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<p>The glenohumeral joint provides greater freedom of motion than any other joint in the body at the expense of decreased stability. Shoulder instability can occur in overhead throwing athletes (chronic, overuse injuries) but more commonly occurs in contact athletes (acute traumatic dislocations). Our understanding of the anatomy and pathologic entities has evolved significantly since initial descriptions of shoulder instability and this has facilitated an evolving repertoire of treatment options. This article reviews the functional anatomy and biomechanics of shoulder stability and outlines the bony and soft tissue lesions associated with shoulder instability in the athlete.</p>	
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<p>Surgical management of recurrent shoulder instability can be complicated in the setting of associated osseous defects of the glenoid, humeral head, or both. A wide variety of surgical options exist for the management of complex shoulder instability. Interventions for addressing glenoid and humeral head bone defects, and their biomechanical effects, are reviewed. Further studies are required to delineate critical defect values and develop validated treatment algorithms.</p>	
<b>Mechanics and Pathomechanics in the Overhead Athlete</b>	<b>637</b>
W. Ben Kibler, Trevor Wilkes, and Aaron Sciascia	
<p>The overhead throwing or serving motion requires the coordinated activation of all of the bony segments in a kinetic and kinematic chain to generate and regulate the forces and motions to accomplish the task. Proper mechanics create the optimum forces and motions. Pathomechanics are frequently associated with alterations in performance and injury risk or injury. Knowledge of normal mechanics and possible pathomechanics can help in the evaluation of athletes with shoulder pain. The evaluation should be comprehensive, including the presence of pathomechanics, the anatomic and physiologic reasons for the pathomechanics, and evaluation of all elements in the kinetic chain.</p>	

- Imaging Instability in the Athlete: The Right Modality for the Right Diagnosis** 653  
Aaron J. Bois, Richard E.A. Walker, Pradeep Kodali, and Anthony Miniaci
- This article reviews the commonly used imaging modalities for evaluating the athlete with symptoms of shoulder instability, including radiography, computed tomography (CT), and CT arthrography, with an initial focus on magnetic resonance (MR) imaging and MR arthrography. Examples of common soft tissue and osseous lesions associated with instability are provided, concentrating on those lesions seen in unidirectional post-traumatic anterior and posterior instability.
- Decision Making in the In-Season Athlete with Shoulder Instability** 685  
James P. Ward and James P. Bradley
- Shoulder instability in the in-season athlete is a common and particularly vexing issue for both the athlete and the treating physician. Both anterior and posterior instability may cause significant pain and disability and interfere with the athlete's ability to complete the season at their desired level. Many athletes can be managed nonoperatively during the season, deferring operative stabilization until the off-season, when time for adequate rehabilitation is available. Success rates for arthroscopic management of both anterior and posterior instability are similar to open management. Athletes can be expected to return to game play 6 to 9 months postoperatively.
- Microinstability and Internal Impingement in Overhead Athletes** 697  
Lauchlan Chambers and David W. Altchek
- A complex interplay exists between the static and dynamic stabilizers in the glenohumeral joint, especially in overhead athletes who need a shoulder hypermobile enough to perform overhead activity yet stable enough to prevent joint subluxation. Concomitant shoulder pathologies commonly occur in the setting of microinstability and internal impingement. Before any surgical intervention, a 3- to 6-month course of conservative measures should first be attempted, with exercises focused on rotator cuff and scapular stabilizer strengthening combined with posterior capsule stretching. If surgery is needed, arthroscopic suture plication with treatment of concomitant lesions has been shown to provide the best clinical outcomes.
- Arthroscopic Management of the Contact Athlete with Instability** 709  
Joshua D. Harris and Anthony A. Romeo
- Shoulder instability is common in contact and collision athletes. This article discusses the anatomy, pathoanatomy, history, physical examination, imaging, management algorithm, and outcomes of surgical treatment of instability of the shoulder in these patients. This article also presents the authors' recommended arthroscopic technique.
- The Latarjet-Patte Procedure for Recurrent Anterior Shoulder Instability in Contact Athletes** 731  
Mithun A. Joshi, Allan A. Young, Jean-Christian Balestro, and Gilles Walch
- Recurrent anterior shoulder instability is common in contact athletes and the high-energy injuries seen in this group make them more prone to

bone loss. Athletes with recurrent instability and associated bone loss have high failure rates when treated with a soft tissue reconstruction procedure. Therefore it is preferred to manage recurrent instability in contact athletes with the Latarjet-Patte procedure. In this article, the authors describe their technique. They have found this procedure to be safe and effective, with very low recurrence and early return to sport. A meticulous surgical technique is important to avoid intraoperative and postoperative complications.

### **Shoulder Instability with Concomitant Bone Loss in the Athlete**

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Justin W. Griffin and Stephen F. Brockmeier

Thorough evaluation of the athlete with persistent shoulder instability and appropriate use of imaging modalities, such as 3-dimensional computed tomography, can help quantify the severity of bony deficiency. Based on obtained imaging and examination, surgical and nonsurgical methods can be considered. In many situations both the humeral- and glenoid-sided bone loss must be addressed. Depending on the extent of bone loss, athletic demands, and surgeon experience, arthroscopic or open surgical options can provide shoulder stability and return athletes to their prior level of activity.

