

Derotational humerus osteotomy and teres major tenotomy for recurrent posterior shoulder instability: A case report

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Abstract

Posterior instability represents about 10 percent of shoulder instabilities. It enclose dislocation or more frequently posterior sub luxation. Posterior instability can be also associated with constitutional laxity and multidirectional instability. The factors related to this instability depends of the etiology (traumatic, atraumatic), bony factors (glenoid and humeral head, defects, ante and retroversions) and the soft tissues. We describe a case of 28 year old lady, with recurrent posterior shoulder instability despite 3 previous interventions (2 posterior bone blocks and a glenoid osteotomy).

For the treatment we combined two techniques: Derotational humerus osteotomy and Teres major tenotomy. We found that Derotational humerus osteotomy can be used as an alternative for glenoid osteotomy, or after failed glenoid osteotomy, to treat the instability. It can be associated with teres major tenotomy which was previously described mainly for voluntary posterior dislocation.

Keywords: Posterior instability, Posterior subluxation, Laxity, Derotational osteotomy, Teres major tenotomy, voluntary, involuntary.

Introduction:

The glenohumeral joint is the least congruent articulation in the body due to the mismatch between the volume of the humeral head and the surface of the glenoid. The stability of this joint is assured by the osseous structures (scapula, humeral head) and the surrounding soft tissues (ligaments, capsule, labrum, muscles). Dysfunction in one or more of these structures can lead to the instability. The treatment of this pathology, depends of the site of the abnormality, therefore different types of treatment.

According to the literature posterior instability of the glenohumeral joint represents about 10 percent of all shoulder instabilities. Understanding the type of the posterior shoulder instability is primordial for the treatment. Regarding this instability several types and classifications has been described, depending on the degree, direction, mechanism of injury and the presence or not of a voluntary factor.

We should differentiate between the true posterior shoulder dislocations and the more frequent posterior subluxation.

For the direction of instability, we differentiate between the unidirectional and the multidirectional instability when the inferior laxity is associated.

Regarding the mechanism of injury, we divide it between:

Acute posterior dislocation, seen after a Traumatic accident or seizure/electric shock, usually with a dramatic presentation, a locked arm in adduction and internal rotation.

And the chronic instability, due to repetitive microtrauma with insidious onset and presentation. Often seen in sports and activities requiring repetitive pushing with the arm in forward flexion position.

When dealing with posterior instability it is also important to assess the voluntary factor. so in conclusion we can classify the posterior shoulder instability, into: acute vs chronic and voluntary vs involuntary.

The treatment

For the acute posterior shoulder dislocation, the first line treatment is to reduce the joint, followed by immobilization in external rotation for 4 to 6 weeks, then muscle strengthening program. The presence of large bone

defects and persistent shoulder instability after reduction will be an indication for surgical treatment.

For chronic instability the first line treatment is physical therapy, with rotator cuff strengthening and use of periscapular stabilizers. Surgery is indicated after the failure of 6 months of conservative treatment.

We divide the interventions in two types, osseous and soft tissue procedures, done by open or arthroscopic approaches. For soft tissue procedures many techniques have been described: labral repair (reverse bankart), capsular plication or shift, thermal capsulorraphy, reverse putti plat, thermal capsulorraphy is no longer recommended. For bony procedures we differentiate between, acts on glenoid (open wedge osteotomy, bone block) and humeral head procedure (McLaughlin, allograft and anteverision osteotomy) and arthroplasties. We found also in old papers the benefits of teres major tenotomy where there is a voluntary factor with the instability.

Here, a review of the main surgical options and indications:

- Posterior Bankart repair, when negative beighton score
- Capsular shift and plication when positive Beighton score.

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Fig. 1: Glenoid retroversion



Fig. 2: Glenoid retroversion– inferior part of the glenoid



Fig. 3: Posterior humeral head subluxation



Fig. 4: Posterior humeral head subluxation

- Posterior glenoid opening wedge osteotomy, when excessive congenital glenoid retroversion.

- Subscapularis transfer, McLaughlin or modified McLaughlin for chronic dislocation <6 months old, and in reverse hill-sachs defects < 40 %

- Shoulder arthroplasty (Hemi or total), when chronic dislocation >6, months old and reverse hill-sachs >40%

Anteroglenoid humeral osteotomy and teres major tenotomy are not described in recent literature as part of the main surgical options.

