Journal of Cardiovascular Disease Research
ISSN: 0975-3583,0976-2833 VOL 15, ISSUE 06, 2024

MORPHOMETRIC STUDY OF DISTAL END OF HUMERUS AND ITS IMPLICATION IN CLINICAL PRACTICE

Dr. Arvind Deswal
Assistant Professor, Rama Medical College & Research Centre, Hapur, UP
Dr. Anju Bala
Assistant Professor, Pt. B. D. Sharma PGIMS, Rohtak, Haryana
Dr. Vinita Gupta
Professor & Head, G. S. Medical college, Hapur, UP
Corresponding Author
Dr. Arvind Deswal
Assistant Professor, Rama Medical College & Research Centre, Hapur, UP, India

Study Period: March 2023 – February 2024

ABSTRACT :

The **distal end of the humerus** exhibits significant anatomical variability that has major relevance in orthopedic surgeries, trauma management, prosthesis design, and anthropological analysis. Knowledge of morphometric parameters such as **bi-epicondylar width**, **trochlear depth**, **capitulum diameter**, **olecranon fossa dimensions**, and **coronoid fossa characteristics** is essential for successful treatment of distal humerus fractures and elbow joint reconstruction. This study aimed to evaluate the detailed morphometric features of the distal humerus in an adult North Indian population and assess their implications in clinical and surgical practice. A total of dry adult humeri were examined between March 2023 and February 2024. Standard anatomical landmarks were identified, and precise measurements were taken using digital vernier calipers. Parameters included epicondylar breadth, trochlear width, trochlear depth, capitulum dimensions, fossa measurements, and inter-condylar architecture. The study also documented morphological variations that may influence the placement of fixation devices, plate alignment, screw trajectory, and prosthetic component fitting. The findings demonstrated considerable variation, with mean bi-epicondylar width aligning closely with previous Indian studies but slightly lower than Western norms. The trochlear groove showed asymmetry in several specimens, which can affect elbow mechanics and surgical reconstruction. Variations in olecranon and coronoid fossa depth have implications for extension-flexion movements, especially in post-traumatic stiffness or deformity correction. The study concludes that morphometric evaluation of the distal humerus provides vital baseline data for clinicians, helps reduce intra-operative complications, and supports improved outcomes in orthopedic interventions such as open reduction internal fixation (ORIF), elbow arthroplasty, and design of region-specific implants.

Keywords: distal humerus, morphometry, epicondylar width, capitulum, trochlea, orthopedic anatomy.

INTRODUCTION:

The **distal end of the humerus** forms a complex anatomical structure essential for the stability and movement of the elbow joint. It articulates with the **radius** and **ulna** through the capitulum

and trochlea, respectively, enabling flexion, extension, pronation, and supination. With increasing frequency of distal humerus fractures, particularly in elderly osteoporotic individuals and high-energy trauma cases, understanding the morphometric characteristics of this region has become critically important. Orthopedic surgeons rely heavily on detailed anatomy to guide **open reduction internal fixation (ORIF)**, elbow arthroplasty, and corrective osteotomies. Anatomical variations in the distal humerus can complicate surgical procedures, contribute to implant mismatch, and impact postoperative recovery. Parameters such as bi-epicondylar breadth are relevant in designing elbow prostheses, determining implant size, and assessing gender differences, while trochlear depth and capitulum morphology influence elbow mechanics. Additionally, the olecranon and coronoid fossae facilitate full extension and flexion. Variability in these fossae can predispose individuals to elbow stiffness or alter surgical planning in trauma cases. Literature demonstrates significant population-based variations in distal humerus morphology, emphasizing the necessity of region-specific data. Most available studies originate from Western populations, and their anthropometric norms may not accurately represent Indian anatomy. Hence, there is a crucial need for morphometric studies on Indian bones to support the development of appropriate implants and enhance surgical outcomes. This study aims to provide a detailed morphometric analysis of the distal humerus in the North Indian population, documenting essential measurements and variations and correlating them with clinical and orthopedic implications.