### **Pediatric and Adolescent Shoulder Instability**

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Matthew D. Milewski and Carl W. Nissen

Glenohumeral instability in pediatric and adolescent patients covers a wide range of disease, from traumatic anterior instability to multidirectional instability. The rates of recurrent instability are high. Conservative and operative treatment options have shown variable success. Given the high risk of recurrent instability, young, active patients who seek to return to competitive contact sports should consider arthroscopic stabilization after a first-time instability event. Multidirectional instability should be treated initially with conservative rehabilitation. Patients who fail extensive conservative treatment may benefit from surgical stabilization. Arthroscopic techniques may approach the results of traditional open capsular shift procedures.

### **Posterior Shoulder Instability in the Contact Athlete**

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Eric P. Tannenbaum and Jon K. Sekiya

Athletes participating in contact sports often subject their shoulders to intense activity and high-energy forces. When one or more of the posterior stabilizing structures is damaged, posterior shoulder instability often ensues. Orthopedists must know how to perform the specific physical examination maneuvers to determine posterior shoulder instability and what imaging tests are necessary. Initial management traditionally includes 6 months of conservative nonoperative rehabilitation. If the athlete's shoulder instability persists after conservative treatment, surgery is directed at repairing any soft or bony lesions. Depending on the surgery performed, athletes may expect to gradually return to play between 5 and 8 months.

- Posterior Instability Caused by Batter's Shoulder** 797  
 Richard W. Kang, Gregory T. Mahony, Thomas C. Harris, and Joshua S. Dines  
 The lead shoulder of a batter's swing can undergo tremendous forces, especially when a pitch is missed. Repetitive loads on the shoulder in this setting can lead to posterior instability also known as batter's shoulder. This article reviews the pathomechanics, clinical presentation, imaging, treatment options, and initial clinical results of batter's shoulder.
- Shoulder Instability in Ice Hockey Players: Incidence, Mechanism, and MRI Findings** 803  
 Tim Dwyer, Massimo Petrera, Robert Bleakney, and John S. Theodoropoulos  
 High-level ice hockey players are prone to traumatic injuries. The most common cause of injury is from body checking or player contact, and the reported rate of injury to the shoulder ranges between 8.6% and 21.9%. The authors reviewed a consecutive series of 24 professional ice hockey players presenting between 2010 and 2013 with post-traumatic shoulder instability. Radiologist review of each player's magnetic resonance imaging (MRI)/magnetic resonance angiography (MRA) scan demonstrated a high prevalence of Hill-Sachs lesions, which may contribute to increased failure rates of arthroscopic or open labral repairs. These may need to be addressed with alternative surgical procedures.
- From the Unstable Painful Shoulder to Multidirectional Instability in the Young Athlete** 815  
 Haifeng Ren and Ryan T. Bicknell  
 Shoulder pain is one of the leading complaints among athletes. Instability is a difficult and often missed diagnosis. A heightened clinical suspicion and an accurate, prompt diagnosis are important. This article outlines appropriate treatment resulting in better outcomes for unstable painful shoulder and multidirectional instability.
- Results of Shoulder Stabilization Surgery in Athletes** 825  
 Robert H. Brophy  
 Athletes, especially in contact and collision sports, are at risk for anterior and, less commonly, posterior glenohumeral instability. Studies have demonstrated that both types of instability can be successfully treated with surgery, using either open or arthroscopic techniques. For athletes with anterior instability, open stabilization has a slightly lower recurrence rate than arthroscopic stabilization. For posterior instability, arthroscopic techniques facilitate a higher rate of return to sport than open techniques. Throwing athletes have been shown to have a lower rate of return to sport after the surgical treatment of both anterior and posterior instability.
- Management of the Athlete with a Failed Shoulder Instability Procedure** 833  
 F. Winston Gwathmey Jr and Jon J.P. Warner  
 Athletes often expose their shoulders to significant forces and stresses and treatment of recurrent shoulder instability in this population is challenging. Recurrence after surgical shoulder stabilization in an athlete warrants

a systematic approach to the diagnosis and treatment. The surgeon must develop a clear understanding of the etiology of the failure and take the necessary steps during the management algorithm to prevent a subsequent recurrence. When planning revision surgical stabilization, the surgeon must analyze and address risk factors for recurrence, which include younger age, contact/collision sports, higher level of competition, capsular laxity, glenoid bone loss, and engaging Hill-Sachs deformities. The surgeon must provide the athlete with the surgery that provides the best chance to return to sport and the lowest risk of recurrent instability. While revision arthroscopic Bankart repair may be appropriate in some cases in which there is minimal glenoid bone loss and robust labral and capsular tissue is available, an open procedure such as a Latarjet may be indicated for athletes at high risk for recurrence.

### **Nonoperative and Postoperative Rehabilitation for Glenohumeral Instability**

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Kevin E. Wilk and Leonard C. Macrina

There exists a wide range of shoulder instabilities, from subtle subluxations (as seen in overhead athletes) to gross instability. An appropriate rehabilitation program plays a vital role in the successful outcome following an episode of shoulder instability. Nonoperative rehabilitation is often implemented for patients diagnosed with various shoulder instabilities. Based on the classification system of glenohumeral instability and several key factors, a nonoperative rehabilitation program may be developed. This article discusses these factors, and the nonoperative rehabilitation and postoperative programs designed to return patients to their previous level of function. In addition, a rehabilitation program that focuses on restoring strength, improved posture, scapula stability, neuromuscular control and proprioception will be emphasized.

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