Ulnar Collateral Ligament Reconstruction: Complications and Salvage

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INTRODUCTION

Elbow ulnar collateral ligament (UCL) reconstruction is a successful treatment for overhead athletes with UCL injuries. Although excellent results can be expected in approximately 85% of patients, there is a rather high complication rate. Cain et al. reported complications in 20% of patients undergoing UCL reconstruction.[7] Complications after UCL reconstruction can be divided into four main categories:

1. ulnar nerve dysfunction
2. infection
3. fracture
4. graft failure

Lesser reported complications include graft harvest site problems and postoperative stiffness.

Ulnar Nerve Complications

Rates of ulnar nerve complications following UCL reconstruction vary among different studies, primarily due to different techniques used to perform UCL reconstructions. Of particular relevance is whether ulnar nerve transposition is performed concomitantly with the reconstruction. Dodson et al. reported on 100 consecutive UCL reconstructions using the docking technique. Ulnar nerve transposition was performed in 22 of cases. Of patients who did not have preoperative ulnar nerve symptoms, 2% had transient ulnar nerve neurapraxia following the UCL reconstruction.[12]

Cain et al. reported on 1281 UCL reconstructions performed over 19 years using the American Sports Medicine Institute technique, which involves routine subcutaneous ulnar nerve transposition.[7] Two-year follow-up data were available on 743 of those patients. The authors reported ulnar nerve complications in 121 (16%) of patients. Most of these patients (99 of 121) had only minor tingling and sensory changes in the ulnar nerve distribution, which mostly resolved within the first few days after the procedure; 22 of the patients had sensory problems that resolved by 1 year after surgery. Only one patient experienced complete ulnar sensory and motor disturbances. This patient's symptoms resolved with decompression and neurolysis. It should be noted that ulnar nerve dysfunction did not statistically significantly affect outcomes.[7]

Treatment

The vast majority of ulnar nerve complications following UCL reconstruction can be treated symptomatically. However, in recalcitrant cases, more aggressive treatment may be pursued. If ulnar nerve symptoms persist for 3 months, it is the senior author's (JRA) preference to perform electrodiagnostic studies to evaluate nerve status. If severe neuropathy or significant motor symptoms are identified, neurolysis is performed through the same incision as that used for the reconstruction. Care must be taken not to injure the branches of the medial antebrachial cutaneous nerve because they are likely encased in fibrous scar tissue. The same must also be said for the ulnar nerve if a transposition was performed during the index procedure. Technically, it can be very difficult to differentiate from surrounding scar tissue (Fig. 69.1).

Infection

Infection is a possible complication following any surgical procedure, and UCL reconstruction is no exception. Cain et al.[7] reported a 4% rate of superficial infection at the graft harvest site. However, the authors reported no superficial or deep infections at the site of the UCL reconstruction. All these superficial infections resolved with oral antibiotics. Azar et al.[3] reported superficial infections at the palmaris harvest site in 2 of 91 patients. They also reported a superficial infection at the site of the UCL reconstruction in 1 of 91 patients, and these also resolved with oral antibiotic treatment.

Although infection following UCL reconstruction is infrequent, it usually can be managed with oral antibiotic therapy when it does occur. In the rare event of a deep infection, irrigation and débridement are warranted; however, to date, there have been no reported cases of deep infection in the literature.

Fracture

Although rare, a postoperative fracture of the medial epicondyle or ulnar bone tunnel following UCL reconstruction can be devastating. Cain et al. reported medial epicondyle avulsion fractures in only 0.5% of patients undergoing UCL reconstruction using the American Sports Medicine Institute (ASMI) technique (Fig. 69.2).[7] Paletta et al. reported no fractures at 2-year follow-up in 25 elite overhead athletes undergoing reconstruction using the docking technique. Even more rare than medial epicondyle fracture is a fracture of the bone bridge between the ulnar tunnel drill sites (Fig. 69.3).

