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Upper extremity

Arthroscopy, Volume 40, Issue 4

One- and 2-Year American Shoulder and Elbow Surgeons Scores Do Not Vary Significantly After Arthroscopic Rotator Cuff Repair: A Prospective Multicenter Analysis of 1,567 Patients

M. Patel, L. McDaniel

DOI: https://doi.org/10.1016/j.arthro.2023.09.024

Purpose: To evaluate whether there are clinically significant changes in patient-reported outcomes between 1 and 2 years' postoperatively after arthroscopic rotator cuff repair (RCR).

Methods: A retrospective analysis of prospective, multicenter registry was queried for all patients who underwent RCR. Patients with preoperative, 6-month, 1-year, and 2-year postoperative American Shoulder and Elbow Surgeons (ASES) scores were included. We evaluated mean postoperative ASES scores, Δ (change from preoperative) ASES, and the %MOI (% maximum outcome improvement). We also evaluated achievement of clinically significant outcomes (CSOs) for the ASES score, including the minimal clinically important difference (MCID), substantial clinical benefit, and patient-acceptable symptom state.

Results: There were 1,567 patients with complete data through 2-year follow-up. There were small differences in achievement of CSOs from 1 to 2 years: 88% to 91% for MCID, 81% to 83% for substantial clinical benefit, and 65% to 71% for patient-acceptable symptom state. There were statistically significant differences from 1 to 2 years in mean ASES (87 to 88, $P < .001$), Δ ASES (37 to 39, $P < .001$), and %MOI (72% to 76%, $P < .001$); however, these changes were well below the MCID of 11.1. From 1 to 2 years, the mean ASES improved only 1.7 points ($P < .001$). At 1 year, patients achieved, on average, 97% of their 2-year ASES.

Conclusion: Both patient-reported outcomes and achievement of CSOs show small differences at 1 and 2 years after RCR. Given the large sample size, there were statistical differences, but these are unlikely to be clinically relevant.

Level of Evidence: Level IV, case series.

BACK

Establishing the Minimal Clinically Important Difference and Patient Acceptable Symptom State Thresholds Following Arthroscopic Capsular Release for the Treatment of Idiopathic Shoulder Adhesive Capsulitis

I. Pasqualini, I. Tanoira

DOI: https://doi.org/10.1016/j.arthro.2023.08.083

Purpose: To determine the minimal clinically important difference (MCID) and the patient acceptable symptom state (PASS) threshold for the visual analog scale (VAS), Constant, Single Assessment Numeric Evaluation (SANE), and American Shoulder and Elbow Surgeons (ASES) scores following arthroscopic capsular release for the treatment of idiopathic shoulder adhesive capsulitis.

Methods: A retrospective review of prospective collected data was performed in patients undergoing arthroscopic capsular release for the treatment of idiopathic adhesive capsulitis at a single institution from January 2018 through January 2019. Patient-reported outcome measures were collected preoperatively and 6 months' postoperatively. Delta was defined as the change between preoperative and 6 months' postoperative scores. Distribution-based and anchored-based (response to a satisfaction question at 1 year) approaches were used to estimate MCIDs and PASS, respectively. The optimal cut-off point where sensitivity and specificity were maximized (Youden index) and the percentage of patients achieving those thresholds were also calculated.

Results: Overall, a total of 100 patients without diabetes who underwent arthroscopic capsular release and completed baseline and 6-month patient-reported outcome measures were included. The distribution-based MCID for VAS, Constant, SANE, and ASES were calculated to be 1.1, 10.1, 9.3, and 8.2, respectively. The rate of patients who achieved MCID thresholds was 98% for VAS, 96% for Constant, 98% for SANE, and 99% for ASES. The PASS threshold values for VAS, Constant, and ASES were ≤2, ≥70, ≥80, and ≥80, respectively. The rate of patients who achieved PASS thresholds was 84% for VAS, 84% for Constant, 89% for SANE, and 78% for ASES.

Conclusion: In patients without diabetes and idiopathic adhesive capsulitis, high rates of MCID and PASS thresholds can be achieved with arthroscopic anteroinferior capsular release.

Level of Evidence: Level IV, retrospective cohort study.

BACK

Journal of Shoulder and Elbow Surgery (JSES), Volume 33, issue 4

Re-tear after arthroscopic rotator cuff tear surgery: risk analysis using machine learning

I. Shinohara, Y. Mifune

DOI: https://doi.org/10.1016/j.jse.2023.07.017

Background: Postoperative rotator cuff retear after arthroscopic rotator cuff repair (ARCR) is still a major problem. Various risk factors such as age, gender, and tear size have been reported. Recently, magnetic resonance imaging-based stump classification was reported as an index of rotator cuff fragility. Although stump type 3 is reported to have a high retear rate, there are few reports on the risk of postoperative retear based on this classification. Machine learning (ML), an artificial intelligence technique, allows for more flexible predictive models than conventional statistical methods and has been applied to predict clinical outcomes. In this study, we used ML to predict postoperative retear risk after ARCR.

Methods: The retrospective case-control study included 353 patients who underwent surgical treatment for complete rotator cuff tear using the suture-bridge technique. Patients who initially presented with retears and traumatic tears were excluded. In study participants, after the initial tear repair, rotator cuff retears were diagnosed by magnetic resonance imaging; Sugaya classification types IV and V were defined as re-tears. Age, gender, stump classification, tear size, Goutallier classification, presence of diabetes, and hyperlipidemia were used for ML parameters to predict the risk of retear. Using Python's Scikit-learn as an ML library, five different AI models (logistic regression, random forest, AdaBoost, CatBoost, LightGBM) were trained on the existing data, and the prediction models were applied to the test dataset. The performance of these ML models was measured by the area under the receiver operating characteristic curve. Additionally, key features affecting retear were evaluated.

Results: The area under the receiver operating characteristic curve for logistic regression was 0.78, random forest 0.82, AdaBoost 0.78, CatBoost 0.83, and LightGBM 0.87, respectively for each model. LightGBM showed the highest score. The important factors for model prediction were age, stump classification, and tear size.

Conclusions: The ML classifier model predicted retears after ARCR with high accuracy, and the AI model showed that the most important characteristics affecting retears were age and imaging findings, including stump classification. This model may be able to predict postoperative rotator cuff retears based on clinical features.

Level of Evidence: Level III, Retrospective Cohort Comparison, Prognosis Study.

BACK

Outcomes of arthroscopic single-row repair alone vs. repair with human dermal allograft patch augmentation in patients with large to massive, posterosuperior rotator cuff tears: a retrospective comparative study

R. Kantanavar, I. El Lee

DOI: https://doi.org/10.1016/j.jse.2023.10.001

Background: Large to massive rotator cuff tears (RCTs) affect shoulder functions profoundly with unmanageable disability without intervention. The retear rates with arthroscopic rotator cuff repair (ARCR) in these patients are abysmal. Patch augmentation has been credited for preventing retears, improving functions by increasing the strength, and acting as a bioconductive scaffold. This study aimed to assess the retear rates and compare the clinical and radiological outcomes between the ARCR with and without acellular human dermal allograft (HDA) augmentation.

Methods: This is a retrospective comparative study among patients diagnosed with large to massive, posterosuperior RCTs, operated between January 2020 and December 2021, including 36 patients (group I) with and 131 patients (group II) without HDA augmentation, with a mean follow-up of 20 (range, 12-35) months. The average age was 64 (range, 49-80) and 66 (range, 41-81) years in groups I and II, respectively. In group I, there were 16 male and 20 female patients, whereas in group II, there were 58 male and 73 female patients.

Results: The visual analog scale score improved to 1.1 ± 1.7 in group I and 2.1 ± 1.7 in group II (P = .005). There was a greater improvement in the University of California, Los Angeles shoulder score to 30.1 ± 4.2 in group I compared with 23.2 ± 3.9 in group II (P = .046). Forward flexion (degrees) improved from a mean of 103.2 ± 18.6 to 138.9 ± 23.5 in group I and from 106.4 ± 21.3 to 127.0 ± 19.5 in group II (P = .004). The acromiohumeral interval (mm) measured in anteroposterior radiographs increased to 8.4 ± 1.8 in group I and 8.2 ± 2.0 in group II (P = .006). The satisfaction after the procedure was 4.4 ± 0.6 in group I and 3.1 ± 1.1 in group II (P = .044). The retear rate in the HDA-augmented group was 5.6% as compared with 29.1% in the nonaugmented group, which was statistically significant (P = .007). There were no complications or adverse tissue reactions against HDA seen in any patients.

Conclusion: In patients with large to massive, posterosuperior RCTs, patch augmentation with acellular HDA significantly averted the retears after ARCR without any graft-related complications. The augmentation also resulted in improved shoulder function and greater range of motion compared with the nonaugmented group.

Level of Evidence: Level III, Retrospective Cohort Comparison, Treatment Study.

