ORIGINAL ARTICLE

STUDY OF ANGLE OF HUMERAL TORSION IN SUBJECTS OF GUJARAT REGION OF INDIA

Patel Shilpa[1], Kubavat Dharati[2], Malukar Ojaswini[3], Nagar SK[4], Parikh Jyoti[5], Ganatra Dimple[6]

[1]Associate Prof, Baroda Med. College, Baroda [2]Assistant Prof., M. P. Shah Med. College Jamnagar, [3]Associate Prof. GMERS Gotri Med. College, [4]Professor GMERS Gotri Med. College, [5]Assistant Prof., Baroda Medical College, Baroda [6]Assistant Prof, B. J. Medical College, Ahmedabad

Correspondence:
Dr. Ojaswini Malukar
Associate Professor, Anatomy Department,
GMERS Gotri Medical College, Baroda India
Email: drmalukar@yahoo.com

ABSTRACTS

Introduction: The longest axes of the upper and lower articular surfaces of the humerus make an angle with each other of little more than 90°.
In man however the upper end of the humerus appears to have been rotated laterally, so that the angle between the two axes has been increased to about 164°. This angulation is referred to as the angle of "humeral torsion". When the two axes are superimposed on each other, they form an angle known as "torsion angle ".
Methodology: Present study was conducted on two hundred humeri collected from medical college, Baroda. Out of these 105 were of the right side and 95 were of the left side. The gender of the bones was also determined...
Observations: The humeral torsion is greater in the male than in the female and greater on right side than left side humeri possibly because most individuals are right handed. The present study showed no correlation between the torsion angle and the length of the humerus.

Key Words: Angle of humeral torsion, Articular Surface

INTRODUCTION:

In lower mammals , the longest axes of the upper and lower articular surfaces of the humerus make an angle with each other of a little more than 90°.

In man, however, the upper end of the humerus appears to have been rotated laterally. So that the angle between the two axes has been increased to about 164°.This angulation is referred to as the angle of "humeral torsion ". Thus, the two axes when superimposed on each other form an angle known as angle of torsion.

Angle of torsion is greater in the male than the female. It is also greater in adults than children ranges from 135° to 165° or more in the male. It is greater in man than in anthropoids.

Torsion is directly proportional to the circumference of the humeral shaft but has no correlation with the length of the bone. These observations are compared with the findings of other workers in different races

Humeral torsion denotes twisting of the bone along its long axis. As a result of this twisting the articular axis of one end is in a plane different from that of the other end.

The error of assuming that torsion occurs, in the humeral diaphysis is a most natural one for the spiral groove does create the illusion of a twist in the bone and it even runs in such a way as to correctly indicate the direction of torsion.

Work of Krahl[1] shows that torsion has occurred not in the shaft of the humerus but at the junction of its proximal epiphysis with the diaphysis.

Angle of humeral torsion

If two ends are viewed from one end, the long axes of the two ends form a right angle in the quadrupeds

In humans (all primates) the inner surface is rotated to become anterior and the angle increased by 74°thus the total angle between the two axes becomes 164°. Torsion occurs through 74°. Hence angle of humeral torsion is 74 °

Humeral torsion viewed from above:

O- original position of long axis of head lying at right angle to long axis of lower end (not drawn) on rotation of inner surface anteriorly the long axis of head lies at new position (N) torsion having occurred through 74°.

Angle of humeral torsion of two ends is viewed from one the long axis of the two ends form a right angle in the quadrupeds. In humerus (all primates) the inner surface is rotated to become anterior and the angle is

increased by 74°. Thus the total angle between the two axes becomes 164° torsion occurs through 74° hence angle of humeral torsion is 74°.

Material and Methods: There are several methods for measurement of humeral torsion, (Kahl's 1944)[1] the angle of humeral torsion is measured with the help of Torsiometer. The torsiometer was devised for present study as under.

The humerus was kept on the osteometric board and the two protractors were used.

