

**Traumatic Anterior Shoulder Instability: A Review of Pathoanatomy  
Diagnosis and Evaluation**

**Derya Celik<sup>1</sup>   Buket Akinci<sup>2</sup>   Saime Nilay Arman<sup>3</sup>**

<sup>1</sup>Assoc.Prof, PT, PhD, Istanbul University, Faculty of Health Science, Division of Physiotherapy and Rehabilitation

<sup>2</sup>PT, PhD Biruni University, Faculty of Health Science, Division of Physiotherapy and Rehabilitation

<sup>3</sup>PT, PhD, Istanbul University, Faculty of Health Science, Division of Physiotherapy and Rehabilitation

**Corresponding Author:** Derya Celik, Associated Prof. PT, PhD, Istanbul University  
Faculty of Health Sciences, Division of Physiotherapy and Rehabilitation, 34740 Bakirkoy, Istanbul,  
Turkey, e-mail: [ptderya@hotmail.com](mailto:ptderya@hotmail.com)

**Abstract**

**Background:** Traumatic anterior shoulder dislocation is the most common type of shoulder dislocation, accounting for 96% of dislocation injuries. The available literature supports early surgical intervention for young male athletes engaged in highly demanding physical activities after the first episode of traumatic shoulder dislocation.

**Objectives:** The aim of this narrative review is to summarize available knowledge about the pathoanatomy and diagnosis of anterior shoulder instability and create the basis of the non-surgical treatment with detailed assessment.

**Major Findings:** Glenohumeral instability represents a broad array of pathology. Many clinicians have agreed on the patient parameters that should be considered prior to surgery for first-time dislocations, including age, degree of athletic participation, and patient quality of life.

**Conclusion:** Excellent patient history and directed physical examination is critical in distinguishing glenohumeral instability from other shoulder pathologies, and further distinguishing between unidirectional and multidirectional instability patterns. Epidemiology, advanced imaging by radiology, computed tomography and detailed assessment is necessary to adequately evaluate for traumatic anterior shoulder instability.

**Key words:** Shoulder pathology, shoulder disorders, dislocation, subluxation, nonsurgical treatment

## **Introduction**

The shoulder is composed of a complex set of joints, which have great range of movement but weak stability due to this range of movement. Dislocations most frequently occur due forces that place the arm in a position of abduction and maximal external rotation, thereby leveraging the humeral head anteriorly out of the joint. Patients typically experience apprehension, recurrent subluxations, and frank dislocations. This pathology limits many activities, including overhead arm motions, external rotation, and, therefore, physical or sport activities. By far the most common type of glenohumeral instability is anterior dislocation, accounting for over 90% of all shoulder dislocations. Rates are increased in men, contact athletes, and enlisted persons (1).

The most common mechanism of injury causing an anterior dislocation is a fall onto an outstretched arm with the shoulder abducted and externally rotated. In this position, the IGHL is the primary restraint to anterior translation of the humeral head. Injury to this ligament and the anteroinferior labrum, termed a Bankart lesion, can occur and has been reported in as high as 90% of traumatic anterior shoulder dislocations (2). Recurrent episodes of instability

further stretch and elongate this ligamentous structure.

Surgical treatment through either an open or arthroscopic approach or nonsurgical treatment has continued to be an area of research and debate. The decision depends partly on the exact etiology of the instability and the extent of soft tissue or bony deficiency. This review serves as an epidemiology, pathology, diagnosis and detailed assessment of the traumatic anterior shoulder instability.

## **Epidemiology**

Shoulder instability arises across much kind of activities and age groups. The reported incidence of acute traumatic shoulder instability ranges from 8.2/100,000 individual-years to 23.9/100,000 individual-years in the general population, with an estimated prevalence of 1.7% (3). Once a dislocation has occurred, the shoulder becomes less stable and develops the tendency to re-dislocate. Rowe reported a recurrence rate as high as 92% (4). Recurrent dislocation tends to be more common in younger patients. For example, a study revealed that 66% of individuals aged from 12 to 22 years at the time of their first dislocation had one or more recurrences, whereas 24% of individuals aged from 30 to 40 years at

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their initial dislocation experienced recurrences at 10-year follow-up. Additionally, the presence of a glenoid bone defect is an important factor in instability; therefore, the size and anatomy of glenoid bone defects should be carefully assessed. Burkhart and De Beer showed that the existence of a glenoid bone defect resulted in a risk of recurrence that ranged from 4% to 68% (5). Owens et al. reported that contact injuries constituted 43.6% of the dislocations found the cumulative incidence rate of traumatic shoulder instability to be 0.7% in male and 0.3% in female patients 70 years or older (6). These estimates were made on hospital records of the patients' who presented to health care facilities. However, it may not be correct values because many patients with subluxation do not pursue medical care. Another study suggested that the prevalence of shoulder instability ranged from 66% to 100% in patients up to 20 years of age, from 13% to 63% in patients aged between 20 to 40 years, and from 0% to 16% in those older than 40 years (7). In a descriptive epidemiologic study based on United States Military Academy cadets during one year, the incidence rate of new traumatic shoulder instability was 23.9 per 100,000 person-years, which was approximately twice the rate previously reported by Owens et al (8,9). In the same study, the risk factors for

shoulder dislocations in the United States population were listed as young age and male sex (9).

