CARPAL DISLOCATION

ESSAY

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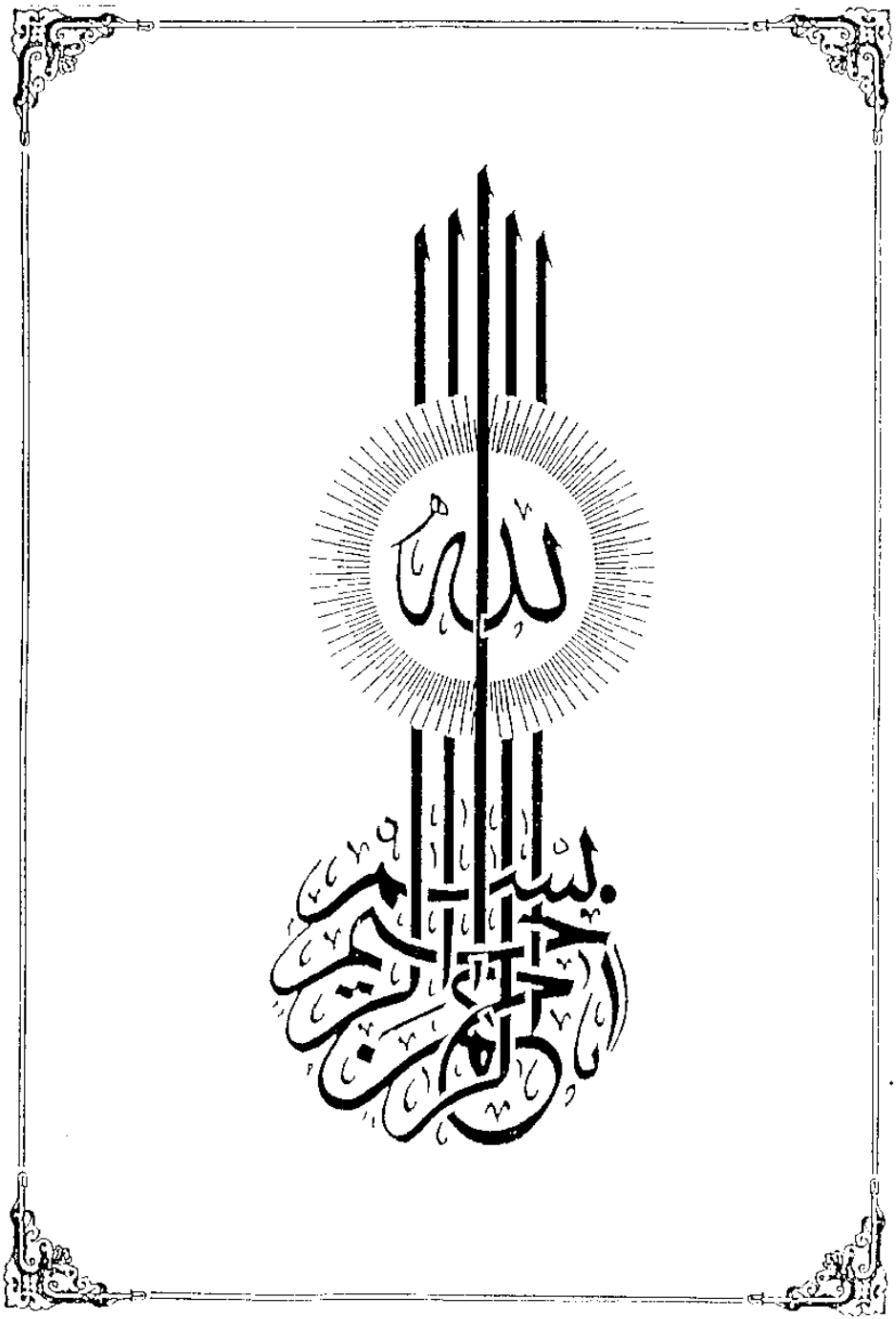

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CONTENTS

ANATOMY

ANATOMY OF THE WRIST

The wrist (carpus) is a pliable osteoligamentous complex interposed between the skeleton of the forearm and that of the digital rays. It presents a proximal condyle for the distal surface of the radius and the triangular ligament, a distal series of irregular articular surfaces for the metacarpals and, on the sides, non-articular surfaces related to the collateral ligaments of the radiocarpal joint.

