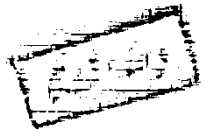
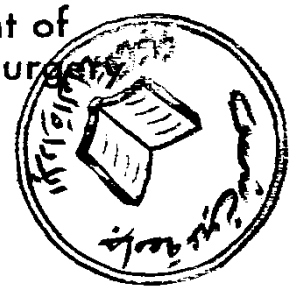
MANAGEMENT OF INTRA-ARTICULAR FRACTURES OF THE DISTAL RADIUS IN YOUNG ADULTS



Thesis

Submitted for partial fulfillment of
M.D. degree in Orthopaedic Surgery



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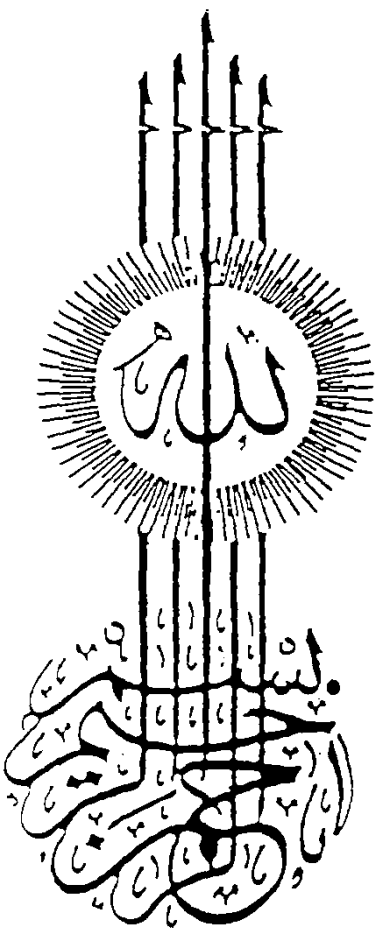
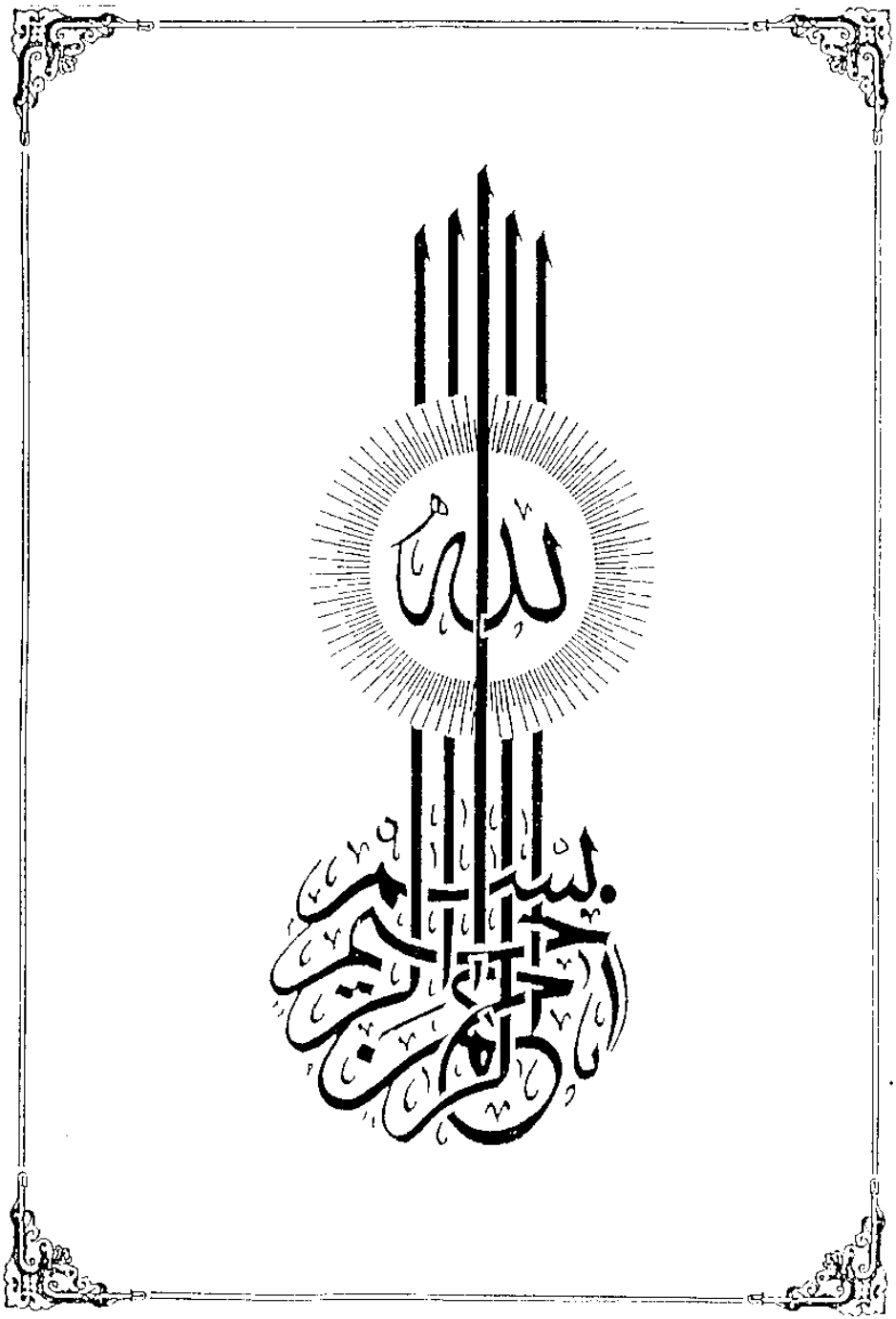




