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REVIEW ARTICLE

POSTERIOR INSTABILITY OF THE SHOULDER JOINT

NIESTABILNOŚĆ TYLNA STAWU RAMIENNEGO

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ABSTRACT
Posterior instability of the shoulder joint, although less common than its anterior counterpart, presents a significant challenge in diagnosis and management. This article delves into the anatomy, epidemiology, pathophysiology, examination techniques, imaging diagnosis, and treatment modalities associated with this condition. Understanding the shoulder's intricate structure, which involves both static and dynamic stabilizers, is crucial for comprehending the mechanisms leading to instability. Clinical evaluation, encompassing visual inspection, palpation, and specialized tests like the Kim and Jerk tests, aids in identifying posterior instability. Imaging techniques, including radiographs, CT scans, and MRIs, play a pivotal role in visualizing dislocations, bone defects, and soft tissue pathologies, thereby facilitating precise treatment planning. The treatment approach typically involves conservative measures, with surgical intervention reserved for severe cases or persistent instability. Awareness of the condition's rarity, coupled with a comprehensive diagnostic and treatment approach, ensures optimal outcomes and prevents progression to advanced stages.

Keywords: posterior instability, shoulder, glenohumeral ligaments, Jerk Test

STRESZCZENIE
Niestabilność tylna stawu ramiennego, choć występuje rzadziej niż jej przedni odpowiednik, stanowi poważne wyzwanie w diagnostyce i leczeniu. Niniejszy artykuł przedstawia anatomię, epidemiologię, patofizjologię, techniki badania, diagnostykę obrazową i metody leczenia związane z tym schorzeniem. Zrozumienie skomplikowanej struktury barku, która obejmuje zarówno statyczne, jak i dynamiczne stabilizatory, ma kluczowe znaczenie dla zrozumienia mechanizmów prowadzących do niestabilności. Ocena kliniczna, obejmująca oględziny, badanie palpacyjne i specjalistyczne testy, takie jak testy Kima i Jerk, pomaga w identyfikacji niestabilności tylnej. Techniki obrazowania, w tym zdjęcia radiologiczne, tomografia komputerowa i rezonans magnetyczny, odgrywają kluczową rolę w wizualizacji przemieszczeń, uszkodzeń kości i patologii tkanek miękkich, ułatwiając w ten sposób precyzyjne planowanie terapii. Metody leczenia zazwyczaj obejmują środki zachowawcze, z interwencją chirurgiczną zarezerwowaną dla ciężkich przypadków lub utrzymującej się niestabilności. Mając świadomość rzadkości występowania tego schorzenia, w połączeniu z kompleksowym podejściem diagnostycznym i terapeutycznym, zapewnia się optymalne rezultaty i zapobiega progresji do zaawansowanych stadiów.

Słowa kluczowe: niestabilność tylna, staw ramienny, więzadła obrąbkowo-ramienne, Jerk Test.

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Introduction

Posterior instability of the shoulder joint arises from micro/macro injuries and developmental abnormalities. It involves the inability to keep the head of the humerus in the acetabulum and is characterized by recurrent dislocations of the shoulder joint. Posterior instability is far less common than anterior instability, so this pathology is very often overlooked, but accurate diagnosis is able to help us correctly differentiate this pathology at an early stage (Song *et al.,* 2015) (Provencher *et al.,* 2011). This article aims to introduce how important the proper diagnosis and management of the patient when this pathology is found is in the diagnosis of posterior instability.

