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Classification of primary glenohumeral osteoarthritis in a Turkish population - morphological study

Türk popülasyonunda primer glenohumeral osteoartrit sınıflaması – morfolojik çalışma

Mustafa Özçamdallı[1], Sinan Oğuzkaya[2], Gökay Eken[3], Turan Bilge Kızkapan[4], Erdal Uzun[5]

Abstract

Aim: This study aimed to investigate the distribution of modified Walch classification groups in a Turkish patient population. We think that there may be glenoid morphologies that do not fit the modified Walch classification due to ethnic differences.

Methods: Computed tomography images of 113 patients with primary glenohumeral osteoarthritis (GHOA) were evaluated. Version angle was measured according to the Friedman method, and classification was made by two blinded surgeons according to the modified Walch classification. Patients who did not meet the modified Walch groups were labeled as "Unclassifiable" and were analyzed as the 8th group.

Results: The mean age of the patients was 85.5 ± 7.5 years. Forty-eight patients were male (42.5%). Eighty-two patients (72.6%) belonged to Walch group A (60 A1 and 22 A2, respectively). The total percentage of group B was 16.7% (20 patients). Two patients were included in the "Unclassifiable" group. One of the patients had glenoid convexity due to advanced disease with 1° anteversion. The other patient in this group had anterior subluxation without underlying pathology.

Conclusion: The distribution of modified Walch groups in the Turkish population may be different from other populations. Posterior defective glenoid and excessive retroversion may concern less in the Turkish population with primary GHOA. Our results were obtained limited population and we think that further epidemiologic studies with larger sample size are needed.

Keywords: glenohumeral joint, osteoarthritis, morphology, Walch classification.

Öz

Amaç: Bu çalışmanın amacı, Türk popülasyonunda modifiye Walch sınıflamasına göre glenohumeral osteoartrit dağılımını belirlemektir. Etnik farklılıklar nedeniyle modifiye Walch sınıflamasına uymayan glenoid morfolojilerinin olabileceğini düşünmekteyiz.

Yöntemler: Primer glenohumeral osteoartrit (GHOA) tanısı almış olan 113 hastanın bilgisayarlı tomografi görüntüleri incelendi. Versiyon açıları Friedman metoduna göre ölçüldü. İki cerrah tarafından modifiye Walch sınıflamasına göre sınıflandırma yapıldı. Modifiye Walch sınıflamasındaki kriterlere uymayan hastalar "tanımlanmamış tip" olarak adlandırıldı ve 8. grup olarak belirlendi.

Bulgular: Hastaların ortalama yaşı 85.5 (±7.5) ve 48' i erkek (%42,5) idi. 82 hasta (%72,6) Walch grup A (60 A1 ve 22 A2)'ya dahil idi. Grup B' de 20 (%16,7) hasta var idi. 2 hasta tanımlanmamış grupta değerlendirildi. Bunlardan birinde 1 derecelik bir anteversiyonla ileri bir osteoartrit ve glenoid konveksitesi mevcut idi. Diğer hastada ise alta yatan başka bir patoloji olmaksızın anterior subluksasyon saptandı.

Sonuç: Türk popülasyonundaki modifiye Walch gruplarının dağılımı diğer toplumlardan farklı olabilir. Primer GHOA olan hastalarda posterior defektif glenoid ve aşırı retroversiyonun daha az görüldüğü saptandı. Çalışmamız kısıtlı popülasyonda yapılmış olup daha geniş hasta grubunda daha net sonuçlar elde edilebileceğini düşünmekteyiz.

Anahtar Kelimeler: Glenohumeral eklem, osteoartrit, morfoloji, Walch sınıflaması.

[1] Başakşehir Çam Sakura City Hospital, Department of Orthopedics and Traumatology, Istanbul, Turkey.
[2] Sivas Şarkışla State Hospital, Department of Orthopedics and Traumatology, Sivas, Turkey.
[3] Uludag University, Faculty of Medicine, Department of Orthopedics and Traumatology, Bursa, Turkey.
[4] Bursa Çekirge State Hospital, Orthopedics and Traumatology Department, Bursa, Turkey.
[5] Erciyes University Faculty of Medicine, Department of Orthopedics and Traumatology, Kayseri, Turkey.

