Review Article

Posttraumatic Elbow Arthritis in the Young Adult: Evaluation and Management

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Abstract

Degenerative joint disease following trauma to the elbow is difficult to manage in any patient. However, this condition becomes substantially more challenging in the young, active population. Increased activity demands and limited functional capacity of total elbow arthroplasty mean that joint arthroplasty should be regarded as a salvage procedure. The primary goal of treatment is to restore a pain-free or minimally painful functional joint while preserving future surgical options. This requires accurate assessment of the primary patient complaint, be it terminal pain and stiffness or pain along the entire arc of motion. Patients who report stiffness and pain at terminal motion may benefit from arthroscopic or open osteocapsular débridement. Those with advanced degenerative changes and pain throughout the entire arc of motion may require joint resurfacing with interposition arthroplasty, partial joint arthroplasty, or total joint arthroplasty.

Elbow trauma can result in a constellation of derangements, including instability, malunion, and nonunion.[1,2] In addition, articular cartilage damage or residual articular surface incongruencies can alter load distribution across bearing surfaces and lead to degenerative changes and early-onset arthritis.[2] Posttraumatic articular injury may be isolated to specific areas of the elbow (eg, radiocapitellar joint) or may encompass the entire joint, resulting in profound functional limitations and pain (Figure 1).

Posttraumatic elbow arthritis in the young patient is a relatively rare condition that presents a challenge to the practicing orthopaedic surgeon. Total elbow arthroplasty (TEA), which is an acceptable first-line treatment in the elderly and low-demand patient populations, should be viewed only as a salvage option in the young, active patient because of the increased demands placed across the implant throughout the patient's lifetime.[3] These demands may arise because of inability or unwillingness to adhere to activity restrictions required for TEA, which otherwise may be associated with an unacceptably high mechanical failure rate. Therefore, in this patient population, the goals of surgery are to provide a minimally painful and functional elbow articulation while maintaining future salvage options.

Patient Evaluation

History and Physical Examination

History of the initial elbow injury should include mechanism of injury,

type of fractures or instability, subsequent treatment, and history of infection. Previous surgical reports should be obtained to determine prior exposures, nerve transposition, hardware, and complications. A treatment plan is then established through assessment of the primary patient complaint as it relates to pain, stiffness, or instability. If pain is the primary complaint, the surgeon should determine whether the patient has pain at terminal motion (ie, impingement), throughout the entire arc of motion, and/or at rest. Impingement-type pain secondary to osteophyte formation or capsular contracture can limit the arc of motion. Generally, pain throughout the entire arc of motion indicates a joint with a damaged bearing surface and advanced degenerative changes. This can be associated with night pain, effusions, and progressive stiffness. Pain at rest is approached with caution regardless of radiographic changes because it may represent nonarticular pain such as infection, cervical spine radicular pain, soft-tissue disease, or reflex sympathetic dystrophy.[1]

The elbow should be examined for deformity, swelling, drainage, crepitus, and previous surgical incisions. For patients with compromised soft-tissue envelopes and previous flap coverage, knowledge of pedicled flaps is essential for surgical intervention.[4] Vascular and neurologic evaluation should include assessment of ulnar nerve irritability, subluxation, and sensory and motor function. Assessment of the arc of motion, including level and location of pain, is compared with that of the contralateral elbow. Finally, muscle strength and collateral ligament stability are evaluated. An accurate characterization of normal and pathologic elbow structures is important to guide treatment planning. The key is to determine which clinical feature is most limiting for the patient so that the best option for that patient may be offered.

Figure 1

A B

AP (**A**) and lateral (**B**) radiographs demonstrating posttraumatic osteoarthritis of the elbow following distal humerus fracture.

