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Case report

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Clinical Observation of Surgical Treatment of Recurrent Dislocation of the Forearm Bones

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AIM OF STUDY To describe a rare clinical case of surgical treatment of chronic recurrent dislocation of the forearm bones using the method of circular plastic surgery of the elbow joint ligaments.

MATERIAL AND METHODS In the conditions of the Department of Traumatology and Orthopedics on the basis of the Department of Traumatology and Orthopedics of the Federal State Autonomous Educational Institution of Higher Education "Russian Peoples' Friendship University" in the V.M. Buyanov City Clinical Hospital of the Moscow Health Department, a comprehensive diagnosis and treatment of a 38-year-old patient with recurrent dislocation of the forearm bones was carried out. Clinical and radiological examinations including computed tomography and magnetic resonance imaging of the elbow joint were performed to verify the diagnosis. After a diagnosis of chronic posterior instability of the elbow joint was established, simultaneous plastic surgery of the medial and lateral ulnar collateral ligaments was performed using a single-loop circular autograft from the peroneus longus tendon.

RESULTS At a follow-up period of 12 months, a successful clinical result of surgical treatment with restoration of stability and function of the elbow joint was observed. Pain syndrome on the VAS scale decreased to 1 cm (before surgery 0 cm) with physical activity. The amplitude of active movements in the elbow joint after surgery was: flexion 140° (before surgery 135°), extension 5° (before surgery 5°), pronation-supination 150° (before surgery 160°). After surgery: QuickDASH score 26 (before surgery 44 points), OES score 72 (before surgery 45), MEPS score 85 (before surgery 55). MEPS was score 55, OES was score 45, QuickDASH was 44 points, QuickDASH (work section) was score 75.

CONCLUSION The method of tendon circular plasty of the elbow joint is an effective method of surgical treatment of multidirectional recurrent instability of the elbow joint, helps restore stability and function of the joint and does not lead to limitation of movements.

Keywords: elbow joint, instability, peroneus longus tendon graft, plastic surgery, medial collateral ligament, lateral ulnar collateral ligament

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EJ – elbow joint
LLC – lateral ligament complex
LUCL – lateral ulnar collateral ligament
MCL – medial collateral ligament
PLRI – posterolateral rotational instability

INTRODUCTION

Forearm bone dislocations are rare injuries with an incidence rate of 5.2–6.1 cases per 100,000 population [1,–3]. In clinical practice, significant soft tissue injuries in the elbow joint (EJ) area may be underestimated and ignored, which may lead to disability and functional impairment [4].

Dislocations of the shoulder joint are the second most common dislocation of large joints in young patients after the shoulder joint and the most common in the pediatric population, accounting for 11 to 28% of all shoulder joint injuries [5, 6]. Associated fractures occur in 30–50% [5]. Historically, acute dislocations without associated bone pathology are considered "simple," while dislocations involving bone pathology are called "complex" [2].

Simple dislocations of the forearm bones are the most common and account for approximately 42–74% of all forearm bone dislocations [3, 7]. Good long-term results have been reported after conservative treatment of simple dislocations; however, a small proportion (2%) of patients require surgical intervention [7]. According to other authors, approximately 8% of patients with conservative treatment still have symptoms of persistent instability [8]. Functional instability also depends on the degree of stress on the joint; thus, in the study *by Kesmezacar* and *Sarikaya ,* chronic instability was observed in 19%, and in the series of observations *by Mehlhoff et al.* it reached 35% [9, 10]. The surgical approach to treatment depends on the model and nature of the injuries and includes refixation or reconstruction of the lateral ligamentous complex (LLC) and/or the anterior portion of the medial collateral ligament (MCL) [2, 4, 5, 11].