BACK

Patient-reported outcomes of arthroscopic repair for partial or full-thickness upper third subscapularis tendon tears with open sub-pectoral biceps tenodesis: minimum 10-year outcomes

R.O. Dey Hazra, M.E. Dey Hazra

DOI: https://doi.org/10.1016/j.jse.2023.07.036

Background: Although short-term results are promising, there are limited data for long-term results of arthroscopic subscapularis (SSC) repair. The purpose of this study is to report minimum 10-year outcomes of primary arthroscopic repair of isolated partial or full-thickness tears of the upper third of the SSC tendon.

Methods: Patients who underwent arthroscopic repair of isolated upper third SSC tears, Lafosse type I (>50% of tendon thickness) or type II were included. Surgeries were performed by a single surgeon between November 2005 and August 2011. Patient-reported outcome measures were prospectively collected and retrospectively reviewed at minimum follow-up of 10 years. Patient-reported outcomes utilized included the American Shoulder and Elbow Surgeons score, Single Assessment Numeric Evaluation score (SANE), Quick Disabilities of the Arm, Shoulder and Hand score (QuickDASH), the Short Form 12 physical component summary, return to activity, and patient satisfaction. A subanalysis of patient age and outcomes was performed. Retears, revision surgeries, and surgical complications were recorded.

Results: In total, 29 patients with isolated upper third SSC repairs were identified. After application of exclusion criteria, 14 patients were included in the final analysis. Follow-up could be obtained from 11 patients. The mean age at surgery was 52.7 years (range: 36-72) and the mean follow-up was 12 years (range 10-15 years). The American Shoulder and Elbow Surgeons score improved from 52.9 ± 21.8 preoperatively to 92.2 ± 13.7 postoperatively ($P < .001$). Regarding the SANE and QuickDASH scores, only postoperative data were available. Mean postoperative SANE, QuickDASH, and Short Form 12 physical component summary scores were 90.27 ± 10.5, 14.6 ± 15.5, and 49.2 ± 6.6, respectively. Median patient satisfaction was 10 (range 6-10). Patients reported improvements in sleep, activities of daily living, and sports. There was no correlation between patient age and clinical outcome ($P > .05$). No patients underwent revision surgery for a SSC retear.

Conclusion: Arthroscopic repair of upper third SSC tendon tears leads to improved clinical scores and high patient satisfaction at minimum 10-year follow-up. The procedure is durable, with no failures in the presented cohort.

Level of Evidence: Level IV, Case Series, Treatment Study.

BACK

Full arthroscopic vs. arthroscopically assisted posterosuperior latissimus dorsi tendon transfer for shoulders with failed and irreparable rotator cuff repair: matched case-control study

J. Kany, M. Siala

DOI: https://doi.org/10.1016/j.jse.2023.08.007

Purpose: To compare clinical outcomes and complication rates of full arthroscopic latissimus dorsi tendon transfer (LDTT) vs. arthroscopically assisted LDTT, for the treatment of irreparable posterosuperior massive rotator cuff tears (mRCTs) in shoulders that had failed rotator cuff repair (RCR).

Methods: We evaluated a continuous series of 191 patients who underwent LDTT over 4 consecutive years. A total of 107 patients did not have previous shoulder surgery, leaving 84 patients who had prior surgical procedures. All procedures performed over the first 2 years were arthroscopically assisted (n = 48), whereas all procedures performed over the last 2 years were full arthroscopic (n = 36). We noted all complications, as well as clinical scores and range of motion at ≥24 months. To enable direct comparison between the 2 techniques, propensity score matching was used to obtain 2 groups with equivalent age, sex, and follow-up.

Results: Compared with the 48 patients who underwent arthroscopically assisted LDTT, the 36 patients who underwent full arthroscopic LDTT had comparable complications (13% vs. 11%) and conversions to RSA (8.3% vs. 5.6%). Propensity score matching resulted in 2 groups, each comprising 31 patients, which had similar outcomes in terms of clinical scores (except mobility component of Constant score, which was better following fully arthroscopic LDTT; P = .037) and range of motion at a minimum follow-up of 2 years.

Conclusion: At a minimum follow-up of 24 months, for the treatment of irreparable posterosuperior mRCTs in shoulders that had surgical antecedents, full arthroscopic LDTT had significantly better mobility component of the Constant score than arthroscopically assisted LDTT, although there were no significant differences in the other clinical or functional outcomes. Arthroscopically assisted LDTT and full arthroscopic LDTT had comparable rates of complications (8.3% vs. 13%) and conversion to RSA (5.6% vs. 8.3%).

Level of Evidence: Level III, Retrospective Cohort Comparison, Treatment Study.

BACK

Knee Surgery, Sports Traumatology, Arthroscopy (KSSTA), Volume 32, Issue 4

Effect of age and gender in rates of achieving minimal clinically important difference and patient-acceptable symptom state 2 years after arthroscopic superior capsular reconstruction

H. Ben, J.W. Yeom

DOI: https://doi.org/10.1002/ksa.12128

Purpose: This study aimed to evaluate patient-reported outcome measures (PROMs) and the effects of gender and age on achieving clinically significant outcomes in patients undergoing arthroscopic superior capsular reconstruction (ASCR) with a minimum 2-year follow-up.

Methods: Patients undergoing ASCR for irreparable rotator cuff tear between 2013 and 2020 were reviewed. Preoperative and minimum 2-year postoperative PROMs were collected, including American Shoulder and Elbow Surgeons (ASES), Constant, single assessment numeric evaluation (SANE), and visual analog scale (VAS) scores. Minimal clinically important difference (MCID) and patient-acceptable symptomatic state (PASS) were calculated for each functional score and analyzed according to age and gender. The percentages of patients achieving MCID and PASS were recorded.

Results: The study included 83 patients, with a mean follow-up of 3.5 ± 1.4 years. Significant improvements were found in ASES, Constant, SANE, and VAS for all groups based on gender and age. Based on receiver-operating characteristic curves, all scores had acceptable areas under the curve for PASS. Values for PASS and MCID were 81.5 and 10.3 for ASES; 61.5 and 6.2 for Constant; 82.5 and 11.5 for SANE and 1.5 and 1.1 for VAS, respectively. Analysis of achieving MCID and PASS showed no difference between the groups in the majority of outcome measures. However, female patients achieved the SANE thresholds for PASS at significantly higher rates than male patients. Patients ≥65 years old achieved ASES and Constant thresholds for MCID at significantly higher rates than patients <65 years old.

Conclusion: Most patients achieved MCID and PASS at a 2-year follow-up. Patients showed comparable rates of MCID and PASS achievement on most outcome tools based on age and gender. Female patients achieved PASS on SANE at significantly higher rates than male patients and older patients achieved MCID on ASES and Constant at higher rates than young patients. Thus, age is a stronger factor for achieving MCID than gender.

Level of Evidence: Level II.

BACK

American Journal of Sports Medicine (AJSM), Volume 52, Issue 5

A Systematic Review and Meta-analysis of Risk Factors for the Increased Incidence of Revision Surgery After Arthroscopic Rotator Cuff Repair

A.D. Darbandi, M. Cohn

DOI: https://doi.org/10.1177/03635465231182993

Background: Approximately 90% of patients who undergo arthroscopic rotator cuff repair (RCR) are satisfied with their pain levels and function after surgery. However, a subset of patients experience continued symptoms that warrant revision surgery. Preoperative risk factors for RCR failure requiring revision surgery have not been clearly defined.

Purpose: To (1) determine the rate of RCR failure requiring revision surgery and (2) identify risk factors for revision surgery, which will help surgeons to determine patients who are at the greatest risk for RCR failure.

Study Design: Systematic review and meta-analysis; Level of evidence, 4.

Methods: A systematic review and meta-analysis in accordance with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines were performed. The initial search resulted in 3158 titles, and 533 full-text articles were assessed for eligibility. A total of 10 studies met the following inclusion criteria: (1) human clinical studies, (2) arthroscopic RCR, (3) original clinical research, and (4) evaluation of preoperative risk factors for revision.

Results: After a full-text review, a total of 16 risk factors were recorded and analyzed across 10 studies. Corticosteroid injection was the most consistent risk factor for revision surgery, reaching statistical significance in 4 of 4 studies, followed by workers' compensation status (2/3 studies). Patients with corticosteroid injections had a pooled increased risk of revision surgery by 47% (odds ratio, 1.44 [95% CI, 1.36-1.52]). Patients with workers' compensation had a pooled increased risk of revision surgery by 133% (odds ratio, 2.33 [95% CI, 2.09-2.60]). Age, smoking status, diabetes, and obesity were found to be risk factors in half of the analyzed studies.

Conclusion: Corticosteroid injections, regardless of the frequency of injections, and workers' compensation status were found to be significant risk factors across the literature based on qualitative analysis and pooled analysis. Surgeons should determine ideal candidates for arthroscopic RCR by accounting for corticosteroid injection history, regardless of the frequency, and insurance status of the patient.

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Arthroscopy, Volume 40, Issue 4

Medicaid Insurance Is Associated With More Complications and Emergency Department Visits but Equivalent 5-Year Secondary Surgery Rate After Primary Hip Arthroscopy

S.M. Gillinov, D.N. Kim

DOI: https://doi.org/10.1016/j.arthro.2023.08.011

Purpose: To compare 90-day complications, 30-day emergency department (ED) visits, and 5-year rate of secondary surgeries for patients with Medicaid vs commercial insurance undergoing primary hip arthroscopy for femoroacetabular impingement syndrome (FAIS) and/or labral tears using a large national database.

