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Reconstruction of medial collateral ligament defects with a flexor-pronator fascia patch in complete open release of stiff elbows

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Background: Because medial elbow stability is essential for stiff elbow release, surgical techniques have been reported for reconstructing medial elbow stability. However, medial collateral ligament (MCL) defects, caused by inevitable detachment and resection performed for complete release, make the reconstruction more challenging. To our knowledge, no study has evaluated the outcomes after using a flexor-pronator fascia patch in medial elbow reconstruction for open release of stiff elbows. We hypothesized that this technique is effective for repairing MCL defects.

Methods: We retrospectively reviewed the records of 10 patients. The MCL defects were all reconstructed with a flexor-pronator fascia patch. An external fixator was used in all patients. One patient could not be contacted and was thus excluded from the study. Outcome measures included stability, range of motion, Mayo Elbow Performance Score, ulnar nerve symptoms, power grip, and radiographic findings.

Results: The mean follow-up period was 19.6 months; all elbows were stable by the last follow-up. One patient presented with moderate elbow instability and then regained stability 3 months after the external fixator was removed. The Mayo Elbow Performance Score improved from 58 points to 94 points, and the mean flexion arc improved from 40° to 133°. No radiographic manifestations of elbow dislocation or suture anchor looseness were observed.

Conclusion: A flexor-pronator fascia patch provides sufficient stability for repairing MCL defects without restricting the range of motion gained during arthrolysis.

Level of evidence: Level IV; Case Series; Treatment Study

Keywords: Flexor-pronator fascia patch; medial collateral ligament defects; medial collateral ligament reconstruction; suture anchor; stiff elbow; elbow stiffness; open release

This study protocol was approved by the Ethical Committee of Shanghai Jiao Tong University Affiliated Sixth People's Hospital East Campus: No. DYLL-201509.

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Medial elbow stability has an essential bearing on joint function after the complete release of stiff elbows. For complete elbow release, surgeons have to detach the medial collateral ligament (MCL) from the humeral origin to sufficiently expose scar tissue and heterotopic ossification (HO).[13]

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In addition, severe scar contracture and ossification formation of the MCL cause restriction in range of motion (ROM); thus, the scarred and ossified ligaments may need to be removed.

The MCL, which is the dominant constraint to valgus stress at the elbow, includes the anterior, posterior, and transverse bundles.[1] As the foremost portion of the medial stabilizer, the anterior medial collateral ligament (AMCL) should be preserved during elbow release to ensure sufficient elbow stability.[13,18] However, the AMCL may need to be detached or partially resected in some cases to achieve complete release. In patients with obvious MCL defects, reliable reconstruction of medial elbow stability is required to promote early rehabilitation and the return to activities of daily living. Reconstruction of especially the MCL, in cases of stiff elbow arthrolysis, has been described previously.[6,24]

In this study, we describe a new method for repairing MCL defects by using a flexor-pronator fascia patch, and we examine stability and elbow function over a mean follow-up period of 19.6 months. We hypothesized that this technique is effective for repairing MCL defects.

Methods

Study population and design

We performed a retrospective case series of 10 consecutive patients with open release of stiff elbows in 2014 in which reconstruction of the medial elbow stability was performed with autografts of the flexor-pronator fascia. All operations were performed by a single experienced surgeon (C.-y.F.). The inclusion criteria were (1) patients with elbow stiffness with ROM no greater than 100°; (2) patients in whom the MCL, including the AMCL, was completely detached and the MCL defect could not be repaired by direct suture after release; and (3) patients in whom autografts of the flexor-pronator fascia were used to reconstruct the medial elbow stability with a suture anchor. The exclusion criteria were (1) patients with an AMCL preserved during arthrolysis; (2) patients with an injury to the central nervous system; (3) patients with cubitus varus or valgus; and (4) patients with associated bone nonunion or malunion or severe articular injury requiring arthroplasty.