Injuries to the LLC may lead to chronic posterolateral rotational instability (PLRI) [3, 10, 11]. Reconstruction of the lateral ulnar collateral ligament (LUCL) is considered the "gold standard" of surgical treatment of PLRI by many authors [3, 4, 10–13]. The first results of using this technique were described by *Nestor et al*. in 1992 [14]. After a short time, the proposed technique was modified with good results [10–13, 15, 16]. Subsequently, several more surgical techniques were described for the surgical treatment of elbow instability. The *Jobe* technique, also called the figure-of-eight technique, the *Endobutton technique*, the *docking technique,* and a modification of the *double docking technique* provide stronger fixation and allow tension on both ends of the graft [15, 17–19]. These techniques were initially described for MCL repair and were later used for LUCL repair and also showed good results [19–23]. Although bilateral ligament injuries are not uncommon, the techniques for reconstructing the lateral and medial ligaments have evolved separately. In cases where the medial and lateral stabilizing ligaments require reconstruction, a peripheral graft may be considered [10, 25, 26]. An autologous, homologous, or synthetic tendon graft is used. The original technique involves using either one or two loops of the graft to additionally reconstruct the posterior bundle of the MCL [25]. His proprietary technique also involves the use of

interference screws for additional fixation and prevention of graft slippage.

The aim of the study was to describe a rare clinical observation of surgical treatment of chronic multidirectional instability of the elbow joint using the method of ring grafting of the elbow joint.

MATERIAL AND METHODS

Patient M., 38 years old, came to the V.M. Buyanov City Clinical Hospital with complaints of recurrent dislocations of the right forearm. It is known from the anamnesis that at the age of 12, the patient suffered her first EJ injury and since then she has been bothered by pain during physical activity and a feeling of instability. Since 2018, she has suffered 3 dislocations of the forearm bones: in April 2018, in December 2018 and the last one in December 2020.

All dislocations were reduced in an outpatient trauma unit with immobilization using a plaster splint. After the end of immobilization, she underwent rehabilitation treatment. After the rehabilitation course, she noted the persistence of pain in the right EJ, decreased muscle strength in the hand. X-rays of the EJ were repeatedly taken in two projections, which did not reveal bone pathology. The patient worked as an operating room nurse, but as a result of persistent fear of dislocation with subsequent long-term rehabilitation, she could not perform her professional duties.

Clinical examination data. During examination, the patient complained of pain in the right elbow joint and weakness in the hand. Joint movements were limited due to fear of dislocation. No neurocirculatory disorders in the hand were noted. During examination of the elbow joint, the drawer and *lateral pivot shift tests* were positive. Subjectively, the grip force in the hand was reduced compared to the contralateral side. Hyperextension and valgus deformity at the elbow joint level were visually noted. The clinical and functional state was assessed by measuring the amplitude of elbow joint movements with an orthopedic goniometer and assessing them using three scales and questionnaires: *QuickDASH* (Abbreviated questionnaire on the degree of disability of the arm, shoulder, and hand), *Oxford Elbow Score* (*OES*), *The Mayo elbow performance score* (*MEPS*) [27–29]. The pain syndrome, which was 3 cm, was assessed using the visual analogue pain scale (VAS), the assessment of the functional state of the EJ using the *MEPS scale* was 55 points, *OES* score 45, *QuickDASH* score 44, *QuickDASH* (section of work) score 75.

The amplitude of active movements in the EJ was as follows: flexion 135°, extension -5°, supination and pronation of the forearm 80°. Based on the results of X-ray examination of the EJ, osteoarthritis of the 1st–2nd degree was detected.

Magnetic resonance imaging data of the shoulder joint: signs of osteoarthritis of the right elbow joint of the 2nd degree, post-traumatic changes in the head of the radius and coronoid process were revealed. Insufficiency of the lateral and medial collateral complexes, damage to the tendons of the extensors and flexors of the hand were also revealed (Fig. 1).

Fig. 1. Magnetic resonance imaging of the right elbow joint of a 38-year-old patient. 1 – damage to the medial colateral ligament; 2 – damage to the lateral ligamentous complex and the common extensor tendon of the wrist and hand; 3 – damage to the lateral ligamentous complex and the posterolateral part of the capsule of the elbow joint; 4 – damage to the annular ligament. * – subluxation of the ulna

Based on the results of clinical and instrumental examination, the diagnosis was: "Multidirectional chronic post-traumatic instability of the right elbow joint, recurrent dislocation of the bones of the right forearm. Post-traumatic defect of the head of the radial bone."

Considering the duration of the disease and the lack of effect from conservative treatment, the patient was offered surgical treatment in the following volume: one-stage ring plastic surgery of the medial and lateral collateral complexes.

