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Bare spot and tubercle of Assaki

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Background: The definition of the bare spot and tubercle of Assaki is controversial, with studies reporting different incidences, locations, and clinical significance. The aims of this study were to evaluate the incidence of the bare spot, to determine the length and width of the bare spot, and to assess the relationship between the bare spot and tubercle of Assaki.

Materials and methods: A total of 140 shoulders from 30 men and 40 women were dissected and examined. After exposure of the glenoid fossa with the glenoid labrum attached, direct measurement of the length and width of the bare spot was undertaken using digital calipers. The repeatability and reliability of the measurements was assessed using Kruskal-Wallis one way analysis of variance on ranks, with statistical significance set at $P < .05$.

Results: A bare spot was observed in 80.7% ($n = 113$) of shoulders, being more common in men than in women, with an overall mean length and width of 7.2 mm and 6.2 mm. It was significantly longer ($P = .002$) and wider ($P = .018$) in men.

Conclusion: A bare spot exists within the glenoid fossa and differs from the tubercle of Assaki. It is a characteristic round to oval lesion in the central or eccentric cartilage. It should not be misdiagnosed as a pathologic lesion.

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Controversy exists about the definition of the bare spot and tubercle of Assaki within the glenoid fossa. The bare spot has been defined as thinning of the central area of hyaline cartilage covering the glenoid fossa.⁸ However, it has also been described as a focal, centrally located cartilaginous defect and is considered a normal variation in adults.^{10(cited in 9)} The tubercle of Assaki is defined as thinning of the middle of the articular cartilage and thickening of the underlying subchondral bone² in the center of the inferior glenoid fossa.^{3(cited in 4)} Earlier, Paturet¹² considered the tubercle of Assaki to be the bare spot.

As many as 88% of adult specimens have been observed to have a bare spot.¹³ However, the incidence in children is low, with those up to 10 years old showing no evidence, whereas a small number between 11 and 20 years old have a central or eccentric bare spot.⁹ A bare spot has not been observed in fetal shoulders.⁵ A bare spot at the center of the glenoid in a 14-year-old boy after a football injury was observed by Kim.⁸ Similarly, Gagliardi and Carino⁶ observed a bare spot in a 14-year-old with a traumatized shoulder; there was

a 4-mm central area of hyaline cartilage loss without changes in the subchondral bone.

With this in mind, the aims of this study were to evaluate the incidence of a bare spot in an adult population, to determine the length and width of the bare spot, and to assess the relationship between the bare spot and tubercle of Assaki.

Material and methods

Source of population

A total of 140 shoulders from 30 male and 40 female cadavers, with an average age of 81.5 years (range, 53–101 years), were dissected and examined.

Dissection and measurement

All muscles and blood vessels surrounding the shoulder joint as well as the fibrous capsule were inspected and then removed to expose the glenoid fossa with the glenoid labrum attached. By use of a digital caliper, the maximum length between the most superior and inferior aspects of the bare spot was taken; its maximum

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width was taken as the distance between the most anterior and posterior points.

Statistics

Data were double entered into the Statistical Package for Social Sciences (version 21; IBM, Armonk, NY, USA). Kruskal-Wallis and one way analysis of variance on ranks tests were used to determine statistical significance, which was set at $P < .05$. The repeatability and reliability of the measurements taken was determined by randomly selecting shoulders from the study cohort. Three measurements were taken on 3 separate occasions by 1 individual; measurements were taken by 2 other individuals on 2 separate occasions.

Results

A bare spot was observed in 80.7% ($n = 113$) of shoulders, being more common in men than in women (Fig. 1). In men, it was more common on the left side, whereas in women, it was more common on the right. The overall mean length and width of the bare spot were 7.2 mm and 6.2 mm, respectively (Table I). Taking gender into account, the bare spot was significantly longer ($P = .002$) and wider ($P = .018$) in men compared with women. In women, it was longer but narrower on the left compared with the right, whereas in men, it was longer and wider on the right compared with the left (Table I). However, the differences were not statistically significant.

Discussion

There is controversy concerning both the bare spot and the tubercle of Assaki in the glenoid fossa. The bare spot has been defined as thinning of the central area of hyaline cartilage,⁸ whereas others consider it a focal, centrally located cartilaginous defect that is a normal adult variation.¹⁰ In contrast, the tubercle of Assaki is thinning of the middle of the articular cartilage accompanied by thickening of the subchondral bone²; it is located in the center of the inferior glenoid.³ This thickening is suggested to be due to the constant pressure of the humeral head against the glenoid.¹⁵ This study partly supports Kim⁸ and Warner et al,¹⁵ observing that a bare spot exists, with the tubercle of Assaki being the thickest region of subchondral bone within the glenoid fossa.

In contrast to Burkhart et al,³ Ly et al,¹⁰ Kim,⁸ and Al-Mulhim,² who reported that the bare spot and tubercle of Assaki were centrally located, but similar to Aigner et al,¹ this study observed an

eccentric location of the bare spot as well as of the tubercle of Assaki.

