“OVIDIUS” UNIVERSITY OF CONSTANŢA
DOCTORAL SCHOOL OF MEDICINE
FIELD: MEDICINE

MORPHOMETRY OF THE BONES OF THE HAND

PhD THESIS
SUMMARY

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CONTENT

INTRODUCTION

The upper limb ends with a particularly perfected segment, the hand, indispensable to the complicated movements and performed by man during the execution of work, but also during daily life. The upper limb is characterized by mobility and the ability to perform various movements: grasping, hitting and fine movements, characteristic especially of the human species. These features are especially noticeable in the hand when performing manual movements. The effectiveness of hand functions comes largely from the ability to place it in the proper position through movements in the joints of the shoulder, elbow, radius, and joints between the bones of the hand [Moore].

The phylogenetic development of man would not be possible without a proper development of the hand, without the appearance of the complex possibility of grasping. This terminal segment of the upper limb is, on the one hand, an improved organ of movement, and on the other hand, a specialized organ of sensitivity.

Since the 4th century î. Cr., Aristotle [quoted by Bacchus] states that the hands "**were the first instruments of man, being those instruments that preceded and produced all the other instruments, organs of both investigation and locomotion.**"

The development of the nervous system, intelligence and consciousness have been closely linked to the development of the hand. Engels [quoted by Baciu] opinionated that "**the domination of nature began with the development of the hand and labor**," and the Russian philosopher Radishev [quoted by Baciu] asserted: "**the hands formed the path to intelligence.**"

To treat wrist injuries or degenerative changes, it is essential to understand the anatomy, biomechanics and function of the wrist and wrist joints, including the ligaments that connect the bones of these joints. Successful diagnosis of injuries, interpretation of images and their treatment depend on information accurate to the normal morphology of the bones of the hand.

Anatomical and biomechanical research of the hand has provided a substantial amount of information that improves our basic knowledge of carpal morphology and function of the fist and joints of the hand and provides information to better evaluate and improve treatments for various joint problems of these joints [Kijina] .

Knowledge of hand bone morphology is necessary to address diseases at this level, such as osteoarthritis, intercarpal fusion, carpal tunnel syndrome (with or without median

neurolysis), intercarpal instability, in performing arthrodesis, mediocarpal hemiarthroplasty, prosthesis, etc.

PURPOSE OF THE STUDY

Determination of the dimensions of the bones of the hand: carpal, metacarpal, phalanges and sesamoid bones, measuring their length and width, representing a normal database of measurements, which can be made on postero-anterior radiographs and which could be used as a basis for comparison in radiological and surgical practice.

The study was carried out with the necessary approvals from the higher hierarchical bodies (department director, dean, manager of the imaging clinic, ethics commission of the "Ovidius" University of Constanţa), all of whom agreed with the research.

The personal results were capitalized by the publication of two articles "in extenso" in the "Romanian Journal of Functional and Clinical Anatomy, Macro- and Microscopic and Anthropology" (B + indexed journal). Also, two papers were presented at the XXI Congress of the Romanian Society of Anatomy, whose papers took place in Sovata, organized by the Faculty of Medicine in Tg-Mures and whose abstracts were published in the volume of abstracts of the congress.

I would like to thank the general manager of "SC Medimar Imagistic Service SRL" from the University Emergency Clinical Hospital in Constanţa, for providing the radiographs, Dr. Ion Georgiana, for the help in selecting the imaging, Dr. Ciota Alexandra Ecaterina, who helped me in making the graphics and in the technical editing of the thesis and especially to Mr. Prof. Dr. Bordei Petru, the scientific leader of the thesis, who guided me for a period of about four years, for the realization and finalization of the doctoral thesis.

METHODS AND WORKING MATERIAL

My study was performed on 200 radiographs that were performed on a Siemens Luminos device, Power: 65/80 kW, Detector type: a-Si / CsI Pixel size: 148 µm, equipped with the radiology clinic "Medimar" a Of the Emergency University Clinical Hospital „St. Andrei ”from Constanţa.

Morphometric data were processed on the computer, using a RadiAnt Dicom Viewer program, license 11111111, on a machine ID, BX2NT-N9EFC-BC9SY-HBQME-LLEAA, on a DESKTOP-OTVT-25L computer.

Selected subjects were included if they had no history of fist and hand injuries or chronic diseases that could affect the soft tissues at this level. Subjects were specifically

excluded if they had a history of fracture of the forearm, radiocarpal region or hand region, or severe osteoarthritis.

Of the 200 radiographs, 98 were male (49 radiographs on the right hand and 49 radiographs on the left hand) and 102 radiographs belonged to the female sex (51 radiographs on the right hand and 51 radiographs on the left hand). The male subjects were between 14-77 years old, and the female subjects were between 10-85 years old.

In presenting the images, I intended to remove any clues that could have led to the identification of the owner.

The present study is an attempt to establish a normal database of measurements, which can be made on postero - previous radiographs and which could be used as a basis of comparison, in radiological practice. Moreover, potential individual variations of the measured parameters are sought. Such variations could provide a partial explanation for variations in carpal bone movement and several concepts of carpal instability.

I will also describe new parameters: the lengths of the bone portions of the hand measured from the middle of the upper face of the carpal massif to the head of the third phalanx of each finger and the crescent-scapho ratios (between vertical and transverse lengths), which may prove useful. in the diagnosis of carpal instability.

The quantification of the bone sizes was also done in order to determine the differences in relation to sex, age, between the two parts of the body (right / left), as well as between neighboring bones of the same type.

The morphometric data were processed on the computer, with the help of a KS 400 program, equipped with the anatomy laboratory.

In the study, we aimed to:

- the length of the bony part of the hand, from the upper face of the carpal massif to the head of the third phalanx of the middle, comparatively right / left; this length will be compared with the length of the radial (lateral) and ulnar (medial) bone columns of the hand;
- carpal massif: shape, width, height comparatively right / left;
- morphometry of the carpals (length, width), comparatively between them within the same carpal mass and comparatively right / left;
- the scaffold-lunar ratio that provides information on the lengths (vertical and transverse) of the scaphoid and crescent;
- metacarpal morphometry: length, width at the middle of the diaphysis, base width, head width;

- phalanx morphometry: the length of each phalanx and the comparison of the lengths of the three phalanges between them and comparatively right / left;
- morphometry of sesamoid bones: length; and their disposition;
- comparison of the obtained results with the existing data in the consulted specialized literature;
- the obtained results were supported by consistent personal images, which do not leave room for interpretations, being represented graphically;
- the analysis of the obtained data was made according to sex, being also mentioned the age of the respective person;
- both in the general part and in the personal part, the Anatomical Terminology appeared in 1998 was observed.
- By age groups, comparative bone morphometry was studied in a total of 190 cases, due to the fact that in males the age of cases was up to 77 years, and in females up to 87 years.

In presenting the images, I intended to remove any clues that could have led to the identification of the owner.

PERSONAL RESULTS

MORPHOMETRY OF THE HAND SKELETON

I found the height between 160-221 mm, **at the level of the right region of the hand**,

I found the height between 160-221 mm, and **at the level of the left region of the hand**, I found the height between 163-221 mm.

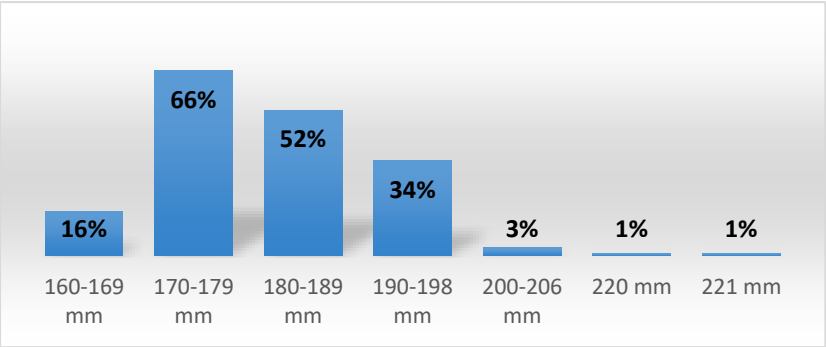


Chart no. 1 The height of the skeleton of the hand region

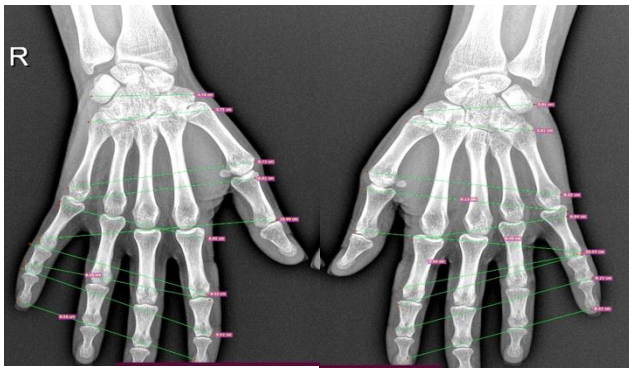


Fig 11. A. The width of the skeleton of the hand at the level of the bone segments (carpal, metacarpal, phalangeal). Right hand; B. Left hand. The width of the carpus is 47.4 mm, being smaller than that of the left carpus by 2.7 mm; the width of the metacarpus at the base is 57.5 mm on the right side and 54.1 mm on the left side; at head level the width is 87.2 mm on the right side and 86.2 mm on the left side; the width of the hand at the base of the phalanx I between the fingers I-V is 90.2 mm on the right side and 91.3 mm on the left side; the width of the hand at the head of the phalanx I between the fingers I-V is 109.9 mm on the right side and 100.4 mm on the left side; the width of the hand at the base of the phalanx I between the fingers II-V is 69.5 mm on the right side, and 69.4 mm on the left side; the width of the hand at the head of the phalanx I between the fingers I-V is 85.3 mm on the right side, and 79.9 mm on the left side; the width of the hand at the base of the phalanx Il between the fingers Il-V is 86.5 mm on the right side, and on the left side 84.9 mm; the width of the hand at the head of the phalanx II between the fingers II-V is 94.3 mm on the right side, and on the left side 92.1 mm; the width of the hand at the base of the phalanx Ill between the fingers Il-V is 85.5 mm on the right side, and 92.1 mm on the left side; the width of the hand at the level of the head of the phalanx between the fingers I-V is 85.5 mm on the right side and 85.21 mm on the left side (male)

Comparing the height of the skeleton on both sides of the hand region we found that ***it was equal*** in 10% of cases), in 35% of cases ***, the right height was higher than the left*** with 1-4 mm, and in 55% of cases ***the left height was higher than the right*** with 1-9 mm.

