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Morphometry of the glenoid bare spot and its reliability as a landmark: a cadaveric study

Abstract

Background: The glenoid bare spot has been proposed as a central landmark for arthroscopic quantification of glenoid bone loss in shoulder instability, but some studies have questioned its consistency and centrality. No cadaveric data exist from the local Kenyan population.

Objective: To describe the presence, morphology, and location of the glenoid bare spot in a Kenyan cadaveric sample and assess its reliability as a geometric center.

Methods: Fifteen formalin-fixed shoulders (7 right, 8 left) from 10 adult cadavers were dissected. Shoulders with damage or degeneration were excluded. Bare spot presence, shape, and diameter were recorded. Distances from the bare spot center to anterior and posterior glenoid rims were measured. Descriptive statistics were applied.

Results: The bare spot was present in all 15 specimens. Shapes were oval (40%), circular (33%), irregular (13%), and crescentic (13%), with median diameter 4.87 mm (range 2.34–14.56 mm). Mean distance to anterior rim was 7.33 mm (range 3.99–9.58 mm); to posterior rim, 9.23 mm (range 3.97–17.02 mm), indicating anterior eccentricity.

Conclusion: In this cadaveric cohort, the glenoid bare spot was universally present but variable in size/shape and consistently anteriorly eccentric. These findings support existing evidence that it is not a reliable central landmark for assessing glenoid bone loss, with potential to overestimate anterior defects if used arthroscopically.

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Introduction

The glenoid bare spot is defined as a thinning of the central area of hyaline cartilage covering the glenoid fossa. It is considered a normal anatomical variant which develops after birth, with its occurrence being seen more in adults than in children.[1–3] It is thought to develop due to compressive loading of the humeral head on the glenoid during shoulder adduction.[2,4] It has been described in cadaveric, radiologic and arthroscopic studies. Some studies have reported a consistent location of the spot, being at the center of a circle defined by the inferior glenoid rim, being equidistant to the anterior, posterior, and inferior glenoid rims.[5] Due to this reported consistent location, it has been used as a landmark to assess and quantify glenoid bone loss arthroscopically.[5,6] However, some studies have reported an inconsistent presence and location of the bare spot and thus its use as a landmark to quantify glenoid bone loss unreliable.[6] Currently no cadaveric data exist from East African / Kenyan populations.

Objective

- To determine the presence and shape variations of the glenoid bare spot.
- To establish the anatomical location of the glenoid bare spot in relation to identifiable landmarks.
- To compare findings with existing literature on different populations.

Materials and methods

This was a cross-sectional descriptive anatomical study undertaken at the Department of Human Anatomy, Egerton University, Njoro, Kenya. Formalin-fixed shoulders from cadavers used for dissection by medical students were used.

Any shoulders with obvious post-mortem damage, traumatic injury or degeneration were excluded. The sample size was determined by availability of cadaveric material during the study period.

The shoulders were dissected and all the muscles attached around the glenoid were removed. The presence or absence of the bare spot was noted. The shape of the glenoid was noted and its diameter measured along its greatest horizontal length. The distance of the bare spot was then measured from the anterior and posterior glenoid rims using a digital vernier caliper. All measurements were taken in millimeters. All measurements were taken twice by the same observer, and the average recorded.

Data were analyzed using descriptive statistics. Continuous variables were summarized using mean, median, range, and standard deviation where appropriate. Categorical variables were expressed as frequencies and percentages. Given the descriptive nature of the study and the limited sample size, no inferential statistical tests were performed. Data analysis was conducted using Microsoft Excel (Microsoft Corp., Redmond, WA, USA).

Results

Twenty shoulders from 10 adult cadavers were initially available for analysis; five shoulders from four cadavers were excluded due to post-mortem damage. The final sample therefore comprised 15 shoulders (7 right, 8 left) from six male and four female donors of indeterminate age. The glenoid bare spot was identified in all specimens. Bare spot morphology was oval in six (40%), circular in five shoulders (33%), irregular in two (13%), and crescentic in two (13%). This is shown in Figure 1. Figure 2 shows an example of a well-developed circular bare spot. The bare spot diameter ranged from 2.34 to 14.56 mm (median 4.87 mm). The mean distance from the anterior glenoid rim was 7.33 mm (range 3.99–9.58 mm; median 7.56 mm), while the mean distance

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from the posterior rim was 9.23 mm (range 3.97–17.02 mm; median 8.77 mm). This is shown in Table 1.

