Arthroscopic assessment of glenoid bone defect in patients with anterior shoulder instability

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Purpose
The purpose of this study was to assess the reliability of arthroscopic estimation of anterior glenoid bone defect in patients with anterior shoulder instability, by comparing it with anteroposterior diameter equation method in computed tomography (CT) glenoid en-face view with head subtraction.
Patients and methods
Thirty patients with anterior shoulder instability underwent shoulder CT glenoid en-face view scans and were found to have anterior glenoid bone defect. The anterior glenoid bone loss of each patient was studied using the anteroposterior distance from the center of a best-fit circle drawn on the inferior portion of the glenoid. Arthroscopic estimation of the anterior glenoid bone defect was done in all those patients as a part of the planned final procedure. The mean percent bone loss studied in CT was compared with arthroscopy to determine the reliability of arthroscopy in the measurement of anterior glenoid bone defect.
Results
The mean percentage of anterior glenoid bone defect calculated with CT diameter equation method was 17.3±9.7, whereas the mean percentage of arthroscopic estimation of anterior glenoid bone defect was 22.55±9.9, which shows statistically significant difference ($P<0.04$) between diameter equation percent and arthroscopic percent in the studied patients. The study showed that the arthroscopic estimation significantly overestimates anterior glenoid bone defect.
Conclusion
Our finding suggests that arthroscopy significantly overestimates anterior glenoid bone defect compared with CT glenoid en-face view anteroposterior distance method, and the surgeons should not relay on arthroscopic measurement of the defect to plan for surgery.

Keywords:
anterior glenoid bone defect, anterior shoulder instability, arthroscopic assessment, computed tomography glenoid en-face view

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Introduction

Anterior shoulder instability is a common orthopedic problem among young people and athletes [1]. Glenoid and humeral bone loss are common, and several studies reported it to be up to 95% after dislocation [1,2]. Glenoid bone loss may be a major cause of failure of arthroscopic soft tissue repair in cases of anterior shoulder instability [3]. The glenoid bony face is pear shaped with a broader inferior portion forming a circle with average width 24 mm [4,5]. The bare spot is the thinning of the cartilage nearly in the center of the glenoid and has a characteristic round to oval appearance which covers an area of subchondral bone thickening called tubercle of Assaki [6].

The bare spot is an important landmark in arthroscopic estimation of glenoid bone loss [7]. This assessment of glenoid bone loss is based on measuring the distance from bare area to anterior and posterior glenoid rim (bare area method) [8].

Preoperative computed tomography (CT) glenoid en-face view may facilitate the accurate assessment of anterior glenoid bone defect [9], which in turn has an important role in decision making regarding the type of the operative procedure whether it is soft tissue stabilization or bone reconstruction [10].

Patients and methods

This prospective study was approved by the ethical committee of Al-Azhar University. Assessment of anterior glenoid bone defect in 30 patients with anterior shoulder instability was done at Al-Azhar University hospitals.

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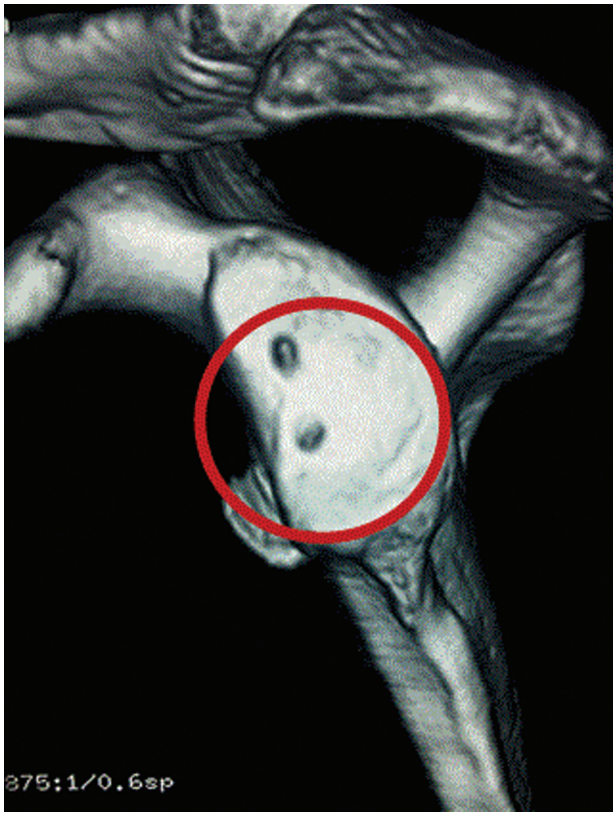
Figure 1

Three-dimensional computed tomography glenoid en-face view showing right glenoid anterior rim bone defect.

