

# GUEST EDITORIAL

## What's New in Shoulder and Elbow Surgery

H. Mike Kim, MD, Eric T. Ricchetti, MD, and Jason E. Hsu, MD

*Investigation performed at the Department of Orthopaedic Surgery, University of Missouri, Columbia, Missouri*

This update is a review of the most impactful studies related to shoulder and elbow surgery published from April 2021 to March 2022. Included are clinical studies primarily from *The Journal of Bone & Joint Surgery*, the *Journal of Shoulder and Elbow Surgery*, *The American Journal of Sports Medicine*, and *Arthroscopy: The Journal of Arthroscopic & Related Surgery*. Specific emphasis has been placed on higher-quality research (Level-I and II studies) and particularly relevant Level-III studies.

### Rotator Cuff Repair

The decision to indicate operative repair for degenerative rotator cuff tears is controversial. Kukkonen et al.<sup>1</sup> provided a mean 6.2-year follow-up in 150 patients who were >55 years of age; had small, full-thickness supraspinatus tears; and were randomized to physiotherapy only, acromioplasty and physiotherapy, or repair, acromioplasty, and physiotherapy. The mean change in Constant score (the primary outcome) was similar in the 3 groups, as were changes in the visual analog scale (VAS) pain and satisfaction scores. There was a significant progression of arthritis from baseline to follow-up for the entire cohort without a difference between groups. The authors suggested that operative repair is no better than conservative treatment and does not protect against degeneration of the glenohumeral joint.

Long-term follow-up comparing single-row and double-row repair techniques is uncommon. Lapner et al.<sup>2</sup> reported a 10-year follow-up to a previous 2-year report of a randomized controlled trial (RCT) of 90 patients comparing single-row and double-row repair. At 10 years, the Western Ontario Rotator Cuff Index (WORC) scores were higher in the double-row group. Between 2 and 10 years, significant decreases in the WORC and American Shoulder and Elbow Surgeons (ASES) scores were seen in the single-row repair group but not in the double-row repair group. Only 30 patients had 10-year ultrasound data, which demonstrated similar retear rates between groups: 23% for the single-row repair group compared with 42% for the double-row repair group ( $p = 0.418$ ). The authors concluded that double-row fixation preserved joint function

between 2 and 10 years whereas single-row fixation demonstrated functional decline in the same time period.

The optimal approach to massive cuff tears is debatable. Wong et al.<sup>3</sup> randomized 30 patients to bridging dermal allograft reconstruction or single-row repair. At 2 years, bridging reconstruction with allograft was associated with better WORC and Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH) scores, decreased progression to rotator cuff arthropathy, and maintenance of the acromiohumeral distance. At a mean of 1.2 years, the complete retear rate was significantly higher in the repair group at 87% compared with 21% in the reconstruction group. Ozturk et al.<sup>4</sup> randomized 42 patients to either arthroscopic-assisted latissimus dorsi transfer or arthroscopic-assisted superior capsular reconstruction. At a mean 32-month follow-up, the ASES and Constant scores were higher in the superior capsular reconstruction group. However, the latissimus dorsi transfer group had a significant increase in acromiohumeral distance and the superior capsular reconstruction group did not.

Optimal management of biceps tendon pathology encountered at the time of cuff repair is uncertain. Van Deurzen et al.<sup>5</sup> performed a multicenter trial of 100 patients who were >50 years of age, had tears of <3 cm, and were randomized to either subpectoral biceps tenodesis or tenotomy. The confidence interval of Constant score differences between groups at 1 year exceeded the noninferiority margin, suggesting that biceps tenotomy was not noninferior to tenodesis. Improvements in the Constant score and the rate of Popeye deformity were similar between groups.

The role of concomitant suprascapular nerve release at the time of cuff repair for traction neuropathy of the suprascapular nerve is unclear. Sachinis et al.<sup>6</sup> performed a double-blinded RCT comparing suprascapular nerve recovery in 37 patients with large or massive tears undergoing either rotator cuff repair alone or repair with suprascapular nerve release. Electromyography-confirmed full nerve recovery was obtained in a similar proportion of the groups at 12 months: 90% of the control group and 83% of the nerve release group. There were no significant differences in ASES, Constant, and DASH scores at 6 or 12 months. The authors concluded that the release of the

**Disclosure:** The Disclosure of Potential Conflicts of Interest forms are provided with the online version of the article (<http://links.lww.com/JBJS/H167>).

## WHAT'S NEW IN SHOULDER AND ELBOW SURGERY

transverse scapular ligament during rotator cuff repair did not lead to better results compared with cuff repair alone.

The role of platelet-rich plasma in healing after rotator cuff repair continues to be studied. Randelli et al.<sup>7</sup> reported on a 10-year follow-up comparing 26 patients who received autologous platelet-rich plasma applied at the end of the repair of a full-thickness tear with 27 patients who had repair without platelet-rich plasma. The authors found that satisfaction was high in both groups without a significant difference in Constant scores, University of California Los Angeles (UCLA) scores, and VAS pain scores. The retear rate was 35% in the platelet-rich plasma group compared with 38% in the control group ( $p = 1.000$ ). The authors concluded that, at 10 years, clinical and radiographic outcomes were similar between the patients who received platelet-rich plasma and the patients who did not.

