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Surgery and Rotator Cuff Disease: A Review of the Natural History, Indications, and Outcomes of Nonoperative and Operative Treatment of Rotator Cuff Tears 1

Thomas E. Moran and Brian C. Werner

Rotator cuff tears are common and multifactorial in etiology. Natural history studies suggest that following initiation of a tear, rotator cuff disease may advance along a continuum of tear enlargement and symptom progression, muscular degeneration and fatty infiltration, and glenohumeral arthritis. Patient- and tear-specific features influence both the risk of clinical progression and the potential for tendon healing following a repair. General guidelines regarding management of rotator cuff tears are influenced by a patient's symptoms, risk of clinical progression, and potential for biologic healing.

Update on Diagnostic Imaging of the Rotator Cuff 25

Jennifer Pierce and Mark Anderson

Understanding the anatomy, injury patterns, and surgical procedures is essential for image interpretation. While direct evaluation of the rotator cuff cannot be made, radiographs of the shoulder provide the initial evaluation of the osseous abnormalities associated with rotator cuff impingement. MR imaging is considered the study of choice for the evaluation of the shoulder because of the comprehensive assessment of both bone and soft-tissue abnormalities. MR can accurately evaluate the size and shape of tendon tears, tendon tear retraction, and tendon and muscle quality. Computed tomography is an excellent modality for the evaluation of osseous detail and detection of gas and calcium deposition; however, conventional CT is much less sensitive for bone marrow edema detection and soft tissue detail of the rotator cuff. Ultrasound can assess the rotator cuff with results similar to MRI, but cannot evaluate osseous structures.

Use of Injections and Biologics for the Nonoperative Treatment of Rotator Cuff Pathology 53

Alexander J. Johnson, Hannah Bradsell, and Rachel M. Frank

Symptomatic rotator cuff pathology is a common musculoskeletal issue with evolving surgical indications. Most of the patients undergo some form of nonoperative treatment before considering surgical intervention. Understanding and optimizing nonoperative treatment modalities is an essential key to successful treatment. This article contains a review of

the current literature regarding the risks, benefits, and alternatives of the most common injections used in the treatment of rotator cuff pathology. Injection options covered include corticosteroids, biologics including platelet-rich plasma and stem cells, hyaluronic acid, and nonsteroidal anti-inflammatory drugs.

Advances in the Treatment of Rotator Cuff Tears: Management of Rotator Cuff Tears in the Athlete **69**

Anna K. Reinholz, Sara E. Till, Alexandra M. Arguello, Jonathan D. Barlow, Kelechi R. Okoroha, and Christopher L. Camp

Unique biomechanical factors in the overhead and throwing athlete lead to a spectrum of rotator cuff pathology, usually with progressive lateralization of the supraspinatus footprint. Initial comprehensive nonoperative management is indicated for all athletes. Progression to arthroscopic debridement, repair of concomitant injuries, and possible rotator cuff repair with a transosseous equivalent technique are the current management strategies for athletes when nonoperative management fails.

Arthroscopic Rotator Cuff Repair: A Review of Surgical Techniques and Outcomes **81**

Michael R. Mancini, Jeffrey L. Horinek, Cameron J. Phillips, and Patrick J. Denard

Arthroscopic rotator cuff repair (ARCR) has become the gold standard management for rotator cuff repair. Double-row repairs have shown increased biomechanical strength and enhanced anatomic footprint coverage. The advancement of knotless techniques has led to decreased operating room time and reduced overall costs. We prefer a suture-bridging double-row repair for most rotator cuff repairs and incorporate a knotless medial mattress sutures (double-pulley technique) for additional support as needed.

