The Role of Arthroscopy in Management of Elbow Disorders

Essay
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INTRODUCTION

Arthroscopy has reduced the morbidity and period of hospitalization associated with orthopaedic surgery and has increased the range of procedures that may be performed. From early operations on the knee it has expanded to include procedures for the shoulder, elbow, wrist, hip, ankle, and foot."[1]"

Burman and colleagues first described access to the elbow joint with an arthroscope in the early 1930s. He himself was doubtful over its usefulness, initially stating it to be 'unsuitable for examination'. However, he later changed his opinion after visualizing the anterior compartment in cadaveric joints. The Japanese had been pioneers of arthroscopy and were responsible for the development of finer bore equipment, making smaller joints accessible to examination. By 1971, Watanabe had produced the 1.7mm needle scope, and by the end of the decade, Ito and Maeda had described different arthroscopic approaches to the elbow. Further development increased the range of its application so that now both diagnostic and therapeutic arthroscopy is well established for a wide range of elbow disorders. Quated by Villar "[2]"

The success of arthroscopy of the elbow is dependent on proper indications, a thorough understanding of the anatomy of the elbow, and

careful attention to technique in portal placement during operative arthroscopy.[3]

Loose body removal is characteristically one of the most gratifying of all arthroscopic procedures. Patient satisfaction is usually high. This is also true for removal of loose bodies associated with disease, such as synovial chondromatosis. Removal of symptomatic loose bodies about the elbow is equally as gratifying as for other joints.[3]

The elbow is a tightly constrained joint surrounded closely by important neurovascular structures. Elbow arthroscopy is a procedure that requires careful attention and through knowledge of the pertinent anatomy.[4]

Aim of the work

The aim of this study is to assess the role of elbow arthroscopy, its advantages over open surgery, recent advances, its technique and complications.

Anatomy Of The Elbow Joint

The elbow is composed of two independent uniaxial joints. One is the humeroulnar joint, which is a hinged, or ginglymoid, joint. The other consists of the humeroradial and proximal radioulnar articulations, a pivoted or trochoid, joint, allowing two degrees of freedom in the elbow joint. Motion in the elbow involves rotation of the ulna about the humerus during flexion and extension and rotation of the radius about the ulna during supination and pronation.[5]

A common articular cavity incorporates the synovium, capsule and ligaments allowing the elbow joint to be considered a single anatomic element.[6]

Articulating Surfaces

Humerus: fig. (1-1)

The distal humerus is divided into separate medial and lateral components, called condyles, each containing an articulating portion and non articulating portion, the non articulating portions include the epicondyles which are the terminal points of the supracondylar ridges. The lateral epicondyle contains a rough anterolateral surface from which the superficial forearm extensors arise; the medial epicondyle is larger and service as the origin of the forearm flexors. The posterior distal portion of the medial epicondyle is smooth and in contact with the ulnar nerve as it crosses the elbow joint.[7]

The articulating surface of the lateral condyle is hemispherical and projects anteriorly, it is called the capitellum. "7". It is covered with hyaline cartilage, which is 2 mm thick anteriorly."8" A groove separates the capitellum from the trochlea and the rim of radial head articulates with this groove throughout the arc of flexion and during pronation and supination. "9"

The articulating surface of the medial condyle, the trochlea, it is spool like, it has very prominent medial and lateral edges. Between these ridges is central groove that articulates with the greater sigmoid notch of the ulna. The diameter of the trochlea at this groove is approximately half that of the medial ridge. The trochlea is covered by articulating cartilage over an arc of 300 degrees. "9"

In the lateral plane the orientation of the articular surface of the distal humerus is rotated anteriorly about 30 degrees with respect to the long axis of the humerus. "9"

