Technical Note

Elbow Arthroscopy for Posteromedial Impingement and Fixation of Olecranon Stress Fracture

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Abstract: Posteromedial elbow impingement due to valgus extension overload often develops as a result of excessive valgus and extension force during repetitive overhead throwing activities. Impingement classically occurs in throwing athletes such as baseball, tennis, softball, or lacrosse players. If isolated, arthroscopic removal of the posteromedial olecranon osteophytes shows excellent postoperative satisfaction, return to sport rates, and return to previous level of activity. This Technical Note describes treatment of posteromedial elbow impingement syndrome and associated olecranon stress fracture treated with arthroscopic removal of posteromedial osteophytes and arthroscopic-assisted screw fixation.

Elbow stability is provided up to 50% by the osseous anatomy. The remaining stability is attributed to muscular and ligamentous structures. The posteromedial articulation of the elbow is a significant stabilizer to medial elbow forces and valgus stress. As a result, posteromedial elbow impingement is a common pathology in the throwing athlete. The repetitive traumatic abutment with extension during the throwing motion can result in osteophyte formation at the posteromedial olecranon.[1,2] Also, 4 types of proximal ulnar stress fracture can be found in the throwing athlete. In the juvenile patient, osteochondrosis and a fracture of the growth plate can be seen. In the adult, a fracture in the midportion of the olecranon and a triceps avulsion fracture can be distinguished.[3] In the treatment of posteromedial impingement without ulnar collateral ligament (UCL) insufficiency, arthroscopic removal of the osteophytes leads to good results with low postoperative complications rate.[2,4] Our Technical Note presents an arthroscopic removal of posteromedial osteophytes and screw fixation technique for posteromedial elbow impingement with concurrent olecranon stress fracture.

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Surgical Technique (With Video Illustration)

Patient Evaluation

Physical examination of the elbow may demonstrate tenderness over the posteromedial olecranon with associated loss of extension, crepitus, and a firm endpoint. The elbow extension impingement test should be performed. The elbow is placed in the 20° to 30° of flexion and then quickly and repeatedly brought into terminal extension. This will elicit pain within the posterior compartment of the elbow in athletes with posteromedial impingement. Given the association between valgus instability and posteromedial impingement, the UCL should be evaluated with the moving valgus stress test, milking maneuver, and/or valgus stress test. Of these 3 tests, the moving valgus stress test is the most sensitive and specific. The athlete can be sitting upright or supine. The shoulder is placed in abduction and external rotation while the examiner holds the thumb with one hand and stabilizes the elbow with the other. The athlete's elbow is then extended and flexed while a valgus stress is applied. A positive test results in pain along the UCL usually at the arc of motion between 70° and 120° of flexion.[2]

Imaging

Standard anteroposterior, lateral, and oblique radiographs at 110° of flexion of the elbow may reveal posteromedial osteophytes, loose bodies, and stress fracture. A computed tomography scan can best demonstrate bone morphologic abnormalities, osteophyte formation, loose bodies, and stress fracture and can help with surgical planning for osteophyte removal.[2] Magnetic resonance imaging has been reported as the gold standard for soft-tissue and chondral pathology, such as flexor–pronator mass pathology, tendinosis at the medial border of the triceps, synovial plicae, bone edema, and stress fractures of the olecranon.[2]

Indications

Indications include loose body removal, osteophyte debridement, synovectomy, and olecranon fracture fixation.

Patient Preparation

The patient is placed in the lateral decubitus position or other positioning based upon the treating surgeons elbow arthroscopy preferences. All bony prominences are well padded, and a bean bag positioner is used to secure the patient to the bed. The nonoperative upper extremity is padded and secured on a Plexiglas arm board protruding only 15 cm from the operating table. The operative extremity is placed on a radiolucent arm board on long post attached at the side of the table, in line with the table axis. A nonsterile tourniquet is applied to the proximal arm. Typically, a low pressure (250 mm Hg) is used during the procedure. The image intensifier comes from the head of the patient, parallel to the long axis of the table. Adequate fluoroscopic images are obtained before starting the case. The upper extremity is then prepped and draped in a traditional sterile fashion (Fig 1).

