Chronic Essex-Lopresti injuries: an alternative treatment method

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Background: Currently, no technique has met general acceptance for the restoration of forearm longitudinal stability in chronic Essex-Lopresti injuries. The purpose of this study is to present an alternative treatment method for chronic Essex-Lopresti lesions by radial head replacement and ulnar shortening osteotomy.

Methods: Seven patients with a mean age of 42.4 years were included in the study. Five patients had a staged approach, and 2 underwent both procedures simultaneously. The pain level was assessed with the use of a visual analog scale. Elbow, forearm, and wrist range of motion was evaluated. The Mayo Elbow Performance Score and Mayo Wrist Score were used to assess the postoperative outcomes.

Results: The mean follow-up time was 33 months. The mean pain level was reduced from 8.4 points preoperatively to 3.3 points postoperatively ($P < .05$). The elbow arc of motion was increased on average from 79° preoperatively to 121° postoperatively ($P < .05$). Forearm rotation improved from 76° preoperatively to 119° postoperatively ($P < .05$). The wrist arc of motion improved from 94° preoperatively to 114° postoperatively ($P < .05$). The mean postoperative Mayo Elbow Performance Score and Mayo Wrist Score were 82 points and 71 points, respectively. The mean ulnar variance was reduced from +8 mm to +3.5 mm postoperatively.

Conclusion: This study shows that radial head replacement in combination with ulnar shortening osteotomy can be used as an alternative reconstructive procedure in the case of a complex chronic Essex-Lopresti injury. This combination of known procedures yields predictable and satisfactory outcomes and a low complication rate.

Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Elbow; Essex-Lopresti; forearm; instability; osteotomy; radial head replacement
Edwards and Jupiter have classified Essex-Lopresti injuries into 3 types: type I, a fracture of the radial head with a large displaced fragment and minimal or no comminution that is amenable to open reduction–internal fixation; type II, a comminuted radial head fracture that cannot be reconstructed and requires radial head excision and prosthetic replacement; and type III, chronic cases with irreducible proximal migration of the radius.

Early diagnosis of this injury pattern usually results in a predictable and satisfactory outcome, with radial head fixation (in type I) or replacement (in type II) in combination with triangular fibrocartilage complex repair and DRUJ stabilization. In contrast, type III injuries (chronic cases) represent a major challenge, even for experienced surgeons, with unpredictable surgical outcomes. Several techniques have been reported in the literature for the treatment of chronic Essex-Lopresti injuries, such as radial head fixation or replacement with or without distal ulna stabilization, Darrach resection, a wafer or Sauve-Kapandji procedure, and reconstruction of the IOM. However, none of the procedures have met general acceptance. The end result of these chronic injuries is often a one-bone forearm.

The purpose of this study is to present our results in 7 patients with chronic Essex-Lopresti lesions treated with radial head replacement and ulnar shortening osteotomy.

**Materials and methods**

Seven patients (five men and two women) with a mean age of 42.4 years (range, 37 to 58 years) were treated operatively by the senior author (D.G.S.) between 2003 and 2009 for the diagnosis of chronic Essex-Lopresti injury (Table I). The operations were performed on 2 right and 5 left forearms, 4 of which were on the dominant side. Two patients had been injured during motor vehicle accidents, 4 had falls from a height, and 1 had injured her elbow during a sporting event. Three patients had been treated previously by excision of the radial head, either acute or delayed, and presented to our clinic after wrist symptoms had developed. One patient had undergone a radial head replacement and presented with a loose and painful implant. The remaining 3 patients presented with the insidious onset of wrist and elbow complaints and were diagnosed with longitudinal forearm instability after a prolonged course of conservative treatment.

Five patients had a staged approach; the radial head was initially replaced, and the ulnar shortening osteotomy was subsequently performed at a later date after the onset of wrist symptoms. The other 2 patients who initially presented with elbow and wrist complaints underwent both procedures simultaneously. The mean time from the initial injury to final surgery was 11 months (range, 6 to 24 months).