Treatment of epicondylar fracture following reconstruction is open reduction and internal fixation if the fragment size allows this to be done. The epicondyle is approached through the same incision as that used for the reconstruction. Care must be taken to identify, mobilize, and protect the ulnar nerve throughout the procedure. The fracture site is prepared by removing any intervening hematoma and fibrous tissue so that a precise reduction can be obtained. The reduction should be held with clamps or temporary Kirschner wires. Definitive fixation is obtained by using a 4.5-mm, partially threaded cannulated stainless steel screw placed across the fracture into the medial column of the distal humerus. A washer can be used to help distribute forces on the medial epicondyle fracture fragment (Fig. 69.4).

Conservative management can be attempted for fractures of the ulnar bone tunnel. Complete rest is required. If the fracture fails to heal, revision UCL reconstruction with placement of the ulnar bone tunnel more distally should be considered. Alternatively, fixation can
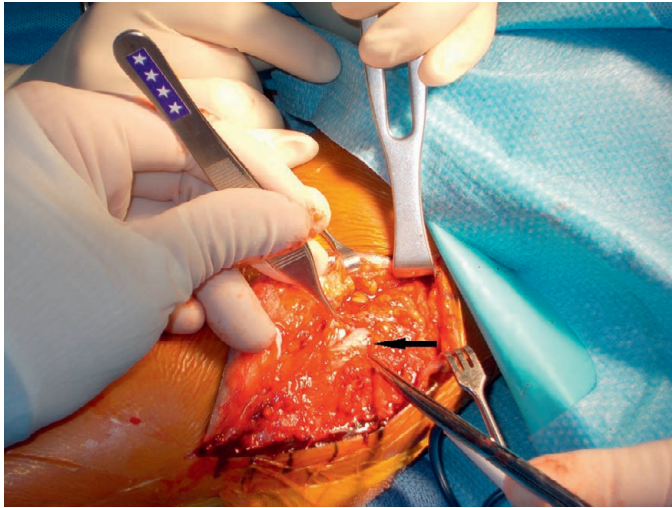
FIG 69.1 The ulnar nerve is encased in scar tissue.

FIG 69.3 Fracture of the ulnar bone tunnel after ulnar collateral ligament reconstruction (arrow).

FIG 69.2 Medial epicondyle fracture after ulnar collateral ligament reconstruction.

FIG 69.4 Screw fixation of a medial epicondyle fracture after ulnar collateral ligament reconstruction.

be achieved in the opposite cortex of the ulna (Fig. 69.5). Open reduction and internal fixation of the small piece of bone can be exceedingly difficult and should usually not be attempted.

Graft Failure

The number of UCL reconstructions being performed nationwide has continued to increase exponentially. Petty et al.[21] noted an increase in UCL reconstructions from 85 in 1988 to 1994 to 609 from 1995 to 2003. This trend was also seen by Andrews et al.,[2] who noted an increase in the number of reconstructions done from nearly 500 in 1999 to 2002 to almost 800 over the next 3-year period, 2003 to 2006.

Studies show that an average of 15 to 20 Major League Baseball (MLB) pitchers undergo UCL reconstruction each year. In 2012, that number increased to 33 MLB pitchers requiring UCL reconstruction.[3] A 2012 to 2013 survey found that 25% of major league and 15% of minor league pitchers have undergone UCL reconstruction at some point in their careers.[8]