AKNOWLEDGMENT

I would like to express my sincere thanks to prof. Dr. Mamdouh Zaki, Professor of Orthopaedic Surgery, Ain Shams University, for his supervision and encouragement to complete this subject.

I am greatly indebted to Prof. Dr. M. Nabil Khalifa, Professor of Orthopaedic Surgery, Ain Shams University who evoked the subject of this study and who was continually guiding and supporting me throughout the accomplishment of this work.

My thanks are also extended to Dr. M. Sadek El Sokkary, Lecturer of Orthopaedic Surgery, Ain Shams University for his valuable advice and guidance.

I am deeply indebted to Dr Gamal El Shentenaway, Consultant Orthopaedic Surgery, Hamad Medical corporation, for his valuable instructions and advice and persistent encouragement and support which had a definite great impact on this work.

I wish also to express my thanks to Dr P. Ahlbeck, Head of Orthopaedic Department, Hamad Medical Corporation and all my colleagues for their constant support and referring their cases to our team.

My appreciation is also extended to Dr Ahmed El-Sherif, Specialist Urologist, Hamad Medical Corporation for his effort in designing the outlay and the desktop publishing of this manuscript.

Finally, I am very grateful to my wife for her patience, sacrifice , understanding and support over the last three years until this work was completed.

CONTENTS

ABBREVIATIONS

DRF.	Distal Radial fracture.
DRFs.	Distal Radial Fractures.
TFCC	Triangular Fibrocartilage Complex.
TFC	Triangular Fibrocartilage.
RIU	Radio-Ulnar
DCLC	Dorsal Carpal Ligament Complex.
UCL	Ulno-Carpal Ligament.
K-wire	Kirschner wire
RTA	Road Traffic Accident.
CR	Closed Reduction.
CREF	Closed Reduction and External Fixation.
ORIF	Open Reduction and Internal Fixation.
No. (in table or figure)	Number of Cases.
No.	Number
%	Percentage
mm	Millimetre.
cm	Centimetre.
°	Degree

INTRODUCTION

INTRODUCTION

Fractures of the distal radius represent the most common fractures of the upper extremity and probably the most common fractures of the human skeleton in general. Beginning with the works of **Pouteu (1783)**, then **Colles (1814)** and later **Dupuytren (1847)** many physicians have thought of distal radius fractures as a homogenous group of injuries with relatively good prognosis, irrespective of the treatment given **(Green, 1988)**.

Because of their frequency, fractures of the distal radius are often regarded and treated casually. The great majority are treated conservatively. Unfortunately, the end result of treatment often leaves much to be desired. The fracture that Abraham Colles described was extra-articular and occurred from a fall on the outstretched hand in a somewhat osteoporotic individual. Today, however, distal radius fractures are recognized as very complex injuries. Different age groups and different mechanisms of injury are now encountered. A variable prognosis is recognizable depending upon the fracture type and the treatment given. Serious disability can result if the reduction is inexact or if secondary displacement occurs, which some authors describe in approximately half the cases.

Cooney, Dobyns and Linscheid (1980) studied 565 Colles' fractures and found 31% with persistent neuropathies, radiocarpal or radioulnar arthritis, and malunions. In many patients, incomplete restoration of radial length or loss of position after reduction caused the complications **(Campbell, 1987)**.

The recent literature discussing this injury is immense. Many authors tried to classify these fractures according to the direction of displacement, the fracture configuration, the degree of comminution, or the mechanism of injury. Controversy and confusion are found throughout the literature as the best way to classify and to treat a fracture of the distal radius. However, the fundamental principle agreed by most authors is the restoration of anatomy, with the hope of producing full painless motion. The method selected to achieve this objective can only be determined after careful study of the individual fracture.

