

# Primary Osteoarthritis and Posttraumatic Arthritis of the Elbow

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## KEYWORDS

- Primary osteoarthritis • Posttraumatic arthritis
- Elbow • Treatment

Arthritis of the elbow resulting from either prior trauma or primary osteoarthritis is similar in that the end result is often a combination of pain and stiffness, but the location of the disorder can be different. Treatment decisions must be made on a case-by-case basis taking into account patient age, level of demand, and location and degree of degenerative changes. This article focuses primarily on the unique pathogenesis and general treatment rationale for primary osteoarthritis and posttraumatic arthritis of the elbow.

## BACKGROUND/PATHOGENESIS

### *Primary Osteoarthritis*

Primary osteoarthritis of the elbow is uncommon and usually presents on the dominant side in middle-aged men who give a history of heavy use through sport or labor. Elbow osteoarthritis has a unique disease progression that provides a role for clinical success with debridement in its early stages, where such a procedure would traditionally be less successful in other joints such as the knee or hip.

The bony architecture of the ulnohumeral joint creates a high degree of articular congruity that leads to preservation of most the articular cartilage until the advanced stages of osteoarthritis. As a result, early disease typically presents with pain primarily at terminal extension and flexion associated with engaging osteophytes at the tips of the coronoid and olecranon, as well as their respective fossae (**Fig. 1**).<sup>1-3</sup> It is not until late-stage disease that there is pain throughout the arc of motion coinciding with diffuse articular

degeneration. The impingement created by the engaging osteophytes not only causes pain, but, as they enlarge, the osteophytes become space-occupying lesions and lead to progressive stiffness resulting in secondary capsular contracture in time.

Primary osteoarthritis of the radiocapitellar joint alone is uncommon (**Fig. 2**). Patients presenting as such frequently have concomitant degenerative changes of the ulnohumeral joint. Therefore, before undertaking treatment of presumed isolated disease at the radiocapitellar joint, one must be certain that the patient's pain and tenderness is indeed located laterally, and that forearm rotation is typically more bothersome than elbow flexion and extension.

Rettig and colleagues<sup>4</sup> specifically studied morphologic characteristics in the osteoarthritic elbow compared with normal controls. No marked differences were seen. They found statistically significant increases in the ulnohumeral joint lateral facet angle on the anteroposterior radiograph as well as the deviation of the radiocapitellar line anteriorly from the center of the capitellum on the lateral radiograph. The investigators questioned the clinical significance of these findings, because the former was a difference of less than 5 degrees and the latter could be a manifestation of advanced elbow arthritis leading to anterior subluxation of the radius.

### *Posttraumatic Arthritis*

Arthritis following elbow trauma can take several forms, usually dependant on the nature of the

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**Fig. 1.** Lateral radiograph of elbow osteoarthritis demonstrating impinging osteophytes in the anterior and posterior ulnohumeral joints as well as on the anterior radial head.

original trauma. One of the more common sources is radiocapitellar arthritis after malunion of a displaced intra-articular radial head fracture (see [Fig. 2](#)). In such cases, similar to cases of symptomatic radiocapitellar osteoarthritis, patients usually present with laterally based elbow pain that localizes well to the radiocapitellar joint and pain with forearm rotation more than elbow flexion and extension. Arthritis secondary to malunion of

intra-articular distal humerus fracture or proximal ulna fracture can be found as well.

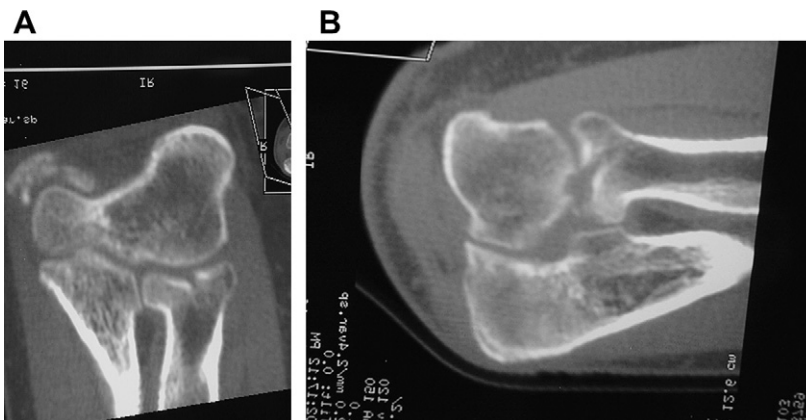
In addition to identifying the arthritic area of the elbow in such patients, it is equally important to assess whether there was any elbow instability at the time of injury in the form of a fracture dislocation, and whether there are signs or symptoms of ongoing instability. The presence of ongoing instability limits the operative options for management in favor of arthroplasty or arthrodesis.