A

B
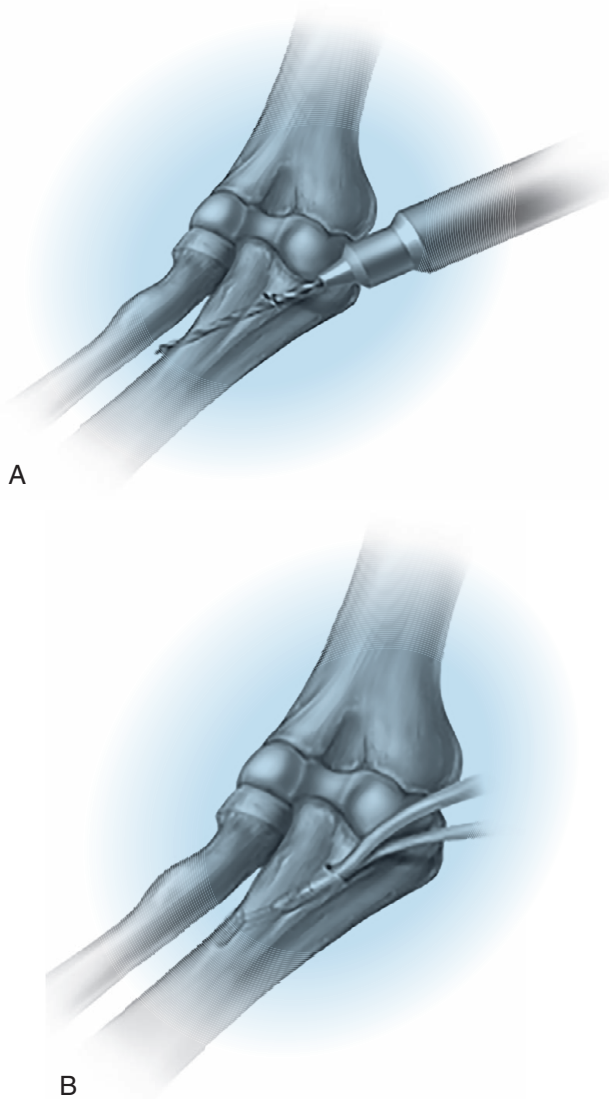
FIG 69.5 For fractures of the sublime tubercle, a drill hole is placed in the opposite cortex of the ulna (A). (B) An Endobutton technique stabilizes the graft distally, and a docking procedure is performed proximally. (From Dines JS, ElAttrache NS, Morrey BF: Failed anterior bundle reconstruction. In Morrey BF, editor: *Master techniques in orthopaedic surgery: the elbow,* ed 3, Philadelphia, 2015, Wolters Kluwer, p 368.)

With such large numbers of UCL reconstructions being performed, one would assume a similar exponential increase in revisions being performed. However, in the largest series of UCL reconstructions to date, only 1% of over 700 athletes required a revision UCL reconstruction.[4] The retear rate for surgically reconstructed UCLs in another large series was reported as low as 2% (9 of 449).[9] In contrast, in 2015, a study of 271 professional pitchers found that 40 (15%) had undergone revision surgery.[3] This increase in UCL revisions may have been caused by rushing the pitcher's rehabilitation and returning to competition too quickly. Although the rates have been increasing for revision surgeries, this is still a rare procedure, making proper diagnosis, surgical technique, and rehabilitation of utmost importance.

EXAMINATION

Just like an initial workup, the diagnostic examination should begin with a thorough history. Some will report an actual pop, whereas others may only complain of vague pain affecting pitching accuracy and/or velocity. Detailed information regarding an injury should include the following: timing of the season, position, level of competition, training regimen, number of pitches and innings when injury occurred, symptoms at onset, including ulnar nerve symptoms, if any, and how long they lasted. Other factors that need to be considered are how quickly the pitcher began throwing and when the pitcher returned to competition following the index procedure. The rehabilitation course following the reinjury should be well documented to include how long pitching was shut down, physical therapy and training regimen, and any other conservative measures taken.

Physical Examination

The physical examination should include a detailed evaluation of the entire upper extremity and kinetic chain. Elbow and shoulder range of motion should be compared to the uninjured side to check for differences. Special attention should be paid to ipsilateral scapular dyskinesis, asymmetric rotator cuff weakness, and glenohumeral internal rotational deficiency. Palpation of the proximal and distal attachments of the UCL can give information about the location of the tear or injury. The most common reason for revision reconstruction is pain.[5] However, other possible symptoms include ulnar nerve symptoms and stiffness.[5] As mentioned previously, medial epicondyle fractures are a known complication of UCL reconstruction. Some feel that the larger drill holes required for hamstring grafts and the number of holes (one versus two) increases this risk. Knowledge of the technique used for the initial procedure is important; it should include information on whether the ulnar nerve was transposed and the initial graft choice for secondary surgical planning.

