ORIGINAL RESEARCH PAPER
Volume - 9 | Issue - 6 | June - 2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

MORPHOMETRIC STUDY OF RADIUS IN INDIAN POPULATION

Anatomy

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ABSTRACT

Introduction: Understanding of morphometric parameters of Radius play a very important and beneficial role for the advanced orthopaedic and plastic manipulations by surgeons. **Aim:** To study the morphological and morphometric parameters of adult Indian radius. **Material and methods:** The material for this study compromised of 87 dry adult human radii (Right = 45, left = 42) obtained from Department of Anatomy Government Medical Collage Srinagar, J&K India and various parameters measured with Vernier Callipers. **Results and conclusion:** The results obtained from this study can be useful for the orthopaedic surgeons for various surgical techniques and prosthesis. These morphometric parameters can prove of great help to department of Surgery, Anatomy and Radiology as well.

KEYWORDS

Radial head, Radial neck, Radial tuberosity, Styloid process

INTRODUCTION:

Word 'Radius' is a Latin word meaning 'spoke' or 'ray'. The radius is the weight bearing bone of the forearm. It is laterally placed and its shaft has expanded ends. The proximal end includes head, neck and bicipital tuberosity. The shaft is triangular and lower end projects as styloid process.[1] Radial head and neck fractures constitute 1.7 -5.4 % of all fractures. Radial head alone constitutes one-third of all elbow fractures and 20% of all elbow trauma cases.[2] Knowledge of the size and shape of radial head is also necessary for creation of radial head prosthesis that is anatomically and biochemically correct.[3]

The measurements of bicipital tuberosity and its angular relationship with radial head are significant in various surgical procedures like reconstruction of biceps tendon, radial head prosthesis implantation, and reconstruction of proximal radius trauma.[4]

The operative treatment for proximal radial fracture with minimal comminuted fractures includes anatomical reconstructions with stable fixation to achieve early recovery of function. In comminuted fractures prosthetic radial head replacement is commonly recommended as an alternative to internal fixation to avoid complications like mal-union, loosening and impingement of hardware in proximal radioulnar joint.[5] The morphometry of distal radius is important in various clinical orthopaedic settings such as reduction of distal radius fractures, design of distal radius prosthesis [6,7] Distal radius fractures compromise 8-15 % of all upper limb fractures[8]. Further measurements of bicipital tuberosity are significant in surgical techniques, like in reconstruction of biceps tendon. It is with these considerations that the present study was undertaken to measure the morphometric parameters of adult Indian radius

MATERIAL AND METHODS

Eighty seven intact, normal, completely ossified, adult Indian radius bones belonging to the Department of Anatomy, Government Medical Collage, Srinagar were included in the study. Each of the radius was labelled with suffix 'R' and 'L' for the Right and the Left radius respectively. No signs of any bony deformity or gross abnormality were seen in these specimens at the time of investigation. Abnormally ossified or damaged radius bones were excluded from the study.

a. Instruments used for the study

- Vernier calliper for the measurement of various parameters.
- Measuring tape for measurement of circumferences.
- Digital camera.
- Black marker pen.

b. The various morphometric parameters of radius studied and measured are as under:

- Side or radius labelled as 'R' for right and 'L' for left.
- Length of radius_ measured as the distance between the tip of styloid and the most lateral portion of radial head.
- Anterio-posterior and the Transverse diameter of the radial head was measured with Vernier calliper.
- Length of the neck of Radius _measured between the head - neck border.
- Proximal radial neck diameter and distal radial neck diameter _ proximal and distal radial neck diameters were measured lateromedially.
- Length of Radial tuberosity.
- Width of Radial tuberosity.
- Mid shaft anterio-posterior diameter.
- Mid shaft transverse diameter.
- Length of styloid process.

Figure 1: Showing measuremet of transverse diameter of the radial head with Vernier calliper.

RESULTS:

The present study "Morphometric study of radius in Indian population" done on 87 adult dry radii of both sides (right 45 and left 42). The mean length of radius, antero posterior diameter (radial head), transverse diameter (radial head), length of neck of radius, diameter of neck (proximal), diameter of neck (distal), length of radial tuberosity, width of radial tuberosity, mid shaft anterio- posterior diameter, mid shaft transverse diameter, length of styloid process in total radius were 22.37, 1.90, 1.72, 1.24,1.62, 1.36, 2.18, 1.25, 1.10, 1.39, 0.95 cm respectively on the right and 23.30, 1.92, 1.80, 1.27, 1.56, 1.29, 2.05, 1.13, 1.07, 1.35, 0.94 cm respectively on the left side.

