

# Finding the Truth: Cadaver and CT scan Study of Differences in Glenoid Width Size in the Indian Population

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## Learning Point of the Article:

The glenoid width of the Indian population is less than Western population.

## Abstract

**Introduction:** Glenoid mass issues have been extensively published in the recent literature. The controversy arose from our need to compare and obtain the appropriate implant size for reverse shoulder arthroplasty patients. Some well-known authors and surgeons say that Indian patients have a smaller glenoid than their Western friends and patients. Therefore, we decided to examine the glenoid size obtained on a computed tomography (CT) scan and the size obtained on a cadaver, preferably the same cadaver in tertiary care medical school. Necessary permissions were obtained from the relatives of the cadaver, the ethical board, the anatomy department, and the radiology department.

**Materials and Methods:** We evaluated 3D CT scans of 100 patients from our medical college during the global pandemic. Of these, we evaluated only 12 patients whose families agreed to postmortem studies and CT scans. Our research focuses on the shoulder of non-orthopedic diseases conducted at KCGMCH and measured the glenoid height, width, and version using a commercially available computer.

**Results:** The mean age of the patients was 38.5 (range 19–59). The mean glenoid height was  $33.8 \pm 3.2$  mm, maximum glenoid width was  $24.3 \pm 2.2$  mm. The mean glenoid version is  $3.48 \pm 4$  retrospectively. The glenoid width appears to be 23–25 mm on CT scan film, which is similar to cadaver studies.

**Conclusion:** The findings from the cadaver study indicate that the average glenoid size is smaller in the Indian demographic when compared to CT scans. Glenoid width is less in one subset of the population, especially female patients than of the average population than Westerners. However, our studies are limited by the small size of the population and a larger study is recommended in our institution in the future. A better understanding of this glenoid size could help us design a smaller glenoid plate plan, especially for patients in the Indian subcontinent.

**Keywords:** Glenoid base mismatch, glenoid version, glenoid width, reverse total shoulder arthroplasty.

## Introduction

The glenoid anatomy has been extensively studied, mainly considering anthropometric studies and geometry [1-5]. Recent studies have focused on the glenoid to understand better and manage shoulder instability [6-10], cuff obstruction, and glenoid fracture [11]. Reverse total shoulder arthroplasty is also the subject of radiographic and tomographic glenoid anatomy

studies for a better understanding of biomechanics and component implantation [12-16]. Reverse shoulder prostheses have been shown to be effective in the treatment of glenohumeral arthritis associated with irreparable rotator cuff tears, with good short or midterm follow-ups [17-20]. The main concern is the relaxation of the glenoid component. In the Delta III reverse prosthesis (DePuy International Ltd, Leeds, UK), the glenoid component is fixed in the glenoid groove with the central pin that

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## Author's Photo Gallery



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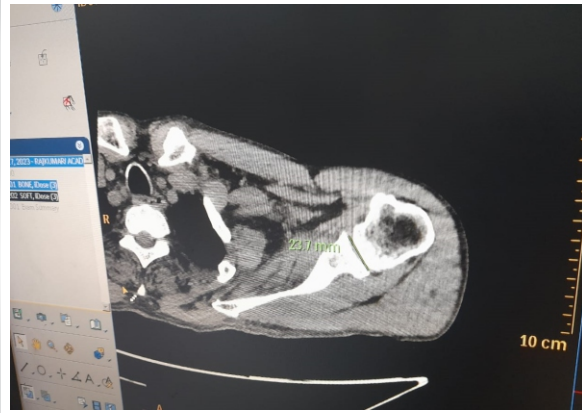
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**Figure 1:** Glenoid length measured manually.



**Figure 2:** 23.7 mm: Length of glenoid on computed tomography scan.

should be in the glenoid body and four screws in the coracoid base. The upper posterior column of the glenoid and glenoid body. For example, the better the screw and screw placement, the better the initial fixation [21-24]. The aim of this study was to evaluate the morphology of the cadaveric glenoid using computed tomography (CT) scan films, as well as contractures of the glenoid component of the shoulder inverted shoulder prosthesis to improve the original fixation of the goods. In turn, this will increase the overall acceptance and success of the prosthesis among Indian patients.