## EVALUATION

### History

When taking a history from a patient with posttraumatic or primary arthritis of the elbow, there are several important factors to address. It is critical to identify the current complaint. If the primary complaint is pain, one should attempt to localize it (ie, radiocapitellar joint, ulnohumeral joint) and confirm whether the patient has pain only at the extremes of flexion and extension or whether there is pain throughout the arc of motion. If stiffness is the primary complaint, it is important to assess whether the patient primarily lacks flexion, extension, or both, and whether there is any significant dysfunction secondary to the condition or whether it is simply an asymmetry the patient has noticed. Patient selection is also critical in elbow stiffness operations, given the extensive rehabilitation required and potential for limited clinical success in the noncompliant or uninformed patient.

The expectations and demand level of the patient must also be considered, because this greatly influences the treatment options, especially for advanced disease when considering arthroplasty alternatives. Special consideration must be given in the case of the previously operated elbow with posttraumatic arthritis. Any history or concerns for



**Fig. 2.** (A) Anteroposterior and (B) lateral radiographs of radiocapitellar post-traumatic arthritis after radial head fracture.

prior or ongoing infection must be carefully elicited, especially if bony nonunion is present, because arthroplasty options may be contraindicated in this setting. If infection is at all suspected, serologic markers for infection should be obtained and an aspiration of the elbow joint performed, with the aspirate analyzed for cell count and Gram stain. All attempts should be made to obtain previous operative reports and records. The history should also routinely include specific questioning regarding any neurologic symptoms, because disorders of especially the ulnar nerve are common with elbow arthritis regardless of the cause.

### **Physical Examination**

Inspection should include documentation of previous surgical incisions and any areas of poor soft tissue coverage or contracture that would affect further operative intervention. Bilateral range of motion of both the elbow and forearm should be documented and it should be noted where within that range of motion pain is reproduced. One must be cautious in evaluating the radiocapitellar joint in cases of primary osteoarthritis, because it frequently seems degenerated but is not usually a pain generator unless there is significant preoperative pain with forearm rotation.<sup>5-7</sup> Elbow stability is critical to assess in the posttraumatic setting. This assessment can be done by looking for frank instability or, more commonly, apprehension with provocative tests such as the posterolateral drawer, or by obtaining stress radiographs. Special attention should be paid to a thorough neurologic examination, in particular of the ulnar nerve, because it commonly shows signs of compression, which the patient may not recognize as such. There should be a low threshold for obtaining electrodiagnostic studies if neurologic function is in question.

### **Imaging**

All attempts should also be made to obtain and review previous radiographs in the posttraumatic or previously operated patient. A full set of current radiographs is obtained. Although rheumatoid arthritis frequently shows symmetric joint-space narrowing, the osteoarthritic elbow often shows preservation of the joint space centrally with degenerative changes and osteophytosis anteriorly and posteriorly (see **Fig. 1**). The congruency of the ulnohumeral and radiocapitellar joints should be confirmed. The degree of joint-space narrowing and osteophyte formation for the ulnohumeral and radiocapitellar joints should be considered separately and any evidence of fracture malunion should be identified. Any factors

that would be contributing to motion loss should also be identified, including not only impinging osteophytes but also heterotopic ossification in the posttraumatic setting.