Anatomy

The shoulder joint is a ball-and-socket joint (McCausland *et al.,* 2023). The articular head is formed by the head of the humerus, which has a spherical shape and diameter of about 43 mm. It is positioned in 20˚ retroversion to the transepicondylar axis and its articular surface is inclined upward by 130˚ compared to the humeral shaft. The acetabulum is composed of the glenoid cavity of the scapula and the glenoid labrum attached to the edges of the glenoid cavity. Due to the presence of glenoid labrum, the surface area of the acetabulum is enlarged by 50%. The acetabulum is a pear shaped, inclined 5˚ upward, and is positioned mostly in 5˚ retroversion to the axis of the scapula. One-third of the head of the humerus connects to the acetabulum, which allows the shoulder joint to have the greatest range of motion among joints in the entire body (Cowan *et al.,* 2023). The stability of this joint is a result of the balance between static stabilizers (glenoid labrum, ligaments, negative intra-articular pressure) and dynamic stabilizers (rotator cuff, long head of biceps brachii muscle, deltoid muscle and periscapular muscles). The joint capsule consists of fibrous membrane as well as synovial membrane, where they attach to the anatomical neck of the humerus, and within the acetabulum to the outer edge of the glenoid labrum (Doehrmann *et al.,* 2023).

The ligaments of the shoulder joint, namely the coracohumeral ligament, extend from the base and lateral edge of the coracoid process to the humeral tuberosities. The glenohumeral ligaments are thickenings of the fibrous capsule of the joint. They attach just like the fibrous capsule membrane of the joint. SGHL – superior glenohumeral ligament is located together with the coracohumeral ligament in the rotator cuff interval, which plays a minor role in the posterior stabilization of the shoulder joint (Mologne *et al.,* 2008). There is also MGHL – medial glenohumeral ligament and IGHL – inferior glenohumeral ligament, which consists of an anterior band and a posterior band (Figure 1). The posterior band, along with the posterior portion of the joint capsule and the glenoid cavity, are the most important static stabilizers of the posterior aspect of the shoulder joint (O'Brien *et al.*, 1995) (Millett *et al.*, 2006).

The dynamic stabilizers which are the rotator cuff consisting of the supraspinatus, subscapularis, obturator minor and subscapularis muscles along with the long head of the biceps muscle and deltoid muscle have a key function in stabilizing the shoulder joint. The contraction of these muscles presses the joint head against the acetabulum, which increases stabilization, and more force is needed for the displacement of the humeral head to occur (Pagnani *et al.,* 1994). The subscapularis muscle is primarily responsible for posterior stabilization (Kido *et al.,* 2003).

Epidemiology

Posterior instability is relatively rare and accounts for about 10% of shoulder instability cases (Song *et al.,* 2015). Anterior instability is much more frequent because it occurs 16–20 times more often (Robinson *et al.,* 2011). Due to the rarity of this condition, it is easy to overlook. It mainly affects athletes such as weightlifters, powerlifters, overhead athletes and military personnel.

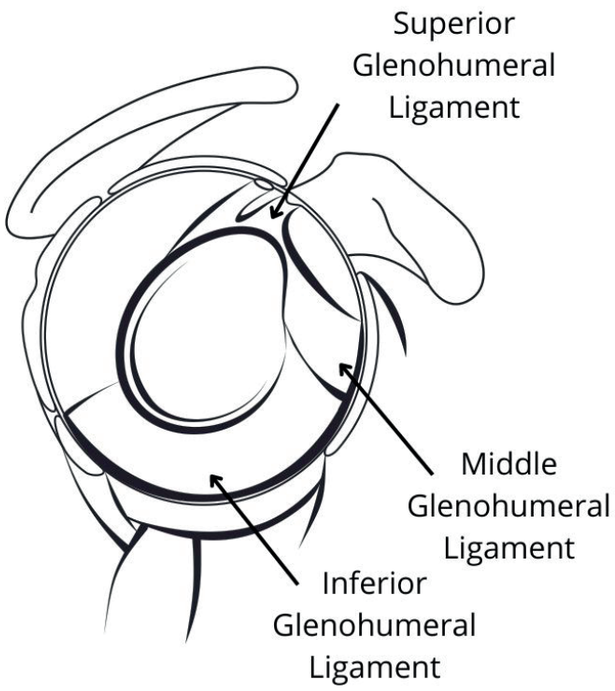

Figure 1. MGHL – medial glenohumeral ligament and IGHL – inferior glenohumeral ligament, which consists of an anterior band and a posterior band