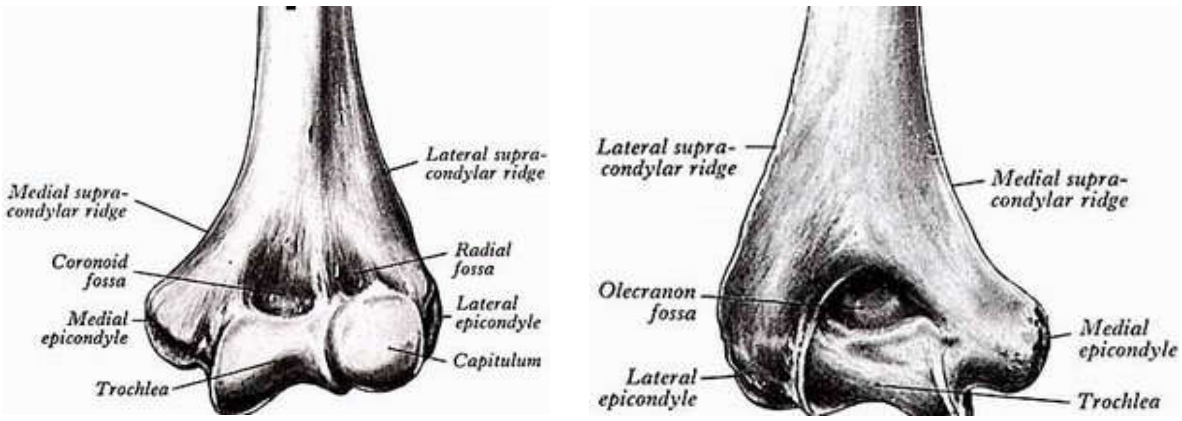

Fig.(1- 1) The distal end humerus, anterior and posterior views."10"

Proximal Radius: fig. (1-2)

The proximal radius includes the radial head, which articulates with the capitellum and exhibits a cylindrical shape with a depression in the midportion to accommodate the capitellum. The disk is secured to the ulna by the annular ligament. Distal to the radial head, the bone tapers to form the radial neck. "11"

Hyaline cartilage covers the depression of radial head as well as 240 degrees of the outside circumference that articulates with the ulna. The anterolateral third of the circumference of radial head is void of cartilage. This part lacks subchondal bone and thus is not as strong as the part that is supports the articular cartilage. This part has been demonstrated to be the portion most often fractured. "9"

Proximal Ulna: fig. (1-2)

The proximal ulna provides the major articulation of the elbow that is responsible for its inherent stability."10" It has large olecranon and coronoid processes and greater sigmoid and lesser sigmoid notches articulating with the humerus and radius. The olecranon, more proximal, is bent forwards at its summit like a beak, which enters the humeral olecranon fossa in extension. The coronoid process projects anteriorly distal to the olecranon, its proximal aspect forming the distal part of the greater sigmoid notch, distal to which, on the lateral

surface, is a shallow smooth, oval lesser sigmoid notch for articulation with the radial head. The coronoid's anterior surface is triangular, its distal part being the tuberosity of the ulna. "10"

In the lateral plane the greater sigmoid notch forms an arc of 190 degrees. The contour is not a true semicircle but rather is epllipsoid. This explains the articular void in the mid portion. The opening of the greater sigmoid notch is orientated approximately 30 degrees posterior to the long axis of the ulna. This matches the 30 degrees of inferior angulation of the distal humerus. "9"

The lesser sigmoid notch consists of a depression with an arc of about 70 degrees and is situated just distal to the lateral aspect of cronoid and articulates with the radial head. "9"

