



RIGHT-LEFT ASYMMETRY

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ABSTRACT Osteoporosis is a disease process that eats away bones that makes them weak and susceptible to fragility fractures. As the bone mass depends on many factors such as genetic, endocrinological, dietary and lifestyle we see that females are affected by osteoporosis more frequently due to menopause than their male counterparts and suffer from its complications in the form of fragility fractures. Metacarpal Radiogrammetry of left second metacarpal bone on hand x rays has been in vogue for more than half a century for detection of osteoporosis. This study demonstrates the bilateral asymmetry of second metacarpal bone radiogrammetrically by studying various parameters on hand x rays using vernier callipers. Our study proves and confirms the finding that right second metacarpal bone in right handed females is significantly bigger in shape and size than left. Limb long bone asymmetry is well documented in literature. The left side bones are weak as compared to right so osteoporosis affects left side bones more than right consequently raising the susceptibility for fracture and its complications due to laterality. Thus osteoporosis can be easily detected on the left hand as compared to the right and may be a cause of more fragility fractures affecting left side upper limb bones than right. The natural asymmetry of the right and left hand bones and its consequences can be explained by factors that lead to more bone formation on right limb such as genetic, dominance and differential mechanical loading of hands.

KEYWORDS : Metacarpal Radiogrammetry , second metacarpal, hand Dominance

INTRODUCTION.

Osteoporosis is a silent killer disease affecting women more than men all over the world and leads to an increase in morbidity and mortality in the form of fractures. Due to early menarche and menopause Indian females suffer from osteoporosis earlier than their western counterparts and hormonal fluctuations lead to decay of bones increasing the probability of pathological fractures.

Bones in the body undergo growth and remodeling right from intrauterine life till old age. There are various factors affecting bones like age, gender, limb dominance, diet, hormones, race, genes, skin colour to name a few¹.

Metacarpal radiogrammetry as a screening tool for the detection of osteoporosis was first described by Barnett and Nordin and further improvised for more than half a century².

AIM

The present study aims to study various morphometric parameters on right and left second metacarpal bone through metacarpal radiogrammetry in the perimenopausal females.

MATERIAL AND METHOD

The present study was conducted in Dayanand Medical College And Hospital, Ludhiana. Fifteen perimenopausal females in their forties were taken as subjects for the study. This study is a part of thesis. Ethical clearance was given and consent was obtained before the study was conducted. Posteroanterior radiograms of both hands were obtained using standardized protocol. Vernier callipers were used to take readings of length and subperiosteal diameter and endosteal diameter at the mid-shaft of second metacarpal of both hands as shown in Figure1. Calculations were done using formulae as given further. Appropriate statistics were applied and both hands were compared as given in Table 1.

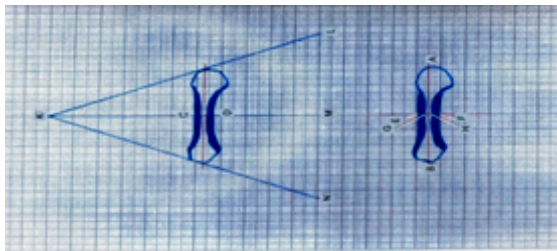


Figure 1. Metacarpal Morphometric Parameters

1. MEASUREMENTS

- 1.1. LENGTH (AB) = L
- 1.2. SUBPERIOSTEAL DIAMETER (EF) = D
- 1.3. ENDOSTEAL DIAMETER (GH) = d

2. FORMULAE

2.1. COMBINED CORTICAL THICKNESS

$$CCT = D - d$$

2.2. METACARPAL INDEX

$$MCI = D - d / DX 100$$

Table no 1 Morphometric analysis of second metacarpal bone on x ray

PARAMETERS Measured & calculated on x rays of both hands	RIGHT 2 nd Metacarpal Mean value	LEFT 2 nd Metacarpal Mean value
D	8.09mm	7.76mm
d	3.59mm	3.65mm
CCT	4.50mm	4.11mm
MCI	55.85%	53.05%

RESULTS AND DISCUSSION

The present study confirms that right hand bone size and mass is greater than that of left. As can be seen in Table . 1 there is a significantly greater total width indicating bone size and a greater cortical thickness as well as metacarpal index of the second metacarpal bone indicating bone density which proves that right hand being the is bigger in size and heavier when compared to left hand . The right limb bones are genetically larger and heavier than those of left. Studies on primate second metacarpal also prove the same. The right hand being larger genetically is the dominant hand and functionally performs better than left so it is the dominant limb in majority of humanoids.³ Another study found that females show greater bilateral asymmetry of upper limb bones than the males⁴. Our study in Indian population is in conforms with previous studies on caucasians . During another study we found one ambidextrous female with no significant difference between right and left hand bone size and mass. Thus upper limb dominance is seen to affect the bilateral asymmetry by increasing it among right dominant individuals and decreasing it in left dominant or ambidextrous ones⁵.

CONCLUSION

All the Upper limb bones display a bilateral asymmetry as reported in various studies on paired dry bones like humerus, radius, ulna and the metacarpal bones proving the right upper limb bones to be stronger than left . Thus the growth and deterioration of upperlimb bones throughout life show an asymmetrical pattern. Though dissimilar but this knowledge is useful in designing metacarpal prosthesis. As there is only a 3 to 4 percent difference in morphometric evaluation in bone size values the metacarpal of unaffected hand can be used in designing customised prosthesis of affected hand⁶. The natural asymmetry of the right and left hand bones and its consequences can be explained by factors that lead to more bone formation on right limb such as genetic, dominance and differential mechanical loading of hands. Hence structure and function are correlated.

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