Pathophysiology

We can distinguish two main mechanisms leading to instability. Acute trauma and microtrauma. In the case of acute trauma, significant force is required, such as in a motorcycle accident, during a convulsion or in cases of electrocution (Provencher *et al.*, 2011). In the microtrauma, repetitive activities that cause microdamage to the posterior part of the joint are performed, such as push-ups, bench pressing, or shooting a gun (Cho *et al.,* 2012). The arm is then positioned in flexion, adduction and internal rotation. The effect of repeated activities is stretching of the posterior stabilizing structures and damage to the glenoid labrum. Isolated damage to the posterior portion of the glenoid labrum is called Reverse Bankart Lesion. When, in addition to the glenoid labrum, a bony fragment from the posterior part of the joint acetabulum is detached, it is called Reverse Bony Bankart Lesion (Figure 2). An incomplete, hidden detachment of the posterolateral labrum is Kim Lesion (Kim *et al.,* 2004). Often, when significant forces are applied in a dislocation, a Hill-Sachs Fracture, which is a fracture of the anteromedial portion of the humeral head, occurs (Bock *et al.*, 2007).

Predisposing factors for posterior instability are: Excessive capsular laxity, and large capsular recess (Bigliani *et al.,* 1995). The key element for stabilization, however, is proper alignment of the head with the articular acetabulum, and proper securing of the two through muscle forces (Lazarus *et al.*, 1996).

Examination

The patient describes pain located deep in the back of the shoulder, may be accompanied by clicking or popping and deterioration of arm strength. The patient should be asked if they have any conditions that cause increased tissue flaccidity such as Marfan's disease (Frank *et al.,* 2017). A physical examination should be performed comparatively with the healthy side starting with a visual inspection, where in about 60% of cases a depression is present on the posteromedial aspect of the arm. Palpation tenderness in the posterior

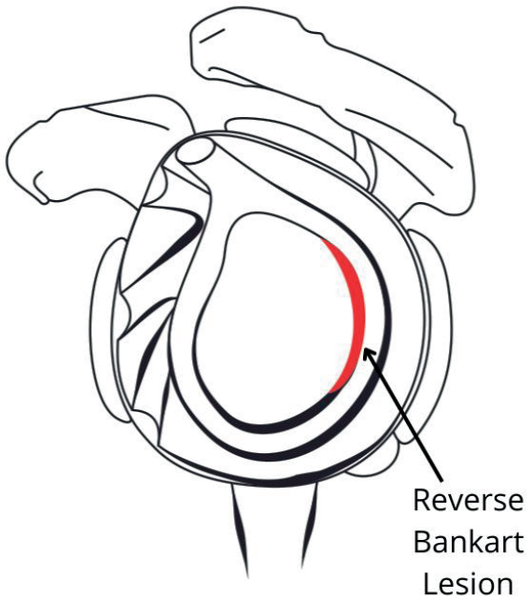

Figure 2. Reverse Bony Bankart Lesion

shoulder may be present, as well as scapular dyskinesis, or abnormal scapular mobility and alignment (Brelin *et al.,* 2017).

A test to detect posterior instability is the Kim test. The patient is in a sitting position, abducts the shoulder and flexes the elbow joint to 90˚. The clinician then presses the abducted arm against the joint, and grabs the elbow with one hand and the deltoid muscle area with the other. The arm is lifted upward 45˚ while the proximal end is pressed downward. Painfulness while performing this test indicates posterior instability of the shoulder joint (Kim *et al.,* 2005) (Figure 4).

Another provocative test for posterior instability is the Jerk Test. The examiner stands next to the patient, holding the patient's elbow with one hand and the distal aspect of the clavicle and the spine of the scapula with the other. Physician abducts the arm and flexes at the elbow to 90˚, pressing the arm against the joint and rotating internally. This test can be considered positive when there is a characteristic click along with pain during horizontal adduction of the arm (Kim *et al.,* 2005) (Figure 3).