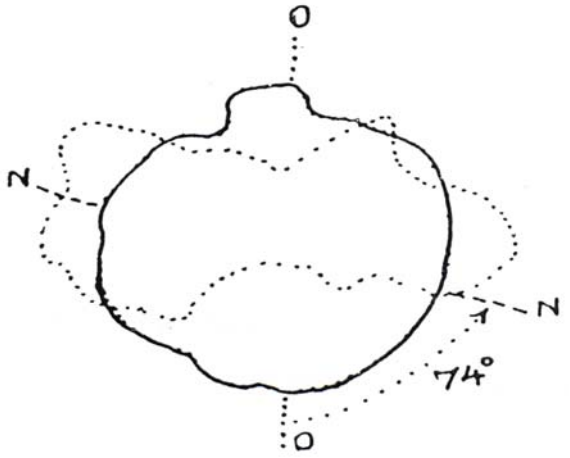
The present study was carried out on 200 dry normal adult human humeri obtained from the collection of bones in the Department of Anatomy Medical College, Vadodara, Gujarat. The bones studied were free of any pathological condition. The humeri were cleaned dried and observed in good daylight. The gender of each specimen was determined by the recognized established practice. The gender of the humeri was determined by the following criteria.

V1 –Maximum length-greatest distance between lower end of medial condyle and upper end of humerus using osteometric board.

V2 –Tubercles length – Distance between the highest point of the greater tubercles and the lowest point of the lateral condyle using osteometric board.

V3 -Antero-posterior diaphyseal curvature – The humerus was placed horizontally on osteometric board and measurement was taken at the highest point of curvature using scale.

V4 –Weight using electronic weighing machine.



Muscularmarkings present on humerus are prominent in the male gender, while in female gender markings are comparatively smooth. These all are the important measurements that will differentiate the sex of the humeri. Weight was one of the best subjective measures for sexing .The length was measured by placing the humerus on osteometric board so that the condyles of the inferior end touch on vertical part of osteometric board where Protractor was placed at right angle to Horizontal plane. The angle of humeral torsion is measured with the help of torsiometer (Kahl's 1944)[1]

The torsiometer was devised for present study as under.

The humerus was kept on the osteometric board and the two protractors were used. One protractor was kept at upper end of humerus and the other protractor was kept at lower end of humerus the center of greater tubercle was considered as the landmark for the measurement of the angle of torsion. The foot-rule was kept at the center of the greater tubercle and wherever the foot-rule touches to the both protractor was taken as the angle of torsion. The method of measurement is shown in the Photograph 1 & 2.

Figure 1:

Figure 2:

Photograph 1 & 2: Method of Measurement used in the study

The male bones were 100 and 100 were female humeri out of 200 dried humeri. Out of two hundred 95 were

left and 105 were right humeri. The data obtained in the present study in respect of torsion angle mean of 200 humeri the angle of torsion is 70.02 . The mean of 100 male humeri the angle of torsion is 71.20 , mean of 100 female humeri 69.82 , mean of 105 right side humeri the angle of torsion is 70.94 & mean of 95 left side humeri the angle of torsion is 68.94.

RESULT

Table 1: Observation of the Torsion Angle

	No. of Bone	Mean
Male	100	71.20
Female	100	69.82
Right Side Bone	105	70.94
Left Side Bone	95	68.94

The observation of present study is the humeral torsion is greater in male than female , and greater on right side than on left side humeri because most individuals are right handed.

The present study showed no correlation between the torsion angle and the length of the humerus.

DISCUSSION

Table 2: A comparison of torsion angle reported by different workers shows under this table

Authors	Series	Torsion angle
Broca (1881)[2]	Whites	74°
Mathewset (1993)	Salado-indians	69°
Martin(1928)[3]	Australian	45.5°
Martin (1928)[3]	Paltacalo-indian	48.5°
Martin (1928)[3]	fuegians	53.9
Martin (1928)[3]	peruvians	60.2°
Martin (1928)[3]	Swiss	74°
Chillida (1943)	Urgentine aborigines	61°
Ayur & upshon	Indian (south)	62.1°
Krahl & evans[4]	whitis	75°
Kate (1969)[5]	Indian (central)	55°
Lalit Mehta & R.P.chaturvedi	Indian (rajasthan)	68.5°
Present study (2003)	Indian (Gujarat)	70.02°

Thus, a comparison of torsion angle reported by different workers shows that there is a considerable racial variation. Values are subtracted by 90' (embryonic rotation) wherever obtuse angle has been measured.

In the present study, the average torsion angle of the right humerus is 70.94°greater than that of the left is 68.94°. Similar observations have been recorded by Lalit Mehta and R.P Chaturvadi and also by Krahl and Evans (1945). Assuming that the majority of individuals whose humeri have been measured in the Lalit Mehta and R.P Chaturvadi study were right handed and consequently with a more powerful musculature in the right arm, it is possible to explain the greater torsion in the right humeri.

