Clinical case
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Surgical treatment of chronic longitudinal radioulnar dissociation (Essex-Lopresti injury)

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Abstract

Introduction An Essex-Lopresti lesion is a fracture of the radial head and a rupture of the interosseous membrane of the forearm, resulting in disruption of the longitudinal relationship between the radius and ulna, leading to longitudinal radioulnar dissociation. Most Essex-Lopresti injuries are diagnosed late, and surgical treatment is challenging even for an experienced orthopaedic surgeon.

The **objective** was to demonstrate and analyze the results of multicomponent surgical treatment first applied for a patient with a chronic Essex-Lopresti injury.

Material and methods A 29-year-old patient was diagnosed with a chronic Essex-Lopresti injury first treated with multicomponent surgical treatment including replacement of the radial head, Adams – Berger ligament reconstruction for the distal radioulnar joint, ulnar corrective shortening osteotomy, interosseous membrane reconstruction using synthetic graft, lateral ulnar collateral ligament reconstruction with an autograft.

Results Pain improved and range of motion increased in adjacent joints at six months. A follow-up X-ray of the forearm showed a consolidating fracture of the ulna.

Discussion Multicomponent surgical treatment of chronic Essex-Lopresti injury ensures restoration of the anatomical relationships of the forearm bones and correction of associated ligamentous injuries improving clinical and functional outcomes even with delayed treatment. Early diagnosis and timely reconstruction of the forearm structures are essential for prevention of irreversible changes providing functionality of the upper limb.

Conclusion The study demonstrated the potential of a multi-component surgical approach as a single-stage treatment for patients with chronic Essex-Lopresti injury.

Keywords: elbow joint instability, forearm instability, radioulnar dissociation, reconstruction of the forearm interosseous membrane, distal radioulnar joint plasty, corrective osteotomy, Essex-Lopresti injury

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INTRODUCTION

An Essex-Lopresti injury, or longitudinal radioulnar dissociation, is characterized by damage to the radial head, interosseous membrane, and distal radioulnar joint, caused by high-energy trauma [1]. An Essex-Lopresti injury is relatively rare among musculoskeletal injuries, accounting for less than 1 % of all radial head fractures [1, 2], but is one of the most severe forearm injuries.

The forearm is normally stabilized by the integrity of the bony and soft tissue stabilizers at the elbow and distal radioulnar joints, as well as the interosseous membrane between the radius and ulna. An injury missed and undiagnosed or not treated in time can lead to longitudinal instability of the forearm or longitudinal radioulnar dissociation [1]. An Essex-Lopresti injury results from an axial load on the forearm caused by a fall on an outstretched arm with the mechanical force being transmitted from the wrist to the elbow through the forearm bones [2].

This rare condition was first described by Curr and Coe in 1946 [3]. In 1951 Peter Essex-Lopresti described the injury as a fracture of the head of the radius, rupture of the interosseous membrane and triangular fibrocartilaginous complex [4, 5]. However, the Essex-Lopresti injury (ELI) of the forearm is a rare and serious condition which is often overlooked due to the lack of knowledge of this pathology in the medical community [6], leading to a poor outcome in 80 % of cases [7].

Surgical interventions used to treat patients with Essex-Lopresti injuries, include radial head arthroplasty [8, 9, 10]; interosseous membrane reconstruction [11–15]; ulnar shortening osteotomy combined with distal radioulnar joint reconstruction [16, 17]. There is no standardized approach to treatment of this cohort of patients.

The **objective** was to demonstrate and analyze the results of multicomponent surgical treatment first applied for a patient with a chronic Essex-Lopresti injury combined with varus instability of the elbow joint.

MATERIAL AND METHODS

A 26-year-old man was admitted to the Trauma and Orthopedic Department of Volgograd Regional Clinical Hospital No. 1 in June 2024. He reported pain and limited range of motion in his left upper limb due to an injury to his left forearm sustained in January 2024, resulting from a fall from a height of 2–3 meters. Immediately after the injury, he was admitted to the emergency department and a radiograph of his left elbow showed a fracture-dislocation of the head of the left radius. With the plaster cast applied, the patient was referred to the inpatient trauma and orthopedic department. He was examined by the department's specialists who recommended conservative therapy. Over the next four months, treatment recommended by specialists at other clinics included exercise therapy, physical therapy, and removal of the radial head without any reconstructive interventions.

The VAS scored 5. Local status of the left upper limb showed forearm flexion of 120°, forearm extension of 140°, pronation of 45°, supination of 50°, wrist extension of 45°, wrist flexion of 20° (Fig. 1). Computed tomography of both forearms revealed a comminuted consolidated fracture-dislocation of the head of the left radius, head of the left ulna dislocated relative to the distal portion of the left radius by 7 mm (ulna "+") (Fig. 2).

