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Upper extremity

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Volume 33, Issue 4 / Volume 33, Issue 5

Treatment of Symptomatic Acromioclavicular Joint Instability by a Docking Technique: Clinical Indications, Surgical Technique, and Outcomes

W. Ben Kibler, Aaron D. Sciascia, Brent J. Morris, David C. Dome

Arthroscopy, April 2017, Volume 33, Issue 4, p696–708

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Purpose

To report functional and objective outcomes resulting from surgical treatment of patients with symptomatic type III through V acromioclavicular (AC) joint injury by use of a modification of the anatomic AC joint reconstruction developed by Carofino and Mazzocca.

Methods

The study included all patients treated in 2009-2014 who presented with a history of direct trauma to the shoulder; deformity of the AC joint on clinical examination; radiographic findings that would classify the injury as a Rockwood type III, IV, or V injury; AC joint instability on clinical examination; and self-reported deficits of arm function on initial presentation, in whom a comprehensive and directed nonoperative program failed. The surgical procedure used an allograft with reinforcing internal sutures passed around the coracoid and through anatomically positioned clavicular holes for the coracoclavicular (CC) ligaments, used a docking technique for reconstruction of the superior AC ligaments, and included repair of the native AC ligaments. Outcomes were reported for patients with a minimum follow-up period of 1.5 years. Outcome measurements included dynamic-static stability evaluation and Disabilities of the Arm, Shoulder and Hand (DASH) scores.

Results

The study included 15 patients with 15 affected shoulders. The postsurgical follow-up period averaged 3 years (range, 1.5-5 years). Postoperatively, one patient showed loss of reduction after a fall. All others showed 2-dimensional radiographic stability and 3-dimensional dynamic clinical stability. Static radiographic measurement of the CC distance at discharge averaged 0.93 cm compared with 2.7 cm on initial examination ($P < .0001$). Patient-reported outcomes at an average of 3 years' follow-up showed a DASH score of 13 compared with a preoperative DASH score of 51 ($P < .0001$).

Conclusion

This study confirms that anatomic CC ligament reconstruction and repair or reconstruction of the AC ligaments help restore arm function as shown by the patient-specific and clinical outcome metrics. These **Results** were achieved by correction of the deformity, which in turn allowed for the obtainment of static and dynamic stability.

Level of Evidence

Level IV.

[BACK](#)

Three-Dimensional Magnetic Resonance Imaging Quantification of Glenoid Bone Loss Is Equivalent to 3-Dimensional Computed Tomography Quantification: Cadaveric Study

Adam B. Yanke, Jason J. Shin, Ian Pearson, Bernard R. Bach Jr., Anthony A. Romeo, Brian J. Cole, Nikhil N. Verma

Arthroscopy, April 2017, Volume 33, Issue 4, p709–715

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Purpose

To assess the ability of 3-dimensional (3D) magnetic resonance imaging (MRI, 1.5 and 3 tesla [T]) to quantify glenoid bone loss in a cadaveric model compared with the current gold standard, 3D computed tomography (CT).

Methods

Six cadaveric shoulders were used to create a bone loss model, leaving the surrounding soft tissues intact. The anteroposterior (AP) dimension of the glenoid was measured at the glenoid equator and after soft tissue layer closure the specimen underwent scanning (CT, 1.5-T MRI, and 3-T MRI) with the following methods (0%, 10%, and 25% defect by area). Raw axial data from the scans were segmented using manual mask manipulation for bone and reconstructed using Mimics software to obtain a 3D en face glenoid view. Using calibrated Digital Imaging and Communications in Medicine images, the diameter of the glenoid at the equator and the area of the glenoid defect was measured on all imaging modalities.

Results

In specimens with 10% or 25% defects, no difference was detected between imaging modalities when comparing the measured defect size (10% defect $P = .27$, 25% defect $P = .73$). All 3 modalities demonstrated a strong correlation with the actual defect size (CT, $\rho = .97$; 1.5-T MRI, $\rho = .93$; 3-T MRI, $\rho = .92$, $P < .0001$). When looking at the absolute difference between the actual and measured defect area, no significance was noted between imaging modalities (10% defect $P = .34$, 25% defect $P = .47$). The error of 3-T 3D MRI increased with increasing defect size ($P = .02$).

Conclusion

Both 1.5- and 3-T–based 3D MRI reconstructions of glenoid bone loss correlate with measurements from 3D CT scan data and actual defect size in a cadaveric model. Regardless of imaging modality, the error in bone loss measurement tends to increase with increased defect size. Use of 3D MRI in the setting of shoulder instability could obviate the need for CT scans.

Clinical Relevance

The goal of our work was to develop a reproducible method of determining glenoid bone loss from 3D MRI data and hence eliminate the need for CT scans in this setting. This will lead to decreased cost of care as well as decreased radiation exposure to patients. The long-term goal is a fully automated system that is as approachable for clinicians as current 3D CT technology.

[BACK](#)

Cost-Effectiveness of Arthroscopic Rotator Cuff Repair Versus Reverse Total Shoulder Arthroplasty for the Treatment of Massive Rotator Cuff Tears in Patients With Pseudoparalysis and Nonarthritic Shoulders

Grant J. Dornan, J. Christoph Katthagen, Dimitri S. Tahal, Maximilian Petri, Joshua A. Greenspoon, Patrick J. Denard, Stephen S. Burkhart, Peter J. Millett

Arthroscopy, April 2017, Volume 33, Issue 4, p716–725

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Purpose

To determine the most cost-effective treatment strategy for patients with massive rotator cuff tears and pseudoparalysis of the shoulder without osteoarthritis of the glenohumeral joint (PP without OA). Specifically, we aimed to compare arthroscopic rotator cuff repair (ARCR) versus reverse total shoulder arthroplasty (RTSA) and investigate the effect of patient age on this decision.

Methods

A Markov decision model was used to compare 3 treatment strategies for addressing PP without OA: (1) ARCR with option to arthroscopically revise once, (2) ARCR with immediate conversion to RTSA on potential failure, and (3) primary RTSA. Hypothetical patients were cycled through the model according to transition probabilities, meanwhile accruing financial costs, utility for time in health states, and disutilities for surgical procedures. Utilities were derived from the Short Form-6D scale and expressed as quality-adjusted life-years. Model parameters were derived from the literature and from expert opinion, and thorough sensitivity analyses were conducted. TreeAge Pro 2015 software was used to construct and assess the Markov model.

Results

For the base-case scenario (60-year-old patient), ARCR with conversion to RTSA on potential failure was the most cost-effective strategy when we assumed equal utility for the ARCR and RTSA health states. Primary RTSA became cost-effective when the utility of RTSA exceeded that of ARCR by 0.04 quality-adjusted life-years per year. Age at decision did not substantially change this result.

Conclusion

Primary ARCR with conversion to RTSA on potential failure was found to be the most cost-effective strategy for PP without OA. This result was independent of age. Primary ARCR with revision ARCR on potential failure was a less cost-effective strategy.

Level of Evidence

Level IV, economic and decision analysis.

[BACK](#)

Arthroscopic Treatment of Snapping Scapula Syndrome: Outcomes at Minimum of 2 Years

Travis J. Menge, Marilee P. Horan, Dimitri S. Tahal, Justin J. Mitchell, J. Christoph Katthagen, Peter J. Millett

Arthroscopy, April 2017, Volume 33, Issue 4, p726–732

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Purpose

To investigate clinical outcomes after primary and revision arthroscopic treatment for snapping scapula syndrome (SSS) and identify predictive factors associated with outcomes.

Methods

Patients who underwent arthroscopic treatment for SSS between October 2005 and December 2013 were identified in a prospectively collected database. The inclusion criteria were patients with a diagnosis of symptomatic SSS, in whom extensive nonoperative modalities failed, who underwent arthroscopic surgery for SSS, and who had undergone surgery a minimum of 2 years earlier. Postoperative clinical outcomes were assessed with the American Shoulder and Elbow Surgeons score; short version of the Disabilities of the Arm, Shoulder and Hand questionnaire; and general health Short Form 12 (SF-12) scores, including both physical component summary and mental component summary. Patient satisfaction was recorded on a 10-point visual analog scale. Scapular bony morphology was determined on preoperative magnetic resonance imaging.

Results

Ninety-two scapulae underwent arthroscopic treatment for SSS. There were 74 scapulae that met the inclusion criteria, including having undergone surgery a minimum of 2 years earlier. An outcome questionnaire was completed for 60 of 74 (81%). The mean age was 33 years (range, 12-65 years), and the mean duration of symptoms before surgery was 4 years (range, 90 days to 20.4 years). The mean follow-up period was 3.4 years (range, 2-7 years). Eight scapulae failed initial surgical management (10.9%) because of recurrent pain and underwent revision surgery at a mean of 309 days (range, 120-917 days). After surgery, there was a significant improvement in all outcome scores, including SF-12 physical component summary score, from 39.2 to 45.4 ($P = .002$); SF-12 mental component summary score, from 45.0 to 49.6 ($P = .023$); American Shoulder and Elbow Surgeons score, from 52.6 to 75.8 ($P < .001$); and score on the short version of the Disabilities of the Arm, Shoulder and Hand questionnaire, from 40.2 to 24.2 ($P = .001$). The median patient satisfaction rating was 7 of 10. Greater age, lower preoperative psychological score, and longer duration of symptoms before surgery correlated with lower postoperative outcome scores.

Conclusion

Arthroscopic surgery is an effective treatment for SSS in both primary and revision cases, showing significant improvements in all postoperative outcome scores at a mean of 3.4 years. Lower preoperative mental status score, longer duration of symptoms, and greater age were associated with poorer outcomes.

Level of Evidence

Level IV, therapeutic case series.

[BACK](#)

Subscapularis Tendon Slip Number and Coracoid Overlap Are More Related Parameters for Subcoracoid Impingement in Subscapularis Tears: A Magnetic Resonance Imaging Comparison Study

Mehmet Cetinkaya, Muhammet Baybars Ataoglu, Mustafa Ozer, Tacettin Ayanoglu, Ulunay Kanatli

Arthroscopy, April 2017, Volume 33, Issue 4, p734–742

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Purpose

To investigate the effects of the subscapularis tendon slip number (STSN) and coracoid morphology by magnetic resonance imaging in patients with and without subscapularis tears.

Methods

Patients who underwent shoulder arthroscopy between February 2004 and June 2015 were re-evaluated. Those with a subscapularis tear (study group) and those with other pathologies (control group) were compared with each other. Magnetic resonance imaging scans and surgery videos of the patients were reassessed. Transverse and sagittal coracohumeral distance (CHD), coracoid overlap (CO), coraco-coracoid base angle (CBA), coracoglenoid distance (CGD), and STSN were measured.

Results

The study and control groups comprised 141 and 78 patients, respectively. The mean age was 57.01 ± 10.95 (similar in both the groups). The mean transverse CHD and sagittal CHD were not different between the groups and also between female and male patients. For the study and control groups, the mean CBA and CGD values were also similar. The mean CO was 24.01 ± 4.9 and 21.29 ± 4.58 for the study and control groups, respectively ($P < .001$). With the receiver operating characteristic curve of the CO, the sensitivity was 62% and the specificity was 64% at the cutoff value of 22.85 mm. The STSN was in the range between 1 and 6; the STSN was 3 or less in 61.5% of the study group and in 38.5% of the control group ($P = .005$).

Conclusion

The CO was the most valuable parameter predicting any potential subcoracoid impingement, and the STSN was inversely correlated with subscapularis tears. However, in predicting a potential subcoracoid impingement, the CHD measurements were not significant, as well the CGD and CBA.

Level of Evidence

Level III, retrospective comparative study.

[BACK](#)

Incidence of Posterior Interosseous Nerve Trauma During Creation of the 3-4 Wrist Arthroscopy Portal in Cadavers

Andre Eu-Jin Cheah, Wei Le, Jeffrey Yao

Arthroscopy, April 2017, Volume 33, Issue 4, p743–747

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Purpose

To describe histologic evidence of nerve trauma during the creation and use of the 3-4 portal.

Methods

Fourteen fresh-frozen cadaveric wrists were mounted on a custom-built frame that simulated a wrist arthroscopy traction tower. After the 3-4 portal was created in the usual manner, the skin was dissected off to identify possible trauma to the posterior interosseous nerve (PIN). Specimens were categorized into those where there was clearly no trauma to the PIN and those where trauma was possible. In the cases where trauma was possible, we harvested the PIN with a cuff of the proximal edge of the portal and examined the cross-sectional histology of the most distal sections for the presence of neural tissue.

Results

There was clearly no trauma to the PIN in 3 of the wrists during the creation of the 3-4 portal. In the remaining 11 wrists with possible trauma to the PIN, we identified axonal tissue on histologic examination at the proximal edge of the 3-4 portal in 7 of these specimens. In summary, 50% (7 of 14) of our specimens had visual and histologic evidence of trauma to the PIN.

Conclusion

Based on the findings of this study, there may be more instances of trauma to the PIN during routine wrist arthroscopy than have been previously reported.

Clinical Relevance

Findings suggest that transection or injury to this nerve may not lead to any clinical sequelae. However, if there is an instance where a patient has persistent, otherwise unexplained, dorsal wrist pain after a wrist arthroscopy procedure, iatrogenic neuroma of the PIN may be responsible and should be considered.

[BACK](#)

Arthroscopic Repair of Isolated Subscapularis Tears: A Systematic Review of Technique-Specific Outcomes

Bryan M. Saltzman, Michael J. Collins, Timothy Leroux, Thomas A. Arns, Justin W. Griffin, Anthony A. Romeo, Nikhil N. Verma, Brian Forsythe

Arthroscopy, April 2017, Volume 33, Issue 4, p849–860

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Purpose

To systematically review the literature to identify all studies reporting outcomes of arthroscopically repaired isolated subscapularis tears, to (1) report outcomes across all repair techniques, (2) compare outcomes by arthroscopic technique, and (3) highlight the frequency and management of associated long head of biceps pathology, and the influence of these concomitant procedures on outcomes following arthroscopic subscapularis repair.

Methods

A systematic literature review was conducted using the MEDLINE, Embase, and Scopus databases with the following term: (“isolated repair” AND “arthroscopic subscapularis tear”). Only studies evaluating the techniques and outcomes of isolated subscapularis repair were included. Data were extracted, including patient characteristics, surgical technique, and outcomes. Descriptive analysis was provided for the available literature.

Results

Eight studies were included in this review. Uniformly, improvements in patient-reported outcome scores were substantial after arthroscopic subscapularis repair. Constant Total scores improved in each individual study from preoperative to postoperative (range, Δ 18.8- Δ 49.8 points), as did Strength (range, Δ 1.3- Δ 13.7 points), Pain (range, Δ 7.6- Δ 8.9 points), Range of Motion (range, Δ 7.3- Δ 13.3 points), and Activities of Daily Living (range, Δ 8.7- Δ 10.2 points) subscores. Significant improvements were seen in most individual studies for belly-press (Δ 21.6 N or Δ 1.9 out of 5) and lift-off strength (Δ 24.3 N or Δ 1.7- Δ 1.9 out of 5), range of motion in forward flexion (29.1° - 37.0°), external rotation (10.3° - 16.0°), and internal rotation. Complications were relatively infrequent overall, with 5 studies reporting no complications, and the remaining 3 studies with rerupture rates between 4.8% and 11.8%. Studies that used only double-row repair reported fewer complications (0% vs 5%-10%) and better outcome scores than single-row repair, similar to those studies that uniformly performed biceps tenodesis compared with no biceps intervention.

Conclusion

This descriptive study highlights that arthroscopic subscapularis repair appears to be a reasonable option for the treatment of isolated tears of the subscapularis to obtain successful functional and patient-reported clinical outcomes. Its findings also pose the question of whether future prospective, comparative studies will find double-row surgical fixation and concomitant biceps tenodesis surgery to be superior to single-row fixation and leaving the biceps alone.