### Postoperative Pain Control

Two RCTs investigated the use of local liposomal bupivacaine after cuff repair. Verdecchia et al.<sup>8</sup> randomized 58 patients to liposomal bupivacaine into the subacromial space or a saline solution control group. All patients received a standard interscalene single-shot nerve block. Pain scores were similar on resolution of the nerve block and postoperative days 1 and 2 but significantly lower in the liposomal bupivacaine group on postoperative day 3. The authors concluded that local injection of liposomal bupivacaine provides minimal improvement in patients undergoing rotator cuff repair. Opioid requirements and patient satisfaction were similar between groups. Hill-esheim et al.<sup>9</sup> randomized 87 patients to either periarticular liposomal bupivacaine injection or single-shot interscalene block. The interscalene block group had significantly lower VAS pain scores and lower opioid consumption on the day of the surgical procedure, but opioid requirements were significantly higher in the interscalene group on postoperative days 1 and 2.

Two studies were confirmatory of the integral role of over-the-counter medications in pain control after rotator cuff repair. Tangtiphaiboonana et al.<sup>10</sup> demonstrated lower opioid consumption in the first postoperative week and lower early VAS pain scores after cuff repair in patients randomized to receive ibuprofen compared with those randomized to receive a placebo. The rate of tendon retear was not significantly different in the 2 groups. Singh et al.<sup>11</sup> randomized 77 patients to 1 of 3 groups: (1) opioid as needed only, (2) opioid and acetaminophen as needed, and (3) scheduled acetaminophen with opioid as needed. They found that patients who received scheduled acetaminophen with opioid as needed required the least amount of opioids and reported significantly better pain control than the other 2 groups.

### Shoulder Arthroplasty

#### Perioperative Management

Given concerns over opioid misuse, there remains interest in investigating multimodal pain control regimens after shoulder arthroplasty. Klag et al.<sup>12</sup> evaluated the effect of 10-mg intravenous dexamethasone within 90 minutes of the surgical

procedure on pain control and postoperative nausea and vomiting in an RCT of 75 patients undergoing anatomic or reverse total shoulder arthroplasty (TSA). The dexamethasone group ( $n = 43$ ) had significantly lower antiemetic use, mean VAS pain scores, and mean morphine equivalent use over the first 24 hours postoperatively compared with the control group ( $n = 32$ ). There was no significant difference in glucose control or complications between groups. An RCT<sup>13</sup> and a systematic review with meta-analysis of all prior Level-I and II RCTs<sup>14</sup> compared local injections with interscalene nerve blocks for postoperative pain control after shoulder arthroplasty and favored the use of interscalene blocks. In the systematic review<sup>14</sup>, 1,358 shoulders across 18 studies were analyzed. At 4 and 8 hours postoperatively, patients who received local liposomal bupivacaine or ropivacaine injections had significantly more pain compared with patients who received either continuous or single-shot interscalene nerve blocks. Patients who had continuous interscalene nerve blocks or single-shot blocks combined with local liposomal bupivacaine injections also had significantly less pain than patients who had other treatment modalities at 24 hours postoperatively. On advanced analysis, single-shot interscalene nerve blocks in isolation or combined with local liposomal bupivacaine injections were the most favorable pain control treatment at time points prior to 24 hours, and continuous interscalene nerve blocks were the best treatment for pain control at 24 and 48 hours and limited opioid use the most at 24 hours.

### Cutibacterium Acnes and Infection Prevention and Treatment

Inoculation of *C. acnes* into the surgical wound during shoulder surgery remains a concern, and multiple recent studies have further investigated methods to decrease *C. acnes* loads in skin and deeper tissues at the time of primary surgery. In an RCT, Scheer et al.<sup>15</sup> compared the effect of preoperative home washes with ( $n = 45$ ) and without ( $n = 55$ ) application of 5% benzoyl peroxide (BPO) gel prior to open shoulder surgery on the reduction of *C. acnes* on the skin and dermis. The use of BPO yielded significantly lower *C. acnes* culture growth on the skin before surgical skin preparation (58% compared with 91%) and after surgical skin preparation (4% compared with 22%) and also lowered *C. acnes* skin growth measured by bacterial colony-forming units at wound closure, but there was no difference between the groups in *C. acnes* growth from deeper dermal cultures. These results add to the existing literature that BPO can reduce but not eliminate *C. acnes* from the surgical incision.

Moor et al.<sup>16</sup> examined the benefit of subcutaneous disinfection to reduce *C. acnes* positive cultures in a 2:1 RCT of patients undergoing primary open deltopectoral shoulder surgery. After skin incision, the subcutaneous layer was treated with povidone-iodine solution in the disinfection group, and culture swabs were then taken from the deeper surgical field. The disinfection group ( $n = 70$ ) had a significantly lower positive culture rate compared with controls ( $n = 38$ ) for

## WHAT'S NEW IN SHOULDER AND ELBOW SURGERY

bacteria overall (19% compared with 37%) and *C. acnes* (9% compared with 26%). The reduction of positive *C. acnes* swab cultures was significant for the surgeons' gloves and surgical retractors. Grewal et al.<sup>17</sup> investigated subcutaneous disinfection in an RCT of patients undergoing primary shoulder arthroplasty, with 30 patients undergoing standard skin preparation and 30 patients receiving an additional application of 3% hydrogen peroxide to the dermis following incision. Culture samples were taken of the skin, dermis, glenohumeral joint, and air. *C. acnes* grew on all positive cultures, which were only from the samples taken from the skin and dermis, with no difference in positive culture rate between the hydrogen peroxide group (20%) and the control group (16%).