A **B**

Fig.13 The height of the skeleton of the right hand (A) is 17.98 mm, being equal to that of the left hand (B) (female)

In males, in 98 of the cases, I found **height** to be between 165-221 mm, ***at the level of the right region of the hand, the height*** between 165-220 mm, ***and at the level of the left hand*** between 165-221 mm. ***Comparing the height of the skeleton on both sides of the hand region*** in ***male sex***, I found that ***it was equal*** in 6.12% of cases, in 38.78% of cases, ***the straight height was higher*** by 1-4 mm, and in 55.10% of cases***, the left height was higher*** by 1-9 mm.

In females, in 102 cases, we found the height to be between 160-221 mm, ***at the level of the right hand*** found it between 160 220 mm, ***and at the level of the left hand*** found it between 163-221 mm.

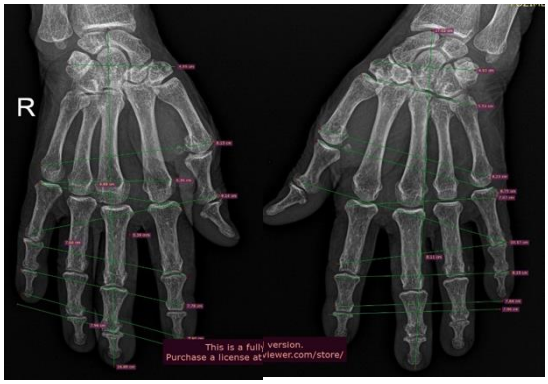


FIG. 16. A. The width of the skeleton of the hand at the level of the bone segments (carpal, metacarpal, phalangeal). Right hand; B. Left hand. The width of the carpus is 49.9 mm, being larger than that of the left carpus by 0.6 mm; the width of the metacarpus at the base is 56.9 mm on the right side and 55.3 mm on the left side; at the head the width is 81.5 mm on the right side and 82.3 mm on the left side; the width of the hand at the base of the phalanx I between the fingers I-V is 82.3 mm on the right side, and 82.3 mm on the left side; the width of the hand at the head of the phalanx I between the fingers I-V is 91.6 mm on the right side and 101.7 mm on the left side; the width of the hand at the base of the phalanx I between the fingers Il-V is 66.8 mm on the right side, and 70.7 mm on the left side; the width of the hand at the head of the phalanx I between the fingers I-V is 91.6 mm on the right side and 101.7 mm on the left side; the width of the hand at the base of the phalanx Il between the fingers Il-V is 76.6 mm on the right side and 82.7 mm on the left side; the width of the hand at the head of the phalanx lI between the fingers lI-V is 79.0 mm on the right side and 81.5 mm on the left side; the width of the hand at the base of the phalanx Ill between the fingers Il-V is 79.6 mm, both on the right and on the left; the width of the hand at the head of the phalanx lII between the fingers lI- V is 79.6 mm on the right side and 85.21 mm on the left side; The height of the skeleton of the hands is 168.9 mm (female).

Comparing the height of the skeleton of the two parts of the hand region in the female sex, I found that it ***was equal in*** 3,73% of cases, in 31.37% of cases **the straight height was higher** by 1-4 mm, and in 54.90% of cases, ***the left height was higher*** by 1-6 mm.

THE CARPAL MASSIVE

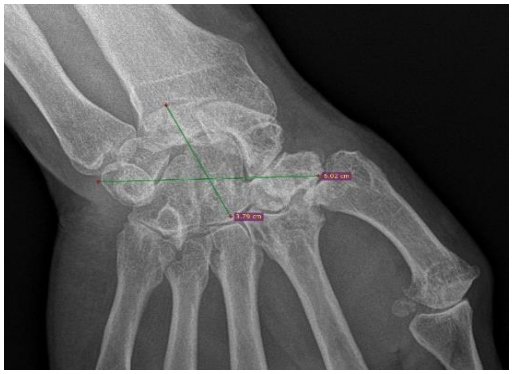


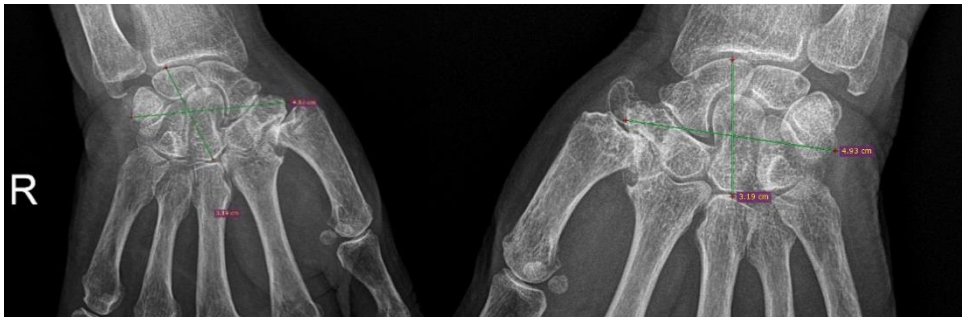
FIG. 21 Massive right carpal: width - 60.2 mm; Height - 37.9 mm, between the two dimensions there is a difference of 22.3 mm (male)

In males, the width measured on 98 was found to be between 37-64 mm, ***at the level of the right carpal massif*** the width being between 38-64 mm, and ***at the level of the left carpal massif*** being between 37-64 mm.

By comparing the width of the two carpal massifs, we found the following situation: ***equal*** in 28.57% of cases, ***the right height higher*** by 1-5 mm in 30.61% of cases and t***he left height higher*** by 1-7 mm in 40, 82% of cases.

The height at the level of the carpal massif, **at the level of the two carpal massifs**, was found to be between 29-56 mm, ***at the level of the right carpal massif***, was found to be between 29-56 mm, and at ***the level of the left carpal massif***, being between 28-56 mm.

By comparing the height at the two carpal massifs, we found the following situation: equal: in 38.78% of cases, ***the right height higher*** by 1-2 mm in 36.73% of cases and ***the left height higher*** by 1-13 mm in 24.49% of cases.

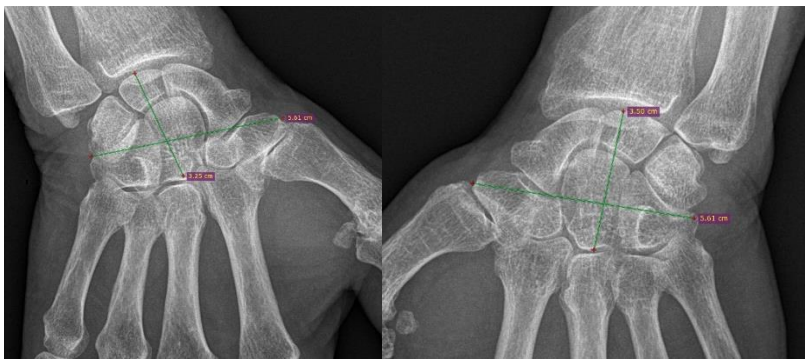


A ***B***

FIG. 27 A. Right carpal mass: width - 48.7 mm, being 0.6 mm smaller than on the left; The height - 31.9 mm, being equal to the left one; Massive left carpal: width - 49.3 mm; Left height: - 31.9 mm (female).

The width at the level of the female carpal massif, at the level of the two carpal massifs, we found it to be between 37-64 mm***, at the level of the right carpal massif***, found it to be between 38-64 mm, and ***at the level of the left carpal massif***, being between 37-54 mm.

By comparing the width of the two carpal massifs in females, we discovered the following situation: **equal** in 19.61% of cases, ***the right width wider by 1-6 mm*** in 33.33% of the cases and ***the left width greater by 1-7 mm*** in 47.06% of the cases.



A ***B***

FIG. 31. A. Right carpal mass: width - 56.1 mm; Height: - 32.5 mm; B. Left carpal mass: width - 56.1 mm; Height - 34.8; Between the width and the height of the right carpal mass there is a difference of 23.6 mm, on the left the difference is 21.3 mm; the width of the right carpal mass is equal to that of the left carpal mass (female).

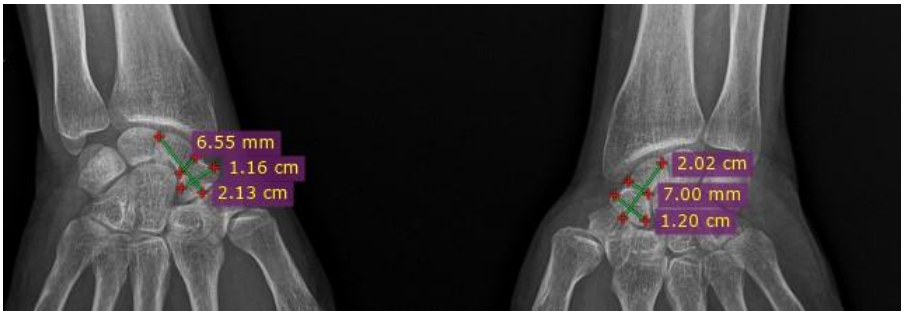
The height at the level of the carpal massif in females, at the level of the two carpal massifs, we found it between 28-43 mm, ***on the right*** it was between 29-42 mm, and ***on the left*** it was between 28-43 mm.

Comparing the height of the two carpal masses in females, we found the following situation***: equal*** in 45.10% of cases; ***the right height*** is 1-3 mm higher in 39.20% of cases and ***the left height*** is 1-13 mm higher in 15.69% of cases.

CARPAL BONE MORPHOMETRY
SCAPHOID BONE MORPHOMETRY

In males, out of 98 cases followed, we found a scaphoid bone ***width*** between 16-31 mm, the bone ***height*** being situated between 6-16 mm.

On the right side, ***the width*** was between 18-30 mm, and ***on the left side*** between 16-31 mm. ***The height on the right side*** was between 6-16 mm, and ***on the left side***, it was between 6-15 mm.



A **B**

FIG. 1 A. right scaphoid: has a height of 21.3 mm, a middle width of 6.55 mm, and a lower width of 11.6 mm; B. the left scaphoid has a height of 20.2 mm, a middle width of 7.0 mm and a lower width of 12.0 mm (male)

By comparing the dimensions of the two sides, we found that t***he width had the same bilateral value*** in 23.47% of cases, in 12.24% of cases the ***right width was higher***, with differences of 1-4 mm, and in 14.29% in some cases, ***the left width*** was larger with differences of 1-3 mm.

The height of the scaphoid was equal bilaterally in 13.27% of cases, also in 13.27% of cases ***the right height was higher*** by 1-6 mm, and in 23.47% of cases ***the left height was higher*** by 1-3 mm .

In females, we found the scaphoid bone ***a width*** between 11-29 mm, the height being between 7-19 mm. ***On the right side, the width*** was between 11-29 mm and ***the height*** between 7-17

A **B**

FIG. 36 A. right scaphoid: has a height of 27.7 mm, a middle width of 10.2 mm, and a lower width of 11.9 mm; B. the left scaphoid has a height of 24.4 mm, a middle width of 13.1 mm and a lower width of 14.7 mm (female)

Fig 2 A right scaphoid: has a height of 27.7 mm, a middle width of 10.2 mm and a lower width of 11.9 mm; B. the left scaphoid has a height of 24.4 mm, a middle width of 13.1 mm and a lower width of 14.7 mm (female)

On the left side, the width was 11-29 mm, and ***the height*** was 7-19 mm.

