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Issue 105.3 Arthroscopy, May 2023

Nederlandse Vereniging voor Arthroscopie

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Upper extremity

Arthroscopy, Volume 39, Issue 5

The Short, 5-Item Shoulder Instability–Return to Sport After Injury Score Performs as Well as the Longer Version in Predicting Psychological Readiness to Return to Sport

I. Pasqualini, L.A. Rossi, et al.

DOI: https://doi.org/10.1016/j.arthro.2022.10.010

Purpose: To reduce the length of the Shoulder Instability–Return to Sport After Injury (SIRSI) scale and determine the predictive validity of the short version compared with the original form.

Methods: This study included patients who underwent an arthroscopic Bankart repair or open Latarjet procedure between 2017 and 2019. One group was used for the SIRSI scale-reduction process, and a second group was used to test the predictive validity of the proposed short SIRSI scale. The Cronbach α value was used to evaluate internal consistency. Validity was determined by calculating the Pearson correlation coefficient with the Western Ontario Shoulder Instability Index scale. Predictive validity was assessed using receiver operating characteristic (ROC) curve statistics.

Results: A total of 158 patients participated in the scale-reduction process, and 137 patients participated in the predictive-validation process. The SIRSI scale was successfully reduced to a 5-item scale constructed by 1 underlying factor accounting for 60% of the variance. The short version showed good internal consistency (Cronbach α = 0.82) and was highly correlated with the Western Ontario Shoulder Instability Index scale and the long version. The short SIRSI scores were significantly different between patients who returned to sports and those who did not. The SIRSI scale had excellent predictive ability for return-to-sport outcomes (area under ROC curve of 0.84 for short version [95% confidence interval, 0.7-0.9] and 0.83 for long version [95% confidence interval, 0.7-0.9]).

Conclusions: A valid 5-item, short version of the SIRSI scale was successfully developed in our patient population. The short version was found to be as robust as the long scale for discriminating and predicting return-to-sport outcomes.

Level of Evidence: Level II, prospective cohort study.

BACK

Arthroscopic Repair Benefits Reparable Rotator Cuff Tear Patients Aged 65 Years or Older With a History of Traumatic Events

Y. Lu, B. Sun, et al.

DOI: https://doi.org/10.1016/j.arthro.2022.12.022

Purpose: To evaluate the clinical outcomes of arthroscopic rotator cuff repair at 2-year follow-up in patients aged 65 years or older with a history of traumatic events divided into groups based on symptom duration (<3 months, 3-6 months, and >6 months from injury to surgery) and to compared patient-reported outcomes among the 3 groups.

Methods: Between 2015 and 2020, 110 patients who met the inclusion criteria were enrolled in this study; these patients were divided into 3 groups according to symptom duration: less than 3 months (group A), 3 to 6 months (group B) and more than 6 months (group C). Preoperative and 2-year postoperative clinical outcomes were compared, including American Shoulder and Elbow Surgeons, Constant-Murley, University of California, Los Angeles, Simple Shoulder Test, and visual analog scale scores; forward elevation; external rotation; and internal rotation. The minimal clinically important difference (MCID), patient acceptable symptom state, substantial clinical benefit, and maximum outcome improvement were also compared among the groups.

Results: The American Shoulder and Elbow Surgeons score, as the primary outcome, improved significantly from 41.0 ± 18.5 to 85.4 ± 8.1 in group A, from 53.7 ± 14.3 to 86.3 ± 11.7 in group B, and from 49.7 ± 18.5 to 83.9 ± 11.9 in group C. All the other parameters showed statistically significant improvements at 2-year follow-up in each group (all $P < .05$). There was no significant difference in each parameter among the 3 groups except the visual analog scale score, which did not achieve the MCID. Overall, 86 patients (78.2%) exceeded the MCID, 87 patients (79.1%) achieved the patient acceptable symptom state, 77 patients (70.0%) achieved substantial clinical benefit, and 62 patients (56.4%) achieved maximum outcome improvement without significant differences among the 3 groups.

Conclusions: In rotator cuff tear patients aged 65 years or older with a history of traumatic events, arthroscopic rotator cuff repair significantly improves clinical outcomes at 2-year follow-up regardless of symptom duration if the tear is fully reparable.

Level of Evidence: Level III, prognostic retrospective study.

BACK

Acellular Dermal Allograft and Tensor Fascia Lata Autograft Show Similar Patient Outcome Improvement and High Rates of Complications and Failures at a Minimum 2-Year Follow-Up: A Systematic Review

G.R. Jackson, T. Tuthill, et al.

Purpose: To compare clinical and radiologic outcomes following superior capsular reconstruction (SCR) using dermal allograft versus tensor fascia lata (TFL) autograft for massive rotator cuff tears with a minimum 2-year follow-up.

Methods: A literature search was performed by querying Scopus, EMBASE, and PubMed computerized databases from database inception through September 2022 in accordance with the 2020 Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Studies evaluating clinical and radiologic outcomes, as well as complications following SCR for the treatment of massive rotator cuff tears were included. Study quality was assessed via the Newcastle–Ottawa Scale and the National Institutes of Health Quality Assessment. The mean change from preoperative to postoperative values (delta) was calculated for each outcome.

Results: Seventeen studies, consisting of 519 patients were identified. Mean duration of follow-up ranged from 24 to 60 months. Mean reduction in visual analog scale pain score ranged from 2.9 to 5.9 points following use of dermal allograft, and 3.4 to 7.0 points following TFL autograft reconstruction. Mean improvements in American Shoulder and Elbow Surgeons score were similar between groups (dermal allograft: 28.0-61.6; TFL autograft: 24.7-59.3). The mean increase in forward flexion ranged from 31° to 38° with dermal allograft, versus 19° to 69° with TFL autograft. Average improvement in active external rotation with dermal allograft ranged from –0.4° to 11° and from 2° to 22.4° using TFL autograft. A similar change in acromiohumeral distance following SCR (dermal allograft: 0.9-3.2 mm; TFL autograft: 0.3-3.6 mm) was appreciated. The rate of complications within the dermal allograft group ranged from 4.5% to 38.2% versus 13.3% to 86.4% following TFL autograft. Failure rate ranged from 4.5 to 38.2% following dermal allograft versus 4.5 to 86.4% with TFL autograft.

Conclusions: Acellular dermal allograft versus TFL autograft for SCR both demonstrate improved VAS and American Shoulder and Elbow Surgeons scores, with increased values in flexion and external rotation, and increased visual analog scale, although with high variability. Both grafts demonstrate high rates of complications and failures at minimum 2-year follow-up.

Level of Evidence: IV; systematic review of level II-IV studies.

BACK

Journal of Shoulder and Elbow Surgery (JSES), Volume 32, issue 5

Efficacy of bone marrow stimulation for arthroscopic knotless suture bridge rotator cuff repair: a prospective randomized controlled trial

T. Shibata, T. Izaki

DOI: https://doi.org/10.1016/j.jse.2023.01.016

Background: The purpose of this study was to investigate the efficacy of bone marrow stimulation (BMS) on the repair integrity of the rotator cuff insertion treated with arthroscopic knotless suture bridge (K-SB) rotator cuff repair. We hypothesized that BMS during K-SB repair can improve the healing of the rotator cuff insertion.

Methods: Sixty patients who underwent arthroscopic K-SB repair of full-thickness rotator cuff tears were randomly allocated to 2 treatment groups. Patients in the BMS group underwent K-SB repair augmented with BMS at the footprint. Patients in the control group underwent K-SB repair without BMS. Cuff integrity and retear patterns were evaluated by postoperative magnetic resonance imaging. The clinical outcomes included the Japanese Orthopaedic Association score, University of California at Los Angeles score, Constant–Murley score, and Simple Shoulder Test.

Results: Clinical and radiological evaluations were completed in 60 patients at 6 months postoperatively, in 58 patients at 1 year postoperatively, and in 50 patients at 2 years postoperatively. Both treatment groups showed significant improvements in the clinical outcome from baseline to the 2-year follow-up, but no significant differences were found between the 2 groups. At 6 months postoperatively, the retear rate at the tendon insertion was 0.0% (0 of 30) in the BMS group and 3.3% (1 of 30) in the control group ($P = .313$). The retear rate at the musculotendinous junction was 26.7% (8 of 30) in the BMS group and 13.3% (4 of 30) in the control group ($P = .197$). All retears in the BMS group occurred at the musculotendinous junction, and the tendon insertion was preserved. There was no significant difference in the overall retear rate or retear patterns between the 2 treatment groups during the study period.

Conclusion: No significant differences were detected in the structural integrity or retear patterns regardless of the use of BMS. The efficacy of BMS for arthroscopic K-SB rotator cuff repair was not proven in this randomized controlled trial.

Level of evidence: Level II, Randomized Controlled Trial, Treatment Study

BACK

Does the timing of tenotomy during biceps tenodesis affect the incidence of Popeye deformity and clinical outcome? An analysis of short-term follow-up of 2 techniques

N.S. Lanham, R. Ahmed

DOI: https://doi.org/10.1016/j.jse.2022.10.031

Background: There are multiple techniques that attempt to maintain anatomic length-tension relationship during biceps tenodesis. However, no direct comparison has been performed with respect to the timing of biceps tenotomy during biceps tenodesis. This study aims to assess the incidence of Popeye deformity and clinical outcomes of 2 all-arthroscopic techniques for biceps tenodesis based on timing of the biceps tenotomy.

Methods: A consecutive series of patients undergoing arthroscopic biceps tenodesis with concomitant rotator cuff tears were enrolled from 2019 to 2021. Biceps tenodesis performed after tenotomy formed the first cohort (group 1). The other cohort had biceps tenodesis performed prior to biceps tenotomy (group 2). Postoperative anterior arm pain, biceps muscle spasms, and patient perceptions of the appearance of the bicep muscle were assessed. In addition, patient-reported outcomes (PROs) were collected at 3 months and minimum 6 months postoperatively.

Results: A total of 71 patients were eligible for participation and 62 patients (53% female, age 58.7 ± 9.0 years) were enrolled (n = 33 in group 1, and n = 29 in group 2). There were no differences between groups with respect to gender, age, and laterality of biceps tenodesis, as well as type and size of rotator cuff repair. At 3-month follow-up, Veterans RAND 12-Item Health Survey (VR-12) physical health summary scores were significantly improved in group 2 (44.8 ± 9.7) compared with group 1 (34.1 ± 3.4) (P = .03). In addition, patients in group 2 experienced significantly less pain in their anterior arm than patients in group 1 (19% vs. 33%, P = .02). There were no differences in biceps muscle spasm (3.4% vs. 5.2%, P = .21) and no other differences in PROs between groups. Final follow-up averaged 11.6 ± 3.3 months in group 1 and 11.8 ± 5.5 months in group 2. There were no significant differences in patient-perceived biceps Popeye deformity between group 1 (12.1%) and group 2 (0%) (P = .652). Furthermore, there were no differences in American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form, EuroQol-5 Dimension, Patient-Reported Outcomes Measurement Information System Global Health (PROMIS 10) physical health, PROMIS 10 depression, VR-12 physical health summary, and Single Assessment Numeric Evaluation scores between the 2 technique groups.

Conclusion: Patients with tenotomy performed after tenodesis had better VR-12 physical health summary scores and less arm pain than patients with tenotomy performed before tenodesis at 3-month follow-up. However, there were no differences in any outcome at final follow-up of nearly 1-year. In addition, there were no differences in perceived Popeye deformity between groups at any time period.

Level of evidence: Level III, Retrospective Cohort Comparison, Treatment Study

BACK

Clinical outcomes and return to play in softball players following SLAP repair or biceps tenodesis

M.A. Rothermich, M.K. Ryan

DOI: https://doi.org/10.1016/j.jse.2022.10.025

Background: Shoulder pain due to labral tears and biceps tendonitis is commonly found in softball players. Surgical options include labral repair and biceps tenodesis. Although past studies are limited by heterogeneous study groups from multiple sports, this is the first study that assesses clinical outcomes and return to play rates for fast-pitch softball players.

Purpose/Hypothesis: The purpose of this study was to evaluate the clinical outcomes and return to play for fast-pitch softball players treated for a superior labrum anterior posterior (SLAP) tear and recalcitrant biceps tendonitis with a biceps tenodesis compared with a traditional SLAP repair. We hypothesized that the biceps tenodesis would have comparable outcomes with a faster return to play compared with SLAP repair.

Methods: We performed a retrospective analysis on fast-pitch softball players treated surgically for SLAP tear, recalcitrant biceps tendonitis, or a combination between 2001 and 2019 at our institution. Inclusion criteria were fast-pitch softball players who underwent biceps tenodesis or a SLAP repair with greater than 2-year follow-up. Exclusion criteria involved slow-pitch softball players, patients with less than 2-year follow-up, and patients who had undergone concomitant procedures on the ipsilateral shoulder at the time of SLAP repair or biceps tenodesis. Follow-up was either self-reported through OBERD, a patient-reported outcomes (PRO)–managing software, or achieved over the phone. Follow-up data included American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form score, Andrews Carson Score, Kerlan-Jobe Orthopaedic Clinic Shoulder and Elbow Score, Numeric Rating Scale for Pain, and our institution-specific return-to-play questionnaire. We statistically compared players who underwent biceps tenodesis or a SLAP repair, and compared pitchers with position players using Student *t* tests and Fisher exact test with statistical significance determined to be $P < .05$.