SURGICAL TREATMENT

Surgical treatment was performed with the patient in a lateral position under combined anesthesia (endotracheal anesthesia + conduction anesthesia) (Fig. 2).

Fig. 2. Lateral position with shoulder support

A 2 cm incision in the projection of the lower third of the fibula of the left leg was used to isolate and harvest the tendon of the long peroneus muscle using a stripper, then the wound was washed with antiseptic solutions and sutured (Fig. 3). The autotransplant was processed and stitched with lavsan thread at both ends.

From the extended posterior approach to the ulnar nerve, the ectopic ulnar nerve was mobilized and retracted using an elastic holder (Fig. 3).

After release and excision of cicatricial incompetent tissues in the area of the EJ and MCL, two bone tunnels with a diameter of 4.5 mm each were drilled. The first tunnel was formed in the distal metaepiphysis of the humerus (isometric points: medially on the lower slope of the epicondyle, laterally - the center of the capitate eminence). The second tunnel with a diameter of 4.5 mm was carried out in the proximal metaepiphysis of the ulna through the elevated tubercle on the medial surface of the coronoid process with an exit distal to the supinator crest on the lateral surface of the ulna (Fig. 3). One end of the transplant was carried out in the humeral tunnel from medial to lateral. The other end of the transplant was carried out in the elbow tunnel, ultimately forming a loop encircling the EJ (Fig. 4). The autograft was tensioned in a 90 degree elbow flexion position and a neutral forearm position. The autograft was then secured with a bioabsorbable screw to prevent slippage in the shoulder tunnel (Fig. 4).

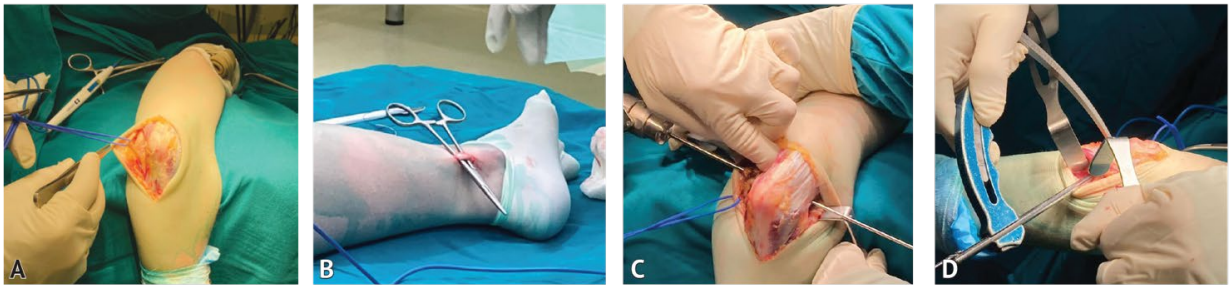

Fig. 3. A – posterior approach with exposure of the ulnar nerve; B – collection of the peroneal tendon graft; C – drilling out the tunnel in the metaepiphysis of the humerus; D – drilling a tunnel in the ulna using a guide sleeve

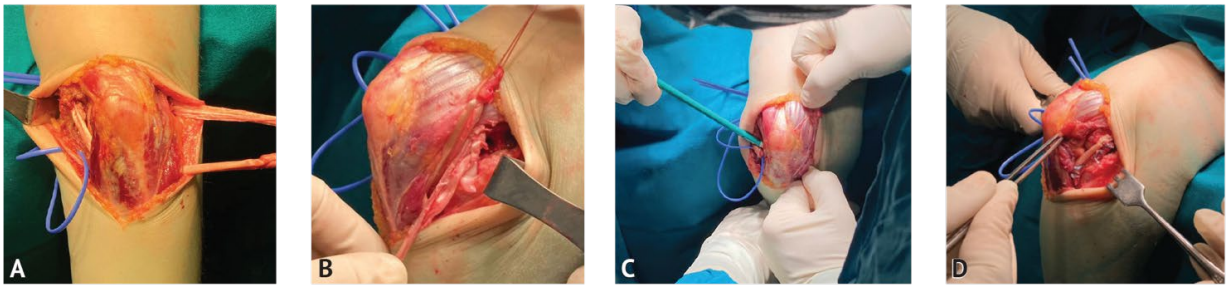

Fig. 4. A – carrying out the graft from the medial to the lateral side; B – tensioning the graft in a position of 90 degrees of flexion in the elbow joint and a neutral position of the forearm; C – fixation with a bioabsorbable screw. D – lateral view after suturing the graft side to side

On the lateral side, the ends of the autograft were stitched together side to side to eliminate the risk of damage to the ulnar nerve (Fig. 4).

