Elbow Instability

Essay

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KEYWORDS

The elow is a hing joint , composed of three joints, Ulno -humeral , radio -capitellar and radio -ulnar joint. The stability of the elbow is based on intact joint surface, medial and lateral collateral ligament . Diagnoses of instability is based on detailed history and physical examination . X-ray , CT and MRI and arthroscopic examination . Treatment is carried out by reconstruction of both collateral ligaments and treatment of associated fractures .

(Bell CM ,Galatz LM ,Yamaguchi K: Elbow instability,treatment strategies and emerging concepts.In Beaty JH, ed.Instructional course lectures(vol.51)American Academy of orthopedic surgery;2002:53-61.)

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INTRODUCTION

Elbow instability represents a spectrum from the acute traumatic dislocation to chronic laxity resulting in transient joint subluxation.In general ,acute elbow dislocation represent the second most common joint dislocation in the adult population and the most common joint dislocation in the pediatric age group.(Botte et al ,2003)

The elbow is a comlex joint that acts as a component link of the lever arm system in placing the hand . As a fulcrum for the forearm lever , it provides the power to perform lifting activities.With crutch walking, the elbow is a weight – bearing joint , In power and fine work activities , the elbow stabilizes the upper extremity linkage (Simon et al, 1994).

Elbow stability is maintained by both static and dynamic constraints.The three primary static constraints to elbow instability are the ulnohumeral articulation,the medial collateral ligament ,an d the lateral collateral ligament complex.The secondary static constraints to stability include the radial head,the common flexor and extensor origins,and the joint capsule.Dynamic constraints to elbow stability is the muscular structures that cross the el bow and function to produce a compressive force at the articular surface (O'Driscoll,2000).

Acute elbow dislocation or instability typically occurs from a fall on the outstretched hand .The body will rotate internall y creating a supination force a cross the elbow joint.A valgus moment results and this combination of valgus stability and supination with axial compression during flexion is the accepted mechanism of instability.While chronic instability can occur as a result of overus e and micro-trauma or as a sequele to acute injuries.Athletic activities including throwing , hammering , pushing , or pulling produces significant stresses about the elbow joint that can result in acute and chronic injuries (Morrey,2000).

The diagnosis of the different types of elbow instability is based on careful history and physical examination combined with radiographs,including plain x-ray,tomography,in addition to MRI and CT scan(Bell,2002).

The aim of the treating instability is to recognize th e pathomechanics and symptoms of the injuries in the elbow and design an appropriate treatment plan for the patient (Jobe et al,1997).

Anatomy of the elbow

The elbow is a synovial joint of the hinge variety between the lower end of the humerus and the upper ends of the radius and the ulna.(O'Driscoll,2000)

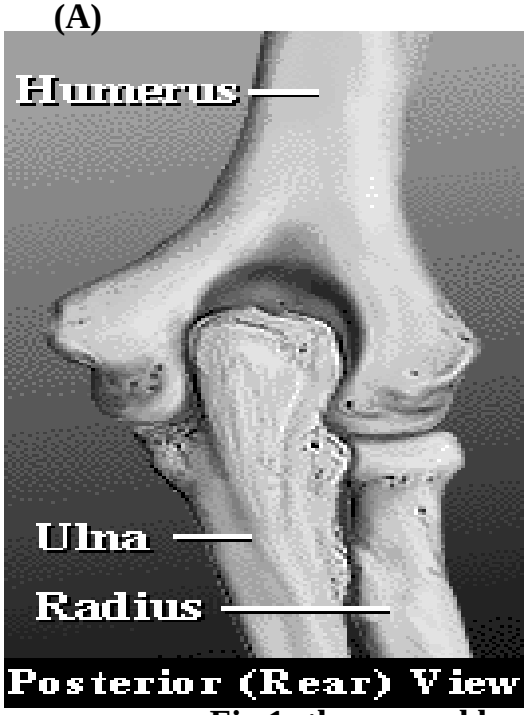
The elbow is actually a combination of thr ee joints(fig.1,A):

1.Ulnohumeral joint : between the trochlea of the humerus and the trochlear notch of the ulna.

2.Radiocapitellar joint : between the capitulum of the humerus and the facet on the head of radius.

