DISLOCATION OF HEAD RADIUS IN CHILDREN

Essay submeted for partial fulfillment of Master degree of Orthopaedic surgery

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2008

Abstract

Dislocation of the head radius in children was wrongly considered a rare condition due to underestimation of cases . However, due to the development of better methods of investigations and treatment it has attracted the attension of many others new. Dislocation may be subluxation (pulled elbow) which is a very common condition. And usually needs no treatment apart from closed reduction.

Key Words :

DISLOCATION OF HEAD RADIUS

Acknowledgment

First, and foremost, I feel always indebted to Allah, The most kind and the most merciful, who guided and aided me to bring this work to light, I would like to express my deepest gratitude and sincerest thanks to **Prof. Dr. Mohamed Kamel Godah** professor of Orthopaedic Surgery, Faculty of Medicine, Cairo university, as he gave me privilege to work under his supervision and valuable advices.

I would like to express my greatest thanks and deepest appreciations to **ASS. Prof. Dr. Wessam Gaber Elanany** professor of Orthopaedic Surgery, Faculty of Medicine, Cairo university, for his comments, ideas, constrictive criticism and support throughout this work. He offered me a lot of help and encouragement.

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Introduction

Originally, isolated dislocation of the radial head is a rare entity, due to under-recognition of cases, however, The cases have been increasingly recognized,

The condition is considered rare mainly due to unclear history, unreliable patients, and familial incoherence.

The average age of incidence is around seven years. There is no sex predilection, however, some claim that traumatic Monteggia is more in male.

The condition may be classified in different ways either according to : -

A- Degree of dislocation whether subluxation or dislocation.

B- Etiologic, whether congenital, acquired, isolated, or developmental.

C- Anatomic, whether anterior, posterior, or lateral.

<u>ANATOMY</u>

The elbow joint is a complex one including three joints included in a common articular cavity.

Embryology

Most of the development of the elbow joint is compelete by 9 weeks. The first sign of joint spaces appears at 8.5 weeks of gestation in the form of three joint cavities, not yet coalesced. At term, they are coalesced, and the capsule reaches maturity. by 9 weeks all of these contain collagen, especially medially and laterally under the future collateral ligaments. ***(Gray, 1992).***

Ossification:

The head radius starts to ossify early at the same time as the medial epicondyle. The ossification center appears by 4 years but may not appear in the same number of boys until 4.5 years. At first the ossification center is elliptical, then it starts to be flatenned as it matures. At about 12 years, it develops a concavity opposite the capitellum. The ossification center may be bipartite and may produce irregularity of the second center ***(Gray, 1992).***

The differentiation and maturation begin at the center of the bone, but it ossifies proximally first at the level of the neck with radial tuberosity remaining unossified until maturity. The ossification center of the head radius fuses with the shaft in the 14 year in females and 17 in males.

Morphology:

The shape of radial head differs as it matures, first it is discoid then becomes rounded its diameter is 1.5 to 3 cm at maturity. The size of radial head varies with ages, as at birth it appear the same diameter as the neck, while at 5 years age, it appears larger. The average ratio of adult and fetal head to neck is quite similar.

The shallow concavity of the head articulates with the capitellum and its border articulates with the coronoid process in the radial notch. The capitellum and the radial head are reciprocally curved and almost contact occurs with a semiflexed radius in pronation.

The capitellum is less than half a sphere and includes inferior and anterior surfaces. The radial head abuts the inferior capitellum in full extension. The radial tuberosity which is extra-articular has rouph posterior portion for biceps insertion*.*

The head is elliptical in cross section. In supination, the long axis of the ellipse is perpendicular to the ulna causing the annular ligament and the anterior border of the quadrate ligament to stabilize the proximal radio-ulnar joint*.*

The contact between the radius and the radial notch is greater in supination due to the broad surface area of the radial head at this position. The portion of the radial head adjacent to the radial notch is less curved and longer proximal to distal than other portion of the circumference. ***(Magil and aitken, 1954).***

Bow of the radius:

The apex of the radius is lateral allowing increased pronation range as the radius rotates around the axis between proximal and distal radio-ulnar joint. ***(Gray, 1992).***

Stability of radial head :

The radial head is kept in place mainly by lateral collateral ligament and the annular ligament *(Fig. 1)*

lateral collateral ligament :

The lateral collateral ligament is fan shaped and extends from the lateral epicondyle to the annular ligament. Some of the posterior fibres of the radial collateral ligament cross the ligament to the proximal end of the ulna's supinator crest. It is intimately blended with the supinator and extensor carpi radialis brevis .