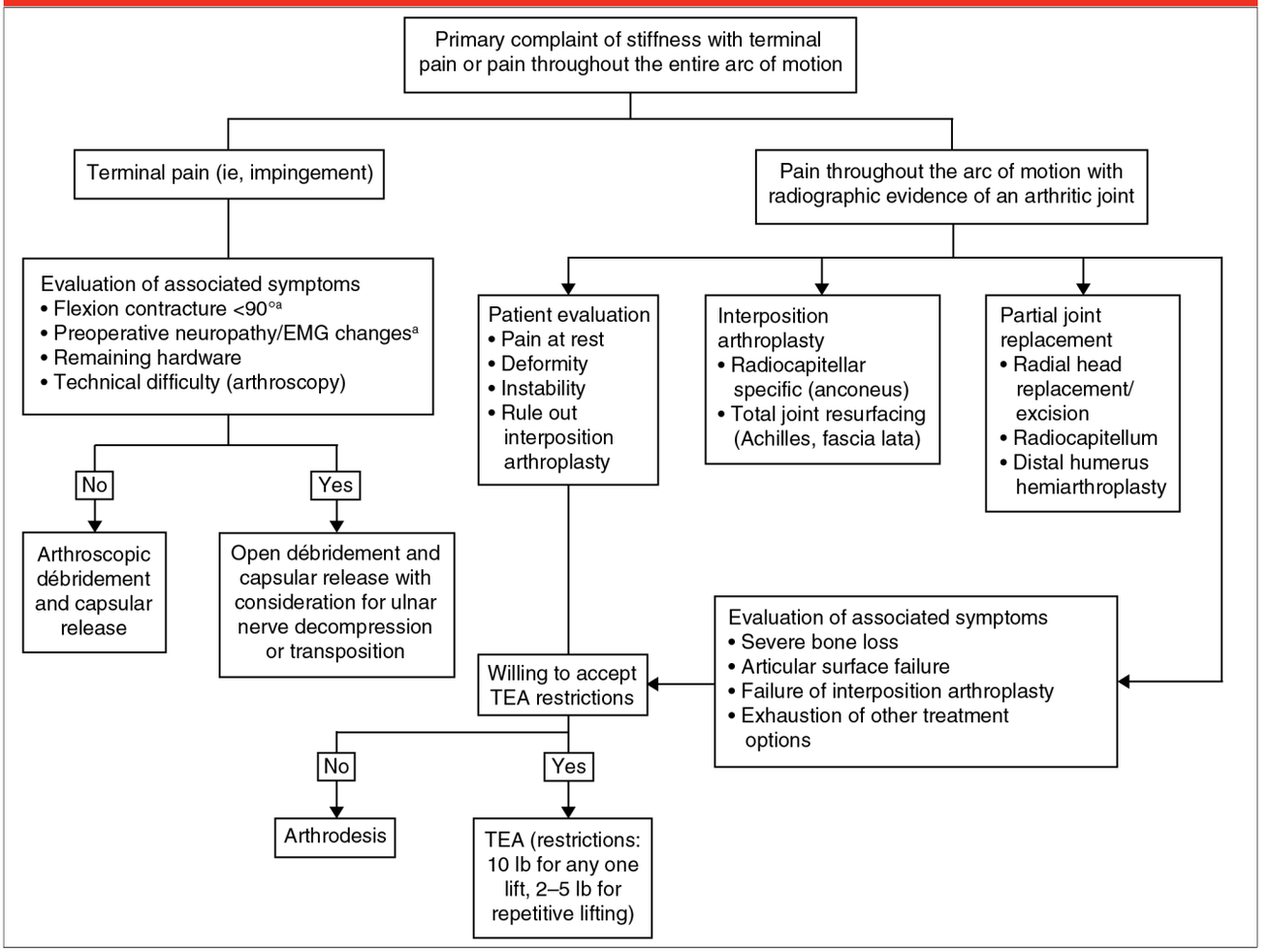
Imaging and Other Complementary Tests

Conventional radiographs, consisting of two orthogonal views of the elbow (ie, AP, lateral), are the standard initial evaluation for posttraumatic osseous deformity. Plain radiographs demonstrate the extent of degenerative disease and can detect subtle degenerative changes, including osteophyte formation, loose bodies, and joint space narrowing.[5] In one study, advanced radiographic changes were associated with worse outcome measures at 65 months following débridement of primary elbow osteoarthritis.[6]

CT is more accurate and has greater interobserver agreement than conventional radiography in detecting osteophytes and loose bodies.[7] CT arthrography allows evaluation of cartilage lesions and soft-tissue pathology.[8] Three-dimensional reconstruction CT has gained popularity as a tool for visualizing osteophyte distribution and assessing complex deformity patterns when planning surgical débridement.[9,10] Although MRI is useful for evaluating soft tissues, its clinical utility in the posttraumatic osteoarthritic elbow has not been demonstrated, and it is not routinely required.

In patients with peripheral neuropathies, an electromyographic evaluation is obtained to provide a baseline for assessing prognosis of nerve function recovery. Ruling out infection is paramount before surgery. In the setting of possible septic arthritis, it is necessary to perform elbow aspiration to determine cell count with differential and cultures. In patients with previous open injuries, history of prior infection, associated nonunion, or a worrisome clinical presentation, preoperative testing and planning are required to check for potential infection. Perioperative testing should include peripheral blood cell count, erythrocyte sedimentation rate, and C-reactive protein level, as well as intraoperative cultures and pathology, and the surgeon and patient have to be prepared for potentially staged procedures.

Figure 2



Treatment algorithm for posttraumatic elbow arthritis in the young patient whose primary complaint is stiffness with terminal pain or pain throughout the entire range of motion.
EMG = electromyography, TEA = total elbow arthroplasty
[a] Ulnar nerve concerns

Management

The mainstay of early treatment of the young patient with posttraumatic arthritis consists of maintaining joint mobility and reducing activities that place stress across the elbow, such as weight bearing and repetitive motions.[1] Nonsurgical measures may be definitive for mild arthrosis, and they can be used as a temporizing measure prior to surgical intervention in persons with advanced arthritis. Nonsteroidal anti-inflammatory drugs and selective intra-articular corticosteroid injections can control pain and facilitate daily use of the arthritic elbow. Temporary pain relief has been reported with intra-articular injections of sodium hyaluronate; however, after 6 months there are no discernible benefits, and it is not currently approved by the US Food and Drug Administration for use in the elbow.[11]

For patients who fail nonsurgical treatment, surgical management should be directed at restoring elbow function and reducing pain (Figure 2). Based on our experience with posttraumatic elbow arthritis, we have concluded that patients with stiffness and pain at terminal motion (ie, impingement) may benefit from open or arthroscopic osteocapsular joint débridement. When patients report pain throughout the entire arc of motion and advanced degenerative disease is evident on imaging, it may be appropriate to consider joint resurfacing with interposition arthroplasty or partial joint arthroplasty. Patients who have failed all other treatment measures may be candidates for total joint arthroplasty, as long as restrictions associated with implants (ie, 10 lb per single lift, <2 to 5 lb for repetitive lifting) and the likelihood of future revision are accepted by the pa-

tient and the surgeon. The goal of treatment is to restore a functional joint while preserving future surgical salvage options. Here, we review management options from the simplest to the more complex.