By comparing the dimensions of the two sides, we found that ***the width had the same bilateral value*** in 45.10% of cases, in 15.69% of the case ***the right width*** was 1-3 mm ***higher***, and in 39.22% of cases ***the left*** width was 1-3 mm larger.

The height of the scaphoid was equal bilaterally in 17.65% of cases, in 17.65% of cases ***the right height*** was 1-6 mm higher, and in 39.22% of cases ***the left height*** was 1-3 mm higher.

SEMILUNAR BONE MORPHOMETRY

A ***B***

In males, we found ***a width*** of 10-23 mm for the crescent bone, ***on the right side***, being 10-21 mm, and ***on the left side*** 10-23 mm. ***The height*** of the crescent bone was 7-24 mm, ***on the right side*** it was 7-24 mm, and ***on the left side*** it was 7-20 mm.

By comparing the dimensions of the crescent on both sides, we found ***that the width had the same bilateral value*** in 36.73% of cases, in 28.57% of cases ***the right width*** was 1-3 mm higher, and in 34.69% of cases ***the left width*** was 1-4 mm larger.

The height of the crescent was equal bilaterally in 30.61% of cases, in 11 22.45% of cases ***the right height*** was 1-4 mm ***higher***, whereas in 46.94% of cases ***the left height*** was 1-6 mm ***higher***.

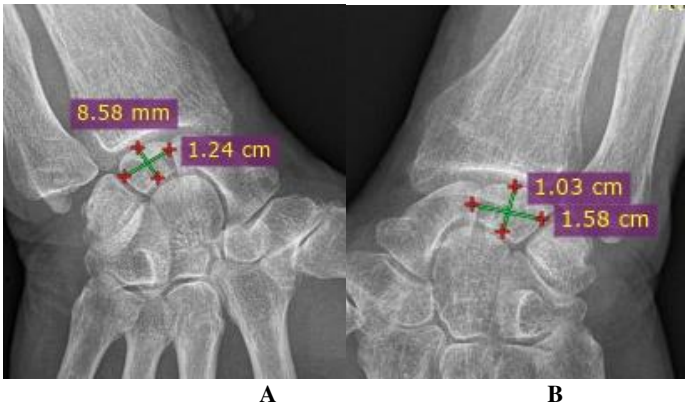
A ***B***

FIG. 4 A. the right semilunar has a height of 8.08 mm and a width of 16.7 mm; B. the left semilunar has a height of 8.31 mm and a width of 15.5 mm (female)

In females, we found a semilunar bone ***width*** between 10-21 mm, ***on the right side***, being between 10-20 mm, and ***on the left side*** between 10-21 mm. ***The height*** of the semilunar bone was between 6-24 mm, on the right side, being between 6-24 mm, and ***on the left side***, it was between 7-17 mm.

Comparing the dimensions of the two sides we found that ***the width had the same bilateral value*** in 17 cases (33.33% of cases). In 37.25% of cases ***the right width*** was 1-2 mm higher, and in 29.41 of cases ***the left width*** was 1-3 mm higher.

The height of the semilunar was equal bilaterally in 29.41% of cases, in 31.37% of cases ***the right height*** was 1-4 mm ***higher***, and in 39.22% of cases ***the left height*** was 1-5 mm ***higher***.

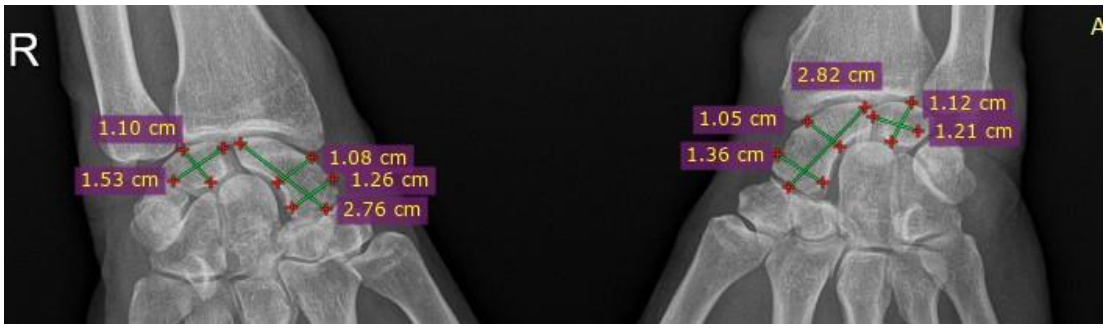


A **B**

FIG. 5 A. the right semilunar has a height of 8.58 mm and a width of 12.4 mm; B. the left semilunar is 10.3 mm high and 15.8 mm wide (male)

SCAPHO-LUNAR RATIO

Between the dimensions (width and height) of the two bones, a rapport is established that gives information on the stability of the carpal mass.



A **B**

FIG. 6 A. the right scaphoid has a height of 27.6 mm, a middle width of 10.8 mm, and a distal width of 12.6 mm; the right crescent has a height of 11.0 mm, a width of 15.3 mm; B. the left scaphoid has a height of 28.2 mm, a middle width of 10.5 mm and a lower width of 13.6 mm; the left crescent has a height of 11.2 mm, the width being 12.1 mm, the scao-lunate ratio at the level of the right width is 82.35%, and at the level of the left width 88.97%, in favor of the scaphoid; the scao-lunate ratio at the level of the right height is 39.86%, and at the level of the left height of 39.75%, in favor of the crescent (female)

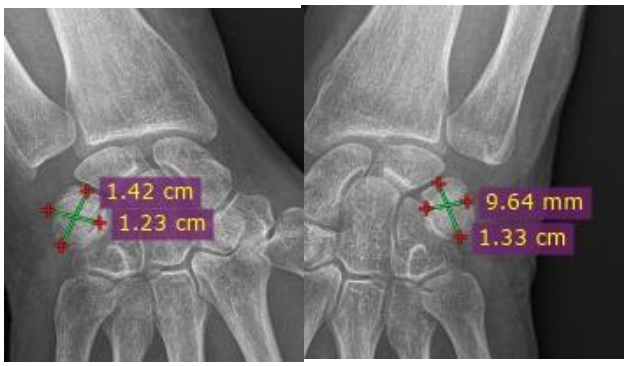
The ratio between the widths of the two bones was found in males to be between 50-60% in the right hand and between 56.25-58.06% in the left hand. In females this ratio was between 54.55-82.75% on the right hand and between 58.62-63.64% on the left **hand.**

A **B**

FIG. 7 A. the right scaphoid has a height of 21.7 mm, a middle width of 8.48 mm, and a distal width of 10.8 mm; the right crescent has a height of 10.1 mm, a width of 12.6 mm; B. the left scaphoid has a height of 23.6 mm, a middle width of 8.71 mm and a lower width of 9.21 mm; the left crescent has a height of 9.51 mm, a width of 8.97 mm; the scao-lunate ratio at the level of the right width is 85.71%, and at the level of the left width of 97.35%, in favor of the scaphoid; the scao-lunate ratio at the level of the right height is 46.54%, and at the level of the left height of 42.30%, in favor of the crescent (male)

The ratio between the heights of the two bones was found in males to be between 66.66-94.12% in the right hand and between 75.0-1006% in the left hand. In females, this ratio was between 70.83-85.71% in the right hand and between 32.30-100% in the left hand.

PYRAMIDAL BONE MORPHOMETRY



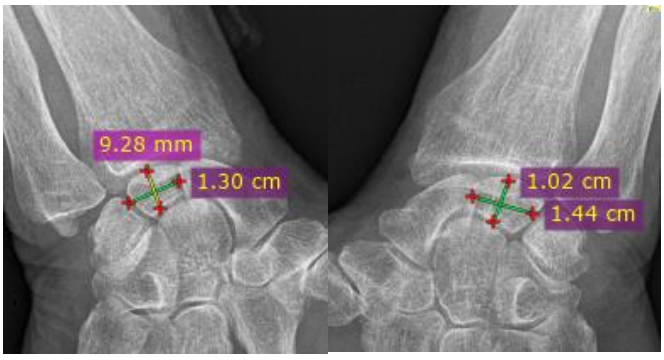
A **B**

FIG. 8 A. the right pyramid is 14.2 mm high and 12.3 mm wide; the left pyramid is 13.3 mm high and 9.64 mm wide (male)

In males, we found a pyramidal bone between 10-18 mm ***wide***, ***on the right side***, being 10-18 mm, and ***on the left side*** measuring 10-18 mm.

By comparing the dimensions of the pyramid on both sides, we found ***that the width had the same bilateral value*** in 59.18% of cases, in 16.33% of cases ***the right width*** was higher by 1 mm, and in 24.49% of cases ***the left width*** was 1-2 mm larger.

The height of the pyramid was equal bilaterally in 34.69% of cases, in 44.90% of cases ***the right height*** was 1-6 mm ***greater***, and in 20.41% of cases ***the left height*** was 0.5-2 mm ***greater***.



A **B**

FIG. 9 A: the right pyramid has a height of 9.28 mm and a width of 13.0 mm; the left pyramid is 10.2 mm high and 14.4 mm wide (female)

With females, we found a pyramidal bone between 9-18 mm wide, ***on the right side***, being between 9-18 mm. ***The height*** was between 7-15 mm, ***on the left side*** the width was between 9-18 mm, and ***the height*** was between 6-15 mm.

By comparing the dimensions of the two sides, left and right, we found that ***the width had the same bilateral value*** the in 43.14% of cases, in 21.57% of cases **the right width** was 1-2 mm ***greater***, and in 35.29 cases ***the left width*** was 1-3 mm ***greater***. ***The height of the pyramid was equal bilaterally*** in 47.06% of cases, in 29.41% of ***cases the right height*** was 1-2 mm ***bigger,*** and in 23.53% of cases ***the left height*** was 1-3 mm ***bigger***.