Clinical Case:

A 29 year old lady presented to our hospital with painful right arm, locked in extension and internal rotation associated with scapula alata.

Since the adolescence this patient suffered from clicking sensation in both shoulders especially when elevating the arms or when putting the hand behind the back.

The only symptom was this sensation of instability, till age of 20 when she started to have pain in the right shoulder, after a first episode of true dislocation. It was due to a simple movement of the arm with no evident trauma.

The mechanism was involuntary. The shoulder was reduced then immobilized.

Physical therapy was started thereafter.

She underwent an operation at age of 21 to stabilize the shoulder with a posterior iliac crest bone block.

The instability persisted, so she was re-operated 2 years later in 2013 for a revision of iliac crest bone block, and then in 2017 with glenoid anteversion osteotomy.

She continued to have this involuntary instability, and few weeks before her presentation to our hospital she declared that her scapula became protruded.

The physical exam upon presentation showed:

- Right arm locked in extension and internal rotation

- Right scapula Alata

- Sulcus test positif (2+) at the contralateral side and also a positif Gagey Abduction test >105 degree.

- Recurvatum of the elbow and hyper extension of the thumb.

- No recurvatum at knees

- Beighton score positive > 4 points

Radiographic exams revealed posterior shoulder dislocation.

Under sedation we did an easy reduction of the dislocation, the shoulder was immobilized with an abduction cushion in external rotation. The scapula was reduced spontaneously after the humeral reduction.

She returned few days later with a new

dislocation.

In front of this recurrent painful involuntary posterior instability, and the failure of the previous interventions, we started the planning for a new surgery:

A Ct scan from 2015, 2 years after the second intervention showed lysis of the bone blocks, 2 screws in place at the posterior aspect of glenoid. The retroversion at the middle part of the glenoid was about 12 degrees and greater in the inferior part, with posterior subluxation of the humeral head. (Fig. 1, Fig. 2)

In 2016 an arthro-scan showed no rotator cuff abnormalities, but always the posterior humeral head subluxation (Fig. 3, Fig. 4).

In 2017 the standard radiography showed no abnormality after the glenoid osteotomy (Fig. 5, Fig. 6).

So we did a new arthro-scan to evaluate the bone stock, the shape of the glenoid, and the retroversion of the humeral head (Fig. 7, Fig. 8).

- Head retroversion: 27 degrees.

- No abnormalities of the anterior labrum, short posterior labrum, no rotator cuff tear

- Humeral head subluxation

- Variable glenoid retroversion between the middle and the inferior part with a maximum of 23 degrees.



Fig. 5: Anteroglenoid osteotomy– Anteroposterior view



Fig. 6: Anteroglenoid osteotomy– Lateral view



Fig. 7: Preoperative arthroscan



Fig. 8: Preoperative arthroscan – glenoid retroversion



Fig. 9: Postoperative X-ray– anteroposterior view



Fig. 10: Postoperative X-ray– lateral view

Table 1: General overview of the surgical options from the article of Tannenbaum [1]

Table 1. Surgical considerations.*

Procedure	Consideration
Soft tissue	
Reverse Bankart repair (open or arthroscopic)	Often performed in combination with an arthroscopic capsular plication, posterior-inferior capsular shift, or reverse Putti-Platt
Arthroscopic capsular plication	Performed on patients with isolated unidirectional posterior instability without a true labral tear
Open posterior-inferior capsular shift	Surgical option for patient with posterior-inferior subluxation with no anterior component and a functionally intact rotator interval
Reverse Putti-Platt	Often reduces range of motion and is thus generally not recommended for athletes requiring full range of motion
Thermal capsulorrhaphy	Not recommended because of high recurrence rates
Osseous	
Posterior bone block or posterior wedge osteotomy	Generally indicated for patients presenting with a failed capsular plication, glenoid hypoplasia, increased glenoid retroversion, or an osteochondral fracture of the glenoid cavity vs posterior glenoid bone loss
McLaughlin's procedure or Neer's modification of McLaughlin's	Performed on patients with locked posterior shoulder dislocation resulting from reverse Hill-Sachs lesions encompassing 25% to 50% of the humeral head
Humeral head allograft	Alternative option to McLaughlin's or Neer's procedures based on the surgeon's preference/experience; our preference as the most anatomic way to reconstruct large engaging reverse Hill-Sachs lesions

*This table represents a general overview of the surgical options; surgical decisions must be made on a case-by-case basis

Table 2: Clinical recommendations. Tannenbaum E, Sekiya JK.

