

ANATOMICORADIOLOGICAL STUDY

Bone morphometry

Jaffar M, Murlimanju BV, Saralaya VV, Prabhu LV, Prashanth KU, Krishnamurthy A

Department of Anatomy, Kasturba Medical College, Manipal University, Bejai, Mangalore (D.K.), India.
flutesnowmm@gmail.com

Abstract: *Objectives:* To compare anatomical measurements with that of radiological measurements.

Background: The radiological measurements are commonly used in clinical practice. It is well known that the anatomical measurements are more accurate than radiological. The comparison of anatomicoradiological measurements is not reported hitherto.

Methods: One human adult cadaveric femur bone was used for the present study. It was measured both anatomically and radiologically.

Results: In digital X-ray measurements, the length from the upper lip of fovea capitis to the most prominent part of greater trochanter was 87.2 mms, from the upper most part of greater trochanter to the isthmus it was 147.9 mms, mediolateral width of medullary cavity at the isthmus was 8.9 mms, the mediolateral width at the distal root of lesser trochanter was 18.5 mms, anteroposterior width of medullary cavity at the isthmus was 11.5 mms, the anteroposterior width at the distal root of lesser trochanter was 16.8 mms. The same measurements were 91.2 mms, 154.6 mms, 11.8 mms, 19.7 mms, 11.9 mms and 18.5 mms when taken anatomically using the digital vernier caliper.

Conclusion: The present study showed that in all the parameters measured the radiological values were slightly lesser than the anatomical values. Considering the variations in the values, the implants can be designed for a particular case in orthopedic surgery. We believe that this study adds an important reference in the scientific literature (Tab. 1, Fig. 2, Ref. 5). Full Text in PDF www.elis.sk.

Key words: anatomical, femur, measurements, morphometry, radiological.

Anthropometry is often viewed as a traditional and perhaps the basic tool of biological anthropology, but it has a long tradition of use in medical sciences especially in the discipline of anatomy and forensic medicine (1). Measurement of the skeleton and its parts is called osteometry. For the clinical practice the osteometric measurements are very important since they provide source of reference to the treating physician. Nowadays, radiological morphometry is becoming more popular because of the advancement of technology. Radiologically the body structures can be measured with the aid of X rays, computed tomography (CT) and magnetic resonance imaging (MRI) scans. Because of multiplanar facilities and exposure to nonionizing radiation, MRI is progressively replacing the CT scanning for quantitative and qualitative measurements, at least in a research environment (2). But the anatomical measurements are more accurate than radiologic, because anatomy provides direct visualization and assess the structure. There are reports available in which the authors (3, 4) estimated the stature and sex of the individual based on the osteometric measurements. But a study comparing the anatomical measurements with radiological has not been reported hitherto. This was the motivation for

undertaking this examination and the objectives were to perform anatomicoradiological comparison of the parameters.

Methods

The study included a femur bone which was freshly removed from a human male adult cadaver. Initially the femur was radiographed (one anteroposterior view and the other lateral view) and few measurements like the length from the upper lip of fovea capitis to the most prominent part of greater trochanter (AA1), from the upper most part of greater trochanter to the isthmus (BB1), mediolateral width of medullary cavity at the isthmus (CC1), mediolateral width at the distal root of lesser trochanter (DD1) were measured in the anteroposterior radiograph (Fig. 1A) digital film using the softwares. The anteroposterior widths of medullary cavity at the isthmus (EE1), at the distal root of lesser trochanter (FF1) were measured using the lateral view radiograph (Fig. 1B) digital film. The X ray tube was kept at a distance of 33 inches which will be usually kept to take the X ray hip joint. Later the same measurements were taken anatomically (Fig. 2A), the femur was cut transversely at the level of isthmus and at the distal root of lesser trochanter. The measurements were repeated using the digital vernier caliper (Figs 2B and 2C). The data were compared with the radiological ones.

In the anatomical specimen the location of the isthmus was calculated by the following formula.

$$X / Y = X1 / Y1$$

$$Y1 = X1Y / X$$

Department of Anatomy, Kasturba Medical College, Manipal University, Bejai, Mangalore (D.K.), India

Address for correspondence: B.V. Murlimanju, MD, Department of Anatomy, Kasturba Medical College, Manipal University, Mangalore – 575004, India.

Phone: +91.824.2211746, Fax: +91.824.2421283

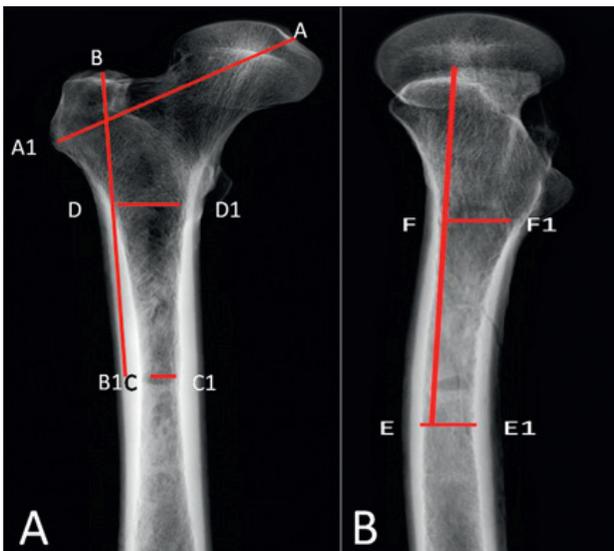


Fig. 1. Radiographic view of the adult femur bone; 1A – X ray anteroposterior view, 1B – lateral view (The radiographic measurements were done using the software, the details about the measurements are explained in the materials and methods section).

