How to Determine Prognosis After Whiplash

What Factors Have Influence on Persistence of Neck Pain After a Whiplash?

Cobo EP, Mesquida MEP, et al:

Spine 2010; 35 (April 20): E338-E343

Older age, dizziness, and greater initial pain predispose to chronic neck pain after whiplash injury.

**Background:** Whiplash-associated disorder (WAD) is a set of symptoms caused by soft-tissue injury to the neck after an acceleration-deceleration event. It is most commonly associated with a rear-end collision. Symptoms are usually self-limiting, but chronic pain develops in 14% to 50% of individuals and permanent disability in 5% to 12%. Given the large incidence of WAD (3 cases per 1000 subjects per year), this becomes a major public health problem. It is still not clear which patients will develop chronic symptoms after whiplash injury.

**Objective:** To determine factors that will help identify patients at risk of having chronic symptoms and disabilities after WAD.

**Design:** Prospective longitudinal study.

**Methods:** Patients presenting to a single center with complaints of acute neck pain after a whiplash injury were followed up prospectively. During the initial visit, data were collected on sociodemographic variables, medical history, crash-related characteristics, and clinical variables. Patients were seen again in 6 months, and clinical data were again collected. Primary outcome was the visual analog scale (VAS) score at 6 months.

**Results:** 682 patients met the inclusion criteria, and 557 had 6-month follow-up data. All patients had neck pain and presented to the center, on average, 30 days after the accident; 66% of patients were drivers, and 71% were involved in rear-impact collision. On average, all clinical variables including VAS score improved significantly at 6 months. After multivariate analysis, several patient variables were noted to predispose to higher VAS score (poorer outcome), including older age, presence of dizziness, initial higher clinical VAS score, and lower Northwick Park Neck Pain Questionnaire score. Self-employed workers had significantly greater than average improvement in VAS at 6 months.

**Conclusions:** For the most part, the authors' findings were consistent with those in previous studies on WAD. The major limitation noted was lack of information on litigation status, a variable known to influence WAD outcomes.

**Reviewer's Comments:** This was a well-conducted study with a large number of patients. It contributes to the body of knowledge about prognostic factors for chronic WAD. The authors did not mention the fact that, of 682 qualified patients, the 6-month follow-up data were collected on only 82%. This could influence the results of the study, since it is likely that the patients lost to follow-up were primarily those who had satisfactory improvement and did not require further evaluation and treatment. (Reviewer-Vladimir Sinkov, MD).

© 2010, Oakstone Medical Publishing

Keywords: Chronic Whiplash Disorder, Chronic Symptoms

Print Tag: Refer to original journal article
Surgical correction of lumbar stenosis and spondylolisthesis leads to outcomes similar to those of hip and knee replacement.

**Background:** Hip and knee replacements are very effective at restoring patients’ function and quality of life. These procedures currently serve as the "gold standard" of successful orthopaedic intervention. Multiple previous studies have shown similar outcomes after spinal surgeries. None, however, analyzed comparative outcomes of a single procedure for a single disease process in the spine.

**Objective:** To follow patients after lumbar decompression and fusion performed for spinal stenosis and spondylolisthesis, gather outcomes data, and compare results with published data on the normal population and those undergoing hip and knee replacements.

**Design:** Prospective cohort study.

**Participants/Methods:** 105 consecutive patients were diagnosed with single-level spinal stenosis and Grade I or II degenerative spondylolisthesis in the lumbar spine. All patients had neurogenic claudication and failed nonoperative therapy. They also underwent posterior lumbar decompression and posterior lumbar interbody fusion with instrumentation. Patients were followed up for at least 12 months postoperatively. Health-related quality of life was measured using the 12-item Short Form (SF-12), a validated questionnaire that uses scores for a physical component summary (PCS-12) and a mental component summary (MCS-12). The data were then compared to outcomes after total hip and knee replacement surgery using the same questionnaire.

**Results:** 100 patients completed the minimum 12-month follow-up. The mean PCS-12 score improvement was 11 points. The historical average PCS-12 score improvements for total hip and total knee replacements were 11 and 8 points, respectively. Total postoperative PCS-12 scores for all 3 surgeries were approaching age-matched South Australian population norms. The mean MCS-12 scores improved by a mean of 4 points after spinal fusion and did not change significantly in the joint replacement groups. Postoperative MCS-12 scores were close to age-matched South Australian population norms in all groups.

**Conclusions:** Lumbar spine laminectomy and fusion with instrumentation for stenosis and degenerative spondylolisthesis result in significant improvement in health-related quality of life, comparable to that of knee and hip replacements. The authors admitted that they were comparing results of their study with results of trials with different designs and different population demographics, which may have affected the results.

**Reviewer’s Comments:** The authors confirmed previous findings that spinal surgery may be as effective as total knee and hip replacements—gold standards of successful orthopaedic procedures. Their findings are more applicable to real life since a defined surgical procedure was used for a defined diagnosis. In the future, large collaborative studies of comparative effectiveness of different orthopaedic procedures in similar populations would allow for more definitive conclusions. Studies of such magnitude would be very difficult to conduct. Therefore, this remains the best evidence to date that spinal decompression and fusion for lumbar stenosis and spondylolisthesis is effective in significantly improving quality of life. (Reviewer-Vladimir Sinkov, MD).

© 2010, Oakstone Medical Publishing

Keywords: Lumbar Decompression, Fusion, Stenosis, Spondylolisthesis

Print Tag: Refer to original journal article
Degenerative tears of the rotator cuff originate approximately 16 mm posterior to the biceps tendon. That represents the junction of the supraspinatus and infraspinatus tendons.