Level of Evidence

Level IV, systematic review of Level IV studies.

[BACK](#)

Distal Tibia Allograft Glenoid Reconstruction in Recurrent Anterior Shoulder Instability: Clinical and Radiographic Outcomes

Matthew T. Provencher, Rachel M. Frank, Petar Golijanin, Daniel Gross, Brian J. Cole, Nikhil N. Verma, Anthony A. Romeo

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Purpose

To assess the clinical and radiographic outcomes of patients with recurrent anterior shoulder instability treated with fresh distal tibia allograft (DTA) glenoid reconstruction.

Methods

Consecutive patients with a minimum 15% anterior glenoid bone loss associated with recurrent anterior instability who underwent stabilization with DTA glenoid reconstruction were retrospectively reviewed. Patients were evaluated with the American Shoulder and Elbow Society score, Western Ontario shoulder instability index, and single numerical assessment evaluation score at a minimum 2 years after surgery. All patients also underwent postoperative imaging evaluation with computed tomography where graft incorporation and allograft angle were measured. Statistical analysis was performed with paired *t*-tests, with *P* < .05 considered significant.

Results

A total of 27 patients (100% male) with an average age of 31 ± 5 years and an average follow-up of 45 months (range, 30-66) were included. There were significant improvements in preoperative to postoperative American Shoulder and Elbow Society score (63-91, *P* < .01), Western Ontario shoulder instability index (46% to 11% of normal, *P* < .01), and single numerical assessment evaluation score (50-90.5, *P* < .01) outcomes. Analysis of computed tomography data at an average 1.4 years postoperatively (available for 25 patients) showed an allograft healing rate of 89% (range, 80% to 100%), average allograft angle of 14.9° (range, 6.6° to 29.3°), and average allograft lysis of 3% (range, 0% to 25%). Grafts with lesser allograft angles ($<15^\circ$) were better opposed to the anterior glenoid, showing superior healing and graft incorporation. There were no cases of recurrent instability.

Conclusion

At an average follow-up of 45 months, fresh DTA reconstruction for recurrent anterior shoulder instability **Results** in a clinically stable joint with excellent clinical outcomes and minimal graft resorption. Optimal allograft placement resulted in superior bony incorporation with the native glenoid.

Level of Evidence

Level IV, therapeutic case series.

[BACK](#)

Arthroscopic Subscapularis Augmentation of Bankart Repair in Chronic Anterior Shoulder Instability With Bone Loss Less Than 25% and Capsular Deficiency: Clinical Multicenter Study

Marco Maiotti, Carlo Massoni, Raffaele Russo, Steffen Schroter, Antonio Zanini, Diana Bianchedi

Arthroscopy, May 2017, Volume 33, Issue 5, p902–909

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Purpose

To assess the short-term outcomes of the arthroscopic subscapularis augmentation (ASA) technique, consisting of a tenodesis of the upper third of the subscapularis tendon and a Bankart repair, and its effect on shoulder external rotation.

Methods

Patients selected for this study were involved in contact sports, with a history of traumatic recurrent shoulder dislocations and a minimum of 2-year follow-up. Inclusion criteria were patients with glenoid bone loss (GBL) ranging from 5% to 25%, anterior capsular deficiency, and Hill-Sachs lesion who underwent ASA technique. Exclusion criteria were GBL >25%, multidirectional instability, preexisting osteoarthritis, and overhead sports activities. Visual analog scale (VAS) scale for pain, Rowe score, and American Shoulder and Elbow Surgeons (ASES) scores were used to assess **Results**. Loss of shoulder external rotation was measured with the arm at the side (ER1 position) or 90° in abduction (ER2 position). Analysis of variance and Fisher tests were used for data evaluation. Significance was established at $P \leq .05$.

Results

One hundred ten patients (84 men and 26 women, mean age 27 years) were evaluated with a mean follow-up of 40.5 months (range: 24 to 65 months). In 98 patients, a Hill-Sachs lesion was observed and in 57 patients a capsular deficiency was present. Three patients (2.7%) had a traumatic redislocation. At final follow-up, the mean scores were as follows: VAS scale decreased from a mean of 3.5 to 0.5 ($P = .015$), Rowe score increased from 57.4 to 95.3 ($P = .035$), and ASES score increased from 66.5 to 96.5 ($P = .021$). The mean deficit of external rotation was $8^\circ \pm 2.5^\circ$ in the ER1 position and $4^\circ \pm 1.5^\circ$ in the ER2 position.

Conclusion

The ASA procedure has been shown to be effective in restoring joint stability in patients practicing sports, affected by chronic anterior shoulder instability associated with anterior GBL (<25%), capsular deficiency, and Hill-Sachs lesions, with mild restriction of external rotation.

Level of Evidence

Level IV, therapeutic case series.

[BACK](#)

Arthroscopic Revision Surgery for Failure of Open Latarjet Technique

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Arthroscopy, May 2017, Volume 33, Issue 5, p910–917

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Purpose

To evaluate the efficacy in treating pain, limited range of motion, and continued instability of the Latarjet open technique via the use of arthroscopy.

Methods

A retrospective review of patients who underwent arthroscopic capsule plication after failure of an open Latarjet technique was performed. Revision surgery was indicated in cases of recurrent instability and associated pain. Only patients with a glenoid defect <25% were considered. The Constant and Rowe scores were administered, whereas pain was assessed with a visual analog scale before the reoperation and at 24 months after operation. Radiographs, computed tomography, and CT arthrography scans were performed.

Results

Twelve patients met the inclusion criteria. All patients had capsular distension and consequently were subjected to a capsuloplasty. Shoulder function, stability, and pain had all improved significantly at 24 months after arthroscopic revision ($P < .0001$). In particular, the Constant score increased from 44.9 (standard deviation [SD] 7.10) to 89.3 (SD 12.6) points, the Rowe score improved from 49.5 (SD 10.1) to 80.9 (SD 10.9), whereas the visual analog scale pain score decreased from 6.75 (SD 1.17) to 1.38 (SD 1.06).

Conclusion

Primary open Latarjet with a glenoid bone defect <25% that failed due to capsular redundancy is amenable to successful treatment with arthroscopic capsuloplasty.

Clinical Relevance

Arthroscopic approaches can offer a good solution for treating previously failed open Latarjet procedures.

Level of Evidence

Level IV, therapeutic case series.

[BACK](#)

Effects of a Single-Dose Interscalene Block on Pain and Stress Biomarkers in Patients Undergoing Arthroscopic Rotator Cuff Repair: A Randomized Controlled Trial.

Xiao Ning Liu, Young-Min Noh, Cheol-Jung Yang, Jung Uk Kim, Mi Hwa Chung, Kyu Cheol Noh

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Purpose

To compare the effects of a single-dose interscalene block and general anesthesia (SISB/GA) with the effects of GA only in the early postoperative period after arthroscopic rotator cuff repair by evaluating subjective pain visual analog scale scores and objective pain-related stress biomarkers.

Methods

Patients refractory to conservative treatment of the affected shoulder were enrolled in this prospective, randomized endpoint study. Patients diagnosed with a rotator cuff tear (1-4 cm) based on magnetic resonance imaging were included. Exclusion criteria were small (<1 cm) and massive (>4 cm) rotator cuff tears. Thirty-one patients each were randomized into the SISB/GA and GA treatment groups. Preoperative pain scores were measured at 6:00 AM on the day of surgery, measured again at 1 and 6 hours postoperatively, and then every 6 hours until 3 days postoperatively. Blood sampling was performed to evaluate the stress biomarkers insulin, dehydroepiandrosterone sulfate, and fibrinogen preoperatively at 6:00 AM on the day of surgery and postoperatively at 18, 42, and 66 hours (6:00 AM on postoperative days 1-3).

Results

Pain scores were significantly decreased in the SISB/GA group (2.50 ± 0.94) versus the GA group (3.82 ± 1.31) on the day of surgery ($P < .001$), and especially at 6 hours postoperatively (SISB/GA: 2.42 ± 1.43 ; GA: 4.23 ± 2.17 ; $P < .001$). Insulin was decreased significantly in the SISB/GA group ($10.55 \pm 7.92 \mu\text{U/mL}$) versus the GA group ($20.39 \pm 25.60 \mu\text{U/mL}$) at 42 hours postoperatively ($P = .048$). There was no significant change in dehydroepiandrosterone sulfate or fibrinogen over time ($P > .05$).

Conclusion

After arthroscopic rotator cuff repair, an SISB effectively relieved pain on the day of surgery without any complications. In addition, insulin levels were significantly reduced at 42 hours postoperatively.

Level of Evidence

Level I, prospective randomized controlled trial.

[BACK](#)

Arthroscopic-Assisted Latissimus Dorsi Tendon Transfer for Massive, Irreparable Rotator Cuff Tears: Technique and Short-Term Follow-Up of Patients With Pseudoparalysis

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Purpose

To describe a modified technique for arthroscopic-assisted transfer of the latissimus dorsi tendon in a selected group of patients with irreparable rotator cuff tears and pseudoparalysis and to evaluate its short-term results.

Methods

Fifteen patients with irreparable rotator cuff tears and pseudoparalysis treated by arthroscopic-assisted latissimus dorsi tendon transfer were included. The mean patient age was 61.53 ± 6.24 years (range, 52-71 years). Patients were assessed with physical examination, University of California Los Angeles (UCLA) Score and Constant-Murley score, as well as visual analog scale score at a mean follow-up of 26.4 ± 2.58 months (range, 24-31 months).

Results

At final follow-up, mean UCLA score increased to 27.47 ± 6.31 compared with the preoperative UCLA score of 6.53 ± 2.1 ($P < .001$). Constant-Murley score was 21 ± 7.41 and 59.73 ± 13.62 ($P < .001$), visual analog scale pain score was 7.47 ± 1.06 and 2.47 ± 0.91 ($P < .001$), active forward flexion was $58^\circ \pm 21.11^\circ$ and $130^\circ \pm 30.05^\circ$ ($P < .001$), active abduction was $51^\circ \pm 21.64^\circ$ and $129.67^\circ \pm 25.45^\circ$ ($P < .001$), and active external rotation was $13.33^\circ \pm 21.68^\circ$ and $32^\circ \pm 18.03^\circ$ ($P < .001$) preoperatively and postoperatively, respectively. Mean acromiohumeral distance was 3.13 ± 1.40 mm preoperatively, whereas it was 5.67 ± 1.67 mm postoperatively ($P < .001$). No significant complications requiring a revision surgery was observed during the final follow-up.

Conclusion

The modified technique of arthroscopic-assisted transfer of the latissimus dorsi tendon is a feasible, minimally invasive option for the surgical treatment of irreparable rotator cuff tears in a subset of patients with pseudoparalysis.

Level of Evidence

Level IV, therapeutic case series.

[BACK](#)

Biomechanical Comparison of Standard and Linked Single-Row Rotator Cuff Repairs in a Human Cadaver Model.

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Purpose

The **Purpose** of this study was to evaluate the time zero cyclic and failure loading properties of a linked single-row rotator cuff repair compared with a standard simple suture single-row repair using triple-loaded suture anchors.

Methods

Eighteen human cadaveric shoulders from 9 matched pairs were dissected, and full-thickness supraspinatus tears were created. The tendon cross-sectional area was recorded. In each pair, one side was repaired with a linked single-row construct and the other with a simple suture single-row construct, both using 2 triple-loaded suture anchors. After preloading, specimens were cycled to 1 MPa of effective stress at 1 Hz for 500 cycles, and gap formation was recorded with a digital video system. Samples were then loaded to failure, and modes of failure were recorded.

Results

There was no statistical difference in peak gap formation between the control and linked constructs (3.6 ± 0.9 mm and 3.6 ± 1.2 mm, respectively; $P = .697$). Both constructs averaged below a 5-mm cyclic failure threshold. There was no statistical difference in ultimate load to failure between the control and linked repair (511.1 ± 139.0 N and 561.2 ± 131.8 N, respectively; $P = .164$), and both groups reached failure at loads similar to previous studies. Constructs failed predominantly via tissue tearing parallel to the medial suture line.

Conclusion

The linked repair performed similarly to the simple single-row repair. Both constructs demonstrated high ultimate load to failure and good resistance to gap formation with cyclic loading, validating the time zero strength of both constructs in a human cadaveric model.

Clinical Relevance

The linked repair provided equivalent resistance to gap formation and failure loads compared with simple suture single-row repairs with triple-loaded suture anchors. This suggests that the linked repair is a simplified rip-stop configuration using the existing suture that may perform similarly to current rotator cuff repair techniques.

[BACK](#)

Traditional Versus Congruent Arc Latarjet Technique: Effect on Surface Area for Union and Bone Width Surrounding Screws.

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Purpose

To compare the surface area available for bony contact and the width of bone on each side of the Latarjet fixation screws in the traditional Latarjet technique versus the congruent arc modification of the Latarjet technique.

Methods

Computed tomographic scans of 24 shoulders in patients with glenohumeral instability who underwent multiplanar reconstruction measurements with multiple dimensions of the coracoid. The surface area of the coracoid available for bony contact with the anterior glenoid and width of bone on each side of a 3.5-mm screw was compared for the traditional Latarjet technique versus the congruent arc modification.

Results

The surface area available for bony contact to the anterior glenoid was $5.65 \pm 1.08 \text{ cm}^2$ using the traditional Latarjet technique compared with $3.64 \pm 0.93 \text{ cm}^2$ using the congruent arc modification of the Latarjet technique ($P < .001$). The mean width of bone on each side of a 3.5-mm screw was $7.1 \pm 1.0 \text{ mm}$ using the traditional Latarjet technique compared with $4.1 \pm 1.0 \text{ mm}$ using the congruent arc modification ($P < .001$).

Conclusion

The traditional Latarjet technique has greater bony contact with the glenoid and greater bone width on each side of the screws compared with the congruent arc modification of the Latarjet technique. This potentially allows for a larger surface for healing in the traditional Latarjet technique. Moreover, because of smaller width of the bone around the screw, the congruent arc modification is potentially less tolerant of screw-positioning error compared with the traditional Latarjet technique.

Level of Evidence

Level III, retrospective comparative study.

[BACK](#)

An Anatomic Evaluation of Arthroscopic Access to the Radial Head.

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Purpose

To determine the area of the radial head accessible for visualization and screw placement from the standard anteromedial and anterolateral portals used in elbow arthroscopy.

Methods

Five cadaveric elbows were arthroscopically evaluated using standard anteromedial and anterolateral portals. Markers (pins) were placed into the accessible portions of the radial head at maximal pronation and supination. Specimens were then evaluated by computed tomography, and the arc of the radial head accessible from each portal was determined.

Results

A continuous $220.04^\circ \pm 37.58^\circ$ arc of the radial head was accessible from the combination of the anterolateral and anteromedial portals. From the anteromedial portal, the arc obtained measured $147.96^\circ \pm 21.81^\circ$, and from the anterolateral portal, the arc obtained measured $156.02^\circ \pm 33.32^\circ$. Using the radial styloid as a marker for 0° , the mean total arc ranged from $92.3^\circ \pm 34.06^\circ$ dorsal to $127.74^\circ \pm 23.65^\circ$ volar relative to the radial styloid.

Conclusion

Standard anteromedial and anterolateral portals used for elbow arthroscopy allow access to an average 220° area of the radial head.

Clinical Relevance

This study defines the area of the radial head that can be contacted using commonly used, safe, and simple portals.

[BACK](#)

JSES

Volume 26, Issue 4 / Volume 26, Issue 5

Comparison of outcomes with arthroscopic repair of acute-on-chronic within 6 months and chronic rotator cuff tears

JSES, April 2017 Volume 26, Issue 4, Pages 648–655

Jeung Yeol Jeong, MD, Seung Yeop Song, MD, Jae Chul Yoo, , Keun Min Park, MD, Sang Min Lee, CES

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Background

The purpose of this study was to define preoperative and intraoperative findings of acute-on-chronic rotator cuff tears (RCTs). This study also compared the functional and clinical outcomes with acute-on-chronic RCTs and chronic RCTs.