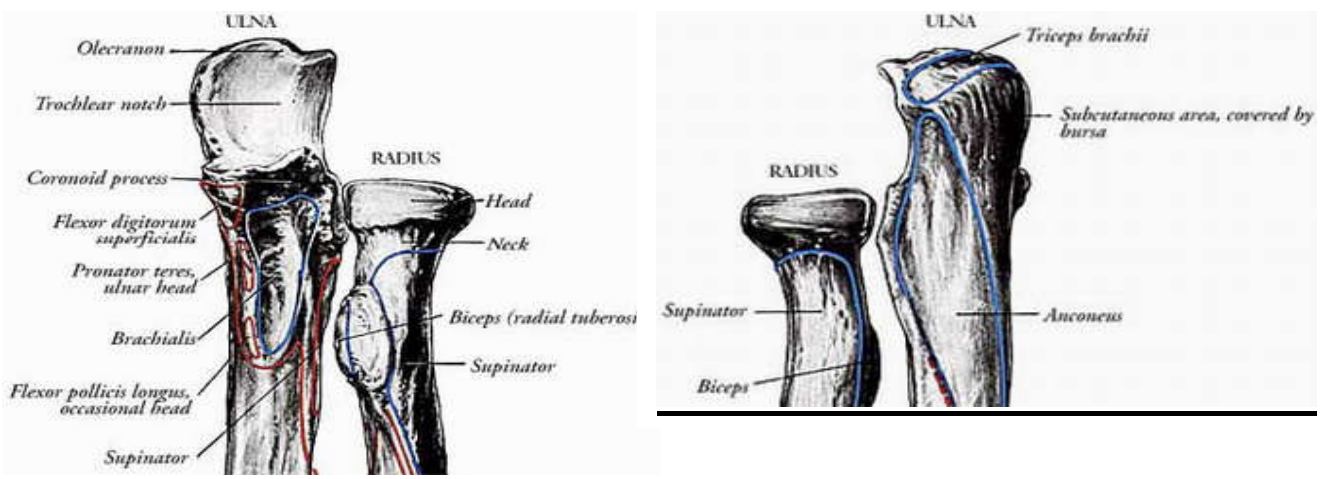

Fig. (1-2) Proximal end radius and ulna, anterior and posterior views. "10"

Joint Capsule: fig. (1-3)

The anterior capsule inserts proximally above the coronoid and radial fossae. Distally, the capsule attaches to the anterior margin of the coronoid medially as well as to the annular ligament laterally. Posteriorly, the capsule attaches just above the olecranon fossa, distally along the supracondylar columns, and then down along the medial and lateral margins of the trochlea. Distally, attachment is along the medial and lateral articular margin of sigmoid notch, and laterally, along the lateral aspect of greater sigmoid notch and blends with the annular ligament. "9"

The anterior capsule is normally a thin transparent structure that allows visualization of the prominence of the articular condyles when the elbow is extended. Significant strength is provided by transverse and obliquely directed fibrous bands. The anterior capsule is taut in extension but becomes lax in flexion. The normal capacity of fully distended elbow is 25 to 30 ml. "9"

The synovial membrane lines the deep surface of the capsule of the elbow and the non articular part of the humerus enclosed within the capsule, it also overlaps the articular margins of the capitellum and trochlea, being separated from the floor of olecranon fossa by a little oily fat. The synovium is separated from the capsule by fat pads opposite the olecranon, coronoid and radial fossae. The synovial

membrane of the proximal radioulnar joint is a prolongation downwards from the elbow laterally, the intra-capsular part of the radial neck is enclosed in tubular sheath and the membrane lines the annular ligament. The synovial membrane of the elbow and proximal rdioulnar joints are effectively one.["11"]

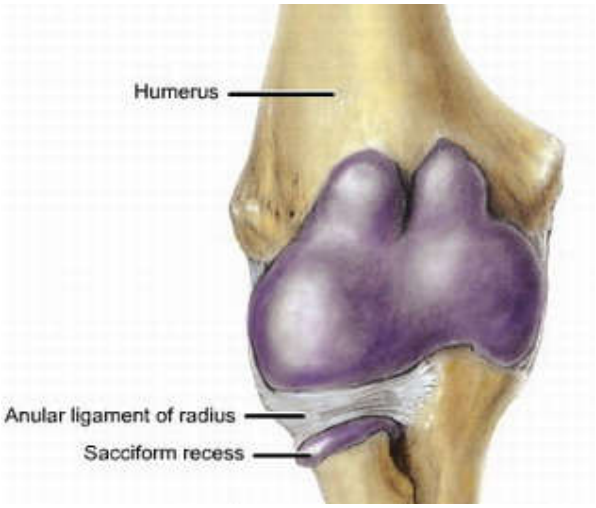

Fig. (1-3) Capsule of the elbow joint, anterior view. ["10"]

Ligaments

Medial Collateral Ligament Complex: fig. (1-4)

It is the primary stabilizer of the medial elbow. The MCL consists of three bands. The prominent anterior band "oblique bundle"

is the functionally significant ligamentous component resisting valgus elbow stress. The posterior and transverse bands have been described to have limited functional significance.["12"] The anterior band has variable morphology; it is either cord shaped or fan shaped. When the elbow is flexed tension is present posteriorly. In full elbow extension, the anterior fibers are tense while the more posterior fibers are lax. As the elbow flexes the middle and posterior fibers bundles become tense in succession. ["12"]