In all patients, preoperative anteroposterior and lateral radiographs of the injured elbow and forearm, as well as both wrists, were obtained (Fig. 1, A and B). The ulnar variance was assessed with a pronated-grip view in all patients (Fig. 1, C). The mean ulnar variance before our treatment was +8 mm (range, +6 to +12 mm).

The radial head prostheses (Fig. 2) were inserted in all patients through a lateral approach. Anterior capsular release and...
Debridement of coronoid osteophytes were carried out in patients with elbow stiffness. The lateral ulnar collateral ligament was repaired or reconstructed in cases with laxity (5 patients). The ulnar shortening osteotomy was performed, as described previously by the senior author, using a step-cut osteotomy stabilized with a lag screw and a palmarly placed 3.5-mm neutralization plate (Fig. 3, A and B). It is our belief that the main aim of the procedure should be to unload the ulnocarpal joint and not to create neutral ulnar variance radiographically. There was no attempt to reconstruct the IOM in any patient.

Follow-up comprised clinical and radiologic examination. Pain levels were determined by a visual analog scale ranging from 0 to 10, with 0 being no pain and 10 representing maximal pain. Range of motion was assessed with a goniometer. At the final follow-up, elbow function was accessed by use of the Mayo Elbow Performance Score and wrist function was addressed with the Mayo Wrist Score. All measurements were assessed by an independent examiner who did not participate in the clinical treatment.

The Wilcoxon signed rank test was used to compare the preoperative and postoperative numerical data. All reported P values are 2 tailed, with P < .05 being considered significant. The analysis of the data was carried out with the SPSS statistical software package, version 17.0 (SPSS, Chicago, IL, USA).

Results

The mean follow-up time was 33 months (range, 26 to 52 months). All patients had significant pain relief. The mean preoperative pain score improved from 8.4 points (range, 8 to 10 points) to 3.3 points (range, 2 to 5 points) at the final follow-up (P = .014). Table II shows the preoperative and postoperative data for each case.

Range of motion significantly improved postoperatively. The elbow arc of motion increased on average from 79° preoperatively to 121° postoperatively (P = .028). The mean elbow flexion improved from 108° to 132° (P = .027), and the mean elbow extension increased from 29° preoperatively to 12° postoperatively (P = .027). The mean forearm rotation increased from 76° preoperatively to 119° postoperatively (P = .018). The mean forearm supination increased from 44° preoperatively to 66° postoperatively (P = .018), and the mean forearm pronation improved from 33° preoperatively to 53° postoperatively (P = .043). The mean wrist arc of motion improved from 94° preoperatively to 114° postoperatively (P = .042). The mean wrist flexion increased from 47° preoperatively to 57° postoperatively (P = .042), and the mean wrist extension improved from 47° preoperatively to 56° postoperatively (P = .042).

The final postoperative Mayo Elbow Performance Score was 82 points on average, with 5 patients achieving good results and 2 achieving fair results. The mean Mayo Wrist Score was 71 points at the final follow-up, with 1 patient reaching a good outcome and the remaining 6 patients having fair results. The mean ulnar variance was reduced from +8 mm (range, +6 to +12 mm) preoperatively to +3.5 mm (range, +2 to +4.5 mm) postoperatively (Fig. 3, C).

There were no major complications apart from a delayed union of the ulnar shortening osteotomy in a smoker, which finally healed nonoperatively at 8 months.

Discussion

Management of the chronic Essex-Lopresti lesion continues to be a challenging therapeutic entity. Several methods have been reported in the literature, but none has met general acceptance. The main goal when treating such injuries is to...
re-establish the longitudinal relationship between the radius and ulna. Restoration of the proximal radioulnar joint (PRUJ) and DRUJ is the key to regaining painless elbow and wrist function.