Methods: The PearlDiver Mariner151 database was used to identify patients with International Classification of Diseases, Tenth Revision diagnosis codes for FAIS and/or labral tear who underwent primary hip arthroscopy with femoroplasty, acetabuloplasty, and/or labral repair between 2015 and 2021. Patients with Medicaid were matched 1:4 to a control group of commercially insured patients based on age, sex, body mass index, and Elixhauser Comorbidity Index. Rates of 90-day complications and 30-day ED visits were compared using multivariate regression models. Five-year rates of secondary surgeries—revision arthroscopy or total hip arthroplasty—were compared between cohorts by Kaplan-Meier analysis.

Results: A total of 2,033 Medicaid patients were matched with 8,056 commercially insured patients. Rates of adverse events were low; however, Medicaid patients were significantly more likely than commercially insured patients to experience any 90-day complication (2.12% vs 1.43%; odds ratio [OR], 1.2; $P = .02$). Medicaid patients also experienced more 30-day ED visits than commercially insured patients (8.61% vs 4.28%), and on multivariate logistic regression, insurance status was the strongest determinant of 30-day ED visits (relative to commercial, Medicaid OR, 2.02; $P < .001$). Despite these differences, 5-year rates of secondary surgeries were comparable between groups (6.1% vs 6.0%; $P = .6$).

Conclusion: In this large national database study, Medicaid patients undergoing primary hip arthroscopy showed significantly greater odds of experiencing 90-day postoperative complications and 30-day ED visits compared to commercially insured patients. Nevertheless, both groups had similar survivorship rates at 5-year follow-up, similar to prior estimates irrespective of insurance. These results document encouraging secondary surgery rates in Medicaid patients.

BACK

Satisfactory Clinical Outcomes and Continuance of Sports After Hip Arthroscopic Labral Repair in Young Competitive Athletes at Minimum 8.5-Year Follow-Up

A. Lamba, A.S. Wang

DOI: https://doi.org/10.1016/j.arthro.2023.08.082

Purpose: To evaluate long-term patient-reported outcomes and achievement rates of patient acceptable symptomatic state (PASS) in young athletes undergoing hip arthroscopy, and to report long-term sports continuance and reoperation.

Methods: Inclusion criteria consisted of age <24 years at surgery, femoroacetabular impingement undergoing primary hip arthroscopy with labral repair, and participation in sport with intent to return to sport after surgery. The enrollment period was from April 2009 to June 2014. Modified Harris Hip Scores (mHHS), Hip Outcome Score (HOS), HOS Activities of Daily Living (HOS-ADL), and HOS Sport (HOS-Sport) were collected preoperatively, 2 years' postoperatively, and final follow-up. Patients were evaluated for PASS achievement, reoperation, and sports participation.

Results: Forty-two hips in 37 patients (11 male, 26 female, age: 17.7 ± 2.1 years, range 13.6-23.0, body mass index 22.8 ± 2.9, range 17.6-33.7) met inclusion criteria and were followed for 10.0 ± 1.3 years (range 8.5-13.0) postoperatively. Mean mHHS, HOS-ADL and HOS-Sports outcome scores at minimum 8.5 years were 82.2 ± 12.9, 89.6 ± 10.9, and 81.8 ± 16.4, respectively, with significant (P < .001) postoperative improvements. Thirty survey respondents (83%) met PASS for mHHS, 27 (75%) for HOS-ADL, and 24 (67%) for HOS-Sports. At minimum 8.5-year follow-up, only 9 of 37 (24%) cited their hip as the reason for stopping sport. Of the remaining patients, 17 of 28 (61%), continued playing their initial sport. There was no difference in patient-reported outcomes between patients who endorsed sports continuance and patients who did not report sports continuance and did not cite their hip as a reason (P ≥ .229). At final follow-up, 4 hips (10%) had undergone subsequent surgical intervention at a mean of 4.8 ± 3.3 years (range 1.0-8.4) postoperatively.

Conclusion: Durable mid-term outcomes and satisfactory PASS achievement rates are observed in young amateur athletes undergoing primary hip arthroscopy. At minimum 8.5-year follow up, approximately 1 in 4 patients discontinue their sports due to hip related reasons.

Level of Evidence: Level IV, case-series.

BACK

During Postless Hip Arthroscopy, Male Patients, High Body Mass Index, Low Beighton Scores, and Limited Range of Motion Require High Traction Force

N.G. Girardi, M.J. Kraeutler

DOI: https://doi.org/10.1016/j.arthro.2023.08.024

Purpose: To determine the effects of demographic and anatomic factors on traction force required during postless hip arthroscopy.

Methods: A prospectively collected database was retrospectively analyzed on patients undergoing hip arthroscopy by the senior author, including patient sex, age, body mass index (BMI), Beighton Hypermobility Score, hip range of motion in clinic and under anesthesia, hip dysplasia, acetabular version, and femoral version. All patients underwent postless hip arthroscopy under general anesthesia. At the initiation of hip arthroscopy, the traction force required to distract the hip joint was measured before and following interportal capsulotomy. Multiple regression analysis was performed to determine the effects of demographic and anatomic factors on measured distraction force.

Results: In total, 352 hips (114 male, 238 female) were included with a mean age of 32.6 years and a mean BMI of 24.1 kg/m^2. Mean initial traction force was 109 lbs and decreased to 94.3 lbs following capsulotomy ($P < .0001$). The starting traction force was significantly greater in male patients ($P < .001$), patients with a lack of hypermobility (Beighton Hypermobility Score of 0-2) ($P = .026$), and in patients with lower abduction ($P < .001$), lower internal rotation ($P = .002$), and lower external rotation ($P = .012$) on multiple regression analysis. When performing a subanalysis divided by sex, male patients with elevated BMI required significantly greater starting traction force ($P = .014$). Lateral center edge angle, sourcil angle, and the presence of hip dysplasia did not demonstrate a significant correlation with traction force.

Conclusion: Male patients, patients with reduced preoperative hip range of motion, patients with a lack of joint hypermobility, and male patients with an elevated BMI require greater initial traction force during postless hip arthroscopy.

Level of Evidence: Level IV, retrospective case series.

BACK

Defining the Percent Thresholds for Achieving the Maximum Outcome Improvement of the Modified Harris Hip Score, the Non-Arthritic Hip Score, the Hip Outcome Score-Sports Subscale, the Visual Analog Scale for Pain, and the International Hip Outcome Tool-12 in Revision Hip Arthroscopy at Minimum 2-Year Follow-Up

D.R. Maldonado, S. Padmanabhan

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Purpose: To determine the respective percent thresholds for achieving the maximal outcome improvement (MOI) for the modified Harris Hip Score (mHHS), the Non-Arthritic Hip Score (NAHS), the Hip Outcome Score-Sports Subscale (HOS-SSS), the visual analog scale (VAS) for pain, and the International Hip Outcome Tool-12 (iHOT-12) that were associated with satisfaction following revision hip arthroscopy, and to identify predictors for achieving the MOI.

Methods: An anchor question was provided to patients who underwent revision hip arthroscopy between April 2017 and July 2020. Patients were included for the final analysis if they answered the anchor question and had minimum 2-year follow-up. Receiver operating characteristic analysis was used to determine the thresholds for the percentage of the MOI predictive of satisfaction. A *P*-value of < .05 was considered significant.

Results: In total, 318 patients underwent revision hip arthroscopy. Of those patients, 292 (91.8%) had minimum 2-year follow-up. Of this cohort, 68 answered the anchor question, with 49 (72.1%) female and 19 (27.9%) male patients. The mean age, and body mass index time were 32.9 ± 13 years and 25.4 ± 5.1, respectively. It was determined that 42.1%, 50%, 48.1%, 50%, and 50% of MOI were the thresholds for maximal predictability of satisfaction for mHHS, NAHS, HOS-SS, VAS for pain, and the iHOT-12, respectively. The presence of unaddressed subspine impingement was a significant predictor for achieving the MOI threshold for the VAS (odds ratio 1.40; 95% confidence interval 1.00-1.95; $P = 0.0273$).

Conclusion: Following revision hip arthroscopy, the percent thresholds for achieving the MOI at a minimum 2-year follow-up for the mHHS, NAHS, HOS-SS, VAS for pain, and iHOT-12 were 42.1%, 50%, 48.1%, 50%, and 50.9%, respectively. Addressing residual subspine impingement was identified as significant positive predictor for achieving the MOI.

Level of Evidence: Level IV, case-series.

BACK

Development of Machine-Learning Algorithms to Predict Attainment of Minimal Clinically Important Difference After Hip Arthroscopy for Femoroacetabular Impingement Yield Fair Performance and Limited Clinical Utility

M.H. Pettit, S.H.M. Hickman

DOI: https://doi.org/10.1016/j.arthro.2023.09.023

Purpose: To determine whether machine learning (ML) techniques developed using registry data could predict which patients will achieve minimum clinically important difference (MCID) on the International Hip Outcome Tool 12 (iHOT-12) patient-reported outcome measures (PROMs) after arthroscopic management of femoroacetabular impingement syndrome (FAIS). And secondly to determine which preoperative factors contribute to the predictive power of these models.