Among the 10 patients included, 1 was lost to follow-up and was thus excluded from the study. There were 3 female and 6 male patients with a mean age of 34 years (range, 13-52 years). The mean interval from the initial trauma to elbow release was 65.9 months (range, 11-240 months). The initial trauma was low-energy damage (falling from a standing height) in 7 patients and high-energy damage (vehicular crash) in 2. The initial treatment of the fracture was open reduction–internal fixation with or without cast immobilization in 5 patients, manual reduction and cast immobilization in 3, and Chinese medical adhesive plaster in 1 (Table I). Arthrolysis had been performed in 1 patient once and in another patient twice at other hospitals before our treatment. Prior to elbow release, the mean extension was 33° (range, 10°-48°) and the mean flexion was 73° (range, 40°-106°). The mean total ROM was 40° (range, 5°-74°) before the operation. The mean preoperative pronation was 48° (range, 0°-85°), and the mean supination was 73° (range, 45°-90°). The mean Mayo Elbow Performance Score (MEPS) was 58 points (Table I). Two patients had ulnar nerve paralysis with a sensation deficit. According to the Amadio rating scale,[2] which evaluated the ulnar nerve function based on pain and motor and sensory function, the average preoperative score for these 2 patients was 6.5. Three patients complained of pain in the elbow. HO was found on plain radiography films in all patients. According to the Hastings classification,[9] which classifies HO by elbow function, 4 patients were classified as class IIA and 5 as class IIC (Table I). Bone union was confirmed with radiography.

Surgical techniques

All operations were performed with a sterile tourniquet and a brachial plexus block. The surgical approach was chosen based on previous incisions and the location of pathology. A medial approach was used to perform medial and posterior arthrolysis. The ulnar nerve was identified, released, and gently retracted. The posterior and transverse bundles of the MCL were detached to expose the pathology. In addition, AMCLs were all detached for sufficient release because of severe contracture and ossification.

Subsequently, triceps isolation, olecranon fossa debridement, and HO resection were performed. To release the anterior and posterior parts, a lateral column procedure via an extended Kocher approach[12] was used. The contracted capsule, scar tissue, and HO were excised. Resection of the radial collateral ligament achieved complete release in all cases, so lateral stability was preserved and the ulnar bundle of the lateral collateral ligament was intact.[18] In patients with a pronation-supination limitation, the annular ligament and humeroradial joint were also released. The posterior approach was performed in patients with a previous posterior midline incision. The same procedures were performed by using medial and lateral incisions after the soft-tissue flaps were created. If satisfactory ROM was achieved under the minimal force, adequate release was achieved.

Increased laxity was found in all patients by using the valgus stress test,[14] which assesses medial instability. Therefore, reconstruction of the MCL was performed in all patients. The elbow was placed through an arc of flexion and extension to confirm the size of the MCL defect. In all patients, the defects could not be efficiently repaired by direct suture even under high tension. Therefore, the tendon fascia was collected from the flexor-pronator, which was approximately 4 cm long, 2 cm wide, and 2 mm thick. The size of the fascia varied depending on the size of the patch needed for reconstruction. The rectangular graft was released on 3 sides with the proximal end attached to the origin of muscles (Fig. 1). The isometric point[8] of the MCL of the medial epicondyle was visually identified by placing the elbow in flexion to extension, and then it was reconstructed with a suture anchor (Twinfix; Smith & Nephew, Andover, MA, USA) to achieve MCL repair and muscle reattachment.[1] The bone tunnel was prepared with a 2.0-mm Kirschner wire. Next, the bone suture anchor was screwed into the isometric point[23] (Figs. 2 and 3). The tendon fascia was doubled back over itself (Fig. 4) and sutured with the avulsed ligaments and muscle mass as a patch by using the suture anchor (Figs. 5-7). The MCL was tightened in 100° of flexion with forearm supination while modest valgus stress was applied on the elbow as the suture was tied. The tension was determined by feeling the pulling force on the suture while mobilizing the elbow from extension to flexion. Relaxation of the suture should be avoided to prevent laxity of the autograft after tying. The ulnar nerve was transposed subcutaneously and