Results: From 60 eligible patients identified, follow-up outcome data were successfully captured for 47 (78%). Of the 18 SLAP repair patients, 17 (94%) returned to full competition at an average of 7.9 months. Of the 29 patients who underwent biceps tenodesis, 27 (93%) returned to full competition at an average of 7.1 months. Statistical analysis of PRO scores for each group found no significant differences between any of the measures used to evaluate patient outcomes, including no statistical difference in pitchers compared with position players.

Conclusion: In conclusion, this study demonstrated comparable outcomes between SLAP repairs and biceps tenodesis procedures among our study group of fast-pitch softball players. There was no significant difference between RTP times between the 2 groups.

Level of evidence: Level III, Retrospective Cohort Comparison, Treatment Study

BACK

Clinical outcomes and recurrence rate of 4 procedures for recurrent anterior shoulder instability: ASA, remplissage, open, and arthroscopic Latarjet: a multicenter study

M. Maiotti, A. De Vita

DOI: https://doi.org/10.1016/j.jse.2022.10.030

Background: The aim of the present study was to compare the clinical outcomes of 4 surgical techniques in patients with recurrent anterior shoulder dislocation, glenoid bone loss (GBL) <15% and Instability Severity Index (ISI) score >3.

Methods: A retrospective multicenter study was conducted on 226 patients who underwent 1 of 4 different techniques (Bankart plus arthroscopic subscapularis augmentation (ASA), Bankart plus remplissage, Latarjet, Arthro-Latarjet). The inclusion criteria were: recurrent dislocation, GBL <15%, and ISI score >3. The exclusion criteria were: GBL >15%, voluntary instability, multidirectional instability, preexisting osteoarthritis, throwing athletes' first dislocation, and ISI score<3. Follow-up ranged from 24 months to 6 years. Hyperlaxity was clinically evaluated according to Neer and Coudane–Walch tests. Clinical outcomes were assessed using the Rowe score and the Western Ontario Shoulder Instability Index (WOSI) for each technique. Before surgery, all patients underwent magnetic resonance imaging and computed tomography scanning. The Pico area method was used to assess the percentage of GBL. The operations were performed by 10 experienced surgeons; the functional outcomes were evaluated by 2 independent observers.

Results: A total of 226 patients who met the inclusion criteria were included in the present series. A total of 89.2% of patients in the ASA group reported an excellent Rowe score at the final follow-up, and their scores on the WOSI scale, improved from 838 to 235 points. A total of 79.9% of patients in remplissage (R) group reported an excellent Rowe score at the final follow-up, and their scores on the WOSI scale improved from 1146 to 465 points. A total of 98.5% of patients in the Latarjet (L) group reported an excellent Rowe score at the final follow-up, and their scores on the WOSI scale improved from 1456 to 319 points. A total of 81.6% of patients in the Arthro-Latarjet (AL) group reported an excellent Rowe score at the final follow-up, and their scores on the WOSI scale improved from 1250 to 221 points. The recurrence rates were as follows: ASA group (7%), remplissage group (6.1%), L group (1.5%), Arthro-Latarjet group (0%). Patients in the open L group had 15.5% (10/66) more complications.

Conclusion: The use of ASA and remplissage to augment the Bankart repair have been demonstrated to be effective for restoring joint stability, yielding good clinical outcomes similar to the L procedure in patients affected by recurrent anterior dislocation with GBL <15% and an ISI score score >3. Soft tissues augmentations of the Bankart repair have been demonstrated to be effective for addressing anterior soft tissue deficiency dysfunction and critical Hill–Sachs lesions.

Level of evidence: Level III, Retrospective Comparative Study

BACK

Increased rates of subjective shoulder instability after Bankart repair with remplissage compared to Latarjet surgery

R.W. Paul, M.P. Reddy

DOI: https://doi.org/10.1016/j.jse.2022.11.001

Background: Controversy exists as to the ideal management of young active patients with subcritical glenoid bone loss and an off-track Hill-Sachs lesion, and the Latarjet and arthroscopic Bankart with remplissage are effective surgical options. The purpose of this study was to compare rates of recurrent instability and reoperation, as well as patient-reported outcome measures, between Latarjet and arthroscopic Bankart repair with remplissage surgery patients. The authors hypothesized that there would be no difference in rates of recurrent instability, reoperation, and postoperative outcomes between patients who underwent Latarjet surgery and patients who underwent Bankart repair with concomitant remplissage postoperatively.

Methods: All patients who underwent primary shoulder stabilization for shoulder instability from 2014 to 2019 were screened. Latarjet and Bankart repair with remplissage patients were included if arthroscopic surgery was performed in response to anterior shoulder instability. Recurrent instability, revision, shoulder range of motion, return to sport (RTS), and patient-reported outcome measures (Oxford Shoulder Instability, Single Assessment Numeric Evaluation, and American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form scores) were compared between groups.

Results: Overall, 43 Latarjet patients (age: 29.8 ± 12.1 years, 36 males 7 females) and 28 Bankart repair with remplissage patients (age: 28.2 ± 8.8 years, 25 males 3 females) were included with a mean follow-up of 3.3 ± 1.9 years. Patients who underwent Latarjet surgery had larger amounts of bone loss (19% vs. 11%, $P < .001$), a lower rate of off-track Hill-Sachs lesions (47% vs. 82%, $P < .001$), and more frequently had a history of chronic shoulder dislocations (88% vs. 43%, $P < .001$) compared to Bankart repair with remplissage patients. Latarjet patients less frequently reported feeling subjective shoulder instability after surgery (21% vs. 50%, $P = .022$), which was defined as feeling apprehension or experiencing a shoulder subluxation or dislocation event. There were no differences in rates of postoperative dislocation, revision, reoperation, or RTS, as well as patient-reported outcome scores, between groups (all $P > .05$).

Conclusion: Despite differences in osseous defects, Latarjet and Bankart repair with remplissage patients had similar rates of clinical, patient-reported, and RTS outcomes at a mean of 3.3 years postoperatively. Latarjet surgery patients may be less likely to experience subjective shoulder instability postoperatively than patients who undergo Bankart repair with concomitant remplissage.

Level of evidence: Level III, Retrospective Cohort Comparison

BACK

The statistical fragility of studies on rotator cuff repair with graft augmentation

C. Imbergamo, S.B. Sequeira

DOI: https://doi.org/10.1016/j.jse.2022.12.017

Background: Clinical decision-making often relies on evidence-based medicine. Our purpose was to determine the fragility index (FI) and fragility quotient (FQ) for studies evaluating rotator cuff repair (RCR) with graft augmentation. A lost to follow-up (LTF) value greater than the FI indicates statistical instability for the reported outcomes and conclusions.

Methods: We performed a systematic review using Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines by searching PubMed, the Cochrane library, and Embase in June 2022 to identify studies of RCR with graft augmentation. Comparative studies with at least 1 statistically analyzed dichotomous outcome were included. Seventeen studies published in seven peer-reviewed journals from 2003 to 2019 were subsequently evaluated. The FI was determined by changing each reported outcome event within 2 × 2 contingency tables until statistical significance or nonsignificance was reversed. The associated FQ was determined by dividing the FI by the sample size. LTF values were also extracted from each included study.

Results: The included studies had a total of 1098 patients with 36 dichotomous outcomes. The associated median FI was 4 (interquartile range 2-5), indicating that the reversal of 4 patients' outcomes would have reversed the finding of significant difference. The median FQ was 0.08 (interquartile range 0.04-0.15), indicating that in a sample of 100 patients, reversal of 8 patients' outcomes would reverse statistical significance. The median number of patients LTF was 3 (range 0-25), with 56% of reported outcomes having LTF greater than their respective FI.

Conclusion: Studies of RCR with graft augmentation lack statistical stability, with few altered outcome events required to reverse statistical significance. Larger comparative studies with better follow-up will strengthen the statistical stability of the evidence for RCR with graft augmentation. For future investigations and reports, we recommend including FI and FQ along with traditional statistical significance analyses to provide better context on the strength of conclusions.

Level of evidence: Basic Science Study, Systematic Review and Statistics and Measurement Error

BACK

Knee Surgery, Sports Traumatology, Arthroscopy (KSSTA), Volume 31, Issue 5

Suprascapular nerve release does not provide additional benefits in arthroscopic rotator cuff repair surgery: a systematic review and meta-analysis

T.-H. Yang, M.-H. Lin

DOI: https://doi.org/10.1007/s00167-022-07066-4

Purpose: To investigate the effect of suprascapular nerve release in arthroscopic rotator cuff repair surgery.

Methods: This systematic review was performed to include randomized controlled trials (RCTs) and non-RCTs that compared the outcomes of patients who did and did not receive suprascapular nerve release (SSNR) during arthroscopic rotator cuff repair surgery. MEDLINE, Embase, and the Cochrane Central Register of Controlled Trials were searched for relevant studies. Methodological Index for Non-randomized Studies (MINORS) was used for cohort study assessment. The Cochrane risk of bias assessment tool (version 1.0) was used to assess the risk of bias in randomized trials. The primary outcomes were pain and shoulder function. The secondary outcome was the re-tear rate.

Results: Two RCTs and three non-RCTs with a total of 187 patients (90 patients received SSNR and 97 patients did not receive SSNR) were included in this systematic review. The meta-analysis revealed that the SSNR group did not had a more pain reduction, assessed by visual analogue scale, compared to the non-SSNR group. Also, the SSNR group did not have a significantly more improvement in the UCLA score, compared to the non-SSNR group. In addition, there was no significant difference between the two groups in terms of Constant score and re-tear rate.

Conclusion: The result of this study showed that additional suprascapular nerve release did not provide additional benefit in arthroscopic rotator cuff repair surgery. Routine arthroscopic SSNR is not recommended when treating patients with rotator cuff tear.

Level of evidence: Level III

BACK

Satisfactory functional and structural outcomes of anterior cable reconstruction using the proximal biceps tendon for large retracted rotator cuff tears

H. Yang, S. Lee

DOI: https://doi.org/10.1007/s00167-022-07112-1

Purpose: Large retracted anterior L-shaped tear characterized by a retracted supraspinatus tendon to the glenoid level combined with a relatively preserved infraspinatus tendon is one of the challenging tear patterns in achieving complete repair to the anatomic footprint. The purpose of this study was to evaluate clinical outcomes and tendon integrity of rotator cuff repair combined with anterior cable reconstruction using the proximal biceps tendon in patients with large retracted anterior L-shaped rotator cuff tear.

Methods: This study prospectively enrolled patients who underwent arthroscopic anterior cable reconstruction using the proximal biceps tendon for large retracted anterior L-shaped rotator cuff tears between 2018 and 2020 with a minimum 2-year follow-up. The anterior portion of the rotator cable was reconstructed using tenotomized proximal biceps tendon fixed with two suture anchors at the footprint. The retracted supraspinatus tendon was repaired on the biceps tendon without undue tension. The proximal portion of the infraspinatus tendon was repaired with the biceps tendon-supraspinatus tendon complex. Clinical outcomes was assessed during the follow-up period. Tendon integrity and retear size were evaluated by postoperative MRI.

Results: A total of 32 consecutive patients were included. The ASES score was significantly improved from 66.6 ± 16.6 preoperatively to 94.1 ± 6.1 postoperatively ($P < 0.001$), and the VAS for pain was significantly relieved from 2.8 ± 1.9 preoperatively to 0.5 ± 0.4 postoperatively ($P < 0.001$). All patients were satisfied postoperatively regardless of tendon integrity ($P = 0.015$). Postoperative ROM was increased continuously during the follow-up period ($P < 0.001$). The Popeye sign was found in 4 patients (12.5%). Six patients (18.7%) had rotator cuff retears. However, the ASES score of patients with retear was significantly improved from 72.8 ± 13.3 preoperatively to 91.1 ± 6.7 postoperatively ($P < 0.001$). Relative changes in the retear size compared with the primary tear size were -56.8 ± 14.4% for the anteroposterior diameter and – 70.6 ± 6.1% for the mediolateral diameter.

Conclusion: Rotator cuff repair combined with anterior cable reconstruction using the proximal biceps tendon provided satisfactory clinical and radiological outcomes for large retracted anterior L-shaped tears. Anterior cable reconstruction using the proximal biceps tendon is a sound surgical option for the patients with large retracted anterior rotator cuff tear.