The Essex-Lopresti injury was first diagnosed based on the above complaints, local status and radiographic data [3]. A combined procedure involving radial head replacement, distal radioulnar joint reconstruction, corrective ulnar osteotomy, and interosseous membrane grafting were recommended for the patient. The patient was informed of adverse events and complications, and consent for surgical treatment was obtained.

Fig. 1 Preoperative range of motion showing (a) flexion and extension of the forearm; (b) pronation and supination; (c) extension and flexion of the wrist

Fig. 2 Computed tomography of the left and right forearms

The surgery was performed on July 11, 2024 as planned. The first stage involved a Kocher approach to the radial head. The approach revealed a chronic injury to the ulnar lateral collateral ligament of the elbow and degenerative fiber changes. The radial head was removed. Trial components of the head and endoprosthetic stem were inserted to compensate for the length of the lost bone. A cemented stem with a 24–12 mm modular head (ChM, Warsaw, Poland) was impacted (Fig. 3). The next step included radiographic control of the wrist joint (Fig. 4a),

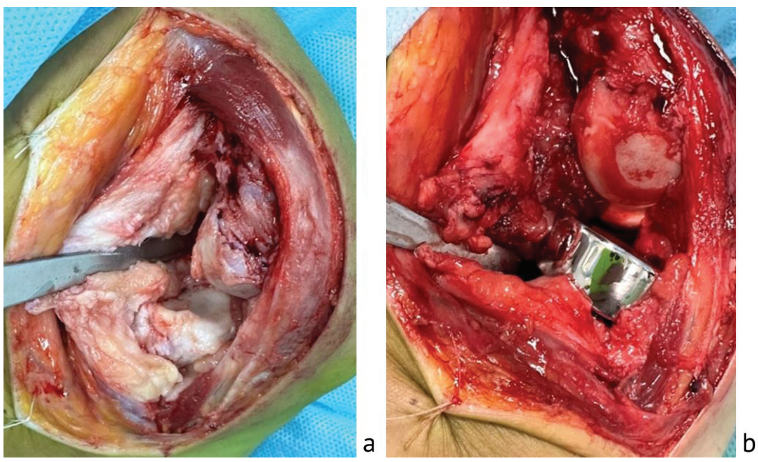

Fig. 3 Lateral approach to the elbow joint showing (a) the radial head and humeral condyle; (b) endoprosthetic radial head implanted

access to the lower third of the forearm, shortening corrective osteotomy of the ulna, fixation with an AO LCP titanium plate, and Adams – Berger reconstruction of the distal radioulnar articulation with a braided FiberWire thread (Arthrex, Naples, FL, USA) (Fig. 4b) [17, 18]. The distal radioulnar articulation was additionally fixed with a Kirschner wire.

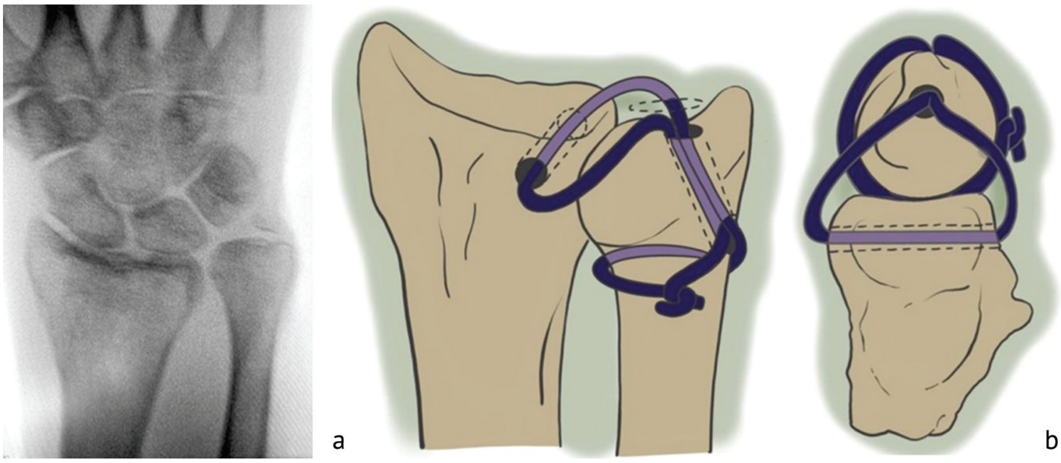

Fig. 4 Radiograph before osteotomy and diagram of the distal radioulnar joint operation: (a) AP radiographic view showing the wrist joint, ulna "+"; (b) schematic technique of the Adams – Berger ligament reconstruction

Access to the middle third of the radius was obtained. A Kirschner wire was placed through the radius and ulna in such a way that with the holes formed for the graft placement, the angle relative to the long axis of the ulna was approximately 21° and corresponded to the force vector of the central bundle of the interosseous membrane. The exit points of the wires from the cortical layers facing the interosseous membrane were located at 35 % of the ulna length and 55 % of the radius length from the styloid processes, which corresponded to the anatomy of the central part of the interosseous membrane [11]. Bone tunnels were created through the wires using a cannulated drill. An artificial graft with TightRope (Arthrex) buttons was placed with the forearm being in a neutral position (Fig. 5).

