

# Shoulder Instability: Anterior, Posterior, Multidirectional, Arthroscopic Versus Open, Bone Block Procedures

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**Abstract:** This article presents a retrospective comprehensive review of the history of anterior, posterior, and multidirectional shoulder instability and also reviews key concepts such as open versus arthroscopic repair and glenoid and humeral head bone loss and associated treatments. The future of shoulder instability will continue to evolve as research and clinical experience will determine the direction of the future.

**Key Words:** shoulder dislocation, subluxation, shoulder instability, Bankart, glenoid track, glenoid bone loss, posterior instability, multidirectional instability

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The glenohumeral joint is the most commonly dislocated joint in the body, with an overall incidence of 17 per 100,000 per year<sup>1–3</sup> with higher incidences in more active patients such as military personnel reported by Owens et al<sup>4</sup> 1.69 per 1000 person-years. Level I evidence suggest that surgical stabilization may be indicated for young first-time dislocators.<sup>5–8</sup> This article describes the history of shoulder instability, the evolution of instability surgery, the currently accepted concepts and what direction we see this concept moving in the future.

## WHERE WE WERE IN THE PAST

Bankart<sup>1</sup> is one of the major contributors in understanding causative mechanisms involved in recurrent shoulder dislocations, in 1923 he first described the “essential lesion” of the anteroinferior labrum and inferior glenohumeral ligament.

In the 1940s local soft tissue transfers proved popular, including the Magnusson-Stack and the Putti-Platt. The Magnusson-Stack procedure transferred the subscapularis from the lesser tuberosity to the greater tuberosity to increase the tension across the anteroinferior joint and acted as a sling for the humeral head. In the Putti-Platt procedure the subscapularis tendon and capsule are divided longitudinally and shortened by “pants-over-vest” technique by securing the medial limb to the anterior glenoid and lateral limb over it. Both of these procedures decreased external rotation<sup>9,10</sup> and excessively tighten the anterior capsule and have since fallen out of favor due to rapid onset and progression of glenohumeral arthritis.<sup>11,12</sup>

In 1954, Latarjet<sup>13</sup> described an open coracoid process transfer to augment the anterior glenoid. This procedure has 2 primary effects; the transferred coracoid acts as a bony

block and the conjoint tendon acts as a dynamic sling to the humeral head that reinforces the anteroinferior capsule. Open coracoid transfers are still in use today and have even gained popularity as Bankart repairs in patients with glenoid bone loss have unacceptably high recurrence rates that are as high as 67% to 89% in contact athletes.<sup>14</sup> Some degree of glenoid bone loss has been reported in up to 22% of patients after an initial dislocation<sup>15</sup> and 76% after a recurrent episode.<sup>16–19</sup>

Humeral head involvement in recurrent anterior shoulder instability is an important consideration and is formally described as the “Hill-Sachs” lesion and is a compression fracture of the relatively soft bone at the posterolateral portion of the humeral head.<sup>20</sup> A number of open techniques have been described to manage this including the use of osteochondral allografts,<sup>21</sup> humeral head rotational osteotomies,<sup>22,23</sup> humeroplasty, partial humeral head resurfacing, and shoulder arthroplasty.<sup>24–27</sup> Connolly<sup>28</sup> first described the remplissage technique of filling the humeral head defect with adjacent infraspinatus in 1972. Purchase et al<sup>29</sup> redefined this procedure arthroscopically and performed a tenodesis of local infraspinatus and posterior capsule into the defect of 22 patients with just a 10% recurrence rate.

The first medical description of a posterior shoulder dislocation occurred in 1822 by Cooper.<sup>30</sup> In 1952, Harrison McLaughlin<sup>31</sup> described the presence of an anterior humeral head bone defect, now termed the “reverse Hill-Sachs” or “McLaughlin lesion” and recognized its role in recurrent posterior instability. In 2003, Kim et al<sup>32</sup> described lesions in the posteroinferior labrum following traumatic, unidirectional, recurrent posterior subluxations, as well as treatment that involved arthroscopic labral repair and posterior capsular shift.

Multidirectional shoulder instability was first described in an oral report at the 1965 American Academy of Orthopaedic Surgeons annual meeting by Thompson and Fielding.<sup>33</sup> This clinical entity was then popularized by Neer and Foster<sup>34</sup> in 1980 and also introduced the open inferior capsular shift procedure for treatment after failed comprehensive strengthening exercises. Then in 1993, Duncan and Savoie<sup>35</sup> described the first arthroscopic inferior capsular shift procedure.

