



Resident's backpack

Recurrent anteroinferior dislocation of the shoulder. Essential articles

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ABSTRACT

Anterior glenohumeral dislocation is one of the most common disorders in orthopaedic traumatology. Knowing its natural history helps us to know what we can offer our patients according to the phase of the condition they are in. The resident's backpack does not intend to offer a protocolised review of this disease condition but to provide a brief review of a series of articles that are essential for the study and understanding of this condition. Through the comments, we can set the basis of aspects that are crucial to the study of shoulder instability. It is of no use to know the latest techniques available to restore shoulder stability if we are not familiar with aspects as basic as the functioning of the shoulder ligaments or the implication of bone defects and how they are related, together with an understanding of middle range stability and end of range stability. We must know what to do in the case of a first traumatic dislocation episode, understanding why it is essential in such a common disorder, and must moreover take into account that patient age is one of the most important factors. Likewise, knowing how to describe the concept of glenoid track and what it is used for is of great help when we are beginning, in order to know the different treatment alternatives open to us.

RESUMEN

Luxación recidivante anteroinferior del hombro. Artículos imprescindibles

La luxación glenohumeral anterior es una de las patologías más comunes que encontramos en la traumatología ortopédica. Conocer su historia natural nos ayuda a saber qué podemos ofrecerles a nuestros pacientes dependiendo de la fase en la que se encuentren. La mochila del residente no pretende ser una revisión reglada de esta patología, sino revisar brevemente una serie de artículos que son imprescindibles para el estudio y el conocimiento de esta patología.

A través de los comentarios se podrá sentar la base de aspectos que son esenciales para el estudio de la inestabilidad de hombro. De nada sirve conocer las últimas técnicas que se realizan para restaurar la estabilidad del hombro si no se conocen aspectos tan básicos como el funcionamiento de los ligamentos del hombro, qué implicación tienen los defectos óseos y cómo se relacionan, así como entender qué es la estabilidad en el rango medio y la estabilidad al final del rango. Conocer qué hacer ante un primer episodio de luxación traumática y por qué es esencial en una patología tan común, además de tener en cuenta que la edad es uno de los factores más importantes. Saber describir el concepto del *glenoid track* y para qué se utiliza es de gran ayuda cuando se está empezando, para saber cuáles son las diferentes alternativas de tratamiento.



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Introduction

Anteroinferior glenohumeral dislocation is one of the most common disorders in orthopaedic traumatology. The prevalence of anterior glenohumeral instability in the general population is about 2%⁽¹⁾. Shoulder instability is most often found in individuals between adolescence and in their mid-thirties. The main problem following primary traumatic anterior shoulder dislocation is the high risk of recurrence, particularly in young patients⁽²⁾. Although in most cases the diagnosis and treatment may be relatively simple, the management of this disease condition continues to evolve with the aim of reducing the recurrence of episodes after a first traumatic anteroinferior shoulder dislocation.

In recommending the following articles we do not intend to offer a thorough review of this disorder but to recommend some publications that are essential for the study and knowledge of this condition, and to offer some short comments on what each article can contribute. Obviously, not all the aspects of the articles will be addressed —only the most important concepts which each of them can offer us.

Itoigawa and Itoi, 2016⁽³⁾

The first step in understanding this disorder is to be familiarised with some basic aspects of the anatomy and biomechanics of the shoulder ligaments. Many publications talk about the function of the shoulder ligaments, but the article by Yoshiaki Itoigawa and Eiji Itoi, entitled: "Anatomy of the capsulolabral complex and rotator interval related to glenohumeral instability" is an obligated review for understanding the anatomy and biomechanics of the shoulder ligaments. The article is easy to read, and based on a review of the literature, the authors describe the most relevant anatomical aspects in shoulder instability.

The glenoid *labrum* has three main functions in relation to the stability of the glenohumeral joint. Firstly, it doubles the anteroposterior depth of the glenoid cavity and deepens the concavity in the superoinferior plane. Secondly, the *labrum* increases the stability of the joint by incrementing the area of contact of the humeral head with the glenoid cavity. Thirdly, the *labrum* acts as a fibrocartilage anchoring for the glenohumeral ligaments.

The superior glenohumeral ligament (SGHL) has a dual origin: the direct fibres originate in the glenoid *labrum* and the oblique fibres do so in the supraglenoid tubercle. Only in the absence of the middle glenohumeral ligament (MGHL) does it fully originate in the glenoid *labrum*. The SGHL is involved in the stabilising mechanisms of the intraarticular portion of the tendon of the long head of the brachial biceps, and is moreover an important anterior and inferior stabiliser of the shoulder in adduction.

