

The Notch Types of the Glenoid Cavity in Adult Dry Human Scapulae

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Abstract

Purpose: The glenoid cavity is a shallow pear shaped articular fossa which is located on the lateral angle of the scapula. To clarify normal glenoid cavity morphometry is important for restoration of normal anatomy which is the goal in orthopedic surgery. The purpose of the present study is to explore the presence or absence of the glenoid notch and the distribution of the type variations of glenoid cavity in dry scapulae bones.

Methods: 63 adult dried human scapulae with unknown ages and gender belonging to the Anatomy Department Laboratory of Dokuz Eylül University, School of Medicine were examined macroscopically. The presence or absence of notch and notch types were evaluated.

Results: The number (%) of notch types of glenoid cavity of 63 scapulae, in descending order, were as follows: type 1a 24 (38.10%), type 2a 17 (26.98%), type 0 13 (20.63%), type 2b 6 (9.53%), type 1b 3 (4.76%). We determined that the most observed type of notch of glenoid cavity was type 1a and the least observed type was type 1b.

Conclusion: In the treatment of the recurrent shoulder subluxations or dislocations, orthopedic surgeons need to pay attention to the presence or absence and the types of the notches at the glenoid cavity.

Keywords: Scapula, glenoid cavity, notch.

INTRODUCTION

The scapula helps to facilitate optimal shoulder function in order to produce efficient movement (1). The glenoid cavity is a shallow pear shaped articular fossa which is located on the lateral angle of the scapula. It provides articular surface for the head of the humerus (2).

The glenoid rim has a notch in its superior and anterior part (3). The shoulder joint is the most frequently dislocated joint in human body (4).

The shoulder joint dislocation is frequently observed between the ages of 20–60 years. Most of the shoulder dislocations are represented as anterior dislocations which are predominately seen in males (5, 6).

In order to protect the posterior displacement of the gleno-humeral contact point and thus to avoid early glenoid loosening and implant failure, modern prosthetic designs and surgical techniques should be applied in restoration of the normal shoulder anatomy and function (7, 8).

Variations of shape and size of glenoid cavity of scapula is important in order to understand of shoulder dislocation, rotator cuff disease and to determine the meticulous size of the glenoid component in the shoulder arthroplasty. These variations also has a prognostic value on the primary gleno-humeral osteoarthritis (4).

In the literature, the shape variations of the glenoid cavity are determined as follows: egg-shaped, oval, teardrop, pear-shaped, round, tear with a notch, shape without a notch and elongated oval (9–12).

A well matched fit between the glenoid component and the underlying bone is necessary for successful replacement (13).

To clarify normal glenoid cavity morphometry is important for restoration of normal anatomy which is the goal in orthopedic surgery (14).

The purpose of the present study is to explore the presence or absence of the glenoid notch and the distribution of the type variations of glenoid cavity in dry scapulae bones.