Options for Impingement Pain, Loose Bodies, and Stiffness

Diminished motion in the early stages of posttraumatic osteoarthritis is consistent with extrinsic elbow contracture. This is characterized by the presence of periarticular osteophytes but no major articular cartilage degeneration. Clinically, patients with extrinsic elbow contracture report pain at terminal motion (ie, impingement) and limited discomfort along the midarc of motion.[2] When nonsurgical measures have failed, options for surgical management include either arthroscopic or open techniques.

Surgical goals include removal of loose bodies and osteophytes, subtotal capsulectomy, selective release of the posterior bundle of the medial collateral ligament to increase flexion, and preservation of the anterior bundle of the medial collateral ligament and lateral collateral ligament complex. Special consideration should be given to the ulnar nerve, which, when not addressed, can play a major role in failed débridement. Currently, we have a very low threshold for in situ decompression of the ulnar nerve with joint débridement, and we recommend transposition in patients with preoperative ulnar neuropathy or <90° of flexion (Figure 3).

Arthroscopy

Technical advances in elbow arthroscopy have made it increasingly popular for the management of posttraumatic extrinsic elbow contracture. Krishnan et al[12] reported improvement in the flexion-extension arc from 60° preoperatively to 133° following arthroscopic ulnohumeral arthroplasty in 11 patients younger than 50 years. The authors reported no major neurovascular complications and complete patient satisfaction at a minimum 2-year follow-up. Other investigations of arthroscopic osteocapsular elbow release have yielded similar results, including good or excellent objective results in approximately 80% of patients[13] using several intraoperative variations, including olecranon fenestration,[14] radial head resection,[15] and capsulectomy.[16]

Cohen et al[17] compared the open Outerbridge-Kashiwagi procedure with arthroscopic débridement and fenestration of the olecranon fossa. They found both procedures to be effective, with borderline significance for superior motion gain following the open procedure and with better pain relief following arthroscopy. The Outerbridge-Kashiwagi procedure utilized a midline posterior incision with a triceps split allowing for initial débridement of the posterior compartment. Fenestration of the olecranon fossa was then performed, allowing for transhumeral débridement of the anterior elbow compartment. DeGreef et al[14] found comparable results between the arthroscopic Outerbridge-Kashiwagi procedure and their open technique. Although results of open and arthroscopic osteocapsular débridement have been described in younger patients with primary OA (mean age, approximately 50 years),[10,12,13,16,18-20] there is a paucity of results on patients with posttraumatic arthritis.[14,21] However, these results likely can be extrapolated to the treatment of young posttraumatic patients without articular surface destruction or pain throughout the arc of motion.