The same special tests apply to an athlete with medial elbow pain with and without previous UCL reconstruction. The milking maneuver, moving valgus stress test, and posteromedial overload maneuver shoulder be performed to evaluate for pain and/or instability.[2] Diagnostic injections of short-acting local anesthetics can also aid in determining intraarticular versus extraarticular causes of ongoing elbow pain.
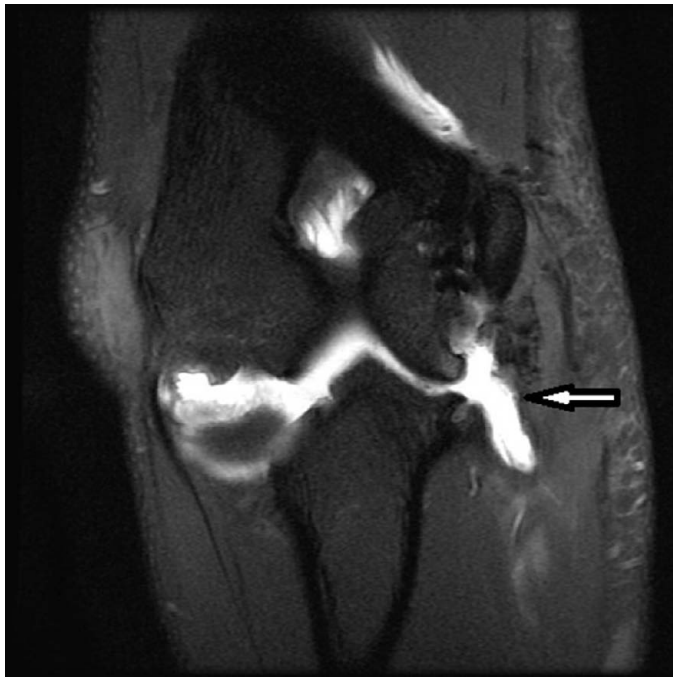
Imaging

Standard radiographic elbow series are performed; these consist of anteroposterior, lateral, oblique, reverse axial (cubital tunnel) and bilateral valgus stress views. Routine radiographs can reveal calcifications within the graft. These calcifications can lead to graft weakening. The radiographs should also be assessed for widening of the previous tunnels. Valgus stress radiographs should be taken of both elbows for comparison. However, studies have shown that pitchers with symptomatic UCL injuries have a similar valgus opening when compared to studies of asymptomatic pitchers calling into question the relevance of these stress radiographs.[10–12] Magnetic resonance imaging (MRI) scans can help better define the soft tissue anatomy but can often be difficult to interpret in the setting of previous surgical reconstruction because of scar formation (Fig. 69.6). Three-dimensional computed tomography (CT) reconstructions are very helpful, especially to determine the extent of fracture (Fig. 69.7).

TREATMENT

Conservative Options

Management of symptomatic pitchers with previous UCL reconstruction can be challenging. Conservative measures are always the first step of the treatment plan. Shutting a pitcher down for 6 to 12 weeks and instituting the appropriate physical therapy regimen are always the initial steps. Antiinflammatory medication, soft tissue work, and

FIG 69.6 Magnetic resonance imaging scan demonstrating complete tearing of the ulnar collateral ligament graft *(arrow)*.

FIG 69.7 Computed tomography scan revealing fracture of the medial epicondyle following ulnar collateral ligament reconstruction. (From Dines JS, ElAttrache NS, Morrey BF: Failed anterior bundle reconstruction. In Morrey BF, editor: *Master techniques in orthopaedic surgery: the elbow,* ed 3, Philadelphia, 2015, Wolters Kluwer, p 365.)

therapeutic modalities should be attempted. Injections such as platelet-rich plasma or bone marrow aspirate are also options. We continue to recommend against steroid injections for fear of attenuation and weakening of the graft. Once the pitcher is pain-free at rest, a progressive return to throwing program is initiated. If there is a failure of conservative treatment, revision reconstruction is considered, especially for high-level pitchers.