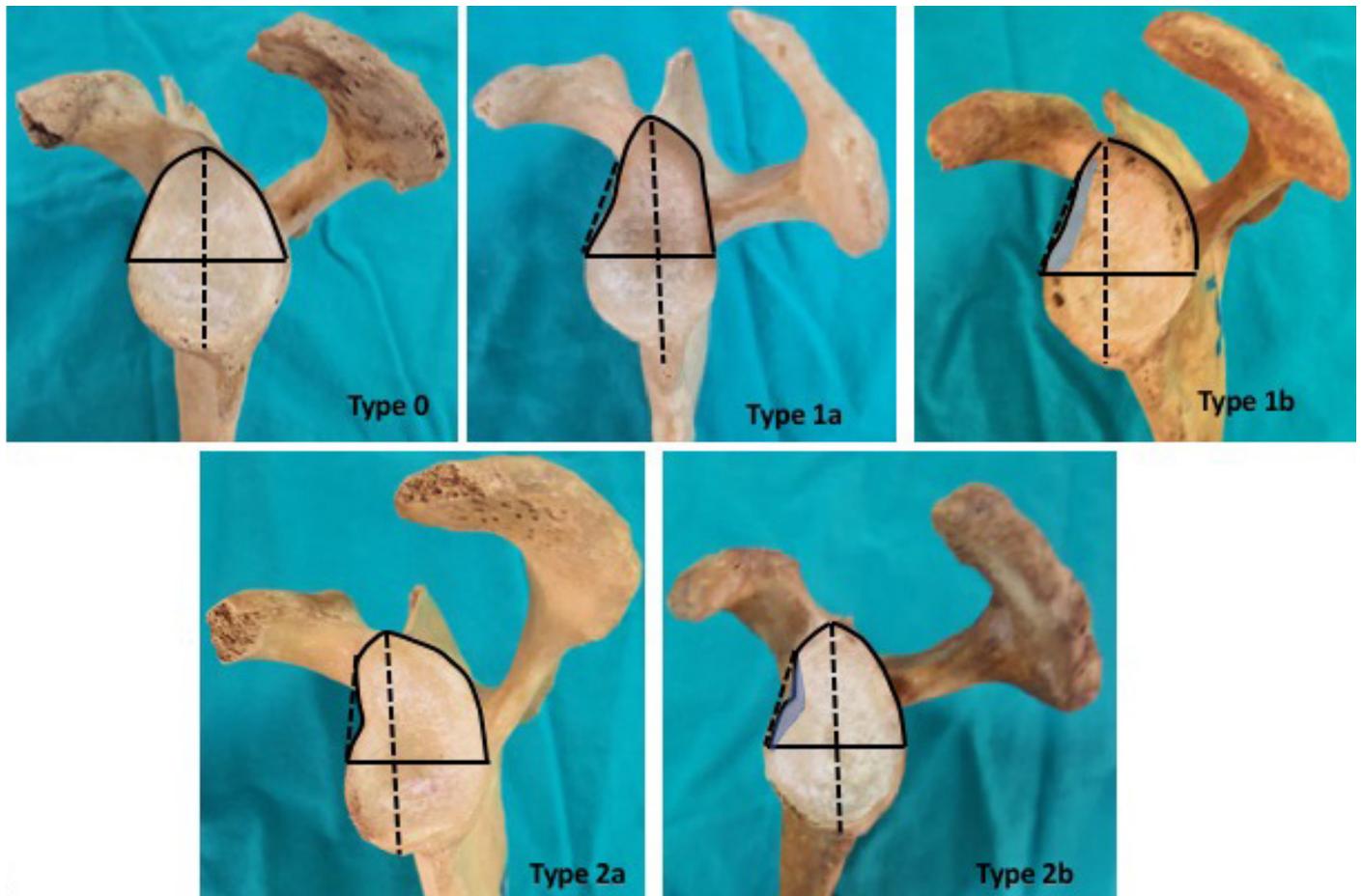


Figure 1. The determination of the notch types of the glenoid cavity. View from the lateral aspect of the left scapulae. Type 0, notch is absent; Type 1a, notch in shallow concave form; Type 1b, notch in shallow concave form with prominent protuberance margin; Type 2a, prominent angular notch; Type 2b, prominent angular notch with prominent protuberance margin.

MATERIALS AND METHODS

63 (18 right, 45 left) adult dried human scapulae with unknown ages and gender belonging to the Anatomy Department Laboratory of Dokuz Eylül University, School of Medicine were examined macroscopically. The scapulae were grouped according to anatomic positions of these specimens as left and right. All scapulae were photographed. The glenoid cavity was divided into two parts (upper and lower) by the horizontal line passing through the middle of the height (supero-inferior diameter) of it. By evaluating the anterior and posterior margins of the upper part, the notch types were defined as Type 0: notch is absent (the anterior and posterior margins are symmetrical in the upper half of the glenoid cavity) (Figure 1), Type 1a: notch in shallow concave form (the anterior and posterior margins are not symmetrical in the upper half of the glenoid cavity) (Figure 1), Type 1b: notch in shallow concave form with prominent protuberance margin (the anterior and posterior margins are not symmetrical in the upper half of the glenoid cavity and prominent protuberance is seen at margin of the notch) (Figure 1), Type 2a: prominent angular notch (anterior margin is 3 or inverted 3 shaped in the upper half of the glenoid cavity) (Figure 1), Type 2b: prominent angular notch with