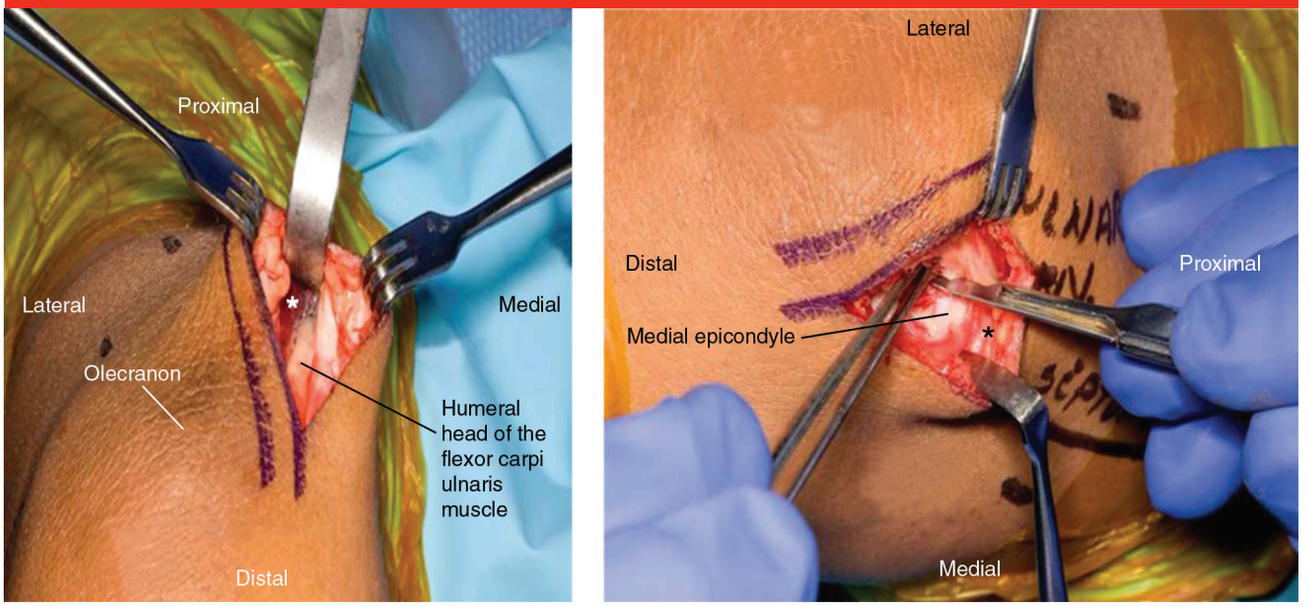
Open Techniques

Several successful surgical options exist for open release of extrinsic elbow contracture, including arthrolysis,[22] osteocapsular débridement,[10] the column procedure,[21] and ulnohumeral arthroplasty.[18] Cikes et al[22] reported on arthrolysis for posttraumatic extrinsic or mixed elbow contracture in 18 patients with an average age of 36 years. Motion improved from 82° preoperatively to 122° postoperatively, with 94% patient satisfaction at mean follow-up of 16 months. In patients with extrinsic elbow contracture, Mansat and Morrey[21] reported good or excellent results in 82% of patients following débridement and capsular release with the column procedure, including improvement in the flexion-extension arc from 49° preoperatively to 94° at a mean of 43 months postoperatively. Although the underlying diagnosis in this study was mixed, the treatment principles still apply.

The column procedure utilizes a limited lateral approach to the anterior and posterior capsule along the lateral supracondylar osseous ridge (ie, lateral column). Anteriorly, the fleshy origin of the flexor carpi radialis longus and the distal part of the brachioradialis are released. Posteriorly, the triceps is elevated from the distal humerus and the posterior capsule. The anterior and posterior capsules are resected and all osteophytes débrided. The lateral ulnar collateral ligament is preserved.

Ulnohumeral arthroplasty may be an option for patients with extensive osteophytes in the olecranon and coronoid fossa.[18] This modification of the Outerbridge-Kashiwagi procedure incorporates olecranon fossa fenestration and allows ulnar nerve release through the same approach in patients with preoperative ulnar neuropathy or flexion limited to <90° to 100°.[19] In long-term follow-up studies of open ulnohumeral arthroplasty (mean, 80 to 85 months), good to excellent results were achieved in approximately 80% of patients, with

Figure 3



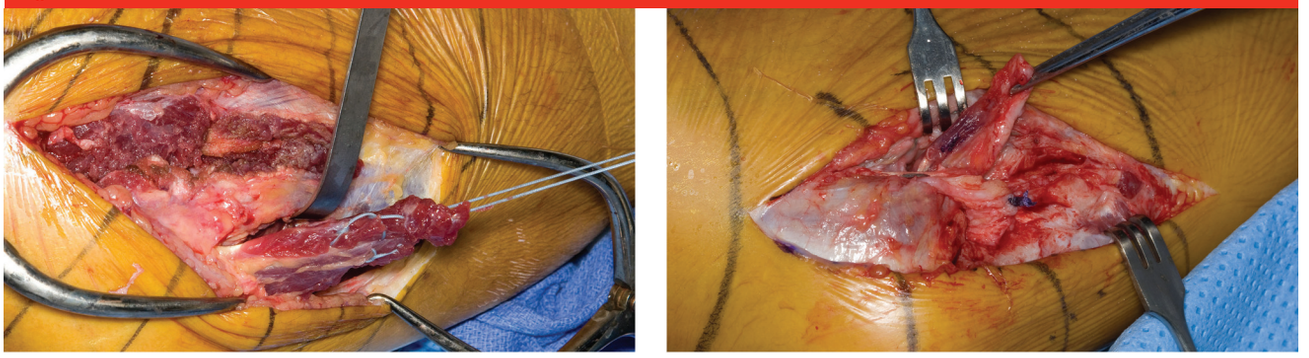
A, Intraoperative photograph demonstrating in situ decompression of the ulnar nerve (asterisk) at the time of osteocapsular arthroplasty. The ulnar nerve lies along the medial head of the triceps. **B,** This same limited skin incision provides access for formal resection of the posteromedial capsule and the posterior band of the medial collateral ligament (MCL). In this photograph, the knife is releasing the posterior band of the MCL, which serves as the floor of the cubital tunnel. The ulnar nerve (asterisk) is protected by the retractor. **C,** The procedure is completed arthroscopically.

an increased flexion-extension arc of 16° to 22°.[19,20] Arthroscopic and open techniques have shown success in the initial management of extrinsic elbow contracture associated with early stages of posttraumatic osteoarthritis.

Options for Addressing Damaged Joint Surfaces

Severe joint destruction typically presents with pain throughout the entire arc of motion and with radiographic joint space narrowing. These findings are consistent with advanced disease and effectively translate into a "bad bearing" joint. It is the authors' opinion that arthroscopy can be used to define the extent of degenerative changes in these patients but that it typically does not provide definitive improvement in pain or motion. Joint arthroplasty may result in the most predictable pain relief and improved joint motion; however, functional restrictions and concern about deterioration over time limit the use of TEA in most young patients with posttraumatic elbow arthritis. Alternative resurfacing options with fewer restrictions may be employed as alternative procedures that still reserve TEA as a future salvage alternative. These options include partial joint arthroplasty and biologic interposition arthroplasty.

