

Arthroscopy-aided fixation for metacarpophalangeal joint collateral ligament injury accompanied by osteochondral avulsion injury: Our results and surgical technique

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Abstract

Aim: Though metacarpophalangeal joint collateral ligament injuries are commonly observed, the presence of accompanying avulsed osteochondral fragment or aponeurosis injury in adult patients is a situation that may require definite surgical treatment. Our study investigated patients attending our clinic after acute hand trauma with radial or ulnar collateral ligament injury who underwent arthroscopy-aided surgical treatment and who regularly attended check-ups to examine the efficacy and results of arthroscopy-aided treatment for collateral ligament injury of the metacarpophalangeal joint.

Material and Methods: The study assessed fracture healing, joint movement angles and complications of 11 patients who attended our hand surgery department from December 2015 to April 2018 who had ulnar or radial collateral ligament injury of the metacarpophalangeal joint with accompanying osteochondral avulsion fracture repaired with the aid of arthroscopy with at least 1 year of continuous attendance at check-ups.

Results: Four patients had 1st proximal finger avulsion fracture accompanying ulnar collateral ligament injury, four patients had 2nd proximal finger avulsion fracture accompanying ulnar collateral ligament injury, 1 patient had 4th finger and 2 patients had 5th finger proximal phalanx fractures accompanying radial collateral ligament injury. The patients' avulsion fractures and ligament injuries healed without problem, 2 patients had limited joint movement angles and 1 patient developed complex regional pain syndrome.

Conclusion: It is considered that the results of arthroscopy-aided collateral ligament injury repair and avulsed fragment fixation are good and perfect healing.

Keywords: Stener Lesion; Fracture; Finger; Small Joints; Arthroscopic Fixation.

INTRODUCTION

Collateral ligament injuries of the metacarpophalangeal joint comprise nearly 1/1000 hand injuries; hence these are injuries that are both rare and are difficult to diagnose and may be missed (1). Nearly 2/3 of collateral ligament injuries involve ligaments in the thumb joints, while the others 1/3 involve other fingers. In the literature it is reported that the incidence of injury increases in the 4th decade, with no clear differences between female and male genders. The injury rate for the 3rd finger is higher compared to the other fingers and the radial and ulnar collateral ligament injury rates are different for these fingers. The 2nd and 3rd metacarpophalangeal joints have higher rates of ulnar collateral ligament injury, while the 4th and 5th fingers have higher rates of radial collateral

injury. These differences are linked to injury due to direct or lateral forces (2).

The collateral ligament may rupture at the point of adhesion or within the ligament depending on the type and severity of trauma. As a result, ligament injury may be accompanied by osteochondral injury, avulsion fractures or extensor tendon ruptures. The most common unique injury types observed within collateral ligament injuries are Stener lesions. First described by Bertil Stener in 1962 the lesion represents injury and displacement of the dorsal aponeurosis of the thumb ulnar collateral ligament. When the literature is investigated it appears that over time injuries with ulnar collateral ligament damage and accompanying bone osteochondral fractures are called Stener lesions, while situations with radial collateral

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ligament damage or ulnar collateral ligament injury without accompanying aponeurosis injury are called Stener-like lesions (3-5).

When osteochondral injury accompanying collateral ligament injury is investigated, it is observed the incidence is very low. It was first published in the literature by Dray et al. 1979, with limited numbers of studies in the following years (6,7). Studies have described a variety of methods using Kirschner wire screws or anchors for bone fragment fixation, commonly mentioning open fixation techniques (8,9).

Arthroscopy of the metacarpophalangeal joint is a relatively new technique, and due to steep learning curve and limited appropriate indications, metacarpophalangeal joint arthroscopy is generally not chosen for the treatment of Stener lesions and Stener-like lesions. The arthroscopy-aided technique was first used for treatment of 8 patients in 1995 and there are limited numbers of studies in the literature (10-12).

In our study we investigated patients attending our clinic after acute hand trauma with radial or ulnar collateral ligament injury who underwent arthroscopy-aided surgical treatment and who regularly attend check-ups to examine the efficacy and results of arthroscopy-aided treatment for collateral ligament injury of the metacarpophalangeal joint.

MATERIAL and METHODS

This study was approved by our institutional review board, and all participants provided signed informed consents. Eleven patients had included to our study who attended our hand surgery department from December 2015 to April 2018 who had ulnar or radial collateral ligament injury of the metacarpophalangeal joint with accompanying osteochondral avulsion fracture repaired with the aid of arthroscopy with at least 1 year of continuous attendance at check-ups.

Inclusion criteria for the study were acute injury history after forced abduction or adduction of the finger in flexion; swelling, pain and movement limitation in the metacarpophalangeal joint after acute injury; attending our clinic within 4 weeks of the trauma; radial or ulnar collateral ligament injury accompanied by avulsed bone fragments; and not missing any check-ups for at least 1 year. Exclusion criteria for the study were metacarpophalangeal joint complaint lasting longer than 4 weeks; previously known rheumatic or degenerative arthritis history; previous trauma or surgery to the traumatized joint; and not attending check-ups within the determined follow-up duration.