It is the primary stabilizer of the elbow joint and some consider it is the secondry stabilizer of the radial head and the radio-ulnar joint. ***(Gray, 1992).***

The annular ligament (Fig. 2):

The orbicular (The annular) ligament consists of strong thick fibers somewhat thicker than the capsule. It encircles the radial head forming four-fifths of a ring retaining the head within the radial notch but allowing it to rotate freely. It may be divided to several bands which may reach the lateral trochlear notch above. ***(Martin,1928).***

The annular ligament's external surface blends with the radial collateral ligament, and has an attachment to a part of the supinator. Posterior to it, are the anconeous and the interosseous recurrent artery. Internally, the ligaments is covered by cartilage where it is in contact with the radial head, distally, it is covered by the synovial membrane which is reflected upwards to the radial neck. *(Martin,1928).*

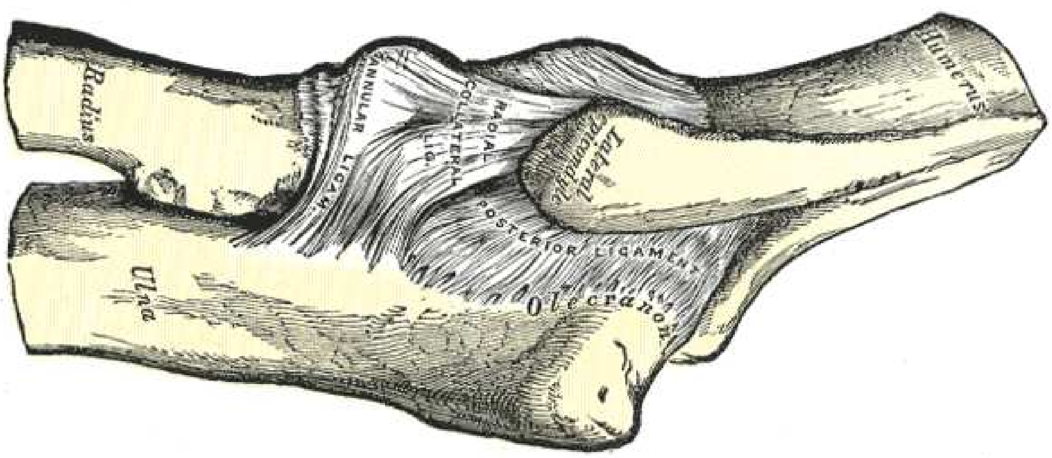

Fig.(1): lateral view of the elbow showing the main stabilizing factors of the elbow

Less imortant stabilizing factors :

The quadrate ligament :

It is a thin quadrangular fibrous band extending from the lower border of the radial notch of the ulna to the neck of the radius closing the joint infer-medially

The oblique cord :

Small instance, thin fasical band on the deep head of the supinator extending from the lateral side of the ulnar tuberosity to the radius distal to its tuberosity and its fibers are perpendicular to those of the interosseous membrane. ***(Martin,1928).***

The interosseous membrane (Fig. 3) :

Broad thin fibrous sheet with its fibers extending disto-medially between the interosseous borders of the radius and the ulna. It is proximally deficient, starting 2 to 3 cm distal to the radial tuberosity, It is broader at its middle and has an oval aperture neer its distal margin conducting the anterior interosseous vessels passing to the back of the forearm.