Methods

This study was conducted between December 2007 and December 2013. An acute-on-chronic full-thickness RCT was diagnosed with preoperative and intraoperative findings on arthroscopy. The study group consisted of 36 patients with preoperative and intraoperative findings (surgery performed within 6 months of trauma) indicative of an acute-on-chronic RCT. Another 36 patients matched for age, sex, and tear size, who underwent arthroscopic rotator cuff repair after 6 months of onset of symptoms (chronic RCT group), were selected from our institution's database within the same time frame. Postoperative indirect magnetic resonance arthrogram was obtained 6 months after the repair, and rotator cuff integrity was graded according to the guidelines as described by Sugaya. Patients were evaluated using the visual analog scale for pain, American Shoulder and Elbow Surgeons Shoulder Assessment score, and Constant scores. Scores and measurements were obtained preoperatively and at 6, 12, and 24 months after surgery.

Results

The clinical outcomes and range of motion recovery were better in the acute-on-chronic RCT group. Although statistically not significant, the acute-on-chronic RCT group's repair appeared closer to the complete repair and was associated with a lesser incidence of retear than the chronic RCT group.

Conclusion

Early repair of an acute-on-chronic full-thickness RCT results in a statistically and clinically superior improvement in outcomes compared with repairs of chronic RCTs.

[BACK](#)

Hill-Sachs lesion classification under arthroscopic findings

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Background

The Hill-Sachs lesion (HSL) plays a role in recurrent glenohumeral joint instability. Currently, there are no studies based on the form characteristics of HSL. The purposes of this study were to report the HSL form characteristics and to determine whether they are correlated with number of prior subluxations and dislocations.

Methods

The study enrolled 134 consecutive patients diagnosed with anterior shoulder instability during an arthroscopic procedure. We classified the arthroscopic findings into 4 types, as follows: type 1, cyst type; type 2, gutter type; type 3, island type; and type 4, wide type. Subsequently, we investigated the correlation between each type and the number of shoulder subluxations and dislocations reported. The following data were analyzed: subluxation and dislocation history, arthroscopic findings, and maximum lesion size.

Results

Of the patients evaluated, 18, 32, 30, and 54 were classified as types 1 to 4, respectively. The mean numbers of shoulder dislocations were 3.3, 7.3, 6.0, and 12.0 for types 1 to 4, respectively. The wide type was correlated with more subluxations and dislocations than the other types ($P = .001$, $.046$, and $.007$, respectively). There were significant differences in mean width among all types ($P < .0001$). HSL width was correlated with lesion type and angle.

Conclusion

We classified HSL into 4 types on the basis of visual inspection and found a correlation between lesion type and lesion size. However, HSL width was correlated with lesion type and angle; that is, the number of dislocations and subluxations does not affect HSL width.

[BACK](#)

Arthroscopic ablation of an osteoid osteoma of the elbow: a case series with a minimum of 18 months' follow-up

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Background

Arthroscopic excision of an osteoid osteoma was first reported in the knee joint; since then, there have been several reports of arthroscopic excisions in the knee, shoulder, and elbow, with inconclusive outcomes because of a limited number of cases. The aim of this prospective study was to evaluate the medium-term functional effects of arthroscopic ablation in cases of an osteoid osteoma around the elbow.

Methods

We treated osteoid osteoma of the elbow through arthroscopic ablation in 10 patients. The arthroscopic resection procedure was performed 23 ± 9 months (range, 12-36 months) after initial symptoms. At the preoperative examination and last follow-up examination, the elbow flexion-extension and forearm supination-pronation ranges of motion were measured. The patients were assessed by the Mayo Elbow Performance Score, the visual analog scale for the elbow and wrist, and the Quick Disabilities of the Arm, Shoulder, and Hand score. Finally, the patients' general satisfaction was assessed.

Results

The postoperative elbow flexion-extension range of motion was significantly higher compared with range of motion before surgery ($P = .001$; $r = 0.86$). According to the Mayo Elbow Performance Score, the average score increased significantly at the final follow-up examination. The mean preoperative and final Quick Disabilities of the Arm, Shoulder, and Hand scores were 47 ± 14 and 1.6 ± 2.8 , respectively ($P < .001$). All patients were satisfied with the operation result.

Conclusion

According to the results of our study, arthroscopic ablation is a safe and efficient method of treatment for osteoid osteoma of the elbow, with a fast rehabilitation time.

[BACK](#)

AJSM

April 2017, Vol 45, Issue 5 / May 2017, Vol 45, Issue 6

The Influence of Evidence-Based Surgical Indications and Techniques on Failure Rates After Arthroscopic Shoulder Stabilization in the Contact or Collision Athlete With Anterior Shoulder Instability

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The American Journal of Sports Medicine Vol 45, Issue 5, pp. 1218 – 1225

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Background: It has been reported that arthroscopic shoulder stabilization yields higher rates of failure in contact or collision athletes as compared with open shoulder stabilization; however, this is largely based upon studies that do not employ modern, evidence-based surgical indications and techniques for arthroscopic shoulder stabilization.

Purpose: To (1) determine the pooled failure rate across all studies reporting failure after primary arthroscopic shoulder stabilization for anterior shoulder instability in contact or collision athletes and (2) stratify failure rates according to studies that use evidence-based surgical indications and techniques.

Study Design: Systematic review.

Methods: A review of PubMed, Medline, and Embase was performed to identify all clinical studies with a minimum of 1-year follow-up that reported failure rates after arthroscopic shoulder stabilization for anterior shoulder instability in contact or collision athletes. Data pertaining to patient demographics, clinical and radiographic preoperative assessment, surgical indications, surgical technique, rehabilitation, and outcome were collected from each included study. An overall failure rate was determined across all included studies. After this, a secondary literature review was performed to identify factors related to patient selection and surgical technique that significantly influence failure after primary arthroscopic shoulder stabilization. Failure rates were then determined among included studies that used these evidence-based indications and techniques.

Results: Overall, 26 studies reporting on 779 contact or collision athletes met the inclusion criteria. The mean patient age was 19.9 years, 90.3% were male, and the most common sport was rugby. There was considerable variability in the reporting of patient demographics, preoperative assessment, surgical indications, surgical technique, and patient outcomes. Across all included studies, the pooled failure rate after arthroscopic shoulder stabilization in the contact or collision athlete was 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%.

Conclusion: The rate of failure after arthroscopic shoulder stabilization in contact or collision athletes decreases from 17.8% to 7.9% after the use of evidence-based surgical indications and techniques.

[BACK](#)

Longitudinal Long-term Magnetic Resonance Imaging and Clinical Follow-up After Single-Row Arthroscopic Rotator Cuff Repair: Clinical Superiority of Structural Tendon Integrity

Philipp R. Heuberer*†, Daniel Smolen*, Leo Pauzenberger*, Fabian Plachel*, Sylvia Salem*, Brenda Laky*†, Bernhard Kriegleder*, Werner Anderl*†‡

<http://journals.sagepub.com/doi/pdf/10.1177/0363546517689873>

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Background: The number of arthroscopic rotator cuff surgeries is consistently increasing. Although generally considered successful, the reported number of retears after rotator cuff repair is substantial. Short-term clinical outcomes are reported to be rarely impaired by tendon retears, whereas to our knowledge, there is no study documenting long-term clinical outcomes and tendon integrity after arthroscopic rotator cuff repair.

Purpose: To investigate longitudinal long-term repair integrity and clinical outcomes after arthroscopic rotator cuff reconstruction.

Study Design:

Case series; Level of evidence, 4.

Methods: Thirty patients who underwent arthroscopic rotator cuff repair with suture anchors for a full-tendon full-thickness tear of the supraspinatus or a partial-tendon full-thickness tear of the infraspinatus were included. Two and 10 years after initial arthroscopic surgery, tendon integrity was analyzed using magnetic resonance imaging (MRI). The University of California, Los Angeles (UCLA) score and Constant score as well as subjective questions regarding satisfaction with the procedure and return to normal activity were used to evaluate short- and long-term outcomes.

Results: At the early MRI follow-up, 42% of patients showed a full-thickness rerupture, while 25% had a partial rerupture, and 33% of tendons remained intact. The 10-year MRI follow-up (129 ± 11 months) showed 50% with a total rerupture, while the other half of the tendons were partially reruptured (25%) or intact (25%). The UCLA and Constant scores significantly improved from preoperatively (UCLA total: 50.6% ± 20.2%; Constant total: 44.7 ± 10.5 points) to 2 years (UCLA total: 91.4% ± 16.0% [P < .001]; Constant total: 87.8 ± 15.3 points [P < .001]) and remained significantly higher after 10 years (UCLA total: 89.7% ± 15.9% [P < .001]; Constant total: 77.5 ± 15.6 points [P < .001]). The Constant total score and Constant strength subscore, but not the UCLA score, were also significantly better at 10 years postoperatively in patients with intact tendons compared with patients with reruptured tendons (Constant total: 89.0 ± 7.8 points vs 75.7 ± 14.1 points, respectively [P = .034]; Constant strength: 18.0 ± 4.9 points vs 9.2 ± 5.2 points, respectively [P = .006]). The majority of patients rated their satisfaction with the procedure as “excellent” (83.3%), and 87.5% returned to their normal daily activities.

Conclusion: Arthroscopic rotator cuff repair showed good clinical long-term results despite a high rate of retears. Nonetheless, intact tendons provided significantly superior clinical long-term outcomes, making the improvement of tendon healing and repair integrity important goals of future research efforts.

[BACK](#)

Clinical Outcome of Arthroscopic Bankart Repair Combined With Simultaneous Capsular Repair

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Background: A capsular tear and humeral avulsion of the glenohumeral ligament lesion are not uncommon findings in association with a Bankart lesion. However, there have been few reports regarding the prevalence of such capsular lesions and the postoperative recurrence after capsular repair.

Purpose/Hypothesis: This study investigated the prevalence of capsular lesions and clarified their influence on the postoperative recurrence of instability. In addition, factors were identified that were associated with the occurrence of capsular lesions and the postoperative recurrence of instability. We hypothesized that clinical outcomes would be improved by combining arthroscopic Bankart repair with simultaneous capsular repair.

Study Design: Cohort study; Level of evidence, 3.

Methods: Capsular lesions were retrospectively examined through operative records, still pictures, and videos in 172 shoulders with traumatic anterior instability. First, the prevalence of capsular lesions and their severity were investigated. Then, postoperative recurrence was determined in shoulders observed for a minimum of 2 years. Finally, factors were assessed that were associated with the occurrence of capsular lesions and the postoperative recurrence of instability.

Results: A capsular lesion was recognized in 37 shoulders (21.5%), being severe and mild in 20 and 17, respectively. All were repaired simultaneously with the arthroscopic Bankart procedure. After follow-up for at least 2 years, recurrence of instability was detected in 10 of 34 shoulders (29.4%), including 6 (31.6%) with severe capsular lesions and 4 (26.7%) with mild lesions. The recurrence rate was significantly higher in shoulders with a capsular lesion than in shoulders without a capsular lesion (18 of 120, 15%; $P = .013$), but there was no significant difference between severe and mild lesions. Regardless of the sport played, capsular lesions were significantly more frequent in patients ≥ 30 years old, patients with complete dislocation, and patients with a coexisting Hill-Sachs lesion. Postoperative recurrence of instability was significantly more frequent in patients < 30 years and competitive athletes.

Conclusion: In shoulders undergoing arthroscopic Bankart repair, capsular lesions were often present and were associated with higher postoperative recurrence of instability. While these lesions were more frequent in older patients, postoperative recurrence of instability was more likely in young competitive athletes.

[BACK](#)

JBJS

2017: March-April, volume 99, issue 5-8

No upper extremity arthroscopy abstracts available

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April - May 2017, Vol 475, Issue 4-5

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April - May 2017, Vol 99-B, Issue 4-5

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Lower extremity

Arthroscopy

Volume 33, Issue 4 / Volume 33, Issue 5

Amateur and Recreational Athletes Return to Sport at a High Rate Following Hip Arthroscopy for Femoroacetabular Impingement

Alexander E. Weber, Benjamin D. Kuhns, Greg L. Cvetanovich, Jeffrey S. Grzybowski, Michael J. Salata, Shane J. Nho

Arthroscopy, April 2017, Volume 33, Issue 4, p748–755

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Purpose

To compare the return-to-play rates, patient-reported outcome (PRO) scores, and satisfaction between high-level amateur athletes and recreational athletes and to evaluate for differences in ability to return to sport in these groups based on patient-related and sport-related characteristics.

Methods

Clinical data were retrieved for 66 (26 male/40 female) consecutive athletes undergoing hip arthroscopy for femoroacetabular impingement. Athletes were classified as high-level amateur or recreational. Athletes were also divided into 6 distinct sporting categories based on the physical demands on the hip. Preoperative and 2-year PROs including a sport-specific questionnaire, modified Harris Hip Score (MHHS), and Hip Outcome Scores with Activities of Daily Living (HOS-ADL) and Sports-Specific (HOS-SS) subscales were collected.

Results

Of the 66 patients, 49 were recreational and 17 were high-level amateur athletes (10 high school and 7 collegiate). High-level athletes were significantly younger than recreational athletes (18.4 ± 2.3 years vs 29.7 ± 6.8 years; $P < .001$). After 2 years, all PROs had improved significantly, with no differences between the 2 athletic groups. There was a high overall rate of return for both recreational and high-level amateur athletes (94% vs 88%; $P = .60$). Increasing preoperative withdrawal time from sport prior to surgery was associated with decreased HOS-SS ($r = 0.33$; $P = .04$) and MHHS scores ($r = 0.02$; $P = .02$). Overall, athletes who had withdrawn from sport for greater than 8 months before surgery returned to sport significantly more slowly ($P = .01$). Increasing body mass index (BMI) was associated with lower improvements in HOS ($r = 0.26$; $P = .04$) and MHHS scores ($r = 0.38$; $P < .01$).

Conclusion

Recreational athletes, despite being significantly older than their high-level counterparts, return to play at a similar high rate and with comparable PROs. Increasing preoperative cessation time from sport significantly prolongs return to sport. Additionally, increasing preoperative cessation from sport and higher preoperative BMI were associated with decreased improvements in PROs.

Level of Evidence

Level III, retrospective comparative study.

[BACK](#)

Anterior Inferior Iliac Spine Morphology and Outcomes of Hip Arthroscopy in Soccer Athletes: A Comparison to Nonkicking Athletes

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Purpose

To describe the anterior inferior iliac spine (AIIS) morphology and clinical outcomes following arthroscopic surgical decompression in a group of high-level soccer athletes presenting with symptomatic hip impingement when compared with a control group of nonkicking athletes.

Methods

From 2009 to 2012, we retrospectively reviewed our prospective hip registry for soccer athletes who underwent arthroscopic treatment for femoroacetabular impingement (FAI) with 2-year follow-up, comparing with a control group of nonkicking athletes. Demographics were collected and radiographic studies (plain radiograph and computed tomographic scan) reviewed for several parameters, including AIIS morphology. Patient-reported outcome scores, including modified Harris Hip Score (mHHS), Hip Outcome Score–Activities of Daily Living (HOS-ADL) and Sport-Specific Subscale (HOS-SSS), and International Hip Outcome Tool–33 (iHOT-33), were administered preoperatively, at 6 months, and at 1, 2, and 3 years postoperatively.