Methods: A retrospective cohort of patients was selected from the UK's Non-Arthroplasty Hip Registry. Inclusion criteria were a diagnosis of FAIS, management via an arthroscopic procedure, and a minimum follow-up of 6 months after index surgery from August 2012 to June 2021. Exclusion criteria were for non-arthroscopic procedures and patients without FAIS. ML models were developed to predict MCID attainment. Model performance was assessed using the area under the receiver operating characteristic curve (AUROC).

Results: In total, 1,917 patients were included. The random forest, logistic regression, neural network, support vector machine, and gradient boosting models had AUROC 0.75 (0.68-0.81), 0.69 (0.63-0.76), 0.69 (0.63-0.76), 0.70 (0.64-0.77), and 0.70 (0.64-0.77), respectively. Demographic factors and disease features did not confer a high predictive performance. Baseline PROM scores alone provided comparable predictive performance to the whole dataset models. Both EuroQoL 5-Dimension 5-Level and iHOT-12 baseline scores and iHOT-12 baseline scores alone provided AUROC of 0.74 (0.68-0.80) and 0.72 (0.65-0.78), respectively, with random forest models.

Conclusion: ML models were able to predict with fair accuracy attainment of MCID on the iHOT-12 at 6-month postoperative assessment. The most successful models used all patient variables, all baseline PROMs, and baseline iHOT-12 responses. These models are not sufficiently accurate to warrant routine use in the clinic currently.

Level of Evidence: Level III, retrospective cohort design; prognostic study.

BACK

Increasing Hip Arthroscopy Case Volume Is Associated With Increased Risk for Revision Surgery but Not Conversion to Total Hip Arthroplasty or 90-Day Hospitalizations: A Cross-Sectional Analysis of 468 Surgeons

C. Nosrat, M.J. Hartwell

DOI: https://doi.org/10.1016/j.arthro.2023.08.078

Purpose: To analyze the effects of surgeon-specific factors, including case volume, career duration, fellowship training, practice type, and region of practice, on rates of 2-year revision surgery, conversion to total hip arthroplasty (THA), and 90-day hospitalizations following hip arthroscopy.

Methods: The PearlDiver Mariner Database was used to query patients undergoing hip arthroscopy between 2015 and 2018. Surgeons performing these procedures were identified, and surgeon-specific demographics and variables were collected from publicly available data. Patients were followed for 2 years to assess for reoperations, including revision hip arthroscopy and conversion to THA, as well as 90-day hospitalizations, including emergency department visits and hospital readmissions. *International Classification of Diseases, Tenth Revision* codes were used to track the laterality of revision hip procedures. Associations between surgeon-specific factors and postoperative outcomes were assessed through univariate and multivariate analyses.

Results: In total, 20,834 patients underwent hip arthroscopy procedures by 468 surgeons. Multivariate analysis with logistic regression adjusted for patient-related factors (age, sex, obesity, Charlson Comorbidity Index, and smoking status) identified increasing surgeon case volume to be associated with increased risk for 2-year revision hip arthroscopy ($P < .001$), but not 2-year conversion to THA or 90-day hospitalizations. Nonsports medicine fellowship-trained surgeons were associated with greater risk for 2-year THA conversion ($P < .001$) and 90-day hospital readmissions ($P < .01$). Surgeons practicing in an academic setting demonstrated greater risk for 90-day hospital readmissions ($P < .001$). Surgeons practicing in the West region of the United States were more likely to incur 2-year revision hip arthroscopy procedures compared to surgeons in the South, Midwest or Northeast ($P < .001$).

Conclusion: Increasing surgeon hip arthroscopy case volume is associated with an increased risk for 2-year revision hip arthroscopy but not conversion to THA or 90-day hospitalizations. Further, non-sports medicine fellowship-trained surgeons were associated with higher risk for 2-year THA conversion after hip arthroscopy.

Level of Evidence: Level III, retrospective cohort analysis.

BACK

Borderline Hip Dysplasia Is Not Associated With Significant Differences in Hip Survivorship or Patient-Reported Outcomes Following Primary Hip Arthroscopy for Femoroacetabular Impingement Syndrome: A Propensity-Matched Cohort Study

Z.I. Li, D.S. Shankar

DOI: https://doi.org/10.1016/j.arthro.2023.09.003

Purpose: To compare hip survivorship and patient-reported outcomes after primary hip arthroscopy for femoroacetabular impingement syndrome (FAIS) in patients with versus without comorbid borderline hip dysplasia (BHD) at 2-year follow-up.

Methods: A retrospective matched-cohort study was conducted involving patients who underwent primary hip arthroscopy for FAIS with a single surgeon from 2010 to 2019. BHD was defined as lateral center edge angle (LCEA) of 20 to 25°. Subjects with BHD were matched 1:2 to controls without BHD on age, sex, body mass index, and preoperative modified Harris Hip Score (mHHS). Alpha angle, LCEA, Tönnis angle, and acetabular retroversion signs were measured on preoperative and/or postoperative hip radiographs. Patient-reported outcomes were assessed using the mHHS and the Non-Arthritic Hip Score. Hip survivorship, outcome scores, and achievement of the minimum clinically important difference were compared between groups using the Mann–Whitney *U* test or Fisher exact test, as appropriate. *P* values <.05 were considered significant.

Results: Thirty-one BHD subjects (mean age 36.8 years, 71.0% female) and 62 controls (mean age 38.0 years, 71.0% female) were included. There were no significant intergroup differences in demographics or preoperative radiographic measurements besides LCEA and Tönnis angle (all $P > .05$). Intraoperatively, subjects with BHD were found to have significantly shorter labral tears (mean 2.6 vs 2.8 clock-face hours, $P = .048$), but there were no significant intergroup differences in acetabular or femoral cartilage status (all $P > .05$). Postoperatively, there were no significant intergroup differences in rates of revision arthroscopy (BHD 6.5% vs control 11.3%) or conversion to total hip arthroplasty (BHD 9.7% vs control 1.6%), in 2-year improvement of the mHHS and Non-Arthritic Hip Score, or in minimum clinically important difference achievement rates (all $P > .05$).

Conclusion: BHD is not associated with a significant difference in hip survivorship or patient-reported outcomes following primary hip arthroscopy for FAIS.

Level of Evidence: Level III, retrospective comparative study.

BACK

Revision and Conversion to Arthroplasty Are Low Among Adolescents Undergoing Meniscal Allograft Transplantation Using the Bridge-In-Slot Technique at Midterm Follow-Up

K.R. Wagner, J.T. Kaiser

DOI: https://doi.org/10.1016/j.arthro.2023.07.059

Purpose: To report midterm outcomes after primary medial and lateral meniscal allograft transplantation (MAT) with fresh-frozen allografts implanted with the bridge-in-slot technique in the adolescent patient population.

Methods: Adolescent patients less than 18 years old at the time of primary MAT from 1999 to 2016 were retrospectively identified. International Knee Documentation Committee (IKDC) subjective form, Lysholm, and Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales scores were collected before surgery and at 1-year, 2-year, and a minimum 5-year follow-up. Thresholds for achieving clinically significant outcomes were calculated, and the proportion of patients achieving minimal clinically important difference (MCID), patient-acceptable symptomatic state (PASS), and substantial clinical benefit (SCB) was determined. Meniscus reoperation (partial, subtotal, or total meniscectomy, repair, or failure) and failure (revision MAT or conversion to arthroplasty) rates were determined.

Results: Forty-four (female n = 33; male n = 11) of 62 identified patients met inclusion criteria and were followed for a mean of 9.5 ± 3.8 years (range, 5.0-17.7). Lateral MAT was performed in most patients (n = 35/44 [80%]). Isolated MAT was performed in 27 (61%) patients. Common concomitant procedures included osteochondral allograft transplantation (32%), autologous chondrocyte implantation (18%), and anterior cruciate ligament reconstruction (14%). MCID, PASS, and SCB were achieved by patients at a minimum 5-year follow-up for IKDC (62%; 76%; 31%), Lysholm (62%; 79%; 23%), and KOOS questionnaires (Pain [65%; 81%; 41%], Symptoms [58%; 81%; 47%], Activities of Daily Living [53%; 77%; 35%], Sport [86%; 75%; 50%], and Quality of Life [59%; 81%; 59%]), respectively. Fourteen patients (32%) underwent reoperation at an average of 5.0 ± 4.3 years (range, 0.8-14.0) after MAT. Three (7%) patients met criteria for failure, requiring revision MAT an average of 3.8 ± 1.1 years (range, 2.8-4.9) after transplantation. No patients underwent arthroplasty. Overall survival free from failure at 1, 2, 5, and 10 years was 100%, 100%, 93%, and 93%, respectively. At the time of final follow-up, 80% of patients reported satisfaction with their current physical status.