The anterior (palmar) surface of the carpus presents a longitudinal concavity, accentuated by the tubercles of the scaphoid and the trapezium laterally and by the pisiform and the hook of the hamate medially. The dorsal surface of the carpus shows an irregular convexity.

The pliancy of the carpus is due to its complex structure. The eight bones forming it can slide on each other at the level of their synovial joints. Their sliding movements, of variable direction and range, are determined by the shape of their articular surfaces as well as by the length and direction of the ligaments (palmar, dorsal, interosseous, radiocarpal, or ulnocarpal) connecting the bones (Fahrer, 1981).

OSSEOUS ANATOMY

Traditional concept:

The seven major carpal bones (excluding the pisiform, which is a sesamoid) are arranged into tow transverse

rows, proximal and distal, with the scaphoid bridging the tow rows and, in fact, being a part of each. The proximal row (triquetrum, lunate, and proximal pole of the scaphoid) is thus an intercalated segment in an inherentlly unstable link system, and the scaphoid act as a "connecting rod" to stabilize the midcarpal joint (Fig. 1).

The so-called wrist joint is therefore composed of two separate articulations, the radiocarpal and midcarple joints.

In humans, the ulna does not articulate with the carpus directly, but rather by way of its cartilaginous meniscus (not to be confused with the triangular fibrocartilage). The carpus is essentially suspended from the radius by ligamentous attachments (Green, 1982).

Columnar carpus concept:

Taleisnik reintroduced the concept of a vertical or columnar carpus that was originally proposed by Navarro in 1919. As origrnally described, this theory suggested that the carpus is composed of three vertical columns: (1) the central (Flexion-extension) column, formed by the lunate, capitate, and hamate; (2) the lateral (rotation) column, composed of the scaphoid, trapezium, and trapezoid; and (3) the medial (rotration) column, consisting of the triquetrum and pisiform. The major point of difference in this concept from the traditional concept is that the triquetrum is given recognition as

an important part of the complex carpal anatomy. Taleisnik has proposed two modifications to this theory: (1) eliminate the pisiform, sinces it does not actually participate in carpal motion; and (2) include the trapezium and trapezoid as part of the central column, since they are integral parts of the distal carpal row. This leads one to conclude that the key elements of carpal anatomy are the scaphoid, lunate, capitate, and triquetrum. Thus, the central column is the main flexion-extension link along the axis of the radius, lunate, and capitate (with the entire distal row acting in concert with the capitate). The scaphoid maintains its previously well-recognized role as the stabilizing or connecting link for the midcorpal joint, and the triquetrum is introduced as the pivot point around which corpal and hand rotation takes place (Green, 1982).

General features of the carpus:

The carpus is composed of eight bones, which are arranged in proximal and distal rows, each containing four elements. The bones of the proximal row, from lateral to medial side, are the scaphoid, lunate, triquetral and pisiform; those of the distal row, the trapezium, trapezoid, capitate and hamate. The pisiform is on the palmar surface of the triquetral and is separated from the other carpal bones, all of which articulate with their immediate neighbours. The other bones of the proximal row form an arch convex proximally, which articulates with the radius and articular disc of the inferior radio-ulnar joint. The concavity of the arch is directed distally and forms a recess into which fit the proximally projecting parts of the capitate and hamate bones. In this way the two rows are adapted to each other strongly and yet without sacrifice of all movement (Warwick and Williams, 1973).

The dorsal surface of the carpus is gently convex from side to side, but the palmar surface is a deep concavity, the carpal groove, partly owing to the presence of certain forward projections on its lateral and medial borders. The medial border of the concavity is formed by the pisiform bone and the hamulus, a hook-like process on the palmar surface of the hamate bone. The pisiform lies in the medial part of the proximal border of the muscular hypothenar eminence which forms the medial part of the palm, and its position in front of the triquetral makes it easy to feel. The hook of the hamate is