prominent protuberance margin (anterior margin is 3 or inverted 3 shaped in the upper half of the glenoid cavity and prominent protuberance is seen at margin of the notch) (Figure 1).

RESULTS

The number (%) of notch types of glenoid cavity of 63 scapulae, in descending order, were as follows: type 1a (notch in shallow concave form) 24 (38.10%) (Figure 2), type 2a (prominent angular notch) 17 (26.98%) (Figure 2), type 0 (notch is absent) 13 (20.63%) (Figure 2), type 2b (prominent angular notch with prominent protuberance margin) 6 (9.53%) (Figure 2), type 1b (notch in shallow concave form with prominent protuberance margin) 3 (4.76%) (Figure 2). We determined that the most observed type of notch of glenoid cavity was type 1a and the least observed type was type 1b.

DISCUSSION

The shape of the glenoid cavity and the glenoid labrum determines the most remarkable feature of the gleno-humeral joint as they precisely stabilizes the humeral head in the center of the cavity

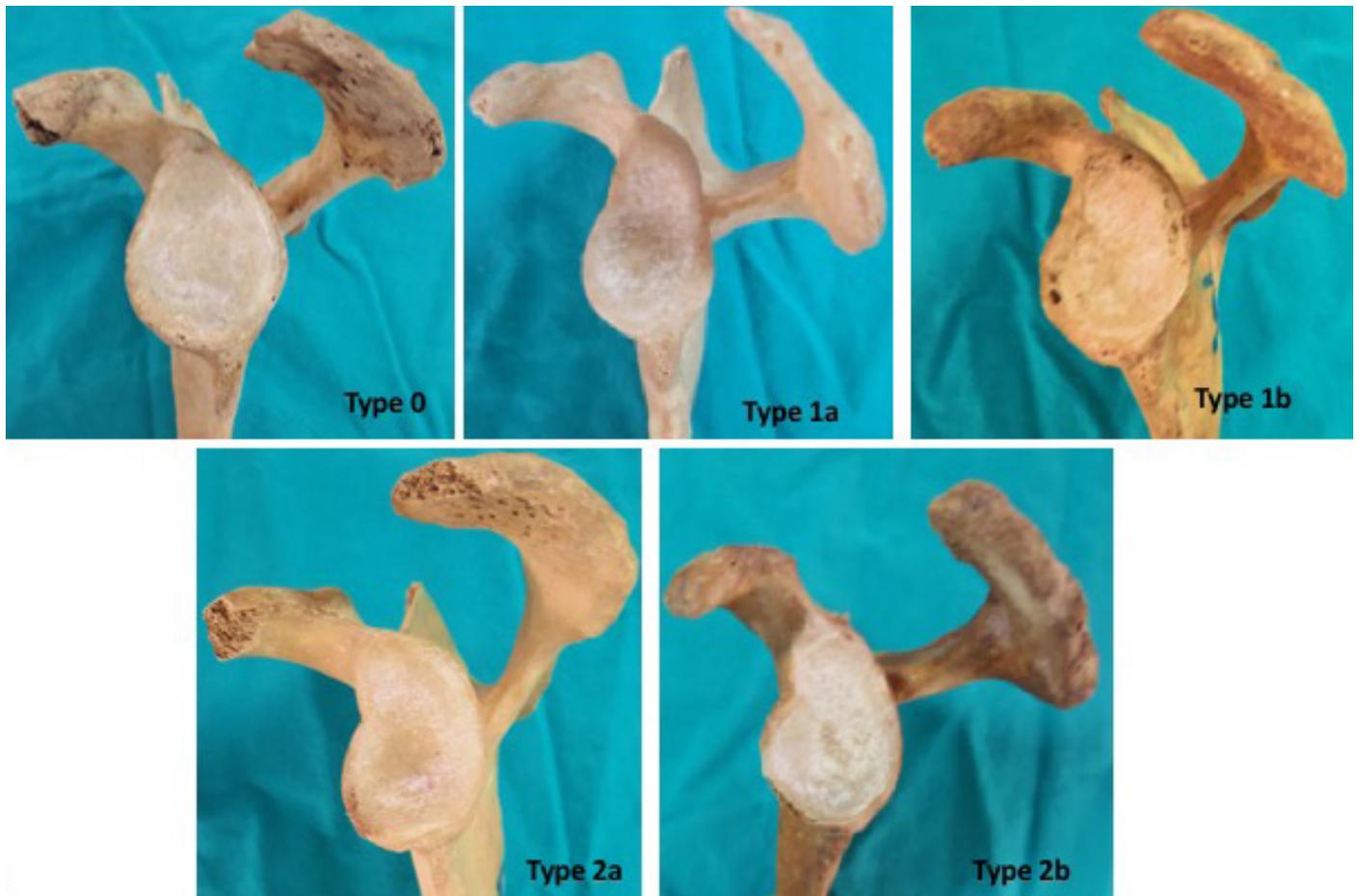


Figure 2. Classification of the notch types of the glenoid cavity. View from the lateral aspect of the left scapulae. Type 0, notch is absent; Type 1a, notch in shallow concave form; Type 1b, notch in shallow concave form with prominent protuberance margin; Type 2a, prominent angular notch; Type 2b, prominent angular notch with prominent protuberance margin.

as well as allowing a vast range of movements (15). There is a positive correlation in between small articulating surface areas of the gleno-humeral joint and dislocation (16, 17). The glenoid notch is found at the anterior margin of the glenoid cavity (18). It is located above the middle of the margin and may be very prominent (18). The causes of the formation of the glenoid notch are not very obvious (19).