Approach

Bony landmarks consisting of the lateral epicondyle, medial epicondyle, radiocapitellar joint, olecranon, and ulnar nerve are marked. Preoperative examination is critical to determine whether the ulnar nerve subluxates, to maintain safety during portal creation. In the setting of isolated posteromedial impingement, only posterior compartment arthroscopy is required. Two primary portals are used, including the central posterior portal (transtriceps) and the posterolateral portal. The straight posterior portal (transtriceps) is 3 cm proximal to the olecranon and midline over the triceps. The posterolateral portal is 3 cm proximal to the olecranon and just lateral to the center of the anconeus triangle (Fig 2). Local anesthetic is injected at the level of the portals. The elbow joint is insufflated and fully distended with normal saline through a standard lateral injection site at the lateral soft spot. The posterolateral viewing portal is created with a nick and spread technique using an 11-blade scalpel and a hemostat. A 30° scope is inserted into the posterior compartment through the posterolateral portal. Under direct visualization, the straight posterior working portal is created. An 18-G spinal needle is used to confirm appropriate pathway to the joint, following by an incision through the skin and triceps muscle tendon.

Arthroscopic Posteromedial Osteophyte Débridement

A careful débridement of synovitis, inflammatory tissue, and fibrotic scar tissue is performed to develop

Fig 1. (A) Lateral position with a bean bag for elbow arthroscopy. (B) Patient is draped, ensuring full access to the elbow joint. The arm can be placed in a bag to help capture fluid from the scope. Right arm is draped; head is to the right of the image and the feet are to the left.

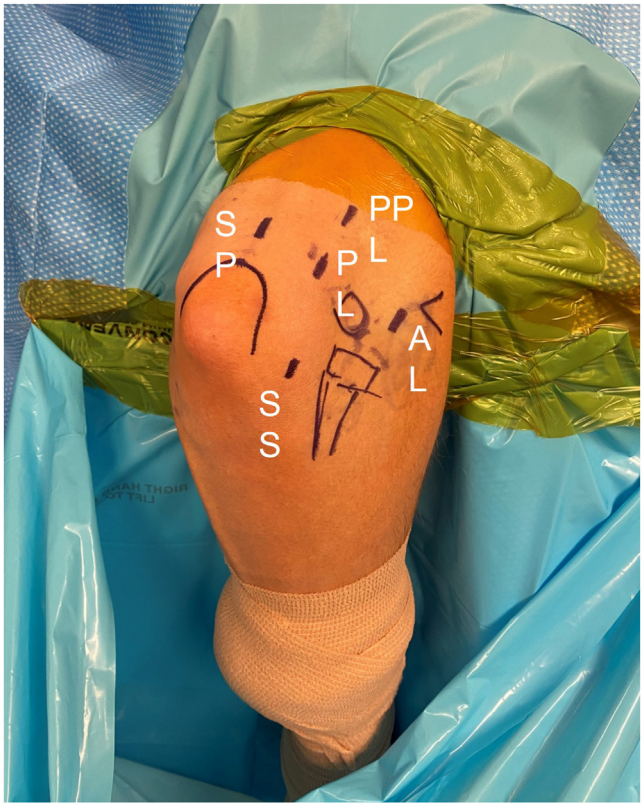

Fig 2. Superficial landmarks are drawn, and prospective portals are marked. (AL, anterolateral; PL, posterolateral; PPL, proximal posterolateral; SP, straight posterior; SS, soft spot.)

the posterior compartment and to perform the diagnostic arthroscopy (Video 1). The shaver is used to expose the posteromedial border of the olecranon taking care to protect the ulnar nerve. The distal humerus, trochlea and olecranon tip are identified. The central, lateral, and medial olecranon is evaluated for the presence of any posteromedial osteophytes and other areas of impingement are confirmed. Often the osteophytes are attached to the underlying bone through fibrotic soft-tissue attachments requiring their release (Fig 3). An elevator is used to free the osteophytes from the soft tissues, and a grasper is used to remove the loose fragments. The posterolateral portal is used to remove the loose osteophytes as it is difficult to do so through the straight posterior portal due to triceps tendon (Fig 4). A prominent olecranon tip can be found in throwing athletes and can be a block to full extension. The olecranon is contoured using an 1/8-inch osteotome and pieces are retrieved with a grasper (Fig 5). Care is taken throughout the bony resection to not over resect greater than 3 mm, as that can destabilize the elbow joint in valgus, leading to UCL insufficiency.[4-6] Also, attention is taken not to plunge too deep with the osteotome to prevent iatrogenic injury to the articular cartilage of the distal humerus. A bone shaver is then introduced, and the remainder of the