Figure 2



Anterior glenoid bone defect with previous failed arthroscopic Bankart repair by anchors.

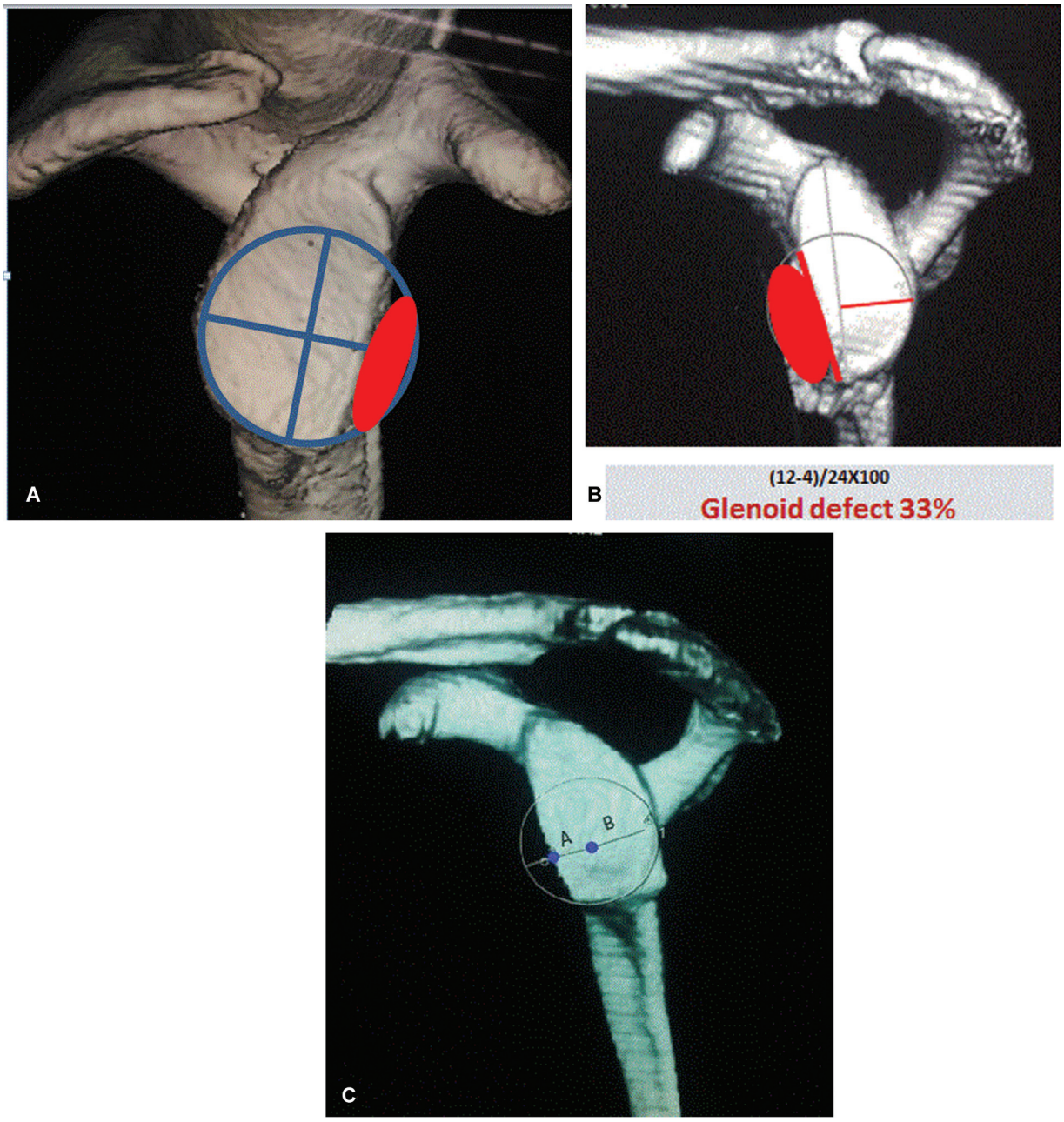
The inclusion criteria were anterior shoulder instability with anterior glenoid bone defect, visible bare spot, and glenoid bone defect not more than 40–50%. Patients with posterior shoulder instability, posterior glenoid bone defect, and obvious arthritic changes of the glenoid were excluded.