According to Prescher and Klumpen the pressure from the tendon of the subscapular muscle becomes main cause of its formation (20). Frazer stated that the glenoid notch marks the junction between the “coracoid” and “scapular” parts of the glenoid cavity (21). Regardless of the way of its formation the existence of an evident glenoid notch may lead to local detachment of the glenoid labrum which may cause to development of a synovial recess (19).

In the present study, the glenoid cavity was divided into two parts (upper and lower) by the horizontal line passing through the middle of the height (supero-inferior diameter) of it. By evaluating the anterior and posterior margins of the upper part of glenoid cavity, the notch types were defined as Type 0: notch is absent (the

anterior and posterior margins are symmetrical in the upper half of the glenoid cavity), Type 1a: notch in shallow concave form (the anterior and posterior margins are not symmetrical in the upper half of the glenoid cavity), Type 1b: notch in shallow concave form with prominent protuberance margin (the anterior and posterior margins are not symmetrical in the upper half of the glenoid cavity and prominent protuberance is seen at the margin of the notch), Type 2a: prominent angular notch (anterior margin is 3 or inverted 3 shaped in the upper half of the glenoid cavity), Type 2b: prominent angular notch with prominent protuberance margin (anterior margin is 3 or inverted 3 shaped in the upper half of the glenoid cavity and prominent protuberance is seen at margin of the notch) (Figure 1). In the previous studies, the most frequently observed shape of the glenoid is the pear-shaped (supero-inferior height greater than the antero-posterior width (22). Checroun et al. reported that 71% of their specimens had a pear-shaped aspect and 29% of them seemed elliptical (23). Prescher stated that glenoid notch well expressed with a pear-shaped aspect in 55% of the specimens, whereas in 45% of the specimens the notch was found absent and the glenoid was found oval (9). The incidence of pear-shaped of glenoid cavity was the highest as aforementioned

studies, whereas in the present study, type 1a (notch in shallow concave form) was the most observed type.