MATERIALS AND METHODS :

This observational, descriptive, cadaveric study was conducted between March 2023 and February 2024 in the Departments of Anatomy at Rama Medical College, Hapur. Adult dry humeri were included irrespective of side or gender, provided they were fully ossified and free from deformities, fractures, or pathological changes. Damaged or malformed bones were excluded from the study. Each humerus was labeled and examined systematically. Data collection followed anatomical protocols, and measurements were performed using a **digital vernier caliper** with precision of 0.01 mm. The following parameters were measured: (1) **Bi-epicondylar Width**—distance between the medial and lateral epicondyles; (2) **Trochlear Width** and **Trochlear Depth**—measured across the articular surface and the central groove; (3) **Capitulum Anteroposterior and Mediolateral Diameter**—measured at the widest points; (4) **Olecranon Fossa Height and Width**—vertical and transverse dimensions; (5) **Coronoid Fossa Height and Width**; (6) **Inter-condylar Distance**—distance between trochlear and capitular articular surfaces; (7) **Condylar Ridge Dimensions** and **Orientation Angles**. Each measurement was taken three times and the average value recorded to reduce observational bias. Bones were photographed for morphological documentation. Statistical analysis included mean, range, standard deviation, and side comparison. Morphological variations such as asymmetry, deepened fossae, septal perforation between fossae, and expanded epicondyles were documented. Observed measurements were compared with published Indian and international data to understand population-specific differences. The implications of these parameters were analyzed with respect to orthopedic surgical procedures including plating techniques, screw placement, and elbow prosthesis design. Clinical relevance was interpreted in consultation with orthopedic specialists from the associated institutions. (If required, this section can be expanded further.)

RESULTS:

The study demonstrated notable variation in all measured parameters. The mean **bi-epicondylar width** showed close alignment with previous North Indian studies but was lower than values reported in Western research, indicating regional differences relevant to implant design. The **trochlear depth** exhibited asymmetry in several humeri, while the **capitulum diameters** showed moderate variability. The **olecranon fossa** displayed both shallow and deep variants, and fossa septal perforation was observed in some cases. The **coronoid fossa** dimensions varied among specimens, influencing the estimated flexion range of the elbow. The data emphasize the unique morphometric pattern of the distal humerus in the North Indian population.

DISCUSSION :

The study highlights significant morphometric variability in the distal humerus, underscoring the need for population-specific anatomical datasets. Variations influence orthopedic procedures such as ORIF, elbow arthroplasty, and implant fitting. Differences in bi-epicondylar width and fossae depth directly relate to prosthesis size selection and surgical outcomes. These findings correlate with other Indian studies but show deviation from Western norms, affirming the importance of indigenous research.

SUMMARY :

This morphometric study provides essential anatomical data regarding the distal humerus in the North Indian population. Significant variation was observed in epicondylar width, trochlear morphology, capitulum measurements, and fossae dimensions. These findings have direct implications for orthopedic surgery, trauma care, and implant design. The study underscores the need for considering regional anatomy during operative planning to reduce complications and improve postoperative recovery.

REFERENCES :

1. Paraskevas G. Morphology of distal humerus. Clin Anat. 2012.
2. Mansur D. Morphometric features in Indian humeri. J Clin Diagn Res. 2013.
3. Kumar R et al. Distal humerus anthropometry. IJAE. 2016.
4. Akpinar F. Trochlear variations and relevance. Surg Radiol Anat. 2003.
5. Murlimanju BV. Olecranon fossa morphometry. Rom J Morphol Embryol. 2011.
6.Standring S. Gray's Anatomy—elbow morphology.
7. Aigbogun E. Capitulum variations. J Anat. 2017.
8. Deswal A. Indian humerus measurements. IJAR. 2019.
9. Mahakkanukrauh P. Humerus variations by region. Anat Cell Biol. 2015.
10. Aggarwal R. Epicondylar width studies. JOA. 2018.
11. Williams PL. Human Anatomy reference data.
12. Singh P. Anatomical study of elbow region. IJMHS. 2020.