After intraoperative testing of the ulnar ligament stability and its range of motion, the ulnar nerve was transposed to the anterolateral surface of the ulnar ligament and the wound was sutured layer by layer (Fig. 5).

REHABILITATION

After the operation, the elbow joint was immobilized with a plaster splint in a 90º flexion position and neutral rotation of the forearm for 4 weeks. After the end of immobilization, the patient underwent a course of rehabilitation treatment.

RESULTS

Repeated X-ray scans after surgery and 12 months are shown in Fig. 6, 7. The patient's postoperative period was uneventful. She noted a decrease in pain syndrome and an improvement in subjective stability already 6 weeks after surgery. No complications were encountered in the early and late postoperative periods. A control clinical examination of the patient with an assessment according to scales was performed 6 weeks, 3, 6 and 12 months after the surgery. At the last control examination, the pain syndrome was assessed according to the VAS scale at 1 cm according to VAS (minor pain syndrome) during physical activity. The

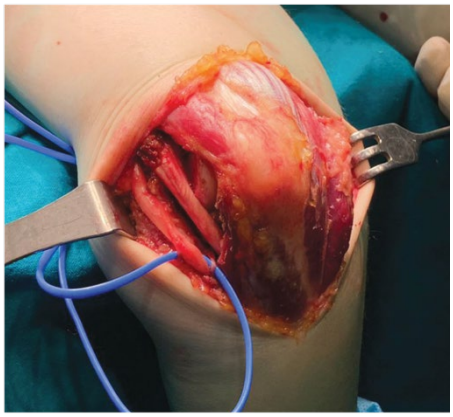

Fig. 5. Medial view after plastic surgery

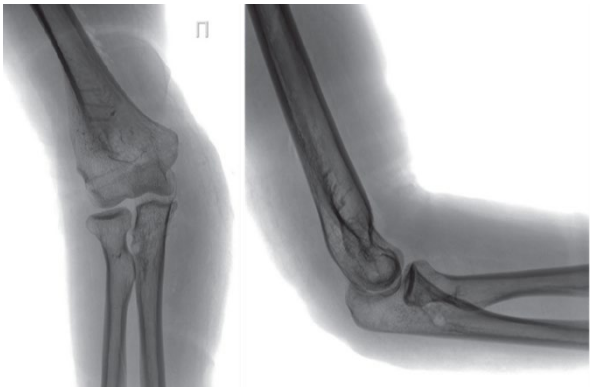

Fig. 6. Postoperative radiographs of the elbow joint in two projections

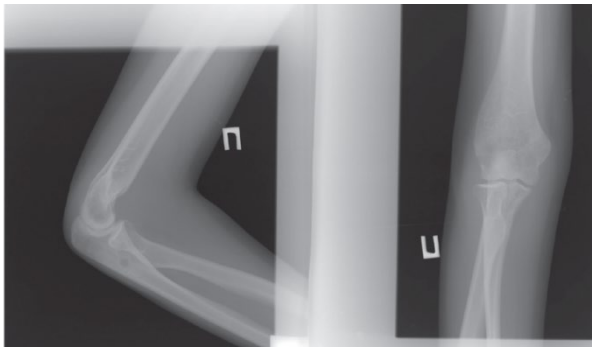

Fig. 7. Radiographs of the elbow joint in two projections 12 months after surgery

Fig. 8. Functional result 12 months after surgery

amplitude of active movements in the EJ was: flexion 140°, extension 5°, pronation-supination 150° (Fig. 8). According to the *QuickDASH scale*, it was assessed at 26 points, *OES score* 72, *MEPS* score 85. The patient had no complaints after the surgery and was satisfied with the clinical result. Due to the restoration of the EJ function, the patient was able to return to her professional activities.