The origin of the ligament is posterior to the axis of flexion and extension, arising from the posterior distal aspect of the medial epicondyle. Its insertion has an arch configuration along the base of coronoid process. ["12"]

Morrey and Ann reported that in full extension, valgus stability was equally conferred by the MCL, anterior capsule, and bony articulation. At 90 degrees of flexion, they found the MCL provided 55% of valgus stability while the bony articulation provided the remainder. They reported a minimal contribution to stability by the posterior band of MCL and gross instability after isolated sectioning of the anterior band of the MCL. Quoted by Frank ["12"]

The role of the MCL as primary stabilizer of the medial elbow has been indirectly confirmed by surgical studies, Joseffsson et al noted that in 15 of 15 patients undergoing surgery for dislocation of the elbow there was a complete rupture of the anterior band of the

MCL. Quoted by Frank [12]

Lateral Collateral Ligament Complex: fig. (1-4)

Unlike the medial collateral ligament complex, with it rather constant pattern, the lateral ligaments of the elbow joint are less discrete, and some individual variation is common.[9] Morrey suggested that several components make up the lateral ligament complex: (1) the radial collateral ligament, (2) the annular ligament, (3) accessory lateral collateral ligament, (4) the lateral ulnar collateral ligament.

The radial collateral ligament originates from the lateral epicondyle and terminates in the annular ligament. Its superficial aspect provides a source of origin for a portion of the supinator muscle. The length averages approximately 20 mm with a width of approximately 8mm. this portion of the ligament is almost uniform taut throughout the normal range of flexion and extension.[9]

The annular ligament is a strong band of tissue originating and inserting on the anterior and posterior borders of the lesser sigmoid notch maintaining the radial head in contact with the ulna. The ligament contributes to four-fifths of the fibro-oseous ring.[9] A synovial reflection extends distal to the lower margin of the annular ligament forming the sacciform recess. The radial head is not pure circular disc, thus it has been observed that the anterior insertion

becomes taut during supination and the posterior aspect becomes taut during extremes of pronation. "9"

The lateral ulnar collateral ligament is first described by Morrey and An. It originates from the lateral epicondyle and blending with the fibers of the annular ligament. The insertion is to the tubercle of the supinator crest of the ulna. It represents the lateral stabilizer of the elbow and is taut in flexion and extension. "9"

Superficial fibers of annular ligament have been noted to attach on the ulna separately, and these fibers are the accessory lateral collateral ligament. This ligament is seen in only small percentage of cadavers. "9"