MÖ: 0000-0002-9000-2135
SO: 0000-0003-3032-5714
GE: 0000-0001-9447-4749
TBK: 0000-0002-6614-888X
EU: 0000-0002-5456-3699

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Sorumlu yazar / Corresponding author:
Gökay Eken
Adres/Address: Uludag University, Faculty of Medicine, Dept of Orthopedics and Traumatology, Gorukle Campus, 16059, Nilufer, Bursa, Turkey.
e-mail: gokay_eken@yahoo.com
Tel/Phone: :+905392498264

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Introduction

Primary glenohumeral osteoarthritis (GHOA) is a well-defined cause of pain and disability in the elderly population. Degeneration of articular cartilage and subchondral bone with narrowing of the glenohumeral joint are the main characteristics of GHOA. Posterior glenoid is usually first affected region of the shoulder joint during osteoarthritis (OA) progression [1]. Normal shoulder anatomy can show variations among different populations. East Asian individuals have smaller glenohumeral dimensions than North American individuals except acromial length [2,3]. Moreover, there are many significant differences between the Chinese population and the Western population regarding proximal humeral anatomy [4].

Glenoid morphology is not also homogeneous among patients with GHOA. Walch et al. [5, 16] described five glenoid types according to the glenoid version and relation to the humeral head. Interobserver reliability of the original Walch classification has been questioned by many studies [6-8]. Bercik et al. [9] modified the Walch classification and added two more groups to the original Walch classification, which improved interobserver and intraobserver reliabilities with a modified Walch score. The specific outcomes are also supported by other studies [10].

Although the modified Walch classification suggested increased reliability, some points still exist for improvement. The modified version uses the scapular axis method (SM) to calculate humeral head subluxation, rather than the mediatrice method (MM) used in the original Walch classification. Although the SM has better interobserver and intraobserver reliabilities than the MM, Kidder et al had demonstrated that the SM notably increases the measurement for posterior humeral head subluxation [11]. Despite these known findings, the value for a centered humeral head remained unchanged at 45% to 55% [11]. Further evaluation by Jacxsens et al revealed that by using a 95% normal range to determine the cutoff value, displacement of the humeral head beyond 62% is considered posterior subluxation when using the SM, but this has yet to be incorporated into the modified Walch classification [12].

The Turkish gene pool contains a mixture of Asian, Middle Eastern, and European characteristics. Through studying the existing literature, to our knowledge, there have been no studies investigating primary GHOA morphology in the Turkish population. The primary aim of this study was to describe glenoid morphologic characteristics in patients with primary GHOA in the Turkish population.

Material and methods

Ethical approval was obtained for this morphologic type of study from institutional review board (Ordu University Clinical Research Ethics Committee, Approval date-number: 09/05/2019-2019/70) and medical records of the patients who were admitted to the outpatient clinic with shoulder pain between January 2016 and June 2019 at the Ordu University Hospital, Kırsehir Ahi Evran University Hospital, and Bursa Cekirge State Hospital were evaluated. This study has been performed in accordance with the 1964 Declaration of Helsinki and its later updates. Patients who have international classification of disease (ICD) codes related with shoulder diseases were searched and the files of patients with new or old diagnoses of glenohumeral osteoarthritis were selected. The inclusion criteria for the study were primary glenohumeral osteoarthritis with adequate computed tomography (CT) scan images to measure the glenoid version. In our clinic, CT is performed to patients who have been diagnosed with GHOA using X-ray radiography and require a treatment plan (surgery or conservative), trauma patients with suspected shoulder fracture or dislocation on X-ray images, patients with shoulder problems who cannot undergo an MRI for various reasons, patients with Bankart lesions to assess for bone pathology, and patients who undergo CT for shoulder problems. Exclusion criteria were having a history of previous rotator cuff disease, posttraumatic arthritis, avascular necrosis, and other secondary causes of GHOA. A total of 723 patient medical records were evaluated. Overall, 556 patients had underlying shoulder pathology (previous trauma, rotator cuff tear, avascular necrosis, etc.), and CT scans in 54 patients were not considered appropriate for glenoid version measurement. After excluding non-suitable participants, CT images of 113 patients were evaluated (Figure 1). The demographic data of the patients were recorded. Glenoid version was measured according to Friedman's [13] method by two blinded examiners twice 30 days apart. Glenohumeral interrelation was categorized according to the modified Walch classification system [9]. Patients who did not meet the criteria for any of the modified Walch groups were marked as "Unclassifiable." Those patients were analyzed together as a separate group. All measurements were performed by an orthopedic surgeon and a musculoskeletal radiologist. Gender and side differences were evaluated.