Results

Twenty-six soccer players (34 hips) and 87 nonkicking athletes (115) hips were identified. Demographics, including age (19.2 ± 4.1 vs 20.1 ± 3.8 years) and gender distribution (53.8% vs 51.7% male), were similar between the soccer and nonkicking athletes ($P = .288, .849$). Eighty-four percent of soccer players demonstrated some abnormality of the AIIS extending to (type II, 52%) or below the anterior acetabular rim (type III, 32%), compared with 52% nonkicking athletes ($P < .001$). At a mean follow-up of 35 months (range, 24–57 months) there was significant improvement in all outcome scores in both groups from pre- to postoperation ($P < .001$). There was no evidence of differences in outcome scores between groups (mHSS: 89 ± 14.6 vs 88.2 ± 14.4 , $P = .804$; HOS-ADL: 94.1 ± 9.1 vs 92.2 ± 11.1 , $P = .431$; HOS-SSS: 86 ± 17.1 vs 81.3 ± 24.3 , $P = .362$) with the exception of iHOT-33 (81.7 ± 19 vs 70.3 ± 23.6 , $P = .027$).

Conclusion

High-level soccer players have a significantly higher rate of subspine impingement compared with nonkicking athletes. There should be a high index of suspicion when treating soccer players for FAI, where appropriate recognition and treatment of subspine impingement can yield excellent clinical results.

Level of Evidence

Level III, retrospective case-control study.

[BACK](#)

Comparison of Radiographs and Computed Tomography for the Screening of Anterior Inferior Iliac Spine Impingement

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Purpose

To compare radiographic and 3-dimensional (3D) computed tomography (CT) imaging modalities for the screening of anterior inferior iliac spine (AIIS) impingement by establishing imaging measurement related to the AIIS.

Methods

Anteroposterior and false-profile radiographs and 3D CT scans were obtained on 10 human cadaveric pelvises. On the anteroposterior view for each methodology, 2 measurements were calculated: distance to the most lateral AIIS from the 12 o'clock position on the acetabular rim, and the angle between the lateral AIIS and the sagittal plane. On the false-profile view for each methodology, 2 measurements were calculated: distance to the anterior AIIS from the 12 o'clock position on the acetabular rim, and the angle between the anterior AIIS and the sagittal plane. Inter-rater and intrarater reliability analyses were performed for both methods in addition to an intermethod analysis.

Results

The radiographic false-profile view was the most repeatable orientation, with intraclass correlation coefficients showing excellent reproducibility in both inter-rater (angle: 0.980, distance: 0.883) and intrarater (angle: 0.995, distance: 0.995) analyses. The mean distance from the 12 o'clock position of the acetabular rim to the most anterior/lateral aspect of the AIIS was 41.4 mm and 16.0 mm on the radiographic false-profile and anteroposterior views, respectively. Intermethod analysis showed a systematic, quantitative bias between modalities (anteroposterior view: -4.1 mm, 6.7°; false-profile view: -0.1 mm, 8.3°), which will remain relatively consistent as evidenced by the strong individual reproducibility of each measurement.

Conclusion

AIIS morphology in relation to the acetabular rim 12 o'clock position and its angle relative to the sagittal plane can be quantitatively determined using either radiographic or 3D CT imaging modalities.

Clinical Relevance

Radiographic evaluation may be a valuable tool in the screening of AIIS impingement.

[BACK](#)

Isolated Acetabuloplasty and Labral Repair for Combined-Type Femoroacetabular Impingement: Are We Doing Too Much?

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Purpose

To evaluate patient outcomes after isolated arthroscopic volumetric acetabular osteoplasty and labral repair for the treatment of patients with combined femoroacetabular impingement (FAI) lesions.

Methods

A review of a prospectively collected registry identified 86 patients (106 hips) with an average age of 38.1 years (range, 17-59 years) with combined-type FAI that underwent isolated acetabular osteoplasty and labral repair. Preoperative α -angle, degree of radiographic degenerative changes, and presence of a crossover sign were recorded. Clinical outcomes were assessed with the modified Harris Hip Score (mHHS), International Hip Outcome Tool–12 (iHOT-12), Hip Outcome Score Sport-Specific Subscale (HOS-SSS), and patient satisfaction score (out of 10) at a minimum 2-year follow-up.

Results

Clinical follow-up was obtained at a mean follow-up of 37.2 months (range, 27.9-79.2 months). Patients with Tönnis grade 0 and I findings had significantly higher mHHS (83.5 vs 71.5, $P = .01$), HOS-SSS (81.3 vs 59.9, $P = .02$), and iHOT-12 scores (71.1 vs 58.8, $P = .04$) compared to patients with Tönnis grade II changes. However, patient satisfaction scores (8.0 vs 7.2, $P = .45$) were no different. No significant difference was noted between unilateral and bilateral hip patient outcome scores. Patient age and preoperative α -angles did not correlate with any outcome scores (all $R^2 < 0.05$). There were no cases of revision surgery or progression to arthroplasty.

Conclusion

Isolated acetabular decompression may adequately address the underlying impingement in combined-type FAI while avoiding the risks associated with femoral-sided decompression. Good to excellent patient-reported outcomes and satisfaction scores were noted with significantly higher scores in patients with minimal arthritic change. Patient age and preoperative α -angle had less effect on postoperative outcomes.

Level of Evidence

Level IV, therapeutic case series.

[BACK](#)

Complex Medial Meniscus Tears Are Associated With a Biconcave Medial Tibial Plateau

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Purpose

To determine whether an association exists between a biconcave medial tibial plateau and complex medial meniscus tears.

Methods

A consecutive series of stable knees undergoing arthroscopy were evaluated retrospectively with the use of preoperative magnetic resonance imaging (MRI), radiographs, and arthroscopy documented by intraoperative videos. Investigators independently performed blinded reviews of the MRI or videos. Based on the arthroscopy findings, medial tibial plateaus were classified as either biconcave or not biconcave. A transverse coronal plane ridge, separating the front of the tibial plateau from the back near the inner margin of the posterior body of the medial meniscus, was defined as biconcave. The medial plateau slope was calculated with MRI sagittal views. General demographic information, body mass index, and arthroscopically confirmed knee pathology were recorded.

Results

A total of 179 consecutive knees were studied from July 2014 through August 2015; 49 (27.2%) biconcave medial tibial plateaus and 130 (72.8%) controls were identified at arthroscopy. Complex medial meniscus tears were found in 103. Patients with a biconcave medial tibial plateau were found to have more complex medial meniscus tears (69.4%) than those without a biconcavity (53.1%) ($P = .049$) despite having lower body mass index ($P = .020$). No difference in medial tibial plateau slope was observed for biconcavities involving both cartilage and bone, bone only, or an indeterminate group ($P = .47$).

Conclusion

Biconcave medial tibial plateaus were present in 27.4% of a consecutive series of patients undergoing knee arthroscopy. A biconcave medial tibial plateau was more frequently associated with a complex medial meniscus tear.

Level of Evidence

Level III, case-control study.

[BACK](#)

Viable Stem Cells Are in the Injury Effusion Fluid and Arthroscopic Byproducts From Knee Cruciate Ligament Surgery: An In Vivo Analysis

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Purpose

To examine the number of viable stem cells contained in the postinjury effusion fluid and the waste byproducts of arthroscopic cruciate ligament surgery.

Methods

This study included patients older than 18 years of age with acute (<5 weeks old) cruciate ligament injuries requiring arthroscopic surgery. The postinjury effusion fluid (effusion fluid), fat pad and cruciate ligament stump debridement tissue (byproduct tissue), and arthroscopic fluid collected during fat pad and/or stump debridement (byproduct fluid) were collected at the time of surgery from 30 individuals. Specimens were analyzed, investigating cell viability, nucleated cell counts, cell concentrations, colony-forming unit assays, and flow cytometry. Samples from the first 20 individuals were collected in small specimen containers, and samples from the last 10 individuals were collected in larger specimen containers.

Results

Cells of the injury effusion exhibited the greatest viability ($86.4 \pm 1.31\%$) when compared with the small volume harvest byproduct tissue ($50.2 \pm 2.5\%$, $P = .0001$), small volume harvest byproduct fluid ($48.8 \pm 1.88\%$, $P = .0001$), large volume harvest byproduct tissue ($70.1 \pm 5.6\%$, $P = .0001$), and large volume harvest byproduct fluid ($60.3 \pm 3.41\%$, $P = .0001$). The culture analysis of fibroblast colony-forming units found on average 1916 ± 281 progenitor cells in the effusion fluid, 2488 ± 778 progenitor cells in the byproduct tissue, and 2357 ± 339 progenitor cells in the byproduct fluid. Flow cytometry confirmed the presence of immature cells and the presence of cells with markers typically expressed by known stem cell populations.

Conclusion

Viable stem cells are mobilized to the postinjury effusion at the time of cruciate ligament injury and can be found in the byproduct waste of cruciate ligament surgery.

Clinical Relevance

The methodology around effusion fluid and byproduct tissue capture during cruciate ligament surgery should be investigated further. Cell amounts available from these tissues with current technologies are not sufficient for immediate evidence-based clinical application.

[BACK](#)

Fibrous Synovium Releases Higher Numbers of Mesenchymal Stem Cells Than Adipose Synovium in a Suspended Synovium Culture Model

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Purpose

To develop an in vitro model, the “suspended synovium culture model,” to demonstrate the mobilization of mesenchymal stem cells (MSCs) from the synovium into a noncontacted culture dish through culture medium. In addition, to examine which synovium, fibrous synovium or adipose synovium, released more MSCs in the knee with osteoarthritis.

Methods

Human synovial tissue was harvested during total knee arthroplasty from knee joints of 34 patients with osteoarthritis (28 patients: only fibrous synovium, 6 patients: fibrous and adipose synovium). One gram of synovium was suspended with a thread in a bottle containing 40 mL of culture medium and a 3.5-cm-diameter culture dish at the bottom. After 7 days, the culture dish in the bottle was examined. For the cells harvested, multipotentiality and surface epitopes were analyzed. The numbers of colonies derived from fibrous synovium and adipose synovium were also compared.

Results

Colonies of spindle-shaped cells were observed in the culture dish in all 28 donors. Colonies numbered 26 on average, and the cells derived from colony-forming cells had multipotentiality for chondrogenesis, adipogenesis, calcification, and surface epitopes similar to MSCs. The number of colonies was significantly higher in fibrous synovium than in adipose synovium ($P < .05$, $n = 6$).

Conclusion

We developed a suspended synovium culture model. Suspended synovium was able to release MSCs into a noncontacted culture dish through medium in a bottle. Fibrous synovium was found to release greater numbers of MSCs than adipose synovium in our culture model.

Clinical Relevance

This model could be a valuable tool to screen drugs capable of releasing MSCs from the synovium into synovial fluid.

[BACK](#)

Medial Open-Wedge High Tibial Osteotomy May Adversely Affect the Patellofemoral Joint

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Purpose

To evaluate 2-stage arthroscopic findings of the patellofemoral joint before and after medial open-wedge high tibial osteotomy (HTO) and verify whether the patellofemoral joint would be influenced by medial open-wedge HTO.

Methods

We prospectively reviewed 114 cases of medial open-wedge HTO for the treatment of osteoarthritis with a varus knee. First-look arthroscopy was performed during HTO. The mean age at the time of HTO was 56.34 ± 5.4 years (range, 40-69 years). Second-look arthroscopy was performed concomitantly with plate removal at an average of 26.1 ± 6.0 months (range, 21.6-32.0 months) after HTO. We assessed the patellofemoral joint using the International Cartilage Repair Society (ICRS) grading system by first- and second-look arthroscopy and compared it before and after HTO. Postoperative anterior knee pain was also evaluated.

Results

Compared with first-look findings, second-look arthroscopic ICRS grading was changed as follows: In terms of the patella, 89 cases (78.1%) were not progressed whereas 25 cases (21.9%) were progressed. In terms of the femoral trochlea, 67 cases (58.8%) were not progressed whereas 47 cases (41.2%) were progressed. There was significant progression of the ICRS grade of the patella ($P = .001$) and femoral trochlea ($P < .001$) compared with first-look arthroscopic findings. The incidence of postoperative anterior knee pain was 11.4% (13 cases), and it was related to the ICRS grade of the patellofemoral joint at the time of second-look arthroscopy ($P < .001$ for patella and $P < .001$ for trochlea).

Conclusion

This study showed that the patellofemoral joint might be adversely affected by medial open-wedge HTO. Although the incidence of postoperative anterior knee pain was low, it was clinically correlated with patellofemoral arthritis.

Level of Evidence

Level IV, therapeutic case series.

[BACK](#)

Bone Incorporation of Silicate-Substituted Calcium Phosphate in 2-Stage Revision Anterior Cruciate Ligament Reconstruction: A Histologic and Radiographic Study

Jan von Recum, Johannes Schwaab, Thorsten Guehring, Paul-Alfred Grützner, Marc Schnetzke

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Purpose

To evaluate the histologic and radiographic outcomes of using silicate-substituted calcium phosphate (Si-CaP) as bone graft substitute for the augmentation of tunnel defects in 2-stage revision anterior cruciate ligament (ACL) reconstruction.

Methods

Forty patients undergoing 2-stage revision ACL reconstruction were included in a prospective, randomized controlled clinical trial between 2012 and 2015. The inclusion criteria were tunnel diameter of the tibial and/or femoral tunnel of 10 mm or greater after failed ACL reconstruction. Twenty patients received autologous bone from the iliac crest and 20 patients received Si-CaP as a bone graft substitute for tunnel grafting at the first-stage procedure. Punch biopsy specimens of the augmented tunnels were taken at the second-stage procedure, and histologic examination included quantitative analysis of the area of immature bone formation, lamellar bone, and bone marrow. Radiographic analysis included determination of the filling rates of the tunnels on postoperative computed tomography scans.

Results

Forty patients with a mean age of 32 years (standard deviation [SD], 11.0 years) were analyzed. Histologic examination of the tunnels filled with Si-CaP showed that 15% (SD, 14%) of the area was covered with immature bone formation, 41% (SD, 10%) with well-organized lamellar bone, and 44% (SD, 8%) with bone marrow. In the control group (autologous bone), 58% (SD, 3%) of the area was covered with well-organized lamellar bone and 42% (SD, 3%) with bone marrow. Quantitative evaluation of the postoperative computed tomography scans showed a trend of better filling rates in patients with Si-CaP for the tibial tunnel (86% [SD, 17%] vs 78% [SD, 14%]; $P = .131$). Intraoperatively, Si-CaP was completely integrated into the original bone tunnel providing good stability for tunnel placement and tendon graft fixation comparable to autologous bone.

Conclusion

Si-CaP as bone graft substitute for tunnel augmentation in 2-stage revision ACL reconstruction shows good histologic, radiographic, and intraoperative integration comparable to autologous bone.

Level of Evidence

Level I, prospective randomized controlled trial.

[BACK](#)

Isolated Syndesmosis Diastasis: Computed Tomography Scan Assessment With Arthroscopic Correlation

Tae-Keun Ahn, Seung-Myung Choi, Jae-Young Kim, Woo-Chun Lee

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Purpose

To investigate which method can predict tibiofibular diastasis more accurately among the tibiofibular interval at the ankle joint level or previous parameters taken 1 cm above the joint line.

Methods

An arthroscopic examination was performed in 78 consecutive patients with anterolateral ankle pain. Four different methods were performed to take measurements of the tibiofibular interval using an axial computed tomography (CT) scan under existing arthroscopic diagnosis. Three previously reported parameters were assessed at 1 cm above the joint level. In the first method, 2 measurements were obtained. The anterior measurement was the closest distance between the anterior border of the fibula and anterior tibial tubercle. The posterior measurement was the closest distance between the medial border of the fibula and posterior tibial tubercle. In the second method, an angle between the fibular axis and the line connecting the anterior and posterior tibial tubercle was measured. In the third method, the nearest distance between the line perpendicular to the line connecting the tubercles at the anterior tubercle of the distal tibia and the anterior-most margin of the fibula was measured. The fourth method, which was developed in this study, measured the narrowest tibiofibular distance at the joint level. Data were analyzed using Student's *t*-test and the receiver operating characteristic curve to make comparisons among 4 CT-based parameters.