Positive cultures following presumed aseptic revision shoulder arthroplasty are common and have been deemed unexpected positive cultures, yet their clinical importance is still not well understood. Falstie-Jensen et al.<sup>18</sup> conducted a prospective, nationwide cohort study over a 3-year period of all patients undergoing a presumed aseptic 1-stage revision shoulder arthroplasty with a minimum 2-year follow-up (n = 124). Five deep-tissue specimens were sent for culture in each case. Cases with  $\geq 3$  positive cultures of the same bacteria were classified as unexpected positive cultures and were treated with a 6-week course of combined intravenous and oral antibiotics. Unexpected positive cultures were present in 27 revisions (22%), more commonly in men and most commonly growing *C. acnes* (67% [18 of 27]). No significant differences were found between the groups with or without unexpected positive cultures with regard to the Oxford Shoulder Score and shoulder motion both preoperatively and at the most recent follow-up.

### Anatomic TSA

Iannotti et al.<sup>19</sup> prospectively evaluated patients with moderate to severe Walch B2 (n = 29) and B3 (n = 21) glenoid pathology undergoing anatomic TSA with stepped augmented anchor peg glenoid components compared with patients with Walch A1 glenoids and non-augmented anchor peg glenoids (n = 42). The authors examined the clinical outcomes and sequential 3-dimensional (3D) computed tomography (CT) at a minimum 2-year follow-up. On analysis of the 3D CT, augmented components restored premorbid glenoid anatomy in patients with Walch B2 glenoids, and there was no significant difference in glenoid component central peg osteolysis (CPO) between patients with Walch B2 glenoids and augmented components (10%) and patients with Walch A1 glenoids with non-augmented glenoids (5%). Patients with Walch B3 glenoids with augmented components had a significantly higher CPO rate at 29% compared with patients with Walch A1 glenoids at 5%, and more glenoid component medialization compared with patients with Walch A1 and B2 glenoids. Penn Shoulder Scores and rates of glenoid component shift were not significantly different across groups. These patients were part of a larger prospective anatomic TSA cohort (n = 152) that was

evaluated for glenoid component migration or shift and radiolucency over time using sequential 3D CT analysis. Ricchetti et al.<sup>20</sup> found that, at a minimum 2-year follow-up, glenoid component shift occurred in 78 patients (51%), most commonly into superior inclination, although CPO occurred in only 19 patients (13%) and most patients with shift did not develop CPO (81%).

### Reverse TSA

Multiple recent RCTs have evaluated treatment interventions in primary reverse TSA. Torrens et al.<sup>21</sup> compared baseplate positioning between the deltopectoral approach (n = 49) and the anterosuperior approach (n = 49). There were no differences with regard to the glenosphere overhang, but slightly more superior tilt was seen in the anterosuperior approach across several measures. No significant differences were found between groups at the 2-year follow-up with regard to the Constant score, scapular notching, and complications. Van de Kleut et al.<sup>22</sup> compared clinical outcomes and humeral implant migration between standard-length cemented stems (n = 19) and press-fit short stems (n = 17) using model-based radiostereometric analysis on sequential radiographs in a 2-year follow-up. Press-fit short stems migrated significantly more inferiorly at 6 months and 1 and 2 years, consistent with subsidence, and had greater total mean translation at 2 years ( $1.0 \pm 1.1$  mm) compared with cemented standard stems ( $0.4 \pm 0.2$  mm), but the mean migration between 1 and 2 years was minimal for both groups. There was no difference in shoulder motion, pain, or validated outcome measures between groups at 2 years. The same randomized cohort was also used to compare clinical outcomes and glenoid implant migration between bony increased offset (BIO) baseplates (n = 17) and metal-augmented baseplates (n = 18) in a 2-year follow-up.<sup>23</sup> No significant differences were observed in implant migration at any time point. The mean total glenoid component translation at 2 years was  $0.4 \pm 0.2$  mm in the BIO group and  $0.5 \pm 0.3$  mm in the metal-augmented group. Active external rotation was significantly better in the BIO group at 2 years, but no other clinical outcomes differed between groups.

### Instability

Studies have shown promising results of surgical treatment after first-time traumatic anterior shoulder dislocations in young patients, but such treatment is not universally accepted. Pougès et al.<sup>24</sup> conducted an RCT in which 40 patients between 18 and 25 years of age were randomized into either an operative treatment group or a nonoperative treatment group after a first-time anterior shoulder dislocation. The operative treatment group was treated with arthroscopic Bankart repair within 2 weeks of dislocation, and the nonoperative treatment group was treated with immobilization for 3 weeks followed by physical therapy. Patients with hyperlaxity, a glenoid bone defect of  $>25\%$ , or a humeral avulsion of the glenohumeral ligament were excluded. The operative treatment group had