Level of evidence: Level IV

BACK

Knotted and knotless double row transosseous equivalent repair techniques for arthroscopic rotator cuff repair demonstrate comparable post-operative outcomes

M.A. Fox, J.D. Hughes

DOI: https://doi.org/10.1007/s00167-022-07121-0

Purpose: To compare failure rates and outcomes after transosseous equivalent (TOE) double row (DR) knotted suture bridge versus knotless suture tape bridge repair techniques for rotator cuff tears.

Methods: A consecutive series of 272 shoulders in 256 patients who underwent arthroscopic, double row, TOE repair for full-thickness tears of the supraspinatus tendon were reviewed. Eighty-four shoulders were repaired using knotted suture bridge (KSB) technique, and 188 shoulders were repaired using all knotless suture tape bridge (KTB) technique. Revision procedures and concomitant subscapularis tendon repairs were excluded from analysis. The minimum follow-up was 12 months. Primary outcome was failure of surgical repair, defined as either confirmed retear on MRI and/or need for revision surgery. Secondary clinical outcome measures were assessed including range of motion, strength, visual analog scale (VAS), operative time, subjective shoulder value (SSV), Patient-Reported Outcomes Measurement Information System (PROMIS) mental and physical health, American Shoulder and Elbow Surgeons Shoulder Score (ASES), Brophy shoulder activity scores, and need for manipulation under anesthesia (MUA).

Results: A total of 127 shoulders (38 KSB and 89 KTB) met inclusion criteria for the study. No significant difference in demographic variables were present between the groups at baseline. Supraspinatus tear size and average follow-up time did not differ significantly between groups. Failure rates were similar between the KSB and KTB repairs (13.1 vs 7.9%, n.s.). There was no significant difference in functional outcomes including strength, range of motion in forward flexion and external rotation, as well as patient reported outcomes including VAS, SSV, PROMIS, ASES, and Brophy scores between the groups. There was also no difference in post-operative stiffness requiring MUA.

Conclusion: Both KSB and KTB repair techniques demonstrate low retear rates with excellent functional outcomes when compared to pre-operative examination. Both KSB and KTB techniques are viable options for achieving a successful rotator cuff repair.

Level of evidence: Level III

BACK

Suspension fixation of iliac bone grafts under arthroscopy is an effective method for the treatment of unstable bony Bankart disease of the shoulder joint in patients with joint relaxation

P. Zhou, H. Shao

DOI: https://doi.org/10.1007/s00167-022-07127-8

Purpose: To evaluate the results of arthroscopic autologous iliac bone graft suspension fixation combined with the Remplissage procedure in the treatment of recurrent shoulder dislocation with bony Bankart lesions and joint hyperlaxity.

Methods: From 2018 to 2020, 22 patients with joint laxity underwent arthroscopic autologous iliac bone graft suspension fixation and Bankart repair combined with the Remplissage procedure due to recurrent shoulder dislocation. Clinical assessment included range of motion (forward flexion, abduction, 90° external rotation, conventional external rotation, adduction, and internal rotation), visual analog scale (VAS) score, Rowe score, University of California Los Angeles (UCLA) score, and Western Ontario Shoulder Instability Index (WOSI) score. Post-operatively, the healing of the bone graft was evaluated with computed tomography (CT) scanning.

Results: All 22 patients were followed up for a mean of 19.3 ± 4.1 months. CT imaging showed that the healing time of the bone graft was 6–8 weeks. The patient satisfaction rate was 100%, there were no cases of redislocation, all patients returned to their preinjury training state, and the fear test was negative. At the final follow-up, the UCLA, VAS, Rowe, and WOSI scores were 29.8 ± 2.1, 2.2 ± 0.8, 89.4 ± 4.2, and 482.3 ± 46.2, respectively ($p < 0.001$).

Conclusion: Arthroscopic autologous iliac bone graft suspension fixation and Bankart repair combined with the Remplissage procedure are effective in preventing recurrent instability with joint hyperlaxity. Furthermore, no patient had redislocation.

Level of evidence: Level IV

BACK

The prevalence, classification, radiological and arthroscopic findings of intratendinous subscapularis tears

L. Lin, L. Zhang

DOI: https://doi.org/10.1007/s00167-022-07262-2

Purpose: To investigate the clinical characteristics of intratendinous subscapularis (inSSC) tears.

Methods: Retrospectively, 69 patients with arthroscopically confirmed inSSC tears were identified from 2018 to 2019. Preoperatively and at final follow-up, thorough physical examination was performed and clinical outcomes (American Shoulder and Elbow Surgeons [ASES] score; University of California, Los Angeles [UCLA] score; visual analogue scale [VAS] for pain; and Simple Shoulder Test [SST]) were recorded. Features of pre-operative magnetic resonance image (MRI) such as high signalling within the tendon substance, communication to the bicipital groove and long head of biceps tendon (LHBT) lesions were investigated. Characteristics of arthroscopic view were investigated. Bear-hug and internal rotation resistance test at 90° abduction and external rotation (IRRT90°) test were used to assess the SSC strength.

Results: The mean follow-up was 2.4 (2–3) years. The prevalence of arthroscopically confirmed inSSC tears was 69/675 (10.2%) among arthroscopic rotator cuff repairs. Pre-operative physical examination found positive IRRT90° and bear-hug test in 41/60 (68.3%) and 42/69 (60.8%) patients, respectively. The Cohen kappa coefficient was interpreted to be substantial for the evaluation of all MRI parameters. According to the conditions of LHBT, inSSC tears were classified into 3 types: type I: without LHBT subluxation and tear; type II: with LHBT subluxation or tears and type III: with LHBT dislocation. At final follow-up, mean ASES, UCLA, VAS, and SST scores improved significantly from mean of 50.6 ± 14.7, 19.4 ± 3.07, 6.2 ± 2.0, and 6.1 ± 2.5 to mean of 90.7 ± 9.5, 32.2 ± 1.8, 1.4 ± 1.2 and 9.8 ± 2.2, respectively ($P < 0.001$). Bilateral symmetric strength was found by bear-hug and IRRT90° test in all patients postoperatively.

Conclusion: Understanding features of pre-operative MRI, physical examination and arthroscopic view is helpful to identify inSSC tears. Arthroscopic repair yielded satisfactory clinical outcomes in patients with inSSC tears.

Level of evidence: Level IV

BACK

American Journal of Sports Medicine (AJSM), Volume 51, Issue 6

Minimum 10-Year Clinical Outcomes After Arthroscopic Capsulolabral Repair for Isolated Posterior Shoulder Instability

Benjamin B. Rothrauff MD, PhD, Justin W. Arner MD, Spencer E. Talentino MD, James P. Bradley MD

DOI: https://doi.org/10.1177/03635465231162271

Background: Arthroscopic capsulolabral repair for posterior shoulder instability has been shown to improve patient-reported outcomes and return to sport at short-term and midterm follow-up, but long-term outcomes are unknown.

Purpose: To determine the objective and subjective clinical outcomes of shoulder function after arthroscopic posterior shoulder stabilization at a minimum 10-year follow-up.

Study Design: Case series; Level of evidence, 4.

Methods: A total of 53 patients (55 shoulders) with unidirectional recurrent posterior shoulder instability who underwent arthroscopic capsulolabral repair were evaluated at a mean follow-up of 15.4 years. Outcomes such as the American Shoulder and Elbow Surgeons (ASES) shoulder score, Kerlan-Jobe Orthopaedic Clinic shoulder and elbow score, and subjective strength, stability, range of motion, and pain were evaluated preoperatively and postoperatively at a minimum 10-year follow-up. Outcomes from the same patient cohort were previously collected at 3.0-year follow-up and were evaluated for longitudinal analysis. Subgroup analyses for sport type (contact vs noncontact), position (thrower vs nonthrower), and revision versus nonrevision were performed. Risk factors for revision surgery based on magnetic resonance imaging findings, patient characteristics, and surgical findings were investigated.

Results: Arthroscopic capsulolabral repair for posterior shoulder instability led to a statistically significant improvement on all outcome measures, with similar values at short-term (3.0-year) and long-term (15.4-year) follow-up. Across the total population, patients with 19 of 55 shoulders (35%) returned to sport at the same preinjury level, and patients with 33 of 55 shoulders (60%) returned to sport at some level. At long-term follow-up, patients with only 22% of shoulders were involved in the primary sport in which the injury was sustained, with patients with 28% of shoulders discontinuing sporting participation because of ongoing shoulder issues. Throwers trended toward lower Kerlan-Jobe Orthopaedic Clinic scores than nonthrowers both preoperatively (36.5 ± 22.8 vs 48.7 ± 22.9, respectively; P = .10) and postoperatively (57.4 ± 27.0 vs 73.5 ± 26.8, respectively; P = .09) but had similar improvements. Contact and noncontact athletes had similar preoperative and postoperative values, with equal improvements after surgery. With failure defined as revision surgery, an ASES score <60, or a stability value >5, 19 of 55 shoulders (35%) met failure criteria at final follow-up. Overall, 7 of 55 shoulders (13%) underwent revision surgery. At long-term follow-up, patients who underwent revision surgery had worse outcomes than those who did not undergo revision (ASES score: 53.1 ± 25.9 vs 81.8 ± 19.4, respectively; P < .001). An acute injury in the postoperative period (P < .001) and a smaller glenoid bone width on magnetic resonance imaging (P = .02) were the only identified risk factors for revision surgery.

Conclusion: Arthroscopic capsulolabral repair for posterior shoulder instability was a durable treatment option that improved long-term shoulder pain and function and facilitated return to sport in the majority of patients at a mean follow-up of 15.4 years, although a notable proportion of patients met various criteria for failure.

BACK

Outcomes of Open Versus Arthroscopic Treatment of HAGL Tears

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DOI: https://doi.org/10.1177/03635465231164141

Background: Lesions that involve humeral avulsions of the glenohumeral ligament (HAGLs), although less common, are primary contributors to recurrent events of dislocation and subluxation of the glenohumeral joint.

Purpose: To describe the clinical presentation, examination, and surgical outcomes of patients presenting with HAGL lesions who underwent repair using an arthroscopic or open technique.

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

Methods: A multicenter retrospective review of prospectively collected data was performed of skeletally mature patients without glenohumeral arthritis who presented with HAGL lesions and subsequently underwent arthroscopic or open repair between 2005 and 2017. Independent variables included patient characteristics, clinical presentation, physical examination findings, and arthroscopic findings. Dependent variables included pre- and postoperative Single Assessment Numeric Evaluation (SANE) score, Western Ontario Shoulder Instability Index (WOSI) score, and range of motion outcomes.

Results: Eighteen patients diagnosed with a HAGL lesion who underwent primary arthroscopic repair (n = 7) or open repair (n = 11) were included. There were 17 male patients and 1 female patient with a mean age of 24.9 years (range, 16-38 years). Mean follow-up duration was 50.9 months (range, 24-160 months). Seventeen patients (94.4%) reported pain as the most common symptom, and 7 (38.9%) reported sensation of instability. Scores significantly improved from pre- to postoperative for the arthroscopic and open groups ($P < .001$): SANE (mean ± SD; arthroscopic, 30.7 ± 15.7 to 92.1 ± 12.2; open, 45.5 ± 8.50 to 90.7 ± 5.24) and WOSI (arthroscopic, 51.4 ± 11.4 to 2.49 ± 3.70; open, 45.5 ± 7.37 to 11.5 ± 5.76). The magnitude of improvement in SANE scores was significantly higher for patients treated arthroscopically (Δ60.0; open, Δ46.5; $P = .012$). Postoperative WOSI scores were also significantly better in the arthroscopic cohort (2.49 ± 3.70; open, 11.5 ± 5.76; $P = .00094$).

Conclusion: Symptomatic HAGL tears present primarily with pain as opposed to instability, necessitating a high index of suspicion for injury. The tears may be treated successfully with an arthroscopic or open technique with significant improvements in patient-reported outcomes and stability.

BACK

Lower Extremity

Arthroscopy, Volume 39, Issue 5

Staged Bilateral Hip Arthroscopy for Femoroacetabular Impingement Syndrome: Index Surgery Patient Reported Outcome Measures Predict Contralateral Surgery Results at 2 Years

N.S. Horner, M.W. Rice, et al.

DOI: https://doi.org/10.1016/j.arthro.2022.10.048

Purpose: To determine whether (1) patient-reported outcome (PRO) scores after index hip arthroscopy correlate with PRO scores for the contralateral hip in patients undergoing staged bilateral hip arthroscopy and (2) patients who achieved minimal clinically important difference (MCID) or patient-acceptable symptom state (PASS) for the index hip were more likely to achieve MCID or PASS for the contralateral hip.

Methods: Patients who underwent staged bilateral hip arthroscopy for femoroacetabular impingement syndrome were retrospectively reviewed. PRO scores were prospectively collected at preoperative and 1- and 2-year timepoints. Odds ratios for achievement of MCID and PASS for the contralateral hip given achievement for the index hip were calculated. Improvements from before surgery to 2 years after surgery were correlated between both hips.