The modified Walch classification of primary glenohumeral osteoarthritis includes the following types. Type A1, minor erosion of glenoid with centered humeral head. Type A2, major central glenoid erosion with centered humeral head. Type B1, humeral head posterior subluxation without bone defect. Type B2, posterior erosion of glenoid cavity with biconcavity of the glenoid and posterior subluxated head. Type B3, mono concave and posteriorly defective glenoid with more than 15° retroversion and/or posterior humeral head subluxation of more than 70%. Type C, dysplastic glenoid with more than 25° retroversion. Type D, anteverted glenoid or subluxated humeral head of less than 40% [9].

Statistical analysis

The mean, standard deviation, frequency, and ratio were used in the descriptive statistics. The intraclass correlation coefficient was used in the evaluation of agreement between individual measurements. We defined 0–0.2 as slight, 0.21–0.40 as fair, 0.41–0.60 as moderate, and 0.61–0.8 as substantial agreement, and values >0.81 as perfect agreement in the intraclass correlation (ICC) evaluations according to Landis and Koch [14]. The significance level was set at $p<0.05$. IBM SPSS for Windows, version 22 (IBM corp., Armonk, NY, USA) was used in the statistical analyses.

Results

The mean age in the study population was 85.5 (SD: 7.5) years. Forty-eight patients were male (42.5%) and 65 (57.5%) were female. Eighty-five patients had right (75.2%) side OA and 28 patients had left (24.8%) side OA. Two patients (1.8%) did not meet any of the criteria of the modified Walch classification and these patients were grouped as unclassified as less frequent type. One of the patients had 1° of anteversion and the glenoid cavity lost its concavity because of advanced GHOA (Fig. 2). This patient had symmetrical bone erosion but belonged neither to the A1 nor to the A2 group. Another patient had asymmetrical OA with anterior subluxation without anterior erosion of the glenoid and without any history of previous trauma, rotator cuff disorder,

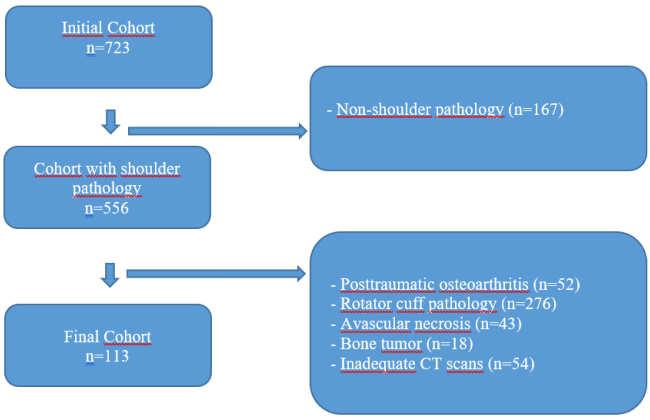

Figure 1. Flowchart of the study. CT: computed tomography

or anterior glenohumeral joint instability. This patient also did not fit any of the seven modified Walch groups and was marked as "Unclassifiable" (Fig. 3).

The frequencies of the modified Walch groups are shown in Table 1. Most frequent types were; 60 patients had type A1 (53.1%), and 22 patients had type A2 (19.5%) glenoid morphology. The mean retroversion of the modified Walch groups is shown in Table 2. Perfect intra- (ICC: 0.825 [0.819 - 0.831]) and interobserver (ICC: 0.846 [0.836 - 0.856]) agreement were achieved regarding all measurement parameters.

Table 1. Distribution of modified Walch classification groups in the study population.