SORT: Strength of Recommendation Taxonomy

A: consistent, good-quality patient-oriented evidence

B: inconsistent or limited-quality patient-oriented evidence

C: consensus, disease-oriented evidence, usual practice, expert opinion, or case series

Clinical Recommendation	SORT Evidence Rating
Conservative physical therapy treatment is recommended as the initial form of treatment for patients presenting with posterior shoulder instability. ^{14,25,26,34,37,38}	B
An open or arthroscopic posterior capsulorrhaphy is recommended for patients with unidirectional recurrent posterior instability who fail conservative treatment after 6 months. ^{15,34,37,38}	B
A posterior bone block or glenoid osteotomy is recommended for patients with glenoid hypoplasia, increased glenoid retroversion, or an osteochondral fracture of the glenoid cavity. ^{25,34,38}	B
Arthroscopic thermal capsulorrhaphy is not recommended to treat patients with recurrent posterior shoulder instability. ^{26,38}	B

Surgery: Derotational osteotomy of the humerus with teres major tenotomy.

Surgical technique:

To avoid two incisions and changing the patient position during the intervention, we decided to do the tenotomy and the osteotomy from the deltopectoral approach. Under general anesthesia, mid position between dorsal and lateral decubitus, deltopectoral approach, tenotomy of the pectoralis major from the anterior lip of the bicipital groove. Exposition of the insertion of latissimus dorsi, tenotomy from the floor of the groove, exposition of the teres major tendon, then tenotomy. The tendon of the latissimus dorsi and pectoralis major were reinserted.

Exposition of the humeral head and the rotator cuff which is intact. Osteotomy of the humerus at the level of surgical neck, then derotation for 25 degrees. Fixation with plate and screws. Closure of all layers. At the end of the surgery the shoulder was stable. Post operative radiography control: Fig. 9, Fig. 10.

After the surgery, physical therapy was started early, and marked with absence of shoulder apprehension.

At three months post-operation: Consolidation was confirmed with continuous amelioration of the active range of motion of the shoulder:

Forward flexion: 130 degrees, external rotation: 40 degrees, internal rotation: at the level of L5.

No pain at rest, during exercises 3/10
An electromyography showed no abnormalities of the long thoracic nerve.

At five months post operation:

Forward flexion 170 degrees, external rotation 45 degrees, internal rotation: at the level of T12.

No signs of apprehension, no instability only inferior laxity which was already present before the intervention.

Discussion

The treatment of recurrent posterior shoulder instability is difficult. It is a rare pathology, comparing to the anterior instability.

We will mainly discuss the posterior instability in its chronic form.

To understand this entity of instability we should evaluate the displacement and its direction, the provocative factors (traumatic,

microtraumatic), differentiate between voluntary and involuntary instability, search for multidirectional instability.

This work is done through the history of the patient, clinical and radiological exams. Through the history of the patient we will search for the provocative factors and the mechanism of injury, if there is any recent or old trauma. In the absence of an obvious traumatic accident we evaluate the activity of the patient to check for a microtraumatic origin (lancer sports). Then we should evaluate if this instability is voluntary or not. If there is a true shoulder dislocation, repetitive or not, or if its only sensation of subluxation, and the circumstances of reproduction.

On physical exam, we check first if there is a true dislocation by inspecting the shoulder, the limb motion and position. If it's not dislocated usually the patient will present for pain on flexion, adduction and internal rotation. Several tests are done during the physical exam. Posterior load and shift test, jerk test, Kim test, to assess the degree of subluxation and the labral tears.

It is important to evaluate the laxity of the patient, by doing the Beighton score. Regarding the shoulder we should do also the sulcus test and the Gagey test to evaluate inferior laxity which can be associated with posterior instability. Usually the laxity is congenital, and present at the contralateral side or other articulations. In these cases, the instability starts at early age and it's associated with a minor trauma or even with no traumatic incident.

with the imaging's (RX, MRI, CT scan), we can assess the soft tissues (labrum, capsule, rotator cuff) and the bones defects and orientation (glenoid, humeral head). We found in literature recent several papers, where this type of chronic posterior instability is investigated to understand the factors and also to create an algorithm for the treatment, Tannenbaum et al [1] (2011), Paul et al [2] (2011), Backer et al [3] (2018). In their review of 107 patients Tannenbaum et al [1], described the different options for procedures to treat posterior instability Table 1, which was a general overview of the possible choices, and the indication will be made case by case.