The MGHL originates in the *labrum* separate from or jointly with the SGHL, and its fibres mix with parts of the subscapularis tendon approximately 2 cm medial to its insertion in the lesser tuberosity. It is the most variable of the different glenohumeral ligaments. Its maximum tension is found in 45° abduction, 10° extension and external rotation, though it continues to exhibit significant tension in 90° abduction. The ligament therefore contributes to anterior stability, though to a variable extent.

The inferior glenohumeral ligament (IGHL) in turn is a hammock-shaped structure of the capsule that extends from the anteroinferior portion to the posteroinferior portion of the glenoid cavity. The anterior band of the IGHL extends along the middle portion of the anterior glenohumeral joint, and at 90° abduction and external rotation it restricts anterior and inferior movement of the humerus. This band, together with the *labrum*, is essential for anterior stability of the shoulder. The posterior band of the IGHL in turn extends from the 7 to 9 o'clock position at the posteroinferior glenoid margin to the 4 o'clock position in the head of the humerus. In the posterior loading position (shoulder in internal rotation and anterior flexion), the posterior band of the IGHL is the most important stabilising ligament, protecting from posterior dislocations. The posterior capsule, which contains this reinforcement, is relatively thin and its biomechanical performance is not as robust as that of the anterior capsule.

In conclusion, the stability of the shoulder depends on its position, and the capsule and ligament structures are the main stabilisers in situations of anteroinferior instability when the joint is positioned at the end of its range of motion, i.e., in 90° abduction and maximum external rotation.

Burkhart and De Beer, 2000⁽⁴⁾

Although the ligaments of the shoulder contribute to stability at the end of the range of motion, stability over the middle range is achieved thanks to the negative pressure in the joint, as well as the concavity-compression effect. This effect is altered in the presence of a bone defect, which is a key factor in recurrent dislocations.

Although now well known, in the history of this disease condition, the first mention of bone defects as a cause of instability took place in the year 2000 in the original article published by Stephen S. Burkhart and Joe F. De Beer, entitled: "Traumatic glenohumeral bone defects and their relationship to failure of arthroscopic Bankart repairs: significance of the inverted-pear glenoid and the humeral engaging Hill-Sachs lesion". These authors conducted a retrospective analysis of a series of 194 patients subjected to arthroscopic Bankart repair. The most relevant observation was that those patients with an important bone defect presented a 67% recurrence rate, which proves unacceptable for any type of procedure.

This article introduced two concepts that have been the basis for advancement in the study of bone defects: "inverted pear" shape glenoid defects and engaging Hill-Sachs lesions. The "inverted pear" shape glenoid defects concept thus appeared for the first time—a circumstance occurring when the bone defect is so large that it inverts the natural form of the glenoid cavity, which is pear-shaped. Although more precise methods are currently used to measure glenoid defects⁽⁵⁾, the "inverted pear" concept is considered to be associated to defects larger than 21%. Another new concept was the engaging Hill-Sachs lesion versus the non-engaging lesion. This concept, which proved difficult to understand in the article, marked the starting point for defining what are now known as on-track and off-track lesions, which will be addressed further below. According to Burkhart, an engaging lesion is present when, on positioning the arm in maximum abduction and external rotation, the long axis of the Hill-Sachs defect lies parallel to the anterior margin of the glenoid cavity. It is worth carefully reading the seven conclusions of the mentioned article.

The review of the above two articles defines the anatomical factors that influence instability of the shoulder: the capsulolabral structures are important at the end of the range of motion, while bone defects affect the middle range.

Hovelius *et al.*, 2008⁽⁶⁾

A key article for knowing the natural history of shoulder instability is the article published by Lennart Hovelius *et al.*, entitled: "Non-operative treatment of primary anterior or shoulder dislocation in patients forty years of age and younger. A prospective twenty five-year follow-up". This was a prospective longitudinal study with a 25-year follow-up period involving 255 patients between 12-40 years of age who had suffered a first traumatic dislocation episode and had been treated on a conservative basis with different types of immobilisation. The overall findings of this study were that of the 229 shoulders included in the 25-year follow-up, 7% had experienced only one or two luxation or subluxation episodes; 27% had to be operated upon due to recurrent dislocations; 22% had suffered recurrent dislocations but had not been operated upon; and 43% had experienced no further episodes after the first dislocation. The authors found that the immobilisation time did not influence the risk of recurrence, as later also confirmed by other studies⁽⁷⁾.