PISIFORM BONE MORPHOMETRY

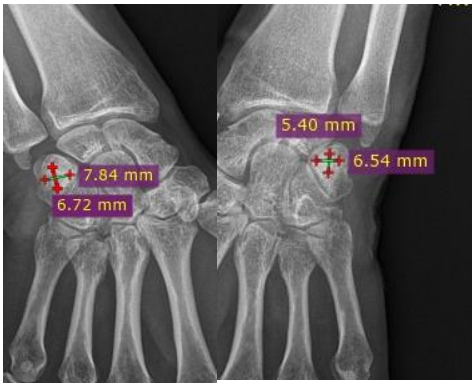


FIG. 10 A: the right pisiform has a height of 6.72 mm and a width of 7.84 mm; B. the left pisiform has a height of 7.52 mm and a width of 6.15 mm (male)

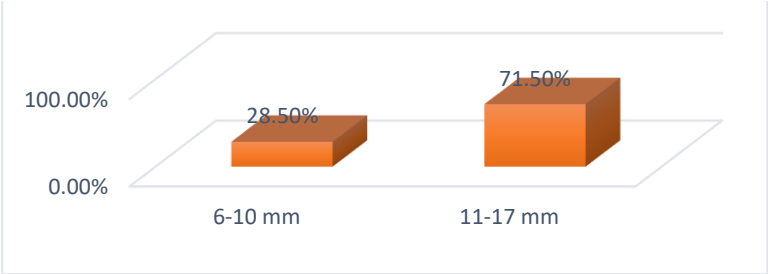
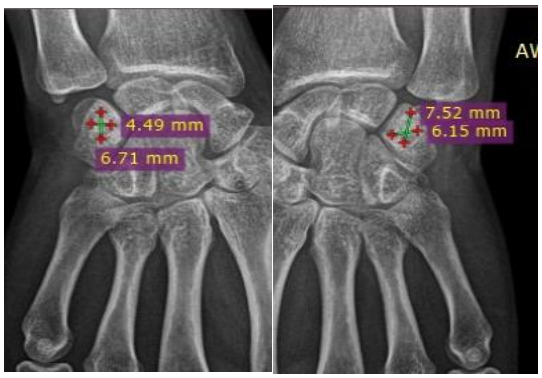


Chart no. 22 Pisiform bone width

In males, we found a pisiform bone between 4.49 and 17 mm ***wide***, with ***a height*** between 6-17 mm. ***On the right side***, the width of the pisiform was between 4.49-17 mm, and ***the height*** between 6-15 mm. ***On the left side***, the width of the pisiform was between 6.15-17 mm, and ***the height*** between 7-15 mm.

Comparing the dimensions of the pissiform on both sides, we found that **the width had the same bilateral value** in 34.69% of cases, in 28.57% of cases ***the right width*** was 1-2 mm higher, and in 36.73% of the cases ***the left width*** was 1-4 mm higher. ***The height of the pisifoma was equal bilaterally*** in 40.82% of cases, in 26.53% of cases ***the right height*** was 1-4 mm higher, and in 32.65% of cases ***the left height*** was 1-4 mm higher.



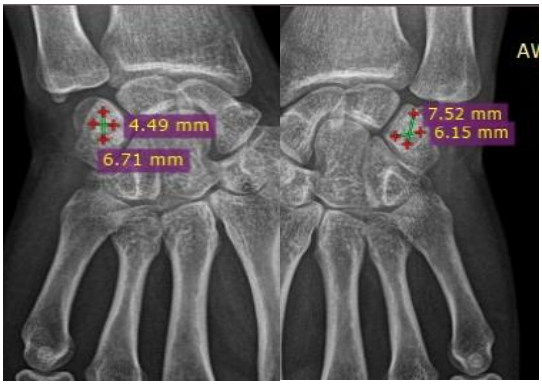
A **B**

FIG. 11 A: the right pisiform has a height of 6.71 mm and a width of 4.49 mm; B. the left pisiform has a height of 7.52 mm and a width of 6.15 mm (female)

In females, we found a pisiform bone with ***a width*** between 4.49-16 mm, and ***a height*** of 5-15 mm. ***On the right side, the width*** of the pisiform was between 6-16 mm, and the height was 5-14 mm. ***On the left side*** it was between 7.70-16 mm, and ***the height*** was between 6.93-15 mm

By comparing the dimensions of the two sides, we found that ***the width of the pisiform had the same bilateral value*** in 27.45% of cases, in 37.25% of cases ***the right width was higher*** by 1 mm, and in 35.29% of cases ***the left width*** was 1-4 mm larger.

The height of the pisiform was equal bilaterally in 45.10% of cases, in 29.41% of cases the ***right height*** was 1-4 mm ***greater***, and in 25.49% of cases ***the left height*** was 1-3 mm ***bigger.***



A **B**

FIG. 12 A: the right pisiform has a height of 6.71 mm and a width of 4.49 mm; B. the left pisiform has a height of 7.52 mm and a width of 6.15 mm (male)

A *B*

FIG. 13 A: the right trapezoium has a height of 10.3 mm and a width of 12.8 mm; B. the left trapezium is 9.91 mm high and 10.6 mm wide (male)

TRAPEZIUM BONE MORPHOMETRY

In males, we found a trapezoidal ***width*** between 10-19 mm, and ***the height*** was between 7-17 mm. ***On the right side***, the width of the trapezium was 10-19 mm, and the height was 7-16 mm. ***On the left side***, the width of the trapezium was 10-19 mm, and the height was between 8-17 mm

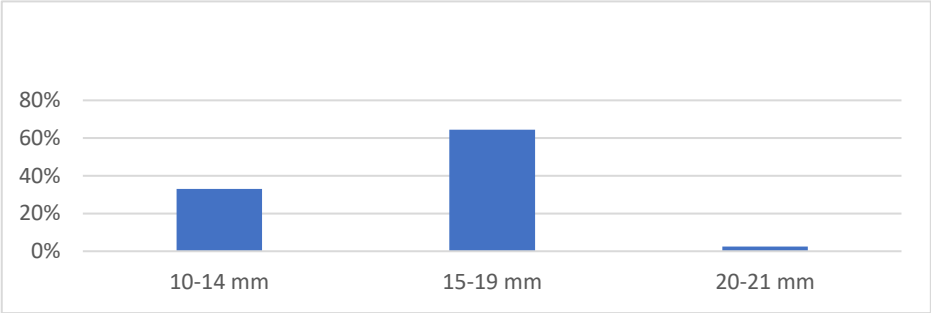


Chart no. 26 Trapezium bone width

FIG. 14 A: the right trapezoid has a height of 10.3 mm and a width of 12.8 mm; B. the left trapezoid is 9.91 mm high and 10.6 mm wide (male)

On comparing the dimensions of the trapezium on both sides, we found that ***the width had the same bilateral value*** in 38.78% of cases, in 8.16% of cases ***the right width was higher*** by 1 mm, and in 53.06% of cases ***the left width*** was 1-4 mm larger.

The height of the trapezium was equal bilaterally in 20.41% of cases, in 32.65% of cases ***the right height*** was 1-5 mm greater, and in 46.94% of cases ***the left height*** was greater with differences between 1 -3 mm.

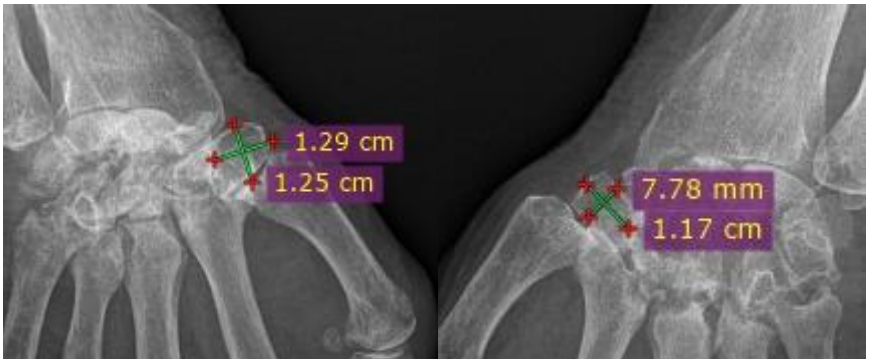


FIG. 14 A: the right trapeziumhas a height of 12.5 mm and a width of 12.9 mm; B. the left trapezium is 7.78 mm high and 11.7 mm wide (female)

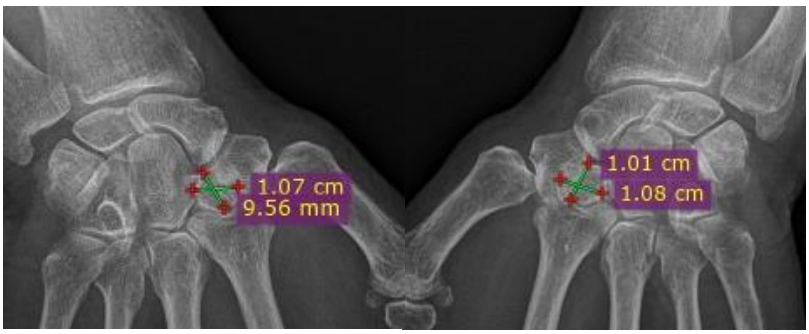
A ***B***

In females, we found a trapezium ***width*** between 10-21 mm, and ***the height*** was between 6-18 mm. ***On the right side, the width of the trapezium*** was 10-19 mm, and the height was 6-18 mm. ***On the left side, the width of the trapezium*** was 10-21 mm, and ***the height*** was between 6-18 mm.

On comparing the dimensions of the two sides, we found that ***the width of the trapezium had the same bilateral value*** in 39.22% of cases, in 13.73% of cases ***the right width*** was 1-3 mm ***higher,*** and in 47.06% of cases ***the left width*** was 1-2 mm ***larger***.

The height of the trapezium was equal bilaterally in 33.33% of cases, in 9.80% of cases ***the right height was greater*** by 0.5-1 mm, and in 52.94% of cases ***the left height*** was ***greater*** by 1-3 mm.

TRAPEZOID BONE MORPHOMETRY

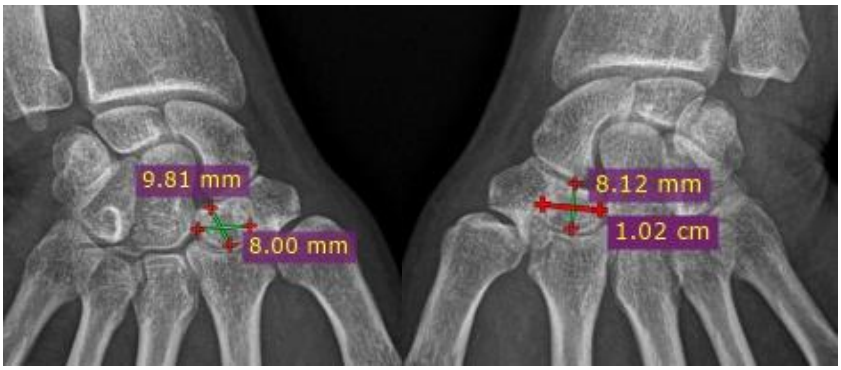


A *B*

FIG. 15 A: the right trapezoid bone has a height of 9.56 mm and a width of 10.7 mm; the left trapezoid bone is 10.1 mm high and 10.8 mm wide (male)

In males, we found a trapezoid bone between 9-17 mm wide and 7-14 mm high. ***On the right side***, in 49 cases, ***the width of the trapezoid bone*** was 9-16 mm, and ***the height*** was 8-14 mm. ***On the left side***, ***the width of the trapezoid bone*** was 9.5-17 mm, and ***the height*** was between 7-13 mm.

