

Total Elbow Arthroplasty and Rehabilitation

Surgical Indications and Considerations

Anatomical Considerations: There are three bones and four joint articulations that have a high degree of congruence in the elbow. Also, the ulnar nerve runs directly through the ulnar groove of the humerus and travels down the medial forearm. With joint replacement, careful consideration must be taken to limit ulnar nerve entrapment. The ulnar nerve is subject to transient (10%) or, occasionally, partial dysfunction. Routine anterior translocation has been beneficial, but there is considerable variation in technique in this regard. Triceps insufficiency can be virtually eliminated with the Kocher lateral-to-medial or the Bryan lateral-to-medial triceps-sparing approach.

Pathogenesis: In elbow arthritis the joint surface is destroyed by wear and tear, inflammation, injury, or previous surgery. This joint destruction makes the elbow stiff, painful, and unable to carry out its normal functions. Rheumatoid arthritis (RA) usually affects the elbow in the first five years of onset. Individuals with RA of the elbow usually notice pain, stiffness, and loss of the ability to use the elbow for their usual activities. Commonly, they have difficulty sleeping on the affected arm and notice a limited range of motion in the elbow. Some people with arthritis notice a grinding feeling when the elbow is moved. Rheumatoid arthritis of the elbow usually gets worse over time, but the rate of this progression varies widely. Distal humerus fractures typically occur during high energy situations (such as motor vehicle accidents) or during low energy situations (such as a fall).

Epidemiology: Total elbow arthroplasties are most commonly performed on elbows with severe rheumatoid arthritis and elbows with distal humerus fractures. Elbow fractures comprise approximately 4.3% of all fractures. These fractures typically occur in young boys ages 5-10. In contrast, total elbow arthroplasty is also considered to be a viable treatment for women over the age of 65 with distal humerus fractures.

Diagnosis

- Intractable pain
- Joint Instability
- Failed synovectomy
- Decreased elbow ROM
- Severe RA
- Ulnohumeral ankylosis

Non-operative Vs Operative Management: Non surgical interventions such as casting can be recommended for distal humerus fractures. Although, surgical intervention can become necessary for distal humerus fractures when fracture type, soft tissue involvement, joint stability and bone integrity are assessed. Surgical intervention is normally recommended for elbow joints with severe rheumatoid arthritis. The goal of elbow replacement arthroplasty is to restore functional mechanics to the joint by removing scar tissue, balancing muscles, and inserting a joint replacement in the place of the destroyed elbow.

Post Surgical Considerations

- Risk of infection
- Joint dislocation
- Prosthetic loosening

Surgical Procedure: There are many different surgical approaches and implants for total elbow arthroplasties. The Coonrad-Morrey implant has been found to prevent dislocation without increasing the risk of loosening (Little, 2005). This implant is semiconstrained (unlinked prosthesis) which requires the preservation of bone stock and the ability to achieve stability of the collateral ligaments. Elbow joint replacement surgery is a highly technical procedure; each step plays a critical role in the outcome.

The Bryan-Morrey approach is often used for this procedure. A straight 15cm incision centered lateral to the medial epicondyle and medial to the tip of the olecranon. The ulnar nerve is located and translocated to protect it from damage.

After the anesthetic has been administered and the elbow has been prepared, an incision is made along the medial aspect of the proximal ulna, from three inches above the elbow to three inches below it. This incision allows access to the joint without damaging the important muscles that are responsible for the elbow's motion. The medial aspect of the triceps along with the anconeus is reflected laterally. The radial and ulnar collateral ligaments are also released from the anconeus. This is done to avoid fracturing the medial column by the ligament when the forearm is manipulated. The ulnar nerve is also isolated to protect it during the procedure; as a result, the little finger is sometimes numb for a period of time after this surgery.

The muscles and other tissues near the elbow are mobilized by removing any scar tissue that may restrict their motion. The capsule is released in front of and behind the elbow joint. The distal end of the humerus and the proximal of the ulna are fit to receive their respective implants. The components are stabilized by cementing their stems inside the bones using polymethylmethacrylate (bone cement). Once the implants are securely fixed, they are linked together using a hinge pin. At the conclusion of the procedure, the deep tissues and skin are closed and a protective dressing is applied.

PREOPERATIVE & POST OPERATIVE REHABILITATION

Note: The following rehabilitation protocol is taken from Protocol for Rehabilitation from Seacoast Orthopedics and Sports Medicine (sosmed.org). Refer to the previously noted website for further information regarding this progression.

General Rehabilitation Guidelines Program for Total Elbow Arthroplasty

Rehabilitation Considerations: Hematoma formation follow elbow arthroplasty can lead to pain and loss of motion in the early phases after surgery. Attempts to reduce and mobilize edema are critical in the early phases. Hematoma also increases the risk of infection which occurs in 2-3 percent of elective cases and up to 7% of cases performed for trauma.

Full flexion and extension can usually be obtained on the table but stiffness may ensue rapidly. Continuous passive motion is almost always employed when possible but patients must be encouraged to perform daily stretching exercises to preserve motion.