In a recent paper, Morder P. and Scheibel M. [4] described the ABC classification of posterior shoulder instability, based on the pathomechanical type of the instability.

Group A: acute first time posterior instability, which occurred in terms of subluxation (A1) or dislocation (A2)

Group B: Recurrent posterior dynamic instability in the form of a functional instability (B1) or structural instability (B2)

Group C: Chronic static posterior instability, constitutional (C1) or acquired (C2).

They also described the possible treatment of each subgroup. Different types can overlap or co-exist, and the progression from one group or subgroup to another is possible over time. Conservative treatment is usually warranted in most patients with type A1, B1, C1 instabilities. Surgical treatment depends of the structural defects, chronicity, symptoms and the functional demand of the patient. We found this classification very important since it divides the pathology in several subgroups and discusses the treatment options for each subgroup.

In literature, it's clear that the first line of treatment is conservative. These treatments are recommended especially for athletes where lesions are due to repetitive micro traumatism, and in adolescents where a majority will heal at adult age. If failure after 6 months of treatment then surgery is indicated.

The surgical treatment can be arthroscopic or by open approach. It addresses the soft tissues and/or the bone. The choice of the surgical technique depends of the site of pathology, in order to decrease the volume of the capsule or treat a labral lesion, a bone defect or to correct the bone orientation.

In soft tissues many techniques were described like capsular shift and plication, Neer et al [5], tendon transfer, reverse bankart repair.

Bony procedures include bone block, bone grafting, glenoid osteotomy and rotational osteotomy of humerus.

Usually bony procedures are added to soft tissue procedures, when a bone pathology is present, like humeral head defect, or glenoid defect or retroversion (>10 degree, Scott et al [6]), to decrease the risk of recurrence.

Tenotomy of teres major is an old technique but it is not frequently applied. It was described by Grammont [7] for recurrent voluntary dislocation.

Humerus osteotomy was described also for anterior instability and posterior instability. Described by Weber [8] for anterior instability, then used by Chaudhuri [9] and Surin [10] for posterior instability. Used by Meynet [11] after a failure of posterior bone block.

In the recent literature when posterior labral tear is present, repair is indicated with a success rate of 80 to 85 % with similar outcome in open or arthroscopic repair.

Posterior capsular shift is recommended if there is a concomitant laxity (Beighton score +). When excessive glenoid retroversion is present, glenoid osteotomy is recommended.

Susacapularris transfer is indicated in chronic dislocation to decrease the force of internal rotation, and the modified transfer including the lesser tuberosity to fill a reverse Hill-Sachs defect. Arthroplasties are reserved for old patients with chronic dislocations, or arthritis, and for large humeral head defects >40%.

In our case, there was a recurrence of the dislocation even after surgeries aiming the glenoid (posterior bone block and glenoid osteotomy) and the capsule.

The investigation showed the persistence of the retroversion of the glenoid, and no evident posterior labrum tear (only short labrum). There was a history of voluntary instability at early age especially the patient is hyper lax and during the time this instability became involuntary. If we want to classify this case it will be a type B1 posterior functional dynamic instability from the ABC classification [4] since the patient has a retroverted glenoid and laxity. During the time it became type B2 due to the weakness of

capsule as result of the previous interventions and the evolution of the instability.

So our idea was to decrease the retroversion of the humeral head to do the compensation since a new intervention aiming the glenoid will be difficult. And since there was a history of voluntary dislocation at early age, and the patient presented signs of laxity, we preferred to associate Teres major tenotomy [7] to our intervention. Due to the previous interventions, we believed that this capsule will be already thin and weak and it is not suitable for any application or shift.

Conclusion

We think that we should add the derotational humerus osteotomy to the algorithm of treatment of posterior shoulder instability when failure of the other procedures, and not only for locked dislocations. When there is a voluntary factor in the history of the patient we should think to associate teres major tenotomy.

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