Imaging diagnosis

Plain radiographs in patients with posterior instability are recommended in anteroposterior, lateral and axillary projections (Williams *et al.,* 2007). It can visualize posterior dislocation, bone defects, or Hill-Sachs lesion. If the radiograph is not sufficient to visualize the bony structures, computed tomography should be used (Van Tongel *et al.,* 2010). In order to better visualize the soft structures of the joint, MRI is used, which can visualize the loss of the glenoid labrum, pathologies of the joint capsule, posterior humeral avulsion of the glenohumeral ligament and posterior labrum periosteal sleeve avulsion, or Kim lesion (Kim *et al.,* 2004) (Bey *et al.,* 2005) (Yu *et al.,* 2002).

Treatment

When planning the management of a patient with posterior instability of the shoulder, there are many factors to consider, such as reducing pain, improving mobility and preventing possible recurrence (Frank *et al.,* 2017). A conservative approach of at least 6 months is typically the first line of treatment for patients with posterior instability, with outcomes dependent on the underlying

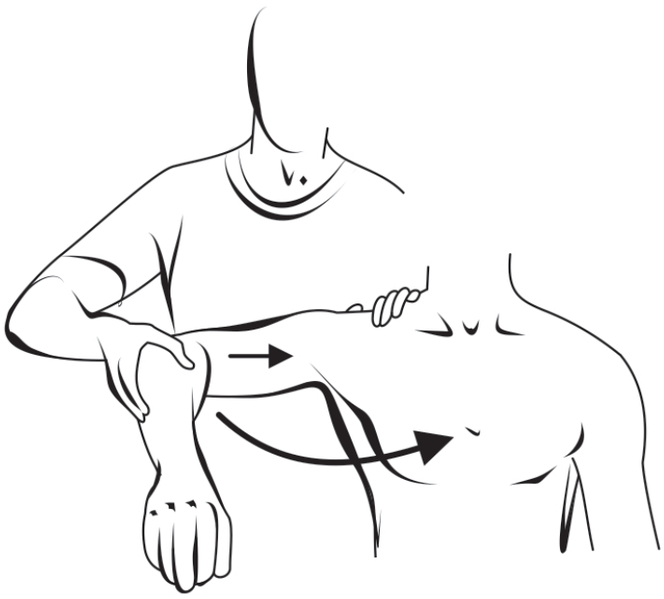

Figure 3. Jerk Test – provocative test for posterior instability

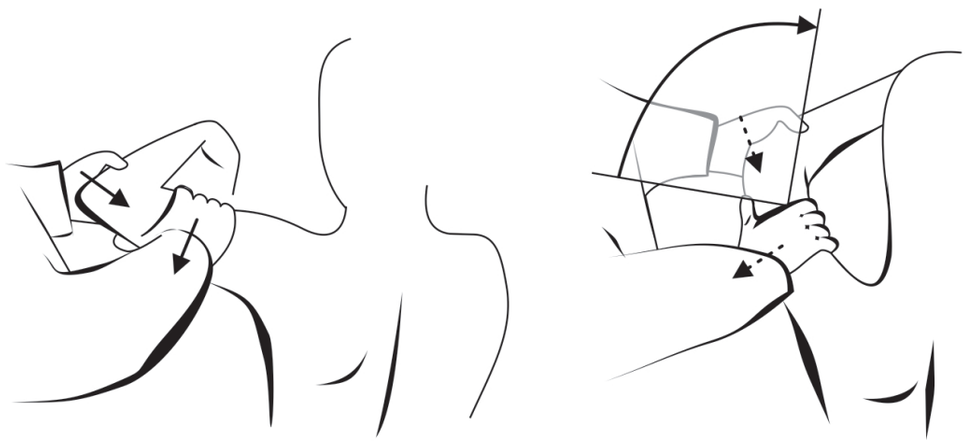

Figure 4. Kim test – test to detect posterior instability

etiology [2] (Frank *et al.*, 2017) (Brelin *et al.*, 2017) (Antoniou *et al.*, 2001) (Tannenbaum *et al.*, 2013) (Robinson *et al.*, 2005).

In the treatment of posterior instability of the shoulder joint, there are two treatment options. One is non-operative treatment, which in most cases is used for non-traumatic shoulder joint instability, or joint limp (a state of joint hypermobility in which the mobility of the joint is above accepted norms). The group of non-traumatic instability also includes connective tissue diseases and anatomical variants in the development of bones and joint surfaces. Non-operative treatment primarily relies on conservative methods and is based on: rehabilitation, changes in physical activity and patient education (Doehrmann *et al.*, 2023).

