



Arthroscopic Ulnohumeral Arthroplasty

42

Ilse Degreef

42.1 Background

Ulnohumeral arthroplasty was initially introduced by Outerbridge and Kashiwagi (a.k.a. OK procedure or ulnohumeral arthroplasty) as a minimal invasive open procedure [1]. Through a direct posterior approach, limited longitudinal triceps split with subsequent osseous perforation of the humeral fossa, both posterior and anterior elbow joint compartments could easily be debrided with a rather quick recovery. Although all compartments can easily be accessed by the technique of joint arthroscopy without the technical need for humeral perforation, the OK procedure can still be added to an arthroscopic elbow debridement. The reason is that by opening the humeral fossa, the pain appears to improve significantly in elbow degeneration, certainly if joint debridement aims for a higher range of motion in stiff elbows [2]. A possible explanation for this pain release is that in deep flexion, the anterior impingement by the coronoid process is resolved. This is especially true if coronoid osteophytes are present and motion is increased by capsular debridement. Likewise, the posterior olecranon tip impingement resolves with increased space in the posterior humeral compartment in full elbow

joint extension. Decreased pain in full range of motion exercises permits better rehabilitation with increased range of motion after arthroscopic stiff elbow release.

42.1.1 Surgical Anatomy

The most challenging part on surgical anatomy in arthroscopic OK procedure is the localization, the direction, and the width of the intended humeral perforation [3]. The distal humerus is composed of two divergent columns. In the frontal plane, the lateral column is more vertical than the medial column (20° with the shaft versus 45°). Also, it is typically wider than the medial column, since it has the capitellum to its distal end. Therefore, the lateral column allows for greater bony resection than the medial column does. Proximal to the trochlear cartilage, the distal humeral fossa can be found. This fossa is more pronounced on the posterior side of the humerus. This is the place where the perforation of the OK procedure is commenced and it is centered between the epicondyles, slightly more to the ulnar side. If a 90° directed tunnel on the humeral shaft is drilled, the anterior perforation of the humerus will be immediately proximal to the trochlear cartilage at the position of the coronoid process in deep flexion. This can be seen during the arthroscopy.

I. Degreef (✉)
Orthopaedic and Hand Surgery, University Hospitals
Leuven, Leuven, Belgium
e-mail: ilse.degreef@uzleuven.be

42.2 Indications and Contraindications

Since the humeral perforation allows for deeper flexion and extension of the elbow joint in bony impingement of the coronoid and/or the olecranon tip, respectively, any articular change that causes this bony conflict may be addressed with the OK technique. Most common cause of this impingement is degenerative arthritis. Osteophytes typically form at both bony ends and the spurs impinge against the distal humerus. Debridement of these osteophytes often leads to quite rapid recurrence due to bony regrowth. Therefore, one can consider a primary or secondary (in former debridement) arthroscopic OK procedure in painful elbow degeneration, especially in anterior or posterior elbow pain in deep flexion and/or extension or even limited range of motion due to osteophytes (Fig. 42.1). A reasonably intact ulnohumeral articular surface is a prerequisite. However, increasing motion in a joint with severe cartilage degeneration at the

trochlea may even increase pain, and therefore the OK procedure is not indicated in severe arthritis of the hinge joint articulation itself.

The arthroscopic OK procedure may also be considered in younger patients with bony impingement of the elbow [3]. This is most often the case in chronic valgus extension overload as seen in overhead throwing athletes. Although most of these patients can be helped with physiotherapy, infiltration, or even arthroscopic debridement and/or ligament reconstruction or augmentation, in exceptionally recurrent impingement, the OK procedure can improve complaints. Sports can be resumed at the same or even higher level after this. However, care must be taken that a sufficiently long interval is respected. Indeed, certainly in high-load labor, contact sports, and torque-inducing activities, there is a risk of intra-articular distal humeral fractures through the weakened columns and humeral perforation until bony remodeling is sufficient and muscle tone has normalized (estimated at 6 weeks at the earliest).