Results: A total of 143 patients (286 hips) were included in the final analysis. Average time between surgeries was 8.5 months (range, 0.7-57.2). Both hips demonstrated significant improvement ($P < .05$ for all) in all PROs at 2 years. Achievement of MCID in Hip Outcome Score Activities of Daily Living (HOS-ADL) at the 1-year timepoint for the index hip was predictive of achievement of MCID in HOS-ADL at 2 years for the contralateral hip. Achievement of PASS in all PROs at the 1-year timepoint for the index hip were predictive of achievement of PASS in the equivalent outcome score at the 2-year mark for the contralateral hip. Achievement of MCID or PASS at the 2-year timepoint for the index hip was predictive of achievement of the equivalent outcome at the 2-year timepoint for the contralateral hip. The strongest correlation between improvement in PRO scores for the index and contralateral hips was noted in patients who underwent staged hip arthroscopy within less than 3 months.

Conclusion: Patients experience significant clinical benefit in both hips after staged bilateral hip arthroscopy. Results from the initial hip arthroscopy at either 1- or 2-year follow-up can be used to predict outcomes on the contralateral side; however, there is a higher degree of predictive value using 2-year results. Average correlations between 2-year PROs on the index and contralateral hips were moderate to strong, regardless of the time between surgeries.

Level of Evidence: Level III, retrospective cohort study.

BACK

Patients Who Underwent Primary Hip Arthroscopy for Femoroacetabular Impingement with Acetabular Microfracture Show 77% Survivorship at 10-Year Follow-Up

B.G. Domb, M.S. Lee, et al.

DOI: https://doi.org/10.1016/j.arthro.2022.11.018

Purpose: To report minimum 10-year follow-up survivorship, defined as non-conversion to total hip arthroplasty (THA), and patient-reported outcome scores (PROS) after primary hip arthroscopy with acetabular microfracture in the setting of femoroacetabular impingement syndrome (FAIS) and acetabular chondral lesions, respectively.

Methods: Data were prospectively collected and retrospectively analyzed on all patients who underwent a primary hip arthroscopy and received an acetabular microfracture between June 2009 and January 2011. Patients with a minimum 10-year follow-up for the modified Harris Hip Score (mHHS), Nonarthritic Hip Score (NAHS), and the visual analog scale (VAS) for pain were included. If available, the minimum 10-year follow-up for the Hip Outcome Score-Sport-Specific Subscale was reported. The demographics, intraoperative findings, surgical procedures, PROS, rate of achieving the minimal clinical important difference (MCID), and secondary surgeries were analyzed and reported.

Results: Twenty-two hips (20 patients) were included in the study, and the mean follow-up time was 124.5 ± 2.2 months. There were 17 hips (77.3%) from males and 5 hips (22.7%) from females. The average patient age at the time of surgery was 42.3 years ± 9.6. All patients on average experienced statistically significant improvement ($P < .05$) between preoperative and minimum 10-year follow-up scores for all PROs. In total, 77.3% of the patients did not require conversion to THA. Additionally, 83.3% of the patients achieved the MCID for the mHHS, NAHS, and VAS for pain.

Conclusion: At a minimum 10-year follow-up, survivorship of 77.3% was reported for patients who underwent primary hip arthroscopy with acetabular microfracture for the treatment of FAIS and focal/full-thickness acetabular cartilage lesions. Further, in the patients that did not require THA conversion, significant improvement in all PROS was demonstrated.

Level of Evidence: IV, case-series study.

BACK

Clinical and Radiographic Criteria Define "Acceptable" Surgical Correction of Hip Femoroacetabular Impingement Syndrome as Well as Postoperative Complications: An International Modified Delphi Study

DOI: https://doi.org/10.1016/j.arthro.2022.11.023

Objectives: To develop recommendations for clinical and radiographic criteria to help define the "acceptable" surgical correction of femoroacetabular impingement syndrome (FAIS) and identify/define complications postoperatively.

Methods: A 3-phase modified Delphi study was conducted involving a case-based survey; a Likert/multiple choice-based survey concerning radiographic and physical examination characteristics to help define FAIS correction, as well as the prevalence and definition of potential postoperative complications; and 2 consensus meetings.

Results: Of the 75 experts invited, 54 completed the Phase I survey, 50 completed the Phase II survey (72% and 67% response rate), and 50 participated in the Phase III consensus meetings. For both typical and atypical (complex) cases, there was consensus that fluoroscopy with multiple views and dynamic hip assessment should be used intraoperatively (96% and 100%, respectively). For typical FAIS cases, the Expert Panel agreed that Dunn lateral and anteroposterior radiographs were the most important radiographs to evaluate the hip postoperatively (88%, consensus). When asked about evaluating the correction of cam impingement postoperatively, 87% voted that they use subjective evaluation of the "sphericity" of the femoral head. In the case of focal and global pincer-type FAIS, there was consensus that the reduction or elimination of the crossover sign (84%) and lateral center-edge angle (91%) were important to inform the extent of the FAIS correction. There was consensus for recommending further investigation at 6 months postoperatively if hip pain had increased/plateaued (92% agreed); that additional investigation and treatment should occur between 6 and 12 months (90% agreed); and that a reoperation may be recommended at 12 months or later following this investigation period (89% agreed).

Conclusions: This consensus project identified the importance of using fluoroscopy and dynamic hip assessment intraoperatively; Dunn lateral and anteroposterior view radiographs postoperatively; evaluating the "sphericity" of the femoral head for cam-type correction and the use of dynamic hip assessment; reducing/eliminating the crossover sign for focal pincer-type FAIS; evaluating the lateral center-edge angle for global pincer-type FAIS; and avoiding overcorrection of pincer-type FAIS. In cases in which postoperative hip pain increased/plateaued, further investigation and treatment is warranted between 6 and 12 months, and a reoperation may be recommended at a minimum of 12 months depending on the cause of the hip pain.

Clinical Relevance: Hip arthroscopy surgeons have yet to reach a firm agreement on what constitutes an "acceptable" or "good" surgery radiographically and how they can achieve desired clinical outcomes. Although this was a comprehensive effort, more study is needed to determine therapeutic thresholds that can be universally applied.

BACK

Primary Hip Arthroscopy for Femoroacetabular Impingement Syndrome in Adolescents Improves Outcomes and Clinical Benefit Achievement Rates at Short-Term Follow-Up: A Multicenter Analysis

D.R. Moldanado, A.Y. Kufta

DOI: https://doi.org/10.1016/j.arthro.2022.11.020

Purpose: To report minimum 2-year follow-up patient-reported outcome scores (PROs) and rates of achieving the minimal clinically important difference (MCID), the patient-acceptable symptomatic state (PASS), and the maximal outcome improvement (MOI) on adolescents following primary hip arthroscopy for femoroacetabular impingement syndrome (FAIS). Second, to determine risk factors for revision surgery.

Methods: Prospectively collected data from two high-volume hip arthroscopy centers were retrospectively reviewed on adolescents (≤19 years old) who underwent primary hip arthroscopy between November 2008 and February 2019. Adolescents with a minimum 2-year follow-up for the modified Harris Hip Score (mHHS), Non-Arthritic Hip Score (NAHS), Hip Outcome Score-Sports Specific Subscale (HOS-SSS), International Hip Outcome Tool-12 (iHOT-12), and visual analog scale (VAS) for pain were included regardless of their growth plate status. Exclusion criteria were Tönnis grade >1, lateral center edge-angle <18°, and previous ipsilateral hip surgery or conditions. Preoperative and postoperative radiographic data, MCID, PASS, MOI, secondary surgeries, and complications were reported. A multivariable survival analysis for risk factors for secondary surgery was conducted.

Results: A total of 287 hips (249 patients) were included (74.9% females). The mean values for age, body mass index, and follow-up were 16.3 ± 1.3 years, 22.3 ± 3.5, and 26.6 ± 9.4 months, respectively. Further, 88.9% underwent labral repair, 81.5% femoroplasty, and 85.4% capsular closure. Improvement for all PROs was reported ($P < .001$) with high patient satisfaction (8.8 ± 1.5). Achievement for the MCID was 71.7%, 83.0%, 68.1%, and 79.5% for the mHHS, NAHS, HOS-SSS, and iHOT-12, respectively. Achievement for the PASS was 68.3% for the mHHS and 73.2% for the NAHS. The MOI for mHHS, NAHS, and VAS was 58.3%, 77.0%, and 59.6%, respectively. Rates of revision hip arthroscopy, cam recurrence, and heterotopic ossification were 5.8%, 1.7%, and 5.5%, respectively. Acetabular retroversion was found to be a risk factor for revision surgery ($P = .03$).

Conclusion: The results of this multi-center study demonstrated that adolescents who underwent primary hip arthroscopy for FAIS reported significant improvement in all PROs, with satisfactory achievement rates for the MCID, PASS, MOI, and high patient satisfaction at a minimum 2-year follow-up.

Level of Evidence: IV, retrospective multicenter study.

BACK

Outcomes of Arthroscopic All-Inside Repair Are Improved Compared to Transtibial Pull-Out Repair of Medial Meniscus Posterior Root Tears

K.H. Yoon, W. Lee

DOI: https://doi.org/10.1016/j.arthro.2022.11.025

Purpose: The purpose of the present study was to compare the clinical outcomes of patients who underwent an all-inside repair (with a bony trough) versus transtibial pull-out repair in medial meniscus posterior root tears (MMPRTs).

Methods: We retrospectively investigated consecutive patients who underwent MMPRT repairs in nonacute tears in age over 40 from November 2015 to June 2019. All patients were divided into a transtibial pull-out repair group and an all-inside repair group. Different surgical techniques were used during different time frames. All patients were followed-up for a minimum of 2 years. The data collected included the International Knee Documentation Committee (IKDC) Subjective, Lysholm, and Tegner activity scores. Magnetic resonance imaging (MRI) was performed at the 1-year follow-up to assess meniscus extrusion, signal intensity, and healing.

Results: The final cohort consisted of 28 patients in the all-inside repair group and 16 in the transtibial pull-out repair group. In the all-inside repair group, the IKDC Subjective, Lysholm, and Tegner scores improved significantly at the 2-year follow-up. In the transtibial pull-out repair group, the IKDC Subjective, Lysholm, and Tegner scores did not improve significantly at the 2-year follow-up. Postoperative extrusion ratio increased in both groups, and patient-reported outcomes at follow-up did not differ between the two groups The change in the extrusion ratio was significantly less in the all-inside repair group (P = .009), as was the postoperative meniscus signal (P = .011). Postoperative MRI revealed significantly better healing in the all-inside group (P = .041).

Conclusion: All-inside repair improved the functional outcome scores. Radiologically, all-inside repair was better than transtibial pull-out repair. All-inside repair may be a viable MMPRT treatment option.

Level of Evidence: III, retrospective cohort study.

BACK

Femoral Nerve Block and Local Instillation Analgesia Associated With More Reliable Efficacy in Regional Anesthesia Interventions Within 24 Hours Following Anterior Cruciate Ligament Reconstruction: A Network Meta-analysis

H. Liu, X. Song, et al.

DOI: https://doi.org/10.1016/j.arthro.2022.12.014

Purpose: To assess the relative effectiveness of different regional anesthetic techniques (peripheral nerve blocks, local instillation analgesia, including intra-articular, subcutaneous, and periarticular infiltration) in patients undergoing anterior cruciate ligament reconstruction (ACLR).

Methods: PubMed, Embase, Cochrane Library, and Web of Science databases were searched from their inception to December 31, 2020. The search was supplemented by manual review of relevant reference lists. Randomized controlled trials of participants after ACLR that compared regional anesthesia interventions were selected. The 2 coprimary outcomes were (1) rest pain scores and (2) cumulative oral morphine equivalent consumption on day 1 (24 hours) post-ACLR. Data were pooled using a Bayesian framework.

Results: Of 759 records identified, 46 trials were eligible, evaluating 9 interventions in 3,171 patients. Local instillation analgesia (LIA), including intra-articular, subcutaneous, and periarticular infiltration, had significant improvement in pain relief as compared with placebo (–0.91; 95% CrI –1.45 to –0.37). Femoral nerve block (FNB) also showed significant effects in relieving pain as compared with placebo (–0.70; 95% 95% credible interval [CrI] –1.28 to –0.12). Compared with placebo, a significant reduction in opioid consumption was found in LIA (mean difference –13.29 mg; 95% CrI –21.77 to –4.91) and FNB (mean difference –13.97 mg; 95% CrI –24.71 to –3.04). Femoral and sciatic nerve block showed the greatest ranking for pain relief and opioid consumption without significant evidence ($P > .05$) to support superiority in comparison with placebo, respectively.

Conclusions: Our meta-analysis shows that FNB and LIA can significantly diminish postoperative pain and reduce opioid consumption following ACLR compared with placebo in the setting of regional anesthesia, and femoral and sciatic nerve block may be the number 1 top-ranked analgesic technique despite high uncertainty.

Level of Evidence: I, Systematic review of Level I studies.