Comparing the dimensions of the trapezoid of the two parts in males, we found that ***the width had the same bilateral value*** in 38.78% of cases, in 32.65% of cases ***the right width*** was 0.5-2 mm higher, and in 28.57 cases ***the left width*** was ***larger*** with differences between 1-2 mm***. The height of the trapezoid was equal bilaterally*** in 55.10% of cases, and in 28.57% of cases ***the right height*** was 1-4 mm ***higher***, and in 16.33% of cases ***the left height was higher*** with differences between 1 -4 mm.



A **B**

FIG. 16 A: the right trapezoid has a height of 9.81 mm and a width of 8.0 mm; the left trapezoid is 8.12 mm high and 10.2 mm wide (female)

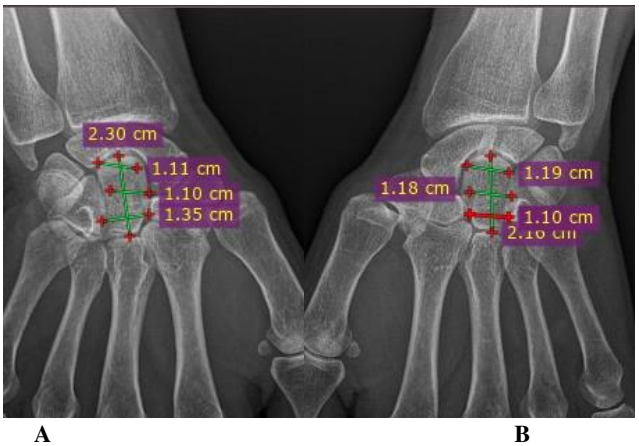
In females, we found a trapezoidal bone between 7-16 mm ***wide***, and ***the height*** was between 5-13 mm. ***On the right side***, ***the width of the trapezoid*** was 7-16 mm, and ***the height*** was between 6-12 mm. ***On the left side***, ***the width*** of the trapezoid was 7-15 mm, and ***the height*** was 5-13 mm. ***Comparing the dimensions of the two parts***, we found that ***the width of the trapezoid had the same bilateral value*** in 43.14% of cases, in 15.69% of cases ***the right width*** was higher by 1 mm, and in 41.18% of ***cases the left width*** was higher by 1-4 mm. ***The height of the trapezoid was equal bilaterally*** in 60.78% of cases, in 17.65% of cases ***the right height*** was 1-2 mm ***greater***, and in 21.57% of cases ***the left height*** was 1-3 mm ***bigger***.

CAPITATE BONE MORPHOMETRY

A **B**

FIG. 17 A: the right capitate bone has a height of 26.6 mm; the middle width is 10.4 mm, the head width is 12.9 mm, and the base width is 14.5 mm; the left capitate bone has a height of 24.7 mm; the average width is 11.4 mm, the head width is 13.1 mm and the base width is 14.3 mm (male)

In males, we found **a width** between 8-27 mm for the capitate bone, whereas ***the height*** was between 14-28 mm. ***On the right side***, the width was between 8-27 mm, and ***the height*** was between 10-26 mm. ***On the left side***, ***the width*** of the capitate bone was between 8-25 mm, and ***the height*** was between 14-28 mm. ***Comparing the dimensions of the capitate bone by the two parts***, we found that ***the width*** had the same bilateral value in 51.02% of cases, in 14.29% of cases ***the right width*** was 1-2 mm higher, and in 34.69% of the cases the ***left width*** was 1-5 mm ***higher***. ***The height of the capitate bone was equal bilaterally*** in 10.20% of cases, in 61.22% of cases ***the right height*** was ***greater*** by 1-5 mm, and in 28.57% of the cases, ***the left height*** was ***greater*** by 1-6 mm.



A **B**

FIG. 18 A: the right capitate bone has a height of 23.0 mm; the middle width is 11.0 mm, the head width is 11.1 mm, and the base width is 13.5 mm; the left capitate bone has a height of 21.6 mm; the middle width is 11.8 mm, the head width is 11.9 mm, and the base width is 11.0 mm (female)

In females, we found ***a width*** *between 9-24 mm for the capitate bone*, the difference between the extreme values being 15 mm, and ***the height*** was between 13-28 mm. ***On the right side, the width of the capitate bone*** was between 9-24 mm, and ***the height*** was between 15-27 mm.

On the left side, the width of the capitate bone was between 10-24 mm, and ***the height*** was between 13-28 mm. ***Comparing the dimensions of the two parts***, we found that ***the width of the capitate bone had the same bilateral value*** in 45.10% of cases, in 19.61% of cases ***the right width*** was 1-2 mm higher, and in 35.29% of in cases ***the left width*** was 1-2 mm higher. ***The height of the capitate bone was equal bilaterally*** in 15.69% of cases, in 43.14% of cases ***the right height*** was 1-5 mm ***greate***r, and in 41.18% of cases ***the left height*** was ***higher than the right***, with 1-6 mm.

HAMATE BONE MORPHOMETRY

FIG. 20 The right hamate bone is 15.6 mm high and 12.0 mm wide; the left hamate bone is 15.6 mm high and 10.7 mm wide (male)

In males, we found the hamate bone ***a width*** between 10-24 mm, and the height was between 12-23 mm. ***The width of the hamate bone on the right side*** was 10-23 mm, and ***on the left side*** it was 10-24 mm. *The height of the hamate bone on the right side* was 14-22 mm, and ***on the left side***, it was between 12-23 mm. ***Comparing the dimensions of the hamate bone on both sides***, we found that the width had the same bilateral value in 73.50% of cases, in 112.24% of cases ***the right width*** was 1-3 mm higher, and in 14.29% of in cases ***the left width*** was 1-4 mm higher***. The height of the hamat bone was equal bilaterally*** in 16.33% of cases, in 46.94% of cases ***the right height*** was 1-6 mm ***bigger***, and in 36.73% of cases the ***left height*** was 1-3 mm ***greater***.

A B

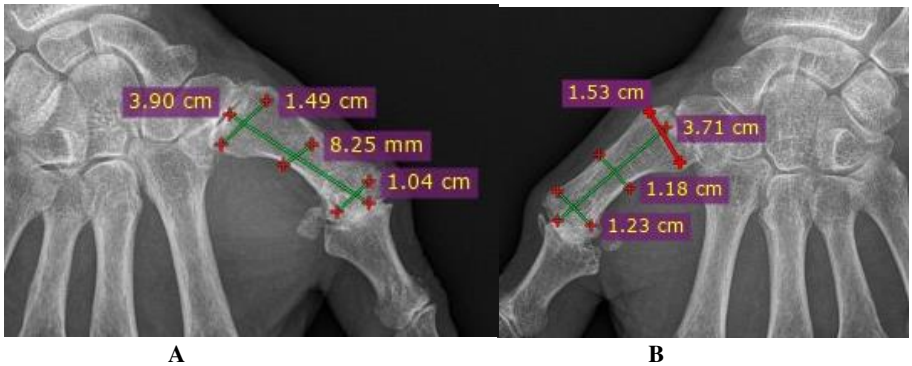
FIG. 20 The right hamate bone has a height of 22.9 mm and a width of 16.0 mm; the left hamat bone is 22.1 mm high and 14.4 mm wide (female)

In females, we found ***a width*** between 8-23 mm for the capped bone, and ***a height*** between 9.5-26 mm. ***On the right side, the width of the hamate bone*** was also 8-23 mm, and the height was 9.5-26 mm. ***On the left side, the width of the hamate bone*** was 8-23 mm, and the height was between 10-23 mm. ***Comparing the dimensions of the hamate bone on the two sides,*** *we found that* ***the width of the hamate bone had the same bilateral value*** in 64.71% of cases, in 9.80% of ***cases the right width*** was 1-2 mm ***higher,*** and in 25.49 of cases ***the left width*** was 1-4 mm ***higher***.

The height of the hamate bone was equal bilaterally in 23.53% of cases, in 41.18% of cases ***the right height*** was 1-7 mm ***bigger***, and in 35.29% of cases ***the left height*** was ***bigger*** with differences varying between 0,5-2 mm.

METACARPIAN MORPHOMETRY I

M*ORPHOMETRY OF THE METACARPIAN IN MALE SEX*

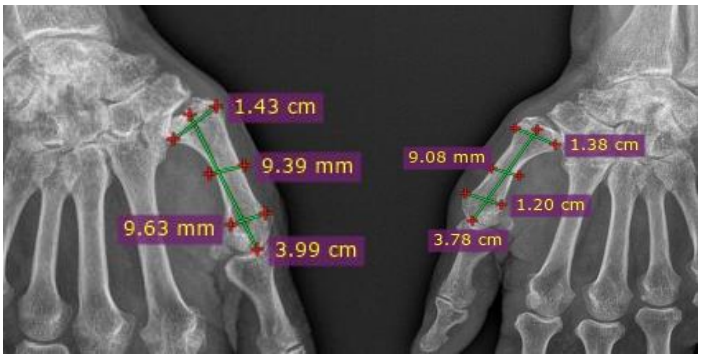


A B

FIG. 21 A: the length of the right first metacarpal is 39.0 mm; the width in the middle of the diaphysis is 8.25 mm; the width at the base is 14.9 mm, and the width at the head is 10.4 mm; B: the length of the left metacarpal I is 37.1 mm; the width in the middle of the diaphysis is 11.8 mm; the width at the base is 15.3 mm, and the width at the head is 12.3 mm (male).

The length of the first metacarpal in males was found to be between 33-51 mm, ***the length of the right first metacarpal*** being 33-50 mm, and the length of ***the left first metacarpal*** being 38-51 mm. I found ***the width of the first metacarpal*** between 4-13 mm, the ***width of the right first metacarpal***, being 4-13 mm, and ***the width of the left first metacarpal***, being 5-12 mm. ***Comparing the right / left,*** we found the following situation for ***the length of the metacarpal I: the right length was equal to the left one*** in 62.27% of cases, ***the right length was 1 mm longer*** in 20.41% of cases and ***the left length was larger*** with differences of 1 mm in 16.33% of cases. ***Comparing the right / left***, we found the following situation for the width of the first metacarpal in males***: the right width was equal to the left*** one in 30.61% of cases; ***the straight width*** was ***bigger*** with differences of 1-2 mm: in 46.94% of cases; ***the left width*** was ***bigger*** with differences of 1-2 mm in 32.45% of cases.

I found ***the width of the base of the right metacarpal I*** in the male sex between 11-19 mm, and I found ***the width of the head of the metacarpal I*** between 8-18 mm.