Modified Walch Classification	Frequency n (%)
A1	60 (53.1)
A2	22 (19.5)
B1	10 (8.8)
B2	7 (6.2)
B3	3 (2.7)
C	6 (5.3)
D	3 (2.7)
Unclassifiable	2 (1.8)
Total	113 (100)

Table 2. Glenoid version of the modified Walch classification groups.

Modified Walch Classification	Mean Version (°)	Standard deviation
A1	-9.0	7.7
A2	-8.3	5.4
B1	-13.0	6.8
B2	-15.7	8.8
B3	-23.0	10.8
C	-24.3	8.1
D	-0.3	5.8
Unclassifiable	0.5	0.7
Total	-9.7	8.1

Discussion

This is the first study evaluating the glenohumeral morphology in the Turkish population with primary GHOA. Our findings may be helpful for surgeons in patient selection and preoperative planning. To the best of our knowledge no study previously examined "Unclassifiable" Walch groups in GHOA. From our study, it was derived that even a small number of two patients with "Unclassifiable" morphology can guide future studies to define new categories of Walch groups.

The modified Walch classification of primary glenohumeral osteoarthritis distribution in the population reported at many previous studies. Neyton et al. [15] evaluated the CT images of 611 patients with primary GHOA, and their study population consisted of 30.6% type A, 62.4% type B, 4% Type C, and 3% type D glenoid. At another morphologic study related with shoulder osteoarthritis, based on an American population, showed similar distribution in Walch groups [10]. In the present study, type A glenoid frequency was twice higher than that previously reported. However, type B glenoid frequency was lower than previous studies. Our results were different from previous studies that included different ethnic populations. These differences may be due to ethnic differences. Besides, we did not include patients who had undergone shoulder arthroplasty for GHOA, which might have affected our results. Gender distribution was similar between previous studies and our study [5]. We think that the cause of our glenoid morphology distribution is related with ethnic differences.

GHOA can change the glenoid morphology. Moreover, the morphology can be changed during glenohumeral OA progression [5]. Walker et al. [5] evaluated the shoulders of 65 patients during a 24-month interval. According to their results, they concluded that asymmetrical bone loss is unlikely in type A1 glenoid. However, type B1 glenoid tend to progress to type B2 or B3 glenoid. Based on our findings, we can speculate that posterior defective glenoid incidence is of less concern in the Turkish population.

The main limitation of this study was the retrospective design and use of 2D images for defining glenoid morphology. Only retroversion of the glenoid was assessed; inclination and posterior humeral subluxation were not discussed in the present study. However, the use of 2D images for defining glenoid morphology is not necessarily an inferior method of measurement. Dominique et al. [17] reported that 3D CT showed no superiority in measuring the glenoid version compared to other methods. Moreover, our study was a single-center one, limited number of patients and our sample may not be considered representative compared to the entire population of Turkey. The interobserver reliability of the modified Walch classification has been discussed in a few studies in the existing literature and has been so far reported to be fair to moderate [9, 10]. However, perfect intra- and interobserver agreement was found in our study. Other limitation is that the progression of GHOA with time was not included in this study. GHOA may progress with time and Walch type of a patient can change. Further studies are needed which assess the progression of GHOA.

Preoperative planning for shoulder arthroplasty is a crucial step for to obtain satisfactory long-term results. For Turkish patients, it should be kept in mind that glenoid morphology may be different from general population, which was described by previous studies. During preoperative planning, surgeons should consider such ethnic differences in joint morphology, as it might affect bone cut and placement of shoulder prosthesis, which might lead to long-term complications.

In conclusion, the distribution of modified Walch groups in the Turkish population may differ from other populations that reported in the previous literature. According to our findings, most patients had type A glenoid, and type B glenoid was less frequently detected. Posterior defective glenoid and excessive retroversion may concern less in the Turkish population with primary GHOA. Also, two unidentified morphologies show us that modified Walch classification may not be enough for primary GHOA classification. Our results were obtained from limited population, and we think that further epidemiologic studies with larger sample size are needed for

more realistic conclusions and new classifications may include all the glenoid morphologies.

Figure 2. Unclassifiable patient 1. One degree of anteversion with the loss of glenoid cavity concavity.

Figure 3. Unclassifiable patient 2. Asymmetrical OA with anterior subluxation of the humeral head without anterior erosion of the glenoid.

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