The underlying causes for the tubercle of Assaki and bare spot are unknown. However, the suggestion that the tubercle of Assaki results from constant pressure of the humeral head against the glenoid fossa¹⁵ is reasonable for two reasons: first, the number of bare spots observed in this and other^{4,7} studies on adults; and second, the absence of a bare spot in fetuses⁵ and in children aged 0–10 years, with only 12 individuals aged 11–20 years observed to have a bare spot.⁹

In an analysis of the distribution of mineralization in the subchondral bone of dominant-side throwing shoulders using computed tomography–osteodensitometry, Mochizuki et al¹¹ divided the glenoid labrum into 1 central area and 6 peripheral areas; they reported that the mechanical stress associated with throwing affected the peripheral regions (anterior, anteroinferior, posterior, and posteroinferior) more than the central region. Earlier, in a computed tomography–osteodensitometry assessment of shoulders to evaluate the distribution of mineralization of the subchondral bone plate, Schulz et al¹⁴ reported that the maximum density localization showed that long-term stress distribution is in the periphery of the glenoid fossa, and it is often bicentric.

According to Aigner et al,¹ the bare spot was constant, variable in shape, and mainly situated eccentrically within the inferior glenoid fossa. This constant appearance was assumed to be due to the distribution of hyaline cartilage covering the glenoid fossa; it cannot, therefore, be taken as a marker for operative measurement. De Wilde et al⁴ support this, observing the tubercle of Assaki to be round to oval, with an average diameter of 6 mm; in 98.9% of specimens, the center of the inferior glenoid coincided with the anterosuperior quadrant of the surface area of the tubercle of Assaki. Huysmans et al⁷ observed a bare spot in 87.5% of specimens, all of which were located in the center of the inferior glenoid; there was no significant difference in the distance between the center of the bare spot and the anterior, inferior, or posterior cartilage or bony rim. This suggests that the bare spot is the center of both the articular surface of the inferior glenoid and the bony inferior glenoid. In this study, a bare spot was observed in 80.7% ($n = 113$) of specimens examined, being more common in men than in women. The overall mean length and diameter in both genders were 7.16 mm and 6.19 mm, giving it a

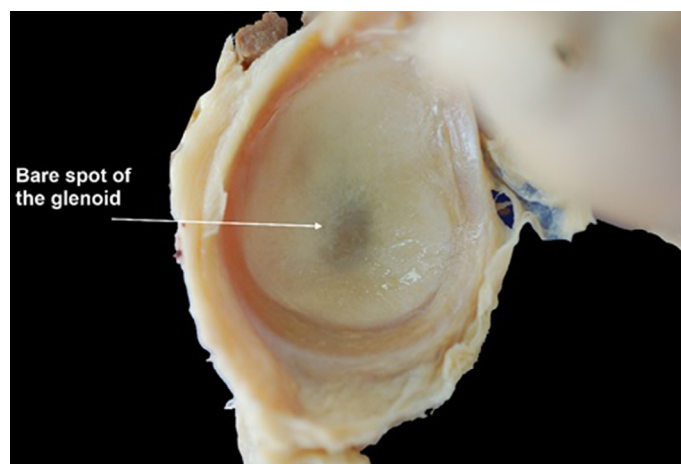


Figure 1 Right shoulder showing the bare spot within the glenoid fossa.

Table I

Dimensions of the bare spot overall as well as for men and women on the right and left sides

	Mean (mm)	Range (mm)	Standard deviation (mm)	Presence (%)
Both genders				80.7
L	7.2	2.3–12.6	1.87	
W	6.2	3.0–11.5	1.66	
Women only				72.5
L	6.6	2.3–11.931	1.73	
W	5.8	3.0–11.5	1.77	
Right side				37.5
L	6.6	2.3–11.9	1.95	
W	6.4	3.6–11.5	2.1	
Left side				35
L	6.7	3.3–9.3	1.49	
W	5.4	3.0–8.2	1.19	
Men only				91.7
L	7.7	5.3–12.6	1.90	
W	6.6	4.1–11.1	1.47	
Right side				45
L	7.8	5.3–12.6	1.60	
W	6.7	4.1–9.8	1.81	
Left side				46.7
L	7.7	5.4–12.0	1.81	
W	6.5	4.0–11.1	1.37	

L, length; W, width.

round to oval shape; however, the length and width were significantly different ($P = .002$ and $P = .018$, respectively) between men and women, being greater in men.

It could be questioned if the bare spot can be modified or more difficult to find with age as the cartilage thickness decreases in elderly individuals. Several studies reported that the incidence of bare spot in children is low and could not be seen in fetal shoulders.^{5,9} The average age of the shoulders in this study was 81.5 years (range, 53–101 years), and the bare spot could be identified easily.

As this study was done on cadaveric shoulders and also because of lack of the medical history, we were not able to investigate the correlation between the existence of bare spot, tubercle of Assaki, and any underlying shoulder diseases, including osteoarthritis, inflammatory arthritis, osteonecrosis, and trauma. Therefore, further studies are recommended to evaluate if there is any association between bare spot, tubercle of Assaki, and shoulder pathologic processes.

Conclusion

The bare spot has a characteristic round to oval appearance, being a central or eccentric cartilage lesion within the glenoid fossa. The absence of any bare spots in children younger than 10 years and the low incidence in the second decade of life and high incidence in the elderly support the theory that it is an acquired phenomenon. Surgeons and radiologists should be familiar with this finding and not misdiagnose it as a pathologic lesion. Further studies are needed to inform the clinical correlation between the bare spot and the tubercle of Assaki as well as morphologic changes in the glenoid labral tissue and the hyaline cartilage covering the glenoid fossa.

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Disclaimer

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