BACK

Elevated Posterior Tibial Slope Is Associated With Anterior Cruciate Ligament Reconstruction Failures: A Systematic Review and Meta-analysis

R. Duerr, B. Ormseth, et al.

DOI: https://doi.org/10.1016/j.arthro.2022.12.034

Purpose: To evaluate the association of posterior tibial slope (PTS) with anterior cruciate ligament (ACL) reinjury following primary ACL reconstruction.

Methods: PubMed, Scopus, Embase, and CINAHL databases were searched from inception through March 1, 2021, to retrieve relevant studies. Comparative studies reporting PTS measurements in a cohort of patients experiencing ACL graft failure versus patients with intact primary ACL reconstruction or studies comparing patients undergoing revision ACL reconstruction versus primary ACL reconstruction were included for analysis. A random-effects model was used to calculate the overall standardized mean difference (SMD) between groups. The following inclusion criteria were used: English language; full text available; Level I, II, or III evidence; studies in humans; and skeletally mature patients.

Results: After we systematically screened 1,912 studies, 15 studies met the inclusion/exclusion criteria. Radiographic measurements were used in 6 studies reporting medial PTS in 411 ACL failures versus 2808 controls. Patients with ACL failure had significantly greater medial PTS compared with controls (SMD 0.50; 95% confidence interval [CI] 0.23-0.77; $P < .001$). Magnetic resonance imaging (MRI) was used in 9 studies reporting lateral PTS measurements in 641 patients with a failed ACL reconstruction compared with 705 controls. Seven of the MRI studies also measured medial PTS in 552 failures versus 641 controls. Patients with ACL failure had significantly greater lateral PTS on MRI (SMD 0.58; 95% CI 0.13-1.03; $P = .012$) and medial PTS on MRI (SMD 0.59; 95% CI 0.23-0.96; $P = .001$) compared with controls.

Conclusions: The present meta-analysis demonstrated that patients with elevated PTS on radiographs and MRI are at increased risk for ACL graft failure after primary ACL reconstruction.

Level of Evidence: Level III, meta-analysis of Level III studies.

BACK

Complication Rates After Medial Patellofemoral Ligament Reconstruction Range From 0% to 32% With 0% to 11% Recurrent Instability: A Systematic Review

G.R. Jackson, T. Tuthill

DOI: https://doi.org/10.1016/j.arthro.2023.01.098

Purpose: To review the incidence of complications following primary medial patellofemoral ligament (MPFL) reconstruction for recurrent patellar instability.

Methods: A literature search was conducted by querying PubMed and Scopus databases from database inception through August 2022 according to the 2020 Preferred Reporting Items for Systematic Review and Meta-analysis guidelines using the terms “Medial Patellofemoral Ligament,” “MPFL,” “reconstruction,” “patellar,” and “instability.” Inclusion criteria included studies reporting complications following primary MPFL reconstruction for recurrent patellar instability. Exclusion criteria consisted of studies reporting on patients undergoing concurrent osteotomy procedures, revision reconstruction, and biomechanical or anatomic studies. The incidence of specific complications was aggregated from the included studies.

Results: Twenty-eight studies, consisting of 1,478 patients (n = 1521 knees), with a mean age of 23.3 years (mean range, 19-34.3 years) were identified. The overall incidence of complications ranged from 0% to 32.3% of knees. Failure ranged from 0% to 10.7% of knees, whereas patellar fractures occurred in 0% to 8.3% of knees, primarily in patients treated with full-length transverse tunnel or 2-tunnel techniques. All patellar fractures occurred in patients with patellar tunnels ranging from 4.5 to 6.0 mm in diameter. The incidence of postoperative knee stiffness/range of motion deficit ranged from 0% to 20%. Persistent anterior knee pain, ranged from 0% to 32.3%.

Conclusions: Complications following primary MPFL reconstruction ranged from 0% to 32.3% of knees, primarily consisting of residual anterior knee pain. Failure ranged from 0% to 10.7% of knees, whereas patellar fractures were reported in 0% to 8.3% of knees. Fractures primarily occurred with a full-length transverse tunnel or 2-tunnel techniques, whereas all fractures occurred with patellar tunnels ranging from 4.5 mm to 6.0 mm in diameter.

Level of Evidence: IV; Systematic Review of Level I-IV studies.

BACK

Knee Surgery, Sports Traumatology, Arthroscopy (KSSTA), Volume 31, Issue 5

Knee flexor strength and symmetry vary by device, body position and angle of assessment following ACL reconstruction with hamstring grafts at long-term follow-up

D. Ogborn, S. McRae

DOI: https://doi.org/10.1007/s00167-021-06712-7

Purpose: Persistent deficits in knee flexor strength following harvest of semitendinosus and gracilis for anterior cruciate ligament reconstruction are inconsistent in the literature. Variation in methodology, including measuring torque at higher knee flexion angles may partially explain these discrepant findings. The objective of this study was to determine whether positioning (seated vs supine), consideration of peak or joint-angle-specific torque or device (Isokinetic Dynamometer vs NordBord Hamstring Dynamometer) impact the magnitude of knee flexor strength differences between limbs.

Methods: Participants ($n = 31$, 44.2 ± 10.7 years,) who were at 14 ± 4.4 years follow-up for unilateral ACL reconstruction with semitendinosus/gracilis grafts completed the ACL Quality of Life outcome and an assessment including isokinetic concentric knee extensor and flexor strength in seated and supine with peak torque and torque at 60° (T60) and 75° (T75) knee flexion measured, followed by an eccentric Nordic Hamstring Curl.

Results: Isokinetic concentric knee flexor torque was reduced in supine relative to seated, on the reconstructed limb against the unaffected, and at higher degrees of knee flexion relative to peak torque (T60 and T75 against peak torque). Limb symmetry varied by methodology ($F_{(6,204)} = 8.506$, $p = 0.001$) with reduced symmetry in supine T75 against all measures ($71.1 \pm 16.5\%$, $p < 0.05$), supine T60 against seated peak torque ($82.7 \pm 14.2\%$, $p < 0.05$), and the NordBord was lower than seated peak torque that was not statistically significant ($83.9 \pm 12.8\%$, n.s.). Knee extensor peak ($r^2 = 0.167$ ($F_{(1,27)} = 5.3$, $p = 0.03$) and Nordic curl eccentric torque ($r^2 = 0.267$, $F_{(2,26)} = 4.736$, $p = 0.02$) were predictors of ACL-QoL score, although a combined model did not improve over Nordic torque alone.

Conclusion: Limb symmetry cannot be assumed in clinical practice across differing assessment methods for knee flexor strength as deficits are greatest in the supine position with torque measured at 75° knee flexion. Isokinetic knee extensor and eccentric knee flexor torque during the Nordic hamstring curl were predictors of ACL-QoL scoring and should be considered alongside patient-reported outcomes for patients following ACL reconstruction with hamstring grafts.

Level of evidence: Level IV

BACK

Early MRI-based quantitative outcomes are associated with a positive functional performance trajectory from 6 to 24 months post-ACL surgery

S.W. Flannery, M.M. Murray

DOI: https://doi.org/10.1007/s00167-022-07000-8

Purpose: Quantitative magnetic resonance imaging (qMRI) has been used to determine the failure properties of ACL grafts and native ACL repairs and/or restorations. How these properties relate to future clinical, functional, and patient-reported outcomes remain unknown. The study objective was to investigate the relationship between non-contemporaneous qMRI measures and traditional outcome measures following Bridge-Enhanced ACL Restoration (BEAR). It was hypothesized that qMRI parameters at 6 months would be associated with clinical, functional, and/or patient-reported outcomes at 6 months, 24 months, and changes from 6 to 24 months post-surgery.

Methods: Data of BEAR patients ($n = 65$) from a randomized control trial of BEAR versus ACL reconstruction (BEAR II Trial; NCT02664545) were utilized retrospectively for the present analysis. Images were acquired using the Constructive Interference in Steady State (CISS) sequence at 6 months post-surgery. Single-leg hop test ratios, arthrometric knee laxity values, and International Knee Documentation Committee (IKDC) subjective scores were determined at 6 and 24 months post-surgery. The associations between traditional outcomes and MRI measures of normalized signal intensity, mean cross-sectional area (CSA), volume, and estimated failure load of the healing ACL were evaluated based on bivariate correlations and multivariable regression analyses, which considered the potential effects of age, sex, and body mass index.

Results: CSA ($r = 0.44$, $p = 0.01$), volume ($r = 0.44$, $p = 0.01$), and estimated failure load ($r = 0.48$, $p = 0.01$) at 6 months were predictive of the change in single-leg hop ratio from 6 to 24 months in bivariate analysis. CSA ($\beta_{standardized} = 0.42$, $p = 0.01$), volume ($\beta_{standardized} = 0.42$, $p = 0.01$), and estimated failure load ($\beta_{standardized} = 0.48$, $p = 0.01$) remained significant predictors when considering the demographic variables. No significant associations were observed between MRI variables and either knee laxity or IKDC when adjusting for demographic variables. Signal intensity was also not significant at any timepoint.

Conclusion: The qMRI-based measures of CSA, volume, and estimated failure load were predictive of a positive functional outcome trajectory from 6 to 24 months post-surgery. These variables measured using qMRI at 6 months post-surgery could serve as prospective markers of the functional outcome trajectory from 6 to 24 months post-surgery, aiding in rehabilitation programming and return-to-sport decisions to improve surgical outcomes and reduce the risk of reinjury.

Level of evidence: Level II

BACK

Higher return to pre-injury type of sports after revision anterior ligament reconstruction with lateral extra-articular tenodesis compared to without lateral extra-articular tenodesis

M.N.J. Keizer, R.W. Brouwer

DOI: https://doi.org/10.1007/s00167-022-07018-y

Purpose: To evaluate the rate of return to pre-injury type of sports (RTS type) in patients after revision anterior cruciate ligament reconstruction (ACLR) with lateral extra-articular tenodesis (LET) compared to patients after revision ACLR without LET.

Methods: Seventy-eight patients who underwent revision ACLR with an autologous ipsilateral bone-patellar tendon-bone autograft with and without LET were included at least one year after surgery (mean follow-up: 43.9, SD: 29.2 months). All patients filled in a questionnaire about RTS type, the Knee injury and Osteoarthritis Outcome Score (KOOS), the International Knee Documentation Committee subjective form ($IKDC_{subjective}$), and the Tegner activity score.

Results: The RTS type for revision ACLR with LET was 22 of 42 (52%), whereas 11 of 36 (31%) of the patients who underwent revision ACLR without LET returned to the pre-injury type of sport ($p = 0.05$). No significant differences were found in KOOS subscores, $IKDC_{subjective}$, and Tegner activity scores.

Conclusion: An additional LET increases the rate of RTS type after revision ACLR.

Level of evidence: Level III

BACK

Adjustable-loop implants are non-inferior to fixed-loop implants for femoral fixation in anterior cruciate ligament reconstruction

S.B. Elmholt, T.G. Nielsen

DOI: https://doi.org/10.1007/s00167-022-07034-y

Purpose: Button implants with an adjustable-loop device (ALD) are often used in anterior cruciate ligament reconstruction (ACLR). Clinical research comparing ALDs with fixed-loop devices (FLD) has mainly been conducted in small patient populations with short follow-up times. To determine whether ALDs are safe to use in ACLR, a non-inferiority study with a large sample population and a long follow-up period would be beneficial. This study compared ALDs with FLDs to determine non-inferior revision surgery rates, knee stability, and patient-reported outcomes (PROM) in ACLRs.

Methods: This non-inferiority register-based cohort study was conducted using data from the Danish Knee Ligament Reconstruction Registry (DKRR). A total of 12,723 patients > 15 years of age with primary ACLR using hamstring tendon autografts and either an FLD or ALD for femoral fixation were included: 9719 patients were in the FLD group, and 3014 patients were in the ALD group. The primary outcome was revision ACLR with a non-inferiority margin for ALDs at 4% at the 2-year follow-up. The secondary outcomes were anterior and rotatory knee stability and PROMs based on the Knee Injury and Osteoarthritis Outcome Score (KOOS) at the 1-year follow-up.

Results: The crude cumulative revision rates in ALD implants at 2 and 5 years were 2.1% (95% CI 1.62–2.68) and 5.0% (95% CI 4.22–5.96), respectively. In the FLD group, the rates were 2.2% (95% CI 1.89–2.48) at 2 years and 4.7% (95% CI 4.31–5.20) at 5 years. The 1-year side-to-side differences were 0.97 mm (95% CI 0.90–1.03) in the ALD group and 1.45 mm (95% CI 1.41–1.49) in the FLD group. In the FLD group, 13% had a positive pivot shift, and in the ALD group, 6% had a positive pivot shift. There were no differences in KOOS.

Conclusion: ALDs were non-inferior to FLDs regarding revision rates, knee stability, and patient-reported outcomes. Based on this conclusion, ALDs are safe to use for femoral fixation in ACLR.