Recently the intra-articular type of these fractures is recognized as a separate group of injuries that received special interest regarding its classification, treatment, and the outcome results. The number of young adults suffered such fracture is increasing nowadays due to more violent trauma which may leave them with serious disabilities.

The aim of this work is to study the intra-articular fractures of the distal radius in young adults treated surgically by closed reduction and external fixation or open reduction and external fixation or both.

ANATOMY

ANATOMY OF THE DISTAL RADIUS

The radius, which plays a secondary role at the elbow, becomes the dominant bone at the wrist, being responsible for the entire bony articulation between the forearm and hand and thus subject to the major forces in falls on outstretched hand (**Osterman and Bora, 1980**).

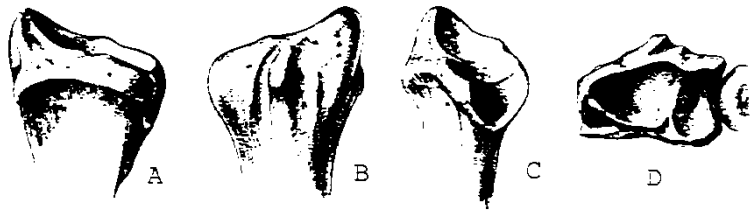
The distal radius functions as an articular plateau upon which the carpus rest, and from which the radially based supporting ligaments of the wrist arise. The hand and radius, as a unit, articulates with and rotates about the ulnar head via sigmoid notch of the radius. This latter relationship is maintained primarily by the ulnar-based supporting ligaments of the wrist: the triangular fibrocartilage complex *(TFCC)*.

Studies have shown that the radius, through its articulation with the lateral carpus, carries approximately 80% of the axial load of the forearm and that the ulna, through its articulation with the medial carpus, via the TFCC, carries about 20%. Changes in the forearm unit length ratio, as seen with a settled DRF, increase radial loading beyond physiological limits. Despite the load borne by the distal radius and the wide range of motion to which the wrist is subjected, a precise relationship is normally maintained among the various components of the wrist joint. This intrinsic stability is the result of the inherent geometry of the distal radial articulations and their surrounding ligamentous supports (**Palmer, 1988**).

The metaphyseal flare of the distal radius begins a few centimeters above the distal articular surface. As the radius flares, the thickness of the cortical bone decreases and the amount of cancellous bone increases. This compromises the shock-absorbing role, hence the frequency of fractures at this region.

FIGURE 1.

The Surfaces of the distal radius: A- anterior; B- Posterior; C- medial and D. Distal articular.



For descriptive reasons the distal radius is divided into five surfaces:

1. The Anterior Surface

It is a smooth and concave in both planes forming a hollow which is covered by the pronator quadratus, over which the flexor tendons and the median nerve pass as they enter the carpal canal. Distal to this hollow, the anterior surface shows a prominent ridge which can be felt about 2.5 cm above the ball of the thumb. Between this ridge and the articular margin is a smooth area, pitted with vascular foramina. From this area arise the major radial supporting ligaments of the wrist; the radial collateral ligaments, radio-capitate, and radiotriquetral ligaments **(Harrison et al., 1972)**. At the palmar aspect of the anterior-posterior mid radial ridge is a tubercle for origin of the very important radioscapholunate ligament or ligament of "Testut", (fig. 2).

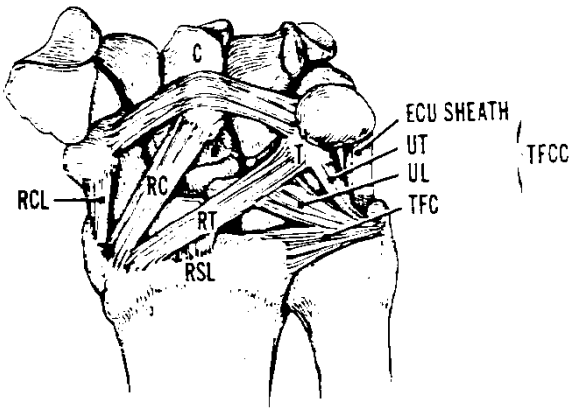


FIGURE 2. The volar ligaments of the wrist. (RCL=radial collateral ligament; RC=radiocapitate; C= capitate; RT = radiotriquetral ; T = triquetrum; RSL = radioscapholunate; TFCC = triangular fibrocartilage complex; ECU = extensor carpi ulnaris; UT = ulnotriquetral; UL = ulnolunate; TFC = triangular fibrocartilage. After (Palmer A.K., 1988).