**Objective:** To determine location and patterns of degenerative rotator cuff tears.

**Design:** Retrospective clinical review.

**Participants/Methods:** 262 patients with unilateral shoulder pain underwent bilateral shoulder ultrasonography to visualize the symptomatic and asymptomatic rotator cuff. Inclusive criteria included a tear in the asymptomatic shoulder and no history of trauma or inflammatory arthritis. Exclusion criteria included previous rotator cuff surgery, torn or dislocated long head of the biceps, and/or a mid-substance cuff tear. The following measurements were made by ultrasound: (1) width of tear; (2) length of tear; (3) distance from biceps tendon to anterior edge of tear; and (4) distance from biceps tendon to posterior edge of tear.

**Results:** 360 shoulders in 233 patients met the criteria to become the study group, with 106 unilateral and 127 bilateral studies. Half the shoulders were symptomatic, and half were asymptomatic. Overall, the mean age was 64.7 years (range, 36 to 90 years), with 98 women and 135 men; 272 shoulders had a full-thickness tear, and 88 had a partial-thickness tear. Overall, the mean cuff tear size was 16.3 mm wide and 17.0 mm long. The 272 full-thickness tears had a mean size of 18.5 mm by 20.1 mm. The 88 partial-thickness tears had a mean size of 9.3 mm by 6.9 mm. Of the 272 full-thickness tears, 82 were classified as small (<10 mm), 136 were medium (10 to <30 mm), 38 were large (30 to <50 mm), and 16 were massive (≥50 mm). For the full-thickness tears, the most common site (88%) was 16 mm posterior to the biceps tendon. A histogram of tear location revealed unimodal distribution of the cuff tear location about the position 16 mm posterior to the biceps tendon. Conversely, only 12% of the full-thickness tears were intact at the 16-mm position. The partial-thickness tears revealed a similar unimodal distribution, with 76% of the tendons involving the position 13 to 15 mm posterior to the biceps tendon.

**Conclusions:** Degenerative rotator cuff tears most commonly begin 13 to 17 mm posterior to the biceps tendon.

**Reviewer’s Comments:** This is an outstanding article that greatly contributes to our understanding of degenerative rotator cuff tears. It challenges conventional teaching that tears begin anterior and propagate posteriorly. This information certainly explains MRI and clinical involvement of the infraspinatus cuff tears. Anatomically, this position 13 to 17 mm posterior to the biceps tendon is the junction of supraspinatus and infraspinatus tendons in the rotator crescent. This is a must-read article for all surgeons treating rotator cuff disease. (Reviewer-John H. Wilckens, MD).

© 2010, Oakstone Medical Publishing

Keywords: Tears, Location, Patterns

Print Tag: Refer to original journal article
Field Surface Makes a Difference in Sports Injuries

Incidence, Mechanisms, and Severity of Game-Related College Football Injuries on FieldTurf Versus Natural Grass: A 3-Year Prospective Study.

Meyers MC:


There are fewer game-related football injuries in collegiate athletes playing on FieldTurf versus grass.

**Objective:** To compare the incidence of football-related injuries sustained on FieldTurf versus natural grass at the collegiate level.

**Design:** Cohort study.

**Methods:** 24 Division I universities over a 3-year period collected information regarding injuries sustained during football games. These universities were part of the Atlantic Coast, Big 12, Big East, Conference USA, Mountain West, Western Athletic Conference, and Pac-10, representing multiple geographic areas. During this period, 465 games were played, with 230 occurring on FieldTurf and 235 on natural grass. Injuries were evaluated for injury category, time of injury, loss time due to injury, injury mechanism and situation, location and grade of injury, type of tissue injured, player position, and environmental conditions. Injuries included any that resulted in lost game time, injuries treated by a full-time certified athletic training staff or physician, and all head and neck injuries. Injuries resulting in 0 to 6 days loss of playing time were regarded minor; 7 to 21 days loss was considered substantial; and >22 days loss of playing time was severe.

**Results:** Overall, there were 1050 injuries (46.6%) on FieldTurf, for an incidence of 45.7. On natural grass, there were 1205 injuries (53.4%), for an incidence of 51.2. Looking at minor injuries, the injury rate for FieldTurf was 38.0 compared to 39.9 for grass. For substantial injuries, the injury rate for FieldTurf was 5.0 versus 7.2 for grass. For severe injuries, the incidence on FieldTurf was 2.7 versus 4.1 for grass. For injuries specific to the head, shoulder, and knees, no significant difference was seen between FieldTurf and grass. There was a significantly lower incidence of injuries on FieldTurf compared to grass for rushing, pass defense, punting, and pile-on situations. There appeared to be no difference in injuries by position for the 2 playing surfaces. When the temperature was ≥70°F, there were significantly fewer injuries on FieldTurf than on natural grass. However, there were more injuries on FieldTurf when the temperature was <70°F.

**Conclusions:** At the collegiate level, FieldTurf is as safe as or safer than natural grass for injuries sustained playing football.

**Reviewer’s Comments:** FieldTurf is much different than the first-generation Astroturf and more duplicates the playing condition of natural grass. It may actually enhance the level of play and allow greater speed, particularly during inclement weather. Despite providing a faster surface, with greater energy for contact, there were actually fewer injuries of all types. This suggests that many football-related injuries may actually occur from contact with the ground and not the opponent. Surprisingly, there were no increased injuries with increased temperature or increased dermatologic-related injuries. These findings are very specific for collegiate-level play. These findings may differ at a lower level of play (high school) or a higher level of play (professional). (Reviewer-John H. Wilckens, MD).

© 2010, Oakstone Medical Publishing

Keywords: Field Surface, Football Injuries

Print Tag: Refer to original journal article
Acute arthroscopic stabilization represents a reasonable treatment recommendation for the first-time shoulder dislocator, particularly in patients <25 years of age who play a contact sport.

Objective: To review the literature and update the information on the treatment of first-time shoulder dislocations.