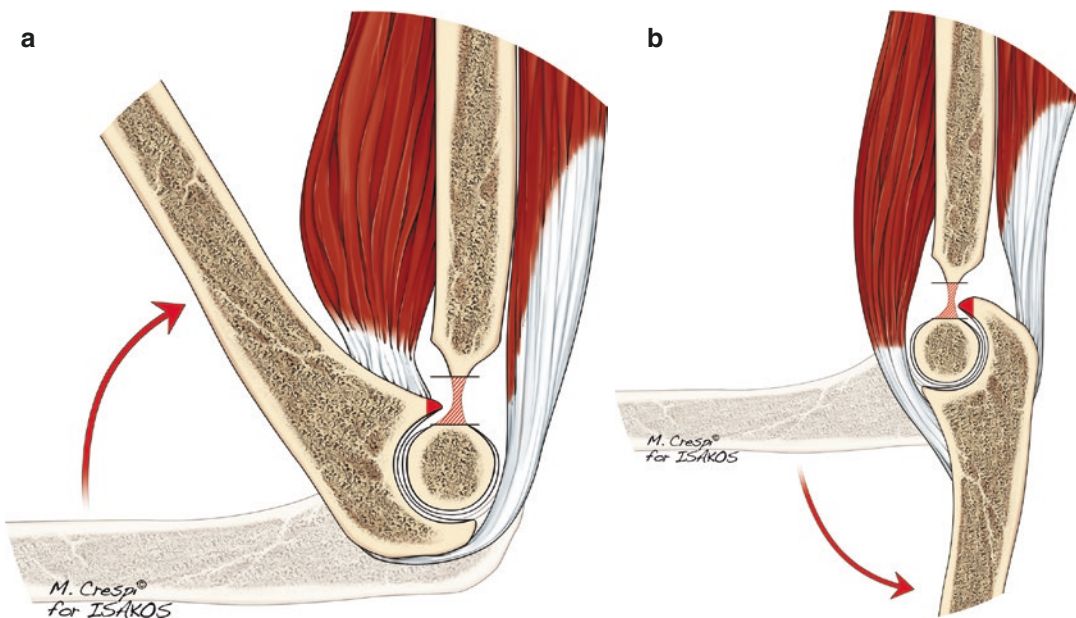


Fig. 42.1 Illustration of the surgical advantage of creating a hole in the distal humeral fossa (transection of the bone); in flexion (a) and extension (b), the olecranon tip

and coronoid process of the ulna do not impinge on the distal humerus. (M. Crespi © for ISAKOS)

42.3 Surgical Technique

The patient is placed in lateral decubitus and the arm is positioned on a Mayo support. The elbow should be higher than the thorax to allow for camera freedom in a 30–45° angle downwards (over the lateral side of the shoulder), while performing the humeral perforation.

- First, anterior joint debridement is performed through proximal anteromedial anterolateral portals. The coronoid process and its osteophytes are removed. If needed, the anterior joint capsule is excised and finally the anterior aspect of the distal humerus is debrided.
- Next, the posterior compartment of the elbow is debrided through a direct posterior and midposterolateral portal. Camera and working instruments are exchanged regularly in between these portals to allow for vision and humeral perforation. With a 4 mm arthroscopic shaver, the posterior compartment is thoroughly debrided (Fig. 42.2). Osteophytes are removed from the tip of the olecranon. Elbow extension exposes the tip of the olecranon and osteophytes well.
- Thereafter, in the region where the tip of the olecranon is in contact with the distal posterior humerus in extension, a perforation through the humerus is made in the middle of



Fig. 42.2 Posterior distal humerus and olecranon fossa is cleared with shaver

the epicondyles with a 4 mm arthroscopic burr and shaver (Fig. 42.3a, b). This is directed perpendicularly towards the anterior side of the humerus. Once the humerus is perforated (this can take a while and the bony depth can be 5–10 mm), the diameter of the hole is widened up to 15–20 mm with a Kerrison rongeur through the direct posterior portal (Fig. 42.3c, d). The remaining medial and lateral columns should be about 15–20 mm wide (Fig. 42.4).