Because the extensor mechanism must heal back to the ulna, active elbow extension, such as using the arm to assist in rising from a chair, is not permitted for 8 weeks.

Adjacent joint therapy may be particularly important for patients with rheumatoid arthritis who may have concomitant disease of the shoulder and wrist.

Pre-rehabilitation:

- Instruct in application of ice and encourage use as much as tolerated within a 24 hour period for first week. If using ice packs, encourage to ice 20-30 minutes every 3-4 hours while awake.
- Instruct in home program of elbow flexion, extension, pronation and supination.
- Instruct in basic progression of rehabilitation program and expectations for time course to recovery
- Arrange follow-up physical therapy appointment on 7th-10th day post-op to correspond with physician's post-operative evaluation

Inpatient: (0-4 days)

- Arm is generally splinted in extension with hemo-vac drain in place for 1st 36 hours to prevent swelling and reduce chance of a hematoma. Arm is generally elevated in a sling on a pole.
- Evening of the first postoperative day, the splint is removed and patients are started on CPM set to provide full flexion and extension.
- Arm should be removed every 1-2 hours to prevent compressive neuropathy
- Cryotherapy in between sessions

ROM

- Instruct in home program, and begin, active assisted elbow and wrist flexion, extension, pronation and supination
- Instruct in home program, and begin, self-assisted forward elevation and external rotation of the shoulder to prevent adjacent joint stiffness
- Finger ROM but no aggressive grip strengthening so that muscular attachments heal

Other

- Instruct to don and doff sling
- Methods of edema control
- Instruct in precautions of no active elbow extension and avoid direct pressure on posterior aspect of elbow
- Instruct on proper use of ice or cryocuff 20-30 minutes at a time, several times per day, especially after exercises
- Arrange for outpatient physical therapy follow-up to begin on day of office follow-up

Wound Instructions

- Dry gauze to wound q day until dressing totally dry, then cover prn
- May shower at 7 days but no bath or hot tub for 3 weeks

Outpatient Phase 1: (Hospital Discharge to Week 4)

ROM

- Continue program active elbow and wrist flexion, pronation and supination and active assisted elbow flexion.
- Continue shoulder flexibility exercises

Strength

- Can start gentle grip strengthening but no active elbow or wrist strengthening exercises until Phase II

Sling

- Sling should only be used when patients are out in busy or crowded locations but not around the house and not to bed

Other

- Incision mobilization and desensitization
- Modalities for pain, inflammation and edema control (no e-stim)
- Cryotherapy as needed
- Ulnar nerve desensitization

Outpatient Phase 2: (Weeks 5-8)

ROM

- Continue shoulder elbow and wrist ROM
- At 6 weeks can add active extension (anti-gravity only but no resistance)
- Night time extension splinting if flexion contracture developing

Strength

- May begin gentle isometric and isotonic wrist flexion/extension and elbow flexion strengthening
- Biceps strengthening should be done with elbow supported
- No elbow extension strengthening

Sling

- Sling should be fully discontinued at this point

Other

- Continue scar massage

Outpatient Phase 3: (Weeks 9 -12)

ROM

- Active range of motion in all planes

- Continue night time extension splinting if necessary
- Dynasplint if flexion contracture $>30^{\circ}$

Strength

- Continue isotonic strengthening
- May add anti-gravity active extension but no resistance
- May add UBE at very low resistance for conditioning
- May add exercises for shoulder to promote generally upper extremity conditioning

Outpatient Phase 4: Weeks 12 - 16)

ROM

- Continue maintenance flexibility program

Strength

- Progressive isotonic resistance including elbow extension
- Progress to functional use

Selected References:

Frankle MA, Herscovici D, DiPasquale TG, Vasey MB, Sanders RW. A Comparison of Open Reduction and Internal Fixation and Primary Total Elbow Arthroplasty in the Treatment of Intraarticular Distal Humerus Fractures in Women Older Than Age 65. *J of Orthop Trauma*. 2003(8);17(7):473-480.

Little CP, Graham AJ, Karatzas G, Woods DA, Carr AJ. Outcomes of Total Elbow Arthroplasty for Rheumatoid Arthritis: Comparative Study of Three Implants. *J Bone Joint Surg Am*. 2005;87:2439-2448.

Mansat P, Morrey BF. Semiconstrained Total Elbow Arthroplasty for Ankylosed and Stiff Elbows. *J Bone Joint Surg Am*. 2000; 82:1260.

Morrey BF, Bryan RS. Complications of Total Elbow arthroplasty. *Clinical Orthop Relat Res*. 1982;170:204-12.

Morrey BF. *The Elbow and its Disorders* 2nd ed. Philadelphia, PA: W.B. Saunders Co.; 1993: 648-765.

Shafer BL, Fehringer EV, Boorman RS, Churchill RS, Matsen FA. Ulnar Component Fracture After Revision Total Elbow Arthroplasty with Proximal Ulnar Bone Loss: A Report of 2 Cases. *J Shoulder Elbow Surg*. 2003; 12:297-30.1