Tikrit Journal of Pharmaceutical Sciences 2007, 3(1) :36 - 41

Anatomical and statistical study of hip joints in Iraqis

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Received 13/5/2007 :accepted 2/5/2007

Abstract

As the environment plays an important role in the development of human being it was thought that the change in the environment might have led to some kind of change in the parameters of the bony component of the hip joint. Therefore, 54 cadaveric hip joints with soft tissue in situ were studied. Dimensions of acetabulum and femoral head were obtained with Vernier scale. It was observed that these dimensions were greater in males when compared with that of females but the difference was statistically non significant. On the left side the measured parameters were greater than those of the right side in both the sexes but of no statistical significance. Acetabular diameter was greater than the diameter of femoral head in both the genders. Clinically, this knowledge plays an important role in understanding the occurrence of primary osteoarthrosis in Iraqis. The present study is of value to the forensic experts, orthopaedicians and prosthetists as it gives the dimensions of acetabulum and femoral head.

دراسة تشريحية وإحصائية لمفصل الورك في العراقيين

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المستخلص

تَلعبُ البيئةُ دوراً مهماً في تطوير الإنسان لذلك قد يكون التغييرَ في البيئةِ رُبَّمَا يؤدي إلى نوع من التغيير في أبعاد المكوّن العظمي لمفصل الورك. لذا تم دراسة54 مفصل وركي جثماني مع نسيجه الناعم وفي موقعه الأصلي مع أخذ أبعاد الحُق ورأس عظم الفخذ الذي حُصِل عليهما بمِقياس الورنيّةِ. لوحظ بأنَّ هذه الأبعادِ كَانتْ أعظم في الذكور عندما قورنت بمثلها مِنْ الإناث لكن الإختلافَ لم يكن مهما إحصائياً، بينما على الجانبِ الأيسر القياسات المدروسة كَانتْ أكبر على الجانب الأيمن في كلا الجنسين وبدون أهمية إحصائية في حين أن قطر عظم الحقّ كَانَ أكبرَ مِنْ قطر رأس عظم الفخذ في كلا الجنسين. سريرياً هذه المعرفةِ تَلعبُ دوراً مهماً في فهْم حدوثِ داء الفصال العظمي الأولي في العراقيين. إنّ الدراسة الحالية ذات أهمية بالنسبة إلى خبراء الطبّ العدلي وجراحي العظام وخبراء تعويض الأعضاء المفقودة حيث تَعطي فهماً لأبعاد الحّق ورأس عظم الفخذ.

Introduction

The hip joint which was originally referred to as a ball and socket joint is now being described theoretically as a rotational conchoid [1]; or it is more of a conchoid than a ball and socket type [2]. To understand the hip joint mechanics the knowledge of anatomy of proximal femur is very necessary, also knowledge of various bony components of hip joint will not only help the radiologists but will also be of immense importance to the orthopaedicians and prosthetists. As race, clime, heredity and geographical areas have strong influence over the human parameters of bone, therefore the present study was undertaken to note the average diameter of the femoral head and the average diameter & depth of acetabulum in cadaveric hip joints. Although various dimensions of acetabulum and femoral head have been measured by several investigators on dry specimens, but this study is unique in measuring the parameters with soft tissues in situ. Availability of such data can help in constructing best possible prostheses for patients of total hip replacement in Iraq and any deviations of these dimensions from normal have strong correlation with development of various kinds of pathologies of hip joint. Fifty four cadaveric hip joints were dissected. All measurements were taken with Vernier scale, and the data obtained was precisely analyzed and interpreted.

Materials and Methods

This study was conducted in the Anatomy Department of Medical College of Tikrit University and Forensic Medicine Department of Tikrit Teaching Hospital in Salah-Aldin governorate. Fifty four cadaveric hip joints belonging to the age group of 20-70 years of both sexes were dissected and the specimens were grossly inspected for the presence of any osteoarthritic changes which if present would alter the geometry of the joint. The hip joints were considered normal when (a) the articular cartilage of femoral head was smooth and was of uniform appearance till the margin where it disappeared with no evidence of marginal ossification (b) the acetabulum was hemispherical and cartilage lining it was smooth and horse shoe shaped, ending abruptly at the inner margin framing the acetabular fossa as unbroken line. Outer edge of cartilage and labrum blended without any distinctive demarcation, then the acetabular fossa that filled with connective tissue (fibers and fat) exposed with a smooth surface. Six hip joints were excluded from the study because of the presence of irregularity in the cartilage and osteophytes. Various parameters of the acetabulum and the upper end of femur of the remaining forty-eight joints (36 male & 12 female; 24 rights & 24 left) were measured as following:

1. Depth of acetabulum: A thin metallic strip was placed across the diameter of the acetabulum and the depth of the acetabulum was measured in millimeters using Vernier scale from the center of the acetabulum to the metallic strip.
2. Diameter of acetabulum: Maximum transverse diameter of the acetabulum was measured using Vernier scale.
3. Vertical diameter of femoral head: Vernier scale was used to measure the vertical diameter of the femoral head. It was taken at right angle to the long axis of the neck of femur which meant the straight distance between the most superior to the most inferior points of the femoral head (Fig. 1). Statistical variation was excluded by measuring each parameter three times and the mean of the reading obtained was recorded.