Figure 4



A B

Intraoperative photographs of anconeus interposition arthroplasty. **A,** The anconeus muscle has been dissected and prepared for interposition. **B,** The anconeus has been passed underneath the collateral ligament complex to be interposed in the radiohumeral joint.

Isolated Radiocapitellar or Distal Humeral Joint Disease

In young patients, isolated arthritis of the radiocapitellar articulation or the articular surface of the distal humerus commonly results from fracture malunion, nonunion, or cartilage injury.[2] Patients with isolated radiocapitellar arthritis typically report lateral-sided elbow pain and limited and/or painful forearm rotation.[2] For young patients with symptomatic posttraumatic radiocapitellar degenerative disease who have failed extensive nonsurgical treatment, surgical options other than TEA include radial head resection, limited biologic interposition arthroplasty, and prosthetic replacement of the capitellum and/or radial head.

Radial Head Resection

Although radial head resection effectively removes the arthritic surface in patients with radiocapitellar degenerative changes, the long-term effect of transferring force transmission entirely through the ulnohumeral articulation is unknown. This consideration may be especially important in the young patient given the possible propagation or development of ulnohumeral arthrosis. In spite of concern for the development of ulnohumeral arthritis, few data are available to determine the clinical impact of altered joint forces following radial head resection. Antuña et al[23] retrospectively reviewed 26 patients following radial head resection for radial head fractures without instability. At the time of surgery, all patients were younger than 40 years. Follow-up was a minimum of 15 years after surgery. The authors reported that, although osteoarthritic radiographic changes were uniformly present, 92% of patients had satisfactory results with no associated functional impairment. Although information reported in the setting of an acute radial head fracture does not necessarily translate to patients with an arthritic joint, isolated resection of the radial head remains attractive because it is easy to perform and does not require the use of implants or biologic resurfacing.

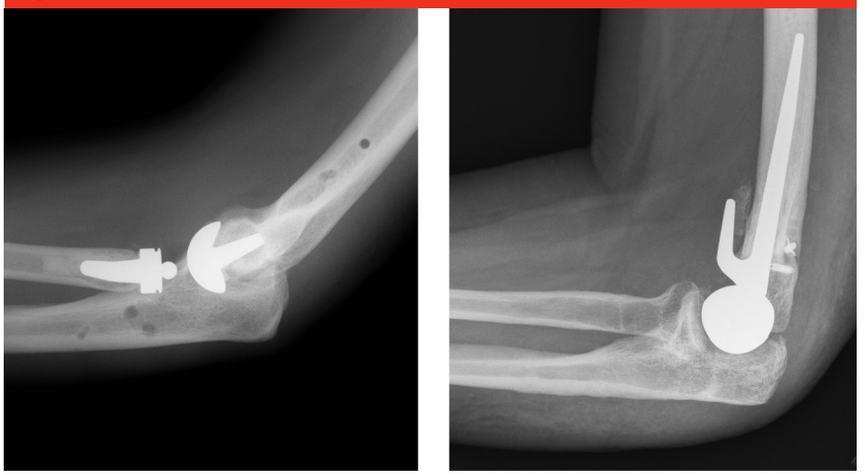
Partial Interposition Arthroplasty

Interposition arthroplasty of the radiocapitellar joint is another alternative that does not require prosthetic implants. We have been impressed with the clinical results obtained with interposition of the anconeus muscle into the radiohumeral joint. In this procedure, the radial head is excised, and the anconeus muscle is reflected from its distal insertion, taking care to preserve its neurovascular integrity, after which the anconeus is rotated into the radiocapitellar articulation underneath the lateral collateral ligament complex. This also increases stability through ligament tensioning (Figure 4). Clinical data have demonstrated this to be a useful procedure in patients with an arthritic capitellum and associated radiohumeral impingement or rotatory radioulnar impingement; however, interposition arthroplasty does not provide axial stability.[24]

Partial Joint Arthroplasty

Prosthetic replacement of the arthritic bearing surface may also be considered. Isolated radial head replacement removes the diseased articulation, restores lateral column stability in patients with valgus laxity, and rebalances force distribution across the elbow joint. However, an isolated radial head implant decreases radiocapitellar contact area by an average of 68% compared

Figure 5



A B

A, Lateral radiograph demonstrating partial unicompartmental radiocapitellar joint arthroplasty. **B,** Lateral radiograph demonstrating distal humerus hemiarthroplasty.

with the native radiocapitellar joint, which may result in further capitellar degenerative changes.[25] To address this, a radiocapitellar system may be used to replace both the capitellum and the radial head[26] (Figure 5, A). In addition to resurfacing the arthritic articulation, capitellar resurfacing hemiarthroplasty maintains external rotation and valgus stability of the lateral joint compared with capitellar excision.[27,28] However, isolated capitellar replacement is currently an off-label application, and there are limited data to judge clinical outcomes following radiocapitellar replacement. In the only current outcome study, Heijink et al[29] reported on a case series of three patients who underwent radiocapitellar prosthetic implantation. All three patients had a functional implant with no signs of dissociation or loosening at a mean follow-up of 83 months. Although further research is required to determine the utility of radiocapitellar replacement, this procedure provides an option for resurfacing an arthritic articulation and helps restore lateral joint stability.