Surgical Treatment and Techniques
Preoperative Planning
Planning for revision UCL reconstruction starts with analyzing the original operative note and initial technique. The primary surgery operative note should be reviewed for technique, graft type, ulnar nerve handling and/or transposition, other procedures concomitantly performed, and documentation of any complication. Elbow radiographs and CT scans are used to assess for any arthritic changes, loose bodies, tunnel widening, tunnel position, avulsion fractures, postero-medial olecranon osteophytes, and intraligamentous calcifications. MRI scans can help evaluate the integrity of the previous graft, flexor-pronator tears, impinging plicas, articular cartilage, and other soft tissue abnormalities.

Approach
The previous surgical incision can generally be used for the revision procedure. Extra care must be used when looking for the medial antebrachial cutaneous and ulnar nerves due to additional scarring from the initial reconstruction.

Graft Choice
The graft of choice for most UCL reconstructions is still a palmaris autograft. If the palmaris is used on the index procedure, the graft of choice for the senior author (JRA) for revision surgery is a contralateral gracilis autograft. Other options include a contralateral palmaris autograft or allograft tendon. The gracilis autograft usually provides a larger diameter tendon than a palmaris tendon. This theoretically should provide increased initial strength. However, a larger graft also requires larger drill holes. Due to the larger drill holes and greater strength of the larger tendon, the gracilis graft has been shown to increase the risk of medial epicondyle fractures.[13] The senior author (JRA) has not used an allograft, but others have used them successfully.

Surgical Technique
Tunnel widening is a rare occurrence in UCL reconstructions. Unlike revision anterior cruciate ligament reconstructions, staged procedures with bone grafting are usually not required. The initial surgical technique will frequently dictate the revision strategy. If figure-of-8 tunnels via a modified Jobe-ASMI technique were used, they will be used again if they are in an appropriate position.[14]

The DANE technique can be useful in revision cases if bone bridges have been compromised or if the sublime tubercle is insufficient. This technique is particularly useful in these situations, given the fact that only one ulnar tunnel is needed.[5,15] Some believe that there is less risk for medial epicondyle fractures using the docking technique because only one humeral tunnel is drilled.

REVISION ULNAR COLLATERAL LIGAMENT RECONSTRUCTION OUTCOMES

Due to the rarity of the procedure, there are limited outcome data following revision UCL reconstruction. However, similar to other revision procedures, outcomes are not as promising as primary

reconstructions. Dines et al.[11,12] found that only 5 of 15 of pitchers (33%) return to preinjury level and noted a higher complication rate (40%). Major league pitchers had a better chance of return to play (75%) as compared to minor league pitchers (14%).[19]

The largest study to date on revision UCL reconstruction outcomes assessed 18 MLB pitchers, of whom 14 of 18 (78%) were able to return to the MLB level in two full seasons.[20] However, starting and relief pitchers were only able to resume 35% and 50% of their previous workload, respectively. Relief pitchers displayed better pitching statistics comparted to starting pitchers. One needs to consider the fact that this study was unable to evaluate differences in surgical approach and techniques, which have been shown to affect outcomes in primary reconstruction.[21]

Wilson et al.[25] reviewed 271 professional pitchers, of whom 40 (15%) required revision surgery. The average career length of those having undergone primary reconstruction was 4.9 years versus 2.5 years following revision surgery. Although the rate of primary reconstructions was noted to rise significantly from 2007 to 2014, the rate of revision procedures seemed to be steady. This may be due to better surgical and rehabilitation techniques.

Complications

Complications from revision UCL reconstruction are similar to those of primary reconstruction. They include transient ulnar nerve symptoms, medial epicondyle fractures, stiffness, heterotopic ossification, graft failure, and continued pain.

CONCLUSION

Reconstruction of the UCL is a very successful and dependable procedure in the overhead thrower, especially considering the tremendous physiologic loads placed on the thrower's elbow. Although there are complications with this procedure, most of them are minor and resolve with conservative treatment. The necessity for revision surgery will continue to rise as more primary reconstructions are performed. Due to the unpredictable success of revision UCL reconstruction, the procedure should only be considered for high-level overhead athletes who are not ready for retirement.

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