- Flexion and extension motion freedom are measured under direct visualization of the perforations. Through the posterior portals, anterior inspection is now possible and the coronoid process can be seen in the middle of the humeral perforation in full flexion, if it was made at the correct position (Fig. 42.5a, b).
- After thorough joint rinsing, portals are left open to allow for the swelling of the joint to go down fast under a sterile dressing.

42.4 Tips and Tricks

- Correct patient positioning is crucial for good arthroscopic visualization. If the camera does not have freedom to move around (usually by not installing the elbow high enough on the Mayo support), visualization of the posterior compartment will be poor.
- Suction is avoided and water pressure should not be too high: if edema arises, this will influence instrument exchange and elbow joint motion, needed to control the position and efficiency of the humeral perforation.
- To localize the correct position to start the humeral perforation, it is important to correctly position the midposterior portal in the posterior fossa. The fossa can be located in the midportion of the epicondyles and about 1 cm more proximal to the olecranon tip. Also, once the drilling is started, anatomical orientation is necessary to avoid maldirection and unnecessary weakening of the humeral columns.

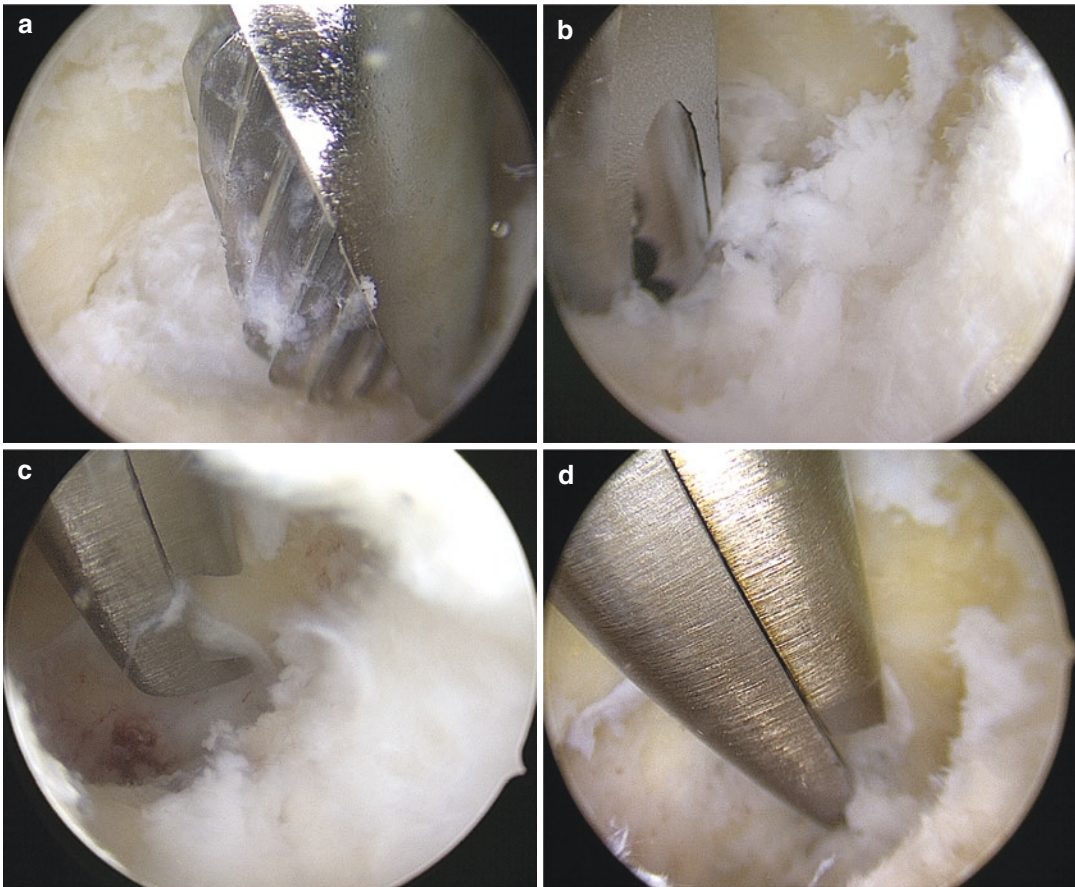


Fig. 42.3 Steps to create perforation are shown using a burr (a), and shaver (b), and rongeur (c, d)