All the parameters were recorded as per anatomical basis. Various statistical results calculated are mentioned in the below tables.

TABLE 1: Mean and range of all parameters of radius in cm(Right).

Parameters	Mean± SD (cm)	Range (cm)
Length of radius	23.77± 1.8	20-28
ANTERIO_POSTERIOR DIAMETER (RADIAL HEAD)	1.90± 0 .16	1.48-2.32

Parameters	Mean± SD (cm)	Range (cm)
Length of radius	23.77± 1.8	20-28
ANTERIO_POSTERIOR DIAMETER (RADIAL HEAD)	1.90± 0 .16	1.48-2.32

TABLE 2: Mean and range of all parameters of radius in cm (Left)

Parameters	Mean± SD (cm)	Range(cm)
Length of radius	23.30±2.18	19-27
ANTERIO_POSTERIOR DIAMETER (RADIAL HEAD)	1.92 ± 0.14	1.46-2.34
TRANSVERSE DIAMETER. (RADIAL HEAD)	1.80±0.22	1.42-2.33
LENGTH OF NECK OF RADIUS	1.27± 0.21	0.66-1.90
DIAMETER OF NECK (PROXIMAL)	1.56± 0.19	1.10-1.74
DIAMETER OF NECK (DISTAL)	1.29± 0.15	1.05-1.78
LENGTH OF RADIAL TUBEROSITY	2.05 ± 0.29	1.4-2.06
WIDTH OF RADIAL TUBERSOIY	1.13± 0.31	0.7-1.58
MID SHAFT NTERIO_POSTERIOR DIAMETER	1.07± 0. 19	0.80-1.58
MID SHAFT TRANSVERSE DIAMETER	1.35± 0.16	1-1.75
LENGTH OF STYLOID PROCESS	0.94±0.06	0.60-1.14

DISCUSSION

Length of the radius provides optimal accuracy in determination of sex and the stature. Furthermore, knowledge of the size and shape of the radial head is essential for construction of radial head prosthesis. Orthopaedic surgeons treating radius fractures use the available reference values, which have proven to be of great significance.[4] In the present study the mean length of radius was 23.53cm, which is in accordance with the study of Ivan James et al 2012.[16] Van Riet et al [15] also found the mean radial length as 23.5 cm, and we also got similar values.

In the present study the most common shape of the radial head was circular in 62% cases which was in accordance with the study conducted by Gupta et al 2015[11]. Puchwein et al[14] found the mean AP diameter of the radial head at its widest part as 2.3 and 2.16 cm, respectively, and in the transverse plane as 2.24 and 2.1 cm, respectively. In our study, we got the values as 1.91 and 1.76 cm, respectively. So, our values are less than those reported by Puchwein et al[14], which may be because they measured the values on CT scan and we did it manually on dry bone.

The mean length of styloid process was 0.94cm which is slightly less than the study conducted by Ivan James et al 2012.[16] The mean length and the width of the radial tuberosity for the right side were 2.15cm and 1.25 cm and for the left side 2.05 and 1.13 respectively which when compared with the study conducted by Sheetal Chandel et al, 2018[13] are slightly less the present study. The mean length and width of the radial tuberosity where found slightly higher on the right side. The measurements of radial styloid process and radial tuberosity prove to be of significant role in reduction of distal radius fractures or reconstruction of the distal biceps tendon.

The mean length of the neck of radius was 1.24cm and 1.27 cm for the right and left side respectively which is in accordance with the study conducted by Gupta et al, 2015.[11] The proximal and the distal diameters of the radial neck were calculated and the mean values for the right side were1.62 and 1.36cm respectively which is slightly higher than the study done by Sheetal Chandel et al, 2018.[13] The values for the proximal and the distal diameters of radial neck on the left side were 1.56cm and 1.29 cm respectively. The mean proximal neck diameter was found slightly more and the mean distal neck diameter was found slightly less than the study done by Gupta et al [11].