Results

Fifty four hip joints were dissected and grossly inspected; six of these displayed osteoarthritic changes in the form of erosion of cartilage and presence of osteophytes. The remaining hip joints which grossly appeared normal were measured. The data obtained was analyzed in the following manner:- (a) measurements of right side in males were compared with measurements of right side in females (b) measurements of left side in males were compared with left side measurements in females and (c) right side measurements were compared with left side measurements in males (d) right side measurements of females were compared with left side measurements. It was observed that the depth of the acetabulum was greater in males than females both on right and left side (Table 1). On the right side the difference being statistically significant (right p=0.02, left p=0.06). It was noticed that the depth of the left acetabulum was greater than that of the right side in both sexes but the difference was statistically non significant (male p=0.34, female p=0.20). The diameter of acetabulum was greater in males than females as in (Table 2). On the right side there was marginal statistically significant difference in the diameter of acetabulum between the two sexes (right p=0.04, left p=0.22). In both the genders left acetabulum had greater diameter than that of right side but of no statistical significance (male p=0.75, female p=0.06). The vertical diameter of femoral head was greater in males than in females both on right and left sides (Table 3) but was statistically non significant (right p=0.42, left p=0.42). It was also noticed that in both sexes the vertical diameter was more on the left side than the right side though the difference was statistically non significant (male p=0.71, female p=0.28).

Table(1): Depth of Acetabulum (Total No. 48; right 24 & left 24)

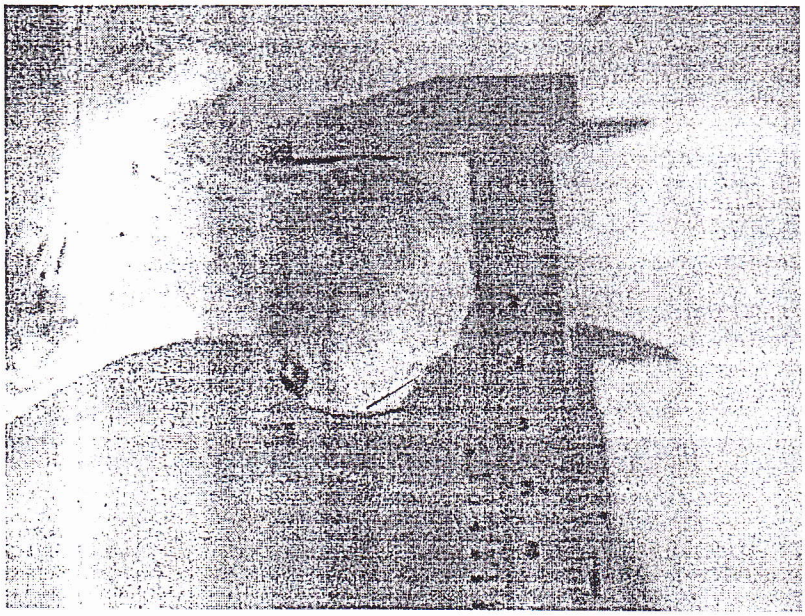
	Male (Total No. 36)		Female (Total No.12)	
	right (No.18)	left (No.18)	right (No.6)	left (No.6)
Range of depth acetabulum (in mm)	23.0-34.0	24.3-34.0	23.0-26.0	23.0-28.0
Average depth acetabulum (in mm)	27.4±2.7	28.1±2.5	24.6±1.2	25.7±2.1

Table(2): Diameter of Acetabulum (Total No. 48; right 24 & left 24)

	Male (Total No. 36)		Female (Total No.12)	
	right (No.18)	left (No.18)	right (No.6)	left (No.6)
Range of diameter acetabulum (in mm)	40.0-52.3	40.0-52.4	39.0-48.0	43.0-49.0
Average diameter acetabulum (in mm)	47.1±2.9	47.4±3.0	44.3±3.0	46.0±2.2

Table(3): Vertical Diameter of Femoral Head (Total No. 48; right 24 & left 24)

	Male (Total No. 36)		Female (Total No.12)	
	right (No.18)	left (No.18)	right (No.6)	left (No.6)
Range of femoral head diameter (in mm)	38-51	38-52	38-46	41-48
Average diameter of femoral head (in mm)	45.4±3.0	45.8±3.2	43.8±2.9	44.6±2.8



