

Stiffness of the Elbow

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Overview

1. Most activities of daily living require elbow range-of-motion (ROM) arcs comprising 100° (30° to 130°) of flexion/extension and 100° (50°/50°) of pronation/supination.
2. Flexion loss generally causes more disability than extension loss.

Epidemiology

1. Elbow stiffness is often associated with arthritis or trauma.
2. Other causes
 - 1) Congenital-Arthrogyrosis, radial head dislocation
 - 2) Cerebral palsy
 - 3) Head injury
 - 4) Burn (contracted eschar or heterotopic ossification)

Pathoanatomy

1. Intrinsic pathologic conditions
 - 1) Intra-articular fractures, malunions
 - 2) Joint incongruity
 - 3) Intra-articular adhesions
 - 4) Inflammatory arthropathy
 - 5) Osteochondritis dissecans
 - 6) Posttraumatic arthritis
2. Extrinsic pathologic conditions
 - 1) Heterotopic ossification
 - 2) Skin (eschar after burn)

- 3) Muscle-Myositis ossificans
- 4) Capsular fibrosis/adhesions

Evaluation

1. History

- 1) Duration of elbow contracture
- 2) Initial injury
- 3) Previous surgical procedures
- 4) Trials of splinting, therapy
- 5) Complications of surgery
- 6) Patient's work, life demands, and goals

2. Physical examination

- 1) Assess function of the upper extremity (shoulder, wrist, and hand).
- 2) Examine the soft tissue surrounding the elbow for previous skin incisions, eschar, or infection.
- 3) ROM should be assessed.
 - (1) Active and passive flexion, extension, supination, and pronation (examine the contralateral elbow for comparison)
 - (2) If the elbow has 90° to 100° of flexion, the posterior bundle of medial collateral ligament (MCL) is contracted and must be released to restore flexion.
- 4) Neurovascular examination
 - (1) The ulnar nerve is of utmost importance because of its anatomic proximity to the elbow. The posterior bundle of the MCL forms the floor of the cubital tunnel, along the course of the ulnar nerve.
 - (2) Conduct electromyography/nerve conduction velocity studies if there is any question about neurologic dysfunction.

3. Imaging

- 1. Radiographs should always be obtained.
 - (1) AP, lateral, and oblique radiographs are standard, with serial radiography as follow-up when heterotopic ossification is present.
 - (2) The primary bony landmarks include the ulno-humeral joint, the coronoid process, the radial head, the capitellum, the radiocapitellar joint, the olecranon tip, the coronoid/olecranon fossae, and the trochlear ridge.
- 2. CT is helpful when assessing for malunion architecture and/or loose bodies; use three dimensional CT to check for heterotopic ossification. CT is not necessary when the stiffness is

entirely soft-tissue related. However, if there is any joint incongruity or abnormal bony anatomy, CT is beneficial.

3) MRI can be used to evaluate ligaments and tendons, but it is rarely indicated.

Classification

1. Intrinsic contracture

- 1) Intra-articular fractures, malunions
- 2) Joint incongruity
- 3) Intra-articular adhesions
- 4) Inflammatory arthropathy
- 5) Osteochondritis dissecans
- 6) Posttraumatic arthritis
 - (1) Coronoid osteophytes
 - (2) Olecranon tip osteophytes
 - (3) Narrowing of the coronoid fossa/olecranon fossae
 - (4) Narrowing of the radiocapitellar joint space

2. Extrinsic contracture

- 1) Heterotopic ossification
- 2) Skin (eschar after burn)
- 3) Muscle-Myositis ossificans
- 4) Capsular contracture (anterior and posterior)

3. Mixed-type contracture

- 1) Most common
- 2) Late sequelae of intrinsic pathologic condition can lead to extrinsic stiffness.

Treatment

1. Nonsurgical

- 1) Physical therapy (active and passive ROM), non-steroidal anti-inflammatory drugs
- 2) Splinting/ROM regimen
 - (1) Dynamic
 - (2) Progressive static stretch
 - (3) Turnbuckle (adjustable static type)

(4) 21-hour program, alternate flexion/extension

2. Surgical

1) Indications

- (1) Surgical release is ideally indicated for extrinsic contractures when the joint surface is congruous and normal joint architecture is maintained.
- (2) Surgical release can be helpful for some contractures of intrinsic origin, such as osteoarthritis; however, once the joint surface is altered or incongruous, the results are much less predictable.
- (3) Failed nonsurgical course of treatment
- (4) patient compliant with postoperative therapy
- (5) Heterotopic ossification can be resected once it is mature. This is evident by well corticalized margins of the new bone and lack of changes on serial radiographs

2) Contraindications

- (1) Intraarticular ankylosed elbow
- (2) Neurologic elbow disorder
- (3) Charcot elbow
- (4) Deficient skin envelope-May need rotational flap
- (5) Posttraumatic arthritis-Surgical release is rarely indicated for contractures $<40^\circ$.

3) Surgery can be performed with or without indwelling regional anesthesia.