Results

In the comparison between the patients with arthroscopic diastasis and without diastasis, the posterior parameter in the first method and the narrowest tibiofibular distance at the joint level in the fourth method showed a significant difference ($P < .05$). The areas under the receiver operating characteristic curve (AUCs) of the anterior and posterior parameter of the first method were 0.58 (95% confidence interval [CI], 0.43-0.73; $P = .167$) of anterior measurement and 0.6 (95% CI, 0.45-0.75; $P = .029$) of posterior measurement, respectively. The second and third methods presented AUCs of 0.59 (95% CI, 0.44-0.74; $P = .458$) and 0.48 (95% CI, 0.33-0.64; $P = .987$), respectively. The fourth method presented an AUC of 0.86 (95% CI, 0.75-0.94; $P = .000$). When the syndesmosis was measured at the joint level, 2 mm of syndesmosis interval as a cutoff value showed 76% of sensitivity and 81% of specificity.

Conclusion

Syndesmosis assessment using an axial CT scan at the joint level best correlated with the arthroscopic examination. When there is more than 2 mm of widening in syndesmosis on the axial CT scan at the joint level, there is a high likelihood of diastasis of the distal tibiofibular syndesmosis in patients who are suspicious clinically to have acute or chronic syndesmosis lesion.

Level of Evidence

Level III, retrospective comparative study.

[BACK](#)

Treatment Options for Patellar Tendinopathy: A Systematic Review

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Purpose

To compare the efficacy of common invasive and noninvasive patellar tendinopathy (PT) treatment strategies.

Methods

A systematic search was performed in PubMed, Google Scholar, CINAHL, UptoDate, Cochrane Reviews, and SPORTDiscus. Fifteen studies met the following inclusion criteria: (1) therapeutic outcome trial for PT, and (2) Victorian Institute of Sports Assessment was used to assess symptom severity at follow-up. Methodological quality and reporting bias were evaluated with a modified Coleman score and Begg's and Egger's tests of bias, respectively.

Results

A total of 15 studies were included. Reporting quality was high (mean Coleman score 86.0, standard deviation 9.7), and there was no systematic evidence of reporting bias. Increased duration of symptoms resulted in poorer outcomes regardless of treatment (0.9% decrease in improvement per additional month of symptoms; $P = .004$). Eccentric training with or without core stabilization or stretching improved symptoms (61% improvement in the Victorian Institute of Sports Assessment score, 95% confidence interval [CI] 53% to 69%). Surgery in patients refractory to nonoperative treatment also improved symptoms (57%, 95% CI 52% to 62%) with similar outcomes among arthroscopic and open approaches. Results from shockwave (54%, 95% CI 22% to 87%) and platelet-rich plasma (PRP) studies (55%, 95% CI 5% to 105%) varied widely though PRP may accelerate early recovery. Finally, steroid injection provided no benefit (20%, 95% CI -20% to 60%).

Conclusion

Initial treatment of PT can consist of eccentric squat-based therapy, shockwave, or PRP as monotherapy or an adjunct to accelerate recovery. Surgery or shockwave can be considered for patients who fail to improve after 6 months of conservative treatment. Corticosteroid therapy should not be used in the treatment of PT.

Level of Evidence

Level IV, systematic review of Level II-IV studies.

[BACK](#)

Fluid Extravasation in Hip Arthroscopy: A Systematic Review

Seper Ekhtiari, Chloe E. Haldane, Darren de SA, Nicole Simunovic, Olufemi R. Ayeni

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Purpose

The Purpose of this systematic review was to (1) characterize cases of fluid extravasation during hip arthroscopy and explore common factors among them and (2) describe management strategies and outcomes of this complication.

Methods

The databases MEDLINE, EMBASE, and PubMed were searched and screened in duplicate. Data regarding patient demographics, fluid management, presentation, management, and outcomes were collected. Study quality was assessed in duplicate using the Methodological Index for Non-Randomized Studies Criteria.

Results

Fourteen studies (1,286 patients) were included. Twenty-two occurrences of symptomatic fluid extravasation were reported in 21 patients (1.6% of total patients; one patient had fluid extravasation during 2 separate hip arthroscopies). Two studies of normal fluid extravasation in asymptomatic patients reported 1.13 to 3.06 L of extravasated fluid observed on computed tomography. Nine case studies were included, which provided detailed patient and surgical information. Of these 9 patients (10 cases) with a mean age of 38.2 years old (range, 15 to 55 years), 6 were female. Signs of fluid extravasation included abdominal distension (89%), hypothermia (56%), hypotension, and metabolic acidosis (33% each). Four patients required surgical intervention, while 3 underwent paracentesis. Two patients were managed conservatively. All patients stabilized and were discharged, with one patient reporting abdominal complaints at latest follow-up (length of follow-up unspecified).

Conclusion

Fluid extravasation is a rare but potentially life-threatening complication of hip arthroscopy. It is important for surgeons and anaesthesiologists to be aware of its existence in order to recognize and manage it promptly. Most patients require interventional management by surgery or paracentesis, but some stabilize with conservative management.

Level of Evidence

Level IV, systematic review of Level IV studies.

[BACK](#)

Hip Preservation Surgery Expectations Survey: A New Method to Measure Patients' Preoperative Expectations

Carol A. Mancuso, Catherine H. Wentzel, Hassan M.K. Ghomrawi, Bryan T. Kelly

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Purpose

To develop a patient-derived expectations survey for hip preservation surgery.

Methods

Patients were eligible if they were undergoing primary hip surgery and were recruited in person or by telephone. The survey was developed in 3 phases. During phase 1, 64 patients were interviewed preoperatively and asked open-ended questions about their expectations of surgery; a draft survey was assembled by categorizing responses. During phase 2, the survey was administered twice to another group of 50 patients preoperatively to assess test-retest reliability and concordance was measured with weighted kappa values and intraclass correlations. All patients also completed valid standard hip surveys electronically. During phase 3, final items were selected, factor analysis was performed, and a scoring system was developed.

Results

In phase 1, 509 expectations were volunteered from which 21 distinct categories were discerned and became the items for the draft survey. In phase 2, the draft survey was completed twice, 4 days apart. In phase 3, all 21 items were retained for the final survey addressing pain, mobility, sports, resumption of active lifestyles, future function, and psychological well-being. An overall score is calculated from the number of items expected and the amount of improvement expected, and ranges from 0 to 100; higher is more expectations. For phase 2 patients, mean scores for both administrations were 82, Cronbach alpha coefficients were 0.88 and 0.91, and the intraclass correlation was 0.92. A higher score (i.e., greater expectations) was associated with worse hip condition measured by standard hip surveys ($P \leq .05$).

Conclusions

We developed a patient-derived survey that is valid, reliable, and addresses a spectrum of expectations. The survey generates an overall score that is easy to calculate and interpret and offers a practical and comprehensive way to record patients' preoperative expectations.

Level of Evidence

Level II, prognostic study, prospective sample.

[BACK](#)

Brake Reaction Time After Hip Arthroscopy for Femoroacetabular Impingement and Labral Tear

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Purpose

To determine if a difference exists in brake reaction time (BRT) before and after hip arthroscopy for femoroacetabular impingement (FAI) and labral tear compared with age- and gender-matched controls.

Methods

Consecutive adult subjects undergoing primary hip arthroscopy were eligible for this prospective investigation. Individuals with symptomatic FAI and labral tear that underwent hip arthroscopy with minimum 8 weeks follow-up were included. BRT was measured using the RT-2S reaction time tester a maximum of 6 weeks preoperatively and every 2 weeks postoperatively for 8 weeks. Sit-to-stand test (STST) was measured at each BRT testing session. An age- and gender-matched control group without hip or lower extremity symptoms were selected and completed both BRT and STST. Continuous pre- and postoperative BRT values were compared with Mann-Whitney and analyses of variance. Association of BRT and STST tests was performed with Spearman correlation. An a priori sample size calculation determined that minimally 18 subjects per group (surgery group vs control group) were necessary to detect, with 80% power (difference of 0.2 seconds in BRT).

Results

Nineteen subjects (age 37.1 ± 12.7 years, 10 women, 11 right hip) were analyzed. All subjects underwent arthroscopic labral repair and FAI correction. There was no difference between preoperative (604 ± 148 milliseconds [ms]) and postoperative (608 ms 2 weeks; 566 ms 4 weeks; 559 ms 6 weeks; 595 ms 8 weeks) BRT. There was no difference between controls and subjects at any time point. There was a strong negative correlation between BRT and STST preoperatively and at 4 and 6 weeks postoperatively and a moderate negative correlation at 2 weeks postoperatively.

Conclusions

After hip arthroscopy for FAI and labral tear, BRT is not different from preoperative values or that of controls. In addition, BRT had a significant correlation with STST in the first 6 weeks after surgery.

Level of Evidence

Level II, diagnostic, prospective.

[BACK](#)

Cyclic and Load to Failure Properties of All-Suture Anchors in Synthetic Acetabular and Glenoid Cancellous Bone

Nathan P. Douglass, Anthony W. Behn, Marc R. Safran

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Purpose

To evaluate the cyclic displacement, maximum load to failure, and failure mode of multiple all-suture anchors (ASAs) in 2 different densities of sawbones cancellous bone substitute.

Methods

Anchors tested included the Suturefix Ultra 1.7 mm, JuggerKnot 1.45 mm (No. 1 and No. 2 MaxBraid) and 2.9 mm, Y-Knot Flex 1.3 mm and 1.8 mm, Iconix 1, 2, 25, and 3, Q-Fix 1.8 mm, and Bioraptor 2.3 PK. The Bioraptor served as a non–all-suture-based control. Seven to eleven anchors were tested in both 20 and 30 pounds per cubic foot (pcf) test blocks that were chosen to simulate glenoid and acetabular cancellous bone, respectively. After a 40 N deployment force, anchors were cyclically loaded at 0.5 Hz from 10 to 50 N and then 10 to 100 N for 200 cycles each. Surviving specimens were pulled to failure at 10 mm/s. Displacement, stiffness, maximum load, and failure mode were recorded. Welch *t*-tests and Welch analysis of variance with Games-Howell post hoc tests were used for statistical analysis.

Results

In higher density blocks, 11 of 12 anchors had significantly ($P < .05$) higher maximum loads to failure, and 8 anchors showed significantly lower post-cyclic displacement. The Q-Fix 1.8 displayed the lowest post-cyclic displacement in both densities (0.1 ± 0.2 mm, mean \pm standard deviation, in both densities). All other groups exhibited at least 2.8 mm and 0.6 mm post-cyclic displacement in 20 and 30 pcf, respectively. The Bioraptor did not survive cyclic testing in 20 pcf and had 0.6 ± 0.3 mm post-cyclic displacement in 30 pcf.

Conclusions

ASAs show better fixation in higher density synthetic bone. The cyclic displacement and maximum load of ASAs vary widely depending on anchor design and bone density. Most anchors fail by suture anchor pullout. In general, the Bioraptor 2.3 PK outperformed ASAs in higher density test blocks with mixed results in lower density test blocks.

Clinical Relevance

ASAs show mixed results compared with a traditional suture anchor. They perform better in higher density bone substitute.

[BACK](#)

Does Bony Regrowth Occur After Arthroscopic Femoroplasty in a Group of Young Adolescents?

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Purpose

To evaluate femoral head-neck bone regrowth and PROs in skeletally immature patients that underwent arthroscopic femoroplasties over a minimum 2-year period.

Methods

Eleven skeletally immature hips (10 patients) with open femoral head physes underwent femoroplasty between October 2008 and November 2013. Inclusion criteria were minimum 2-year follow-up with patient-reported outcomes (PROs) and radiographs preoperatively, at 2 weeks, and at a minimum of 2 years postoperatively. Exclusion criteria were >16 years of age, preoperative Tönnis grade >1 and previous hip conditions. Preoperative radiographs were used to assess skeletal immaturity, which was indicated by a Risser score ≤ 4 and femoral head physis >1 mm. Alpha angles were measured preoperatively, at 2 weeks, and at a minimum of 2 years postoperatively. PROs, including the modified Harris Hip Score (mHHS), Non-Arthritic Hip Score (NAHS), Hip Outcome Score–Sports Specific Subscale (HOS-SSS), and visual analog scale (VAS) score, were measured preoperatively and at the latest follow-up.

Results

Mean age at surgery was 14.7 years (range: 13.2–15.9). Mean follow-up was 35.7 months (range: 23.3–61.4). All hips tested positive for anterior impingement preoperatively. The mean preoperative alpha angle was 61.8° , which decreased to 41.5° postoperatively ($P < .0001$) and was 40.7° at a minimum of 2 years postoperatively. No bony regrowth was documented at the latest follow-up. Mean improvements in scores were as follows: mHHS = 58.5 to 79.8 ($P < .0001$), NAHS = 56.8 to 87.1 ($P = .008$), HOS-SSS = 34.3 to 78.3 ($P = .004$), and VAS score = 7.5 to 1.3 ($P < .0001$). Mean patient satisfaction was 8.7 ± 1.7 . One hip (9.0%) required revision arthroscopy at 31.1 months. No postoperative complications were reported.

Conclusions

Bony regrowth of the femoral head-neck region did not occur in this study of skeletally immature females who underwent arthroscopic femoroplasty. In this group of patients, hip arthroscopic treatment of FAI and labral tears is a safe and favorable intervention because of its high patient satisfaction and outcome scores and absence of postoperative complications.

Level of Evidence

Level IV, prognostic study.

[BACK](#)

Five-Strand Hamstring Autograft Versus Quadruple Hamstring Autograft With Graft Diameters 8.0 Millimeters or More in Anterior Cruciate Ligament Reconstruction: Clinical Outcomes With a Minimum 2-Year Follow-Up

Rafael Calvo, David Figueroa, Francisco Figueroa, Alex Vaisman, Andrés Schmidt-Hebbel, Nelson Morales, Guillermo Izquierdo

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Purpose

To compare the outcomes of 2 groups of patients undergoing anterior cruciate ligament (ACL) reconstruction: the first with a quadrupled semitendinosus gracilis (ST-G) autograft larger than 8 mm diameter and the second with a 5-strand ST-G autograft larger than 8 mm due to an insufficient diameter graft harvesting.

Methods

This was a retrospective study with 70 patients divided into 2 groups. Inclusion criteria included ACL ruptures of less than 3 months, ST-G ACL reconstructions, and final (4-strand or 5-strand) graft size larger than 8 mm. Exclusion criteria included multiligament knee injuries, meniscal or chondral pathology, ACL re-ruptures, inflammatory joint disease, or other procedures in the knee.

Results

Group A comprised 33 patients with a quadruple ST-G graft, and group B comprised 37 patients with an insufficient graft diameter (<8 mm) in which a 5-strand graft was used. Mean age in group A was 29.7 (range 17-52) years and in group B was 30.6 (range 13-53) years ($P = .78$). Average follow-up in group A was 32.2 (range 24-48) months and in group B was 30.35 (range 24-48) months ($P = .75$). Average graft diameter in group A was 8.5 mm (range 8-10) and in group B when the graft was measured as quadruple was 7.2 mm (range 6.5-7.5) and 9.2 mm (range 8-10) when it was converted to 5-strand ($P = .00596$). Group A had 3 (9%) re-ruptures, and group B had 2 (5.4%) ($P = .55$). The average postoperative Lysholm score in group A was 93.3 (range 71-100) and in group B was 97.1 (range 80-100) ($P = .79$). Mean postoperative International Knee Documentation Committee in group A was 91 (range 75.9-100) and in group B was 96.8 (range 82-100) ($P = .18$).