After joint physical examination of patients included in the study, patients had standard anterior-posterior and lateral radiogram, with 45 degree and 15 degree oblique pronation graphics taken as described by Cain et al. (13) for assessment of accompanying avulsed fragments. Patients considered to have ligament injury accompanied

by avulsed osteochondral fragment were assessed with standard metacarpophalangeal joint procedure (Figure 1A-B).



Figure 1A. Preoperative antero-posterior radiogram of a patient with Stenerlesion, **1B.** Preoperative lateral radiogram of a patient with Stenerlesion

The majority of cases had joint imaging with a 2.7 mm 30-degree angle Storz brand optics and camera, and rarely needed 1.9 mm optics. After finger traction under general anesthesia, the joint was swollen with 3 ml physiologic serum and radial and ulnar dorsal portals were used. After entering the joint, the joint and fragment fixation were assessed with the aid of a 3 mm hook, followed by joint cleaning with a 2.5 mm shaver. After cleaning of the fragment and surroundings and debridement of the fracture line, fixation was completed using a Kirschner wire and then ligament repair if the procedure was completed arthroscopically. If the procedure could not be completed arthroscopically, a dorsal mini incision was used to open the joint with fragment fixation using a Kirschner wire or mini anchor and ligament repair performed. (Figure 2A-C)



Figure 2A. Arthroscopic fracture view of the same patient, **2B.** Arthroscopic fracture reduction of the same patient, **2C.** Arthroscopic fracture fixation of the same patient

After surgery patients had finger-supported short-arm splint fixation applied, with anti-edema treatment of cold compress and NSAID recommended in the early period. One week later, patients used a functional brace or body tape for 2 weeks duration. Full movement began after the Kirschner wire was removed at the end of the 4th week.

Statistical analysis used the SPSS software (IBM corp version 22), with quickdash scores and joint movement assessed with the paired samples t test. Significance level was determined as $p < 0.05$. Mean and standard deviation were calculated for all variables, with frequency values calculated with the same software.

RESULTS

The mean age of the 11 patients included in the study was 29.9 ± 11.97 (17-59) years, with 9 male patients and

2 female patients. Six of the patients were injured due to work accidents, while 3 patients were injured playing sports.

Four of the 11 patients included in the study had 1st proximal finger avulsion fracture accompanying ulnar collateral ligament injury, four had 2nd proximal finger avulsion fracture accompanying ulnar collateral ligament injury, one patient had 4th finger and 2 patients had 5th finger proximal phalanx fractures accompanying radial collateral ligament injury.

During surgery, all patients with ulnar collateral ligament injury had KW fixation. Two of the patients with radial collateral ligament injury had mini anchor fixation while 1 patient had KW fixation.

When the joint movement angles were calculated 1 year after surgery, only two patients had extension limitation (-20 and -40 degrees) observed, which was not statistically significant, with full extension in the other 9 patients. The mean MP joint flexion after surgery was 85 ± 7.41 (75-100) (Figure 3A-B).



Figure 3A. Postoperative antero-posterior lateral radiogram of the same patient, **3B.** Postoperative lateral radiogram of the same patient

Clinical check-ups of patients at the end of 4 weeks observed that the swelling and pain in the joint of 10 patients had ameliorated, while 1 patient appeared to have chronic regional pain syndrome linked to increased reflex sympathetic activity. Though the patient began contrast baths and exercise treatment, and a rehabilitation protocol for chronic regional pain syndrome, at 1-year check-up 40-degree limited extension and 25-degree limited flexion were observed. In 9 patients KW wire was removed while 2 patients had no problems related to mini anchor. No patient included in the study required revision and no infection or wound site problems were observed (Figure 4A-D).



Figure 4A. Clinical antero-posteriorview after treatment, **4B.** Clinical oblique view after treatment,

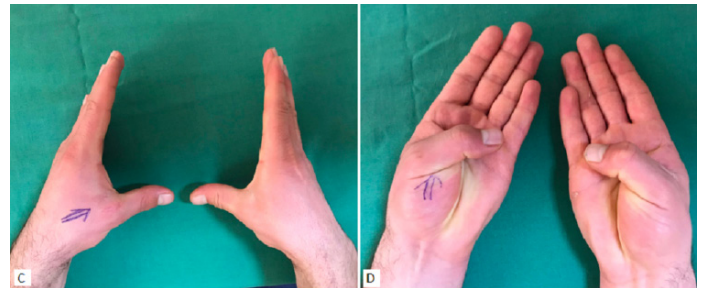


Figure 4C. Clinical lateral view after treatment, **4D.** Range of motion of the thumb after treatment

DISCUSSION

Stener et al. (14) in addition to describing the association of ulnar collateral ligament injury with aponeurosis injury, stated that this lesion is a definite situation requiring surgical treatment which is accepted in the majority of the literature (3). Since the description of ulnar collateral ligament injury, there is no algorithm to determine the gold standard among treatment choices for accompanying pathologies or Stener-like situations due to the insufficient numbers of patients encountered (4-6,15).