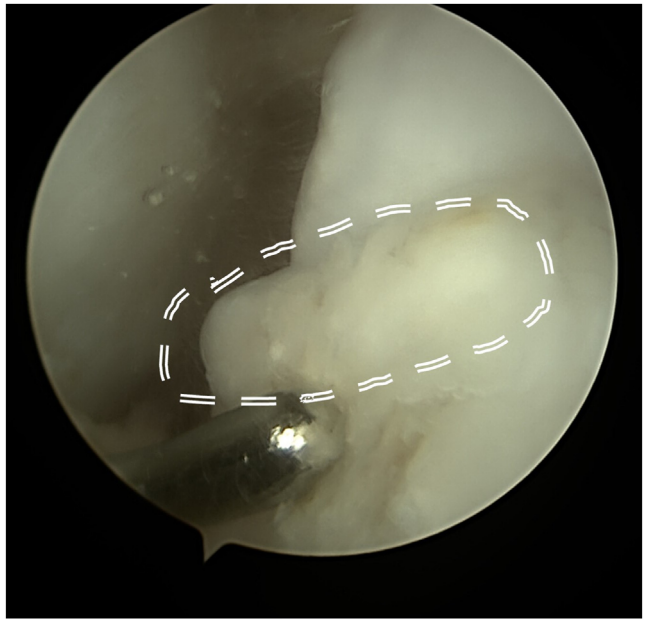

Fig 3. Right elbow visualized with 30° arthroscope from the posterolateral portal. Posteromedial aspect of the olecranon is seen, with the loose osteophytes (dotted white oval) being probed.

posterior olecranon is contoured to remove any bony impingement (Fig 6). Following removal of the osteophytes, range of motion is assessed to ensure full motion from 0 to 135° with no block to extension.

Stress Fracture Fixation

The scope is removed, and attention is turned to fixation of the stress fracture. A guidewire for a

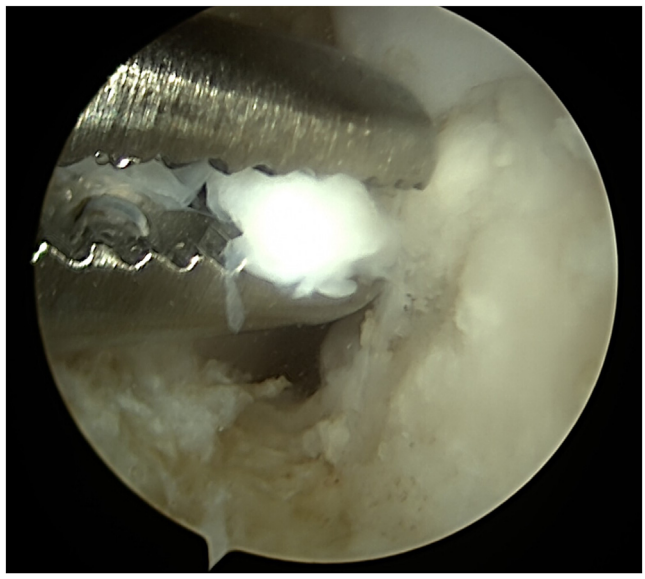

Fig 4. Right elbow visualized with 30° arthroscope from the posterolateral portal. Posteromedial aspect of the olecranon is seen, with the loose osteophytes being retrieved with a grasper from the straight posterior portal.

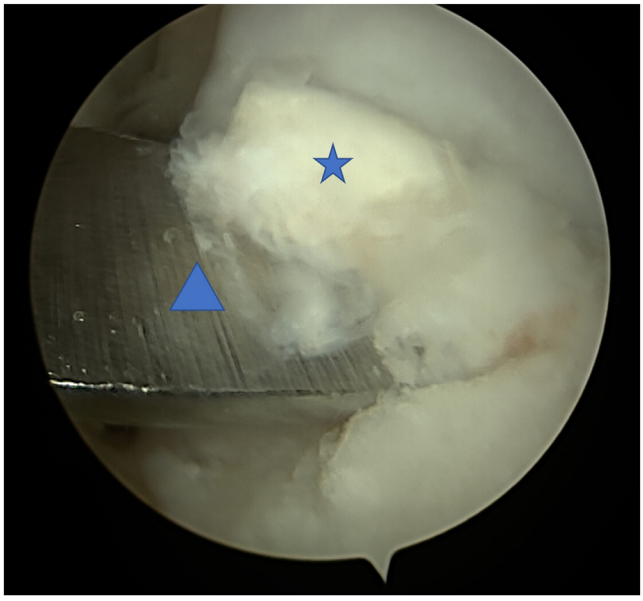

Fig 5. Right elbow visualized with 30° arthroscope from the posterolateral portal. The olecranon tip (star) is contoured using an 1/8-inch osteotome (triangle) coming from the direct posterior portal and pieces are retrieved with a grasper.

cannulated headless compression screw is placed in the posterior olecranon spanning the fracture site (Fig 7). Safe trajectory of the guidewire is confirmed on orthogonal views. Screw length is measured using the depth gauge. The guidewire is over drilled with a 2.7-mm drill bit and, an Arthrex (Naples, FL) 3.5-mm cannulated fully threaded headless compression screw is placed spanning the stress fracture (Fig 8). Final fluoroscopy, and final films are taken in the room.