The pathognomonic lesion in Essex-Lopresti injury is the rupture of the IOM. \textsuperscript{11,17,21} When this rupture is accompanied by the loss of the radial head, the primary longitudinal forearm stabilizer, the resultant longitudinal instability leads to proximal migration of the radius, and elbow and wrist symptoms may subsequently develop in the patient. \textsuperscript{18,24} Re-establishment of the radiocapitellar articulation to prevent proximal migration of the radius with a metallic radial head implant generally has been met with satisfactory results. \textsuperscript{13,14} However, Heijink et al\textsuperscript{10} reported on 8 cases of chronic Essex-Lopresti injury treated with a metallic radial head implant with 5 cases of failure after a mean of 3 years. They concluded that the coexistent residual lateral ulnar collateral ligament laxity was the leading cause of failure. We agree that the integrity of the lateral ligamentous complex is very important to radial head stability and should be formally reconstructed whenever it is deficient. Radial head allografts have also been used to restore the primary longitudinal stabilizer, but the results were disappointing.\textsuperscript{15}

Radial head replacement can be troublesome especially in neglected cases. Contraction and scarring may result in fixed proximal migration of the radius, making an extensive elbow release prerequisite to a successful radial head implant. Selecting the appropriate implant size is crucial to the elbow and PRUJ stability. An undersized implant can lead to recurrent instability of the elbow particularly in the presence of occult lateral ulnar collateral ligament insufficiency. In contrast, an overstuffed implant can result in persistent elbow stiffness and pain due to chondrolysis of the capitellum. Selecting the correct radial head size is difficult when the head has been excised during a previous operation. In such cases, we prefer the radial head to be slightly undersized. Our goal is to place the radial head implant at or just proximal to the lateral facet of the coronoid, floating on the capitellum, to avoid overstuffing of the joint.\textsuperscript{5} With the appropriate-sized radial head in place, the elbow is stable, is aligned, and tracks properly.

To restore radioulnar length relations, after radial head replacement, a leveling procedure at the DRUJ is often necessary. It is crucial to have radiographs of the contra-lateral forearm to make this assessment. Ulnar shortening osteotomy levels the DRUJ and addresses ulnocarpal abutment. This procedure should not be used alone because it does not address forearm instability when the radial head is absent or deficient.\textsuperscript{19} It is our belief that the main aim of the procedure is to partially unload the ulnocarpal joint and not to re-establish normal ulnar variance. Ulnar shortening osteotomy is contraindicated in chronic cases with DRUJ arthritis. In such cases, a Sauve-Kapandji procedure or an Achilles tendon interposition arthroplasty may represent an alternative option.\textsuperscript{9,13,23}

We addressed the first 5 cases in our series in a staged manner, replacing the radial head initially and then waiting a period for soft tissue healing and DRUJ readjustment to the lengthened radial height. Our initial strategy was based on reconstructing the primary longitudinal stabilizer, which is the radial head, believing that restoring the PRUJ would control the proximal migration of the radius and thus solve the problem. Intraoperatively, we noted that replacing the radial head with a metallic implant was not enough to reduce the DRUJ completely. Initially, we elected not to proceed to an ulnar shortening procedure concomitantly and decided to wait for soft tissue healing and DRUJ readjustment to the lengthened radial height. All of those patients continued to have ulna-sided wrist symptoms because of a persistently prominent ulnar head. An ulnar shortening osteotomy was performed at a second stage in these 5 patients. We concluded that both procedures should be performed simultaneously to achieve rapid rehabilitation.
and prevent the need for a second operation. Subsequently, all chronic Essex-Lopresti cases have been treated as described earlier in 1 stage.

Several attempts to reconstruct the IOM have been reported in the literature in both cadaveric models and in vivo with variable results.3,6,16,22,26,29 A plethora of materials and tendon grafts have been used, but all of them have shown inferior biomechanical properties compared with the IOM.25,27 Future studies emphasizing reconstruction of both the isometry and mechanical properties of the IOM are needed to improve the clinical results. Finally, conversion of the injured forearm to a one-bone forearm remains the last salvage option for chronic cases that cannot be reconstructed.2,12,20

**Conclusion**

Forearm instability is an extremely complex problem that must be recognized and addressed early for a successful outcome.30 This study shows that radial head replacement in combination with ulnar shortening osteotomy can be used as an alternative reconstructive procedure in the case of a complex chronic Essex-Lopresti injury. It is a dependable procedure with predictable and satisfactory outcomes and a low complication rate.

**Disclaimer**

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**References**