A **B**

FIG. 22 A: the length of the right first metacarpal is 39.9 mm; the width in the middle of the diaphysis is 9.39 mm; the width at the base is 14.3 mm, and the width at the head is 9.63 mm; B: the length of the left metacarpal I is 37.8 mm; the width in the middle of the diaphysis is 9.08 mm; the width at the base is 13.8 mm, and the width at the head is 12.0 mm (female).

MORPHOMETRY OF THE METACARPIAN I WITH FEMALE SEX

The length of the first metacarpal in females, we found it between 33-51 mm, ***the length of the right first metacarpal***, being between 33-51 mm, and ***the length of the left first metacarpal*** being between 33-51 mm***. The width of the first metacarpal*** was between 6-12 mm, ***the width of the right metacarpal*** was 7-12 mm, and ***the width of the left metacarpal I*** was 6-12 mm. ***Comparing the right / left***, as regarding ***the length of the first metacarpal*** in females, we found the following situation: ***the right length was equal to the left*** in 56.86% of

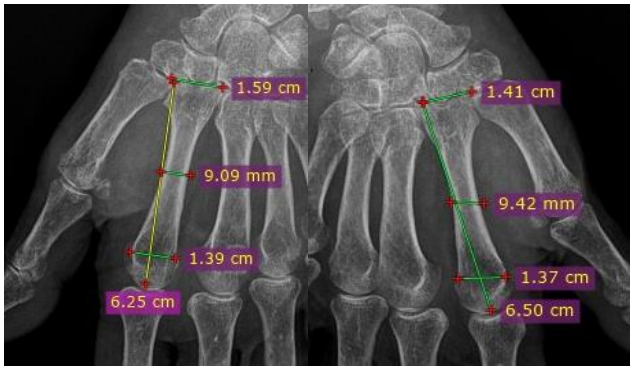
cases; ***the straight length*** was 1-3 mm ***bigger*** in 17.65% of cases; ***the left length*** was 1 mm ***greater*** in 27.45% of cases. ***Comparing the right / left***, we discovered the following situation for ***the width of the first metacarpal*** in females: ***the right width was equal to the left one*** in 29.1% of cases; ***the right width*** was 1-2 mm ***higher*** in 54.90% of cases; ***the left width*** was ***greater*** with differences of 1 mm in 15.65% of cases.

The width of the base of the right metacarpal I was found to be between 9-18 mm, and the width of the head of the metacarpal I was found to be between 8-17 mm.

METACARPIAN MORPHOMETRY II

MORPHOMETRY OF THE SECOND METACARPIAN IN MALE SEX

The length of the metacarpal II in males was found to be between 51-79 mm, ***the length of the right metacarpal II*** being 57-79 mm, and ***the length of the left metacarpal II*** being 51-79 mm.

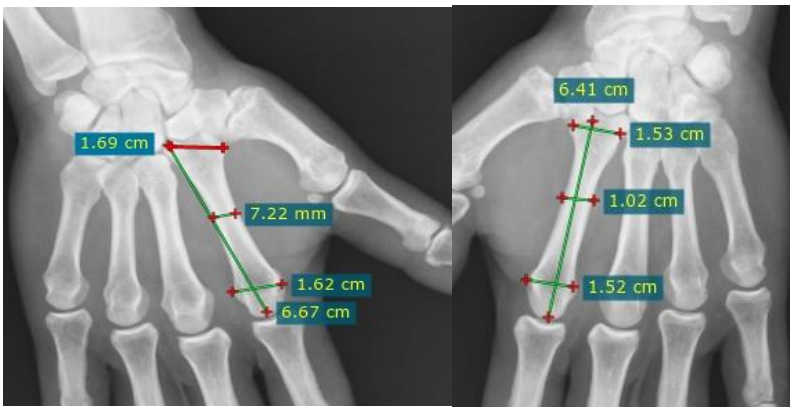


A ***B***

FIG. 23 A: the length of the right metacarpal II is 62.59 mm; the width in the middle of the diaphysis is 9.09 mm; the width at the base is 15.9 mm, and the width at the head is 13.9 mm; B: the length of the left metacarpal II is 65.0 mm; the width in the middle of the diaphysis is 9.42 mm; the width at the base is 14.1 mm and the width at the head is 13.7 m (male)

The width of the male metacarpal II was found to be between 6-11 mm, ***the width of the right metacarpal II*** being between 6-11 mm, and ***the width of the left metacarpal II*** between 6-10 mm. ***Comparing the right / left,*** we found the following situation for the ***length of the male metacarpal II***: ***the right length was equal to the left one*** in 62.27% of cases; ***the right length*** was 1 mm longer in 20.41% of cases; ***the left length*** was 1 mm longer in 16.33% of cases. ***Comparing the right / left***, we found the following situation for ***the width of the male metacarpal II***: ***the right width was equal to the left one*** in 32.65% of cases; ***the right width*** was 0.5-2 mm ***higher*** in 46.94% of cases; ***the left width*** was 1-2 mm more in 20.41% of cases.

I found the width of the base of the right metacarpal II in the male sex to be between 12-23 mm, and I found ***the width of the head of the metacarpal II*** situated between 10-18 mm.



A **B**

FIG. 24 A: the length of the right metacarpal II is 66.7 mm; the width in the middle of the diaphysis is 7.22 mm; the width at the base is 16.9 mm, and the width at the head is 16.2 mm; B: the length of the left metacarpal II is 64.1 mm; the width in the middle of the diaphysis is 1.02 mm; the width at the base is 15.3 mm and the width at the head is 15.2 mm (female)

METACARPIAN MORPHOMETRY II IN FEMALE SEX

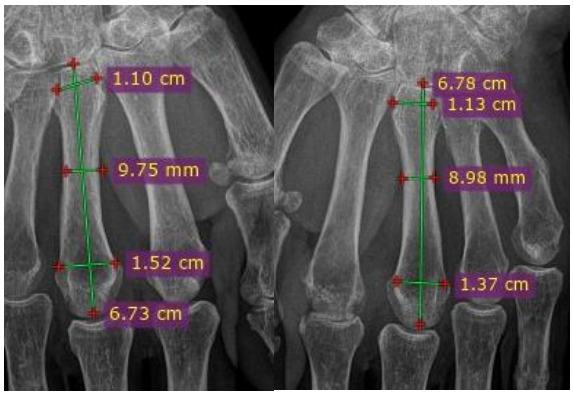
The length of the second metacarpal in females, we found it between 37-79 mm, ***the length of the right metacarpal II*** being 37-79 mm, and ***the length of the left metacarpal II*** of 37-79 mm. We found ***the width of the metacarpal II*** between 6-10 mm, ***the width of the right metacarpal II***, being 6-10 mm, and ***the width of the left metacarpal II*** of 6-10 mm. ***Comparing the right / left***, we found the following situation for ***the length of the second metacarpal in females***: ***the right length was equal to the left one*** in 43.14% of cases; ***the right length*** was 1-2 mm ***bigger*** in 27.45% of cases***; the left length*** was 1 mm ***bigger*** in 29.41% of cases. ***Comparing the right / left,*** we found the following situation for ***the width of the second metacarpal in females***: ***the right width was equal to the left one*** in 58.82% of cases; ***the straight width*** was 1-2 mm ***higher*** in 23.53% of cases; ***the left width*** was 1-2 mm ***higher*** in 15.69% of cases.

The width of the base of the metacarpal II was found in females between 10-23 mm, and ***the width of the head of the metacarpal II*** was between 9-19 mm.

METACARPIAN III

MORPHOMETRY OF THE METACARPIAN III IN MALE SEX

The length of the metacarpal III in males, we found it between 57-79 mm, ***the length of the right metacarpal III*** being 57-79 mm, and ***the length of the left metacarpal III*** having the same value.



A **B**

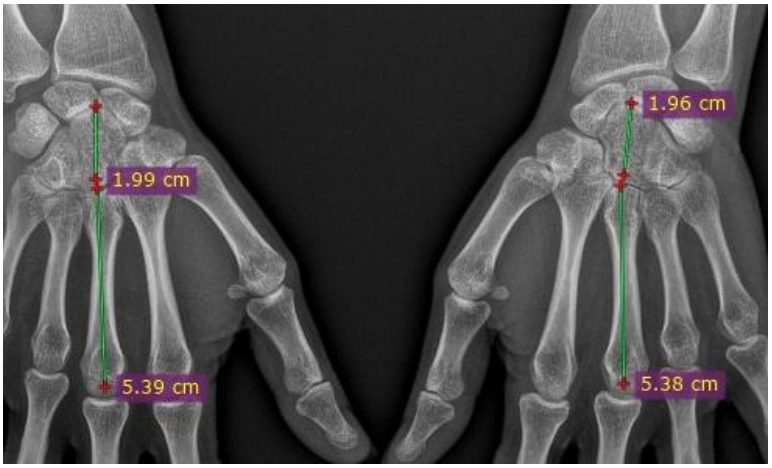
FIG. 25 A: the length of the right metacarpal III is 67.3 mm; the width in the middle of the diaphysis is 9.75 mm; the width at the base is 11.0 mm, and the width at the head is 15.2 mm; B: the length of the left metacarpal III is 6.8 mm; the width in the middle of the diaphysis is 8.95 mm; the width at the base is 11.3 mm and the width at the head is 13.7 mm (male sex)

The width of the metacarpal III was found to be between 6-11 mm, ***the width of the right metacarpal*** being 6-11 mm, and ***the width of the left metacarpal*** being 6-10 mm.

Comparing the right / left, we found the following situation for ***the length of the metacarpal III: the right length was equal to the left one*** in 44.90% of cases; ***the right length*** was 1-6 mm ***bigger*** in 23.65% of cases; ***the left length*** was 1-5 mm ***bigger*** in 22.45% of cases. ***Comparing the right / left***, we found the following situation for t***he width of the metacarpal III: the right width was equal to the left one*** in 34.69% of cases, ***the right width*** was 0.5-2 mm ***higher*** in 42.86% of cases; ***the left width*** was 1-2 mm ***higher*** in 22.45% of cases

The width of the base of the right metacarpal III in males was found to be between 11-23 mm, and ***the width of the head of the metacarpal IIII*** was found to be between 10-18 mm.

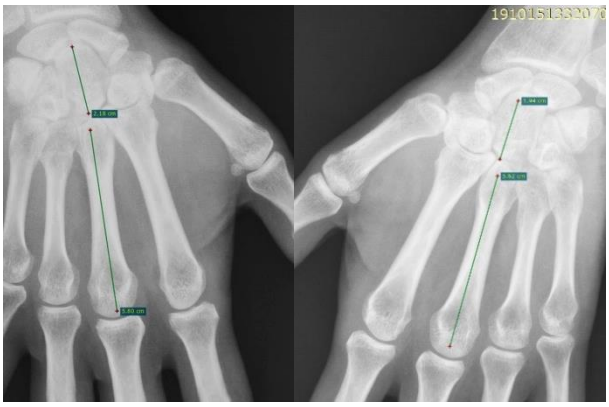
In females, the ratio between the axis of the head and the axis of the metacarpal III in the case of minimum values is 29.42-40.54% on the right side and 22.81-30.28% on the left side.