Level of evidence: Level III

BACK

No evidence in support of arthroscopic partial meniscectomy in adults with degenerative and nonobstructive meniscal symptoms: a level I evidence-based systematic review

F. Migliorini, F. Oliva

DOI: https://doi.org/10.1007/s00167-022-07040-0

Purpose: It is unclear whether the results of arthroscopic partial meniscectomy (APM) are comparable to a structured physical therapy (PT). This systematic review investigated efficacy of APM in the management of symptomatic meniscal damages in middle aged patients. Current available randomised controlled trials (RCTs) which compared APM performed in isolation or combined with physical therapy versus sham arthroscopy or isolated physical therapy were considered in the present systematic review.

Methods: This systematic review was conducted according to the 2020 PRISMA statement. All the level I RCTs which investigated the efficacy of AMP were accessed. Studies which included elderlies with severe OA were not eligible, nor were those in which APM was combined with other surgical intervention or in patients with unstable knee or with ligaments insufficiency. The risk of bias was assessed using the software Review Manager 5.3 (The Nordic Cochrane Collaboration, Copenhagen). To rate the quality of evidence of collected outcomes, the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) was used.

Results: Data from 17 studies (2037 patients) were collected. 48.5% (988 of 2037 patients) were women. The mean age of the patients was 52.7 ± 3.9 years, the mean BMI 27.0 ± 1.3 kg/m^2. The current evidence suggests no difference in functional PROMs (quality of the evidence: high), clinical PROMs (quality of the evidence: high), pain (quality of the evidence: high), quality of life (quality of the evidence: high), physical performance measures (quality of the evidence: moderate), and OA progression (quality of the evidence: moderate).

Conclusion: The benefits of APM in adults with degenerative and nonobstructive meniscal symptoms are limited. The current evidence reports similarity in the outcome between APM and PT. Further long-term RCTs are required to investigate whether APM and PT produce comparable results using validated and reliable PROMs. Moreover, future RCTs should investigate whether patients who might benefit from APM exist, clarifying proper indications and outcomes. High quality investigations are strongly required to establish the optimal PT regimes.

Level of evidence: Level I

BACK

Concentration of synovial fluid biomarkers on the day of anterior cruciate ligament (ACL)-reconstruction predict size and depth of cartilage lesions on 5-year follow-up

D.H. Markus, E.T. Hurley

DOI: https://doi.org/10.1007/s00167-022-07045-9

Purpose: The current investigation evaluated the relationship between the synovial fluid cytokine microenvironment at the time of isolated anterior cruciate ligament (ACL) reconstruction and the presence of subsequent chondral wear and radiologic evidence of osteoarthritis (OA) on cartilage-specific MRI sequences at a minimum of 5-year follow-up.

Methods: Patients who underwent primary ACL reconstruction with no baseline concomitant cartilage or meniscal defects and had synovial fluid samples obtained at the time of surgery were retrospectively identified. Patients with a minimum of 5 years of postoperative follow-up were contacted and asked to complete patient-reported outcome (PRO) measures including Visual Analog Scale (VAS) for pain, Lysholm Scale, Knee Injury and Osteoarthritis Outcome Score (KOOS), and Tegner Activity Scale, along with postoperative magnetic resonance imaging (MRI). The concentration of ten biomarkers that have previously been suggested to play a role in cartilage degradation and inflammation in the joint space was measured. Linear regression controlling for age, sex, and body mass index (BMI) was performed to create a model using the synovial fluid concentrations at the time of surgery to predict postoperative semiquantitative cartilage lesion size and depth on MRI at a minimum of 5 years follow up.

Results: The patients were comprised of eight males (44.4%) and ten females (55.6%) with a mean age at the time of surgery of 30.8 ± 8.7 years (range 18.2–44.5 years). The mean follow-up time was 7.8 ± 1.5 years post-operatively (range 5.7–9.7 years). MCP-1, VEGF, and IL-1Ra were found to have significant associations with the presence of postoperative cartilage wear ($p < 0.05$). No correlations were demonstrated among the biomarker concentrations at the time of injury with PRO scores at final follow-up (NS).

Conclusion: Synovial fluid inflammatory biomarker concentrations at the time of injury can predict progression of early-stage post-traumatic osteoarthritis at a mean of almost 8 years post-operatively. Findings from this study may help identify treatment targets to alter the natural history of cartilage loss following anterior cruciate ligament injury.

Level of evidence: Level III, retrospective cohort study.

BACK

Tibial tunnel expansion does not correlate with four-strand graft maturation after ACL reconstruction using adjustable cortical suspensory fixation

A. Biset, A. Douiri

DOI: https://doi.org/10.1007/s00167-022-07051-x

Purpose: Anterior cruciate ligament reconstruction (ACLR) using a short, quadrupled semitendinosus (ST-4) autograft, fixed with an adjustable suspensory fixation (ASF), has several potential advantages. However, the construct is suspected to generate micromotion, tunnel widening and poor graft maturation. The aim of this study was to evaluate post-operative tibial tunnel expansion, graft maturation and clinical outcomes for this type of ACLR.

Methods: One-hundred and forty-nine patients were reviewed at a minimum of 2 years following 4-ST ACLR, mean 25.6 ± 3.5 months [24–55], with clinical follow-up and MRI scans. Graft maturity of the intra-articular part of the graft and the tibial tunnel portion was assessed using Signal-to-Noise Quotient (SNQ) and Howell score. Tibial tunnel expansion, bone–graft contact and graft volume in the tibial tunnel were calculated from the MRI scans.

Results: Mean tibial tunnel expansion was 13 ± 16.5% [12–122]. Mean SNQ for graft within the tibial tunnel was 3.8 ± 7.1 [– 7.7 to 39] and 2.0 ± 3.5 [– 14 to 17] for the intra-articular portion of the graft. The Howell score for graft within the tibial tunnel was 41% Grade I, 37% Grade 2, 20% Grade 3, 2% grade 4, and for the intra-articular part 61% Grade 1, 26% Grade 2, 13% Grade 3 and 1% Grade 4. The mean tibial tunnel bone–graft contact was 81 ± 23% [0–100] and mean graft volume was 80 ± 22% [0–100]. No correlation was found between tibial tunnel expansion and graft maturity assessed at both locations. Graft maturity was correlated with higher graft-bone contact and graft volume in the tibial tunnel ($p < 0.05$).

Conclusion: ST-4 ACLR with ASF had low levels of tunnel enlargement at 2 years. No correlation was found between graft maturation and tibial tunnel expansion. Graft maturity was correlated with graft–bone contact and graft volume in the tibial tunnel.

Level of evidence: Level III

BACK

Joint effusion at 3 months after anterior cruciate ligament reconstruction is associated with reinjury

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DOI: https://doi.org/10.1007/s00167-022-07081-5

Purpose: To evaluate whether joint effusion at 3 months after anterior cruciate ligament (ACL) reconstruction is associated with ACL reinjury.

Methods: The medical records of 227 consecutive patients who underwent single-bundle ACL reconstruction between 2015 and 2018 were reviewed in this retrospective single-center study. Demographic data such as sex and age at surgery, as well as data on preinjury Tegner activity scale score, time from injury to surgery, presence of meniscus and cartilage injuries, and the occurrence of ACL reinjury within 2 years, were collected. Joint effusion was defined as grade 3 (range 0–3) according to the ACL Osteoarthritis Score by magnetic resonance imaging at 3 months postoperatively. Multivariate logistic regression analysis was performed to control for potential confounders.

Results: A total of 176 patients (mean age 22.5 ± 9.9 years) were included. Among these patients, 18 (10.2%) had ACL reinjury. At the multivariate logistic regression analysis, higher Tegner activity scale (odds ratio [OR] 3.12; 95% confidence interval [CI] 1.61–6.04; $p < 0.001$) and presence of joint effusion (OR 34.5; 95% CI 6.63–179.7; $p < 0.001$) increased the odds of ACL reinjury, and older age (OR 0.68; 95% CI 0.51–0.92; $p = 0.012$) decreased the odds of ACL reinjury.

Conclusion: Joint effusion with a larger fluid volume at 3 months postoperatively was one of the risk factors for ACL reinjury independent of confounders, such as age and activity level. This result suggests the possibility of postoperative intervention for ACL reinjury.

Level of evidence: Level III

BACK

Arthroscopic repair of degenerative medial meniscus tears in patients aged over 45 years resulted in favorable clinical outcomes and low clinical failure rates at a minimum 2-year follow-up

S. Zhu, X. Li

DOI: https://doi.org/10.1007/s00167-022-07133-w

Purpose: This study aimed to investigate clinical and radiological results of arthroscopic repair for isolated medial degenerative meniscus tears (DMTs) in patients over 45 years old at a minimum 2-year follow-up.

Methods: From 2013 to 2017, patients aged over 45 years with isolated medial DMT refractory to conservative management or with true mechanical symptoms who had undergone arthroscopic repair were retrospectively reviewed. Arthroscopic meniscus repair was performed using all-inside or all-inside and inside-out technique in combination with bone marrow venting procedure. Tear patterns were classified according to arthroscopic findings. Magnetic resonance imaging (MRI) and outcome evaluations, including Lysholm score, Tegner activity score, and International Knee Documentation Committee (IKDC) score, were evaluated preoperatively and at the final follow-up. International Cartilage Repair Society grades of the medial compartments and MRI signal at tear sites were assessed preoperatively and at the final follow-up. A grade 0 to 2 signal at the repair site suggested a healed meniscus, whereas a grade 3 signal suggested an unhealed meniscus. Clinical failure was determined according to Barrett criteria.

Results: Twenty-seven patients (mean age, 57.7 ± 7.4 years) were enrolled. The mean follow-up was 52.0 ± 15.6 months. Among tear patterns, 48% were complex tears, 30% were horizontal tears, and 22% were other patterns. The mean Lysholm score and IKDC score significantly improved from 53 ± 25 to 89 ± 15 ($p < 0.001$) and 34 ± 24 to 72 ± 15 ($p < 0.001$) at the final follow-up, respectively. The median Tegner activity score significantly improved from 1 (range 1–4) to 4 (range 2–7, $p < 0.001$). Three (11%) patients were considered clinical failures, and five patients (19%) had cartilage lesion progression. At the final follow-up, MRI showed grade 0 in one (4%) patient, grade 1 in nine (33%) patients, grade 2 in six (22%) patients, and grade 3 in eleven (41%) patients.

Conclusion: Arthroscopic repair of isolated medial DMT refractory to conservative management or with true mechanical symptoms in patients aged over 45 years had good to excellent clinical outcomes with low clinical failure rates, despite unhealed menisci being observed on MRI in 41% of patients at a mean 4.3-year follow-up. Arthroscopic repair could be a treatment option for these patients.

Level of evidence: Level IV

BACK

Sustained clinical success at 7-year follow-up after arthroscopic Lift-Drill-Fill-Fix (LDFF) of primary osteochondral lesions of the talus

Q.G.H. Rikken, J.N. Altink

DOI: https://doi.org/10.1007/s00167-022-07243-5

Purpose: To describe the long-term clinical results of arthroscopic fragment fixation for chronic primary osteochondral lesions of the talus (OLT), using the Lift-Drill-Fill-Fix (LDFF) technique.

Methods: Eighteen patients (20 ankles) underwent fixation for a primary OLT with an osteochondral fragment using arthroscopic LDFF and were evaluated at a minimum of 5-year follow-up. Pre- and postoperative clinical assessment was prospectively performed by measuring the Numeric Rating Scale (NRS) of pain at rest, during walking and when running. Additionally, the change in Foot and Ankle Outcome Score (FAOS) and the procedure survival (i.e., no reoperation for the OLT) at final follow-up was assessed.

Results: At a mean follow-up of 7 years, the median NRS during walking significantly improved from 7 (IQR 5–8) pre-operatively to 0 (IQR 0–1.5) at final follow-up ($p = < 0.001$). This result was sustained from 1-year follow-up to final follow-up. The NRS during running significantly improved from 8 (IQR 6−10) to 2 (IQR 0–4.5) ($p < 0.001$) and the NRS in rest from 2.5 (IQR 1–3) to 0 (IQR 0–0) ($p = < 0.001$). The median FAOS at final follow-up was 94 out of 100 for pain, 71 for other symptoms, 99 for activities of daily living, 80 for sport and 56 for quality of life. The FOAS remained significantly improved post-operatively on all subscales, except for the symptoms subscale. The procedure survival rate is 87% at final follow-up.

Conclusion: Arthroscopic LDFF for fixable chronic primary OLTs results in excellent pain reduction and improved patient-reported outcomes, with sustained results at long-term follow-up. These results indicate that surgeons may consider arthroscopic LDFF as treatment of choice for fragmentous OLT.

Level of evidence: Level IV, prospective case series.