Its main function is to augment the deep group of muscles attachments and to connect both bones. It transmits forces passing from the humerus to the radius and the hand. The membrane is tense only when the hand is midway between pronation and supination and relaxed in compelete pronation and supination. ***(Martin,1928).***

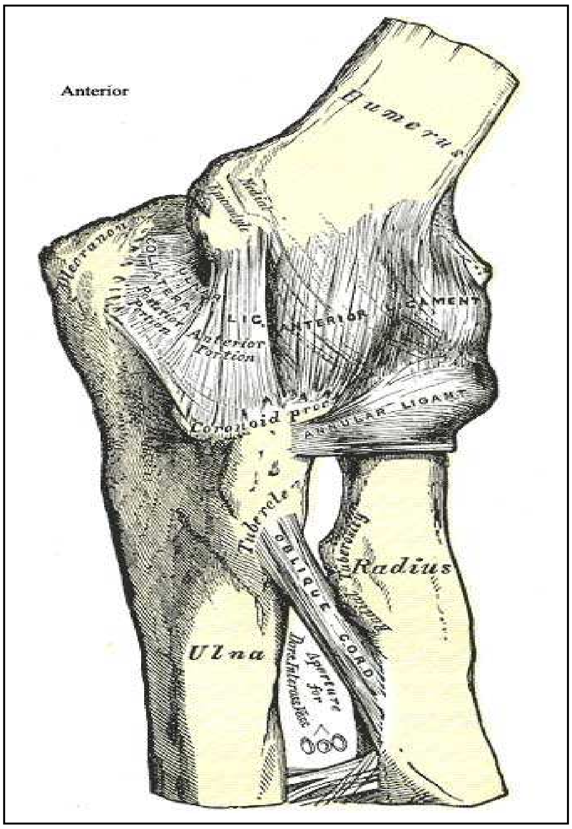

Fig.(2): the annular ligament, the oblique cord and the radial collateral ligament

Relation:

Anteriorly in its proximal three quarters it gives attachment to flexor pollicis longus (laterally) and flexor digitorum profundus (medially) with the interosseous vessels In between. In its distal quarter, it is related to prontor quadratus *.*

Posteriorly it is related to supinator, abductor pollicis longus, extensor pollicis brevis, and longus, extensor indicis, the carpus, the anterior interosseous artery and the posterior interosseous nerve. ***(Martin,1928).***

A . styloid process of radius .
B . radius .
C . radial tuberosity
D . neck of radius
E . head of radius
F . olecranon process
G . trochlear notch
H . cronoid process
I . proximal R. U . J .
J . ulna
K . interosseous membrane
L . head of ulna
M . styloid process of ulna
N . distal R. U . J.

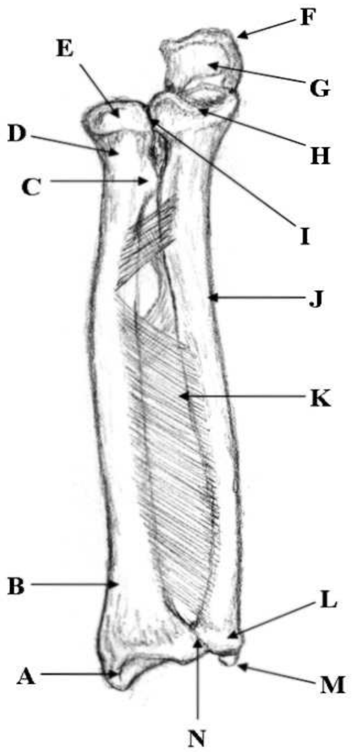

Fig.(3): . interosseous membrane of the forearm
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Blood supply :

The blood supply of head radius comes from the rich anastomosis around the elbow. The major arterial trunk which is the brachial artery lies in the ante-cubital fossa. The blood supply of the elbow can be divided into intra-osseous and Extra-osseous blood vessels.

Extra-osseous come from the vessels which course posteriorly. They have two characters, first, no communication between the metaphyseal vasculature and the ossific centers, second, The vessels do not penetrate the articular surfaces (Fig. 4)

Intra- osseous blood vessels are supplying mainly the developping distal humerus namely the lateral condyle and thus they are not our subject.

The blood supply comes mainly from anastomosis around the lateral epicondyle consisting of :

1- Infront the lateral epicondyle:

- The anterior descenging branch of profunda (radial collateral) anastomosis with the radial recurrent branch of brachial artery.

2- Behind the lateral epicondyle:

- The posterior descenging branch of profunda anastomosis with posterior interosseous recurrent artery (branch of posterior interosseous artery.