The precise knowledge of morphometric parameters is of great importance for better management of various clinical conditions. The present study has to some extent thrown some light on the morphometric asymmetry between the right and left radii bones. The morphometry of the radius can prove to be quiet fruitful for various orthopaedic surgeons in various surgical interventions. These measurements are of great use in making of precise prosthetic designs and various reconstruction surgeries. The mean length of radius, length of radial styloid head, and radial styloid process will facilitate in various surgical procedures such as reconstruction of the distal biceps tendon, radial head prosthesis implantation, and reconstruction of proximal radius trauma.[4]

New modular designs have enhanced sizing to better replicate the anatomy of the proximal radius, and they are easier to insert intraoperatively.[9] Smith et al. found that the “safe zone” is approximately one-third of the radial head circumference and can be reliably determined with the technique of intraoperative marking as delineated.[10] Forensic experts can utilise these measurements in determining the sex and height of an individual. There are certain morphometric studies that have been conducted across the globe but more studies need to be done to have more precise knowledge about the normal parameters or radius.

REFERENCES

1. Singh V. Bones of the upper limb. In Singh V (editor) Textbook of Anatomy: Upper limb and thorax. 2nded, Vol-1. New Delhi: Reed Elsevier India Pvt Ltd; 2014. pp.10-33.
2. Caputo AE, Mazzocca AD, Santoro VM. The non- articulating portion of the radial head.: Anatomic and clinical correlations for internal fixation. J Hand Surg Am 1998; 23:1082-92.
3. Captier G, Canovas F, Mercier N, Thomas E, Bonnel F. Biometry of the radial head: biomechanical implications in pronation and supination. Surg Radiol Anat 2002;24(5):295-301.
4. Mazzocca AD, Cohen M, Berkson E, Nicholson G, Carofino BC, Arciero R. The anatomy of the bicipital tuberosity and distal biceps tendon. J Shoulder Elbow Surg 2007; 16(1):122-127.
5. Giannicola G, Manauzzi E, Sacchetti FM, Greco A, Bullitta G, Postacchini F. Anatomical variations of the proximal radius and their effects on osteosynthesis. J hand Surg Am 2012; 37(5):1015-1023.
6. Chan CYW, Vivek AS, Leong WH, Rukmanikanthan S. Distal Radius Morphometry in the Malaysian Population. Malaysian Orthopaedic Journal 2008; 2 (2); 27-30.
7. NG CY, McQueen MM. What are the radiological predictors of functional outcome following fractures of the distal radius? Journal of Bone and Joint Surgery 2011; 93B (2):145-150.
8. Jupier JB, Masem M. Reconstruction of post-traumatic deformity of the distal radius and ulna. Hand Clin 1988:4:377-90.
9. Chien HY, Chen AC, Huang JW, Cheng CY, Hsu KY. Short to medium-term outcomes of radial head replacement arthroplasty in post-traumatic unstable elbows: 20 to 70 months follow-up. Chang Gung Med J 2010; 33:668-18.
10. Smith GR, Hotchkiss RN. Radial head and neck fractures: Anatomic guidelines for proper placement of internal fixation. J Shoulder Elbow Surg 1996; 5:113-7
11. Gupta C, Kalthur SG, Malsawmzuali JC, D'souza AS. A morphological and morphometric study of proximal and distal ends of dry radii with its clinical implications, Biomed J2015:38(4); 323-28.
12. Pritishkumar IJ, Francis DV, Nithyanand M, Verghese VD, Samuel P. Morphometry of the distal radius- an osteometric study in the Indian population. Indian J Basic Appl Med Res2012; 1(3):166-71.
13. Sheetal chandel. Morphological and morphometric study of adult human radius in Jammu region, International Journal of Scientific Research. Vol-7. Issue-10, 2018| ISSN no 2277-8179.
14. Puchwein P, Heidari N, Dorr K, Struger L, Pichler W. Computer-aided analysis of radial head morphometry. Orthopedics 2013; 36: e51-7.
15. Van Riet RP, Van Glabbeek F, Neale PG, Bimmel R, Bortier H, Morrey BF. Anatomical considerations of the radius. Clin Anat 2004; 17:564-9.
16. Ivan JP, Deepak VF. Indian Journal of Basic & Applied Medical Research; June 2012: Issue-3, Vol.-1, P. 166-171