Design: Review article. Pathology: Glenohumeral dislocations represent the most common large joint dislocation and represent a 1.7% incidence in the general population. In young patients <25 years of age, 97% of patients may have a Bankart lesion, an avulsion of the inferior glenohumeral ligament, and capsulolabral complex. Ten percent of patients may also have a SLAP lesion, and 39% have a Hill-Sachs lesion, usually small after the initial instability episode. The incidence of rotator cuff tears is 29% at <30 years of age but 53% at age ≥30 years. Natural History: The recurrence rate for shoulder dislocations is very high, in particular with young patients (72% to 95%). The incidence decreases to 56% to patients aged 23 to 29 years, 27% for patients aged ≥30 years, and 14% to 22% for those aged ≥50 years. Contact sports and occupations that require overhead arm motion represent additional risk factors for recurrent instability.

Nonsurgical Treatment: Historically, treatment consisted of a closed reduction and sling immobilization in internal rotation for a variable period of 1 to 4 weeks. Some more recent studies have demonstrated improved coaptation of the Bankart lesion in shoulder immobilizer in 30° to 60° of external rotation. Surgical Management: Surgical treatment consists of arthroscopic lavage and arthroscopic or open Bankart repair. Patients who underwent lavage alone had a 73% incidence of recurrent instability. Arthroscopic Bankart repair resulted in a much lower incidence, 5% to 16%. Arthroscopic tack or suture anchor fixation did much better than early transglenoid fixation with fewer complications.

Operative Versus Nonoperative Treatment: 2 recent randomized clinical trials revealed better results of operative over nonoperative treatment in young patients with first-time dislocations (11% to 16% recurrent dislocation vs 47% to 75% recurrent dislocation in those treated nonoperatively). Additionally, surgical patients had higher clinical outcome scores such as the Western Ontario Shoulder Instability index, single assessment numeric evaluation, American Shoulder and Elbow Surgeons, and L’Insalata assessments.

Conclusions: The authors recommend early surgical treatment of a first-time shoulder dislocation, particularly in patients 15 to 25 years of age who play a contact sport.

Reviewer’s Comments: This is a review of the recent literature on first-time shoulder dislocators. The authors point out that recurrent instability episodes can lead to greater glenohumeral damage; this usually occurs in patients over the age of 40 years and has not otherwise been universally reported. Even in skilled surgical hands, the redislocation rate for surgically fixed shoulders that require revision surgery is 10% to 18%. Revision surgery does not carry the same prognosis as the index reconstruction. For in-season dislocation, early surgical intervention will end the athlete’s season; in this case, it is reasonable to treat the patient nonoperatively and operate as needed after the season has ended. Improved immobilization strategies and rehabilitation may improve nonoperative outcomes. (Reviewer-John H. Wilckens, MD).
Examination of the injured anterior cruciate ligament is inaccurate and unreliable.

**Objective:** To evaluate the sensitivity and reliability of examining anterior cruciate ligament (ACL) injuries among different health group providers in a multidisciplinary sports medicine clinic.

**Design:** Retrospective chart review.

**Methods:** Charts of 112 patients with a surgically reconstructed ACL were reviewed. All patients were evaluated in a community-based sports medicine setting. Providers included 5 therapists, 18 family practice surgeons, and 6 orthopaedic surgeons; all providers had training and clinical experience in treating musculoskeletal injuries. Charts were reviewed by the 3 different types of health care providers on the utilization and accuracy of 3 standard clinical examinations for an ACL injury: the Lachman test, anterior drawer test, and pivot shift test. In addition, the times to MRI, visit to the orthopaedic surgeon, and surgery were also collected.

**Results:** As a group, therapists used the Lachman test 64% of the time, the anterior drawer test 55% of the time, and the pivot shift test 18% of the time. Of the evaluations, the Lachman test was confirmed only 27% of the time, the anterior drawer test was confirmed 36% of the time, and the pivot shift test was confirmed 0%. If any test was positive, 46% of these cases were confirmed ACL injuries. For the primary care doctors, 63% used the Lachman test, 34% used the anterior drawer test, and 19% used the pivot shift test; 53% of cases evaluated by the Lachman test had a confirmed ACL injury compared with 33% of cases evaluated with the anterior drawer test and 15% of cases evaluated with the pivot shift test. If any test was positive, 60% of these subjects had an ACL tear. The orthopaedic surgeons utilized the Lachman test 72% of the time, the anterior drawer test 47%, and the pivot shift test 34% of the time; 86% of cases evaluated with the Lachman test had a confirmed ACL versus 39% of those evaluated with the anterior drawer test and 63% with the pivot shift tests. If any test was positive, 87% of these patients had a confirmed ACL injury. The initial visit was performed, on average, 8 days from injury (range, 0 to 61 days). MRI was ordered an average of 161 days after injury (range, 34 to 357 days). Initial orthopaedic assessment was performed on day 277 (range, 0 to 1540 days), and surgery was performed an average of 438 days after injury (range, 22 to 2143 days). On average, it took 4.5 visits by a primary care physician (range, 1 to 11 visits) before referral to an orthopaedic surgeon.

**Conclusions:** Basic clinical examination of an ACL-injured knee is inaccurate and unreliable and can delay definitive surgical treatment.

**Reviewer's Comments:** The anterior drawer test is not a sensitive clinical exam by any provider in the acute setting. The pivot shift test is more reliable only in the hands of orthopaedic surgeons. The Lachman test was the best for diagnosing an ACL injury, but therapists and primary care doctors use only approximately 60% of the evaluation and are not very accurate. The orthopaedic surgeon results best approximate the literatures experience on the accuracy and utility of the Lachman exam. Even in a multidisciplinary sports medicine setting, ACL injuries are difficult to diagnose clinically, with significant delay to diagnosis and treatment.

(Reviewer-John H. Wilckens, MD).