Distal humerus hemiarthroplasty may be done in cases of degenerative changes that primarily involve the distal humerus (Figure 5, B). This technique, which involves resurfacing of the humeral articulation with preservation of the native ulnar articulating surface, has been described for the management of acute distal humeral fracture, nonunion, and failed fixation.[28] However, definitive outcomes data are limited for patients with posttraumatic arthritis. In addition, as with isolated capitellar replacement, distal humeral hemiarthroplasty is an off-label application of the implant. In a review of data from the Mayo Clinic Joint Replacement Database, Steinmann[28] found that patients undergoing hemiarthroplasty reported an average Mayo Elbow Performance Score (MEPS) of 74.5 but had a 16.7% revision rate with relatively short-term follow-up. Adolfsson and Nestorson[30] reported an 88% satisfactory rate (seven of eight patients) in low-demand elderly patients treated with humeral hemiarthroplasty. One patient had an ulnar periprosthetic fracture 3 years postoperatively. Although this procedure is rarely required, it is an option for patients with distal humeral pathology following fracture malunion or nonunion.

Interposition Arthroplasty

Interposition arthroplasty, which uses autograft material (eg, fascia lata, cutis) or allograft material (eg, Achilles tendon, dermis) to resurface the elbow articulating surface, provides an alternative to TEA in the young, high-demand patient[31] (Figure 6). Proponents of this procedure see interposition as a viable treatment option for this population, in particular, because it does not carry the postoperative use and weight-bearing restrictions recommended after TEA. In addition, and perhaps more important, with interposition arthroplasty, there are several reconstruction options available, including another interposition arthroplasty or TEA.[32,33]

Elbow interposition arthroplasty is indicated for painful loss of motion in the young or active patient who wants to avoid the functional restrictions of TEA.[34] Contraindications include gross instability or deformity, active infection, open physes, and absence of flexor motor power.[1] In addition, inadequate elbow bone stock and elbow pain at rest are associated with suboptimal outcomes.[31,35] For patients with these complicating factors, partial or total joint arthroplasty may result in superior outcomes and should be considered despite the associated functional limitations and concern regarding revision procedures (Figure 2). Deformity and instability must be addressed in either instance.

Possibly because of the technically demanding nature of the procedure, the frequency with which interposition arthroplasty is performed is unknown. However, posttraumatic arthritis appears to be a leading diagnosis. Celli

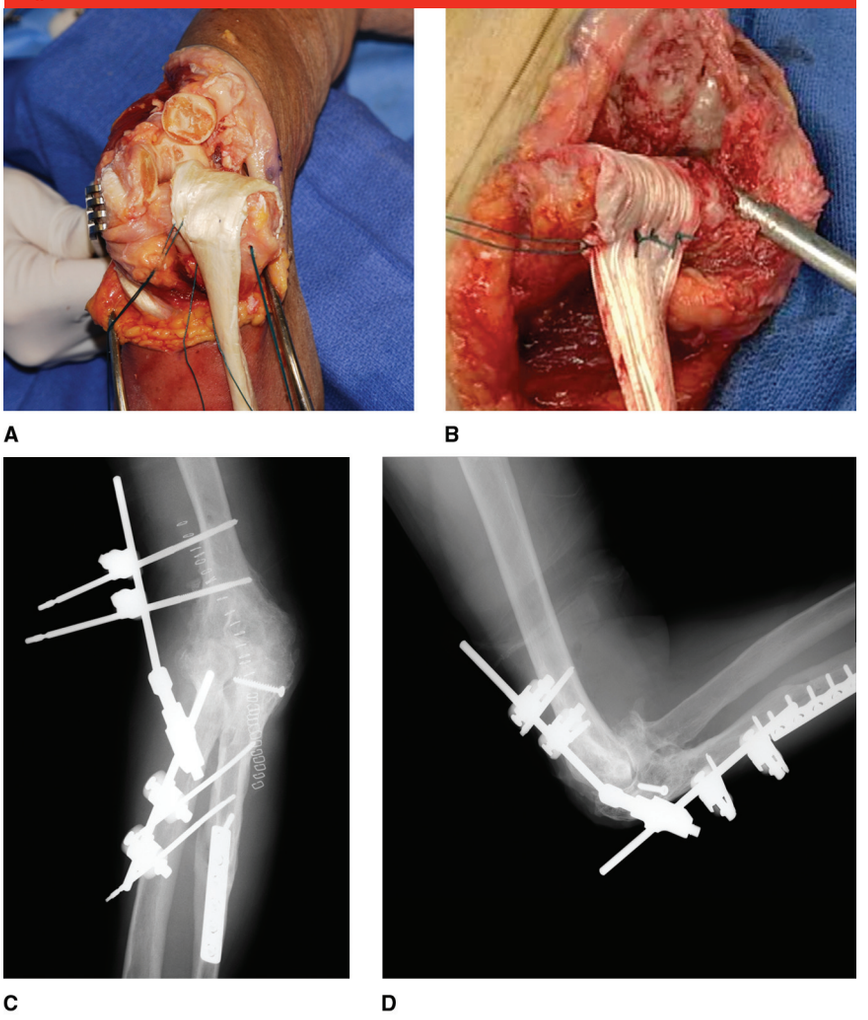
and Morrey[3] reported that posttraumatic arthritis accounted for 71% of the 133 interposition arthroplasties performed at Mayo Clinic over a 20-year period. An age distribution was not included in their data. Larson and Morrey[31] found the same percentage in a group averaging 39 years of age.