Fig(1): Method of Measurement of diameter of Femoral Head

Discussion

Hip joint is one of the major joints of the body, though described conventionally as a ball and socket variety of synovial joint, but Menschik [2] reports it to be a rotational conchoid. Knowledge of the anatomical parameters of the bony components of hip joint is very essential as it will open new horizons into better understanding of pathogenesis of diseases like primary osteoarthrosis of hip joint. An incongruous joint is more prone to develop degenerative changes than a joint having normal anatomy and the awareness of the average dimensions of the bones of the hip joint in both sexes will also help in early detection of disputed sex by Forensic experts [3]. As total hip replacement is a

common surgery performed now a days, so knowledge of the dimensions of acetabulum and femoral head will assist, prosthetists to construct suitable prostheses for Iraqi peoples. Studying cadaveric hip joints is of immense importance as various dimensions are taken with the soft tissues in place and this gives the average values of various parameters to near normal situations as would be encountered in the patients at operation table. Study conducted on the hip joint of Nigerians revealed that the mean vertical diameter of the head of femur on the right and left sides in males is 54.2 mm and 54.0 mm respectively and in females it is 47.1mm and 46.8 mm [4]. It was noticed by Prasad, et al [5] that the vertical diameter of the head of dry femur had an average value of 43.0 mm in males and 39.1 mm in females in South Indian population, while Javadekar [6] was of the opinion that the average diameter in males is 45.2 mm and in females is 40.3 mm. In contrast according to the present study the femoral head diameter on an average is 45.4 mm and 43.8 mm in males and females respectively on the right side and 45.8 mm and 44.6 mm respectively on the left side. According to Isaac, et al [7] short stature have smaller diameter of femoral head which can be easily appreciated when the present study is compared with that of Asala, et al [4], the cause may be due to that the Nigerians are relatively taller than average Iraqis and so their femoral heads are bigger than that of Iraqis. A particular sex can not be determined only by visual examination of the bone as reported by Krogman [8] and Stewart [9] though to some extent it can be possible by seeing the hip bone as reported by Asala et al [4]. Therefore, in addition to the already existing knowledge on the hip bone for determining sex of an individual it would be beneficial if the dimensions of acetabulum could also be incorporated. Measurements of acetabulum are scarcely found in literature as far as our knowledge extends. Average depth of acetabulum according to Mukhopadhaya and Barooah [10] on right and left sides is 24.7 mm and 24.5 mm respectively. Difference in their observations when compared with the present study exists as they included the dimensions of both the sexes while calculating the mean; also they worked upon fresh specimens where this study was on preserved specimens. It is likely that in preserved materials, the soft tissues shrink and therefore the emergence of higher values in the present study. Average diameter of acetabulum was 48.5 mm and 46.0 mm on the right and left side respectively in study of Mukhopadhaya and Barooah [10] which is nearly the same as seen in this study. It would be noticed that in the Iraqis hip joints belonging to males or females, the average diameter of femoral head is smaller than the average diameter of acetabulum impressing upon the fact that the femoral head is snugly fitted into the acetabulum which is one of the major reasons why primary osteoarthrosis of hip joint is so uncommon in Iraqis. Various parameters measured had a higher value on left side than right, Chhibber & Singh [11]; Singh [12] and Dogra & Singh [13] suggest that left limb is dominant. Whether a person is right handed or left handed more people use left lower limb for weight bearing Chhibber & Singh [11]; therefore, the dimensions of the bones forming the hip joint of left side should be more so as to bear greater loading force on femur. Though, in the present study left hip joint dimensions are greater than the right yet they are statistically non significant. There should not be much of a difference between the sides otherwise everyone would be walking with an abnormal gait! The

present study hence provides valuable parameters which would help the forensic experts, orthopaedicians and prosthetists to deliver excellent performance in their respective specialties.

References

1-Menschik F. The shape and Kinematics of the hip joint. Journal of Bone & Joint Surgery. 1993; 75(2): 111.

2 -Menschik F. The hip joint as a conchoid shape. Journal of Biomechanics. 1997;30(9): 971-3.

3 -Murray RO. The aetiology of primary osteoarthritis of the hip. British Journal of Radiology. 1965; 38: 810-24.

4-Asala SA, Mbajiorgu FE & Papandro BA. A comparative study of femoral Head diameters & sex differentiation in Nigerians. Acta Anatomica. 1998; 162: 232-7.

5- Prasad R, et al. Reconstruction of femur length from makers of its proximal end. Clinical Anatomy Journal. 1996; 9: 28-33.

6- Javadekar BS. A Study of measurements of the femur with special references to sex. Journal of Anatomical Society of India. 1961; 10: 25-7.

7-Isaac B, et al. Prediction of the femoral neck shaft angle from the length of the femoral neck. Clinical Anatomy Journal. 1997; 10: 318-23.

8- Krogman WM. Skeleton in Forensic medicine. Transactions of Institute of Medicine Chicago. 1946; 16: 154- 67.

9-Stewart TD. Medicolegal aspects of Skeleton according to Age, Sex, Race and Stature. American Journal of Physical Anthropology. 2004; 6: 314-9.

10- Mukhopadhaya B & Barooah B. Osteoarthritis of hip in Indians–A clinical and anatomical study. Indian Journal of Orthopaedics. 2005; 1(1): 55-62.

11-Chhibber SR & Singh I. Asymmetry in muscle weight and one side dominance in the human lower limbs. Journal of Anatomy. 1970; 106(3): 553-6.

12- Singh I. Functional asymmetry in the lower limbs. Acta Anatomica.1970; 77: 131-8.

13-Dogra SK & Singh I. Asymmetry in bone weight in the human lower limbs. Anatomischer Anzeiger. 1971; 128: 278- 80.