© 2010, Oakstone Medical Publishing

Keywords: ACL Clinical Examination, Accuracy, Reliability

Print Tag: Refer to original journal article
Mallet Finger Injuries -- Which Type of Splint Works Best?

Blinded, Prospective, Randomized Clinical Trial Comparing Volar, Dorsal, and Custom Thermoplastic Splinting in Treatment of Acute Mallet Finger.

Pike J, Mulpuri K, et al:
J Hand Surg Am 2010; 35 (April): 580-588

Dorsal or palmar aluminum and custom thermoplastic splints all have similar outcomes and complication rates in the treatment of mallet finger injuries.

Objective: To compare volar, dorsal, and custom splinting for acute mallet finger injuries.
Design: Prospective, single-incomplete-blinded, randomized clinical trial.
Participants/Methods: 87 patients were identified with a soft-tissue or small avulsion fragment mallet injury that had occurred within 28 days of presentation. Patients with open injuries, arthritis, articular fragments greater than one-third of the articular surface, or distal interphalangeal (DIP) subluxation were excluded. Radiographic extensor lag was compared to the contralateral uninjured same finger to determine the radiographic lag difference. All patients were randomized to receive a padded aluminum dorsal splint, an unpadded aluminum palmar splint, or a custom occupational therapy thermoplastic splint all in slight hyperextension at the DIP joint. Splints were worn full time for 6 weeks. A residual 20 degrees or more of lag at 6 weeks or patient preference allowed an additional 4 weeks of splintage. The primary outcome measure was radiographic lag difference 12 weeks after initiating treatment, and 77 patients were available at that time point.
Results: There was no significant difference between radiographic extensor lag at week 12 between the 3 treatment groups. There were also no differences between groups with regard to Michigan Hand Questionnaire scores or complications. Clinical measurement estimated a greater degree of lag than radiographic measurement during the first 12 weeks of treatment. A moderate correlation was found between increased age and increased lag at the 12-week mark.
Conclusions: All 3 splint options provided statistically similar radiographic extensor lag at 12 weeks after initiation of treatment for soft-tissue or small avulsion fragment mallet injuries.
Reviewer's Comments: This is a relatively well-executed effort to study splint options for mallet finger injuries. The obvious strengths are its prospective, randomized, comparative design with an attempt to blind the evaluators to treatment type as best as possible. Weaknesses include no specific effort to ensure, or document, splint compliance, which the authors acknowledge. A post hoc power analysis suggested that the study may have been underpowered to detect a clinically significant improvement in extensor lag with the custom splint, based on the observed results. In the end, current evidence suggests that all 3 of these most commonly used splint options are acceptable for the treatment of soft-tissue or small avulsion fragment mallet injuries. (Reviewer-Kenneth R. Means, Jr, MD).

© 2010, Oakstone Medical Publishing

Keywords: Mallet Finger, Thermoplastic Splinting

Print Tag: Refer to original journal article
In patients with diffuse anterior knee pain, clinical findings do not accurately predict chondromalacia patellae. MRI had a diagnostic accuracy of 73%. The sensitivity of MRI is higher in higher grades of chondromalacia.

**Background:** No clinical test to date has been shown too specific for chondromalacia patellae. The accuracy of MRI for chondromalacia patellae has varied with studies.

**Objective:** (1) To evaluate the relationship between chondromalacia patellae and clinical systems of anterior knee pain; and (2) to examine the reliability of 1.0T MRI for chondromalacia patellae compared with arthroscopy.

**Design:** Diagnostic study; level of evidence, I.

**Participants/Methods:** 56 military recruits with anterior knee pain who underwent arthroscopy were followed up in this study. Patients underwent evaluation with standard clinical tests and radiographs. Patients initially underwent nonoperative treatment, consisting of rest and nonsteroidal anti-inflammatory agents. If they had continued pain, they underwent a course of physical therapy. The patients who failed these modalities underwent arthroscopic evaluation and treatment of additional pathology. All patients underwent an MRI, usually the day before surgery. MRIs were evaluated for chondromalacia using a 5-grade scale. The arthroscopies were performed by an orthopaedic surgeon blinded to the MRIs to evaluate chondromalacia and other pathologies.

**Results:** 54 men and 2 women (median age, 19.5 years) were included in the study. All patients were diagnosed with anterior knee pain clinically. Twenty patients (36%) were seen to have chondromalacia patellae on MRI. Twenty-five patients (45%) were diagnosed with chondromalacia patellae at arthroscopy. Of the 25 knees with arthroscopically diagnosed chondromalacia, 8 were grade I lesions, 9 were grade II lesions, and 8 were grade III lesions. There were no grade IV lesions. The sensitivity of detecting chondromalacia patellae on MRI was 60%, and the specificity was 84%. The positive predictive value for MRI in predicting chondromalacia patellae was 75%, while the negative predictive value was 72%. The diagnostic accuracy was 73%. For grade I lesions, MRI had a sensitivity of 13%. It was increased for higher-grade lesions. Additional findings at arthroscopy included a synovial plica in 25 patients (45%), a meniscal tear in 4 patients (7%), and a tibiofemoral chondral lesion in 4 (7%). Six patients (11%) had normal anatomy.

**Conclusions:** Clinical findings in diffuse anterior knee pain do not accurately predict chondromalacia patellae. MRI had a diagnostic accuracy of 73%. The sensitivity of MRI was increased in higher grades of chondromalacia.

**Reviewer's Comments:** This article shows that diffuse anterior knee pain presents a diagnostic dilemma. Clinical symptoms of diffuse anterior knee pain do not seem to indicate definite patello-femoral structural pathology. MRI is more accurate, but there are still limitations. The use of an MRI with higher strength, for example 1.5T, may have increased the accuracy in assessing chondromalacia patellae. It is interesting that no grade IV lesions were seen. This may represent a form of selection bias that would negatively skew the accuracy of the clinical examination. (Reviewer-Nathaniel P. Cohen, MD).