42.5 Pitfalls

The perforation should be performed in the middle of the distal humerus. The lateral and medial column need to be intact, and preservation of a width of at least 15 mm is recommended. Deviating from the intended 90° drilling pathway can lead to an asymmetrical hole. This can be seen in full flexion when the coronoid process is not well centered within the hole. If the columns are sufficient, the hole may be widened in the direction needed to allow for full range of motion. Fluoroscopy is useful to assess the remaining bony columns.

42.6 Postoperative Management and Rehabilitation

Early active motion is allowed. The bulky sterile dressing is replaced by small bandages and this allows for early active range of motion exercises. An active rehabilitation program is advised with physiotherapy to focus on regaining range of motion and muscle tone in upper and lower arm. However, due to the weakening of the distal humerus after its perforation, contact sports, especially with humeral torque, are not allowed for 6 weeks. Although case reports on complications of the OK procedure are very rare, the frac-

ture risk is higher (40% lower force needed to fracture) and eventual fractures are likely to be intra-articular through the humeral perforation. After 6 weeks, if muscle tone is back to normal (as measured by a Jamar grip force) and bone remodeling of the columns is obvious on radiography, full activity can be gradually resumed.

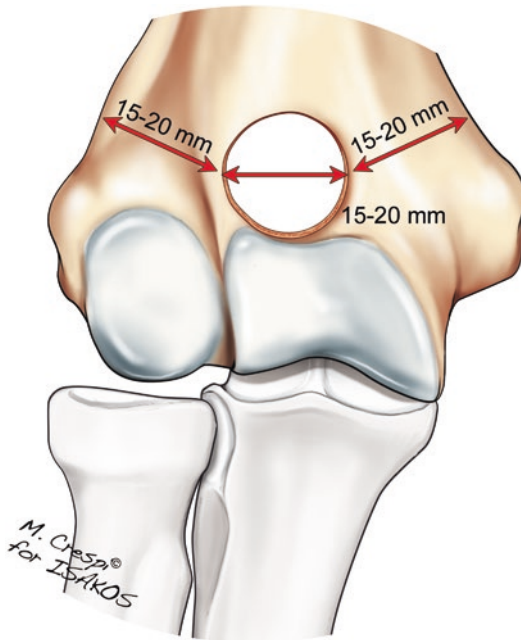


Fig. 42.4 Bony structure of the distal humerus after a perforation is created. The estimated mean diameters of the remaining columns and central hole are shown. (M. Crespi © for ISAKOS)

42.7 Complications

- Complications are rare if performed by a surgeon experienced in elbow arthroscopy. Wound infection, transient ulnar nerve paresthesia, and CRPS (complex reactive pain syndrome) are much less common in arthroscopy than in open surgery.
- In severe preoperative loss of range of motion (60–100° motion loss), with adequate correction and significant gain, postoperative ulnar nerve dysfunction is more likely [1]. Ulnar nerve decompression and even anterior transposition may be considered in these severe cases.
- The mostly feared complication of the OK procedure (open or arthroscopic) is a distal intra-articular humeral fracture. However, the author has never encountered any fracture, even in heavy-duty workers or overhead throwing athletes. Only one case report is found in the literature. Biomechanical research on cadaver specimens has demonstrated a bony weakness and a higher risk of intra-articular fractures of the distal humerus after the OK procedure [3]. Therefore it is advised to not make the fenestration diameter wider than the individual remaining columns. After 6 weeks, bony remodeling is obvious on radiographs and it is presumed that the possibly higher fracture risk is normalized. Nevertheless,