concave on its lateral side; its tip can be identified in the living subject 2.5 cm distal to the pisiform and in line with the radial border of the ring finger. In this situation the superficial division of the ulner nerve can be rolled from side to side over this bony point. The projecting lateral border of the carpal groove is formed by the tubercle of the scaphoid and the tubercle of the trapezium. The former is on the distal part of the anterior surface of the scaphoid and can be felt- and sometimes seen-as a small, rounded knob, in the medial part of the proximal border of the muscular thenar eminence ('ball' of the thamb), which forms the lateral part of the palm. The tubercle of the trapezium is a rounded ridge which runs vertically across the anterior surface of the bone, being slightly hollowed out on its medial side. It lies immediately distal and slightly lateral to the tubercle of the scaphoid, and can be felt only on deep pressure. The carpal groove is converted into an osseofibrous carpal tunnel by a strong fibrous retinaculum attached to the bony margins. The tunnel transmits the flexor tendons and median nerve to the hand. The fibrous retinaculum increases the strength of the carpus and the efficiency of the flexor muscles. The palmar and dorsal surfaces of the carpal bones, apart from the triquetral and pisiform, are rough for the attachment of ligaments [radiocarpal, intercarpal and corpometacarpal] (Warwick and Williams, 1973).

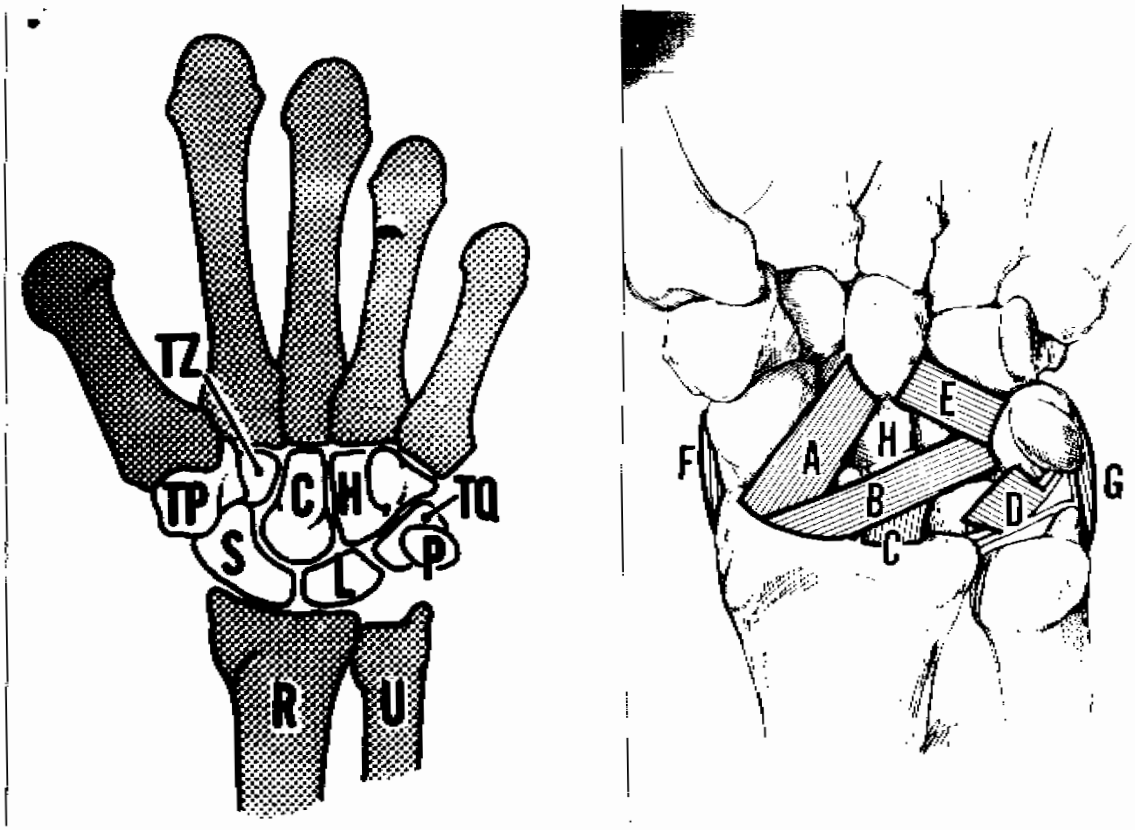

Fig. 1: *The carpal bones. The disal row consists of the hamate (H), Capitate (C), trapezoid (TZ), trapezium (TP) and distal pole of the scaphoid (S). In the proximal row are the triquetrium (TQ), lunate (L) and proximal pole of the scaphoid (S). Note the unique role of the scaphoid, bridging the two rows. The pisiform (P) is a sesamoid and dose not play a major role in carpal dislocations (Green, 1982).*