Rettig and colleagues<sup>4</sup> devised a classification system for radiographic staging of elbow osteoarthritis, and showed that the effectiveness of debridement diminishes as stage of disease increases. Class I elbows show marginal osteophyte formation at the ulnohumeral joint but no arthritic changes of the radiocapitellar joint. Class II elbows have progressed to include degenerative changes of the radiocapitellar joint, and class III elbows also have subluxation of the radiocapitellar joint.

Computed tomography (CT), often combined with intra-articular contrast injection, is helpful in primary osteoarthritis in identifying loose bodies, defining the borders of heterotopic ossification, and identifying osteophytes poorly seen on plain radiographs such as shelf osteophytes in the olecranon fossa, coronoid fossa, and radial fossa, posterior capitellar osteophytes, and osteophytes in the medial gutter adjacent to the ulnar nerve (**Fig. 3**). CT is also useful in posttraumatic arthritis not only for the reasons listed earlier but also to evaluate for suspected fracture nonunion and better characterize deformity. Magnetic resonance imaging (MRI) and bone scintigraphy are primarily only used in cases of suspected infection.



**Fig. 3.** Sagittal CT scan demonstrating complex osteophytes in the anterior and posterior ulnohumeral joints.

## TREATMENT PRINCIPLES

Both osteoarthritis and posttraumatic arthritis are treated conservatively in the early stages. Nonsteroidal antiinflammatory medications and activity modification are encouraged, but adherence to the latter is often difficult for the laborer or athlete. The role of viscosupplementation for elbow arthritis was studied by van Braken and Eygendaal,<sup>8</sup> who found minimal decrease in pain and activity impairment at 3 months, but no lasting benefits at 6 months in 18 patients. There were no complications from the injections.

When conservative treatment has failed, regardless of whether the arthritis has resulted from osteoarthritis or trauma, there are several factors to consider in planning surgical intervention. The first factor is the patient's primary complaint. Patients with primary complaints of stiffness rather than pain in the setting of mild or moderate arthritis are ideal candidates for open or arthroscopic debridement and capsular release. The same can usually be applied to patients with primary osteoarthritis and pain just at the extremes of motion, because they usually present with painful engaging osteophytes anteriorly and/or posteriorly but with much of the articular surface well preserved. Patients with diffuse joint-space narrowing and pain throughout the arc of motion suggestive of more advanced disease are not good candidates for debridement and are more likely to benefit from procedures such as distraction interposition arthroplasty, total elbow arthroplasty, or elbow arthrodesis.

Regardless of whether open or arthroscopic debridement is chosen, the treatment principles in these cases are the same. Loss of flexion and anterior impingement symptoms are addressed by resection of anterior bony impingement, often between the coronoid and coronoid fossa but occasionally the radial head and radial fossa, and release or excision of the posterior capsule as needed. Conversely, loss of extension and posterior impingement are addressed by resection of posterior bony impingement between the olecranon and olecranon fossa and release or excision of the anterior capsule as needed.

The early description of open debridement for elbow osteoarthritis, also known as the Outerbridge-Kashiwagi procedure,<sup>9</sup> was through a posterior approach that allowed direct visualization for debridement of the posterior ulnohumeral joint, followed by debridement of the coronoid through a circular cavity in the humerus just proximal to the trochlea (Fig. 4). Although providing excellent exposure posteriorly, this procedure makes access to the radiocapitellar joint and the



Fig. 4. Anteroposterior radiograph after the Outerbridge-Kashiwagi procedure showing the circular defect above the trochlea.

anterior capsule difficult and thus has limited indications. Open debridement is now more commonly performed using medial and/or lateral exposures that provide full access to the structures of the anterior and posterior elbow. Several series of open debridement have shown improvements in pain as well as increases in range of motion averaging 20 to 30 degrees.<sup>10-12</sup>