BACK

Early analysis shows that endoscopic flexor hallucis longus transfer has a promising cost-effectiveness profile in the treatment of acute Achilles tendon ruptures

P. Diniz, A.S. Ferreira

DOI: https://doi.org/10.1007/s00167-022-07146-5

Purpose: Current options for treating an Achilles tendon rupture (ATR) include conservative and surgical approaches. Endoscopic flexor hallucis longus (FHL) transfer has been recently proposed to treat acute ruptures, but its cost-effectiveness potential remains to be evaluated. Therefore, the objective of this study was to perform an early cost-effectiveness analysis of endoscopic FHL transfer for acute ATRs, comparing the costs and benefits of current treatments from a societal perspective.

Methods: A conceptual model was created, with a decision tree, to outline the main health events during the treatment of an acute ATR. The model was parameterized using secondary data. A systematic review of the literature was conducted to gather information on the outcomes of current treatments. Data related to outcomes of endoscopic FHL transfers in acute Achilles ruptures was obtained from a single prospective study. Analysis was limited to the two first years. The incremental cost-effectiveness ratio was the main outcome used to determine the preferred strategy. A willingness-to-pay threshold of $100,000 per quality-adjusted life-year was used. Sensitivity analyses were performed to determine whether changes in input parameters would cause significant deviation from the reference case results. Specifically, a probability sensitivity analysis was conducted using Monte Carlo simulations, and a one-way sensitivity analysis was conducted by sequentially varying each model parameter within a given range.

Results: For the reference case, incremental cost-effectiveness ratios exceeded the willingness-to-pay threshold for all the surgical approaches. Overall, primary treatment was the main cost driver. Conservative treatment showed the highest direct costs related to the treatment of complications. In the probabilistic sensitivity analysis, at a willingness-to-pay threshold of $100,000, open surgery was cost-effective in 50.9%, minimally invasive surgery in 55.8%, and endoscopic FHL transfer in 72% of the iterations. The model was most sensitive to parameters related to treatment utilities, followed by the costs of primary treatments.

Conclusion: Surgical treatments have a moderate likelihood of being cost-effective at a willingness-to-pay threshold of $100,000, with endoscopic FHL transfer showing the highest likelihood. Following injury, interventions to improve health-related quality of life may be better suited for improved cost-effectiveness.

Level of evidence: Level III

BACK

Deltoid ligament (DL) repair produced better results than DL nonrepair for the treatment for rotational ankle instability

H. Li, X. Xue

DOI: https://doi.org/10.1007/s00167-022-07169-y

Purpose: To compare the clinical and magnetic resonance imaging (MRI) results after arthroscopic deltoid ligament (DL) repair versus DL nonrepair in patients with rotational ankle instability.

Methods: All patients with rotational ankle instability were enrolled in this retrospective cohort study. Clinical evaluation was performed by the American Orthopedic Foot and Ankle Society (AOFAS) score, Karlsson Ankle Functional Score (KAFS), and Tegner activity score preoperatively and at a minimum follow-up of 2 years. MRI at follow-up was performed to evaluate the DL morphology.

Results: A total of 50 patients were enrolled in this study. Among them, 24 patients received DL repair (the repair group), whereas 26 patients did not (the nonrepair group). No significant difference was found in the AOFAS score (98 ± 4 vs. 97 ± 4; n.s.), KAFS (94 ± 7 vs. 93 ± 9; n.s.), or Tegner activity score (5 ± 2 vs. 5 ± 1; n.s.) between the repair group and the nonrepair group at the final follow-up. However, the repair group had a significantly shorter return-to-sport time than the nonrepair group (4.6 ± 1.6 mo vs. 6.0 ± 2.5 mo; $p = 0.03$). Comparison of the postoperative deltoid ligament showed that the repair group had a lower signal intensity than the nonrepair group.

Conclusion: Arthroscopic treatment of rotational ankle instability revealed good to excellent clinical results. However, patients who underwent DL repair had a significantly earlier return to sports as well as a lower signal intensity of DL than those who did not undergo DL repair.

Level of evidence: Level III

BACK

A three-dimensional (3D) printed simulator as a feasible assessment tool for evaluating hip arthroscopy skills

B. Cai, S. Duan

DOI: https://doi.org/10.1007/s00167-022-07125-w

Purpose: The aims of this study were (1) to develop a three-dimensional (3D) printed simulator that facilitates the simulation of surgical skills for portal placement, intra-articular identification of anatomical structures and arthroscope navigation for hip arthroscopy and (2) to concurrently examine the feasibility of using this simulator as an assessment tool to evaluate trainees' surgical competencies.

Methods: A simulator was developed using a combination of medical imaging, computer-aided design, and 3D printing. A cross-sectional study was conducted with 29 participants divided into 3 subgroups (novice, intermediate and experienced). All participants performed related skills on the simulator, and their performance was evaluated using different assessment parameters. The participants' qualitative feedback regarding the simulator was also collected. The data collated from each group of participants were subsequently compared.

Results: Significant differences were observed between the three subgroups of participants with regard to the total checklist score ($F_{2,26} = 11.3$), total Arthroscopic Surgical Skill Evaluation score ($F_{2,26} = 92.1$), overall final global rating scale score ($F_{2,26} = 49$), number of times the participants used fluoroscopy ($F_{2,26} = 7.4$), and task completion times ($F_{2,26} = 23.5$). The participants' performance in the simulated operation was correlated with their prior clinical experience. There was mainly positive feedback with regard to the fidelity and utility of the simulator in relation to the surgeons' prior clinical experience.

Conclusion: This study demonstrated that a reliable hip arthroscopic simulator can be developed for use by orthopedic surgeons to evaluate their hip arthroscopic skills before performing actual surgical operations.

Level of evidence: Level III

BACK

Satisfactory results after endoscopic gluteus medius repair combined with selective gluteus maximus reflected tendon release for the treatment of a full-thickness tear of gluteus medius

F. Della Rocca, V. Di Francia

DOI: https://doi.org/10.1007/s00167-022-07140-x

Purpose: The current study aimed to report the mid-term follow-up results of endoscopic gluteus medius repair combined with a systematic release of the gluteus maximus reflected tendon.

Methods: Twenty-two patients with a symptomatic full-thickness tear of the gluteus medius tendon, as diagnosed by clinical examination and imaging (MRI), and who had a failure of conservative treatment for at least 6 months, were retrospectively enrolled for this study. An endoscopic repair of gluteus medius was performed for all patients in combination with gluteus maximus reflected tendon release according to the Polesello technique. The Visual Analogue Scale (VAS) for pain, Modified Harris Hip Score (mHHS), Lower Extremity Functional Scale (LEFS), Hip Outcome Score-Activity Daily Life (HOS-ADL), and Hip Outcome Score-Sport Specific Subscale (HOS-SSS) were administered to each patient before surgery for 6 months, 1 year, and every following year after surgery.

Results: All analysed hip scores (mHHS, LEFS, HOS-ADL, and HOS-SSS) showed statistically significant improvements between the pre-operative and post-operative values at 6 months, 1 year, and the latest follow-up appointments after surgery ($p < 0.001$). The mean pre-operative pain was 8.6 ± 1.0 on the VAS. After surgical treatment, the pain was significantly reduced ($p < 0.001$) on the VAS at 6 months (5.4 ± 1.5), 1 year (4.4 ± 1.8) and the latest follow-up control visit (3.6 ± 2.2). No patient-reported major complications (re-rupture, deep infection or neurovascular injury). Eleven (50%) patients indicated the results as excellent, 7 (32%) as good, 2 (9%) as fair, and 2 (9%) as poor.

Conclusion: The use of abductor tendon repair in combination with a systematic release of the reflected tendon of the gluteus maximus according to the Polesello technique seems to be a safe and effective endoscopic way of treating a full-thickness tear of the gluteus medius.

Level of evidence: Level IV

BACK

American Journal of Sports Medicine (AJSM), Volume 51, Issue 6

Meniscal Ramp Lesions in Adolescent Patients Undergoing Primary Anterior Cruciate Ligament Reconstruction: Significance of Imaging and Arthroscopic Findings

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DOI: https://doi.org/10.1177/03635465231154600

Background: Meniscal ramp lesions are associated with anterior cruciate ligament (ACL) injuries and may affect knee stability when left untreated. The diagnostic accuracy of magnetic resonance imaging (MRI) to identify this meniscocapsular injury of the posterior horn of the medial meniscus remains poor, and the arthroscopic findings require vigilance.

Purpose: To determine the concordance of arthroscopic and MRI findings to better identify the presence of a ramp lesion in children and adolescent patients undergoing primary ACL reconstruction.

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

Methods: Patients aged <19 years who underwent primary ACL reconstruction at a single institution between 2020 and 2021 were included. Two cohorts were developed by the presence of a ramp lesion arthroscopically. Basic patient descriptive data, preoperative imaging (radiologist assessment and independent reviewer assessment), and concomitant arthroscopic findings at the time of ACL reconstruction were recorded.

Results: An overall 201 adolescents met criteria with a mean age of 15.7 years (range, 6.9-18.2) at the time of injury. A ramp lesion was identified in 14% of patients (28 children). No differences were detected between cohorts with regard to age, sex, body mass index, weeks from injury to MRI, or weeks from injury to surgery ($P > .15$). The primary predictor of an intraoperative ramp lesion was the presence of medial femoral condylar striations, with an adjusted odds ratio of 722.2 (95% CI, 59.5-8768.2; $P < .001$); the presence of a ramp lesion on MRI had an adjusted odds ratio of 11.1 (95% CI, 2.2-54.8; $P = .003$). Patients with neither a ramp lesion on MRI nor medial femoral condylar striations had a 2% rate (2/131) of ramp lesion; those with either of the significant risk factors had a 24% rate (14/54). All patients with both risk factors (100%; n = 12) had a ramp lesion noted on intraoperative examination.

Conclusion: The concordance of medial femoral condylar chondromalacia, particularly striations, noted during arthroscopy and posteromedial tibial marrow edema on MRI with or without direct evidence of posterior meniscocapsular pathology should increase suspicion for the presence of a ramp lesion in adolescents undergoing ACL reconstruction.

BACK

Improved Mental Health Status and Patient-Reported Outcomes After Hip Arthroscopy for Femoroacetabular Impingement

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DOI: https://doi.org/10.1177/03635465231160289

Background: Femoroacetabular impingement (FAI) is often a chronic problem, which can lead to a decrease in mental well-being.

Purpose/Hypothesis: The purpose of this study was to determine patient mental health improvement after hip arthroscopy and if this improvement correlated with improved outcomes. It was hypothesized that patients with low mental health (LMH) status would improve after hip arthroscopy for FAI and that their patient-reported outcomes (PROs) would significantly improve after surgery.

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

Methods: Patients who underwent hip arthroscopy with labral repair between 2008 and 2015 were included. The minimum follow-up was 2 years. PROs included the modified Harris Hip Score (mHHS), Hip Outcome Score–Activities of Daily Living (HOS-ADL), HOS–Sports (HOS-Sports), and 12-Item Short Form Health Survey (SF-12). The minimal clinically important difference and Patient Acceptable Symptom State (PASS) were determined for HOS-ADL, HOS-Sports, and the mHHS based on previously published studies. Patients who scored <46.5 on the SF-12 Mental Component Summary (MCS) were in the LMH group, and those who scored ≥46.5 were in the high mental health (HMH) group.

Results: In total, 120 (21%) of the 566 patients were in the LMH group and 446 (79%) patients were in the HMH group preoperatively. There was no difference in age or sex between groups. Patients in the LMH group had lower mHHS, HOS-ADL, and HOS-Sports at the mean 4-year follow-up and were less likely to reach PASS for the scores. Postoperatively, 84% (478/566) of the entire group was in the HMH group. A total of 88 (73%) of the LMH group improved to HMH. A multiple linear regression model for change in MCS identified independent predictors of changes in preoperative MCS to be LMH group preoperatively, change in HOS-Sports, and change in mHHS ($r2 = 0.4$; $P < .001$).

Conclusion: HMH was achieved in 84% of the patients after hip arthroscopy for FAI. Improvement in MCS was correlated with function and activity, as indicated by a significant correlation with HOS-ADL and HOS-Sports. A small percentage of patients did see a decline in their MCS score. This study showed that patients with LMH scores before hip arthroscopy for FAI can improve to normal/high mental health, and this correlated with higher PROs.

BACK

Long-term Outcomes After Arthroscopic Treatment of Femoroacetabular Impingement for Patients With Borderline Dysplasia

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DOI: https://doi.org/10.1177/03635465231161348

Background: Outcomes after isolated hip arthroscopic surgery for patients with dysplasia have been unfavorable. Results have included iatrogenic instability and conversion to total hip arthroplasty at a young age. However, patients with borderline dysplasia (BD) have shown more favorable results at short- and medium-term follow-up.

Purpose: To assess long-term outcomes after hip arthroscopic surgery for femoroacetabular impingement in patients with BD (lateral center-edge angle [LCEA] = 18°-25°) compared with a control group of patients without dysplasia (LCEA = 26°-40°).

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

Methods: We identified a group of 33 patients (38 hips) with BD who were treated for FAI between March 2009 and July 2012. An age- and sex-matched control group of 83 patients (96 hips) was also identified. Patient-reported outcome scores were collected preoperatively and subsequently at a mean of 9.6 years postoperatively.