## WHAT'S NEW IN SHOULDER AND ELBOW SURGERY

significantly fewer recurrences of instability (10%) than the nonoperative treatment group (70%). The Walch-Duplay and Western Ontario Shoulder Instability Index (WOSI) scores were significantly better in the operative treatment group compared with the nonoperative treatment group after 2 years. Their findings confirmed that arthroscopic Bankart repair reduced the risk of secondary dislocation and improved functional outcomes after a first-time dislocation in young patients compared with nonoperative treatment. The concept of immobilization in external rotation after a first-time dislocation was introduced to reduce the risk of recurrent instability<sup>25,26</sup>, but its efficacy remains controversial. Itoi et al. recently conducted a long-term follow-up study<sup>27</sup> on the original patient cohort included in their 2007 RCT<sup>26</sup>. Their original study<sup>26</sup> had 159 patients who completed a mean 2-year follow-up and showed a significantly lower rate of recurrent instability in the external rotation group (26%) than in the internal rotation group (42%). The follow-up study<sup>27</sup> included 56 patients with a mean follow-up period of 18.2 years. The overall recurrence rate was 33% in the external rotation group and 55% in the internal rotation group, which was not a significant difference. When patients who had undergone stabilization surgery and those with a Single Assessment Numeric Evaluation (SANE) score of  $\leq 70\%$  were counted as “failure” cases, the failure rate in the external rotation group (26%) was significantly lower than in the internal rotation group (52%).

For chronic recurrent anterior instability, numerous studies demonstrated the efficacy of arthroscopic Bankart repair to be comparable with that of open Bankart repair in the short to intermediate term, but the long-term efficacy had not been examined in prospective randomized trials. Bottoni et al.<sup>28</sup> conducted a 15-year follow-up study on 60 patients who were randomized into arthroscopic stabilization or open stabilization. The long-term failure rate was not significantly different between the arthroscopic stabilization group (14.3%) and the open stabilization group (12.5%). The subjective shoulder outcome scores were not significantly different. Two (25%) of 8 patients with a glenoid off-track lesion and 6 (12.5%) of 48 patients with an on-track lesion had treatment failure, which did not reach significance. Arthroscopic remplissage has evolved in recent years as a reproducible surgical technique, and its efficacy in decreasing recurrence of instability has been demonstrated in many low-level studies. In an RCT, MacDonald et al.<sup>29</sup> examined the efficacy of arthroscopic remplissage in patients with recurrent anterior instability and an engaging Hill-Sachs lesion. All patients had  $< 15\%$  glenoid bone loss. A total of 108 patients were included and had a mean follow-up of 25 months. The rates of recurrent instability were significantly different between groups, with 18% in the no-remplissage group and 4% in the remplissage group. The rate of revision surgery was significantly higher in the no-remplissage group (12%) than in the remplissage group (0%). Additionally, the authors noted a higher risk of redislocation in patients with a Hill-Sachs lesion  $\geq 20$  mm

in width or  $\geq 15\%$  of humeral head diameter if a concomitant remplissage was not performed.

The size of a labral tear in patients with instability can be an important consideration in patient counseling and surgical planning. Preoperative imaging and physical examination have been shown to be poor predictors of labral tear size. In a multicenter, prospective cohort study on 1,235 patients with instability, Cronin et al.<sup>30</sup> investigated factors predictive of a large labral tear involving a  $> 270^\circ$  arc of the labrum. They found that patients with a labral tear  $> 270^\circ$  were more likely to be male and have worse preoperative WOSI scores. Additionally, patients who had a body mass index of  $> 25$  kg/m<sup>2</sup> and played contact sports were at higher risk for having a large tear. Age, number of dislocations, and injury during sports participation were not associated with having a larger tear.

### Fracture

Nonoperative treatment of proximal humeral fractures has been widely adopted and has shown overall satisfactory outcomes. However, few studies have examined patient-reported outcomes of nonoperative treatment in a large cohort. In a prospective cohort study, Goudie et al.<sup>31</sup> examined patient-reported outcomes at 1 year in 774 patients in whom a proximal humeral fracture was treated nonoperatively. All included patients underwent the same nonoperative treatment consisting of 3 weeks of immobilization followed by physical therapy. The authors observed considerable variation in shoulder function and perceived general health. Although satisfactory outcomes and near-normal functional scores were observed in the majority of patients, a substantial proportion of patients (30.9%) had mediocre or poor outcomes. Most of the variation in the outcomes could be predicted by pre-morbid demographic and psychosocial characteristics; the level of independency, social deprivation score, and history of affective (mood) disorder were consistently the strongest independent predictors of a poor outcome. There is no evidence-based consensus on the duration of immobilization if nonoperative treatment is chosen for a proximal humeral fracture. Martínez et al.<sup>32</sup> reported the result of their randomized clinical trial, which randomized 111 patients into 1-week or 3-week immobilization groups. They collected data on VAS pain, Simple Shoulder Test, and Constant scores at multiple time points up to 2 years. The 2 groups showed no significant differences in those measures at any time points, indicating that a 1-week immobilization was as effective as a 3-week immobilization. Secondary fracture displacement was more common in the 1-week immobilization group (0.7%) than in the 3-week immobilization group (0.2%). The complication rates were not significantly different between the groups. One common scenario for choosing operative treatment for a proximal humeral fracture is when there is a high risk of nonunion, but it is difficult to predict the nonunion risk in the immediate postinjury period. Goudie and Robinson<sup>33</sup> performed a retrospective cohort study on 2,230 patients in whom a proximal humeral fracture was

## WHAT'S NEW IN SHOULDER AND ELBOW SURGERY

treated nonoperatively to investigate the prevalence and predictors of nonunion. Overall, 10.4% of patients developed nonunion at 24 weeks following the injury, but patients with valgus angulation of the humeral head showed an extremely low risk of nonunion (<1%). An analysis of patients with neutral or varus head angulation identified  $\geq 50\%$  head-shaft translation,  $\leq 90^\circ$  head-shaft angle (more varus), and smoking as independent risk factors for nonunion.