Advances in elbow arthroscopy have established a role in treating many cases of primary osteoarthritis arthroscopically, especially in young patients. Excellent results with improvements in pain and range of motion have been reported.<sup>13,14</sup> The indications for both open and arthroscopic debridement include those listed earlier, but the authors believe there are cases in which open treatment is superior, including elbows with significant heterotopic ossification in which the tissue planes are difficult to establish arthroscopically, cases with significant deformity, and most elbows that have been previously operated on, especially if the ulnar nerve has been transposed or the radial head was exposed. If the radial head has been affected in this way, potential scarring of the radial nerve to the anterior capsule should be suspected. Open ulnar nerve decompression and/or transposition should be considered along with open or arthroscopic elbow debridement if the patient has signs (a positive Tinel test) or symptoms of ulnar neuropathy preoperatively or if the patient

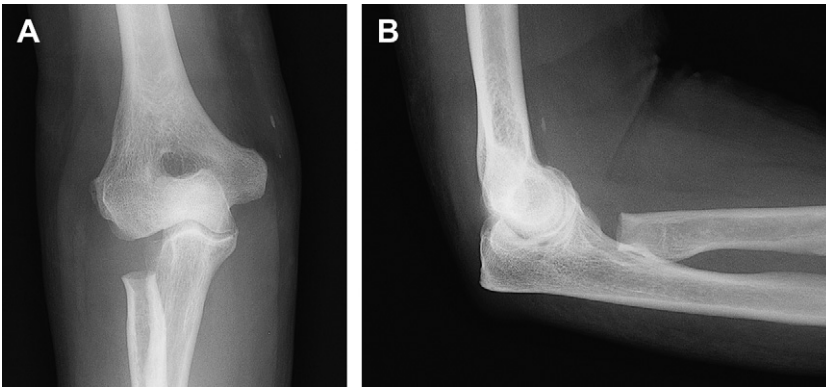


Fig. 5. (A) Anteroposterior and (B) lateral radiographs after radial head excision.

cannot flex past 100 to 110 degrees before surgery, because the increased postoperative flexion would put the nerve at risk of traction neuropathy.<sup>10</sup> The specific indications, techniques, and results of open and arthroscopic debridement for elbow arthritis are discussed by Leonid I. Katolik; and Savoie and colleagues respectively elsewhere in this issue.

Isolated radiocapitellar arthritis exists as a separate entity, most commonly a posttraumatic disorder after radial head fracture but occasionally as primary osteoarthritis. These patients often present with more limitation of elbow flexion and extension than pronation and supination but do have painful forearm rotation. Pain with rotation most commonly differentiates the patient with symptomatic radiocapitellar arthritis from the patient with painful ulnohumeral arthritis and incidental asymptomatic radiocapitellar disease. For the former, when no instability is present, good results for increased motion and decreased pain have been reported for both open<sup>15</sup> and arthroscopic<sup>5,6</sup> radial head resection (Fig. 5). The latter frequently does well with treatment of the ulnohumeral arthritis but not the radiocapitellar

joint despite a degenerative appearance arthroscopically, thus avoiding the risk of increased load across the ulnohumeral joint after radial head excision.<sup>7</sup>

Radial head arthroplasty (Fig. 6) is another treatment option in this patient population, with proposed benefits compared with radial head excision that include prevention of proximal migration of the radius and prevention of ulnohumeral arthritis from repeated valgus load. Arthroplasty is especially useful in the posttraumatic setting with instability, but does carry a risk of degenerative changes of the capitellum in time. Resurfacing of the capitellum in this setting has been described but has not been studied in depth.<sup>16,17</sup> The indications, preferred implant designs, and outcomes of radial head arthroplasty continue to be refined as midterm outcome studies become available.

Advanced degenerative disease involving most of the ulnohumeral joint is typically not amenable to successful treatment by debridement alone. For the younger patient with inflammatory arthritis (<30–40 years old) or posttraumatic/osteoarthritis (<60 years old), interposition arthroplasty or elbow arthrodesis are the primary surgical options

