



Metacarpal Radiogrammetry Revisited

KEYWORDS

metacarpal radiogrammetry, cortical thickness, vernier caliper, Punjabi women

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ABSTRACT *Background and Aim -According to WHO Technical Report Series released in 1990 Osteoporosis is a silent killer disease affecting mainly the aged population especially the western Europeans as well as Americans, frequently Indians and rarely blacks. Both men and women lose bone after 40 years. We aim to study on standardized hand x ray films, the cortical thickness of 2nd right hand metacarpal bone radiogram with advancing age in 60 Punjabi females staying in Ludhiana. Material and method-vernier callipers were used graphimetrically on standardised hand x-rays of 2nd right metacarpals to observe the cortical thickness. This technique revealed statistically significant low values of the same indices with progressive age. Results-We have observed that women reach peak bone density till 34 years and we observed a drastic reduction in thickness of cortex values in Punjabi females with advancing age after 40 years coinciding with hormone reduction due to female climacteric. Discussion-Many studies abound in the same findings in different races Conclusion-We conclude that Punjabi women have a weak bone structure and as age advances it deteriorates further leading to possibility of hip fractures, Colles' fracture in addition to vertebral collapse at a younger age than their female counterparts in other races residing in developed parts of the world especially Caucasians and Blacks.*

Introduction

Osteoporosis is the term used for diseases that cause a reduction in the mass of bone per unit volume. It is used to define any degree of skeletal fragility sufficient to increase the risk of fracture. This disorder is characterized by a decrease in cortical thickness and in number and size of trabeculae of cancellous bone. Osteoporosis is an important cause of morbidity in the elderly. Bone remodeling involves formation and resorption continuously, since the bone mass is decreased in osteoporosis the affected individual either failed to obtain optimal skeletal mass during the first 3 decades of life and/or the rate of bone resorption exceeded that of bone formation after peak skeletal mass was attained. This difference is exaggerated by the normal menopause. Peak bone mass is attained by 30-35 years for cortical bone. Various factors lead to the sad occurrence of fragility fractures like fracture of hip, distal end of radius and vertebral crush syndrome in the elderly due to a simple fall as a result of osteoporosis. Hence there is a need for an early and cheap modality of diagnosis like an x-ray. Due to a simple fall as a result of osteoporosis a fracture can occur. Hence there is a need for an early and cheap modality of diagnosis like an X-ray and vernier caliper to study bone density in the population including women in late adulthood using manual radiogrammetry. Before the disease manifests itself let us avoid it. *Moreover this technique is easily affordable as compared to digital radiogrammetry and gold standard DEXA and offers the orthopaedician a wide scope to improve the health of the population as after diagnosis the treatment given would easily reduce the morbidity and mortality in the form of hip fracture, Colles' fracture and vertebral crush syndrome apart from relief from vague pains and disability.* Hence to make the diagnosis cheap and easily affordable this study attempts to evaluate manual metacarpal radiogrammetry as a diagnostic aid for detecting osteoporosis in Indian setup. Before the disease manifests itself let us avoid it.

The first attempt has been made in the past by workers such as Barnett and Nordin way back in 1960¹. Since then many researchers have taken up this modality to diagnose osteoporosis as it reflects the cortical thinning with

age whether taken in different age groups or as a longitudinal population study. In addition femoral neck fractures are much more common in elderly women. Therefore if the 30% to 40% of bone loss that occurs between 40 to 70 years of age could be prevented definitely a reduction in hip fractures should occur.

Aim – Analysis Of Morphometric Measurements On Right 2nd Metacarpal From Hand Radiographs Of Women

Material and method

This study was taken up in the Dayanand Medical College and hospital using a vernier caliper and hand x-rays. The cortical thickness with other parameters was assessed in young and old individuals. 60 women belonging to and around Ludhiana district were included in this study. 15 subjects falling between 25-34 years were included so as to take the control group for comparison with elderly population which subsequently included another 45 females. The distribution of subjects is given in table no 1. The radiographs were obtained from patients coming to x-ray department for unrelated procedures. Hand radiographs of subjects ranging in age beginning with 25 till late 70s belonging to Ludhiana district in Punjab. The tools used were a big X-Ray view box, vernier calipers and a graphimetric measurement was done for assessing the metacarpal. Posteroanterior radiographs of right hand of each subject were obtained. The hand was placed with palm facing downwards and in contact with it at a tube to film distance of one metre. The second metacarpal was chosen as it is approximately circular at mid shaft and the medullary cavity is heavily centered in the tubular bone cylinder at that point. The right hand was selected as it has more bone mass than left. The midshaft of the 2nd metacarpal was determined and readings of total width/subperiosteal diameter and medullary width/endosteal diameter were obtained using vernier calipers as shown in diagram no. 1. Using the given formula the combined cortical thickness can be easily calculated at the mid shaft of right second metacarpal on hand x-ray.