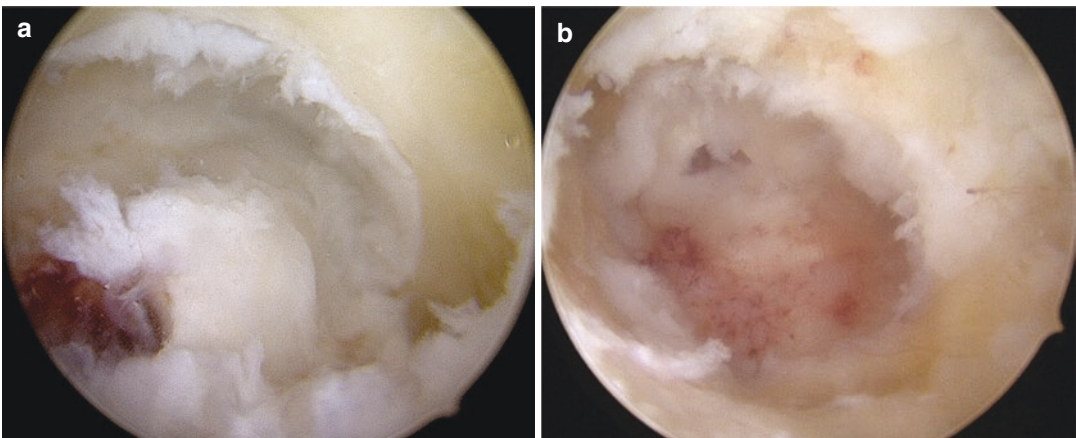


Fig. 42.5 Visualization of anterior coronoid process in mild flexion (right side, view from posterolateral portal) and mild extension (upper side picture, view from midposterior portal)

since the columns are temporary weakened after the humeral perforation, caution is advised and contact sports should be disallowed for 6 weeks after surgery.

42.8 Results

If the indication is strict (coronoid and/or ulna tip impingement and grossly intact ulnohumeral joint surface), high satisfaction rates (up to 90%) are common. Chances of good outcome are increased if symptoms were present less than 2 years before presentation and a 75% definite return to the previous work is reported [4, 5]. More than increased motion, pain usually significantly improves [6]. However, joint degeneration is likely to progress and therefore long-term follow-up (over 10 years) demonstrates recurrence of complaints in 20–40% of the patients. In cases where a new arthroscopic procedure was performed, the bony hole was smaller than originally made, and a fibrous cover actually appears to close the gap. Exceptionally, the fenestration may even close with bony regrowth and consolidate in the long term.

References

1. Antuña SA, Morrey BF, Adams RA, O'Driscoll SW. Ulnohumeral arthroplasty for primary degenerative arthritis of the elbow: long-term outcome and complications. *J Bone Joint Surg Am.* 2002;84(12):2168–73. <https://doi.org/10.2106/00004623-200212000-00007>.
2. Cohen AP, Redden JF, Stanley D. Treatment of osteoarthritis of the elbow: a comparison of open and arthroscopic debridement. *Arthroscopy.* 2000;16(7):701–6. <https://doi.org/10.1053/jars.2000.8952>.
3. Degreef I, Van Audekercke R, Boogmans T, De Smet L. A biomechanical study on fracture risks in ulnohumeral arthroplasty. *Chir Main.* 2011;30(3):183–7. <https://doi.org/10.1016/j.main.2011.03.001>.
4. Forster MC, Clark DI, Lunn PG. Elbow osteoarthritis: prognostic indicators in ulnohumeral debridement—the Outerbridge-Kashiwagi procedure. *J Shoulder Elb Surg.* 2001;10(6):557–60. <https://doi.org/10.1067/mse.2001.118416>.
5. Phillips NJ, Ali A, Stanley D. Treatment of primary degenerative arthritis of the elbow by ulnohumeral arthroplasty. A long-term follow-up. *J Bone Joint Surg Br.* 2003;85(3):347–50. <https://doi.org/10.1302/0301-620x.85b3.13201>.
6. Sarris I, Riano FA, Goebel F, Goitz RJ, Sotereanos DG. Ulnohumeral arthroplasty: results in primary degenerative arthritis of the elbow. *Clin Orthop Relat Res.* 2004;420:190–3.