Conclusion: Primary MAT in adolescent patients resulted in significant and durable functional improvements at mid- to long-term follow-up. At an average of 9.5 years after surgery, meniscal reoperation rate was 32% whereas graft survival free of revision MAT was 93%. Adolescents undergoing MAT demonstrated similar functional outcomes and graft survivability when compared to available adult MAT literature.

Level of Evidence: Level IV, retrospective case series.

BACK

Arthroscopic Meniscal Repair and Meniscectomy for Adult Discoid Lateral Meniscus Results in Progression to Valgus Alignment and Lateral Compartment Degeneration Compared With Nonoperative Treatment and Nondiscoid Lateral Meniscus

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DOI: https://doi.org/10.1016/j.arthro.2023.08.085

Purpose: To analyze the effect of the arthroscopic meniscal procedure in adult discoid lateral meniscus (DLM) according to the age and meniscal-preserving by making comparisons with the nondiscoid lateral meniscus (N-DLM).

Methods: From March 2014 to October 2020, a comparative analysis was performed in adults with DLM who underwent arthroscopic meniscal procedures (operative DLM: 134 knees), nonoperative treatment (nonoperative DLM: 56 knees), and adult N-DLM who underwent arthroscopic meniscal procedures (operative N-DLM: 64 knees). These patients were between 20 and 65 years old and completed a minimum follow-up of 2 years. Patients with DLM who underwent arthroscopic procedure were divided into subgroups according to age and extent of the meniscal-preserving. The following parameters were assessed and compared between the groups: (1) coronal limb alignment, (2) osteoarthritis grade, and (3) clinical outcomes and the minimal clinically important difference.

Results: The coronal limb alignment was significantly changed to valgus in the order of operative DLM, N-DLM, and nonoperative DLM (Δ mechanical hip–knee–ankle angle: 3.23 ± 1.85 vs 1.35 ± 1.03° vs –0.57 ± 1.88°; $P < .05$). Operative DLM showed most prominent osteoarthritic change in the lateral compartment, followed by the N-DLM and nonoperative DLM groups (40.3% vs 17.2% vs 5.3%; $P < .05$). These changes in operative DLM were more prominent in older adults who underwent meniscal-sacrificing procedures and resulted in less-satisfactory clinical outcomes (all $P < .05$).

Conclusion: Arthroscopic surgery for adult DLM resulted in progression to valgus alignment and lateral compartment degeneration compared with nonoperative treatment and arthroscopic surgery of the adult N-DLM. Old ager and having a meniscal-sacrificing procedure showed more rapid radiographic changes and lower clinical outcomes.

Level of Evidence: Level III, retrospective comparison study.

BACK

Quadriceps Tendon With Bone Autograft Has Better Stability and Magnetic Resonance Imaging Maturation Than Hamstring Tendon Autograft After Anterior Cruciate Ligament Reconstruction in Patients With Knee Hyperextension

S. Yamasaki, Y. Hashimoto

DOI: https://doi.org/10.1016/j.arthro.2023.08.013

Purpose: To compare the clinical outcomes of anterior cruciate ligament (ACL) reconstruction between methods using quadriceps tendon with bone (QTB) and hamstring tendon (HT) in patients with hyperextension of the knee.

Methods: The medical records of patients with knee hyperextension greater than 8° who underwent arthroscopic ACL reconstruction between October 2010 and October 2020 with follow-up for at least 2 years (median, 3 years; interquartile range [IQR], 2.0-4.6 years) were retrospectively reviewed. Side-to-side difference in anterior translation, pivot-shift test grade, Lysholm score, and graft intensity using the Howell grade on magnetic resonance imaging at final follow-up were compared between the QTB and HT groups.

Results: The HT and QTB groups consisted of 42 patients and 21 patients, respectively. The overall mean age was 21.5 years (range, 14-48 years), and the median Tegner Activity Scale score was 6 (range, 3-9). Postoperatively, the median side-to-side difference in anterior translation was 1.75 mm (IQR, 1-3 mm) in the HT group and 1.0 mm (IQR, 0-1.75 mm) in the QTB group (P = .01). Pivot-shift testing showed grade 0 in 74.7%, grade 1 in 18.7%, and grade 2 in 6.6% of patients in the HT group and grade 0 in 85.7% and grade 1 in 14.3% of those in the QTB group (P = .03). The median postoperative Lysholm score was 99 in both groups. Graft signal intensity showed a significant between-group difference: grade I in 52%, grade II in 36%, and grade III in 12% of patients in the HT group versus grade I in 85.7%, grade II in 9.5%, and grade III in 4.8% of those in the QTB group (P = .03).

Conclusion: In patients who underwent ACL reconstruction for hyperextension of the knee, QTB yielded better clinical outcomes than HT with respect to anterior stability, rotational stability, and graft signal intensity on median 2-year follow-up magnetic resonance imaging.

Level of Evidence: Level III, retrospective case-control study.

BACK

Patients With Segond Fracture Demonstrate Similar Rates of Return to Sport and Psychological Readiness After Anterior Cruciate Ligament Reconstruction: A Matched Cohort Study at Minimum 2-Year Follow-Up

S. Garra, Z.I. Li

DOI: https://doi.org/10.1016/j.arthro.2023.08.080

Purpose: To compare clinical outcomes, rate of return to sports, and psychological readiness among patients undergoing anterior cruciate ligament reconstruction (ACLR) with and without concomitant Segond fracture.

Methods: We retrospectively identified patients who underwent primary ACLR from January 2012 to December 2020 with minimum 2-year follow-up. Exclusion criteria were additional ligamentous injury, age <16 years, or a concomitant lateral augmentation procedure. Preoperative knee radiographs were reviewed to identify Segond fractures. Identified patients were matched 1:2 to controls by age/sex/body mass index/graft type. Charts were reviewed for pre- and postoperative knee stability. Surveys administered included preinjury sport participation and return status, Lysholm score, Tegner activity scale, and ACL-Return to Sport Index (ACL-RSI), a metric of psychological sport readiness. Multivariable logistic regression was conducted to identify predictors of return to sport.

Results: There were 120 patients who were included in the final analysis (40 Segond, 80 controls) at a mean follow-up of 5.7 ± 2.4 years. A total of 52.5% of patients received bone–patellar tendon–bone autograft. The overall rate of return to sport was 79.5% in the Segond group compared with an 83.8% rate of return in the control group (P = .569). In total, 48.7% of the Segond group and 56.8% of the control group returned to their preinjury level of sport (P = .415). Lysholm (89.6 ± 10.3 vs 85.4 ± 16.7, P = .296), Tegner (5.7 ± 1.8 vs 6.1 ± 2.2, P = .723), and ACL-RSI (62.2 ± 25.4 vs 56.6 ± 25.4, P = .578) scores were similar between Segond and control groups. There was a single graft failure in the Segond group 5 years' postoperatively. Increasing ACL-RSI score was significantly predictive of return to sport (P < .001).

Conclusion: Patients who had an ACL tear and a concomitant Segond fracture who underwent isolated ACLR without lateral augmentation procedures had similar clinical outcomes and rates of return sport compared with a matched isolated ACLR control group at minimum 2-year follow-up. There was no significant difference in psychological readiness between groups as measured by the ACL-RSI.

Level of Evidence: Level III, retrospective cohort study.

BACK

Clinical Outcomes After Polyurethane Meniscal Scaffolds Implantation Remain Stable Despite a Joint Space Narrowing at 10-Year Follow-Up

R. Torres-Claramunt, J. Alós-Mairal

DOI: https://doi.org/10.1016/j.arthro.2023.08.081

Purpose: To report the clinical outcomes, radiologic evolution, and survivorship of a series of patients affected by the postmeniscectomy syndrome and treated with a polyurethane scaffold at a minimum 10-year follow-up. In addition, the radiologic evolution of these patients was also assessed.

Methods: All the patients operated on with a polyurethane meniscal scaffold implantation to treat postmeniscectomy syndrome from 2008 to 2011 were prospectively followed. Clinical evaluations and radiologic studies were assessed at the preoperative period, at 5-year follow-up, and at minimum 10-year follow-up. Clinical outcomes were based on patient-reported outcomes (e.g., the Knee injury and Osteoarthritis Outcome Score, International Knee Documentation Committee, Lysholm, and Tegner). Radiographical evaluation of the joint-space narrowing was done in the Rosenberg view. Failure was defined as patients who required surgery to remove the scaffold or those patients who needed surgery for a total or partial knee replacement.

Results: Twenty-one of 27 patients, with a mean age of 56 ± 9.8 years, were available for the final follow-up. The mean follow-up was 11.8 (range, 10-12.7) years. Six patients were lost to follow-up. All functional scores showed a significant improvement ($P < .001$) at the 5- and 10-year follow-up. The exception was the Tegner score, which remained stable. The joint-space width was maintained from the preoperative period (1.9 ± 1.2 mm) up to the 5-year follow-up (1.3 ± 1.5 mm, $P = .3$) and decreased by the last evaluation (0.6 ± 1.2 mm, $P = .001$) at the last follow-up. Two (9.5%) of 21 patients were converted to a total knee replacement during the study period. None of the other patients needed revision surgery during the study period.