A **B**

FIG. 26 The ratio between the height of the capitate bone and the height of the metacarpal III. A: right - the capitate bone has a height of 19.9 mm, and the metacarpal III has a height of 53.9 mm; the ratio has the value of 36.92%; B. left - the capitate bone has a height of 19.6 mm, and the metacarpal III has a height of 53.8 mm; the ratio is 36.43% (female)

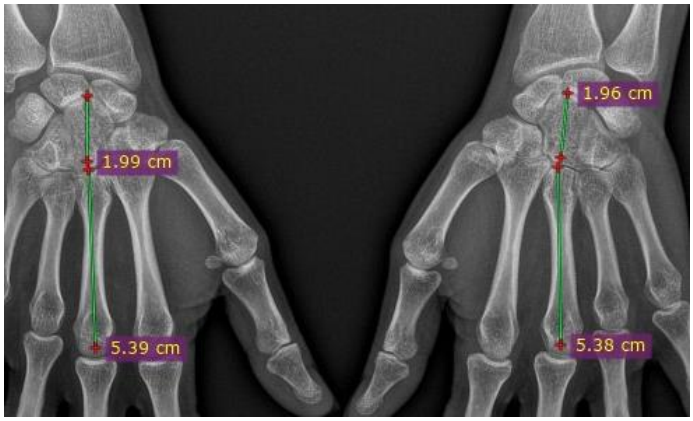
In the case of maximum values in females, the ratio between the axis of the capitate bone and the axis of the metacarpal III is 32.44-34.18% on the right side and 33.52-36.43% on the left side.



A ***B***

FIG. 27 The ratio between the height of the capped bone and the height of the metacarpal III. A: right - the capped bone has a height of 21.8 mm, and the carpal massif has a height of 56.0 mm; the ratio has a value of 38.93%; B. left - the capped bone has a height of 19.4 mm, and the matacarpal III has a height of 56.2 mm; the ratio is 34.52% (female)

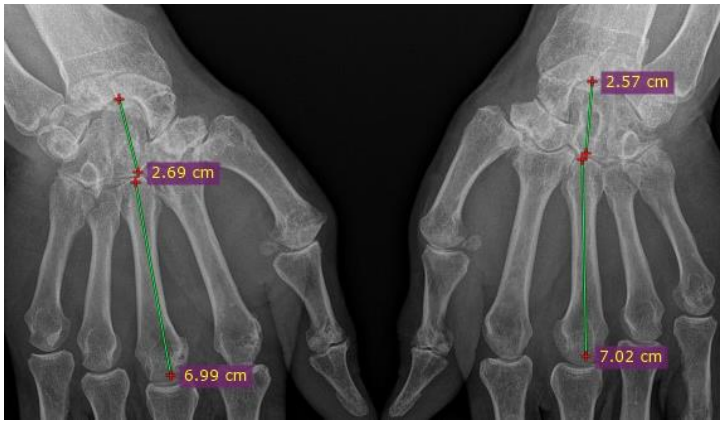
In males, the ratio between the axis of the head and the axis of the metacarpal III in the case of minimum values is 29.41-31.58% on the right side and 24.56-30.28% on the left side.



A **B**

FIG. 28 The ratio between the height of the capitate bone and the height of the metacarpal III. A: right - the capitate bone has a height of 19.9 mm, and the carpal massif has a height of 53.9 mm; the ratio has the value of 36.92%; B. left - the capitate bone has a height of 19.6 mm, and the matacarpal III has a height of 53.8 mm; the ratio is 36.43% (male)

In the case of maximum values in males, the ratio between the axis of the capitate bone and the axis of the metacarpal III is 32.44-36.92% on the right side and 35.44- 38.48% on the left side.



A ***B***

FIG. 29 The ratio between the height of the capitate bone and the height of the metacarpal III. A: right - the capitate bone has a height of 26.9 mm, and the carpal massif has a height of 69.9 mm; the ratio caitat-metacarpal III is 38.48%. B. left - the capped bone has a height of 25.7 mm, and the matacarpal III has a height of 70.2 mm; the ratio caitat-metacarpal III is 38.48%. (male)

METACARPIAN MORPHOMETRY IV

MORPHOMETRY OF THE METACARPIAN IV IN MALE SEX

The length of the IV metacarpal in males, was found to measure between 48-73 mm***, the length of the right metacarpal*** being 49-73 mm, and ***the length of the left metacarpal,*** 48-73 mm. ***The width of the IV metacarpal in males***, was found to be between 5-11 mm, in ***the right metacarpal*** being 5-10 mm, and ***the width of the left metacarpal*** 5-11 mm. ***Comparing the right / left***, for the length of the IV metacarpal in males, the following were discovered: ***the right length was equal to the left*** in 63.27% of cases, ***the right length*** was 1-11 mm ***greater*** in

22.45% of cases and ***the left length*** was 1-2 mm ***bigger*** in 14.29% of cases. ***Comparing the right / left***, we found the following situation for ***the width of the IV metacarpal in males: the right width was equal to the left*** in 36.73% of cases***, the right width*** was 1-3 mm ***higher*** in 34.69% of cases ***and the left width*** was 1-2 mm ***higher*** in 28.57% of cases.

I found ***the width of the base of the right IV metacarpal in males*** to be between 8-15 mm, and ***the width of the head of the IV metacarpal*** to be between 8-15 mm.

MORPHOMETRY OF THE METACARPIAN IV IN FEMALE SEX

The length of the IV metacarpal in females, we found it between 46-73 mm, **the length of the right IV metacarpal** being 46-73 mm, ***and the length of the left metacarpal***, being also between 46-73 mm. ***The width of the IV metacarpal*** was found to be between 5-9 mm, with a difference between the extreme values of 4 mm, and ***the width of the IV metacarpal*** of 6-10 mm***. Comparing the right / left***, we found the following situation for ***the length of the IV metacarpal in females: the right length was equal to the left one*** in 62.75% of cases; ***the straight length*** was 1-9 mm ***bigger*** in 23.53% of cases; ***the left length*** was 1 mm ***greater*** in 13.73% of cases. ***Comparing the right / left***, we found the following situation for ***the width of the metacarpal IV in females: the right width was equal to the left one*** in 52.94% of cases; ***the right width*** was 1 mm ***higher*** in 25.49% of cases; ***the left width*** was 0.5-2 mm in 19.61% of cases.

I found ***the width of the base of the right IV metacarpal*** in females between 9-15 mm, and I found ***the width of the head of the right IV metacarpal*** between 8-19 mm.

METACARPIAN MORPHOMETRY V

A **B**

FIG. 30 A: the length of the right metacarpal V is 45.2 mm; the width in the middle of the diaphysis is 4.93 mm; the width at the base is 10.3 mm, and the width at the head is 4.52 mm; B: the length of the left metacarpal V is 46.9 mm; the width in the middle of the diaphysis is 9.20 mm; the width at the base is 9.32 mm and the width at the head is 10.1 mm (male)

METACARPIAN MORPHOMETRY V IN MALE SEX

The length of the V metacarpal in males, was found between 46-73 mm***, the length of the right metacarpal*** measuring 49-73 mm, and ***the length of the left metacarpal*** 46-61 mm. We found ***the width of the metacarpal V*** between 5-11 mm***, the width of the right metacarpal V*** having between 5-11 mm. ***Comparing the right / left***, we found the following situation for ***the length of the metacarpal V in males: the right length was equal to the left one*** in 71.43% of cases; ***the riight length*** was 1-9 mm longer in 20.41% of cases; ***the left length*** was 2 mm longer in 8.16% of cases. ***Comparing the right / left***, we found the following situation for ***the width of the metacarpal V*** in males: ***the right width was equal to the left one*** in 34.69% of cases; ***the right width was 1-2 mm higher*** in 44.90% of cases; ***the left width was greater*** with differences of 1-2 mm in 20.41% of cases.

I found ***the width of the base of the straight metacarpal V in males*** to measure between 9-16 mm, and ***the width of the head of the metacarpal V in males*** to be as long as 7-15 mm

METACARPIAN V MORPHOMETRY IN FEMALE SEX

The length of the V metacarpal in females was found to be 43-67 mm, ***the length of the right metacarpal*** 43-67 mm, and ***the length of the left metacarpal*** 44-67 mm. ***The width of the metacarpal V in females***, was found to measure between 5-15 mm, ***the width of the right metacarpal*** being 5-15 mm, and ***the width of the left metacarpal*** 5-14 mm. ***Comparing the right / left***, we found the following situation for ***the length of the metacarpal V in females: the right length was equal to the left*** in 54.90% of cases, *the right length* was 1-4 mm ***greater*** in 33.33% of cases and ***the left length*** was 1-4 mm ***greater*** in 11.76% of cases. ***Comparing the right / left***, we discovered the following situation for ***the width of the metacarpal V*** in females: ***the right width was equal to the left one*** in 54.90% of cases; ***the right width*** was 1-2 mm ***higher*** in 29.41% of cases***; the left width*** was 1-2 mm ***higher*** in 15.69% of cases.

The width of the base of the right metacarpal V and ***the width of the left metacarpal IV head in females*** was found to rest in between 7-16 mm.

ORIGINALITY OF THE THESIS

- The large number of cases on which the study on the morphometry of the bones of the hand was performed, their dimensions being made with the help of a modern program: RadiAnt Dicom Viewer. 200 radiographs were followed, 98 cases in males and 102 cases in females.
- The size of the bones of the hand was followed comparatively according to sex, by age groups, comparatively right / left and comparatively between bones of the same type. The obtained results were compared with the existing data in the literature, in general, in most cases lacking particular references on the bone landmarks followed.
- Description of some reports of clinical importance in the carpal stability, representing an important means in the evaluation of the carpal spatial integrity and in the reconstructive surgery of the hand: the scapho-lunate, capitato-massive carpal and capitato-metacarpal relations III.
- Determining the degree of right / left symmetry of the skeletal bones of the hand.
- The use of anatomical terms in relation to the last Anatomical Terminology, published in 1998.
- The results obtained are supported by a large number of conclusive graphics and personal images, both in representative numbers: 122 graphics and 121 radiological images.

CONCLUSIONS

The scarcity of the bibliographic material throughout the specialized literature regarding the morphometry of the skeletal bones of the hand and especially on the metacarpals, phalanges and sesamoid bones is noticeable. My results were obtained from a relatively representative number of cases (200 cases for each bone type), with clarifications in relation to sex, age and right / left comparison.