Fig. 2: *The major intercarpal ligaments on the volar side of the wrist are: radiocapitate (A); radiotriquetral (B); radioscaphoid (C); ulnolunate (D); capitotriquetral (E); radial collateral (F); ulnar cullateral (G); space of Piorer (H) (Green, 1982).*

The Individual Carpal Bones

The scaphoid bone:

The scaphoid bone is the largest element in the proximal row and lies with its long axis directed distally, laterally and slightly forwards. Its tubercle is a rounded elevation on the distal part of the palmar surface and is directed slightly laterally. It gives attachment to the flexor retinaculum and a few fibres of the abductor pollicis brevis, and is crossed by the tendon of the flexor carpi radialis. The dorsal surface is rough and slightly grooved, and is narrower than the palmar surface. It is pierced by a number of small nutrient foramina and in a small proportion of cases [13 percent], these are restricted to the distal half of the bone. The lateral surface, also narrow and roughened, has attached to it the radial collateral liganent of the wrist joint. The remaining surfaces of the bone are articular. The radial surface is convex and is directed proximally and laterally. The lunate surface is a flattened, narrow semilune, directed medially. The capitate surface, large and concave, is directed medially and distally. The surface for the trapezium and the trapezoid bones forms a continuous convex area, directed distally (Warwick and Williams, 1973).

Flexor carpi radialis sometimes give a slip of attachment to the scaphoid, and this tendon then carries some blood vessels to the bone (Last, 1978).

The lunate Bone:

The lunate [semiluner] bone shows a cylindrical proximal facet for the radius, extended more on the dorsal than the ventral surface. To each side there is a facet for the adjoing bones [scaphoid and triquetral] of the proximal row, and these are continued distally into an antro-posterior concavity for the capitate only the broad anterior and narrow posterior surfaces are non-articular, and these are perforated, especially posteriorly, by vascular forarmina (Last, 1978).

The triquetral bone:

The triquetral [cuneiform] bone shows a slight concavity for the lunate, projected into a proximal convexity for the ligementous surface of the wrist joint, and a distal concavity for the hamate. The ventral surface has an oval facet distally for the pisiform. The rest of the ventral surface, as well as the medial and dorsal surfaces, are non articular. A smooth surfaced tubercle on the distal part of the medial surface is produced by the attachment of the ulnar collateral [medial] ligament of the wrist joint (Last, 1978).

The pisiform:

The pisiform has a flat surface for articulation with the triquetral and the convexity of the remainder of the bone leans somewhat towards the radial side, over the concavity of the carpus (Last, 1978).

The flexor carpi ulnaris is attached on the palmar surface and its continuation, viz, the pisometacarpal ligament, to the distal part of the bone. Hence in its relationship to this tendon, the pisiform has all the appearance of a sesamoid bone. The flexor retinaculum is attached to the palmar part of the lateral aspect, while the abductor digiti minimi and the extensor retinaculum are attached to the medial and distal aspects (Warwick and Williams, 1973).

The trapezium:

The trapezium articulates with the adjacent trapezoid, and these together by concave facets fit the distal convexity of the scaphoid. A distal articular surface, saddleshaped, is for the thumb metacarpal and this is a separate synovial joint. The trapezium articulates narrowly with the tubercle on the base of the index-finger metacarpal. There is a prominant ridge [the crest] lying obliquely on its flexor surface. The extensor surface, on the lateral convexity of the nonarticular area, carries a prominant tubercle for attachment of carpometacarpal ligament (Last, 1978).
The tendon of the flexor carpi radialis sends a constant slip of insertion to the trapezium (Fahrer, 1981).

The trapezoid bone:

The trapezoid lies wedged between trapezium and capitate, articulating proximally with the scaphoid and distally with the index-finger metacarpal. Its dorsal