Prescher and Klumpen determined that there was no any sexual dimorphism in prevalence and types of the glenoid notch shapes, whereas females were more likely to have asymmetric (non-bilateral) glenoid notches than males (20). Iliev observed that the glenoid notch was present in 92% of the male and in 50% of the female scapula (19).

Alashkham et al. classified the glenoid notch according to the notch severity as mild (type I oval shaped), moderate (type II pear shaped) and severe (type III comma shaped) respectively and observed that the incidences of type II and type III of glenoid notches were significantly higher in females, whereas type III was the most observed in males. They reported that there was a significant association in between the type of glenoid notch and gender (13).

The higher incidence of shoulder dislocation in males compared to females may be explained with the percentages indicating the distribution of the types of glenoid cavity among the genders. Cutts et al., Chechik et al. and Gutierrez et al. reported that in human body the shoulder joint was the most mobile joint which made this joint predisposed to dislocations, particularly in males (5, 24, 25).

In the present study, the number (%) of notch types of glenoid cavity of 63 scapulae, in descending order, were as follows: type 1a (notch in shallow concave form) 24 (38.10%), type 2a (prominent angular notch) 17 (26.98%), type 0 (notch is absent) 13 (20.63%), type 2b (prominent angular notch with prominent protuberance margin) 6 (9.53%), type 1b (notch in shallow concave form with prominent protuberance margin) 3 (4.76%) (Figure 2), (Table 1). We determined that the most observed notch type of glenoid cavity was type 1a and the least observed type was type 1b.

This difference may be due to the number of scapulae and/or variations in grouping criteria of notch types of the glenoid cavity.

In their study, Prescher and Klumpen revealed that if the glenoid notch was present the glenoid labrum was not attached to the margin of the glenoid cavity in the zone of the notch (20). In the presence of this kind of attachments, the joint becomes less resistant to the forces and more prone to dislocations and other injuries. In clinical practice labral tears and avulsions was frequently observed in the anterior part of the glenoid margin. It may be supposed that the presence of the glenoid notch and the nonattachment of glenoid labrum in this region may result in a weak spot for the shoulder joint (20).

The anatomical basis and variations of shape and size of glenoid cavity of scapula is very important while evaluating of rotator cuff diseases, shoulder dislocation and while determining the proper size of the glenoid component in the shoulder arthroplasty (4).

In the treatment of the recurrent shoulder subluxations or dislocations, orthopedic surgeons need to pay attention to the presence or absence and the types of the notches of the glenoid cavity. Detailed anatomy of this region has great importance in surgical approaches for normal anatomy restoration to prevent the recurrent shoulder dislocations.

In the present study as we didn't know the ages and gender of the scapulae bones, we could not compare the incidence of the notch types in between males and females of different age groups. All these studies were performed in dry bones. In order to clarify the effect of the age and gender on cases with the gleno-humeral dislocation, further research is needed.

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Table 1. The distribution of notch types of the glenoid cavity on the right or left sides of the scapulae

Notch types of glenoid cavity	Number (%) of notch types of the glenoid cavity		Total (%)
	Right (%)	Left (%)	
Type 0	3 (4.76)	10 (15.87)	13 (20.63)
Type 1a	5 (7.94)	19 (30.16)	24 (38.10)
Type 2a	7 (11.11)	10 (15.87)	17 (26.98)
Type 1b	2 (3.17)	1 (1.59)	3 (4.76)
Type 2b	1 (1.59)	5 (7.94)	6 (9.53)
Total	18 (28.57)	45 (71.43)	63 (100)

Type 0: notch is absent, **Type 1a:** notch in shallow concave form, **Type 1b:** notch in shallow concave form with prominent protuberance margin, **Type 2a:** prominent angular notch, **Type 2b:** prominent angular notch with prominent protuberance margin.

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