Augmentation of Arthroscopic Rotator Cuff Repair: Biologics and Grafts **95**

Caleb N. Morgan, Kevin F. Bonner, and Justin W. Griffin

Arthroscopic augmentation of massive and irreparable rotator cuff tears proves to be a valid and evidence-based treatment option to maximize healing and patient outcomes following rotator cuff repair. Integration of acellular dermal allografts as augment or interposition grafts demonstrates definitive benefit in patients with high risk of retear or individuals with severely retracted tears, respectively. Furthermore, these allografts have demonstrated benefit when used for superior capsular repair for chronic, atrophied tears in young, active patients who do not want to proceed with a reverse total shoulder replacement.

Superior Capsular Reconstruction for Irreparable Rotator Cuff Tear **109**

Phob Ganokroj, Annalise M. Peebles, Matthew L. Vopat, and Matthew T. Provencher

Superior capsular reconstruction (SCR) was developed as a minimally invasive, innovate technique to restore normal shoulder biomechanics for patients who present with massive, irreparable rotator cuff tear (MIRCTs) that preclude shoulder arthroplasty. Current studies have shown

that SCR for MIRCTs result in excellent short-term clinical outcomes, adequate pain relief, and functional improvement with low graft failure and complication rates. This article aims to critically evaluate the biomechanics, indications, procedural considerations, clinical outcomes, rehabilitation program, and complications associated with the SCR procedure.

Tendon Transfers, Balloon Spacers, and Bursal Acromial Reconstruction for Massive Rotator Cuff Tears **125**

Samuel J. Mease, Kevin C. Wang, Frank S. Cautela, and Bradford O. Parsons

Several options exist for the management of irreparable rotator cuff tears without advanced arthritic changes. Tendon transfer poses technical challenges and has limited but promising outcomes data. Newer procedures such as balloon spacers and bursal acromial reconstruction are currently being investigated as a reproducible solution to this challenging problem. Ultimately the decision to continue with conservative measures, use one of the aforementioned techniques, or proceed with reverse shoulder arthroplasty remains a decision to be made in the context of patient's unique demands and provider comfort with the various modalities of treatment.

Failed and Revision Rotator Cuff Repair **141**

Ian S. MacLean and Stephen F. Brockmeier

With an increasing incidence of rotator cuff repairs (RCRs), and by extension, RCR failures, surgeons must be facile in the diagnosis and management of this complication. A detailed history and physical exam as well as familiarity with the patient-specific, anatomic, and technical variables that increase a patient's risk of RCR failure is critical. Modifiable factors should be addressed prior to revision RCR and non-modifiable factors should be examined as they may disqualify an individual from a revision attempt. A methodical surgical approach is critical. In general, outcomes following revision RCR are typically favorable although inferior than those following primary RCR.

Treatment of Massive Rotator Cuff Tears with Reverse Shoulder Arthroplasty **157**

Evangeline F. Kobayashi, Sameer R. Oak, Bruce S. Miller, and Asheesh Bedi

Most massive rotator cuff tears (MCTs) are often successfully treated with nonoperative treatment; however, various surgical treatment options are available if conservative management fails. Several joint preserving techniques for MCT are commonly used, but the options are limited if an MCT is irreparable. Reverse total shoulder arthroplasty (RTSA) is gaining popularity over hemiarthroplasty as a treatment option for irreparable MCT, especially if glenohumeral degenerative changes are present. RTSA has been shown to have improved functional outcomes and range of motion postoperatively, particularly in the elderly and patients with pseudoparalysis.

Rehabilitation and Return to Work and Sport After Rotator Cuff 175

Adam Z. Khan, Kurt E. Stoll, and Brandon J. Erickson

This review covers a systematic approach to rehabilitation following rotator cuff repair. Rates of return to work and return to a prior level of sports activity in patients that have undergone rotator cuff repair will be reviewed. Risk factors and predictors of a patient's inability to return to work or prior level of sports participation will be discussed. Overall, there is a high level of return to work and sports following rotator cuff repair. Heavy manual laborers are at higher risk of not returning to a prior level of work, whereas professional overhead athletes are at higher risk of not returning to their prior level of play following rotator cuff repair.