Torsion and rotation are two different phenomena. The angle made by the crossing of the axes of the two opposite ends when measured erroneously include the 90°rotation which the entire limb undergoes during its development in the uterus. The true angle of humeral torsion is obtained by subtracting 90° from the measured obtuse angle. This observation was done by Lalit Mehta and R.P Chaturvadi. Such observation cannot be done by present study.

They also observed that the medially deviated course of the bicipital groove, including the correlation of its angular value (bicipital angle) with the torsion angle is in agreement with those of Krahl's (1948)[6] observations. However, the values of the torsion and bicipital angle are not the same. This is explained by the fact that some degree of torsion 20-30 is present (hereditary) even before the ontogenic torsion takes place. They also show that the circumference of the shaft is directly proportional to the torsion angle that Krahl and Evans (1945)[4] observed the inverse proportion in the American negroes and direct proportion in the white race. Between the thickness and the torsion angle. The thicker bone shows greater degree of torsion, as the thickness of the bone is the measure of muscle strength and the torsion is a result of muscular forces. Such observation cannot be done by the present study. Such observation has been recorded by Lalit Mehta and R. P. Chaturvedi, T he torsion angle is greater on right (74.35°) than on the left (61.8 °) side The present study showed the average angle of the humeral torsion 70.02°. Torsion angle is greater in male is 71.20° than in female is 69.82° , the torsion angle is greater on the right 70.94° than on the left 68.94° side. Similar observation has been recorded by Lalit Mehta and R. P. Chaturvedi. The bicipital angle is also measured and its direct correlation is found with torsion angle. the average bicipital angle is 46° with a range of 15° to 66° and is greater on right (58.5°) than on the left side (41.6°) Torsion is directly proportional to the circumference at the humeral shaft but no correlation with the length of the bone. The value of torsion angle, bicipital angle length and circumference of humeral shaft are greater on the right side.

However, the observation of Lalit Mehta and R.P. Chaturvedi shows that on an average, the right humerus is longer than the left by 0.8 cm and possesses a greater torsion angle, the present study shows that on an average the right humeral angle is greater than left side humeri angle.

Krahl and Evans (1945)[4] studied the pair of humeri of individuals and found that the right humerus is longer than the left and shows greater degree of torsion.

Gegenbaur (1868) measured the torsion angle in different age groups while Brocca (1981)[2] made a comprehensive study of the humeral torsion in over

600 humeri . A correlation between torsion angle and the length and thickness of the bone has been reported Krahl and Evans, 1945[4].

Observation of Vernon E. Krahl is that the spiral angle increases essentially in direct proportion to the corresponding torsion angle. The torsion occurs at the proximal epiphysis of the humerus not in the shaft.

Le Damany (1903, 1906) , Krause (1909) , Rouffia (1924) Evans and Krahl[4], these writers write that the twisting of humerus has occurred not in the shaft but rather at the junction of the diaphysis with the proximal epiphysis.

Phylogenetic and ontogenetic surveys of torsion reveal that

(a) The spiral angle like the torsion angle increases with age

(b) That the deformation of the bicipital groove is a direct consequence of humeral torsion and is proportion to the degree of torsion

(c) That the torsion occurs between the terminal of the bicipital groove namely at epiphyseal cartilage and that in the finished bone the bicipital groove stands as a clearly visible record which indicate both the direction and extent of the torsion process.

REFRENCES

1. Krahl VE. An apparatus for measuring the torsion angle in long bones.1944;22:498.
2. Broca P. La Torsion de1'humreus et la Tropometre. (Redigepar L. Manouvriver) Revue d'Anthrop. 1881; 4: 193-210,385-423.
3. Martin CP. Cause of torsion of the humerus and of the notch on the anterior edge of the glenoid cavity of the seapula. J. of Anat. 1933;67(1932-1933):573-582.
4. Krahl VE, Evans FG. Humeral torsion in man. Am.J.Phys Anthoropo.1945;3:229-253.
5. Kate BR. Humeral torsion Indians. J. Anat. Soc . of India. 1969;18:31.
6. Krahl VE. The bicipital groove : A visible record of humeral torsion. Anat. Rec.1948;101:319-331.