Results: The mean LCEA and Tönnis angle were 22.42°± 2.02° and 6.27°± 3.23° in the BD group, respectively, and 31.71°± 3.52° and 2.42°± 3.02° in the control group, respectively ($P < .001$). At a mean follow-up of 9.6 years (range, 8.2-11.6 years), there was a significant improvement in all patient-reported outcome scores in both groups ($P < .001$). There were no significant differences between preoperative and postoperative scores or rates of achieving the minimal clinically important difference between the BD and control groups. Bilateral surgery was noted to be a risk factor for any revision during the follow-up period ($P < .001$). There were 2 hips (5.3%) that underwent revision surgery in the BD group and 10 hips (10.4%) in the control group; of these, 1 patient in the BD group underwent total hip arthroplasty, and 1 patient who had undergone bilateral surgery in the control group underwent bilateral hip resurfacing.

Conclusion: Durable outcomes (>9 years) with low revision rates can be expected after hip arthroscopic surgery with an approach that involves labral preservation where possible and careful attention to capsular closure in patients with BD. The observed outcomes were similar to those of a femoroacetabular impingement group with normal coverage. These results highlight the importance of classifying patients into impingement or instability categories and tailoring treatment appropriately with arthroscopic surgery or periacetabular osteotomy, respectively.

BACK

The Relationship Between the Joint Space and Outcomes After Hip Arthroscopic Surgery for Femoroacetabular Impingement: Reevaluating the 2-mm Rule

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DOI: https://doi.org/10.1177/03635465231161372

Background: A limited joint space (<2 mm) is associated with poorer outcomes and conversion to total hip arthroplasty (THA) after hip arthroscopic surgery. As indications for hip arthroscopic surgery expand, it is important to reevaluate established risk factors among large patient populations.

Purpose: To reevaluate the relationship between the radiographic joint space and outcomes after hip arthroscopic surgery and to assess the validity of a joint space of 2 mm as the accepted cutoff for successful hip arthroscopic surgery.

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

Methods: Patients aged 18 to 50 years who underwent hip arthroscopic surgery for femoroacetabular impingement between January 2008 and December 2016 and had a minimum 2-year follow-up were included. Patients with previous ipsilateral hip surgery, a history of hip fractures, dysplasia (lateral center-edge angle <20°), or osteoarthritis (Tonnis grade >2) were excluded. The joint space was categorized as diminished (≤2 mm), borderline (>2 to ≤3 mm), or preserved (>3 mm). Minimum 2-year patient-reported outcomes (modified Harris Hip Score [mHHS], Hip Outcome Score–Activities of Daily Living [HOS-ADL], Hip Outcome Score–Sports-Specific Subscale [HOS-SSS]), revision rates, and rates of conversion to THA were compared between groups.

Results: A total of 699 patients (782 hips) with a mean age of 33.8 ± 10.1 years met 2-year inclusion criteria. The mean follow-up time was 4.2 ± 2.1 years. Overall, 51 hips (6.5%) had a diminished joint space, 297 (38.0%) had a borderline joint space, and 434 (55.5%) had a preserved joint space. Patients with a diminished joint space had larger femoral and acetabular defects compared with those with larger joint spaces. All groups had improved patient-reported outcome scores compared with baseline ($P < .001$ for all), and there were no differences between the groups in the percentage of patients who reached the minimal clinically important difference or patient acceptable symptom state. There were also no differences between the groups in revision rates ($P = .95$). A greater number of hips with a diminished joint space converted to THA (n = 8 [15.7%]) compared with those with a borderline (n = 9 [3.0%]) or preserved (n = 9 [2.1%]) joint space ($P < .001$). Considering joint space as a continuous variable, adjusted logistic regression showed that for every millimeter decrease in the joint space, the odds of conversion to THA increased by a factor of 2.5 (odds ratio, 2.5 [95% CI, 1.6-3.8]).

Conclusion: This study demonstrated that patients with a diminished joint space were at a higher risk of conversion to THA. Although 2 mm should not serve as a strict cutoff, patients should be counseled based on their preoperative radiographic findings accordingly.

BACK

Accelerated Bilateral Hip Arthroscopy (1 Week Apart): Outcomes Compared With Delayed Bilateral Procedure (4-12 Weeks) and Case-Control Matched Unilateral Arthroscopy

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DOI: https://doi.org/10.1177/03635465231162647

Background: Staged bilateral hip arthroscopy is an option for athletes who have symptomatic bilateral femoroacetabular impingement; however, the optimal timing of the second procedure is unknown.

Purpose: To evaluate minimum 2-year outcomes for patients undergoing accelerated bilateral arthroscopy against those undergoing (1) delayed bilateral and (2) unilateral arthroscopy.

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

Methods: A retrospective review was performed of prospectively collected data from patients undergoing bilateral primary hip arthroscopy for femoroacetabular impingement between 2009 and 2022. Inclusion criteria entailed competitive athletes with concurrent bilateral symptoms at initial presentation. Exclusion criteria (either hip) were Tönnis grade >1, dysplasia (lateral center-edge angle <25°), Perthes disease, protrusio acetabuli, and avascular necrosis. Two groups were established based on the duration between procedures: within 7 days (accelerated group) and within 4 to 12 weeks (delayed group). Patients from the accelerated group were matched in a 1:2 ratio with patients undergoing unilateral surgery based on age ±2 years, sex, and athletic status. Minimum 2-year postoperative patient-reported outcomes (PROs) (including modified Harris Hip Score, University of California Los Angeles activity scale, 36-Item Short Form Health Survey, and Western Ontario and McMaster Universities Osteoarthritis Index), rates of achieving the minimal clinically important difference, rates of continuing to play main sport, and satisfaction were compared between groups.

Results: A total of 131 athletes (262 hips) with bilateral femoroacetabular impingement were included: 91 in the accelerated group and 40 in the delayed group. Duration between surgeries was 0.99 ± 0.02 and 6.35 ± 2.18 weeks, respectively. All accelerated athletes were each successfully matched to 2 athletes with unilateral procedures (N = 182). All 3 groups demonstrated significant improvement from baseline across all PROs ($P < .001$ for all). Acquired change in PROs was similar and not significantly different between groups ($P > .05$). Satisfaction with relief from pain was achieved by 85.9% of patients in the accelerated group compared with 83.1% in the delayed group ($P = .053$) and 87.3% in the unilateral group ($P = .933$). The minimal clinically important difference for the modified Harris Hip Score was achieved by 84.9% of patients in the accelerated group compared with 91.5% in the delayed group ($P = .212$) and 87.6% in the unilateral group ($P = .456$). At 2 years postoperatively, the continue-to-play rate was 73.6% for the accelerated group compared with 77.1% for the delayed group ($P = .577$) and 73.0% for the unilateral group ($P = .903$). There were no increased complications associated with the accelerated group.

Conclusion: Accelerated bilateral hip arthroscopy 1 week apart was a safe and effective treatment option for athletes with bilateral symptoms. Improvement in PROs and continue-to-play rates were comparable with those after a delayed duration between procedures and with those case-control matched athletes undergoing unilateral arthroscopy.

BACK

Miscellaneous

Arthroscopy, Volume 39, Issue 5

Meditation Using a Mobile App Improves Surgery Trainee Performance: A Simulation-Based Randomized Controlled Trial

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DOI: https://doi.org/10.1016/j.arthro.2022.09.008

Purpose: To primarily investigate: (1) whether a 10-minute instant meditation practice using a mobile app could enhance arthroscopy performance and (2) whether a 10-day app-based meditation could reduce short-term arthroscopic skills deterioration.

Methods: Orthopaedic residents with no previous experience in arthroscopy and meditation were randomly assigned to groups A, B, and C. After initial standard competency-based arthroscopy training on the simulator on day 1, a pretest was performed via the simulator by all participants to assess their initial level of performance, then groups A and B were required to practice app-based mindfulness meditation 10 min/day for 10 consecutive days while group C did nothing. On day 11, all participants returned to perform a posttest. Before the posttest, the participants in group A practiced app-based meditation (10 minutes), whereas groups B and C had no intervention.

Results: In total, 43 participants were included and reached similar level of performance after initial training phase in day 1. On day 11, participants in group A had statistically a better instant arthroscopy performance than group B, with greater total score (mean difference [MD] 3.57; $P < .001$), less completion time (MD –42.89 seconds; $P = .001$), shorter camera (MD –23.38 cm; $P < .001$) and grasper (MD –15.23 cm; $P = .002$) path length, and less cartilage injury (MD –1.07%; $P = .012$). Participants in group B had less skills deterioration than group C, with better total score (MD –5.42; $P < .001$), less completion time (MD 51.96s; $P = .002$), camera path length (MD 28.41 cm; $P = .007$), and cartilage injury (MD 1.19%; $P = .038$).

Conclusions: Meditation training using a mobile app enhanced instant simulation-based arthroscopy performance and reduced short-term skills deterioration of orthopaedic residents with no arthroscopy hands-on experience.

Clinical Relevance: A meditation using mobile app for clinicians and educators should be incorporated into simulation-based arthroscopy curriculums and perhaps clinical settings to improve arthroscopy performance and mental health of orthopaedic residents without any previous arthroscopy experience.

BACK

Knee Surgery, Sports Traumatology, Arthroscopy (KSSTA), Volume 31, Issue 5

Knot tying in arthroplasty and arthroscopy causes lesions to surgical gloves: a potential risk of infection

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DOI: https://doi.org/10.1007/s00167-022-07136-7

Purpose: Recent studies have shown that the incidence of glove lesions during arthroscopy is much lower than that during primary and revision arthroplasty. However, the rate of glove damage after knot tying has not yet been systematically recorded. Therefore, the aim of the study was to determine the impact of surgical knot tying on glove integrity. It was hypothesized that knot tying increases the rate of glove damage, especially in arthroscopic surgery, which could be of special relevance in the treatment of rotator cuff tears.

Methods: Gloves that were changed immediately before suturing and only worn during knot tying were investigated for their integrity by means of water tightening test according to EN455. A total of 234 gloves from 40 total hip arthroplasties (THAs), 42 total knee arthroplasties (TKAs) and 36 rotator cuff repairs (RCRs) were collected. A bacterial pass-through test (BPTT) on glove lesions was performed under simulated sterile surgical conditions for 3 surgeons after a wear duration of 45 min.

Results: Glove damage by knot tying occurred in 25% of THA, 36.6% of TKA and 25% of RCR surgeries. In THA, the pulling hand (PH) was affected in 46.2%, and the main area of damage (15.4%) was detected on the tip of the middle finger; in TKAs the PH was damaged in 75%, and in RCRs the PH was affected in 66.7%, with most of the lesions (20% each) occurring on the tip of the index finger and the ring finger. The BPTT showed *Staphylococcus hominis and Bacillus cereus.*

Conclusion: Intraoperative knot tying causes damage to gloves, which is of special relevance for arthroscopic surgery. Whereas knot tying is only partly responsible for glove damage in arthroplasty, the general rate of glove damage in arthroscopic surgery is low without knot tying. The surgical knot tying process must be understood as a possible damaging impact on the glove. Therefore, single gloving is not recommended, which is especially important in arthroscopic surgery, where double gloving is not yet standard.

Level of evidence: Level IV

BACK

Violation of expectations is correlated with satisfaction following hip arthroscopy

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DOI: https://doi.org/10.1007/s00167-022-07182-1

Purpose: The mechanism by which preoperative expectations may be associated with patient satisfaction and procedural outcomes following hip preservation surgery (HPS) is far from simple or linear. The purpose of this study is to better understand patient expectations regarding HPS and their relationship with patient-reported outcomes (PROs) and satisfaction using machine learning (ML) algorithms.

Methods: Patients scheduled for hip arthroscopy completed the Hip Preservation Surgery Expectations Survey (HPSES) and the pre- and a minimum 2 year postoperative International Hip Outcome Tool (iHOT-33). Patient demographics, including age, gender, occupation, and body mass index (BMI), were also collected. At the latest follow-up, patients were evaluated for subjective satisfaction and postoperative complications. ML algorithms and standard statistics were used.

Results: A total of 69 patients were included in this study (mean age 33.7 ± 13.1 years, 62.3% males). The mean follow-up period was 27 months. The mean HPSES score, patient satisfaction, preoperative, and postoperative iHOT-33 were 83.8 ± 16.5, 75.9 ± 26.9, 31.6 ± 15.8, and 73 ± 25.9, respectively. Fifty-nine patients (86%) reported that they would undergo the surgery again, with no significant difference with regards to expectations. A significant difference was found with regards to expectation violation ($p < 0.001$). Expectation violation scores were also found to be significantly correlated with satisfaction.

Conclusion: ML algorithms utilized in this study demonstrate that violation of expectations plays an important predictive role in postoperative outcomes and patient satisfaction and is associated with patients' willingness to undergo surgery again.

Level of evidence: IV

BACK