### Adhesive Capsulitis

Nonoperative treatment is the mainstay of treatment for primary idiopathic adhesive capsulitis. Koraman et al.<sup>34</sup> conducted an RCT to evaluate the efficacy of multisite corticosteroid injections in comparison with a single glenohumeral intra-articular injection. The authors randomized 76 patients with primary adhesive capsulitis into 2 groups and collected clinical data up to 1 year after the injection. The multisite injection group showed significant superiority in pain scores, ASES and UCLA scores, and range-of-motion restoration compared with the single glenohumeral injection group. It should be noted that the doses and compositions of the injections administered to the 2 groups were not identical, and the multisite injection group received a higher total dose of triamcinolone than the single-injection group.

### Elbow

It is unknown whether continuous passive motion provides greater benefit than physical therapy in maintaining elbow motion after open contracture release for elbow stiffness. O'Driscoll et al.<sup>35</sup> performed a randomized clinical trial comparing these 2 approaches. At 1 year, the arc of elbow motion was significantly greater in patients who received continuous passive motion. In addition, the rate of recovery was faster in the continuous passive motion, as demonstrated by the greater range of motion at both 6 weeks and 3 months compared with physical therapy. The proportion of patients who obtained functional range of motion was 62% higher in the continuous passive motion group compared with the physical therapy group. The authors suggested that these data may help to decrease barriers to insurance approval of continuous passive motion use.

The treatment of Mason type-2 radial head fractures is controversial. Mulders et al.<sup>36</sup> performed a multicenter RCT

comparing operative fixation with nonoperative treatment. The DASH, Oxford Elbow, and Mayo Elbow Performance scores were similar between groups at 3, 6, and 12 months. The authors suggested that operative fixation is not superior to nonoperative treatment of Mason type-2 fractures.

The need for postoperative immobilization after single-incision distal biceps fixation with a cortical button was studied by Bergman et al.<sup>37</sup>. There were 101 patients randomized to either early mobilization with active range of motion as tolerated or 6 weeks of immobilization in a splint with no active motion. There were no differences between groups in the primary outcome of return to work. The early mobilization group had significantly greater passive supination and a trend toward greater pronation. Full-thickness retear occurred in 1 patient in each group.

### Evidence-Based Orthopaedics

The editorial staff of *JBJS* reviewed a large number of recently published studies related to the musculoskeletal system that received a higher Level of Evidence grade. In addition to articles cited already in this update, 4 other articles with a higher Level of Evidence grade relevant to shoulder and elbow surgery are appended to this review after the standard bibliography, with a brief commentary about each article to help guide your further reading, in an evidence-based fashion, in this subspecialty area.

H. Mike Kim, MD<sup>1</sup>  
Eric T. Ricchetti, MD<sup>2</sup>  
Jason E. Hsu, MD<sup>3</sup>

<sup>1</sup>Department of Orthopaedic Surgery, University of Missouri, Columbia, Missouri

<sup>2</sup>Department of Orthopaedic Surgery, Cleveland Clinic Foundation, Cleveland, Ohio

<sup>3</sup>Department of Orthopaedic Surgery, University of Washington, Seattle, Washington

Email for corresponding author: hmikekim9@gmail.com

### References

- Kukkonen J, Ryösä A, Joukainen A, Lehtinen J, Kauko T, Mattila K, Äärimala V. Operative versus conservative treatment of small, nontraumatic supraspinatus tears in patients older than 55 years: over 5-year follow-up of a randomized controlled trial. *J Shoulder Elbow Surg.* 2021 Nov;30(11):2455-64.
- Lapner P, Li A, Pollock JW, Zhang T, McIlquham K, McRae S, MacDonald P. A multicenter randomized controlled trial comparing single-row with double-row fixation in arthroscopic rotator cuff repair: long-term follow-up. *Am J Sports Med.* 2021 Sep;49(11):3021-9.
- Wong I, Sparavalo S, King JP, Coady CM. Bridging allograft reconstruction is superior to maximal repair for the treatment of chronic, massive rotator cuff tears: results of a prospective, randomized controlled trial. *Am J Sports Med.* 2021 Oct;49(12):3173-83.
- Ozturk BY, Ak S, Gultekin O, Baykus A, Kulduk A. Prospective, randomized evaluation of latissimus dorsi transfer and superior capsular reconstruction in massive, irreparable rotator cuff tears. *J Shoulder Elbow Surg.* 2021 Jul;30(7):1561-71.
- van Deurzen DFP, Auw Yang KG, Onstenk R, Raven EEJ, van den Borne MPJ, Hoelen MA, Wessel RN, Willigenburg NW, Klaassen AD, van den Bekerom MPJ; BITE Study Group. Long head of biceps tenotomy is not inferior to suprapectoral tenodesis in arthroscopic repair of nontraumatic rotator cuff tears: a multicenter, non-inferiority, randomized, controlled clinical trial. *Arthroscopy.* 2021 Jun;37(6):1767-1776.e1.
- Sachinis NP, Papagiannopoulos S, Sarris I, Papadopoulos P. Outcomes of arthroscopic nerve release in patients treated for large or massive rotator cuff tears and associated suprascapular neuropathy: a prospective, randomized, double-blinded clinical trial. *Am J Sports Med.* 2021 Jul;49(9):2301-8.