© 2010, Oakstone Medical Publishing

Keywords: Patello-Femoral Pain Syndrome, MRI, Chondromalacia Patellae

Print Tag: Refer to original journal article
Femur Fractures in Adolescents: A Comparison of Four Methods of Fixation.
Ramsier LE, Janicki JA, Narayanan UG:


Union takes longer after external fixator treatment of femur fractures in adolescents.

**Objective:** To compare results and complications of 4 fixation methods of adolescent femoral fractures and determine factors related to the complications.

**Participants/Methods:** Adolescents (age range, 11 to 18 years) treated at the Hospital for Sick Children in Toronto between 1995 and 2005 were studied. Patients were included if they had follow-up to union. There were 194 fractures in 189 children that met these criteria. The patients were followed for a mean of 15 months; their mean age was 13.4 years and their mean weight was 49 kg. More than 50% of the patients suffered high energy trauma. There were 13 open fractures. Fixation was according to surgeon choice; 105 fractures were fixed with flexible nails, 37 with rigid intramedullary nails, 33 with external fixation, and 19 with plating, either compression or bridge. The patients who were fixed with rigid nails were significantly older and heavier than those fixed by other methods. The external fixation group had a significantly higher proportion of spiral fractures and of open fractures.

**Results:** The mean length of hospital stay was 5 days and the mean time to union was 12 weeks. The time to union was significantly higher in those treated with external fixation (mean, 16 weeks). In multivariate analysis, treatment with an external fixator had a significantly greater risk of loss of reduction, with an odds ratio of 12 times, even after adjusting for the number of open fractures. No significantly different rate of loss of reduction between rigid and elastic nail treatment was found. There was a 14% rate of reoperation overall, led by 52% in the external fixation group and 8% in the elastic nail group. A rigid nail had the lowest rate of reoperation.

**Conclusions:** Union takes longer after external fixation of femoral fractures in adolescents, even after adjusting for other factors, and also has a significantly higher complication rate when compared with the other 3 methods of fixation. Body weight was not significantly associated with an increased risk of complications, as had been hypothesized. The use of rigid intramedullary nails is associated with a very low rate of complications. The authors feel that a prospective randomized trial may be better able to determine the relative risks of each treatment. They also found that elastic nails performed as well as other fixation methods.

**Reviewer's Comments:** This article proves growth-changing weight and fracture characteristics prevent 1 method of fixation of femur fractures from being clearly better in adolescents. The external fixator seemed to perform less well than the other methods, even when adjusting for the greater incidence of open fractures in this group. The authors make a case that flexible nails can be appropriately used in this age group, even though it has some pitfalls. On the basis of raw data, the rigid intramedullary nails had the best results. Femur fractures in children and adolescents are treated by a number of different methods. These have varied over the years. They also vary with age. The adolescent age group, in particular is confounded by the risk of avascular necrosis in piriformis nailing. Because variability may contribute to poorer outcomes, the study of outcomes is useful. (Reviewer-Paul D. Sponseller, MS, MD).

© 2010, Oakstone Medical Publishing

**Keywords:** Femur Fractures, Adolescents, Fixation

**Print Tag:** Refer to original journal article
Knowledge of costs involved in patient care can help lead to cost-reduction strategies.

**Objective:** To determine the main drivers of costs in treating adolescent idiopathic scoliosis. The authors theorized that there were demographic and surgical factors that correlated with costs.

**Methods:** The charts of 125 patients who underwent surgery for treatment of adolescent idiopathic scoliosis were retrospectively reviewed. Costs and charges were obtained.

**Results:** Data on 125 patients (mean age at time of surgery, 15 years) were included in this study. The average preoperative thoracic curve measure was 50°, and the mean lumbar curve measure was 41°. Within the group, 101 patients had a posterior approach, 14 had an anterior approach, and 10 had a combined approach. Three patients required readmission later. All patients had autograft, and most also had allograft; all had spinal cord monitoring intraoperatively. Posteriorly, patients had a mean of 10 levels fused and anteriorly, they had a mean of 6 levels fused. For patients fused with pedicle screws, there were a mean of 15 screws used per case. The mean blood loss was 1125 cc, and the mean hospital stay was 4.6 days. The mean charge was $73,000, cost was $32,000, and reimbursement was $39,000. Hospitals were reimbursed 54% of charges and 120% of costs. For rehospitalizations, reimbursements were 93% of costs. The main determinants of the costs were implant (29%), hospital room and ICU costs (22%), operating room charges (10%), and bone graft (9%). The hospital was reimbursed 53% of charges and 120% of costs. The surgical approach, number of levels fused, and number of pedicle screws used were independently correlated with the costs. Anterior and anteroposterior procedures had the highest costs. The costs varied with Lenke type, being least for Lenke 1 (single thoracic) at $29,000 and greatest for Lenke 4 (triple major) at $60,000. Lenke 1 was also the most common, accounting for 50% of the cases. Average figures for specific costs were: implants, $9900; bone graft, $2100; neuromonitoring, $1014; and cell saver, $1300. Mean curve at postoperative follow-up was 14°.

**Conclusions:** This article shows how various inputs combine to produce impressive cost figures over a short period of time. The methodology did not capture surgeon and anesthesiology charges, which would increase the figures by at least 30%. Knowledge of these figures can help lead to cost-reduction strategies. The article also shows that the hospital lost money on treating complications, which helps to align their incentives with avoiding or preventing complications.

**Reviewer's Comments:** It was interesting to see how much everything costs in the process of providing surgical care. Many of the things done here are done differently at each institution. For instance, at some hospitals, idiopathic scoliosis patients do not routinely go to ICU. As difficult as it is to quantify costs, it will be even more difficult to quantify patient benefit, as that will play out over the rest of their lifetime. (Reviewer-Paul D. Sponseller, MS, MD).