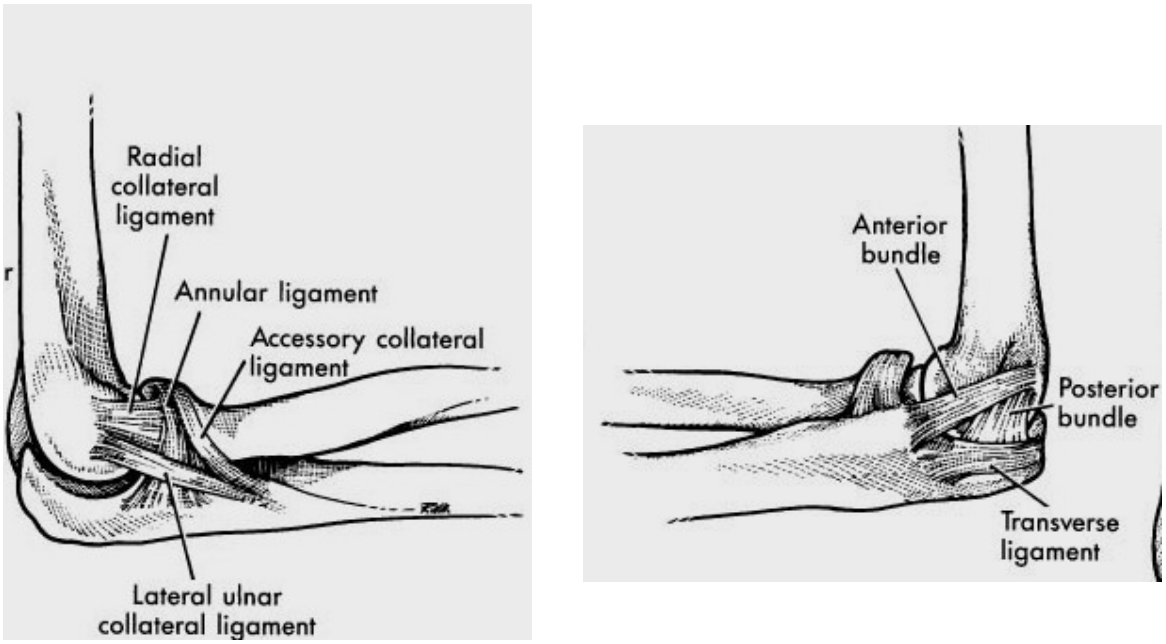

Fig. (1-4) ligaments of the elbow joint, lateral and medial views. "10"

Related Arteries and Nerves

Brachial Artery: fig. (1-5)

At the elbow the brachial artery sinks deeply into the triangular intermuscular cubital fossa. The fossa's base is an inter-epicondylar line, the sides being the medial edge of the brachioradialis and the lateral margin of pronator teres; the 'floor' consists of brachialis and supinator. The fossa contains the tendon of the biceps, the terminal part of the brachial artery and accompanying veins, the beginning of the radial and ulnar arteries and parts of the median and radial nerves. The brachial artery is central and it divides near the neck of the radius into its terminal branches, the radial and ulnar arteries. Anterior to it are the skin, superficial fascia and median cubital vein, separated by the bicipital aponeurosis. Posteriorly the brachialis separates it from the elbow joint. "10"

Radial Artery: fig. (1-5)

In most instances, the radial artery originates at the level of the radial head emerges from the antecubital space between the brachioradialis and the pronator teres muscle, and continues down the forearm under the brachioradialis muscle. A more proximal origin occurs in up to 15 percent of individuals. "10"

Ulnar Artery: fig. (1-5)

The ulnar artery is the largest of the two terminal branches of the brachial artery. There is relatively little variation in its origin, which is usually at the level of the radial head. The artery traverses the pronator teres between its two heads and continues distally and medially behind the flexor digitorum superficialis muscle. "10"

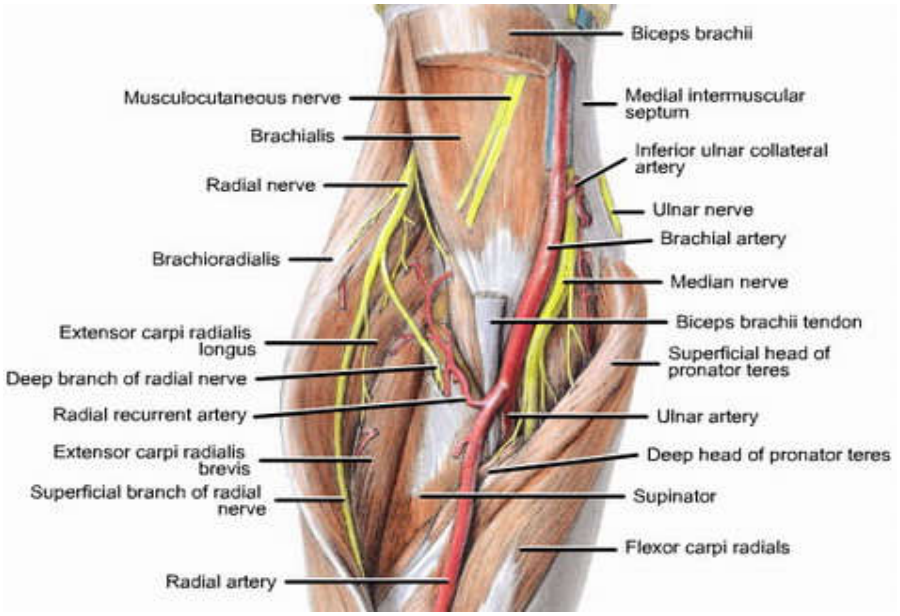

Fig. (1-5) Arteries related to the elbow joint. "10"

Median Nerve: fig. (1-6)

The median nerve enters the arm at first lateral to the brachial artery; near the insertion of the coracobrachialis it crosses in front of (rarely behind) the artery, descending medial to it to the cubital fossa where it is posterior to the bicipital aponeurosis and anterior to the brachialis, separated by the latter from the elbow joint, It usually