Age group distribution	No of subjects studied BY means of x-ray films (females)
25-34 years	15
41-50 years	15
51-60 years	15
61 years and above	15

TABLE NO 1. AGE DISTRIBUTION OF SUBJECTS



- LINE SEGMENT CD BISECTS THE 2ND METACARPAL AT MID SHAFT
- EF-SUBPERIOSTEAL DIAMETER AT MIDSHAFT(REFERS TO D)
- GH=ENDOSTEAL DIAMETER AT MIDSHAFT (REFERS TO d)

DIAGRAM 1 METHOD FOR MEASUREMENTS OF METACARPAL ON RADIOGRAPHS

(CCT)COMBINED CORTICAL THICKNESS=D- d (DEQUEKER,1976)³

D-SUBPERIOSTEAL DIAMETER MEASURED IN MM AT MIDSHAFT OF 2ND RIGHT METACARPAL
 d-ENDOSTEAL DIAMETER MEASURED IN MM AT MIDSHAFT OF 2ND RIGHT METACARPAL

Results

Lets see what happens to cortical bone from what we have observed A steady decline in the mean value of cortical thickness after 40 years was observed in women who were peri or post menopausal indicating bone loss which can lead to osteoporosis-fracture.The following values of mean cortical thickness in the various age groups from 25 years onwards are as follows values given are in millimetres 5.17>4.50>4.37>3.93.refer to Table no. 2

In women the thickness of cortical bone portrayed a decreasing trend in the study which is imperative in the etiology of fracture study and this fact can be utilized to do mass screening before the epidemic sets in. *Though DEXA remains the gold standard people at risk can be identified and remedial steps can be taken before its too late*

2ND METACARPAL

AGE GROUP	MEAN		
	Subperiosteal diameter (mm)	Endosteal diameter (mm)	Cortical Thickness (mm)
25-34 years	7.86	2.69	5.17
41-50years	8.09	3.59	4.50
51-60years	8.11	3.75	4.37
61 AND ABOVE-years	7.91	3.97	3.93

AGE GROUP	MEAN		
	Subperiosteal diameter (mm)	Endosteal diameter (mm)	Cortical Thickness (mm)
CORRELATION COEFFICIENT r		0.419	-0.462
SIGNIFICANCE	NS	P<0.01 HS	P<0.01HS

TABLE NO 2.COMBINED CORTICAL THICKNESS WITH ADVANCING AGE
 NS-NOT SIGNIFICANT
 HS-HIGHLY SIGNIFICANT

DISCUSSION

According to the reference range and mean values given in table no 2 a there is a steady increase in endosteal diameter but on the other hand minimal changes in subperiosteal diameter resulting in a steady decline in the mean value of cortical thickness after 40 years as was observed in women peri or post menopausal women indicating bone loss which can lead to osteoporosis causing a fracture.The decrease observed is statistically highly significant p<0.01. The thickness of cortical bone shows a definite decreasing trend as was observed in the study which is imperative in the etiology of fracture study and this fact can be utilized to do mass screening before the epidemic sets in. Though Dual energyX Ray Absorptiometry remains the gold standard to confirm diagnosis but to identify people at risk this could be used as a routine screening procedure so that they can be identified and remedial steps can be taken before its too late. In the year 1969 Garn et al derived similar conclusions as the present study that adult bone loss is an international phenomenon which takes place with advancing age in both sexes and in females it begins around 40 years of age and in some due to extreme amounts of bone loss results in fractures of hip,distal end of radius and vertebral crush syndrome .⁴ In 1994 Derisquebourg et al evaluated a new method of assessment of the second metacarpal based on automated radiogrammetry.They concluded that although this technique not be the best modality of bone density assessment as even its automation does not improve it but it is of interest in mass screening.⁵ In 1997 Maggio et al undertook a cross sectional study on a population of Caucasian descent using photodensitometry and radiogrammetry of the second metacarpal bone.he drew the following conclusions for metacarpal ageing-an acceleration in cortical bone loss occurs in females after 65 years of age which causes cortical thinning.⁶

Conclusion –

We found that women attain their maximum bone mass by 33 years thereafter they begin to lose cortical bone due to reduced diet,hormonal factors,age, racial differences and some genetic link to mediterranean stock in addition to mutant vitamin-D receptor. And which is easily preventable due to early diagnosis with the introduction of this simple technique which can be used for mass screening .To conclude women lose bone with age as a result of female climacteric .In the present study we observed that the subjects matched for age were having lesser bone density as compared to their western counterparts .⁵This can be prevented by calcium supplements, bisphosphonates such as alendronate and estrogen replacement therapy.Food sources rich in calcium such as milk cheese, cream,butter ,spinach ,nuts , should be taken in moderate amounts regularly. This requires an early diagnosis and quick intervention at

a low cost in a country such as India. Therefore metacarpal radiogrammetry especially manual could be even used in rural primary health care facilities for mass screening and prevention of osteoporosis. Can we call osteoporosis a mal-nutrition disorder of the elderly ?

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