#### **Pathology**

The pathologies may vary and may be observed in isolation or in combination, and may affect or include the following:

1. The capsulolabral complex
2. The rotator cuff
3. The glenoid and humeral head contact
4. Hill-Sachs lesions
5. The central/peripheral nervous system
6. Proprioception

#### **Diagnosis**

A thorough patient history, physical examination and clinical assessment serve as the primary factors influencing diagnosis and treatment decisions.

##### **1. History**

An assessment of patient history should include information regarding the following: 1. recurrence or re-injury, 2. time to re-injury or recurrence, 3. continuous pain 4. subjective instability, 5. patient satisfaction, 6. complications (e.g., fracture ) and 7. injury severity. In addition, age, activity level, sports participation and hand dominance should be noted. First dislocations due to high-impact trauma in older people may be associated with shoulder fractures, which could displace if they are not detected prior to attempting reduction.

Moreover, axillary nerve injuries can occur in up to 12.5% of dislocations. Performing a historical examination is important because it may aid in decision-making regarding whether surgical treatment should be recommended (10,11).

### **2. Physical examination**

Physical examination should be performed using visual inspection of both shoulders to assess whether there is evidence of asymmetry in the bones or muscles. Palpation should include the bony prominences and tonus of the shoulder and scapular muscles. The range of motion and muscle strength should be compared using the uninvolved shoulder as a reference. Specific attention should be given to the functioning of the axillary nerve and the rotator cuff, especially in elderly people. Additionally, scapular dyskinesia, global laxity, core stability and balance should be assessed.

### **3. Clinical Assessment**

The most commonly utilized tests for detecting anterior shoulder instability include the positive apprehension test, the relocation test and the anterior drawer test, sulcus, load and shift tests.

**Positive apprehension test:** The apprehension test may be performed in the sitting or supine position. The arm places in 90° of abduction to stress the glenohumeral joint by applying an

anteriorly directed force or an external rotatory force. In patients with anterior shoulder instability, the feeling that the shoulder will slipped out of the joint is considered a positive test. However, Hawkins and Kvitne have described pain following this maneuver as indicative of subtler anterior instability (12,13). Additionally, Milgrom et al. have suggested that performing the supine apprehension test after a first shoulder dislocation may be beneficial in predicting the risk of recurrent instability (14).

**Relocation test:** The relocation maneuver has been intended as a diagnostic test for discrimination between pain secondary to instability or pain generated from other causes (15,16,17). Jobe et al. declared that the relocation test should be performed with the shoulder in the abducted and maximally externally rotated position (18). A posteriorly directed force is then applied to the proximal humerus. It has been assumed that patients without instability will report no change in symptoms, whereas patients with instability will report decreased pain or apprehension and will be able to tolerate increased external rotation.

**Anterior Drawer Test:** The anterior drawer test may be used to demonstrate instability of the shoulder, both clinically and radiographically. This test may also

be performed on painful shoulders in cases in which the apprehension test is difficult to interpret, and it has enabled the unequivocal diagnosis of anterior subluxations even in patients with a negative apprehension test. The test is performed with the patient in a supine position and should not be performed using a standing or seated position. The clinician holds the affected shoulder in a manner that enables the patient to remain relaxed. The shoulder is then abducted to 80-120°, forward flexed up to 20°, and laterally rotated up to 30°. The examiner stabilizes the patient's scapula with the opposite hand, pushing the spine of the scapula forward while the thumb applies pressure to the coracoid process. Using the hand that is holding the patient's arm, the clinician draws the humerus forward. The test is performed bilaterally. The consideration of a positive result depends on the degree of anterior translation. The presence of a clicking sound during the test may indicate slippage of the humeral head over the glenoid rim or a labral tear (18).

**The sulcus test:** The sulcus test is used to assess the integrity of the rotator interval, which is formed by the superior glenohumeral ligament and the coracohumeral ligament. Test is performed by pulling inferiorly on the humerus with the arm in zero degrees of

abduction. If the humeral head subluxates inferiorly, it will create a depression between the humeral head and the acromion. The sulcus test is graded, with 1+ representing subluxation up to 1 cm, 2+ representing subluxation 1-2 cm, and 3+ representing subluxation greater than 2 cm. The sulcus test is then repeated in external rotation. If the sulcus sign clear away in external rotation, the rotator interval is deemed competent (19).