Conclusions

In our study, the 5-strand hamstring autograft in ACL reconstruction was clinically comparable with the quadruple autograft larger than 8 mm. The differences in re-rupture and clinical outcomes were not statistically significant between the 2 groups, suggesting that it is a valid option when we have a graft of insufficient diameter.

Level of Evidence

Level III, retrospective comparative study.

[BACK](#)

Assessment of the Isometry of the Anterolateral Ligament in a 3-Dimensional Weight-Bearing Computed Tomography Simulation

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Purpose

To simulate the most isometric insertion points of the anterolateral ligament (ALL) in a weight-bearing 3-dimensional computed tomography (CT) model using previously published anatomic landmarks and to define radiographic landmarks, which make for an easier identification of the optimal insertion points.

Methods

The most isometric femoral insertion points were analyzed for 10 individuals, using data of weight-bearing CT scans in increasing knee flexion positions. An automatic string generation algorithm helped identify isometrically optimal points using an isometric score (0 indicating optimal isometry). Subsequently, a general femoral insertion point was determined, which preserved the isometry in all tested individuals. Based on the femoral insertion point, we assessed the influence of varying tibial insertion points on the isometric behavior of the ALL.

Results

The defined femoral insertion point, which preserved the isometry in all analyzed individuals, had a median isometric score between 0.167×10^{-3} and 0.559×10^{-3} . The average distance from the most prominent point of the lateral epicondyle was 9.7 mm (standard deviation [SD], 1.6) in a straight superior direction. In a straight lateral radiographic view, this point is located exactly at the intersection of a tangent set between the posterior cortex of the femur and a second perpendicular line intersecting at the level of the most (superior-) posterior point of the Blumensaat line. The best isometric behavior was found on the anatomically defined mean tibial insertion point, located at 37% of the width of the tibial plateau, which worsened gradually if corrected to anterior or posterior.

Conclusions

We determined femoral and tibial insertion points as well as radiographic landmarks for the reconstruction of the ALL that are based on published anatomic descriptions and preserve isometry in all analyzed individuals in this study.

Clinical Relevance

This study provides new information, which might be helpful to define isometrically optimal insertion points for ALL reconstruction.

[BACK](#)

The Anterolateral Ligament Has Similar Biomechanical and Histologic Properties to the Inferior Glenohumeral Ligament

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Purpose

To characterize the tensile and histologic properties of the anterolateral ligament (ALL), inferior glenohumeral ligament (IGHL), and knee capsule.

Methods

Standardized samples of the ALL ($n = 19$), anterolateral knee capsule ($n = 15$), and IGHL ($n = 13$) were isolated from fresh-frozen human cadavers for uniaxial tensile testing to failure. An additional 6 samples of the ALL, capsule, and IGHL were procured for histologic analysis and determination of elastin content.

Results

All investigated mechanical properties were significantly greater for both the ALL and IGHL when compared with capsular tissue. In contrast, no significant differences between the ALL and IGHL were found for any property. The elastic modulus of ALL and IGHL samples was 174 ± 92 MPa and 139 ± 60 MPa, respectively, compared with 62 ± 30 MPa for the capsule ($P = .001$). Ultimate stress was significantly lower ($P < .001$) for the capsule, at 13.4 ± 7.7 MPa, relative to the ALL and IGHL, at 46.4 ± 20.1 MPa and 38.7 ± 16.3 MPa, respectively. The ultimate strain at failure was $37.8\% \pm 7.9\%$ for the ALL and $39.5\% \pm 9.4\%$ for the IGHL; this was significantly greater ($P = .041$ and $P = .02$, respectively) for both relative to the capsule, at $32.6\% \pm 8.4\%$. The strain energy density was 7.8 ± 3.1 MPa for the ALL, 2.1 ± 1.3 MPa for the capsule, and 7.1 ± 3.1 MPa for the IGHL ($P < .001$). The ALL and IGHL consisted of collagen bundles aligned in a parallel manner, containing elastin bundles, which was in contrast to the random collagen architecture noted in capsule samples.

Conclusions

The ALL has similar tensile and histologic properties to the IGHL. The tensile properties of the ALL are significantly greater than those observed in the knee capsule.

Clinical Relevance

The ALL is not just a thickening of capsular tissue and should be considered a distinct ligamentous structure comparable to the IGHL in the shoulder. The tensile behavior of the ALL is similar to the IGHL, and treatment strategies should take this into account.

[BACK](#)

Optimization of Anteromedial Portal Femoral Tunnel Drilling With Flexible and Straight Reamers in Anterior Cruciate Ligament Reconstruction: A Cadaveric 3-Dimensional Computed Tomography Analysis

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Purpose

To use 3-dimensional custom CAD technology to evaluate how knee flexion angle affects femoral tunnel length and distance to the posterior wall when using curved and straight guides for drilling through the anteromedial portal (AMP).

Methods

Six cadaveric knees were placed in an external fixator at various degrees of flexion (90°, 110°, 125°, and maximum 135° to 140°). Computed tomography scans were obtained at all flexion points for 3-dimensional point-cloud models. Using custom CAD software, surgical guides through the AMP were replicated along with virtual tunnels at each flexion angle. Distance from the posterior cortex and tunnel dimensions were collected after 8-mm and 10-mm tunnel creation.

Results

At 90° of flexion, the average tunnel length down the posterior aspect of 8-mm tunnel was 25.0 mm (95% confidence interval [CI] 16.2-33.8) and 12.0 mm (95% CI 7.3-16.7) for curved and straight guides, respectively; 31.0 mm (95% CI 26.8-35.2) and 28.6 mm (95% CI 24.8-32.4) at 110°; 33.8 mm (95% CI 30.1-37.5) and 31.1 mm (95% CI 26.8-35.4) at 125°; and 35.0 mm (95% CI 34.1-35.9) and 35.5 mm (95% CI 34.2-36.8) with maximal flexion. Values between curved and straight guides are significantly different ($P < .001$), with straight guides breaching the posterior wall at 90° and 110° of flexion in some specimens. The average distance to the posterior wall cortex was 0.9 mm (95% CI -1.5 to 3.3) and -0.6 mm (95% CI -2.3 to 1.1) for curved and straight guides, respectively, at 90° of flexion ($P = .014$); 2.3 mm (95% CI -0.2 to 4.8) and -0.1 mm (95% CI -2.4 to 2.2) at 110° ($P = .001$); 4.4 mm (95% CI 2.8-6.0) and 3.9 mm (95% CI 1.9-5.9) at 125° ($P = .299$); and 6.7 mm (95% CI 6.2-7.2) and 8.3 mm (95% CI 6.1-10.5) at maximal flexion ($P = .184$). Posterior wall blowout was noted when using 10-mm straight guides at both 90° (2 specimens) and 110° (3 specimens). Using 10-mm curved guides posterior blowout was noted in 1 specimen at 90°. Maximum footprint coverage occurred at 110° for straight guides and 90° for curved guides.

Conclusions

When using the AMP, flexible guides and reamers result in a greater distance of the tunnel to the femoral cortex while preserving adequate tunnel length at lower knee flexion angles. To create long femoral tunnels without breaching the posterior cortex, the knee should be flexed to at least 110° for curved reamers and 125° for straight.

Clinical Relevance

Femoral tunnel drilling through the AMP using curved and straight reamers requires different degrees of knee flexion to achieve optimal tunnel dimensions.

[BACK](#)

Prevalence of Surgical Repair for Athletic Pubalgia and Impact on Performance in Football Athletes Participating in the National Football League Combine

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Purpose

To examine the prevalence and impact of athletic pubalgia (AP) surgery in elite American football athletes participating in the National Football League (NFL) Combine.

Methods

Results from 1,311 athletes participating in the Combine from 2012 to 2015 were evaluated. Athletes with a history of AP repair were identified using the NFL Combine Database. Athlete history and available imaging was reviewed. NFL performance based on draft status, games played, games started, and current status in the NFL was gathered using publicly available databases. Statistical analysis was performed to detect for significant associations between athlete history and NFL performance in the presence of AP repair and pelvic pathology on postsurgical magnetic resonance imaging (MRI).

Results

AP repair was identified in 4.2% ($n = 55$) of athletes. MRI was performed in 35% ($n = 19$ of 55) with AP repair, of which 53% ($n = 10$ of 19) had positive pathology. Athletes with repair were not at risk of playing ($P = .87$) or starting ($P = .45$) fewer regular season games, going undrafted ($P = .27$), or not being on an active NFL roster ($P = .51$). Compared with athletes with negative imaging findings, positive pathology on MRI did not have a significant impact on games played ($P = .74$), games started ($P = .48$), draft status ($P = .26$), or being on an active roster ($P = .74$). Offensive linemen ($P = .005$) and athletes with a history of repair within 1 year of the Combine ($P = .03$) had a significantly higher risk of possessing positive pathology on MRI.

Conclusions

Athletes with a history of successful AP surgery invited to the NFL Combine and those with persistent pathology on MRI are not at increased risk for diminished performance in the NFL. Offensive linemen and athletes less than 1 year out from surgery have a higher risk for positive MRI findings at the pubic symphysis.

Level of Evidence

Level IV, prognostic study-case series.

[BACK](#)

Biomarker Changes in Anterior Cruciate Ligament–Deficient Knees Compared With Healthy Controls

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Purpose

To establish how synovial fluid biomarker concentrations change in patients after anterior cruciate ligament (ACL) tears, with and without associated cartilage injury, with comparisons made to healthy controls.

Methods

Patients were prospectively enrolled between January 2013 and December 2014. Inclusion criteria included any patient undergoing knee arthroscopy. Patients with a confirmed ACL tear were allocated to either the ACL tear with cartilage injury group or the ACL tear without cartilage injury group based on intraoperative assessment. Patients who underwent an arthroscopic procedure with no injury history or symptoms in their contralateral knee were asked to provide samples to serve as healthy controls. These subjects may or may not have been the same ones with noted ACL pathology. The concentrations of 20 biomarkers were determined using a multiplex magnetic bead immunoassay. Biomarker concentrations were then compared between the 3 study groups (ACL tears with and without cartilage injury, and uninjured contralateral knees) using an analysis of variance test with pairwise comparisons. The minimal clinically important difference was calculated based on the standard error of measurement.

Results

The study included synovial fluid samples from 134 knees: 34 ACL tears without cartilage injury (mean age 34.0 years), 28 ACL tears with cartilage injury (mean age 36.3 years), and 72 healthy controls (mean age 41.1 years). Analysis of variance testing showed significant differences among groups for matrix metalloproteinase-3 ($F = 81.8$; $P < .001$), tissue inhibitor of metalloproteinase (TIMP)-1 ($F = 7.9$; $P \leq .001$), TIMP-2 ($F = 4.5$; $P = .015$); fibroblast growth factor-2 ($F = 4.9$; $P = .011$), interleukin-6 ($F = 8.2$; $P = .001$), and macrophage inflammatory protein-1 beta ($F = 7.3$; $P = .001$). Pairwise comparisons showed no significant differences between ACL tears with, and without cartilage injury, but did show that both groups of ACL tears had significantly higher concentrations of (first P value = ACL tears with and then ACL tears without cartilage injury): matrix metalloproteinase-3 ($P < .001$; $P < .001$), TIMP-1 ($P < .001$; $P = .011$), interleukin-6 ($P = .009$; $P = .038$), and macrophage inflammatory protein-1 beta ($P = .003$; $P = .045$) compared with contralateral controls. ACL tears without associated cartilage damage had significantly lower concentrations of TIMP-2 ($P = .011$) and fibroblast growth factor-2 ($P = .014$) compared with controls. All biomarker concentration differences that reached statistical significance were also larger than calculated minimal clinically important differences.

Conclusions

The current study identified 6 pro- and anti-inflammatory synovial fluid biomarkers whose concentrations after ACL injury were significantly different compared with uninjured controls. No significant differences in synovial fluid biomarker concentrations were seen between ACL injured knees with and without associated cartilage damage.

Level of Evidence

Level III, retrospective comparative study of prospectively gathered data.

Anatomic Anterior Cruciate Ligament Reconstruction via Independent Tunnel Drilling: A Systematic Review of Randomized Controlled Trials Comparing Patellar Tendon and Hamstring Autografts

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Purpose

To collect the highest **Level of Evidence** comparing anatomic anterior cruciate ligament (ACL) reconstruction via independent tunnel drilling using bone–patellar tendon–bone (BTB) and hamstring tendon (HT) autografts in terms of clinical outcome and failure rate.

Methods

We performed a systematic review of clinical trials that randomized patients to ACL reconstruction with either BTB or HT autografts with a minimum 2-year follow-up. Only trials using independent tunnel drilling, including outside-in and anteromedial portal techniques, for both autografts were eligible for inclusion, whereas all transtibial studies were excluded. Study design, demographics, surgical technique, rehabilitation protocol, and clinical outcomes were compiled. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed. Quality assessment was performed using the Coleman Methodological Scale (CMS).

Results

Six published studies reporting on 5 randomized controlled trials (RCTs) met the inclusion criteria. No study reported a difference in rerupture rate between BTB and HT. BTB-reconstructed knees experienced a greater incidence of anterior knee pain or crepitus in 2/7 trials and radiographic evidence of degenerative change in 3/7 trials. HT-reconstructed knees had increased instrumented laxity in 2/7 trials and less knee flexion strength postoperatively.

Conclusions

This study collects all available Level I and II evidence for anatomic ACL reconstruction using BTB and HT grafts. According to the data presented in these studies, clinical outcome scores and failure rates showed no differences for anatomic reconstruction using either autograft. However, in some studies, BTB-reconstructed knees experienced a greater incidence of anterior knee pain and radiographic evidence of degenerative change, and in others, HT-reconstructed knees had increased laxity and less knee flexion strength. In our opinion, both BTB and HT autografts remain valid options for ACL reconstruction when using anatomic drilling techniques, providing a stable knee with reliable return to activity.

Level of Evidence

Level II, systematic review of Level I and II studies.

[BACK](#)

The Effect of Femoral Nerve Block on Quadriceps Strength in Anterior Cruciate Ligament Reconstruction: A Systematic Review

Katherine R. Swank, Alex C. DiBartola, Joshua S. Everhart, Christopher C. Kaeding, Robert A. Magnussen, David C. Flanigan

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Purpose

To assess the isokinetic, functional, and patient-reported outcomes of femoral nerve block (FNB) compared with traditional multimodal anesthesia for FNB in anterior cruciate ligament (ACL) reconstruction.

Methods

A systematic search of PubMed, Scopus, Cumulative Index to Nursing and Allied Health Literature, Cochrane Reviews, and Google Scholar was conducted according to the 2009 Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Effects of FNB on quadriceps function were evaluated by isokinetic testing, functional scoring systems, range of motion, and patient self-report questionnaires. Heterogeneous reporting of outcomes precluded a formal meta-analysis. The methodologic merit of all studies included was evaluated by the Coleman Methodology Score.

Results

Six studies were identified with outcome measures reported between 7 days and 6 months postoperatively. At 6 months, 2 of 4 studies that reported isokinetic testing found significantly greater deficits among patients who received a nerve block; one of the remaining studies showed a deficit at 6 weeks but not 6 months. Limited data showed no significant differences in functional or patient-reported outcomes at 6 months after reconstruction, and data regarding the impact of FNB on return to sport were inconclusive. The mean Coleman Methodology Score for the included studies was 53, indicating poor overall methodologic quality of the available literature.

Conclusions

The limited data available suggest that FNB causes a measurable deficit in quadriceps isokinetic strength during the early postoperative period but has no effect on functional outcomes or return to sport at 6 months after ACL reconstruction. However, current clinical evidence is not sufficient to draw any valid or definitive **Conclusions** regarding the effect of FNB on postoperative outcomes after ACL reconstruction.

Level of Evidence

Level IV, systemic review of Level I through IV studies.