The aim of this study was to evaluate the morphology of the cadaveric glenoid using CT scan films in the Indian population to improve the glenoid component design in reverse shoulder prosthesis for better fixation.

### Materials and Methods

A total of 12 cadaveric three-dimensional CT scans of the glenoid were obtained from the imaging study of 100 non-

orthopedic patients during the COVID-19 outbreak conducted in the cadaver study of the Indian Tertiary Care Medical College in the Department of Anatomy, Radiology, and Orthopaedics. The mean age for the entire series was 38.5 years (range 19–59 years). Among them, there were six females and six males. Digitized anterior, posterior, and glenoid cross-sectional images were obtained from each patient. To obtain a reconstructed image of all 3D reconstructed GLENOIDS,

rotate the surface of the glenoid along the cranial-caudal axis until it becomes a simple line, then rotate this image to obtain a reconstructed 3D image. A true anterior view and posterior view axially laterally medial until the lower part of the coracoid reaches the upper part of the glenoid in the anterior view until the acromion reaches the upper part of the glenoid in the posterior view. The following measurements were taken for each patient: The long neck of the lower glenoid, the angle of the glenoid surface and posterior to the glenoid, the angle of the glenoid axis of the craniocaudal head, and the angle between the central coracoid process and the main bone. The glenoid is between the cranio-caudal glenoid axis and the upper posterior column of the glenoid. Measure the neck length at the bottom of the glenoid in a true anterior view and true posterior view. The length of the lower part of the glenoid neck was measured with a scale formed by measuring the distance of the glenoid shoulder and the glenoid angle to the anterior and posterior lines of the glenoid. Measure the angle between the glenoid surface and the



**Figure 3:** Different scapula harvested from the cadavers and measurements taken.



**Figure 4:** Computed tomography scan size of glenoid: 23.6 mm.



**Figure 5:** Another computed tomography-based size of the glenoid.



**Figure 6:** 23.6 mm is the size of the glenoid.



**Figure 7:** The entire radiology and orthopaedic department for sizing of the cadaveric scapula.

upper part of the glenoid in the true posterior view. In the glenoid process, the angle between the glenoid's major craniocaudal axis and the base of the coracoid process, and the angle between the glenoid's major craniocaudal axis and the glenoid's superior posterior column were measured (Fig. 1-4). All measurements are made digitally. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2584061/figure/F1/> \t "piece" Fig. 1 Lower body glenoid neck external measurement index. a measured from the glenoid surface, b, anterior and Back post of GLENOID from glenoid surface u. HYPERLINK "<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2584061/figure/F2/>" \t "piece" Fig. 2 Posterior measurement of the lower glenoid index. a measured from the glenoid surface; b measured from the glenoid surface to Bridges "<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2584061/figure/F3/>" \t "piece" Fig. 3 Measurement of the angle ( $\phi$ ) between the glenoid surface and the upper part of the glenoid HYPERLINK [https://www.html?title=Click on image to zoom&p=PMC3&id=2584061\\_1749-799X-3-49-4.jpg](https://www.html?title=Click%20on%20image%20to%20zoom&p=PMC3&id=2584061_1749-799X-3-49-4.jpg)" \t "tileshopwindow" Fig. 4 Cranio-caudal measurement angle of axis and coracoid process it is base ( $\alpha$ ) and the angle ( $\beta$ ) between the main cranio-caudal glenoid axis and the upper part of the GLENOID were accepted by Kalpana Chawla Government Medical College (one of the best medical schools in India). All measurements were taken digitally with the help of computerized tomography technology and under the supervision of radiologists and anatomists. Four observers independently made all measurements twice on digitized images, allowing observers and observers to participate in the research. Glenoid dry samples were also measured independently by four observers to allow for interobserver

research. Studies were analyzed with the Kappa index. Statistics include the Mann-Whitney U test and dx2 test.  $P < 0.05$ . To minimize bias in the results, three-dimensional CT of the glenoid and cadaveric glenoid were divided into two groups. One group of anatomists, radiologists, and plastic surgeons did not share details with the other group of doctors, radiologists, and plastic surgeons. Groups A and B were named based on the glenoids obtained from one medical institution. After all the data were collected, both groups sat down to analyze their thoughts and opinions.