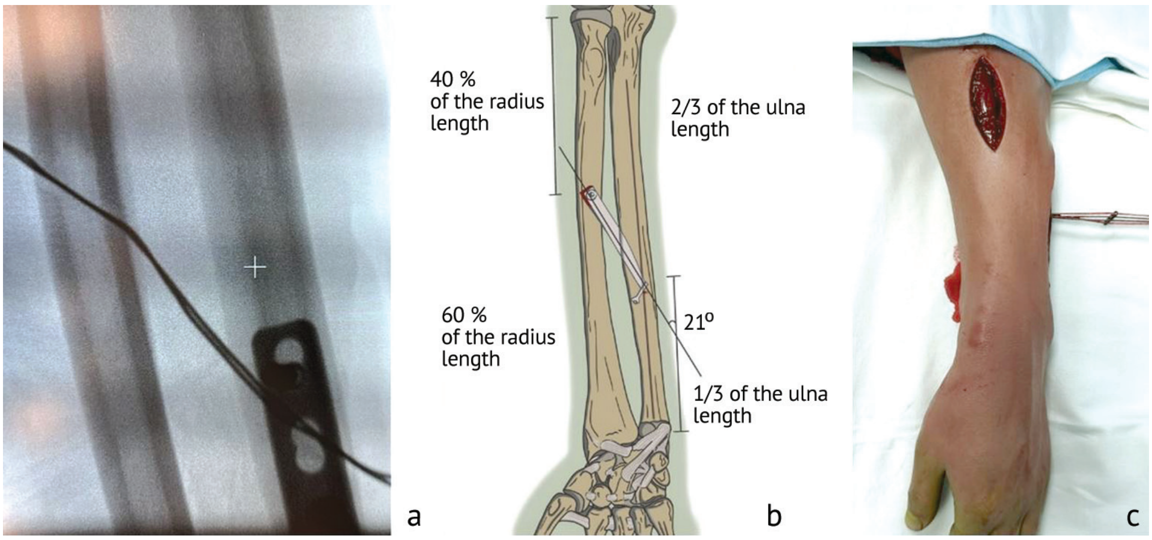

Fig. 5 Reconstruction of the interosseous membrane: (a) a guide for the interosseous ligament; (b) a schematic location of the interosseous ligament graft; (c) an artificial interosseous ligament graft implanted

The final stage included autografting of the ulnar lateral collateral ligament using a fragment of the triceps brachii aponeurosis fixed to the humerus and ulna with titanium Corkscrew (Arthrex) anchors (Fig. 6). Radiographic examination was performed (Fig. 7). A plaster cast was applied postoperatively from the upper third of the humerus to the metacarpal heads with the elbow joint positioned at 90° and the wrist extended at 15°.

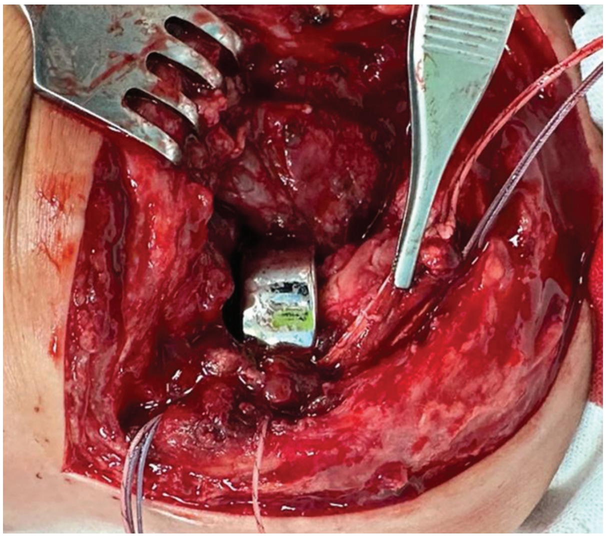

Fig. 6 Plastic surgery of the ulnar lateral collateral ligament using a fragment of the triceps aponeurosis. Endoprosthesis radial head, anchor threads

Fig. 7 Postoperative radiographs of the forearm

RESULTS

The postoperative period was uneventful. The sutures were removed after 12 days. Exercise therapy was administered for the elbow after two weeks. The Kirschner wire was removed after six weeks, and exercise therapy initiated for the wrist.

The surgery was followed by six-month rehabilitation. Follow-up radiographs and CT scans were performed at six months. Radiographs of the forearm showed a healing ulna fracture (Fig. 8).