## WHAT'S NEW IN SHOULDER AND ELBOW SURGERY

7. Randelli PS, Stoppiani CA, Santarsiero G, Nocerino E, Menon A. Platelet-rich plasma in arthroscopic rotator cuff repair: clinical and radiological results of a prospective randomized controlled trial study at 10-year follow-up. *Arthroscopy*. 2022 Jan;38(1):51-61.
8. Verdecchia NM, Rodosky MW, Kentor M, Orebaugh SL. Liposomal bupivacaine infiltration in the surgical site for analgesia after rotator cuff repair: a randomized, double-blinded, placebo-controlled trial. *J Shoulder Elbow Surg*. 2021 May;30(5):986-93.
9. Hillesheim RA, Kumar P, Broliin TJ, Bernholt DL, Sethi PM, Kowalsky MS, Azar FM, Throckmorton TW. Periarticular liposomal bupivacaine mixture injection vs. single-shot interscalene block for postoperative pain in arthroscopic rotator cuff repair: a prospective randomized controlled trial. *J Shoulder Elbow Surg*. 2021 Dec;30(12):2691-7.
10. Tangtiphaiboonatana J, Fignoni AM, Luke A, Zhang AL, Feeley BT, Ma CB. The effects of nonsteroidal anti-inflammatory medications after rotator cuff surgery: a randomized, double-blind, placebo-controlled trial. *J Shoulder Elbow Surg*. 2021 Sep;30(9):1990-7.
11. Singh AM, Kirsch JM, Patel MS, Gutman M, Harper T, Lazarus M, Horneff JG, Namdari S, Voskerijjian A, Abboud JA. Effect of perioperative acetaminophen on pain management in patients undergoing rotator cuff repair: a prospective randomized study. *J Shoulder Elbow Surg*. 2021 Sep;30(9):2014-21.
12. Klag EA, Kuhlmann NA, Tramer JS, Franovic S, Muh SJ. Dexamethasone decreases postoperative opioid and antiemetic use in shoulder arthroplasty patients: a prospective, randomized controlled trial. *J Shoulder Elbow Surg*. 2021 Jul;30(7):1544-52.
13. Ali I, Gupta HO, Khazzam M, Thomas GL, Vattigunta S, Shi BY, Jenkins SG, Sriksmaran U. Do local liposomal bupivacaine and interscalene nerve block provide similar pain control after shoulder arthroplasty? A dual-center randomized controlled trial. *J Shoulder Elbow Surg*. 2021 Jul;30(7S):S145-52.
14. Xiao M, Cohen SA, Cheung EV, Freehill MT, Abrams GD. Pain management in shoulder arthroplasty: a systematic review and network meta-analysis of randomized controlled trials. *J Shoulder Elbow Surg*. 2021 Nov;30(11):2638-47.
15. Scheer VM, Jungeström MB, Serrander L, Kalén A, Scheer JH. Benzoyl peroxide treatment decreases Cutibacterium acnes in shoulder surgery, from skin incision until wound closure. *J Shoulder Elbow Surg*. 2021 Jun;30(6):1316-23.
16. Moor BK, Léger B, Steffen V, Troillet N, Emonet S, Gallusser N. Subcutaneous tissue disinfection significantly reduces Cutibacterium acnes burden in primary open shoulder surgery. *J Shoulder Elbow Surg*. 2021 Jul;30(7):1537-43.
17. Grewal G, Polisetty T, Boltuch A, Colley R, Tapia R, Levy JC. Does application of hydrogen peroxide to the dermis reduce incidence of Cutibacterium acnes during shoulder arthroplasty: a randomized controlled trial. *J Shoulder Elbow Surg*. 2021 Aug;30(8):1827-33.
18. Falstie-Jensen T, Lange J, Daugaard H, Sørensen AKB, Ovesen J, Søballe K; ROSA Study Group. Unexpected positive cultures after revision shoulder arthroplasty: does it affect outcome? *J Shoulder Elbow Surg*. 2021 Jun;30(6):1299-308.
19. Iannotti JP, Jun BJ, Derwin KA, Ricchetti ET. Stepped augmented glenoid component in anatomic total shoulder arthroplasty for B2 and B3 glenoid pathology: a study of early outcomes. *J Bone Joint Surg Am*. 2021 Oct 6;103(19):1798-806.
20. Ricchetti ET, Jun BJ, Jin Y, Ho JC, Patterson TE, Dalton JE, Derwin KA, Iannotti JP. Relationship between glenoid component shift and osteolysis after anatomic total shoulder arthroplasty: three-dimensional computed tomography analysis. *J Bone Joint Surg Am*. 2021 Aug 4;103(15):1417-30.
21. Torrens C, Amestoy J, Rodríguez-Delourme I, Santana F. Positioning of the metaglene in reverse shoulder arthroplasty: deltopectoral versus anterosuperior approach: a prospective randomized trial. *J Shoulder Elbow Surg*. 2021 Dec;30(12):2682-90.
22. Van de Kleut ML, Yuan X, Athwal GS, Teeter MG. Are short press-fit stems comparable to standard-length cemented stems in reverse shoulder arthroplasty? A prospective, randomized clinical trial. *J Shoulder Elbow Surg*. 2022 Mar;31(3):580-90.