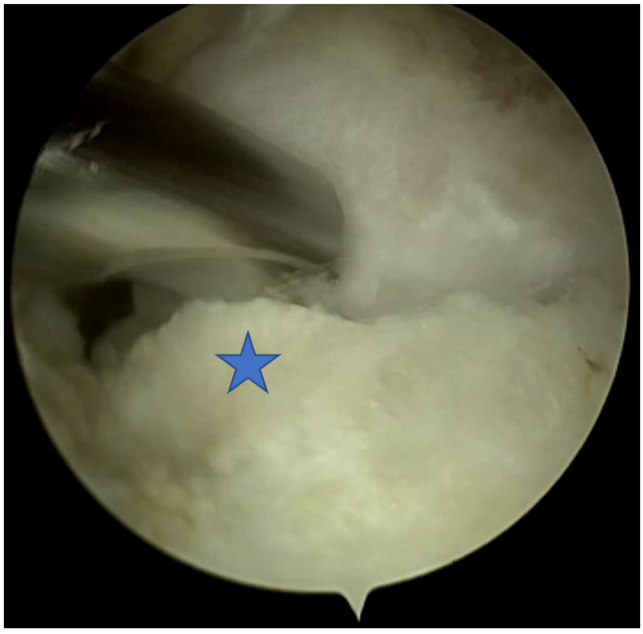

Fig 6. Right elbow visualized with 30° arthroscope from the posterolateral portal. A bone shaver is introduced from the direct posterior portal, and the remainder of the posterior olecranon (star) is contoured to remove any bony impingement if prominent.

Closure

Copious irrigation of the surgical wounds with normal saline is performed. The subcutaneous layer is closed with 2-0 MONOCRYL interrupted inverted sutures. The skin is closed with 3-0 PROLENE interrupted simple sutures. 4 × 4 gauze, Webril, and an Ace wrap are used to dress the patient's wounds.

Postoperative Care

The patient is non−weight-bearing on their upper extremity in a long arm splint for about 1 week and is transitioned into a hinged elbow brace. Forearm elevation placed above the heart level and icing of the operated limb are recommended postoperatively to minimize swelling and to protect the wound closure. Prophylactic antibiotics and anticoagulation are not required postoperatively. Multimodal analgesic medication regimen is given for pain control. Naproxen one 500 mg tablet twice a day (1000 mg total for the day) is prescribed for heterotopic ossification prophylaxis and recommendation is given not take any other nonsteroidal anti-inflammatory drugs during this time. The patient is seen for clinic visits at 2 weeks, 6 weeks, 12 weeks, 6 months, and 1-year postoperatively, with radiographs taken at each visit. At the 2-week visit, the sutures are removed if healing allows and elbow range of motion exercises are initiated. A progressive throwing program starts 12 weeks after surgery. Return to play is allowed 4 to 5 months after surgery.

Discussion

Arthroscopic-assisted posteromedial olecranon osteophyte removal demonstrates good results in the literature, with few rates of postoperative elbow destabilization. Reddy et al.[7] reviewed 187 elbow arthroscopies for posteromedial impingement, loose body formation, and osteoarthritis in elite baseball players. They reported 87% good-to-excellent outcomes, with an 85% return to the same level of play after surgery. Koh et al.,[8] in a recent paper in 2018, evaluated 36 athletes with posteromedial olecranon impingement who required arthroscopic debridement with a mean 51-month follow-up. The authors noted a statistically significant improvement in Andrews and Timmerman elbow scores with a 97% return to the previous level of activity. Most recently, Paul et al.[6] evaluated 36 overhead athletes at 5.1 years after posteromedial osteophyte resection. 77% were able to return to sport with 89% of athletes having excellent-to-good Conway-Jobe score at long term follow-up. Subsequent ulnar collateral ligament reconstruction was required in 5 athletes.

