. Mean MEPS.

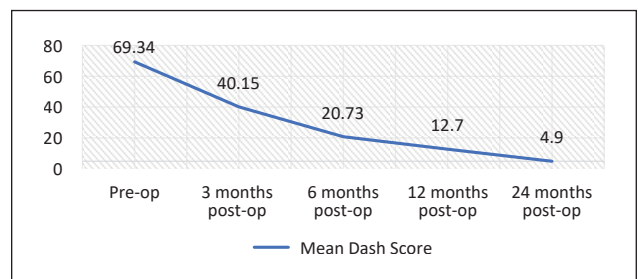


Figure 8. Mean Fil-DASH Score.

Functional outcomes are also generally satisfactory even without using post-operative devices. Cheng used an elbow distractor for three to four weeks to separate the articular surfaces and to protect the fascial graft. Nine of their 13 patients (69%) had satisfactory relief from pain and eight (62%) had excellent or good MEPS results at a mean follow-up of 63 months, while four required revision to total elbow arthroplasty at a mean of 30 months.² In our study, 6 patients (100%) had satisfactory pain relief, and 5 (83%) had an excellent MEPS at their last follow-up and none of these patients were converted to total elbow arthroplasty at a mean follow-up of 20 months. Although our follow-up period is shorter, our patients could bear weight on the reconstructed elbow during activities such as push-ups and weightlifting. This is significant, given that patients who undergo total

elbow arthroplasty typically face a lifetime weight restriction of 15 lbs. While we noted a 92% improvement in the Fil-DASH score at the last follow-up, no other related studies measured DASH scores in their functional outcome.^{1,2,6}

All our patients had painless crepitus during range of motion that disappeared by the 24th month post-surgery. None of the previous authors mentioned this in their study, most probably because they delayed motion.

The study is limited due to the rare diagnosis and indication (i.e., elbow arthroplasty in the young population). This study was still able to demonstrate excellent results in terms of MEPS and Fil-DASH scores.

CONCLUSION

Interposition arthroplasty using tensor fascia lata graft combined with early overhead active motion protocol is a viable surgical option for pain relief and improvement of motion in an ankylosed elbow. In the local setting, in addition to minimizing cost by eliminating the need for any temporary joint fixator, this can be an excellent option for primary arthroplasty. It allows patients to engage in early post-operative rehabilitation while preserving the native elbow joint. Furthermore, it can be successfully converted to a total elbow arthroplasty if indicated subsequently.

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STATEMENT OF AUTHORSHIP

All authors certified fulfillment of ICMJE authorship criteria.

AUTHOR DISCLOSURE

The authors declared no conflict of interest.

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