All patients selected in this study underwent preoperative shoulder CT scan with 3-mm axial cuts being made through the humeral head and glenoid. Furthermore, a three-dimensional CT reconstruction (glenoid en-face view) was performed for each patient (Fig. 1). There were three cases out of the thirty with failed arthroscopic bankart repair and were revised by bony reconstruction procedures (Fig. 2).

A best-fit circle was drawn on the inferior portion of the glenoid, and the center of this circle was detected. The distances from the center to the anterior edge (A) and from this center to the posterior edge (B) were measured, and the percentage of bone loss was determined with the following formula: [(B–A)/(2×B)]×100% (Fig. 3).

Arthroscopic estimation of anterior glenoid bone defect was performed for each of the 30 patients using the bare spot method. Shoulder arthroscopy was performed with the patient in the beach chair position. For each patient, visualization of the glenoid was performed through both the anterior and posterior portals to ensure accurate estimation of glenoid bone loss. Measurements were taken with the anterior superior portal being the viewing

Figure 3



Measurement of anterior glenoid bone defect by anteroposterior diameter equation method.

portal and a graduated probe being passed through the posterior portal. We used the probe to measure the distance from the bare spot to the anterior glenoid rim (A) and the distance from the bare spot to the posterior glenoid rim (B), so we could detect the arthroscopic diameter of the defect by the following formula: [(B–A)/(2×B)]×100% (Fig. 4).

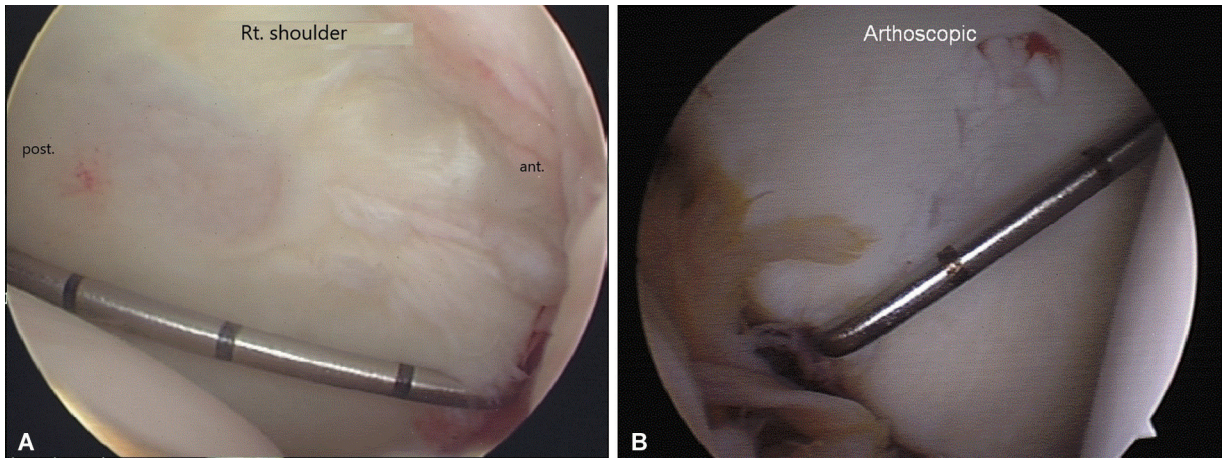
We made statistical analysis between diameter equation method and arthroscopic estimation method, and data were analyzed using statistical program for the social sciences (SPSS; SPSS Inc., Chicago, Illinois, USA) version 15.0.

Results

The mean percentage of anterior glenoid bone loss calculated with diameter equation method in CT glenoid en-face view was 17.3±9.7, whereas the mean percentage of anterior glenoid bone loss measured arthroscopically was 22.55±9.9 with statistically significant difference between diameter equation CT method and arthroscopic estimation method (P=0.04) (Table 1).

The patients in our study were divided into three groups according to percentage of anterior glenoid

Figure 4



Arthroscopic view of the glenoid.