X = A-A1 (radiological)

Y = B-B1 (radiological)

X1 = A-A1 (anatomical)

Y1 = B-B1 (anatomical)

B-B1 (anatomical) = A-A1 (anatomical) x B-B1 (radiological)

/ A-A1 (radiological)

B-B1 (anatomical) = 91.2 mm x 147.9 mm / 87.2 mm

B-B1 (anatomical) = 154.6 mm

The isthmus is a radiological term commonly used in the orthopedics, it is the area at which the medullary cavity is the narrowest.

Results

In digital X-ray measurements, length from the upper lip of fovea capitis to the most prominent part of greater trochanter (AA1) was 87.2 mms, from the upper most part of greater trochanter to the isthmus (BB1) 147.9 mms, mediolateral width of medullary cavity at the isthmus (CC1) was 8.9 mms, the mediolateral width at the distal root of lesser trochanter (DD1) was 18.5 mms, anteroposterior width of medullary cavity at the isthmus (EE1) was 11.5 mms, the anteroposterior width at the distal root of lesser trochan-

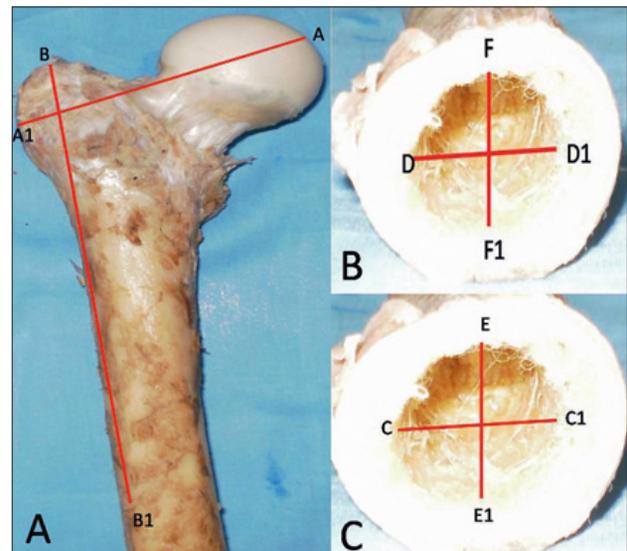


Fig. 2. Anatomical view of the adult femur bone; 2A – surface measurements, 2B – measurements of the medullary cavity at the level of distal root of the lesser trochanter, 2C – measurements of the medullary cavity at the level of the isthmus (The details about the measurements are explained in the materials and methods section).

ter (FF1) was 16.8 mms. The same measurements were 91.2 mms, 154.6 mms, 11.8 mms, 19.7 mms, 11.9 mms and 18.5 mms when taken anatomically directly on the femur using the digital vernier caliper. The distance from the upper most part of greater trochanter to the isthmus (BB1) was calculated by the formula which is described in the materials and methods section. The anatomico-radiological comparison of the parameters measured is presented in Table 1. In all the measurements, the radiological values were slightly lesser than the anatomical measurements.

Discussion

Morphometrics has undergone a revolutionary transformation in the past two decades as new methods have been developed (5). The radiological measurements were commonly used in the clinical practice. In the present study we observed that the radiological values were slightly lesser than the anatomical measurements. The radiological values also vary if the X ray tube distance is changed. Considering the variations in values (though minimal), the implants can be designed for a particular race, gender etc. For example an approximate size of the intramedullary nail can be chosen. Since the differences are minimal, the morphometric studies for the research purpose can be done with the digital X ray softwares. With the formula given above future studies about the anatomicoradiological comparison can be done with a larger sample size.

It was described that the precision in anthropometry is of utmost importance and it requires lots of practice. The difference between radiological and anatomical measurements can be considered as technical error and in order to minimize this error, standard method for recording these measurements should be adopted and internationally recognized. We believe that this idea will be

Tab. 1. Showing the comparison of measurements between radiological (digital software) and anatomical methods (vernier caliper).

Measurements	Radiological	Anatomical
A-A1	87.2 mms	91.2 mms
B-B1	147.9 mms	154.6 mms
C-C1	8.9 mms	11.8 mms
D-D1	18.5 mms	19.7 mms
E-E1	11.5 mms	11.9 mms
F-F1	16.8 mms	18.5 mms

enlightening for the morphologists, anthropologists and clinicians of various fields.

Conclusion

In all the parameters measured the radiological values were slightly lesser than the anatomical values. The present study showed differences between the anatomical and radiological measurements. This finding is important in the clinical set up. Considering the variations in the values, the implants can be designed for a particular case in orthopedic surgery. We believe that this study adds an important reference in the scientific literature. The study may be considered as new and future studies can be done by using the present idea with a larger sample size.

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