2. The Lateral Surface

It is about 1 cm wide and it is a shallow groove for the tendons of the abductor pollicis longus and extensor pollicis brevis as they lie in their synovial sheaths in a single compartment beneath the extensor retinaculum. The edge between this groove and the ante-

rior surface is sharp and easily felt. It gives attachment to the extensor retinaculum (Harrison et al., 1972).

The lateral surface projects downwards as a pyramidal styloid process with the brachioradialis tendon inserted into its base. The radial collateral ligament of the wrist is also attached to it. It is palpable in the proximal part of the anatomical snuff box. Its apex is about 1 cm lower than that of the ulnar styloid. Absence of this feature indicates shortening of the radius in case of fractures.

3. The Posterior Surface

It is convex, with grooves locating the extensor tendons. It acts as a fulcrum for extensor tendon function. The lateral half of this surface continues down on the styloid process and has two shallow grooves for the tendons of extensor carpi radialis longus laterally and brevis medially. These tendons are flat and each has a separate synovial sheath, however both share a single compartment beneath the extensor retinaculum.

The groove for the extensor carpi radialis brevis leads to the prominent ridge or radial tubercle (Lister's tubercle). This ridge is obliquely directed from proximal ulnar to distal radial and is one of the most important surface landmarks on the posterior surface of the distal radius.

On the ulnar side of the radial tubercle is a narrow groove that lodges the tendon of the extensor pollicis longus in its synovial sheath in a separate compartment. The tendon changes its direction sharply around the tubercle. Close apposition of tendon to bone is especially true at this area, therefore, it is a frequent site of post-traumatic tendon rupture due to attrition or to occlusion of its segmental blood supply which comes from branches of the anterior interosseous artery.

Between this groove and the dorsal margin of the sigmoid notch is another broad groove which lodges the four tendons of the extensor digitorum communis; with the tendon of the extensor indicis beneath them. All five tendons share a common synovial sheath. The tendon of the extensor digiti minimi lies over the radioulnar joint.

The forward curve of the distal end of the radius brings its posterior border to a more distal level than the anterior border (Harrison et al., 1972).

Relatively weak and unimportant supporting ligaments arise from the dorsal radial aspect of the radius; these are the radioscaphoid and radiotriquetral ligaments, (fig. 3).

4. The Medial Surface

It has an articular cartilage-lined concavity that articulates with the head of the ulna (sigmoid notch). The edges of the notch give attachment to the capsule except inferiorly. It angles distally and medially an average 22° (Palmer, 1988).

Above the sigmoid notch is a triangular area enclosed by anterior and posterior ridges into which the interosseous border divides. The interosseous membrane is attached to the posterior ridge. In front lies the membrana sacciformis which is a loose area of the capsule that pouches upwards between the two bones. In front of it lies the deepest fibres of the pronator quadratus attached to the front part of the triangle (**Last, 1978**).

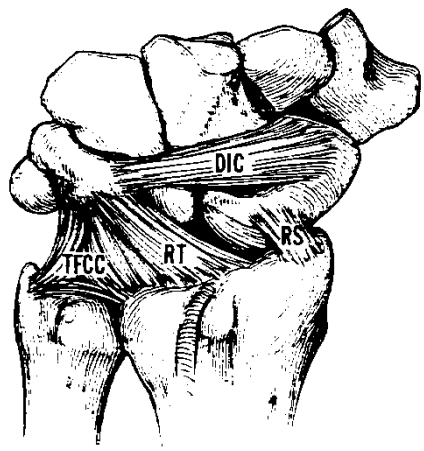


FIGURE 3- Dorsal wrist ligaments. **RS** = radioscaphoid; **RT** = radiotriquetral; **DIC** = dorsal intercarpal ligament. After (Palmer A.K., 1988).

Along the entire ulnar aspect of distal articular surface of the radius, at the distal margin of the sigmoid notch, the TFCC arises. This ligamentous complex, the major stabilizer of the distal radioulnar joint and the ulnar carpus, extends ulnarly to be inserted into the base of the ulnar styloid and distally into the lunate (ulnolunate ligament), triquetrum (ulnotriquetral ligament) and hamate and finally into the base of the fifth metacarpal (fig. 2).

5. The Distal Articular Surface

It is triangular in shape with the apex at the radial styloid process and the base at the sigmoid notch. It is concave in both anteroposterior and lateral directions and has two recognizable facets separated by anteroposterior ridge. The concave areas are covered with hyaline cartilage. The ulnar facet is more or less square and articulates with the lunate. It continues into the sigmoid notch, but in the intact wrist the triangular fibrocartilage is attached to the right angled border between the two and divides the inferior radioulnar and wrist joints from each other.