Table 1 Mean percent anterior glenoid bone defect in computed tomography anteroposterior diameter equation method and arthroscopic estimation method in the studied patients

Variables	Groups		*t*-Test	*P* value
	CT diameter equation method (*N*=30)	Arthroscopic estimation method (*N*=30)		
Mean±SD	17.3±9.7	22.5±9.9	2.02	0.04*

CT, computed tomography. *$P<0.05$, considered significant.

Table 2 Groups of patients according to percent of anterior glenoid bone defect by computed tomography glenoid diameter equation method and arthroscopic estimation method

Percentage of anterior glenoid bone defect	Group 1 (< 10%) [*n* (%)]	Group 2 (10–20%) [*n* (%)]	Group 3 (> 20%) [*n* (%)]
CT glenoid diameter equation method (*N*=30)	6 (20)	15 (50)	9 (30)
Arthroscopic estimation method (*N*=30)	2 (7)	12 (40)	16 (53)

CT, computed tomography.

bone defect measured by CT diameter equation method. The anterior glenoid bone defect was less than 10% in group 1 (six patients), from 10 to 20% in group 2 (15 patients), and more than 20% in group 3 (nine patients). Those patients were reassessed during arthroscopic estimation of the anterior glenoid bone defect, and there were only two patients who had a glenoid defect less than 10%, whereas in 16 patients, the anterior glenoid bone defect was more than 20% (Table 2).

This means that if we assess the anterior glenoid bone defect by arthroscopic estimation method, 16 (53%) patients will need bony reconstruction instead of soft tissue stabilization, whereas if we assess the anterior glenoid bone defect by the CT diameter equation method, only nine (30%) patients will need bony reconstruction of the anterior glenoid bone defect.

Discussion

There are several methods to calculate anterior glenoid bone defect, with no consensus regarding which measure should be used to assess the defect [11,12]. Burkhart *et al.* [3] studied the use of the bare spot method during arthroscopic estimation by arthroscopically examining the location of the bare spot on the glenoid and found that the bare spot is almost exactly located in the center of the inferior portion of the glenoid so it can be used as a consistent reference to measure the percentage of the glenoid diameter bone loss.

In our study, there were statistically significant difference between diameter equation CT method and arthroscopic estimation method (P=0.04) in the measurement of the anterior glenoid bone defect, as arthroscopic estimation method is an operator-dependent measurement, which varies by change in viewing portal and position of bare spot.

Kralinger *et al.* [7] and Cresswell *et al.* [8] performed cadaveric studies on the use of the bare spot method during arthroscopic estimation of the anterior glenoid bone defect, by examining the location of the bare spot on the glenoid, and found that the bare spot is not a reliable landmark for the measurement of anterior glenoid bone loss as the bare spot is not in the exact center of the inferior circular part of the glenoid and it is situated too

anteriorly. Similarly, Cresswell *et al.* [8] found that the size of the bare spot can vary from 2.4 to 9 mm, making measurement from this 'spot' less precise and consistent. Moreover, it has been shown that bare spot may be absent in some patients [13]. All these factors might be a cause of inaccuracy of arthroscopic assessment of the glenoid defect, and therefore, arthroscopic estimation may not be considered the best method for assessment of glenoid bone defect, as arthroscopic estimation also does not allow for visualization and comparison with the contralateral normal glenoid [14,15].

In this study, we did not evaluate surface area method in detection of anterior glenoid bone defect. Sugaya and colleagues, in a clinical series [4,16] involving 42 patients with chronic recurrent glenohumeral instability, calculated glenoid bone loss by the use of two methods (surface area digital calculation with three-dimensional CT scan and a diameter-based equation) and noted that the two values were slightly different. They concluded that digitally measuring the surface area with the aid of a computer was more accurate than the diameter-based method.

To plan for shoulder instability surgery, the surgeon should be aware of the different CT methods [17] before the time of arthroscopy and to be aware that the diameter equation methods only represent the defect in anteroposterior width of the glenoid and overestimate the true surface area of glenoid bone loss, and this may affect the surgeon's estimate [10,12].

Conclusion

Arthroscopic assessment of the glenoid bone defect is not accurate and usually overestimates the defect when compared with CT anteroposterior distance. It may lead to the performance of unneeded procedures if it is the only means of assessment of the defect. However, arthroscopic evaluation is non-negligible, and bone loss measurements remain a subject of considerable debate.

Limitations

There are some limitations of this study. First, it is not a blind study. Second, we use AP diameter method to measure the defect instead of the more accurate surface area method, and contralateral glenoid CT as a reference was not done.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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