The main finding of this study is that the risk of recurrence after a first dislocation is inversely proportional to the age of the patient at the time of the first dislocation episode. Although Hovelius underscored that conservative management is required for the first episode, the study ev-

idences that, after a first episode before the age of 20 years, most of the affected individuals will experience recurrent instability, and one-half will need surgery. In contrast, if the first episode occurs between 34-40 years of age, a full 80% of the patients will not suffer recurrent instability.

Yamamoto *et al.*, 2007⁽⁸⁾

In 2007, Nobuyuki Yamamoto *et al.*, in their article entitled: "Contact between the glenoid and the humeral head in abduction, external rotation, and horizontal extension: a new concept of glenoid track", introduced the glenoid track concept. Although it initially had scant repercussion, this concept currently represents the way we understand how the bone defects are inter-related. The original study was conducted in cadavers, and as with many anatomical articles, it is rather dense to read—though this is a key element for understanding the article.

The glenoid track is the contact between the glenoid surface and the posterior zone of the humeral head in the different degrees of abduction (0°, 30° and 60° with respect to the scapular plane) and in maximum external rotation. The study describes the trajectory of the glenoid cavity over the posterior zone of the humeral head, extending from the inferior and medial zone of the humerus at 0° abduction to the superior and lateral zone at 60° abduction. Based on the calculations made, the authors established that in the cadaver, the glenoid track—i.e., the contact surface of the glenoid cavity with the posterior zone of the humeral head—is defined as the distance from the medial margin of the glenoid cavity to the medial margin of the fingerprint of the posterosuperior cuff in the greater tuberosity. They determined that this distance represents 84% of the surface of the glenoid cavity when abduction is 60°. Posteriorly, *in vivo* studies showed this percentage to be 83%, and this is the value taken for measuring the glenoid track. The formula for measuring the glenoid track is simple: the width of the glenoid cavity is multiplied by 0.83.

Following this description referred to how the bone components inter-relate, we can understand the concept of bipolar shoulder injuries, i.e., bone defects in the glenoid cavity and in the humeral head are intimately related and condition the prognosis of recurrence. Thus, Burkhart engaging and non-engaging lesions evolve towards Yamamoto on-track and off-track lesions.

Di Giacomo, Itoy and Burkhart, 2014⁽⁹⁾

Three great experts in shoulder instability joined to publish the article entitled: "Evolving concept of bipolar bone loss and the Hill-Sachs lesion: from 'engaging/non-engaging' lesion to 'on-track/off-track' lesion". This study, in

addition to consolidating the glenoid track concept, offers a therapeutic algorithm for recurrent shoulder instability in accordance with the glenoid track that has been the subject of debate in recent years.

The article details measurement of the glenoid track and of the Hill-Sachs interval: glenoid track is the contact surface of the glenoid cavity with the posterior portion of the humerus, and corresponds to the distance from the medial margin of the glenoid cavity to the medial margin of the insertion of the cuff in its fingerprint. In turn, the Hill-Sachs interval corresponds to the width of the Hill-Sachs defect plus the bone bridge, which is the distance from the insertion of the cuff to the lateral margin of the Hill-Sachs defect. An on-track lesion is a Hill-Sachs lesion within the glenoid track or, in other words, if the glenoid track is greater than the Hill-Sachs interval, we will have an on-track lesion. On the other hand, an off-track lesion is diagnosed when the Hill-Sachs lesion lies outside the glenoid track or, in other words, if the glenoid track is smaller than the Hill-Sachs interval, we will have an off-track lesion.

At present, measurement of the glenoid track has been validated in arthroscopy, computed tomography and magnetic resonance imaging, and an increasing number of radiologists now define the lesions in this way in their reports. Understanding these concepts is therefore extremely important.

Lastly, based on classification of the lesions as on-track and off-track, the mentioned article defines a therapeutic algorithm that is well explained and constitutes a good basis for guiding the surgical management of shoulder instability —though as mentioned above, it remains subject to debate.

Conclusions

These five articles are essential for the study of shoulder instability and serve as a basis for placing further emphasis on the need to understand how the ligaments function and on the importance of bone defects as key elements for understanding this disease condition. Following a first traumatic shoulder dislocation episode, the usual practice is to prescribe conservative treatment, without forgetting that the younger the patient, the greater the risk of recurrence. Furthermore, in the presence of recurrent shoulder dislocation, it is necessary to evaluate the glenoid track and determine whether the Hill-Sachs lesion is on-track or off-track, with a view to offering our patients the best treatment option.

Ethical responsibilities

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Right to privacy and informed consent. The authors declare that no patient data appear in this article.

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