#### **4. Imaging**

Imaging studies are useful for diagnosis and include radiography, computed tomography (CT) scanning, and magnetic resonance imaging (MRI). Radiographs should include anterior-posterior, scapular-Y, and axillary views. From these images, joint reduction can be determined, as well as associated fractures or bony anatomical pathologies. A CT scan is also useful for preoperative evaluation for the integrity of bony structures, fracture patterns, joint integrity and potential bone loss, all of which may add to the complexity of future surgical procedures. In patients with obvious histories and regular findings on physical examination, an MRI is not routinely necessary, although it should be obtained in the case of an uncertain history or an unclear physical examination. MRI is useful for evaluating soft-tissue structures such as the labral

complex and rotator cuff and should be evaluated for the presence of bone edema and/or the presence of Hill-Sachs lesions. An arthrogram is not usually necessary for evaluating of acute instability due to edema and the presence of effusion within the joint. A glenoid bone defect should be considered in most cases of shoulder instability. The presence of the bone defect may be assessed by apical and oblique radiographs (West Point vs. Didiie radiographs). The most effective assessment is 3D computed tomography (3D CT). Additionally, arthroscopic evaluation of the bone defect may be used (20,21).

### **5. Outcome Assessment**

Patient-reported outcomes represent individuals' perception of their symptoms, activity limitations and sports participation restrictions. In general, patient-reported outcomes are classified into two groups as specific to a diseased joint and those related to general health. The most common disease-specific outcomes for shoulder instability are the Western Ontario Shoulder Instability Index and the Rowe score, whereas in cases of joint-specific shoulder outcomes, the American Shoulder and Elbow Surgeons shoulder outcome score, the Disability of Arm, Shoulder and Hand score and the Instability Severity Index Score may be used (22-26). The SF-36 is

the most commonly utilized general health assessment (27). In addition to the above-described patient-reported outcomes, the Global Rating of Change Scales may be used (28).

### **Western Ontario Shoulder Instability Index (WOSI)**

The WOSI score instrument consists of 21 items. The patient is asked to grade the functions of specific items on a horizontal visual analog scale ranging from 0 to 100 mm. The questions are divided into 4 sections (domains). Whereas physical symptoms and pain are addressed in 10 questions, sport, recreation, and work are addressed in 4 questions. The lifestyle and social functioning domain includes 4 questions and another domain related to emotional wellbeing includes 3 questions. Each question results in a number between 0 and 100, and the total score may be presented as a number between 0 and 2,100 points (where 0 represents no deficit and 2,100 represents the worst possible deficit). Additionally, the score can be presented as a percentage relative to a healthy shoulder, which we believe may be more clinically useful (28).

### **The Rowe Score**

The Rowe Score consists of a total of 100 points and is divided into three domains: *1-stability*, which corresponds to a total 50 points; *2-mobility*, which corresponds to 20 points; and *3-function*, which

corresponds to 30 points. A score ranging from 90 to 100 points is considered excellent with scores between 89 and 75 points considered good, between 74 and 51 points considered fair and below 50 points considered poor (4).

#### **Disabilities of the Arm, Shoulder and Hand (DASH) assessment**

The DASH, published by the American Academy of Orthopedic Surgeons, is a global upper extremity tool. The tool includes 33 items, each with a 5-category answer option. There are 20 questions related to activities, ranging from general to specific actions, such as managing transportation needs. A general question pertains to each area (social activities, work or other regular daily activities, sleep, and level of confidence). An additional 5 questions relate to symptoms and 4 more questions relate to playing sports or musical instruments (22).

#### **Instability Severity Index Score (ISIS)**

The ISIS is a system developed using significant or pertinent risk factors. A stepwise approach was used to determine the best scoring system. The ISIS uses 10 as the best score and includes six significant pre-operative factors. The categories 'patient younger than 20 years' and 'involved in competitive sports' may score two points apiece, whereas 'contact or forced overhead activities' may score one point, and 'anterior or inferior

hyperlaxity' may score one point. When a Hill-Sachs lesion is visible on external rotation or if there is loss of the normal inferior glenoid contour by anterior-posterior radiography, two points are added for each sign (26).

#### **Global Rating of Change (GRC)**

GRC scales are commonly used in clinical research, particularly regarding musculoskeletal diseases. These scales, which are designed to quantify a patient's improvement or deterioration over time, usually determine the effect of an intervention or are used to chart the clinical course of a condition. The responses in GRC are reported as 'much better', 'slightly better', 'stayed the same', 'slightly worse', or 'much worse' (28).

#### **Conclusion**

Glenohumeral instability represents a broad array of pathology. Excellent patient history and directed physical examination is critical in distinguishing glenohumeral instability from other shoulder pathologies, and further distinguishing between unidirectional and multidirectional instability patterns. Epidemiology, advanced imaging by radiology, computed tomography and detailed assessment is necessary to adequately evaluate for traumatic anterior shoulder instability.

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**Conflict of interests**

The Authors declare that they have no conflict of interests regarding the publication of this paper.

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