Conclusion: The polyurethane meniscal scaffold provides significant and stable pain relief over time and improved functional outcomes at a minimum of 10 years after surgery. However, degenerative changes progressed in the treated compartment, with a joint-space narrowing over the 10-year period.

Level of Evidence: Level IV, retrospective case series.

BACK

Rotator Cuff Repair With Patch Augmentation Is Associated With Lower Retear Rates for Large Tears: A Systematic Review of Randomized Controlled Trials

E. Orozco, J. Dhillon

DOI: https://doi.org/10.1016/j.arthro.2023.08.072

Purpose: To perform a systematic review of randomized controlled trials comparing clinical outcomes of rotator cuff repair with and without patch augmentation.

Methods: A systematic review was conducted according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines by searching PubMed, the Cochrane Library, and Embase to identify randomized controlled trials that directly compared outcomes between rotator cuff repair (RCR) with versus without patch augmentation. Patients were evaluated based on retear rate, histological outcomes, radiological outcomes, and patient-reported outcomes (Constant score; American Shoulder and Elbow Surgeons [ASES] score; University of California–Los Angeles shoulder scale; Simple Shoulder Test; EuroQol-visual analog scale; Disabilities of the Arm, Shoulder and Hand score; and PENN shoulder score questionnaire).

Results: Six studies (1 level I, 5 level II) met inclusion criteria, including 188 patients undergoing RCR alone (Control) and 193 patients undergoing RCR with patch augmentation (Patch). Patient age ranged from 56.0 to 68.0 years. The mean follow-up time ranged from 14.0 to 68.4 months. The average body mass index ranged from 24.4 to 29.4, and the overall percentage of males ranged from 32.5% to 82.3%. Three studies found significantly decreased retear rates with patch augmentation. The retear rate ranged from 34.0% to 65.4% in the Control group and 9.1% to 52.9% in the Patch group. One study found a significant difference for the Constant score favoring the Patch group. Two studies found a significant difference for the ASES score favoring the Patch group. One study found significantly better results with patch augmentation in terms of repaired tendon thickness and footprint coverage, based on magnetic resonance imaging.

Conclusion: Patch augmentation of rotator cuff repairs may be associated with lower retear rates for large tears. There is limited evidence to suggest that patch augmentation is associated with improved patient-reported outcomes.

Level of Evidence: Level II, systematic review of level I and II studies.

BACK

Arthroscopy and Microfracture for Osteochondritis Dissecans of the Capitellum in Adolescent Athletes Shows Favorable Return to Sport: A Systematic Review

J. Leal, K.M. Hones

DOI: https://doi.org/10.1016/j.arthro.2023.08.075

Purpose: To assess return to sport (RTS) in the high-risk young athlete population with capitellar osteochondritis dissecans (OCD) undergoing arthroscopic microfracture (MFX) with or without debridement as well as associated indications, clinical outcomes, radiographic outcomes, and complications.

Methods: A literature search of all published literature in the English language from PubMed, EMBASE, Scopus, and Cochrane from database inception to April 4, 2022, was performed following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Included studies presented demographics and outcomes for adolescent (<21 years old) patients diagnosed with capitellar OCD who underwent arthroscopic MFX (or drilling/subchondral drilling) or MFX (or drilling/subchondral drilling) with debridement (or loose body removal/chondroplasty). Studies containing multiple surgical techniques that did not distinguish characteristics and outcomes of individual patients by surgical technique were excluded. Additionally, if there was overlap in patient populations between 2 studies, the study with less outcome data was excluded. Extracted data included study properties, patient demographics, lesion characteristics, surgery details, and patient outcomes, including range of motion, outcome scores, and RTS rates. Bias was assessed via the Methodological Index for Non-Randomized Studies (MINORS).

Results: Nine studies of 136 patients and 138 elbows met criteria. Included articles were published between 2005 and 2020 with MINORS scores of 8 to 14 (50% to 88%). The age ranged from 12.7 to 15.7 years with most patients being involved in baseball or gymnastics and a rate of dominant elbow involvement of 55% to 100%. Patient follow-up ranged from 16 to 138 months. All 9 studies reported RTS, ranging from 65% to 100%. Six of these studies categorized the level to which the patient returned, with patients RTS at the same level of competition ranging from 60% to 100%. Six studies reported complications, with a range rate of 0% to 43%; there were a total of 10 complications, 7 of which required reoperations.

Conclusion: Arthroscopic MFX with or without arthroscopic debridement is a safe and effective treatment for OCD lesions of the capitellum in young, athletic patients. Included studies reported improved clinical, radiographic, and patient-reported outcomes. Aside from 1 study reporting an RTS of 65%, the rate of RTS ranged from 86% to 100%. The percentage of patients returning to sport at the same level of competition ranged from 60% to 100% with a time to RTS ranging from 4.1 to 5 months. A single study reported a complication rate of 43%, while remaining studies reported complication rates between 0% and 19%, with loose bodies being the most common complication requiring reoperation. Follow-up ranged from 16 to 138 months.

Level of Evidence: Level IV, systematic review of Level IV studies.

BACK

Journal of Shoulder and Elbow Surgery (JSES), Volume 33, issue 4

No Lower Extremity Abstracts

BACK

Knee Surgery, Sports Traumatology, Arthroscopy (KSSTA), Volume 32, Issue 4

No Lower Extremity Abstracts

BACK

American Journal of Sports Medicine (AJSM), Volume 52, Issue 5

Modern Hip Arthroscopy for FAIS May Delay the Natural History of Osteoarthritis in 25% of Patients: A 12-Year Follow-up Analysis

P.N. Ramkumar, R.J. Olsen

DOI: https://doi.org/10.1177/03635465241232154

Background: Little is known about the effect of modern hip arthroscopy on the natural history of femoroacetabular impingement syndrome (FAIS) with respect to joint preservation.

Purpose: To (1) characterize the natural history of FAIS and (2) understand the effect of modern hip arthroscopy by radiographically comparing the hips of patients who underwent only unilateral primary hip arthroscopy with a minimum follow-up of 10 years.

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

Methods: Between 2010 and 2012, 619 consecutive patients were reviewed from the practice of a single fellowship-trained hip arthroscopic surgeon. Inclusion criteria were FAIS, bilateral radiographic findings of femoroacetabular impingement, primary unilateral hip arthroscopy (labral repair, femoroplasty, or capsular closure), and minimum 10-year follow-up. The preoperative and minimum 10-year postoperative radiographs of patients were evaluated at each time point. Both operative and nonoperative hips were graded using the Tönnis classification or the presence of hip arthroplasty by 2 independent reviewers. Subgroup analyses were performed.

Results: A total of 200 hips from 100 patients were evaluated at a mean follow-up of 12.0 years. Preoperatively, 98% and 99% of operative and nonoperative hips were evaluated as Tönnis grades 0 and 1, respectively; 5% of nonoperative hips had worse Tönnis grades than operative hips. The nonoperative hip advanced to a worse Tönnis grade in 48% (48/100) of cases compared with 28% (28/100) among operative hips. At follow-up, Tönnis grades between hips were equal in 70% (70/100) of the cases, the operative hip had a better grade 25% (25/100) of the time, and the nonoperative hip had a better grade 5% (5/100) of the time. Modern hip arthroscopy was associated with a relative risk reduction of 42% in osteoarthritis progression. Impingement with borderline dysplasia, age, preoperative Tönnis grade, and alpha angle >65° were key risk factors in the radiographic progression of osteoarthritis.

Conclusion: Although the majority of patients (70%) undergoing hip arthroscopy for FAIS did not experience differences between operative and nonoperative hips in terms of the radiographic progression of osteoarthritis, the natural history may be favorably altered for 25% of patients whose Tönnis grade was better after undergoing arthroscopic correction. Modern hip arthroscopy indications and techniques represent a valid joint-preservation procedure conferring a relative risk reduction of 42% in the progression of osteoarthritis. Arthroscopy for mixed patterns of impingement and instability were the fastest to degenerate.

BACK

Long-term Outcomes of Primary Hip Arthroscopy: Multicenter Analysis at Minimum 10-Year Follow-up With Attention to Labral and Capsular Management

A.M. Boos, A.S. Wang

DOI: https://doi.org/10.1177/03635465241234937

Background: Hip arthroscopy is rapidly advancing, with positive published outcomes at short- and midterm follow-up; however, available long-term data remain limited.

Purpose: To evaluate outcomes of primary hip arthroscopy at a minimum 10-year follow-up at 2 academic centers by describing patient-reported outcomes and determining reoperation and total hip arthroplasty (THA) rates.

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

Methods: Patients with primary hip arthroscopy performed between January 1988 and April 2013 at 2 academic centers were evaluated for postoperative patient-reported outcomes—including the visual analog scale, Tegner Activity Scale score, Hip Outcome Score Activities of Daily Living and Sport Specific subscales, modified Harris Hip Score, Nonarthritic Hip Score, 12-item International Hip Outcome Tool, surgery satisfaction, and reoperations.