DISCUSSION

Simple dislocations of the forearm bones should not be underestimated, as they may be accompanied by severe damage to the capsular-ligamentous apparatus of the EJ [4, 30–32]. Simple dislocations are mainly treated conservatively [3, 5, 31, 32]. Standard therapy involves temporary immobilization and/or mobilization in a hinged fixator after careful assessment of joint coherence and stability [3, 30–32].

However, a small proportion (about 2%) of patients do require surgical intervention [30]. Functional instability up to recurrent dislocations depends on the daily load on the joint, which occurs in 8% of cases [34]. Due to the development of instability, the bones of the forearm may be subluxated, the EJ in this case shifts distally and is located on the articular surface of the head, injuring it and fusing with elongation. Chronic instability of the EJ, although rare, can lead to disability, which was noted in our clinical observation.

This study describes a method of annular elbow plasty and reports on the patient's treatment outcome. The method we used has proven its effectiveness in restoring EL stability in multidirectional chronic instability. The advantage of the method is the use of a single extended posterior approach, which reduces the operation time; the use of only one autologous transplant, which reduces additional trauma to other areas of the musculoskeletal system; the use of an interference screw as additional fixation of the autograft allows us to exclude its slippage in the bone canal.

A similar technique of circular ulnar reconstruction was first described by *Van Riet et al.*; it involves drilling two tunnels into the ulna, using an autograft made of the grace tendon from a posterior medial approach [25, 35]. The authors described single- and double-loop techniques. By drilling two tunnels into the ulna, using the double-loop technique, it is possible to anatomically reconstruct both the anterior and posterior bundles of the MCL. In 2008, the authors published the results of a 13-year-old patient with recurrent MCL dislocation and coronoid process fracture [35]. In this observation, they used a variation of their double-loop technique, fixing one end of the graft to the MCL. After 2 years of observation, the patient's joint was stable with no recurrent dislocations and no registered complications [35]. In the only published case series , *Patrick R Finkbone* and *Shawn W.*

O'Driscoll reported good clinical results using a similar technique involving two approaches to the elbow joint (medial and lateral) using an autograft from the semitendinosus or grace muscles in the form of a two-bundle loop with fixation of the ends of the graft from the medial side [26].

However, with this technique, suturing two loops creates a rather voluminous fixation structure, which may lead to the development of ulnar nerve neuropathy. Also, the use of two approaches limits the visualization of isometric points and the ulnar nerve during the formation of bone canals, which may lead to malposition of bone tunnels and damage to nerve structures. The average follow-up time was 64 months. None of the patients had symptoms or signs of instability during clinical examination and radiographic data. One patient had a slight deviation in both varus and valgus loads at the 3-month follow-up. The EJ was immobilized in a plaster cast for 6 weeks, and a further examination at 6 months showed no instability. The range of motion in this patient at that time was full flexion, 15° extension, pronation, and supination. Functional outcomes were achieved in all 14 patients. The average *QuickDASH score* was 13 points. The average *MEPS score* was 88. And finally, quite recently, the domestic author A.P. Ratyev suggested his method of ring ulnar plasty in severe and complex forms of instability, solving the problems noted by foreign authors. The method ensures a decrease in the trauma of surgical intervention as a result of using a single posterior approach, the absence of additional fixing implants and a decrease in the risk of damage to the ulnar nerve due to stabilization of the ends of the loop from the lateral side [36]. In our study, using a separate clinical example, we obtained a similar result – the patient did not present any complaints after the surgical intervention and was satisfied with the clinical result.

CONCLUSION

This work describes an extremely rare clinical observation of the treatment of a patient with multidirectional chronic instability of the elbow joint and demonstrates the possibility of performing one-stage plastic surgery of the medial collateral and lateral ulnar collateral ligaments of the elbow joint. In this example, a good clinical result was obtained at an observation period of up to 1 year after surgery with elimination of instability and pain syndrome. Complications in the early and late postoperative period were not observed. Ring plastic surgery of the capsular-ligamentous apparatus of the elbow joint is a fast, reproducible technique for treating multidirectional chronic instability of the elbow joint without significant risks and complications.

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