Range of motion and outcome scores demonstrate improvement in patients undergoing interposition arthroplasty; however, these results are inferior to those following joint arthroplasty.[1] Cheng and Morrey[35] reported on 10 patients with painful but mobile posttraumatic arthritis of the elbow following biologic interposition arthroplasty using fascia lata. The postoperative success rate was 70%; however, three patients required revision to TEA at a mean of 30 months. Nolla et al[36] reported on 13 patients with severe posttraumatic elbow arthrosis who underwent interposition arthroplasty and temporary hinged external fixation. Although the mean postoperative Broberg-Morrey score and motion improved markedly, four patients (31%) were found to have severe postoperative instability attributed to bone loss. The authors concluded that although interposition arthroplasty can improve elbow motion and function, it might come at the expense of elbow stability.

In the largest published series to date, Larson and Morrey[31] reported on 38 elbows managed with Achilles tendon allograft interposition arthroplasty at a mean 6-year follow-up (mean patient age, 39 years; 76% posttraumatic diagnosis). Although the mean MEPS improved from 41 points preoperatively to 65 points postoperatively and the mean flexion-extension arc improved from 51° to 97°, 11 patients (29%) had a poor result, and 7 (18%) required revision surgery. Additionally, 11 patients with preoperative instability were found to have a significantly lower MEPS despite collateral ligament reconstruction. Even so, 88% of all patients indicated they would have the procedure again. The authors concluded that, although interposition elbow arthroplasty is a salvage procedure that neither eliminates pain nor restores full function, it might be indicated for young, active patients with severe arthritis and limited elbow motion and no associated elbow instability.

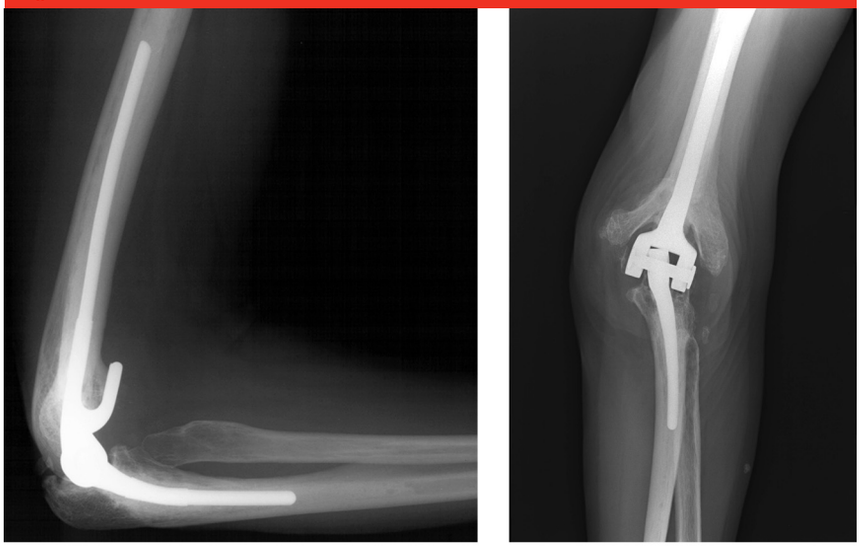
Despite the relatively modest results reported in the literature, one of the most attractive features of interposition arthroplasty is that it does not compromise subsequent salvage procedures. Larson et al[33] reported on nine patients with severe post-

Figure 6



A and **B,** Intraoperative photographs of Achilles tendon allograft used in elbow interposition arthroplasty. Three or four drill holes are created in a posterior-to-anterior direction across the distal humerus, and the prepared graft is securely attached to the humerus with suture through these osseous tunnels. The ulnohumeral joint is subsequently reduced over the graft, and collateral ligament primary repair is completed. If the collaterals are deemed insufficient, the implanted allograft can be used to reconstruct both by threading a strand of the graft through a single drill hole in the ulna, creating a collateral sling. AP (**C**) and lateral (**D**) radiographs following elbow interposition arthroplasty with a hinged external fixator.

Figure 7



A B

A, AP radiograph demonstrating a successful outcome 5 years after total elbow arthroplasty. **B,** Lateral radiograph demonstrating failed total elbow arthroplasty secondary to wear. Notice the absence of osteolysis or loosening.

traumatic arthritis undergoing revision of a failed interposition arthroplasty with another interposition procedure using Achilles tendon allograft. Only one patient had a poor result, and five were satisfied with the revision procedure. The authors concluded that this is an option for young, active patients with severe posttraumatic arthritis who require both mobility and durability of the elbow. In a separate study, Blaine et al[32] demonstrated that conversion of failed interposition arthroplasty to TEA can be performed successfully with reliable pain relief and a satisfactory result in most patients. In that study, 10 of 12 patients reported mild or no pain with satisfactory results at a mean of 9.9 years following conversion. Interposition arthroplasty has moderately successful results, enables elbow use with few restrictions, and preserves the ability for subsequent salvage options.