3.Superior Radioulnar joint : between the circumference of the head of radius and the osseo-fibrous ring formed by the radial notch of the ulna and the annular ligament

(A)



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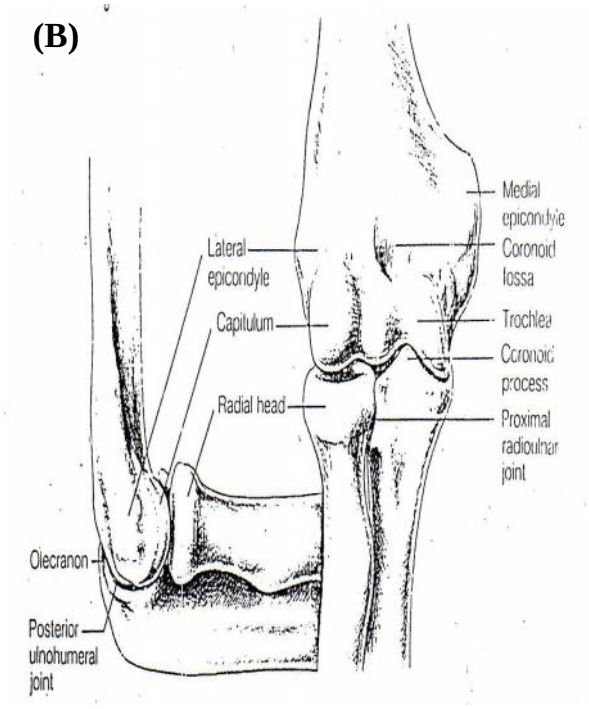

Fig.1: the normal bony articulature of the elbow.

(*Esch and Baker,1993).*

The bony anatomy allows two complex motions: (Fig.1,B)

●. Elbow flexion-extention.

●. Forearm pronation-supination.

The broad,Stable range of motion is imparted by complex interaction of conforming (reciprocal) articulation surface, Capsuloligamentous restraints and dynamic (muscular) stabilizers.(Cage et al,1995)

The Articular Surfaces

The lower end of the humerus:(fig.2)

The distal aspect of the humerus divides into medial and lateral columns. Each of them is roughly triangular and is bound on its outer border by a supracondylar ridge . The divergence of these two columns increases the diameter of the distal humerus in the lateral plane . The distal humerus is divided into medial and lateral components called condyles , each containing articulating portion and a non-articulating portion . Included on the non-articulating portion are the epicondyles, which are the terminal points of the supracondylar ridges.

●-The lateral epicondyle contains a roughened posterolateral surface from which the superf ecial forearm muscles arise.

●- The medial epicondyle is larger than the lateral and serves as the origin of the forearm flexor muscles.

●- The articulating surface of the lateral condyle is hemispherical and projects anteriorly , its called the capitulum, or "little head".Its convex surface articulates with the reciprocally concave head of the radius.

●- The articulating surface of the medial condyle shows the troclea , which is more cylindrical or spool-like.It has very prominent medial and lateral ridges . Between these ridges is a central groove that articulates with the greater sigmoid (semilunar) notch of the proximal ulna . The diameter of the trochlea at this groove is approximately half that of the medial ridge.

The trochlear groove originates anteriorly in the coronoid fossa and terminates posteriorly in the olecranon fossa. On the posterior aspect of the trochlea ,the groove is directed slightly laterally.This obliquity of the trochlear groove produces the valgus " carrying angle"of the forearm when the elbow is extended.

Between the lateral ridge of the trochlea and the hemispheric surface of the capitulum, a sulcus separates the medial and lateral condyles . (The capitulotrochlear sulcus) articulates with the peripheral ridge of the head of radius.

●-The coronoid fossa lies on the anterior surface of humerus proximal to the medial condyle.It receives the coronoid process when the elbow is flexed.

●-The radial fossa lies on the anterior surface of the humerus proximal to the lateral condyle.It receives the head of radius when the elbow is flexed.