23. Van de Kleut ML, Yuan X, Teeter MG, Athwal GS. Bony increased-offset reverse shoulder arthroplasty vs. metal augments in reverse shoulder arthroplasty: a prospective, randomized clinical trial with 2-year follow-up. *J Shoulder Elbow Surg*. 2022 Mar;31(3):591-600.
24. Pougès C, Hardy A, Vervoort T, Amouyel T, Duriez P, Lalanne C, Szymanski C, Deken V, Chantelot C, Upex P, Maynou C. Arthroscopic Bankart repair versus immobilization for first episode of anterior shoulder dislocation before the age of 25: a randomized controlled trial. *Am J Sports Med*. 2021 Apr;49(5):1166-74.
25. Itoi E, Sashi R, Minagawa H, Shimizu T, Wakabayashi I, Sato K. Position of immobilization after dislocation of the glenohumeral joint. A study with use of magnetic resonance imaging. *J Bone Joint Surg Am*. 2001 May;83(5):661-7.
26. Itoi E, Hatakeyama Y, Sato T, Kido T, Minagawa H, Yamamoto N, Wakabayashi I, Nozaka K. Immobilization in external rotation after shoulder dislocation reduces the risk of recurrence. A randomized controlled trial. *J Bone Joint Surg Am*. 2007 Oct;89(10):2124-31.
27. Itoi E, Hatakeyama Y, Kido T, Saito H, Watanabe W, Itoigawa Y, Shiozaki H, Kon Y, Mori S, Yamamoto N, Aizawa T. Long-term effect of immobilization in external rotation after first-time shoulder dislocation: an average 18-year follow-up. *J Shoulder Elbow Surg*. 2022 Mar;31(3):601-7.
28. Bottoni CR, Johnson JD, Zhou L, Raybin SG, Shaha JS, Cruz CA, Lindell KK, Thoma DC. Arthroscopic versus open anterior shoulder stabilization: a prospective randomized clinical trial with 15-year follow-up with an assessment of the glenoid being "on-track" and "off-track" as a predictor of failure. *Am J Sports Med*. 2021 Jul;49(8):1999-2005.
29. MacDonald P, McRae S, Old J, Marsh J, Dubberley J, Stranges G, Koenig J, Leiter J, Mascarenhas R, Prabhakar S, Sasyniuk T, Lapner P. Arthroscopic Bankart repair with and without arthroscopic infraspinatus remplissage in anterior shoulder instability with a Hill-Sachs defect: a randomized controlled trial. *J Shoulder Elbow Surg*. 2021 Jun;30(6):1288-98.
30. Cronin KJ, Magnuson JA, Wolf BR, Hawk GS, Thompson KL, Jacobs CA, Hettrich CM, Bishop JY, Bollier MJ, Baumgarten KM, Bravman JT, Brophy RH, Cox CL, Feeley BT, Frank RM, Grant JA, Jones GL, Kuhn JE, Ma CB, Marx RG, McCarty EC, Miller BS, Neviasser AS, Seidl AJ, Smith MV, Wright RW, Zhang AL; MOON Shoulder Group. Male sex, Western Ontario Shoulder Instability Index score, and sport as predictors of large labral tears of the shoulder: a Multicenter Orthopaedic Outcomes Network (MOON) Shoulder Instability Cohort Study. *Arthroscopy*. 2021 Jun;37(6):1740-4.
31. Goudie EB, MacDonald DJ, Robinson CM. Functional outcome after nonoperative treatment of a proximal humeral fracture in adults. *J Bone Joint Surg Am*. 2022 Jan 19;104(2):123-38.
32. Martínez R, Santana F, Pardo A, Torrens C. One versus 3-week immobilization period for nonoperatively treated proximal humeral fractures: a prospective randomized trial. *J Bone Joint Surg Am*. 2021 Aug 18;103(16):1491-8.
33. Goudie EB, Robinson CM. Prediction of nonunion after nonoperative treatment of a proximal humeral fracture. *J Bone Joint Surg Am*. 2021 Apr 21;103(8):668-80.
34. Koraman E, Turkmen I, Uygun E, Poyanlı O. A multisite injection is more effective than a single glenohumeral injection of corticosteroid in the treatment of primary frozen shoulder: a randomized controlled trial. *Arthroscopy*. 2021 Jul;37(7):2031-40.
35. O'Driscoll SW, Lievano JR, Morrey ME, Sanchez-Sotelo J, Shukla DR, Olson TS, Fitzsimmons JS, Vaichinger AM, Shields MN. Prospective randomized trial of continuous passive motion versus physical therapy after arthroscopic release of elbow contracture. *J Bone Joint Surg Am*. 2022 Mar 2;104(5):430-40.
36. Mulders MAM, Schep NWL, de Muinck Keizer RO, Kodde IF, Hoogendoorn JM, Goslings JC, Eygendaal D. Operative vs. nonoperative treatment for Mason type 2 radial head fractures: a randomized controlled trial. *J Shoulder Elbow Surg*. 2021 Jul;30(7):1670-8.
37. Bergman JW, Silveira A, Chan R, Lapner M, Hildebrand KA, Le IL, Sheps DM, Beaupre LA, Lalani A. Is immobilization necessary for early return to work following distal biceps repair using a cortical button technique? A randomized controlled trial. *J Bone Joint Surg Am*. 2021 Oct 6;103(19):1763-71.