For more serious injuries localized to the shoulder girdle such as: avulsion of posterior band of IGHL, rupture of any of the tendons of the rotator cone muscles, or in patients who

experience recurrent shoulder pain, instability or functional limitations after conservative treatment of 3 to 6 months, surgical treatment is necessary (Provencher *et al.*, 2011) (Doehrmann et a., 2023) (Frank *et al.*, 2017) (Kim *et al.*, 2005) (Antoniou *et al.*, 2001).

Treatments for bone pathology are performed open, while treatments for soft tissue pathology are performed arthroscopically. There is no consensus in the literature on the specific indications for each procedure, so doctors must consider the optimal treatment for the patient on a case-by-case basis (Doehrmann *et al.*, 2023). Although the results are very good for open treatment of anterior instability, the failure rate for open treatment of posterior instability is as high as 30–70% (Provencher *et al.*, 2011). On the other hand, if the pathology in the shoulder bone is small, arthroscopic procedures are used to treat posterior instability, due to their less invasive nature, the ability to view the entire rim and treat concomitant pathologies, and the faster recovery of the patient (Brelin *et al.*, 2017) (Frank *et al.*, 2017). During the arthroscopic procedure, the patient lies on his side. Standard surgical anchors are used to repair the rim, using 3 to 4 portals to facilitate removal and placement of sutures. A diagnostic arthroscopy is performed through the posterior portal, an anteroposterior portal, which is located at the top of the rotator interval to help evaluate the rim damage, and a posterior portal at 7 o'clock located 2 cm laterally and 1 cm anteriorly from the original posterior portal, used to place sutures in the posterior portion of the acetabulum.For isolated posterior capsular and labral pathology, three to four suture anchors spaced about 5 mm apart on the acetabulum are usually sufficient. Regardless of the form of treatment, physiotherapy is an essential part of recovery (Provencher *et al.*, 2011) (Frank *et al.*, 2017) (Brelin *et al.*, 2017).

Rehabilitation

An important part of the rehabilitation process is strengthening the surrounding muscle group to produce additional stabilization in the shoulder joint. Rehabilitation should focus on proprioceptive exercises and strengthening the dynamic stabilizers of the shoulder, particularly the subscapularis. Scapulothoracic mechanics should be evaluated, as dysfunction can be a source of posterior shoulder pain (Brelin *et al.*, 2017) (Doehrmann *et al.*, 2023). Postoperative care of a patient with shoulder joint instability consists of immobilizing the shoulder in a shoulder brace, in such a way as not to stress the posterior shoulder joint muscle group. It is recommended that the patient have the shoulder joint immobilized for no less than 4 weeks. At first, the patient is encouraged to do gentle exercises focusing on the wrist and elbow joint. Then, after about 2 weeks, exercises that activate the rotator cone and shoulder joint are implemented (Provencher *et al.*, 2011) (Brelin *et al.*, 2017) (Doehrmann *et al.*, 2023).

After about 2 to 3 months after surgery, strengthening exercises should also be included. Return to sports is individually interpreted for each case, noting that the patient must achieve 80% of the strength of a healthy shoulder. In order for rehabilitation to be effective, it is extremely important from the very beginning of rehabilitation to involve both the patient and the therapist (Bäcker *et al.*, 2018) (Bradley *et al.*, 2013).

Conclusion

Posterior instability of the shoulder joint is an uncommon condition, and is therefore more difficult to diagnose than injuries that occur more frequently. It is important to pay attention to the anatomical structure of the shoulder, and the pathophysiology, which will help understand the mechanism of injury. Symptoms of the condition, the performance of provocative tests, and imaging allow early detection of pathology as well as assessment of its severity. Treatment consists of conservative as well as surgical methods. However, unlike anterior instability, surgical methods in posterior instability are less

effective, which is why it is so important to correctly and quickly diagnose the disease in order to prevent its advanced stage.

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