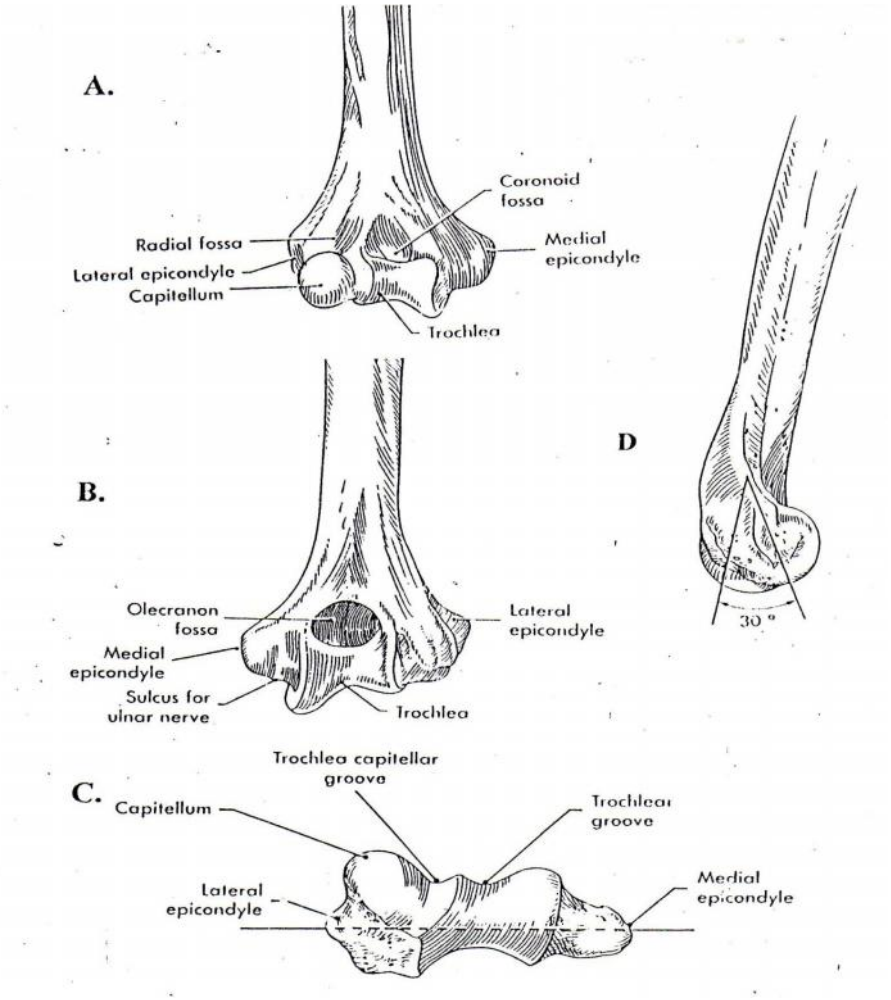

Fig. 2: Distal part of the humerus.

A) Anterior view of the right humerus.

B) Posterior view.

C) Distal view demonstrating the medial rotation of the articular surfaces compared to the axis of the epicondyles.

D) Lateral view , the anterior orientation of the articular surfaces.

(Caldwell et al,1995)

●The olecranon fossa lies on the posterior surface of the humerus proximal to the medial condyle .It is deep hollow for the reception of the olecranon, making it possible for the elbow to go into full of the extension.(Gray,1973)

The upper end of the ulna (fig.3)

It shows the deep trochlear notch . A curved ridge joins the prominences of the coronoid process and the olecranon . The ridge fits the groove in the trochlea of the humerus . The obliquity of the shaft of the ulna to this ridge accounts fo r most of the carrying angle at the elbow .There are commonly two separate articular surfaces in the trochlear notch one on the olecranon and the other on the coronoid process.(McMinn,1994)

The central portion is devoid of articular cartilage a nd covered with a little fibrofatty tissue and synovial membrane.(Gray,1973)

The opening of the trochlear notch is angled 30 degrees posteriorly , allowing for maximum range of motion while maintaining significant articular conformity.At full e xtension , the olecranon tip fits precisely within the eolecranon fossa,while in full flexion,the coronoid process lies within the coronoid fossa.(Caldwell et al,1995)

The Head of Radius:

The upper surface of the cylindrical head of the radius i s spherically concave to fit the capitulum.(Cage et al,1995)