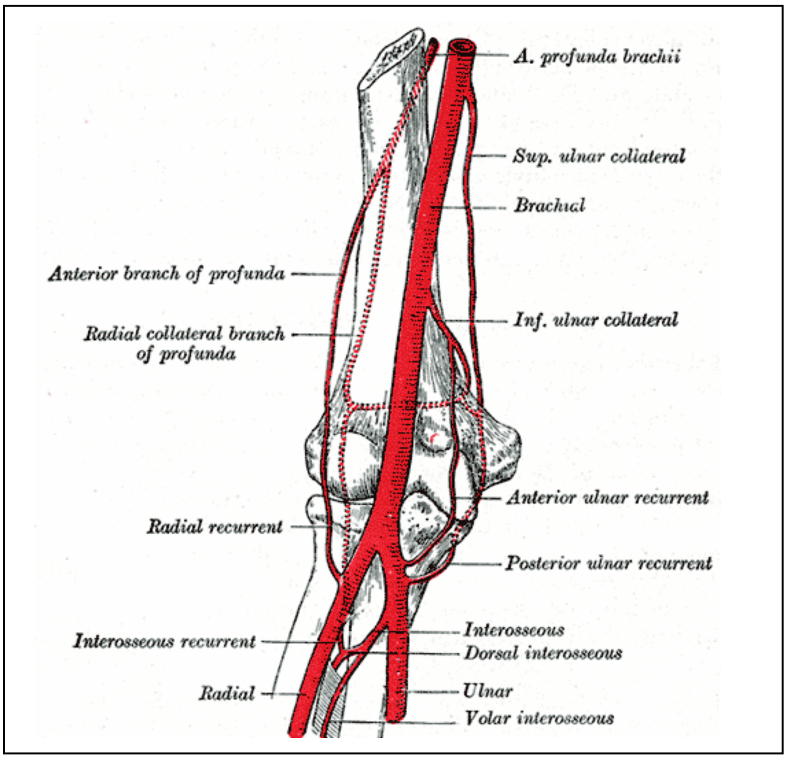

Fig.(4): . the major arteries around the elbow
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Role of radial head in elbow stability:

The elbow owes its extension stability in part to the radial head. Meaning that any radial head injury may be associated with other soft tissue injuries that may jeopardize elbow stability. The soft tissue injury that may accompany radial head injuries is mainly rupture of medial collateral ligament producing valgus instability ***(Morrey and Kaio,1983).*** The radio-capitellar contact may resist valgus forces preventing recurrent dislocation or excessive valgus displacement. ***(O'driscoll et al., 1991).***

In extension the varus and valgus forces exerted across the collateral stabilizing factors are increased due to long lever arm of the forearm and any radial head injury elongates this lever arm. Besides, the anterior capsule becomes taut and resists valgus stress.

In flexion, the posterolateral rotational stability of the elbow is mainly due to an intact radial head. Most stressful activities such as lifting, exert valgus stress at the elbow, which is resisted mainly by ligaments, joint surfaces and by muscle action. ***(Ashrst,1910).***

In flexion, the anterior of the radial collateral ligament is the primary stabilizer aided by radial head which provides a broader base and increases the mechanical advantage of the medial collateral ligament. ***(Morrey and Kaio,1983).***

Biomechanics:

The radial head is seated in the lesser segmoid notch and maintains contact with the ulna through-out forearm pronation and supination.

The dynamic stability provided by flexors, extensors, anteromedial and lateral collateral ligament should not be ignored ***(Schwab et al., 1987).***

Joint reaction forces of the elbow have been calculated to reach two or three times arm weight during strenuous lifting with more stress applied on the radio-capitellar axis and positioning of the elbow affects these forces as they decrease on moving to flexion. ***(Morrey et al.,1979 and Solomonow., 1963).***

Valgus stress at the elbow is resisted by the radio-capitellar axis. Varus stresses are less problematic and resisted mainly by the lateral collateral ligament and anconeus. ***(O'Driscoll et al.,1991).***

When the forearm is loaded in grip or lifting some load sharing occur between the ulno-humeral and radio-capitellar joints but the exact ratio and position dependance are not known. ***(Schwab et al., 1987).***

Morrey and Co-workers have shown in cadavers that as the forearm rotates, there is measurable change in the contact at the radio-capitellar joint. ***(Morrey and Kaio,1983).***