[BACK](#)

AJSM

April 2017, Vol 45, Issue 5 / May 2017, Vol 45, Issue 6

Is It Necessary to Repair Stable Ramp Lesions of the Medial Meniscus During Anterior Cruciate Ligament Reconstruction? A Prospective Randomized Controlled Trial

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Background: A special type of meniscal lesion involving the peripheral attachment of the posterior horn of the medial meniscus (PHMM), termed a “ramp lesion,” is commonly associated with an anterior cruciate ligament (ACL) injury. However, its treatment is still controversial. Recently, stable ramp lesions treated with abrasion and trephination alone have been shown to have good clinical outcomes after ACL reconstruction.

Hypothesis: Stable ramp lesions treated with abrasion and trephination alone during ACL reconstruction will result in similar clinical outcomes compared with those treated with surgical repair.

Study Design: Randomized controlled trial; Level of evidence, 2.

Methods: A prospective randomized controlled study was performed in 91 consecutive patients who had complete ACL injuries and concomitant stable ramp lesions of the medial meniscus. All patients were randomly allocated to 1 of 2 groups based on whether the stable ramp lesions were surgically repaired (study group; n = 50) or only abraded and trephined (control group; n = 41) during ACL reconstruction. All surgical procedures were performed by a single surgeon who was blinded to the functional assessment findings of the patients. The Lysholm score, subjective International Knee Documentation Committee (IKDC) score, and stability assessments (pivot-shift test, Lachman test, KT-1000 arthrometer side-to-side difference, and KT-1000 arthrometer differences of <3, 3-5, and >5 mm) were evaluated preoperatively and at the last follow-up. Moreover, magnetic resonance imaging (MRI) was used to evaluate the healing status of the ramp lesions.

Results: All consecutive patients who were screened for eligibility from August 2008 to April 2012 were enrolled and observed clinically. There were 40 patients in the study group and 33 patients in the control group who were observed for at least 2 years. At the final follow-up, there were no significant differences between the study group and the control group in terms of the mean Lysholm score (88.7 ± 4.8 vs 90.4 ± 5.8 , respectively; $P = .528$), mean subjective IKDC score (83.6 ± 3.7 vs 82.2 ± 4.5 , respectively; $P = .594$), pivot-shift test results ($P = .658$), Lachman test results ($P = .525$), KT-1000 arthrometer side-to-side difference (1.6 ± 1.2 vs 1.5 ± 1.1 , respectively; $P = .853$), or KT-1000 arthrometer grading ($P = .738$). Overall, for both groups (n = 73), 67 patients showed completely healed (38 study, 29 control), 3 showed partially healed (1 study, 2 control), and 3 showed nonhealed (1 study, 2 control) signals on follow-up MRI when evaluating the healing status of the ramp lesions. There was no significant difference regarding the healing status of the ramp lesions between the 2 groups ($P = .543$).

Conclusion: This prospective randomized controlled trial showed that, in terms of subjective scores, knee stability, and meniscal healing status, concomitant stable ramp lesions of the medial meniscus treated with abrasion and trephination alone during ACL reconstruction resulted in similar clinical outcomes compared with those treated with surgical repair.

[BACK](#)

Is Remnant Preservation Truly Beneficial to Anterior Cruciate Ligament Reconstruction Healing? Clinical and Magnetic Resonance Imaging Evaluations of Remnant-Preserved Reconstruction

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Background: Remnant-preserved anterior cruciate ligament (ACL) reconstruction was introduced to improve clinical outcomes and biological healing. However, the effects of remnant preservation and the influence of the delay from injury until reconstruction on the outcomes of this technique are still uncertain.

Purpose/Hypothesis: The purposes of this study were to evaluate whether remnant preservation improved the clinical outcomes and graft incorporation of ACL reconstruction and to examine the influence of the delay between ACL injury and reconstruction on the usefulness of remnant preservation. We hypothesized that remnant preservation improves clinical results and accelerates graft incorporation and that its effect is dependent on the delay between ACL injury and reconstruction.

Study Design: Cohort study; Level of evidence, 2.

Methods: A total of 151 consecutive patients who underwent double-bundle ACL reconstruction using a semitendinosus graft were enrolled in this study: 74 knees underwent ACL reconstruction without a remnant (or the remnant was <25% of the intra-articular portion of the graft; NR group), while 77 knees underwent ACL reconstruction with remnant preservation (RP group). These were divided into 4 subgroups based on the time from injury to surgery: phase 1 was <3 weeks (n = 24), phase 2 was 3 to less than 8 weeks (n = 70), phase 3 was 8 to 20 weeks (n = 32), and phase 4 was >20 weeks (n = 25). Clinical measurements, including KT-1000 arthrometer side-to-side anterior tibial translation measurements, were assessed at 3, 6, 12, and 24 months after reconstruction. Magnetic resonance imaging evaluations of graft maturation and graft-tunnel integration of the anteromedial and posterolateral bundles were assessed at 3, 6, and 12 months after reconstruction.

Results: There was no difference in side-to-side anterior tibial translation between the NR and RP groups. There was also no difference in graft maturation between the 2 groups. Furthermore, the time from ACL injury until reconstruction did not affect graft maturation, except in the case of very long delays before reconstruction (phase 4). Graft-tunnel integration was significantly

increased in both groups in a time-dependent manner. However, there was no difference between the NR and RP groups.

Conclusion: Remnant preservation did not improve knee stability at 2 years after ACL reconstruction. Furthermore, remnant preservation did not accelerate graft incorporation, especially during the acute and subacute injury phases.

[BACK](#)

Safe Drilling Paths in the Distal Femoral Epiphysis for Pediatric Medial Patellofemoral Ligament Reconstruction

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Background: Anatomic surgical reconstruction of the medial patellofemoral ligament (MPFL) has been popularized for the treatment of recurrent patellar instability in the skeletally immature population. Previous anatomic studies have found that the femoral attachment point of the MPFL is very close to the distal femoral physis.

Purpose: To establish the safe angles for drilling the distal femoral epiphysis for MPFL graft placement.

Study Design: Descriptive laboratory study.

Methods: A total of 23 cadaveric distal femoral epiphyses were scanned into high-resolution 3-dimensional images. Using computer-aided design, we identified and marked the femoral insertion site of the MPFL. Cylinders 8 mm in diameter were placed at varying angles to simulate the drill paths for placement of 6-mm interference screws with a 1-mm buffer. The distance from the MPFL footprint to where the tunnel first violated the physis, the intercondylar notch, or the distal cartilage was measured. We recorded the percentage of tunnels that caused violations before reaching 20 mm, the shortest length of a typical femoral tunnel socket.

Results: Measurements indicated that 41% of tunnels angled distally less than 10° violated the physis, 40% of tunnels angled distally more than 10° but anteriorly less than 10° violated the notch, and 27% of tunnels angled distally and anteriorly more than 20° violated the distal femoral cartilage. At least 90% of the tunnels were safe at 20 mm when the drill was angled between 15° and 20° both anteriorly and distally.

Conclusion: Because of the anatomy of the distal femoral physis, drilling into the epiphysis from the MPFL attachment site at improper trajectories risks damage to sensitive structures. Angling the drill to an acceptable degree distally and anteriorly leads to less risk to the physis and notch, respectively, but angling too much leads to risk to the distal femoral cartilage. Small variations in the sagittal plane were better tolerated than variations in the coronal plane, so we recommend that more attention be paid to the radiographic anteroposterior view intraoperatively. It is safest to angle the drill distally and anteriorly approximately 15° to 20° in each plane from the MPFL attachment site.

Clinical Relevance: During drilling into the distal femoral epiphysis at the MPFL origin in skeletally immature patients, angling the drill appropriately 15° to 20° both distally and anteriorly minimizes damage to the physis, notch, and distal femoral cartilage.

[BACK](#)

International Meniscus Reconstruction Experts Forum (IMREF) 2015 Consensus Statement on the Practice of Meniscal Allograft Transplantation

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The American Journal of Sports Medicine Vol 45, Issue 5, pp. 1195 – 1205

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Abstract: Meniscal allograft transplantation (MAT) has become relatively commonplace in specialized sport medicine practice for the treatment of patients with a symptomatic knee after the loss of a functional meniscus. The technique has evolved since the 1980s, and long-term results continue to improve. However, there still remains significant variation in how MAT is performed, and as such, there remains opportunity for outcome and graft survivorship to be optimized. The purpose of this article was to develop a consensus statement on the practice of MAT from key opinion leaders who are members of the International Meniscus Reconstruction Experts Forum so that a more standardized approach to the indications, surgical technique, and postoperative care could be outlined with the goal of ultimately improving patient outcomes.

[BACK](#)

Defining the “Substantial Clinical Benefit” After Arthroscopic Treatment of Femoroacetabular Impingement

Benedict U. Nwachukwu*†, Brenda Chang†, Kara Fields†, Brian J. Rebolledo†, Danyal H. Nawabi†, Bryan T. Kelly†, Anil S. Ranawat†

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Background: The minimal clinically important difference (MCID) has been defined in orthopaedics and is the smallest change that a patient considers meaningful. Less is known about improvements that the patient perceives as clinically considerable, or the substantial clinical benefit (SCB). For the young, highly functioning patient cohort with femoroacetabular impingement (FAI), the SCB is an important measure of clinical success.

Purpose: To derive the SCB for FAI treatment and identify outcome score thresholds and patient variables predictive of the SCB.

Study Design: Cohort study (diagnosis); Level of evidence, 2.

Methods: The modified Harris Hip Score (mHHS), the Hip Outcome Score activities of daily living (HOS-ADL) and sport (HOS-Sport) subscales, and the international Hip Outcome Tool (iHOT-33) were prospectively administered to 364 patients with a minimum 1-year follow-up. At 1 year postoperatively, patients graded their hip function based on several anchor responses such as “no change” and “much improved.” The SCB was defined as the change on each outcome tool that equated to the difference between “no change” and “much improved” on the health transition question. Receiver operating characteristic analysis with area under the curve (AUC) was used to identify optimal values that were most representative of the SCB. Multivariable analysis identified patient variables predictive of the SCB.

Results: The net change in outcome scores corresponding to the SCB for the mHHS, HOS-ADL, HOS-Sport, and iHOT-33 was 19.8, 10.0, 29.9, and 24.5, respectively. The following postoperative outcome scores demonstrated excellent distinction (AUC >0.8) between “no change” and “much improved” and thus were considered absolute values for the postoperative SCB: 82.5 (mHHS), 93.3 (HOS-ADL), 84.4 (HOS-Sport), and 63.5 (iHOT-33). Preoperative scores on the HOS-ADL (83.3) and HOS-Sport (50.0) were significant threshold cutoffs, above which attaining the SCB became less likely. Younger age and lower Outerbridge grade were predictive of achieving the SCB.

Conclusion:

The SCB has not been previously defined in the hip preservation literature and is complementary to the MCID as the upper bound for clinically significant improvement. We identified predictive preoperative and diagnostic postoperative outcome scores for the SCB that can be used to manage patient expectations and grade outcomes. These findings are objective criteria for defining clinical success after arthroscopic FAI treatment.

[BACK](#)

JBJS

2017: March-April, volume 99, issue 5-8

The Relationship Between ACL Femoral Tunnel Position and Postoperative MRI Signal Intensity

Lee, Se Min MD; Yoon, Kyoung Ho MD; Lee, Sang Hak MD; Hur, Dong MD

Journal of Bone & Joint Surgery - American Volume: 1 March 2017 - Volume 99 - Issue 5 - p 379–387

http://journals.lww.com/jbjsjournal/Fulltext/2017/03010/The_Relationship_Between_ACL_Femoral_Tunnel.3.aspx

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Background: The purpose of this study was to find the ideal femoral tunnel position in single-bundle anterior cruciate ligament (ACL) reconstruction using three-dimensional computed tomography (3D-CT) by comparing clinical scores, stability of the knee joint, and graft signal intensity on follow-up magnetic resonance imaging (MRI). We hypothesized that positioning the femoral tunnel near the anteromedial bundle or center would lead to better results in terms of clinical outcomes and graft signal intensity on follow-up MRI than would positioning the tunnel near the posterolateral bundle.

Methods: Two hundred patients underwent arthroscopic single-bundle ACL reconstruction with a soft-tissue graft; all patients had the same surgeon, surgical technique (anteromedial transportal technique), and rehabilitation protocol. Each patient underwent 3D-CT within 1 week after the operation and MRI at 1 year after the operation. Outcomes were evaluated in terms of clinical scores and the stability of the knee joint. We classified patients into three groups based on the femoral tunnel position: the anteromedial position group, the posterolateral position group, and the center position group. We evaluated graft signal intensity on follow-up MRI.

Results: This study included 77 patients: 25 patients in the anteromedial position group, 15 patients in the posterolateral position group, and 33 patients in the center position group. Four patients had an eccentric tunnel position and were excluded. The 3 groups did not differ significantly ($p > 0.05$) in preoperative demographic characteristics. There were no significant differences ($p > 0.05$) between groups in clinical outcomes. However, patients in the anteromedial position group and in the center position group had better graft signal intensity on follow-up MRI than those in the posterolateral position group.

Conclusions: Positioning the femoral tunnel near the anteromedial bundle and center led to better graft signal intensity on follow-up MRI in anatomic single-bundle ACL reconstruction than did positioning the femoral tunnel near the posterolateral bundle. There were no differences in clinical scores or stability of the knee joint among the three groups.

Level of Evidence: Therapeutic Level II. See Instructions for Authors for a complete description of levels of evidence.

[BACK](#)

Open Compared with Arthroscopic Treatment of Acute Septic Arthritis of the Native Knee

Johns, Brenton P. MBBS; Loewenthal, Mark R. MBBS, FRACP; Dewar, David C. MBBS, FRACS, FAOrthoA

Journal of Bone & Joint Surgery - American Volume: 15 March 2017 - Volume 99 - Issue 6 - p 499–505

http://journals.lww.com/jbjsjournal/Fulltext/2017/03150/Open_Compared_with_Arthroscopic_Treatment_of_Acute.8.aspx

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Background: Acute native knee septic arthritis is a joint-threatening emergency. Operative treatments by open or arthroscopic methods are available to surgeons. To our knowledge, the literature to date has primarily consisted of case series and no large study has yet compared these methods. The aim of this study was to compare open and arthroscopic treatment for acute native knee septic arthritis.

Methods: All adult patients with acute native knee septic arthritis treated at our institution with either open or arthroscopic irrigation from 2000 to 2015 were retrospectively evaluated. The clinical findings, laboratory evidence, arthrocentesis and microbiology results, knee radiographs, and outcomes were compared.

Results: There were 161 patients (166 knees) with acute native knee septic arthritis treated between 2000 and 2015. Initially, 123 knees were treated by arthroscopic irrigation and 43 knees were treated by open irrigation; however, 71% in the open treatment group required repeat irrigation compared with 50% in the arthroscopic treatment group. The superiority of an arthroscopic procedure persisted after adjustment for potential confounders by multivariable analysis, with an odds ratio of 2.56 (95% confidence interval, 1.1 to 5.9; $p = 0.027$). After 3 irrigation procedures, the cumulative success rate was 97% in the arthroscopic treatment group and 83% in the open treatment group ($p = 0.011$). The total number of irrigation procedures required was fewer in the arthroscopic treatment group ($p = 0.010$). In the arthroscopic treatment group, the mean postoperative range of motion was greater ($p = 0.016$) and there was a trend toward a shorter median length of stay ($p = 0.088$).

Conclusions: Arthroscopic treatment for acute native knee septic arthritis was a more successful index procedure and required fewer total irrigation procedures compared with open treatment. Long-term postoperative range of motion was significantly greater following arthroscopic treatment.

Level of Evidence: Therapeutic Level III. See Instructions for Authors for a complete description of levels of evidence.