Results: A total of 294 patients undergoing primary hip arthroscopy (age, 40 ± 14 years; 66% women; body mass index, 27 ± 6) were followed for 12 ± 3 years (range, 10-24 years) postoperatively. Labral debridement and repair were performed in 41% and 59% of patients, respectively. Of all patients who underwent interportal capsulotomy, 2% were extended to a T-capsulotomy, and 11% underwent capsular repair. At final follow-up, patients reported a mean visual analog scale at rest of 2 ± 2 and with use of 3 ± 3, a 12-item International Hip Outcome Tool of 68 ± 27, a Nonarthritic Hip Score of 81 ± 18, a modified Harris Hip Score of 79 ± 17, and a Hip Outcome Score Activities of Daily Living of 82 ± 19 and Sport Specific subscale of 74 ± 25. The mean surgical satisfaction was 8.4 ± 2.4 on a 10-point scale, with 10 representing the highest level of satisfaction. In total, 96 hips (33%) underwent reoperation—including 65 hips (22%) converting to THA. THA risk factors included older age, higher body mass index, lower lateral center-edge angle, larger alpha angle, higher preoperative Tönnis grade, as well as labral debridement and capsular nonrepair ($P \leq .039$). Patients undergoing combined labral and capsular repair demonstrated a THA conversion rate of 3% compared with 31% for patients undergoing combined labral debridement and capsular nonrepair ($P = .006$). Labral repair trended toward increased 10-year THA-free survival (84% vs 77%; $P = .085$), while capsular repair demonstrated significantly increased 10-year THA-free survival (97% vs 79%; $P = .033$).

Conclusion: At a minimum 10-year follow-up, patients undergoing primary hip arthroscopy demonstrated high satisfaction and acceptable outcome scores. In total, 33% of patients underwent reoperation—including 22% who underwent THA. Conversion to THA was associated with patient factors including older age, higher Tönnis grade, and potentially modifiable surgical factors such as labral debridement and capsular nonrepair.

BACK

Association Between Chondrolabral Junction Breakdown and Conversion to Total Hip Arthroplasty After Hip Arthroscopy for Symptomatic Labral Tears: Minimum 8-Year Follow-up

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Background: Arthroscopic treatment of femoroacetabular impingement (FAI) and symptomatic labral tears confers short- to midterm benefits, yet further long-term evidence is needed. Moreover, despite the physiological and biomechanical significance of the chondrolabral junction (CLJ), the clinical implications of damage to this transition zone remain understudied.

Purpose: To (1) report minimum 8-year survivorship and patient-reported outcome measures after hip arthroscopy for FAI and (2) characterize associations between outcomes and patient characteristics (age, body mass index, sex), pathological parameters (Tönnis angle, alpha angle, type of FAI, CLJ breakdown), and procedures performed (labral management, FAI treatment, microfracture).

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

Methods: This retrospective cohort study included patients who underwent primary hip arthroscopy for symptomatic labral tears secondary to FAI by a single surgeon between 2002 and 2013. All patients were ≥18 years of age with minimum 8-year follow-up and available preoperative radiographs. The primary outcome was conversion to total hip arthroplasty (THA), and secondary outcomes included revision arthroscopy, patient-reported outcome measures, and patient satisfaction. CLJ breakdown was assessed using the Beck classification. Kaplan-Meier estimates and weighted Cox regression were used to estimate 10-year survivorship (no conversion to THA) and identify risk factors associated with THA conversion.

Results: In this study of 174 hips (50.6% female; mean age, 37.8 ± 11.2 years) with mean follow-up of 11.1 ± 2.5 years, the 10-year survivorship rate was 81.6% (95% CI, 75.9%-87.7%). Conversion to THA occurred at a mean 4.7 ± 3.8 years postoperatively. Unadjusted analyses revealed several variables significantly associated with THA conversion, including older age; higher body mass index; higher Tönnis grade; labral debridement; and advanced breakdown of the CLJ, labrum, or articular cartilage. Survivorship at 10 years was inferior in patients exhibiting severe (43.6%; 95% CI, 31.9%-59.7%) versus mild (97.9%; 95% CI, 95.1%-100%) breakdown of the CLJ ($P < .001$). Multivariable analysis identified worsening CLJ breakdown (weighted hazard ratio per 1-unit increase, 6.41; 95% CI, 3.11-13.24), older age (1.09; 95% CI, 1.04-1.14), and higher Tönnis grade (4.59; 95% CI, 2.13-9.90) as independent negative prognosticators ($P < .001$ for all).

Conclusion: Although most patients achieved favorable minimum 8-year outcomes, several pre- and intraoperative factors were associated with THA conversion; of these, worse CLJ breakdown, higher Tönnis grade, and older age were the strongest predictors.

BACK

Perioperative Intravenous Dexamethasone Significantly Reduces Postoperative Opioid Requirement and Nausea After Unilateral Elective Hip Arthroscopy: A Randomized Double-blinded Placebo-controlled Trial

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Background: Previous studies have shown that dexamethasone has a positive effect on postoperative pain control, opioid consumption, nausea, and vomiting and length of hospital stay after arthroplasty surgery.

Purpose: The purpose of this study was to assess whether adding perioperative dexamethasone to our current pain regimen after hip arthroscopy is more effective than a placebo. It was hypothesized that dexamethasone would reduce postoperative pain, reduce opioid consumption, improve subjective pain and nausea scores, and reduce the number of vomiting events.

Study Design: Randomized controlled trial; Level of evidence, 1.

Methods: A total of 50 patients requiring unilateral elective hip arthroscopy were randomized to receive intravenous dexamethasone immediately before induction of anesthesia and at 8 am on the first postoperative day (2 ×12 mg) or a placebo (sodium chloride 0.9%). The patient, the surgeons, the treating anesthesiologist, and the involved nursing and physical therapy personnel were blinded to group assignment. The primary outcome was postoperative pain, and secondary outcomes were opioid consumption and nausea scores—assessed using a translated revised version of the American Pain Society Patient Outcome Questionnaire 6 hours postoperatively and on days 1 and 2—and vomiting events. A clinical follow-up was performed 12 weeks postoperatively to assess adverse events.

Results: The mean age at inclusion was 29 years in both groups. Postoperative pain levels did not differ significantly in most instances. Opioid requirements during the hospitalization in the dexamethasone group were significantly lower than those in the placebo group (31.96 ± 20.56 mg vs 51.43 ± 38 mg; P = .014). Significantly fewer vomiting events were noted in the dexamethasone group (0.15 ± 0.59 vs 0.65 ± 0.91; P = .034). Descriptive data and surgical parameters did not differ significantly.

Conclusion: Perioperative intravenous dexamethasone significantly reduced postoperative opioid consumption by 40% without compromising pain level and safety, as no corticosteroid-related side effects were observed. Dexamethasone may be a valuable adjuvant to a multimodal systemic pain regimen after hip arthroscopy.

BACK

The Effect of Primary ACL Reconstruction on Career Longevity in English Premier League and Championship Soccer Players Compared With Uninjured Controls: A Matched Cohort Analysis

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Background: Because of the multitude of variables that affect the retirement decisions of professional soccer players, it has proven difficult to isolate the effect of undergoing anterior cruciate ligament (ACL) reconstruction (ACLR) on career longevity.

Purpose: To compare the career longevity of professional soccer players after a primary ACLR with that of an uninjured matched control cohort.

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

Methods: A retrospective review of a consecutive series of primary ACLR was performed between 2008 and 2018 in professional male soccer players from the senior author's practice. Each athlete with ACLR was matched to 3 control athletes who had not undergone ACLR according to age, league, playing position, and preinjury game appearances/minutes played. Player career statistics—including league, game appearances, and game minutes—were compiled for each year until retirement or July 1, 2022.

Results: A total of 82 soccer players in the English Premier League or Championship at the time of their primary ACLR were matched to 246 control athletes. The mean career length after ACLR was 6 ± 2.6 years, while that of the matched control athletes was 7.6 ± 2.8 years ($P < .001$). After primary ACLR, an athlete had a 2 times greater chance of retirement compared with the matched control athlete (hazard ratio, 2.19; $P < .001$). At 5 years after ACLR, 16% of athletes had retired from professional soccer, while 8.5% of the matched cohort were retired ($P = .060$). By 10 years, 72% of the ACLR cohort had retired compared with 43% of the matched cohort ($P < .001$). Forwards were more likely to have shortened careers compared with goalkeepers ($P = .021$); however, no significant differences were observed between midfielders, defenders, and forwards. Within the ACLR cohort, a contralateral ACL tear during the athlete's career caused a 2.30 times ($P = .022$) increased chance of retirement compared with athletes with only 1 ACL tear during their career. Mechanism of injury, meniscal pathology, graft rerupture, and chondral lesions did not affect career length.

Conclusion: Professional male soccer players who underwent ACLR had decreased career length by approximately 1.6 years compared with a matched player cohort.

BACK

Reinjury Anxiety and Return to Sport After Anterior Cruciate Ligament Reconstruction: A Cluster Analysis and Prospective Study Among 162 Athletes

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Background: Recent studies have investigated the effect of psychological factors on return to sport (RTS), but none has tested the existence of psychological profiles linked to reinjury anxiety and its links with RTS and reinjury.