© 2010, Oakstone Medical Publishing

**Keywords:** Scoliosis, Adolescents, Correction Surgery, Cost Analysis

**Print Tag:** Refer to original journal article
How Safe, Effective Is rhBMP-2 in Children?

Complications Associated With the Use of Bone Morphogenetic Protein in Pediatric Patients.

Oetgen ME, Richards BS:

J Pediatr Orthop 2010; 30 (March): 192-198

The Food and Drug Administration has issued a warning against the use of recombinant human bone morphogenetic protein-2 in anterior cervical fusions.

Objective: To review results of the use of recombinant human bone morphogenetic protein-2 (rhBMP-2) at 1 institution in children <18 years of age to determine if there were any complications associated with its use.

Design: Retrospective clinical review; level IV therapeutic study.

Methods: All pediatric cases who received rhBMP-2 between April 2001 and December 2008 were retrospectively reviewed. A list of known complications was compiled by literature review of previous clinical trials of BMP and BMP review articles. Medical records were reviewed to collect baseline demographic, operative, and postoperative data.

Results: 81 patients who had rhBMP-2 treatment at a mean age of 11.3 years were included. The most common indication was anterior or posterior spinal fusion, mostly revision procedures or complex cases (eg, congenital anomalies). The second most common location for its use was the tibia, especially congenital pseudarthrosis of the tibia. The authors have published on this topic separately. Other indications were cervical fusion for deformity in the case of syndromes. Simple bone cyst of the femur was treated with this. There were 9 operative site problems. Complications were equally prevalent in the skeletally immature and the skeletally mature. Only 1 was felt to possibly be due to rhBMP-2. This was a case of progressive dural fibrosis that began 3 months after anterior and posterior application of rhBMP-2 to treat a defect after vertebral column resection. MRI revealed abundant dural fibrosis relieved with repeat decompression. The authors postulated that rhBMP-2 incited an inflammatory reaction. The other cases were felt to be unrelated to the rhBMP-2. No cases of excessive bone formation or stenosis, and no systemic organ complications were noted.

Conclusions: BMP use in the children in this series demonstrated only 1 complication that could be attributed to the substance: the case of epidural fibrosis when used both anteriorly and posteriorly. The authors also note that there have been several reports of inflammation and swallowing difficulty when rhBMP-2 was used in anterior cervical fusions, and the Food and Drug Administration (FDA) has issued a warning against this use. The authors recommend discussing the off-label use of rhBMP if its use is contemplated in skeletally immature patients and avoidance of its use when it could potentially come in contact with the dura.

Reviewer's Comments: This study did not address the efficacy of BMP. The article nicely illustrates the fine line in approval of new drugs and devices. BMP cannot be listed as approved for children, simply based on the age of patients in existing studies (all adults). Recombinant human BMP possesses osteoinductive properties. It is approved by the FDA for patients >18 for the use of single level anterior lumbar fusions, open tibia fractures, and maxillofacial defects. There are 2 versions of this product. It is contraindicated in pregnant women and patients with malignancy or active infection. Pediatric patients have been relatively excluded from potential benefits because the conditions are too rare to be studied readily in a classic FDA trial. Nevertheless, if clinically indicated, it can be used when properly considered and discussed with the family. Mechanisms to more formally study the safety and efficacy of this product in children need to be discussed. (Reviewer-Paul D. Sponseller, MS, MD).

© 2010, Oakstone Medical Publishing

Keywords: Pediatric Patients, rhBMP-2, Complications

Print Tag: Refer to original journal article
Anterolateral ankle impingement syndrome is seen in teens following ankles sprains, and conservative treatment does not appear to help.

**Objective:** To compare the results of conservative therapy with operative therapy for anterolateral ankle impingement in adolescents. The authors’ hypothesis is that conservative therapy is not very effective.

**Methods:** All patients with impingement over an 8-year period at the authors’ institution were studied. The authors made this diagnosis if there was chronic ankle pain anterolaterally as well as pain with forced dorsiflexion. It was mostly a clinical diagnosis, but MRI findings were sometimes seen, including scar tissue with adjacent edema in the talar neck, hypertrophic anterior tibiofibular ligament (ATFL). Treatment included rest and physical therapy for at least 6 weeks, working on strength, range of motion, and proprioception. Nonsteroidal anti-inflammatory agents were also used. The American Orthopedic Foot and Ankle Society (AOFAS) hindfoot and ankle score was determined before and after physical therapy and after surgical treatment.

**Results:** There were 13 patients in this series over the 8-year period; their mean age was 15 years (range, 12 to 18 years). Eleven patients were females and 2 were males. The mean time for undergoing conservative treatment was 7 months. No patient had successful relief of symptoms with conservative treatment, and all underwent arthroscopy for further treatment. Findings included synovitis and scar tissue in 11 ankles, a meniscoid lesion anterolaterally in 1 ankle, and hypertrophic ATFL in 1 ankle; there was 1 case of osteophyte formation. The mean AOFAS score was 68.4 at initial diagnosis, 68.2 after physical therapy, and 90 after surgery. Mean time to return to activity was 2.5 months after arthroscopy. Three complications occurred postoperatively, including 2 neuromas and 1 complex regional pain syndrome (also known as reflex sympathetic dystrophy). One patient had chondral damage and progression of symptoms, requiring cartilage restoration surgery. However, all patients were improved at final follow-up after necessary revision procedures.

**Conclusions:** Anterolateral ankle impingement syndrome is seen in teenagers after ankle sprains. It is primarily a clinical diagnosis. Females are more often affected by this syndrome than males. Conservative treatment did not seem to be of any help in this patient population. Arthroscopy of the ankle had a high complication rate in this population, but the end results were satisfactory.