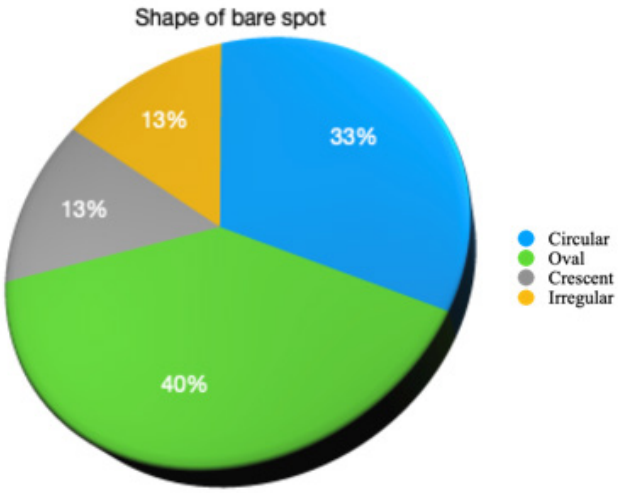

Figure 1 Shape of bare spot

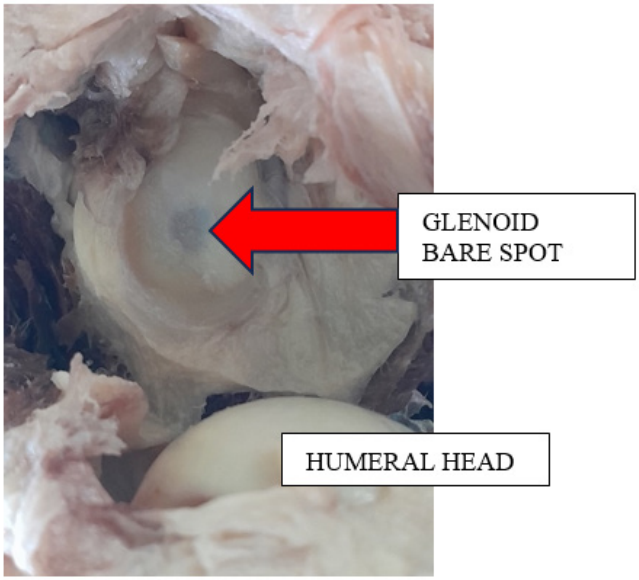

Figure 2 Well-developed circular glenoid bare spot

Table 1 Morphometric Measurements of the Glenoid Bare Spot (n = 15)

Parameter	Minimum (mm)	Maximum (mm)	Mean (mm)	Median (mm)
Bare spot diameter	2.34	14.56	5.69	4.87
Distance from anterior glenoid rim	3.99	9.58	7.33	7.56
Distance from posterior glenoid rim	3.97	17.02	9.23	8.77

Discussion

The current study showed the presence of the bare spot in all the specimens studied, whilst other studies have showed that it's not present in all shoulders. In a cadaveric study from South Africa, Creswell et al found that the bare spot was present in 88 of 100 shoulders studied.[7] Similar results were found by Alashkham et al who found it present in 80.7% of shoulders.[8] The difference in occurrence between the current study and the quoted studies could be due to the small sample in the present study. Though these were all done on cadaveric shoulders, similar results have been obtained in shoulder arthroscopic studies.[9] However, Barcia et al observed it in only 48% of patients undergoing arthroscopic surgery.[10]

The bare spot was oval and circular in most of the specimens in this study, with both shapes seen in 73% of the specimens, with the oval shape being the most predominant. This predilection to the oval and circular shape has been shown in other studies.[8]

In the current study the bare spot was not located centrally in the glenoid, but is located closer to the anterior edge than the posterior edge of the glenoid. This finding is similar to what has been found in other studies.[6,7,9,11–14] Early literature by Burkhart and colleagues suggested that the bare spot represented a reliable marker of the geometric center of the inferior glenoid, and thus could be used to estimate glenoid bone loss arthroscopically.[5] The findings in the present study do not support this assertion.