In the process of time, a limited number of studies have reported avulsion fractures of the proximal phalanx among distal structures forming the metacarpophalangeal joint accompanying collateral ligament injury and no common consensus has been formed about treatment (6,7,16). The formation mechanism is commonly a result of stress due to suddenly developing abduction or adduction forces in the finger in flexion. Considering the mechanism of injury is a normal and commonly-encountered situation, it is considered the low number of studies in the literature may be due to difficulties diagnosing osteochondral avulsion fractures.

Due to the difficult diagnosis, it is stated in previous studies that along with physical examination different imaging methods may be applied to patients considered to have collateral ligament injury. Ishizuki et al. (17) stated that arthrography may be beneficial for diagnosis, while Lane et al. (18) stated that Brewerton imaging, described as 65 degree flexion A-P imaging, may be beneficial for avulsion fractures. In our study, with the aim of aiding diagnosis of avulsion fractures, in addition to standard A-P and lateral graphs, the 45 degree oblique and 15 degree pronation graphs described by Cain et al. (13) were used with computed tomography (CT) and magnetic resonance imaging (MRI) used for preoperative planning in a limited number of patients. Due to the cost-performance balance and unnecessary radiation exposure, CT and MRI were not planned for routine assessment of all patients.

When studies about collateral ligament injury in the literature are investigated, there are no significant differences in the male and female ratio of patients exposed to this injury, with male and female ratios nearly equal (2,19). In our study, the number of male patients was found to be significantly high. Studies with this situation are generally more about trauma caused by sport injuries,

while the cause of injury among patients included in our study was mainly work accidents. The age of the patients included in the study intensified in the 2nd and 3rd decade which is linked to the frequency of injuries caused by work accidents. Previous studies have stated that the most frequent age for this type of injury is the 4th decade (2).

When collateral ligament injury and osteochondral injury fixation techniques are examined, it is clear there is no common consensus. The use of mini screws, suture anchor or Kirschner wires are popular, with the results of published cases generally similar.

Mikami et al. (9) applied fixation with Kirschner wire (KW) to 4 patients with ulnar collateral ligament injury accompanied by avulsed fragments and obtained perfect results for 3 patients and good results for 1. Sakuma et al. (6) used KW for three of six patients with fixation due to osteochondral avulsion fracture and ulnar collateral ligament injury, and reported good results and problem-free healing. Gill et al. (20) in a biomechanical study of ulnar collateral ligament repair with anchors, found fixation with single anchor was unsuccessful; however, they stated fixation with two anchors may be partially successful but full ulnar collateral ligament strength would not be regained. Toffoli et al. (4) in a study reporting the results of 12 patients with UCL and radial collateral ligament (RCL) injury applied anchor repair to 3 patients with RCL rupture and reported good 1-year follow-up results. In our study, in accordance with the literature, patients with UCL injury had fixation with KW wire, 2 patients with RCL injury had fixation with mini anchor and 1 patient with RCL injury had fixation with KW and sufficient healing was present.

Among studies related to collateral ligament repairs, studies about dorsal open incision on the metacarpophalangeal joint using arthroscopic repair and arthroscopy-aided repair have reported a limited number of patients. Chen et al. (21) has published nearly 20 MP joint arthroscopy studies to date in the literature after the definition of small joint arthroscopy in 1979 (6,8,10-12,21,22). Very limited studies related to arthroscopic approaches to collateral ligament repair have been performed, with studies about a limited number of patients mainly about ulnar collateral ligament repair results and arthroscopic results of RCL repair limited to a few patients (11,22).

When the studies in the literature are investigated in terms of follow-up duration, though it is stated that durations of 10 weeks to 1 year are sufficient (1,2,22), there are studies extending the follow-up duration to 2 years (2,4). In our study, at the end of 3 months it appeared all patients had healed, but the study ended with mean 1-year follow-up duration.

CONCLUSION

Considering the results of the study observed chronic regional pain syndrome in only 1 patient and partial joint movement limitation in 2 patients, with other patients having good and perfect results, the arthroscopy-aided collateral ligament injury repair and avulsed fragment

fixation results are considered good and perfect. Apart from increased patient numbers and lengthened follow-up durations, separate evaluation of UCL and RCL after methodological open and arthroscopic repair in controlled broad patient groups may be more significant.

When we look up the limitations of this study, we may increase the patient number by grouping the patients specifically due to treated fingers and separate the true Stener lesions from Stener-like lesions. But it seems as a unique study for our country including finger arthroscopies.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5). Informed consent was obtained from all patients for being included in the study.

Competing interests: The authors declare that they have no competing interest.

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Ethical approval: This work has been approved by the Institutional Review Board.

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