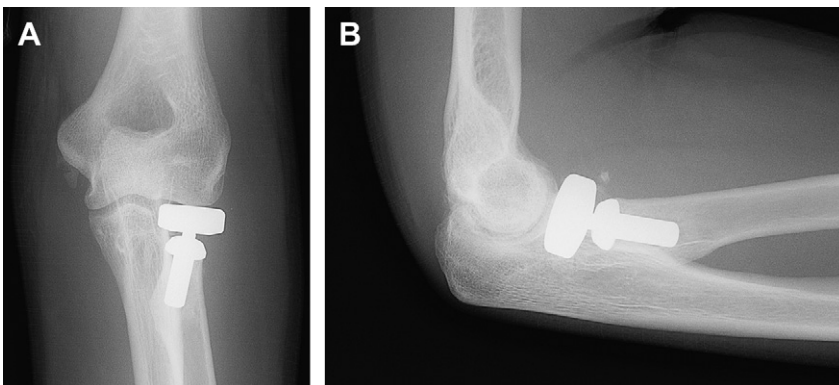


Fig. 6. (A) Anteroposterior and (B) lateral radiographs after metallic radial head arthroplasty.

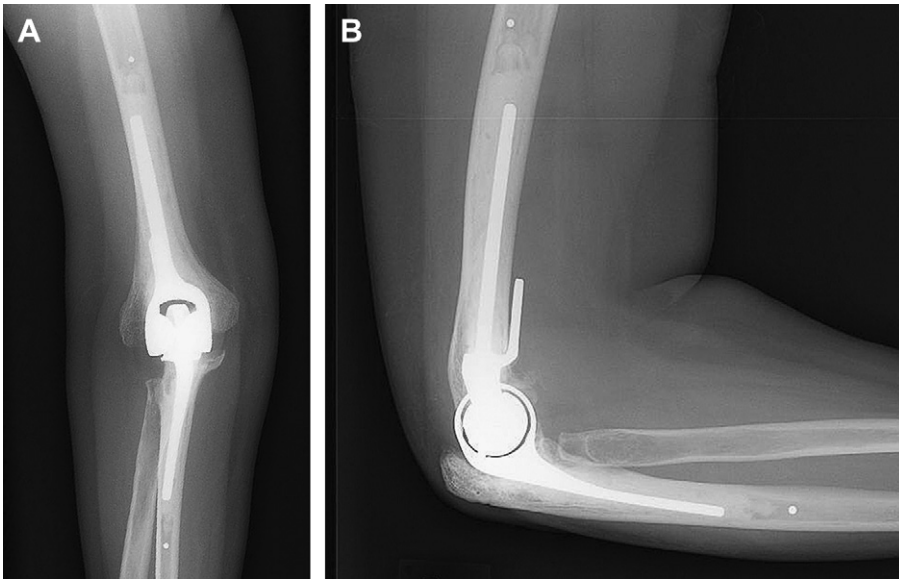


Fig. 7. (A) Anteroposterior and (B) lateral radiographs after total elbow arthroplasty.

because they have increased durability in the higher-demand patient and do not carry the same lifting restriction as total elbow arthroplasty (2.3–4.5 kg). Although good results for interposition arthroplasty with Achilles allograft have been reported,<sup>18</sup> there is a significant risk for elbow instability after surgery, making well-preserved bone stock essential for a good outcome.<sup>18,19</sup> Total elbow arthroplasty is best indicated for the low-demand patient with inflammatory arthritis, or the older patient (>60 years old) with posttraumatic arthritis or osteoarthritis who is willing to comply with the substantial postoperative restrictions placed on the arm following total elbow arthroplasty (Fig. 7). Specific attention is paid to interposition and linked/unlinked total elbow arthroplasty discussed by Donald H. Lee; and Leclerc and colleagues respectively elsewhere in this issue.

## SUMMARY

Treatment of posttraumatic arthritis and osteoarthritis of the elbow must be individualized on a case-by-case basis depending on location of disease, age/demand level of the patient, and stage of disease. Early stage disease is most amenable to debridement. The indications for open versus arthroscopic debridement continue to be refined, but early results of both seem to show similar effectiveness. Both procedures can be performed safely, but arthroscopic debridement requires advanced skill in elbow arthroscopy. Later-stage disease typically requires reconstructive procedures, with the specific choice of

treatment based largely on patient age and demand level. The indications, techniques, and results for each of the treatments described earlier are discussed elsewhere in this edition.

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