Purpose: To assess the effect of different psychological profiles on RTS and reinjury.

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

Methods: The study screened patients who were involved in all types of sports for anterior cruciate ligament (ACL) reconstruction (hamstring and patellar tendon autografts). All participants were included during the RTS phase (90-180 days after ACL reconstruction). Reinjury anxiety, fear of reinjury, kinesiophobia, perceived stress, anxiety, depression, knee confidence, self-esteem, optimism, coping, and pain were measured. Hierarchical cluster analysis (Ward method) and analysis of variance were performed. In the second year after surgery, patients were recontacted by telephone to follow-up. RTS and reinjury were compared by profile type.

Results: A total of 162 athletes were initially included, of whom 123 responded regarding RTS and reinjury. Cluster analysis showed a 4-cluster solution ($\chi 2[21] = 428.59$; $\lambda = .064$; $P < .001$). Profile 1 (27.8%) was characterized by moderate reinjury anxiety and no depression. Profile 2 (22.8%) was characterized by moderate reinjury anxiety and minor anxious-depressive reaction. Profile 3 (30.9%) was characterized by no reinjury anxiety, no depression, and high confidence. Profile 4 (18.5%) was characterized by high anxiety, high depression, and low confidence. Profile 4 had the lowest self-esteem and optimism scores compared with profile 3 ($P < .001$). In addition, a higher percentage of men was found in profile 3 as opposed to profile 4 ($\chi 2[3] = 11.35$; $P < .01$). Profile 4 had the highest rate of non-RTS with 54.2% (profile 1: 14.3%, $P = .001$; profile 2: 25.0%, $P = .031$; profile 3: 22.2%, $P = .011$). Finally, patients with profile 3 had a higher risk of reinjury (13.9%) than those with profile 4 (0%) ($P = .047$), who had an extremely conservative RTS.

Conclusion: The different profiles will affect RTS, but also the risk of reinjury exclusively for profiles 3 and 4. Rehabilitation management will probably require all stakeholders to understand psychological profiles of athletes to develop an on-demand rehabilitation plan.

BACK

Proprioception After Primary Repair of the Anterior Cruciate Ligament

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Background: Primary repair of the anterior cruciate ligament (ACL) has some potential advantages over the reconstruction technique, which include but are not limited to better knee sensation due to preservation of the natural ACL tissue in patients compared with tendon graft. Proprioception is impaired after ACL injuries and the sense of the joint position is lost.

Purpose: The purpose of this study was to compare arthroscopic ACL primary repair and ACL reconstruction techniques clinically and functionally and analyze the differences in proprioception. It was hypothesized that primary repair would restore knee joint proprioception more successfully because the original tissue of the ACL is preserved.

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

Methods: A total of 63 patients (34 underwent reconstruction and 29 underwent primary repair between 2017 and 2020) and 33 healthy controls, as well as the healthy knees of the operated groups, were evaluated between 24 and 48 months (mean, 29 months) postoperatively. Patients with proximal femoral avulsion tears and stump quality suitable for repair underwent primary repair, and those with tears outside these criteria underwent reconstruction using hamstring tendon autograft. Proprioception was evaluated using the active joint position sensation method during weightbearing, with a digital inclinometer used to measure differences between the target and achieved flexion angles of 15°, 30°, and 60°.

Results: At 15° of knee flexion, the deviation angles for the healthy knee of the reconstruction and primary repair groups were significantly smaller than those of the control group ($P < .001$), but there was no statistically significant difference between the groups in terms of deviation angle at 30° and 60° of flexion. The deviation angle of the operated knees was statistically significantly larger in the reconstruction group than in the primary repair group at all angles. The deviation angles at 15°, 30°, and 60° were 2.83°, 2.66°, and 2.66° in the reconstruction group and 1.00°, 1.00°, and 1.33° in the primary repair group, respectively ($P < .001$). There was no statistically significant difference between the reconstruction and primary repair groups in terms of clinical scores.

Conclusion: Primary ACL repair can preserve proprioception in a well-selected patient group. In short-term follow-up, primary repair of the ACL in patients with proximal femoral avulsion tears and stump quality suitable for repair appears to be proprioceptively protective. Future studies are needed to clarify the long-term consequences of primary repair on proprioception in a larger population.

BACK

Knee Biomechanics During Cutting Maneuvers and Secondary ACL Injury Risk: A Prospective Cohort Study of Knee Biomechanics in 756 Female Elite Handball and Soccer Players

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Background: An athlete who returns to sport after an anterior cruciate ligament (ACL) injury has a substantially high risk of sustaining a new secondary ACL injury. Because ACL injuries most frequently occur during cutting maneuvers, such movements should be at the center of research attention.

Purpose: To investigate whether knee biomechanical parameters during side-step cutting maneuvers differ between female elite athletes with and without a history of ACL injury and to evaluate whether such parameters are associated with future secondary ACL injury.

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

Methods: A total of 756 female elite handball and soccer players, of whom 76 had a history of ACL injury, performed a sport-specific cutting task while 3-dimensional kinematics and kinetics were measured. ACL injuries were registered prospectively over an 8-year follow-up period. Seven knee-specific biomechanical variables were the basis for all analyses. Two-way analyses of variance were applied to assess group differences, whereas logistic regression models served to evaluate associations between the knee-specific variables and future secondary ACL injury.

Results: When players with a previous ACL injury performed the cutting maneuver with their ipsilateral leg, they exhibited lower knee abduction angles (mean difference [MD], 1.4°-1.5°; 95% CI, 0.2°-2.9°), lower peak knee flexion moments (MD, 0.33 N·m/kg-1; 95% CI, 0.18-0.48 N·m/kg-1), lower peak knee abduction moments (MD, 0.27 N·m/kg-1; 95% CI, 0.12-0.41 N·m/kg-1), and lower peak knee internal rotation moments (MD, 0.06 N·m/kg-1; 95% CI, 0.01-0.12 N·m/kg-1) compared with injury-free players. When players performed the cut with their contralateral leg, no differences were evident ($P < .05$). None of the 7 knee-specific biomechanical variables was associated with future secondary ACL injury in players with an ACL injury history ($P < .05$).

Conclusion: Approximately 4 years after ACL injury, female elite team-ball athletes still unloaded their ipsilateral knee during cutting maneuvers, yet contralateral knee loading was similar to that of injury-free players. Knee biomechanical characteristics were not associated with future secondary ACL injury.

BACK

Clinical Outcomes of Different Management Techniques for Medial Meniscal Type 3 Ramp Lesions in Anterior Cruciate Ligament Reconstruction: A Comparative Analysis Between All-inside Repair, Suture Hook Repair, and Lesions Left In Situ

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Background: There is ongoing debate about the best way to manage ramp lesions at the time of anterior cruciate ligament (ACL) reconstruction (ACLR). Type 3 lesions are not visible by the transnotch approach without superior debridement, making the management debate even more problematic.

Purpose: The purpose of this study was to evaluate the rate of secondary surgical interventions according to the management method of a type 3 ramp lesion concomitant with primary ACLR. The hypothesis was that the rate of secondary ACL or meniscal interventions would be higher in patients who underwent all-inside repair.

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

Methods: A retrospective analysis of all patients who underwent primary ACLR with a type 3 ramp lesion between January 2012 and May 2020, regardless of the treatment method, was performed. The main criterion analyzed in this cohort was a secondary surgical intervention, defined as revision ACLR or a reintervention of the repaired meniscus. A survivorship analysis was performed to evaluate secondary surgical interventions in 3 groups: all-inside repair, suture hook repair, and left in situ. The following data were collected preoperatively and at the last follow-up: patient characteristics, time to surgery, side-to-side difference in laxity, pivot shift, Lysholm score, subjective International Knee Documentation Committee score, Knee injury and Osteoarthritis Outcome Score, Tegner score, and meniscal repair failure rate.

Results: A total of 113 patients who underwent type 3 ramp lesion repair concomitant with ACLR were included: 52 (46.0%) in the all-inside repair group, 23 (20.4%) in the suture hook repair group, and 38 (33.6%) in the lesion left in situ group. There were 17 patients (15.0%) who underwent a secondary intervention because of ACL graft failure (n = 6) or meniscal repair failure (n = 15 [4 of whom underwent a concomitant ACL reintervention]). Overall, 62 patients (54.9%) underwent combined ACLR and anterolateral ligament reconstruction, while 51 patients (45.1%) underwent isolated ACLR. In the adjusted Cox model, the type of meniscal repair was not statistically significantly associated with secondary surgical interventions. The only risk factor for secondary surgical interventions in this cohort was isolated ACLR (hazard ratio, 8.077; P = .007).

Conclusion: The rates of secondary surgical interventions after medial meniscal type 3 ramp lesion repair concomitant with ACLR were similar regardless of the management method of the meniscal lesion. Despite not being associated with meniscal treatment, this rate was 8 times higher for patients who underwent isolated ACLR in this cohort; this is probably because of the protection that lateral extra-articular procedures provide to the ACL graft.

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Clinical Orthopaedics and Related Research (CORR), Volume 482, Issue 4

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