The skeleton of the two hands is in most cases asymmetrical, there are sexual differences in the size of the carpal bones, in most cases, the size being larger, with variable differences, most often 1-2 mm, in favor of males. We also found special dimensions between the two parts, right and left, either in terms of height or width of the same hand bone, as well as dimensional differences between the age groups studied.

The cases of total right / left symmetry (in which the width and height of a bone are equal on both sides, right and left) were found in relatively infrequent percentages, the

percentages being characteristic of each bone of the hand. Total symmetries were more common in females, finding them more common in 5.12% of cases.

At the level of the carpal bones, we found the most frequent total symmetry in the trapezoid in 17% of cases, in males in 17.34% of cases, and in females in 16.67% of cases. The symmetry of the semilunar was found in the lowest number of cases, in 3.0% of cases, in males in 4.08%, and in females in 1% of cases.

At the level of the metacarpals, we found the most frequent total symmetry in 16% of cases at the level of the metacarpal 4, in the male being in 14.29% of the cases, and in the female in 17.65% of the cases. At the level of metacarpal 1 we found the right / left symmetry in the lowest percentage, in 5% of cases, at the male level in 4.08% of cases, and at the female level in 5.88% of cases.

In relation to age, we found the most common cases of total symmetry in the age group 41-49 years, meeting them in 16.08% of cases, in 10.20% of cases in males and 5 , 88% of cases in females. In the age group 60-69 we found the lowest number of cases of total symmetry, meeting them only in females, in a percentage of 2% of all cases and in 3.92% of female cases. We found the reduced percentage symmetries over the age of 59 years: 4% of cases in the age group 62-69 years and 6% of cases in the age groups, 62-69 years and 72-78 years. These asymmetries are probably due to rheumatic morphometric changes that frequently affect the age of over 60 years.

There are differences between the morphometry of the carpals on both sides, right and left and depending on sex, the dimensions determined being more frequently larger in males and in the right metacarpals (in both sexes). The cases of total morphometric symmetry, in which the four measured dimensions are equal on both sides (right and left), are characteristic of each sex and metacarpal.

At the level of the male sex, I found the longest length of the carpals at the level of the scaphoid, being 31 mm at the right scaphoid and 30 mm at the left scaphoid. In females, the largest length (width) of the carpals was also found at the level of the capped bone, being 29 mm, both on the right and on the left. These dimensions were larger than the level of the male capitate bone by 5 mm on the right and 2 mm on the left. In females they were larger than in the bone capped by 2 mm on both sides.

The largest width, in males, I found it at the level of the capped bone being 27 mm on the right and 25 mm on the left, the dimensions being larger than at the level of the hamat bone by 4 mm on the right and 1 mm on the left. In females, the largest width of the carpals was also found at the level of the capped bone, being 27 mm on the right and 25 mm on the left, the

dimensions being larger than the level of the hamat bone by 4 mm on the right and 2 mm. on the left.

Given the size of the capped bone, it justifies its name of large bone only in terms of its width, its length being exceeded by that of the scaphoid, but it justifies its name especially in terms of its volume.

[Young Yong, Canova] states that the capped bone has the largest volume, regardless of age, its volume being always higher than that of the scaphoid or hamat. It is followed by the hammock, the scaphoid, the trapezoid, the crescent, the pyramidal, the trapezoid and the pisiform. On average, carpal bone volumes in women were 38% lower than the corresponding carpal volumes in men.

The variation in volume between the right and left sides for the capitate can be explained by a bone harvesting error, in the case of establishing the morphometry on the fresh bones harvested from the carcass or due to differences in their formation in the same individual. Moreover, bone growth and maturation are subject to interacting factors, including race, heredity, nutrition, hormonal status, activity, and strength [Young Yang, Canovas]].

We found a link between the size of the carpal bones and the age of the healthy subject, without degenerative rheumatic diseases. [Guillem, Canovas] find a significant correlation between the volume of the carpal bone and age and a very strong link between the volume of a given carpal bone and the volume of all the others, whatever their age. Constantly, the ratio of carpal bone volumes indicates that these bones interact with other metacarpals in the maturation of the bones of the hand [Guillem, Canovas].

According to [Viegas], the proximal bones of the carpal mass can be described as an intercalated segment, because no tendons are inserted on them, and their movement is entirely dependent on the mechanical forces at their surrounding joints. The distal carpal bones are closely connected by strong intercarpal ligaments, and the movement between them can be considered negligible. Similarly, the almost rigid ligament connection of the trapezius and capitate with the metacarpal bones 2 and 3 and the lack of movement between these bones make the distal row considered functional as part of a fixed hand unit that moves in response to the musculotendinous forces of the forearm. .

[Morimoto] reported that radioulnar deviation of the hand joints occurs mainly through the mediocarpal joint, with a smaller contribution from the radiocarpal joint.

The ratios between the carpal bones (scapho-lunate, carpato-capitato-massive) have a special importance in the carpal stability and in the reconstructive surgery of the hand, representing an important means in the evaluation of the carpal spatial integrity.

At the level of the metacarpals, in the male sex, we found the longest length, both on the right and on the left, of 79 mm, at the level of the metacarpals 2 and 3, in the same proportions (18% of cases). We found the same length in the metacarpal 2 and 3, but in a lower percentage by 5.25% of cases than in males. My results contrast with the results in the literature, which give the longest length at the level of the metacarpal II [Kamina, Mestdach, Papilian, Robacki]. Nor does it agree with the results of [Berg], who states that the length of the metacarpals gradually decreases from the second to the fifth metacarpal, I finding that this decrease takes place at the level of the metacarpal 3.

The largest width was found at the level of the metacarpal 1, in the male being 13 mm on the right side and 12 mm on the left side. In females, we found the largest width at the level of the metacarpal 1 of 12 mm in both metacarpals, right and left.

For [Young Yang], the metacarpals play an important role in grip and grip, and if the metacarpal height were to decrease by 2 mm, the grip strength would decrease by 8%. Angulation and malrotation of the metacarpal affect not only the fingers involved, but can also affect the neighboring finger, leading to impaired appearance and dysfunction [Young Yang]. My results are consistent with the results of [Mestdach], who states that the shortest length is at the level of the metacarpal 5.

The ratio between the height of the capped bone and the height of the metacarpal III is an important tool in assessing the carpal spatial integrity.

The joint of the hamat with the fifth metacarpal is very mobile, a special role having the superficial articular surface, in the form of a saddle of the hamat bone. [Young Yang] points out that “the shape of the joint surface on the harness provides minimal stability, but allows for a wider range of motion, which is required for strong grip. The second and third metacarpals, which act as a center console, are firmly attached to the carpals. Therefore, the fourth and fifth carpo-metacarpal joint and the first flexible carpo-metacarpal joint, can move in the form of a cone around the second and third metacarpal. This type of movement facilitates the palm for better grip. In addition to the extent of joint movement, other important factors are those that affect the function of the fifth metacarpal, such as metacarpal height, angulation and rotation.

[Mestdach] finds that the width of metacarpal IV is smaller than that of metacarpal V, which I find to be equal in most cases.

At the level of the phalanges, the longest male length was found at the level of the phalanx 1 of the finger 3, having 50 mm on the right and 51 mm on the left. In females, I also found it at the level of finger 1, having 49 mm, both on the right and on the left.

The largest length of the phalanx 2, in males, I found at the level of the finger 3, having 33 mm on the right and 32 mm on the left. In females, the longest length of the phalanx 2 was also found at the level of the finger 1, having 32 mm, both on the right and on the left.

The largest length of the phalanx 3, in males, I found at the level of the finger 2, having 23 mm on the right and 27 mm on the left. In females, the longest phalanx 3 was found at the level of the finger 4, having 21 mm, both on the right and on the left.

The longest bone portion of the fingers, I found it at the level of the finger 3, having in the male 101 mm, both on the right and on the left. In females it was 97 mm on the right and 101 mm on the left.

The extreme values of the dimensions (minimum and maximum) were frequently encountered in only one case, being followed (in the case of the minimum dimensions) or preceded (in the case of the maximum dimensions) by values in a higher percentage.

The existing differences between different statistics are due to several causes: the number of cases that were worked on (I consider that my results were established on a representative number of cases); the type of device and software used, the experience and especially the attention of the specialist who performed the morphometry; we do not exclude the existence of morphometric characteristics related to territory, occupation, training and age.

The study of hand bone morphometry has applicability both in morphology and radiology (in establishing normal databases), and especially in medical practice (balneology and hand surgery).

Thus, after [Feipel], several parameters are currently used in clinical practice for the diagnosis of carpal pathologies. For example, a shorter scaphoid length would suggest a feature called "scaphoid collapse" and could be due to a displaced fracture or a rotational subluxation of the scaphoid. Similar information on other regions of the wrist can be obtained from other results, such as the quantitative evaluation of the flexed crescent or the position in extension, when analyzing both lengths of the crescent horn.

According to [Crisco], the extensive database of dimensions provided in this study should be useful in the design and insertion of fastening systems and implants.

After [Berg], the goal in reconstructive surgery of deformed scaphoid nonunions in the hump, some recommend restoring normal scaphoid length, while others over-extend the normal length

to ensure carpal realignment and prevent late collapse. The estimation of the scaphoid length is made on the basis of the contralateral scaphoid.

For [Middleton], it is sometimes difficult to determine the correct screw length and size. This should avoid accidents involving the use of fasteners during surgery.

According to [Zubairy], the scaffold fusion into symptomatic chronic scaffold instability is a surgical maneuver that seems sufficient to restore stability with high patient satisfaction.

For [Patterson, Canovas, Efremov29] the decrease in the size of the carpal tunnel would also occur as a result of changes in the size of the carpal bones, having as a consequence in the case of decreasing the width of the canal, the compression of the median nerve. The same view is held by [Rhoades, Gelberman, Castelli, Garland, Tuncali].

After [Alp], the change in the size of the medial carpal bones, especially the pyramidal, leads to the installation of ulnar canal syndrome, affecting the ulnar nerve.

For [Vance], mediocarpal hemiarthroplasty is a new motion-preserving treatment for radiocarpal arthritis and is an alternative to current procedures that provide pain relief to the detriment of wrist biomechanics and natural movement. It is indicated primarily in active patients with a well-preserved distal line and debilitating arthritic symptoms. This technique has theoretical advantages over current treatment options (e.g., arthrodesis and total wrist arthroplasty) because it ensures coupled joint movement, maintains radial length, is technically simple, and avoids the inherent risks of nonunion. failure of the distal component.

Restoring the function of the hand joint is an obvious objective of reconstructive surgery of the hand, requiring a good knowledge of the anatomy of the component bones, an important aspect being their morphometry.

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