**Evidence-Based Orthopaedics**

**Kim H, Kim HJ, Lee ES, Lee S, Park JH, Kim H, Jeon IH, Koh WU, Koh KH.** Postoperative pain control after arthroscopic rotator cuff repair: arthroscopy-guided continuous suprascapular nerve block versus ultrasound-guided continuous interscalene block. *Arthroscopy*. 2021 Nov;37(11):3229-37.

A suprascapular nerve block has the benefit of avoiding potential unintended adverse effects of interscalene nerve blocks such as diaphragmatic paralysis, but its efficacy has not been examined in prospective cohort studies. Kim et al. enrolled 76 patients who received either arthroscopy-guided con-

tinuous suprascapular nerve block or interscalene nerve block after rotator cuff repair. For the suprascapular nerve block group, an indwelling catheter was inserted via the Neviasser portal under an arthroscopic view. The authors found similar pain scores and opioid consumption in the 2 groups at 4, 8, 24, and 48 hours. Temporary neurologic deficits were more common in the interscalene nerve block group (32 patients) than in the suprascapular nerve block group (8 patients). The authors concluded that arthroscopy-guided continuous suprascapular nerve block showed comparable postoperative pain control to interscalene block while causing fewer neurologic deficits. The study was a

## WHAT'S NEW IN SHOULDER AND ELBOW SURGERY

nonrandomized prospective cohort study, and, thus, the study finding needs to be interpreted in light of the potential bias of a nonrandomized design.

**Li RT, Kane G, Drummond M, Golan E, Wilson K, Lesniak BP, Rodosky M, Lin A.** On-track lesions with a small distance to dislocation are associated with failure after arthroscopic anterior shoulder stabilization. *J Bone Joint Surg Am.* 2021 Jun 2;103(11):961-7.

The glenoid track concept has been validated in several studies that demonstrated increased risk of failure following arthroscopic Bankart repair in patients with off-track lesions compared with patients with on-track lesions. Li et al. raised a question about this binary concept and speculated that not all on-track lesions are equal in that on-track lesions with a small distance between the medial margin of the Hill-Sachs lesion and the medial extent of the glenoid track (i.e., small distance to dislocation) may be also at risk for failure. They conducted a retrospective cohort study that evaluated the association between multiple patient factors including distance to dislocation (DTD) and failure of arthroscopic Bankart repair in 173 patients. DTD was found to be the only significant predictor of failure with multivariate analysis. The failure rate was 75% for patients with off-track lesions ( $DTD \leq 0$  mm), 38.5% for those with  $0 \text{ mm} < DTD \leq 8$  mm, and 12.8% for those with  $DTD > 8$  mm. They concluded that lesions with low DTD (especially  $\leq 8$  mm), despite being on-track by definition, were still at an increased risk for failure after arthroscopic Bankart repair.

**MacDermid JC, Bryant D, Holtby R, Razmjou H, Faber K, Balyk R, Boorman R, Sheps D, McCormack R, Athwal G, Hollinshead R, Lo I, Bicknell R, Mohtadi N, Bouliane M, Glasgow D, Lebel ME, Lalani A, Moola FO, Litchfield R, Moro J, MacDonald P, Bergman JW, Bury J, Drosdowech D; JOINTS Canada.**

Arthroscopic versus mini-open rotator cuff repair: a randomized trial and meta-analysis. *Am J Sports Med.* 2021 Oct;49(12):3184-95.

Rotator cuff repair can be approached either arthroscopically or through a mini-open approach. With ever-increasing popularity of minimally invasive approaches across surgical disciplines, mini-open rotator cuff repair can be seen as an obsolete technique. MacDermid et al. tackled this notion

with a multicenter, randomized trial comparing 274 patients randomized to either arthroscopic repair or mini-open repair for small or medium-sized rotator cuff tears. There was no difference in WORC scores at any time point up to 2 years. Additionally, ASES scores, 12-Item Short Form Health Survey (SF-12) scores, range of motion, and strength were similar at each time point, and magnetic resonance imaging (MRI)-documented repair failures were not different between groups. The authors concluded that both arthroscopic and mini-open approaches provide substantial and equivalent clinical benefit with a low rate of complications.

**McCormick KL, Tedesco LJ, Swindell HW, Forrester LA, Jobin CM, Levine WN.** Statistical fragility of randomized clinical trials in shoulder arthroplasty. *J Shoulder Elbow Surg.* 2021 Aug;30(8):1787-93.

There has been increasing awareness of the limitations of solely relying on p values to establish significance, spurring a search for alternative metrics such as the Fragility Index (FI). The FI is defined as the number of patients in a study intervention group needed to alter the significance of a dichotomous outcome if their results changed, with an FI of  $>3$  considered a statistically robust result. A systematic review was performed of all RCTs in shoulder arthroplasty to evaluate the statistical robustness of the trials using the FI. Thirteen studies were identified and evaluated, with FIs calculated for 39 dichotomous, categorical outcomes included in the studies. The trials had a median sample size of 47 patients (mean, 54 patients [range, 26 to 102 patients]) and a median of 7 patients lost to follow-up (mean, 5.8 patients [range, 0 to 14 patients]). The median FI was 6 (mean, 5 [range, 1 to 11]), a higher FI than what has been observed in other orthopaedic subspecialties, although significant outcomes were associated with a lower median FI compared with outcomes that were not significant. The majority of outcomes (74.4%) had FIs of  $>3$ , although most outcomes (89.7%) were not significant. The authors concluded that RCTs in shoulder arthroplasty have comparable statistical robustness with those in other orthopaedic surgical subspecialties and that FI should be included in future comparative studies.