**Reviewer’s Comments:** This article draws attention to a phenomenon that may sometimes be overlooked. I question whether the authors were able to accurately identify all cases that did not come to surgery. Nevertheless, the diagnosis should be kept in mind if caring for teen athletes. I wish there were more objective findings on MRI to support the diagnosis. The preponderance of females is noteworthy. The frequency of neuroma formation and reflex sympathetic dystrophy is sobering. (Reviewer—Paul D. Sponseller, MS, MD).

© 2010, Oakstone Medical Publishing
Age is a confounding factor, but it is not a predictive factor, of anatomical and functional outcomes following rotator cuff repair.

**Background:** The effect that patient age has on the outcomes following rotator cuff repair surgery is unclear.

**Objective:** (1) To define the characteristics of rotator cuff tears according to patient age; (2) to analyze whether age affects repair integrity; and (3) to evaluate the correlation between age and functional outcomes following rotator cuff repair.

**Design:** Retrospective database review.

**Participants/Methods:** 177 patients (81 males, 96 females; mean age, 60 years) who had full-thickness cuff tears and underwent primary rotator cuff repair at 1 institution from 2004 to 2007 were included in the study. All patients underwent a thorough preoperative physical examination and MRI. Either arthroscopically assisted mini-open or all-arthroscopic rotator cuff repairs were performed using either single-row or double-row techniques by a single surgeon. At least 1 year postoperatively, all patients underwent an imaging evaluation in the form of a CT arthrogram, as well as an assessment of functional outcome. Functional outcomes were assessed by visual analog scales for pain and patient satisfaction, the Constant score, the Simple Shoulder Test (SST), the American Shoulder and Elbow Surgeons (ASES) score, and the University of California, Los Angeles (UCLA) score. Univariate and multivariate regression analysis was used to correlate patient age with functional results.

**Results:** Mean final follow-up was 29.0 months (range, 12 to 55 months). On CT arthrogram, 55 patients (31.1%) sustained a retear, whereas 122 patients (68.9%) had an intact cuff. The mean age of the patients in the retear group was significantly higher than that of the patients with intact repairs (63.7 vs 58.4 years; \( P < 0.001 \)). Neither repair technique (mini-open vs arthroscopic) nor row of fixation (single versus double) affected the integrity of the cuff repair (\( P < 0.05 \)). The univariate regression analysis revealed no significant relation between age and the final functional outcomes (\( P > 0.05 \)) except for the Constant score. The Constant score positively correlated with patient age (\( P = 0.009 \)); an increment of 0.313 points could be expected according to each additional year of patient age. According to the multivariate regression analysis, age was not an independent variable that accounted for any functional differences; age was merely a confounding factor of the outcomes.

**Conclusions:** Although increasing patient age is associated with a higher retear rate, the Constant score improves more in older patients than in younger patients. Age is a confounding factor, but it is not a predictive factor of anatomical and functional outcomes following rotator cuff repair.

**Reviewer's Comments:** This study is limited by the heterogeneity of the repair techniques used and by its retrospective nature. Despite these limitations, the study suggests that advanced age is a confounding variable, but not a predictor, of poor outcome and should not be a contraindication to surgery. (Reviewer-Adam J. Farber, MD).

© 2010, Oakstone Medical Publishing

Keywords: Age, Rotator Cuff Tear Repair, Anatomical Outcome, Functional Outcome

Print Tag: Refer to original journal article
Use Reconstruction for Lateral-Sided Multiligament Knee Injuries

Repair Versus Reconstruction of the Fibular Collateral Ligament and Posterolateral Corner in the Multiligament-Injured Knee.

Levy BA, Dajani KA, et al:


In the setting of a lateral-sided multiligament knee injury, there is a significantly higher failure rate for lateral-sided repair compared with reconstruction.

**Background:** Controversy exists on whether or not to repair or reconstruct the collateral ligaments in the setting of a multiligament-injured knee.

**Objective:** To compare outcomes in patients with lateral-sided multiligament-injured knees who underwent single-stage reconstruction of all injured ligaments versus those who underwent staged repair of the fibular collateral ligament (FCL) and posterolateral corner (PLC) followed by delayed cruciate ligament reconstructions.

**Participants/Methods:** Using a prospective database, patients (n=28) with lateral-sided multiligament knee injuries treated by a single surgeon from 2004 to 2007 were identified. During the first 16 months, 10 patients underwent repair of medial- and lateral-sided injuries, followed by staged delayed cruciate ligament reconstructions. In the latter portion of the study, 18 patients underwent single-stage reconstruction of all injured ligament including the FCL/PLC. A single surgeon performed all procedures in this series. Anterior cruciate ligament and posterior cruciate ligament reconstructions were performed with tibialis anterior and Achilles tendon allografts, respectively. Medial collateral ligament (MCL) and posteromedial corner (PMC) repairs were performed with suture anchors; MCL and PMC reconstructions were performed with autograft hamstring tendons. PLC and FCL repairs were performed with suture anchors; PLC and FCL reconstruction was performed using Achilles tendon with a bone block. All patients had a minimum of 2 years of postoperative follow-up. Outcomes measures included the International Knee Documentation Committee (IKDC) subjective scores and Lysholm scores. Failure of the FCL/PLC repairs and reconstructions was defined as clinical instability (1+ or greater laxity to varus stress in full extension and/or 3+ laxity to varus stress at 30° of flexion) or functional instability requiring revision reconstruction.

**Results:** 5 patients required revision surgery for failure of the FCL/PLC structures. There were 4 failures (40%) in the repair group versus 1 failure (6%) in the reconstruction group \((P=0.04)\). Average range of motion at final follow-up was 130° in the repair group versus 115° in the reconstruction group \((P=0.11)\). The mean IKDC subjective score at final follow-up was 79 in the repair group versus 77 in the reconstruction group \((P=0.92)\). The mean Lysholm score was 85 in the repair group versus 88 in the reconstruction group \((P=0.92)\). One patient from the repair group (10%) and 2 patients from the reconstruction group (11%) required manipulations under anesthesia due to stiffness.