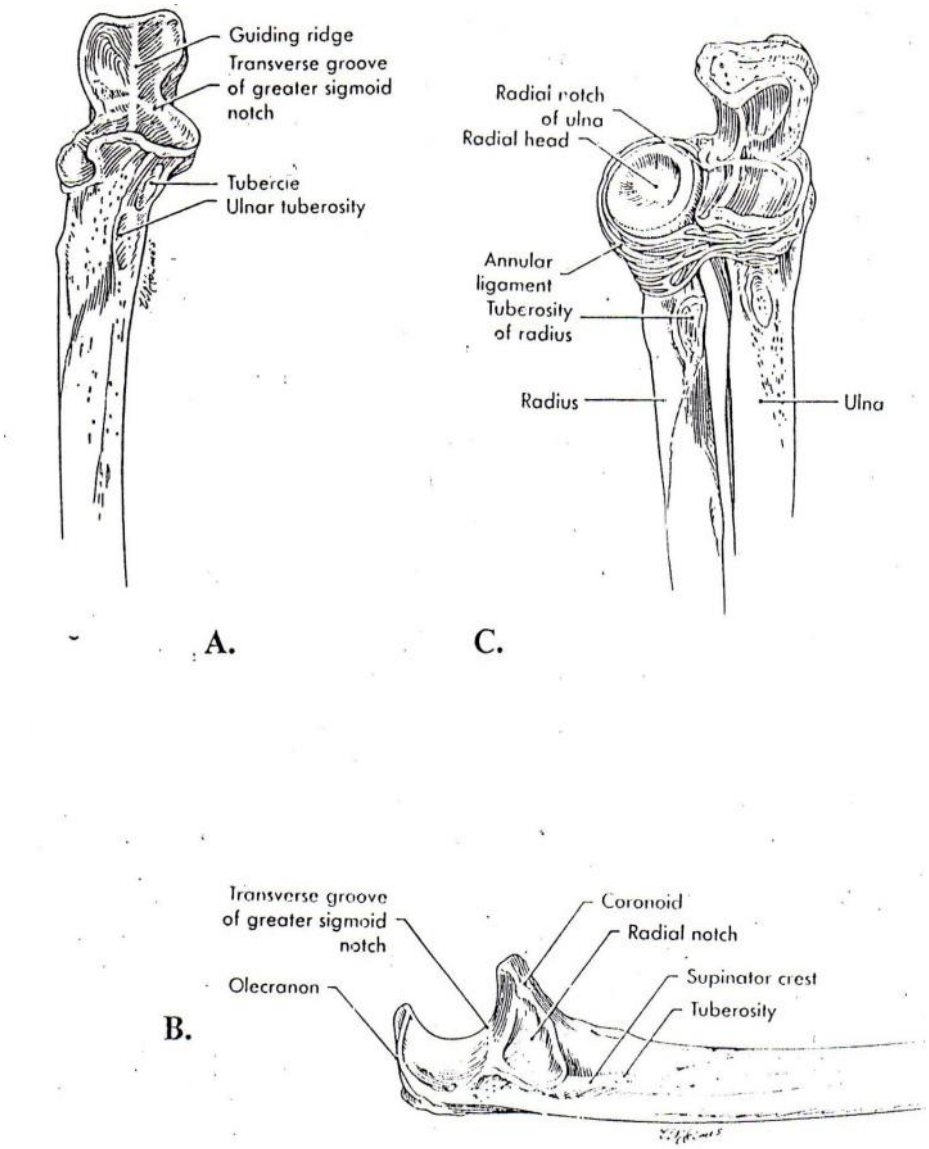

Fig.3: Proximal ulna and radioulnar joint.

A) Anterior view of the proximal ulna.

B) Lateral view of the proximal ulna.

C) Anterior view of the proximal radioulnar complex.Note the congruity of the radial head,annular ligament and radial notch of the ulna.

(Esch and Baker,1993)

The capitulum and the head of radius are reciprocally curved but the best contact is obtained when the semi-flexed radius is in the mid –prone postion . The rim of the head , which is more prominent medially, fits into the groove between the capitulum and the trochlea.(Gray,1973)

The Proximal Radio-Ulnar joint:

The articulation forms a uni-axial pivot between the circumference of the head of radius and the osseo-fibrous ring formed by the radial notch of the ulna and the annular ligament .This joint is synovial and it is continous with the elbow joint.(Gray,1973)

Anatomy of the capsule

The capsule is attached to the humerus at the margins of the lower rounded ends of the articular surfaces of the capitulum and the trochlea , but in front and behind it is carried up over the bone above the coronoid and olecranon fossa.Distally,the capsule is attached to the trochlear notch of the ulna at the edge of the articular cartilage,and to the annular ligament of the proximal radio-ulnar joint.It is not attached to the radius.(MicMinn,1994)

The posterior part of the capsule is very weak in its median part,but the overlying tendon of the triceps is attached to it supporting it and drawing it upward in extension.(Cohen et al,2001)