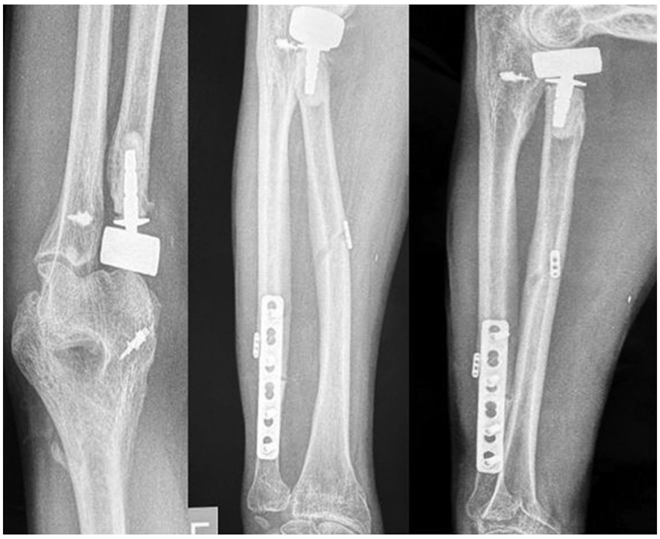

Fig. 8 Radiographs of the upper limb at six months of surgery

The pain VAS scored one on examination. The Mayo wrist score indicated good functionality [19]. The range of motion increased in the left hand with the forearm flexion measuring 160°, forearm extension of 170°, pronation of 85°, supination of 75°, wrist extension of 65°, wrist flexion of 45°

(Fig. 9). The patient could participate in everyday life and return to his professional activities as a tent manufacturer.

Fig. 9 Range of motion at six months of surgery: (a) flexion and extension of the forearm; (b) pronation and supination; (c) extension and flexion of the wrist

DISCUSSION

Restoration of the forearm stability after an Essex-Lopresti injury is challenging, as there is no definitive treatment strategy [5]. It is impossible to predict the outcome of an undiagnosed Essex-Lopresti injury in each individual case, due to its rarity, low awareness among physicians, and the failure to perform additional diagnostic tests (computed tomography, radiography of adjacent joints).

The clinical observation demonstrates a successful approach to the treatment of chronic, undiagnosed Essex-Lopresti injury that resulted from initial strategy failure.

Five mutually complementary interventions to be simultaneously implemented are the key elements of the surgical approach offered:

— the congruence to be restored in the proximal radioulnar joint through replacement of the radial head [8–10];

— reconstruction of the interosseous membrane [11–15];

— reconstruction of the distal radioulnar ligaments using a Adams – Berger technique [16,17];

— osteotomy of ulna [16,17];

— autografting of the lateral ulnar collateral ligament [20].

It is important to note that the five components combined within a single operation has not been reported in the available literature, which emphasizes the novelty of the case presented.

Restoration of the interosseous membrane is essential for the longitudinal stability of the forearm in patients with Essex-Lopresti injury. A variety of methods offered for the purpose include: single- or double-bundle technique using sutures [12], use of a fascia lata allograft [13], autografting from hamstrings when an allograft cannot be used [14], and use of a bone-tendo-bone (BTB) patellar tendon graft [15].

An artificial graft with TightRope buttons (Arthrex) was used in our case. In case of a concomitant injury to the ligamentous stabilizers of the elbow joint reconstruction is to be considered [20, 21]. Autografting of the lateral ulnar collateral ligament was produced for our patient. Comprehensive restoration of all major stabilizers of the forearm prevents recurrent instability and is an important factor in preventing post-traumatic arthritis [22].

Increased range of motion, reduced pain intensity were observed at a six-month follow-up, and the patient could return to daily activities without significant limitations at work and at home, which confirms the effectiveness of the integrated approach.

Despite the limitations associated with the single-case study design, the results obtained are encouraging and suggest the potential value of the comprehensive approach to treating the challenging cases. The surgical team should be prepared to potentially expand the surgical procedure and reconstruct as many forearm stabilizers as possible.

CONCLUSION

This clinical case was the first to demonstrate the feasibility and effectiveness of a single-stage, multicomponent surgical intervention in the treatment of a patient with a chronic Essex-Lopresti injury. The uniqueness of the approach lies in the synergistic combination of radial head replacement, interosseous membrane reconstruction with an artificial graft, distal radioulnar joint reconstruction using the Adams – Berger technique, ulnar osteotomy, and autografting of the ulnar lateral collateral ligament.The treatment strategy resulted in significant functional improvement in a specific patient, ensuring forearm stability and pain relief.

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__Ethical Approval__ The study was conducted in accordance with ethical standards and legislation of the Russian Federation.

__Informed consent__ The patients gave informed consent for publication of the findings without identification.

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