## WHERE WE ARE CURRENTLY

Multidirectional shoulder instability diagnosis is usually a clinical one. Initial treatment is nonoperative with rehabilitation focusing on proprioceptive exercises, scapulothoracic training and core stability. Surgery may be indicated in patients with persistent symptoms despite appropriate physical therapy of  $\geq 6$  months, and open inferior capsular shift or arthroscopic plication are currently the most favored techniques.

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Posterior shoulder instability has been shown to be effectively and reliably treated with arthroscopic procedures with respect to outcome scores, patient satisfaction and return to play as documented by DeLong et al<sup>36</sup> in a 2015 systemic review and meta-analysis. Patients who had undergone arthroscopic repair had superior outcomes compared with patients with open procedures. The overall recurrent instability rate for 815 shoulders undergoing arthroscopic surgery was 8.1% compared with 19.4% (314 shoulders) who had open surgery.

Increasing attention in recurrent anterior shoulder instability is being focused on bony defects and redefining “critical” bone loss. Traditionally, the determining factors in surgical importance of the Hill-Sachs lesions are its size and whether it is “engaging” or not.<sup>37</sup> Historically, lesions <20% were not surgically addressed. However, in recent years, with the concept of the “glenoid track” being introduced by Yamamoto et al<sup>38</sup> in 2007, the position and orientation of the lesion have also been shown to be important. A Hill-Sachs lesion that is “on track” cannot engage with the glenoid, whereas an “off track” lesion has a risk of engagement and dislocation and can be preoperatively determined by 3D computed tomography.

Assessment of the glenoid bone loss is most commonly carried out preoperatively on a computed tomography and using a best-fit circle to determine the percent bone loss and confirming this by arthroscopic measurement. Multiple studies have shown higher failure rates with arthroscopic labral repair in the presence of substantial glenoid bone loss, typically defined as >30%.<sup>37,39</sup> More recently there has been more debate about managing glenoid bone loss when it is 10% to 30% and when there are bipolar lesions on both the glenoid and humeral head. A recent cadaver-based study concluded that combined, bipolar lesions with as little as 8% to 15% of the glenoid, with a medium-sized Hill-Sachs lesion, could compromise a Bankart repair.<sup>40</sup>

Indications for open coracoid transfers are typically reserved for primary or revision cases with >20% to 30% antero-inferior glenoid bone loss; however, they are commonly performed in Europe in cases with <10% bone loss as a primary procedure, this indication is more controversial. Numerous other open bony augmentation has been described, including using iliac crest autograft,<sup>41</sup> fresh cadaveric allografts from the glenoid,<sup>42</sup> femoral head,<sup>43</sup> and distal tibia.<sup>44</sup>

It is our opinion that patient selection and technique are 2 of the most important aspects of successfully treating anterior shoulder instability. In 2016, a systematic review was conducted by Leroux et al<sup>45</sup> looking at the failure rates after arthroscopic stabilization in contact or collision athletes, he pooled failure rate after arthroscopic shoulder stabilization in contact or collision athletes were 17.8%; however, among studies that excluded patients with significant bone loss, used a minimum of 3 suture anchors, and performed the stabilization in the lateral decubitus position, the failure rate was 7.9%.

## WHERE WE ARE GOING IN THE FUTURE

As we move into the future we feel the concepts related to shoulder instability will continue to advance. Recent research has identified the concept of “subcritical” bone loss and the importance related to recurrence. Shin et al<sup>46</sup> identified 17.3% glenoid bone loss as the critical value that leads to recurrent instability following arthroscopic Bankart

repair. In their study, 43% of patients with >17.3% bone loss had surgical failure, which was defined as need for revision surgery or subjective feelings of instability, compared with 3.7% of patients with <17.3% glenoid bone loss.

We predict that the indications for arthroscopic Bankart repair will continue to narrow given the known recurrence rates especially in the setting of critical bone loss and that we will also see a resurgence of open Bankart procedures. Indications for open Bankart repair include; collision male athlete below 20 years of age, >10% to 20% bone loss, poor capsulolabral tissue, multiple dislocations (>5 to 10), revision of arthroscopic repair that was done well with minor bone loss.

However, we do not see the pendulum swinging too far that all shoulder instability should be treated with a primary Latarjet procedure independent of glenoid bone loss. As we do have concerns that graft resorption in the setting of decreased glenoid bone loss may be a risk factor for instability or development of early glenohumeral instability. Di Giacomo et al<sup>47</sup> showed a coracoid graft resorption of 39.6% at 1-year follow-up in patients with <15% glenoid bone loss.

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