These findings reinforce the doubts expressed in other studies that the bare spot is a reliable central landmark of the glenoid cavity and therefore may not represent the geometric center of the inferior glenoid. These results have important implications in arthroscopic evaluation of anterior glenoid bone loss, as assuming centrality of the bare spot may lead to systematic overestimation of true bone loss, in cases of anterior shoulder instability. This is shown in Figure 3, where a 2mm anterior glenoid defect is simulated, where in the centrally located bare spot the calculated bone loss is 10% and 47% where it is eccentrically anteriorly located. In such a situation, this would necessitate augmentation with a bony procedure like the Latarjet. This finding has also been reported in the study by Barcia et al.[10]

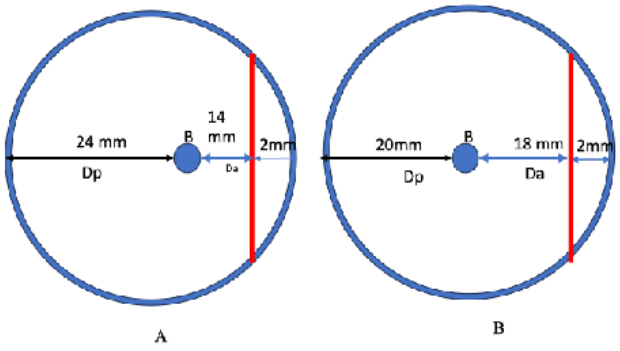

Figure 3 Effect of bare spot location on calculated bone loss in a simulated 2mm anterior glenoid bone loss

Using the bare-spot method of calculating percentage bone loss:

Bone Loss (%)=(D_p-D_a)D_p×100, where D_a is the distance from the bare spot to the anterior glenoid rim while D_p is the distance from the bare spot to the posterior edge of the glenoid.

In the Figure A, where the bare spot is more anteriorly located

*Bone Loss (%)=(24-14)/24×100=**41.7%***

In Figure B where the bare spot is centrally located

*Bone Loss (%)=(20-18)/20×100=**10%***

The eccentric anterior location may be related to directional loading patterns of the humeral head. Repetitive compressive forces during adduction and internal rotation may preferentially thin the anterior

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articular cartilage.[5] Given the growing emphasis on precise bone loss thresholds for procedures such as the Latarjet or bone-grafting, reliance on arthroscopic measurement using the bare spot should be approached with caution, and surgeons may need to incorporate alternative preoperative imaging-based measurement techniques like conventional 2D MPR or 3D scanning.[16] Previous clinical studies have found that arthroscopic measurements significantly overestimate glenoid bone loss compared with CT which is generally regarded as the gold standard to evaluate bone loss.[17,18] Overestimation of bone loss may lead the surgeon to undertake a bony procedure when an arthroscopic soft tissue procedure would suffice. These bony procedures like the Latarjet or Bristow operations are attended by a higher complication profile than soft tissue procedures and thus should only be done when indicated.[19]

Limitations

This study had several limitations which must be acknowledged. First, the small number of shoulders examined, thus firm generalizations cannot be made. Second, the cadavers lacked age records, thus making it hard to assess the effect of this on the observations made. Since all specimens were obtained from Egerton University, Kenya, the findings may not fully represent the diversity of anatomical variations in the African populations. Despite this, the consistency of our findings—particularly the anterior eccentric location of the glenoid bare spot—aligns closely with results reported in larger cadaveric and arthroscopic studies from other populations. This suggests that the observed eccentricity is unlikely to be a chance finding.

Conclusion

In this cadaveric sample, the glenoid bare spot was consistently identified but demonstrated marked variability in size and shape and an anteriorly eccentric location. These findings add to growing evidence that the bare spot is not a reliable indicator of the geometric center of the glenoid. Caution is therefore advised when using the bare spot as a reference for arthroscopic assessment of anterior glenoid bone loss.

Conflicts of interest

The authors declare no conflict of interest. No funding was received for this study.

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