[BACK](#)

Clinical Practice Guidelines Decrease Unnecessary Echocardiograms Before Hip Fracture Surgery

Adair, Chris MD¹; Swart, Eric MD¹; Seymour, Rachel PhD¹; Patt, Joshua MD, MPH¹; Karunakar, Madhav A. MD^{1,a}

Journal of Bone & Joint Surgery - American Volume: 19 April 2017 - Volume 99 - Issue 8 - p 676–680

http://journals.lww.com/jbjsjournal/Fulltext/2017/04190/Clinical_Practice_Guidelines_Decrease_Unnecessary.7.aspx

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Background: Preoperative assessment of geriatric patients with a hip fracture may include transthoracic echocardiography (TTE), which increases resource utilization and cost and may delay surgery. The purpose of this study was to evaluate preoperative TTE utilization at a single institution in order to determine (1) how often TTE is ordered in accordance with clinical practice guidelines (CPGs), (2) how frequently TTE reveals cardiac disease that may alter medical or anesthesia management, and (3) whether following CPGs reduces unnecessary TTE utilization without potentially missing important disease.

Methods: A retrospective review of data on 100 geriatric patients with a hip fracture who had undergone preoperative TTE was performed. Charts were reviewed to evaluate if TTE had been obtained in accordance with the published CPGs from the American College of Cardiology/American Heart Association (ACC/AHA). TTE reports were reviewed for the presence of disease that was important enough to cause modifications in anesthesia or perioperative management, including new left ventricular systolic or diastolic dysfunction, moderate or severe valvular disease, and pulmonary hypertension. Finally, the sensitivity and specificity of accordance with the ACC/AHA CPGs for predicting which patients would have TTE that identified important disease were calculated.

Results: The TTE was ordered in accordance with the published ACC/AHA CPGs for 66% of the patients. TTE revealed disease with the potential to modify anesthesia or medical management in 14% of the patients—for all of whom the TTE had been indicated according to ACC/AHA guidelines (i.e., the guidelines were 100% sensitive). In this study population, following the ACC/AHA guidelines could have prevented the performance of TTE in 34% of the patients without missing any disease (40% specificity).

Conclusions: Preoperative TTE for patients with a hip fracture is frequently obtained outside the recommendations of established CPGs. Utilization of CPGs such as the ACC/AHA guidelines should be considered, as it may decrease variability in care and reduce unnecessary resource utilization without adversely affecting patient outcomes.

[BACK](#)

Emerging U.S. National Trends in the Treatment of Pediatric Supracondylar Humeral Fractures

Holt, Joshua B. MD¹; Glass, Natalie A. PhD¹; Bedard, Nicholas A. MD¹; Weinstein, Stuart L. MD¹; Shah, Apurva S. MD, MBA^{2,a}

Journal of Bone & Joint Surgery - American Volume: 19 April 2017 - Volume 99 - Issue 8 - p 681–687

http://journals.lww.com/jbjsjournal/Fulltext/2017/04190/Emerging_U_S_National_Trends_in_the_Treatment_of.8.aspx

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Background: Understanding national trends in the treatment of pediatric supracondylar humeral fractures will provide important insight into variations in regional treatment and identify areas for improving value and quality in care delivery in the U.S.

Methods: U.S. national trends in the treatment of supracondylar humeral fractures were evaluated through query of the Humana (2007 to 2014) and ING (2007 to 2011) administrative claims databases. Geographic variation and changes in surgical and transfer rates over time were further explored through the Nationwide Emergency Department Sample (NEDS) database (2006 to 2011). Hospital characteristics impacting treatment decisions were identified.

Results: A total of 29,642 pediatric patients with supracondylar humeral fractures were identified in the administrative claims databases and a projected 63,348 encounters for supracondylar humeral fracture were identified in the NEDS database. The majority of the patients (76.1%; 22,563 of 29,642) were treated definitively with cast immobilization. Operative treatment was performed in 23.9% of the patients (7,079 of 29,642), with no change observed in the operative rate over time ($p = 0.055$). Of patients undergoing operative treatment, closed reduction and percutaneous pinning (CRPP) was performed in 87.3%, with a significant increase noted in the rate of CRPP over time ($p = 0.0001$); open reduction was performed in 12.7%, with a significant decrease noted in the rate of open reduction over time ($p < 0.0001$). Regional surgical rates generally showed significant variation from 2006 to 2010, followed by a convergence in the surgical rate among all geographic regions in 2011. These trends occurred simultaneous to a significant increase in transfer rates nationwide, from 5.6% in 2006 to 9.1% in 2011 ($p = 0.0011$). Transfer rates were significantly higher ($p < 0.0001$) for nontrauma, nonteaching, and nonmetropolitan centers while surgical rates were significantly higher ($p < 0.0001$) for trauma, teaching, and metropolitan centers when rates were analyzed by hospital designation.

Conclusions: Operative treatment was performed in 24% of pediatric patients with supracondylar humeral fractures from 2007 to 2014. There was a convergence of surgical rates across geographic regions, suggesting that a “standard of care” in the treatment of supracondylar humeral fractures is being established nationally.

Clinical Relevance: Cases of pediatric supracondylar humeral fracture are increasingly being transferred to and, when managed surgically, receiving care at metropolitan facilities designated as trauma centers or teaching hospitals, with a corresponding decrease observed in the rate of open reduction. The optimization of nationwide referral and treatment patterns may improve value in care delivery.

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CORR

April - May 2017, Vol 475, Issue 4-5

No lower extremity arthroscopy abstracts available

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BJJ

April - May 2017, Vol 99-B, Issue 4-5

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Miscellaneous

Arthroscopy

Volume 33, Issue 4 / Volume 33, Issue 5

Publication Rates of Podium Presentation Abstracts at the Arthroscopy Association of North America Annual Meetings 2004-2012

Jason D. Lehman, Benedict U. Nwachukwu, Richard Ferraro, Brian J. Rebolledo, Eric C. Makhni, Nikhil N. Verma, Lawrence V. Gulotta

Arthroscopy, April 2017, Volume 33, Issue 4, p835–839

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Purpose

To determine the publication rates of podium presentation abstracts at the Arthroscopy Association of North America (AANA) annual scientific meetings from 2004 to 2012.

Methods

A database of podium presentation abstracts at the annual meetings of the AANA was compiled. Abstract presentations that reached manuscript publication were determined by a PubMed search of the MEDLINE database and Google Scholar. The journal and publication date were then recorded for all identified published abstracts.

Results

A total of 658 abstracts were selected for podium presentations at AANA annual meetings from 2004-2012 (range, 53-102 per year). Of these 658 abstracts, 443 (67.3%) went on to eventual publication in peer-reviewed journals. The mean time from the meeting to publication was 20.0 months. Most abstracts were published within 3 years of the meeting (n = 380, 85.8%), with a significant number of published abstracts reaching publication before the time of the meeting (n = 41, 9.3%). Published abstracts were most frequently published in *Arthroscopy* (n = 186, 42.0%), *The American Journal of Sports Medicine* (20.3%), and *The Journal of Bone and Joint Surgery* (6.1%).

Conclusion

The overall publication rate of podium presentations at AANA annual meetings (67.3%) was similar to publication rates for other major orthopaedic annual meetings. Most published abstracts (85.8%) were published within 3 years, and the mean time to publication was 20.0 months.

Clinical Relevance

The rates of publication of podium presentations at AANA annual meetings show the impact and importance of these meetings in the advancement of orthopaedic research.

[BACK](#)

Cell Toxicity in Fibroblasts, Tenocytes, and Human Mesenchymal Stem Cells—A Comparison of Necrosis and Apoptosis-Inducing Ability in Ropivacaine, Bupivacaine, and Triamcinolone

Anja Z. Zhang, Andreas Ficklscherer, Mehmet F. Gülecyüz, Alexander C. Paulus, Thomas R. Niethammer, Volkmar Jansson, Peter E. Müller

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Purpose

To analyze the ability of ropivacaine, bupivacaine, and triamcinolone to induce apoptosis and necrosis in fibroblasts, tenocytes, and human mesenchymal stem cells.

Methods

Human dermal fibroblasts, adipose-derived human mesenchymal stem cells (hMSCs), and tenocytes gained from the rotator cuff tendon were seeded with a cell density of $0.5 \times 10^4/\text{cm}^2$. One specimen of ropivacaine, bupivacaine, and triamcinolone was tested separately on the cells with separate concentrations of 0.5%, 0.25%, and 0.125% for each specimen. The negative control received no agent, only a change of medium. The incubation period for each agent was 30 minutes. After a change of medium and 1 hour, 24 hours, and 7 days of incubation, 10^4 cells were harvested and analyzed via fluorescence-activated cell sorting with double-staining with annexin V and propidium iodide. Statistical analysis to determine significant difference ($P < .05$) between the groups with SPSS statistics 23 through one-way analysis of variance with a univariate general linear model was performed.

Results

Bupivacaine showed necrosis-inducing effects on fibroblasts and tenocytes, with the necrotic effect peaking at 0.5% and 0.25%. Ropivacaine and triamcinolone caused no significant necrosis. Compared with fibroblasts and tenocytes, hMSCs did not show significant necrotic or apoptotic effects after exposure to bupivacaine. Overall, no significant differences in apoptosis were detected between different cell lines, varying concentrations, or time measurements.

Conclusion

Bupivacaine 0.5% and 0.25% have the most necrosis-inducing effects on fibroblasts and tenocytes. Ropivacaine caused less necrosis than bupivacaine. Compared with fibroblasts and tenocytes, hMSCs were not affected by necrosis using any of the tested agents. A significant apoptosis-inducing effect could not be detected for the different cell lines.

Clinical Relevance

Possible cell toxicity raises questions of concern for intra-articular injections using local anesthetics and corticosteroids. The present study demonstrates the necrotic and apoptotic effects of ropivacaine, bupivacaine, and triamcinolone and may give recommendations for intra-articular use of local anesthetics and corticosteroids.

[BACK](#)

Simulation-Based Training Platforms for Arthroscopy: A Randomized Comparison of Virtual Reality Learning to Benchtop Learning

Robert M. Middleton, Abtin Alvand, Patrick Garfjeld Roberts, Caroline Hargrove, Georgina Kirby, Jonathan L. Rees

Arthroscopy, May 2017, Volume 33, Issue 5, p996–1003

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Purpose

To determine whether a virtual reality (VR) arthroscopy simulator or benchtop (BT) arthroscopy simulator showed superiority as a training tool.

Methods

Arthroscopic novices were randomized to a training program on a BT or a VR knee arthroscopy simulator. The VR simulator provided user performance feedback. Individuals performed a diagnostic arthroscopy on both simulators before and after the training program. Performance was assessed using wireless objective motion analysis and a global rating scale.

Results

The groups (8 in the VR group, 9 in the BT group) were well matched at baseline across all parameters ($P > .05$). Training on each simulator resulted in significant performance improvements across all parameters ($P < .05$). BT training conferred a significant improvement in all parameters when trainees were reassessed on the VR simulator ($P < .05$). In contrast, VR training did not confer improvement in performance when trainees were reassessed on the BT simulator ($P > .05$). BT-trained subjects outperformed VR-trained subjects in all parameters during final assessments on the BT simulator ($P < .05$). There was no difference in objective performance between VR-trained and BT-trained subjects on final VR simulator wireless objective motion analysis assessment ($P > .05$).

Conclusions

Both simulators delivered improvements in arthroscopic skills. BT training led to skills that readily transferred to the VR simulator. Skills acquired after VR training did not transfer as readily to the BT simulator. Despite trainees receiving automated metric feedback from the VR simulator, the **Results** suggest a greater gain in psychomotor skills for BT training. Further work is required to determine if this finding persists in the operating room.

Clinical Relevance

This study suggests that there are differences in skills acquired on different simulators and skills learnt on some simulators may be more transferable. Further work in identifying user feedback metrics that enhance learning is also required.

[BACK](#)

Patient Understanding, Expectations, Outcomes, and Satisfaction Regarding Anterior Cruciate Ligament Injuries and Surgical Management

Brian J. Cole, Eric J. Cotter, Kevin C. Wang, Annabelle Davey

Arthroscopy, May 2017, Volume 33, Issue 5, p1092–1096

<http://dx.doi.org/10.1016/j.arthro.2017.01.049>

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Purpose

To characterize and assess the methodological quality of patient and physician surveys related to anterior cruciate ligament reconstruction, and to analyze the factors influencing response rate.

Methods

The databases MEDLINE, Embase, and PubMed were searched from database inception to search date and screened in duplicate for relevant studies. Data regarding survey characteristics, response rates, and distribution methods were extracted. A previously published list of recommendations for high-quality surveys in orthopaedics was used as a scale to assess survey quality (12 items scored 0, 1, or 2; maximum score = 24).

Results

Of the initial 1,276 studies, 53 studies published between 1986 and 2016 met the inclusion criteria. Sixty-four percent of studies were distributed to physicians, compared with 32% distributed to patients and less than 4% to coaches. The median number of items in each survey was 10.5, and the average response rate was 73% (range: 18% to 100%). In-person distribution was the most common method (40%), followed by web-based methods (28%) and mail (25%). Response rates were highest for surveys targeted at patients (77%, $P < .0001$) and those delivered in-person (94%, $P < .0001$). The median quality score was 12/24 (range = 8.5/24 to 21/24). There was high inter-rater agreement using the quality scale (intraclass correlation coefficient = 0.92), but there was no correlation with the response rate ($Rho = -0.01$, $P = .97$).

Conclusions

Response rates vary based on target audience and distribution methods, with patients responding at a significantly higher rate than physicians and in-person distribution yielding significantly higher response rates than web or mail surveys.

Level of Evidence

Level IV, systematic review of Level IV studies.

[BACK](#)

JSES

Volume 26, Issue 4 / Volume 26, Issue 5

Neer Award 2016: reduced muscle degeneration and decreased fatty infiltration after rotator cuff tear in a poly(ADP-ribose) polymerase 1 (PARP-1) knock-out mouse model

Michael B. Kuenzler, MD, Katja Nuss, DVM, Agnieszka Karol, DVM, Michael O. Schär, MD, Michael Hottiger, DVM, PhD, Sumit Raniga, MBChB, FRACS, David Kenkel, MD, Brigitte von Rechenberg, DVM, ECVS, Matthias A. Zumstein, MD

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Background

Disturbed muscular architecture, atrophy, and fatty infiltration remain irreversible in chronic rotator cuff tears even after repair. Poly (adenosine 5'-diphosphate-ribose) polymerase 1 (PARP-1) is a key regulator of inflammation, apoptosis, muscle atrophy, muscle regeneration, and adipocyte development. We hypothesized that the absence of PARP-1 would lead to a reduction in damage to the muscle subsequent to combined tenotomy and neurectomy in a PARP-1 knockout (KO) mouse model.

Methods

PARP-1 KO and wild-type C57BL/6 (WT group) mice were analyzed at 1, 6, and 12 weeks (total n = 84). In all mice, the supraspinatus and infraspinatus muscles of the left shoulder were detached and denervated. Macroscopic analysis, magnetic resonance imaging, gene expression analysis, immunohistochemistry, and histology were used to assess the differences in PARP-1 KO and WT mice.

Results

The muscles in the PARP-1 KO group had significantly less retraction, atrophy, and fatty infiltration after 12 weeks than in the WT group. Gene expression of inflammatory, apoptotic, adipogenic, and muscular atrophy genes was significantly decreased in PARP-1 KO mice in the first 6 weeks.

Discussion

Absence of PARP-1 leads to a reduction in muscular architectural damage, early inflammation, apoptosis, atrophy, and fatty infiltration after combined tenotomy and neurectomy of the rotator cuff muscle. Although the macroscopic reaction to injury is similar in the first 6 weeks, the ability of the muscles to regenerate was much greater in the PARP-1 KO group, leading to a near-normalization of the muscle after 12 weeks.

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AJSM

February 2017, Vol 45, Issue 2 / March 2017, Volume 45, Issue 3

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2017: March-April, volume 99, issue 5-8

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