## Results

At 2 months, the average fossa height was  $33.8 \pm 3.2$  mm, and the maximum fossa height was  $24.3 \pm 2$  mm. The mean glenoid version is  $3.48 \pm 4.7^\circ$  backward. The glenoid width appears to be 23–25 mm on CT scan film, which is similar in cadaver studies. There was no significant difference between the two groups ( $P < 0.001$  for 3D CT glenoids, 95% CI 0.002–0.45, for the cadaver group  $P = 0.034$ , 95% CI 0.25–0.79).

## Discussion

Anatomical research has progressed from the definition [1-5] to the pathomechanical underpinnings of various shoulder disorders for the development of specific surgical techniques. Recently, the reverse shoulder prosthesis model has gained popularity in the treatment of large tears associated with glenohumeral arthritis, but results are limited to short follow-up, short to moderate [17-20]. It can also be assumed that the more the screw penetrates the bone, the better the healing. This study found no significant difference in cadaver and CT scan

size of the glenoid in the Indian population. In the previous similar studies, no attempt was made to measure the 3-dimensional bone structure of the glenoid, but in our study, we investigated the width of the glenoid in cadavers to show that the glenoid is indeed wider in Indian patients compared to the western patients. Small, so we also mentioned the native herb for Indian patients taking RSA throughout our study. All anatomical changes describe major changes in the metaglene component of the back prosthesis to heal bone. Top and bottom screws must have a free direction of at least 10° to best fit the underlying glenoid and can fit either type of glenoid. The free 10° tap can also help improve the quality of the screw to the coracoid base. One of the main reasons for the fixation of the glenoid component is that the medial part of the humeral component comes into contact with the glenoid during adduction, creating an adverse effect on the lower glenoid shaft. Recently, the implantation of glenoid components beyond the inferior glenoid margin has been proposed to avoid this problem [25]. To measure the type and width of the glenoid, several steps must be taken before deciding to extend the glenoid component beyond the inferior part of the glenoid. The differences between the glenoid morphologies found in this study show the individual positions of the screws in the glenoid components to adapt to the anatomy in each case. Three-dimensional CT of the glenoid is an important area when planning surgery with a back prosthesis to better understand the glenoid morphology in each specific case and improve the location of the glenoid components. Since fixed-angle screws often reduce bone loss, it is necessary to change the condyle according to the type of angle between the glenoid surface and the posterior glenoid and the difference in joint position. Basics of the coracoid process. Upper posterior column and arthroscopic course and length. To address the issue of different articulation widths, perhaps two types of articulations and components should be considered as implants. Recently, Codi et al. [26] found a similar dome of the glenoid in the normal glenoid and identified five differences, but emphasized the importance of the integrity of the glenoid vault and subchondral

bone to achieve good recovery of the glenoid material average doctor. It is believed that if implanted, the screw bone can affect stability, but the stability of the glenoid component depends on the fact that the screws surround the bone well, the direction of the screws relative to the force, etc. It has many disadvantages such as correlations were determined in female patients who showed a smaller glenoid width compared to male patients. There is no relationship between the different types of glenoids in terms of the glenoid surface, the posterior column of the glenoid angle, and the anterior or posterior length of the glenoid neck. There is no relationship between the anterior and posterior neck lengths of the glenoid. The Kappa study averaged nearly the inner length of the neck and back; this indicates a reasonable level of consistency and reproducibility of these measurements, and they were nearly all perfect when describing the angle pattern behind the glenoid surface and glenoid level.

### Conclusion

From a cadaveric study, we concluded that the mean glenoid size is smaller in the Indian population compared with CT films. The width of the glenoid is smaller in one group of the average population than in Westerners, especially females. However, due to the small number of participants, our study is limited and larger trials are encouraged in our school in the future. A better understanding of this glenoid size could help develop smaller glenoid plans, especially for patients from the Indian subcontinent. All Glenoid Modifications describe self-adjusting recommendations for implantation of the glenoid component of the Delta III reversible total scapular prosthesis. Three-dimensional CT of the glenoid is an important tool for implantation planning of reverse prostheses.

### Clinical Message

For patients of reverse shoulder arthroplasty, we need indigenous lesser-width glenoid implants.

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Conflict of interest:** Nil **Source of support:** None

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