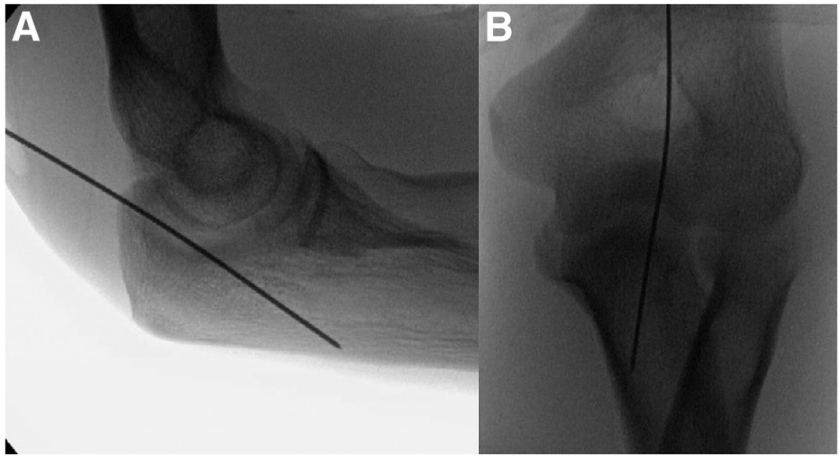

Fig 7. Lateral fluoroscopic view of a right elbow. A guidewire for a cannulated headless compression screw is placed in the posterior olecranon spanning the fracture site.

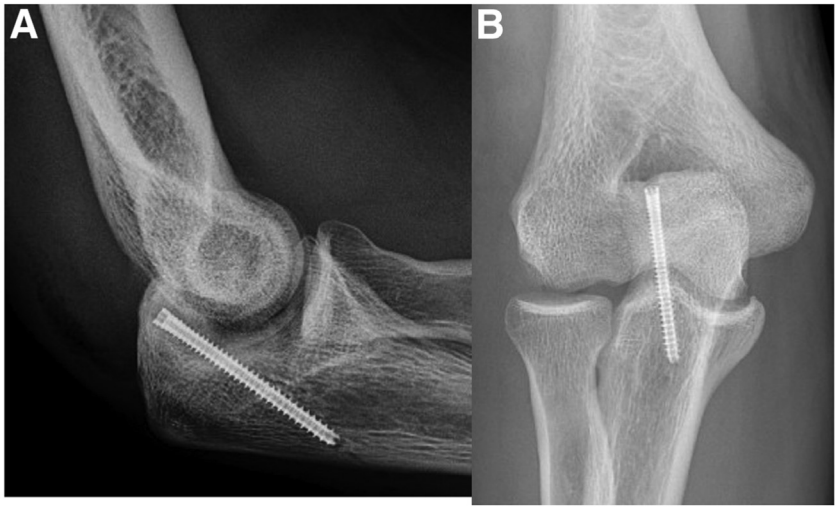

Fig 8. Lateral fluoroscopic view of a right elbow. A 3.5-mm cannulated fully threaded headless compression screw is placed spanning the stress fracture

Table 1. Pearls and Pitfalls

Pearls	Pitfalls
• Proper patient position to allow for elbow arthroscopy in addition to ability to take radiographs with image intensifier in the case of stress fracture	• Over-resection can lead to valgus instability
• Draw landmarks, including course of ulnar nerve, to prevent iatrogenic injury	• Under-resection can lead to continued impingement symptoms
• Nick-and-spread technique for portal creation	• Improper positioning can make both arthroscopy, and fracture fixation difficult
• Take care to not over-resect the posteromedial bone and check range of motion throughout debridement	

Proximal olecranon stress fractures are rare upper extremity fractures that primarily affect throwing athletes and can be found concurrently with posteromedial impingement.[3] Paci et al.[9] reported a series of 18 baseball athletes with olecranon stress fracture treated with cannulated screw fixation. 17 returned to sport at an average of 29 weeks after surgery and on average played an average of 3.2 years of baseball.

There are several technical pearls the surgeon should be aware of when performing this procedure (Table 1). The surgeon should ensure an adequate resection is performed but also be careful to avoid creating medial ulnar collateral instability by means of over resection of the posteromedial olecranon. Arthroscopy treatment offers numerous advantages such as the ability to treat concomitant pathology and

Table 2. Advantages and Disadvantages of the Technique

Advantages	Disadvantages
• Minimally invasive technique • Ability to evaluate and treat other intra-articular pathology during arthroscopy • Ability to treat concomitant pathology such as stress fractures or loose bodies at same time • Use of compression screws affords compression across the stress fracture while minimizing risk of symptomatic hardware	• Inadequate fixation of the stress fracture or prominent hardware may result in need for further surgery

the ability to perform a thorough evaluation of the joint (Table 2).

Conclusions

Posteromedial elbow impingement is a common diagnosis in throwing athletes. Arthroscopic decompression with posteromedial osteophyte removal provides effective clinical results and return to play.

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