Total Elbow Arthroplasty

TEA remains the most definitive functional procedure for end-stage osteoarthritis. However, there is hesitation regarding implantation of TEA in the posttraumatic population because of implant overuse and increased bone-cement stresses associated with relatively high failure rates. Schneeberger et al[37] reported on 41 patients with posttraumatic elbow arthrosis who were managed with semiconstrained TEA (average age, 57 years). A major complication was reported in 27% of patients, and 22% of all patients in the series required additional surgery. Most complications resulted from mechanical failure, including bushing wear and ulnar component fracture. They concluded that because of the mechanical failures encountered in this population, this procedure is relatively contraindicated for patients who anticipate strenuous physical activity or who are not expected to comply with postoperative restrictions.

Mechanical failures become more concerning in the young patient undergoing TEA for posttraumatic arthritis because of patient longevity and increased physical demands (Figure 7). In a follow-up study, Throckmorton et al[38] examined failure patterns in 84 patients (85 TEAs) treated with semiconstrained TEA to manage posttraumatic arthritis. Mechanical wear, consisting of bushing wear and component loosening or fracture, was the primary reason for intermediate- and late-term failure. Notably, 75% of failures in this study occurred in patients who were younger than 60 years of age at the time of surgery. Celli and Morrey[3] reported on the results of 55 semiconstrained TEAs performed in patients aged ≤40 years, including 19 patients who underwent TEA for posttraumatic arthritis. Although the authors reported a satisfactory outcome based on the MEPS in 84% of patients with posttraumatic arthritis, the rate of revision as a result of a complication was 37%.

In some cases, TEA may be the only treatment option. This typically occurs because of severe injury such as massive bone loss, articular disruption, or failure of other treatment options. If TEA is required, implantation with a linked or unlinked design should be considered. An unlinked prosthesis, which has no mechanical linkage between the humeral and ulnar components, may be advantageous for the young patient with a stable articulation because there are lesser bone-cement interface stresses than with linked implants. In unlinked TEA, stability is achieved with implant geometry and soft-tissue balancing rather than with the intrinsic constraint of the articulation.[39] When properly positioned and balanced, these implants are designed to restore near-normal elbow

kinematics and allow load-sharing between implant and soft tissues, diminish implant stresses, and, theoretically, reduce loosening rates.[40] However, loosening can occur with unlinked implants, and results deteriorate over time.[1,38] Additionally, inability to balance surrounding soft tissues is a contraindication for these devices. Thus, unlinked implants are rarely employed for posttraumatic conditions, regardless of patient age. The use of so-called convertible designs that allow for conversion between linked and unlinked articulation with the same implant may provide the greatest variety of options. Implant longevity and the potential need for subsequent revision surgery are important considerations in TEA in the young patient.

Arthrodesis

Elbow arthrodesis is rarely indicated because the adjacent joints do not compensate for motion loss. However, arthrodesis may be an option for young patients with posttraumatic unilateral arthrosis who require a strong and stable joint.[41] Fusion may be obtained using a variety of techniques, including bent plates, compression screws, external fixation, and crossed tibial bone grafts. Complications are relatively uncommon and include nonunion and fracture. Although fusion can create a stable and strong articulation, for the young patient, we recommend other salvage options before resorting to arthrodesis because of the resulting profound functional limitations.

Summary

Osteoarthritic changes of the elbow are commonly encountered in the younger patient following traumatic injury. Although TEA represents the most definitive functional procedure for the management of end-stage osteoarthritis, in this population it is associated with a concerning incidence of complications and failures from increased activity demands and potential implant duration. Therefore, TEA should be considered to be a salvage procedure in this patient population.

Management of posttraumatic elbow arthritis begins with extensive, long-term, nonsurgical symptomatic care. For patients who fail nonsurgical treatment, surgical options are aimed at restoring a functional elbow joint with manageable pain levels (Figure 2). The patient whose primary report is stiffness and pain at terminal motion may benefit from arthroscopic or open osteocapsular débridement. Patients with advanced degenerative changes and pain along the entire arc of motion may be considered for joint resurfacing with either interposition arthroplasty or partial joint arthroplasty.

Patients who have failed all other measures may be candidates for TEA, with the strict understanding of the physical limitations required for this option and the likelihood of revision in the future. Unlinked implants may help disperse mechanical stresses from the cement-bone interface to that of the native tissues, theoretically promoting longevity. However, in practice, patients commonly present with severe bone loss, deformity, and ligament incompetency, which makes implantation of unlinked implants difficult and fraught with complications. The primary goal of treatment in the young patient with posttraumatic elbow arthritis is to restore a minimally painful but functional joint while preserving future surgical salvage options.

References

Evidence-based Medicine: Levels of evidence are described in the table of contents. In this article, references 5, 11, 19, and 22 are level III studies. References 3, 4, 6-10, 13-18, 20, 21, 23, 24, 26, 28-38, and 41 are level IV studies.

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