3. Surgical approaches and procedures

1) Arthroscopic capsular release/ osteocapsular arthroplasty (O' Driscoll)

- (1) Indicated for patients with arthritis or extrinsic capsular contractures
- (2) Arthroscopic capsular release is a technically demanding procedure because of small joint space and close proximity of neurovascular structures.
- (3) Procedure
 - i . Posterior compartment - Debride olecranon osteophytes / fossae; perform posterior capsular release. Avoid debridement / suction medially to protect the ulnar nerve.
 - ii . Anterior compartment - Debride coronoid osteophytes and osteophytes in the coronoid fossa and central trochlear ridge; perform anterior capsulotomy / capsulectomy.
 - iii. To improve visualization, use accessory portals and retractors judiciously.
 - iv. Protect neurovascular structures. The radial nerve is at greatest risk, followed by the ulnar and median nerves.

2) Open lateral column approach (Morrey)

- (1) The lateral column approach can be performed through a posterior or a lateral skin incision.
- (2) Elevate the extensor carpi radialis longus/ brachioradialis muscles anteriorly and the triceps

- muscle posteriorly.
 - (3) Mobilize the brachialis muscle off the anterior capsule.
 - (4) Release and excise the anterior capsule.
 - (5) Debride the coronoid tip/fossae.
 - (6) Decompress the olecranon tip/fossae.
 - (7) Debride the radiocapitellar joint.
 - (8) Release/excise the posterior capsule.
- 3) Open medial “over the top” approach (Hotchkiss)
- (1) Indicated for patients with extrinsic contractures, associated MCL calcification, and ulnar neuropathy
 - (2) Procedure
 - i. Decompress or transpose the ulnar nerve.
 - ii. Release the posterior band MCL/capsule to increase flexion.
 - iii. Work anterior to the flexor/pronator mass.
 - iv. Excise the anterior capsule.
 - v. Debride the coronoid tip/fossae.
- 4) Combined approach-Procedure
- (1) Posterior skin incision, with medial and lateral skin flaps
 - (2) If the elbow has $<90^\circ$ to 100° of flexion, release the posteromedial band MCL and posterior capsule to restore flexion, and consider ulnar nerve decompression or transposition.
- 5) Interposition arthroplasty - Interposition arthroplasty is a procedure in which the distal humerus is resurfaced with biologic material. An external fixator is often used to distract the joint and provide stability in the immediate postoperative period.
- (1) Indications - The procedure is considered for intrinsic contractures in young patients (age 20 to 50 years) in whom the anatomic architecture of the distal humerus and proximal ulna are relatively preserved.
 - (2) Procedure
 - i. Hinged external fixator for distraction and to maintain stability.
 - ii. Interposition- Autologous fascia, dermis, allograft Achilles tendon
 - iii. Reconstruct collaterals if necessary.
- 6) Total elbow arthroplasty is indicated only for older, low-demand individuals with intrinsic contractures.
- (1) High failure rate in young, active individuals
 - (2) Permanent 5-l b lifting restriction

Complications

1. Postoperative heterotopic ossification - Consider prophylactic treatment with indomethacin or low-dose radiotherapy.
2. Neurovascular compromise - The ulnar nerve is at greatest risk and is usually transposed anteriorly.
3. Transient ulnar neurapraxia is often associated with acute increase in flexion >90°.
4. Superficial infections.
5. Prolonged drainage / seroma - Common with open releases.
6. Recurrent contracture

Rehabilitation

1. Continuous passive motion through full ROM, under regional anesthesia
2. Active and active-assisted ROM therapy
3. Compressive, elbow stockings
4. Compressive, cooling elbow wraps
5. Nighttime extension splinting
6. Transition to dynamic or static progressive stretch splinting.

REFERENCES

1. Ball CM, Meunier M, Galatz LM, Calfee R, Yamaguchi K: Arthroscopic treatment of post-traumatic elbow contracture. *J Shoulder Elbow Surg* 2002; 11: 624-629.
2. Cohen MS, Hastings H II: Post-traumatic contracture of the elbow: Operative release using a lateral collateral ligament sparing approach. *J Bone Joint Surg Br* 1998; 80: 805-812.
3. Doornberg JN, Ring D, Jupiter JB: Static progressive splinting for posttraumatic elbow stiffness. *J Orthop Trauma* 2006; 20:400-404.
4. Gates HS III, Sullivan FL, Urbaniak JR: Anterior capsulotomy and continuous passive motion in the treatment of post-traumatic flexion contracture of the elbow: A prospective study. *J Bone Joint Surg Am* 1992; 74:1229-1234.
5. Jupiter JB, O' Driscoll SW, Cohen MS: The assessment and management of the stiff elbow. *Instr Course Lect* 2003; 52:93-111.
6. Mansat P, Morrey BF: The column procedure: A limited lateral approach for extrinsic contracture of the elbow. *J Bone Joint Surg Am* 1998; 80:1603-1615.
7. Morrey BF: Surgical treatment of extraarticular elbow contracture. *Clin Orthop Relat Res* 2000; 370:57-64.
8. Morrey BF: The posttraumatic stiff elbow. *Clin Orthop Relat Res* 2005; 431:26-35.
9. Nguyen D, Proper SI, MacDermid JC, King GJ, Faber KJ: Functional outcomes of arthroscopic release of the elbow. *Arthroscopy* 2006; 8:842-849.
10. Stans AA, Maritz NG, O' Driscoll SW, Morrey BF: Operative treatment of elbow contracture in patients twenty-one years of age or younger. *J Bone Joint Surg Am* 2002; 84:382-387.