**Conclusions:** This series suggests that in the setting of a lateral-sided multiligament knee injury, there is a significantly higher rate of failure for lateral-sided repair compared with reconstruction.

**Reviewer’s Comments:** The main limitation of this study is that in addition to comparing repair versus reconstruction, the authors also compared single-stage versus 2-stage surgery. Future studies that separate these variables may be useful in clarifying the optimal treatment approach for multiligament-injured knees (Reviewer-Adam J. Farber, MD).

© 2010, Oakstone Medical Publishing

Keywords: Knee Dislocation, Fibular Collateral Ligament, Posterolateral Corner, Multiligament Reconstruction

Print Tag: Refer to original journal article
When drilling a guide pin to mark the center of the tibial tunnel during ACL reconstruction, a 3.0-mm guide pin is more accurate than a 2.4-mm guide pin.

**Background:** Accurate tunnel placement is extremely important when performing anterior cruciate ligament (ACL) reconstruction.

**Objective:** To evaluate the accuracy of 2 different sized guide pins (2.4 vs 3.0 mm) used to mark the center of the tibial tunnel during ACL reconstruction and to attempt to assess the precision of estimating the center of the ACL tibial footprint during arthroscopic visualization.

**Design:** Cadaveric anatomic study.

**Methods:** 5 matched pairs of cadaveric knees were utilized in this study. Specimens were disarticulated, but care was taken to ensure that a portion of the ACL footprint remained on the tibial plateau. Using the ACL stump as a guide, the true center of the tibial footprint was recorded using a MicroScribe digitizer. While viewing using an arthroscope, a surgeon attempted to estimate the center of the ACL tibial footprint; this was marked and digitally recorded. Finally, using arthroscopic techniques, the surgeon attempted to drill a guide pin into the spot marked in the center of the tibial ACL footprint. Only 1 attempt was made to drill the guide pin. Two different pin sizes, a 2.4-mm guide pin and a 3.0-mm guide pin, were utilized; 1 guide pin of each size was drilled into 1 knee of each matched pair. The distance between the actual guide pin and the marked spot was measured and used to determine drilling accuracy.

**Results:** The guide pin was inserted at a mean distance of 2.87 ± 1.19 mm from the intended target when the 3.0-mm guide pin was used; however, when the 2.4-mm guide pin was used, the guide pin was at a mean distance of 6.98 ± 1.29 mm from the intended target (P =0.005). The surgeon's estimation of the anatomic center of the ACL tibial footprint was a mean distance of 3.32 ± 2.10 mm from the true anatomic center of the ACL footprint. The surgeon erred posteriorly in all 10 specimens.

**Conclusions:** When drilling a guide pin to mark the center of the tibial tunnel during ACL reconstruction, a 3.0-mm guide pin is more accurate than a 2.4-mm guide pin.

**Reviewer's Comments:** The author speculates that the 3.0-mm pin is more accurate because it is thicker, stiffer, and thus less prone to bending. Based upon this study, I think I will begin to use a 3.0-mm guide pin for the tibial tunnel during my ACL reconstructions. It is also interesting to note that the surgeon consistently estimated the center of the tibial footprint to be more posterior than it was in reality. It is useful to keep this in mind during ACL reconstruction surgery. (Reviewer-Adam J. Farber, MD).

© 2010, Oakstone Medical Publishing

Keywords: ACL Reconstruction, Guide Pin, Accuracy, Tibial Footprint

Print Tag: Refer to original journal article
Age Does Not Affect Results of Allograft BPTB ACL Reconstruction

Anterior Cruciate Ligament Reconstruction Using Patellar Tendon Allograft: An Age-Dependent Outcome Evaluation.

Barber FA, Aziz-Jacobo J, Oro FB:

Arthroscopy 2010; 26 (April): 488-493

When allograft bone-patellar tendon-bone tissue is used to perform primary anterior cruciate ligament reconstruction, there is no difference in terms of laxity or subjective results in patients aged ≥40 years versus those <40 years old.

Background: When performing anterior cruciate ligament (ACL) reconstructions, many surgeons prefer to use autograft tissues in younger patients and allograft tissues in older patients. It is unclear whether this decision-making algorithm is justified.

Objective: To compare the outcomes of primary ACL reconstructions performed using allograft bone–patellar tendon–bone (BPTB) tissue in patients aged ≥40 or <40 years.

Methods: 32 consecutive patients (21 men and 11 women; mean age, 35 years; age range, 18 to 55 years) who underwent primary ACL reconstruction with BPTB allograft tissue from 2002 to 2005 and had a minimum of 2-year postoperative follow-up were included in this study. The decision to proceed with allograft tissue was made by the patient. All patients underwent surgery performed by a single surgeon. Graft fixation was accomplished with biodegradable interference screws in both the femoral and tibial tunnels. All patients underwent a standardized postoperative rehabilitation protocol and both preoperative and postoperative evaluation. Outcome measures included validated scoring systems (Cincinnati, Lysholm, Tegner scores, and International Knee Documentation Committee [IKDC] activity scores) as well as assessment of knee stability (Lachman test, pivot-shift test, and KT arthrometer measurements). For outcome analysis, patients were divided into 2 groups based on age: those ≥40 years (n=11; mean age, 46 years) and those <40 years (n=21; mean age, 31 years).

Results: Mean final follow-up was 35 months (range, 24 to 58 months). All patients in both groups experienced statistically significant increases in the Cincinnati score, Tegner score, Lysholm score, and IKDC activity score (P <0.05 for all). There were no statistically significant difference is in the mean postoperative Cincinnati score, Tegner score, Lysholm score, or IKDC activity score between the patients ≥40 versus those <40 (P >0.05 for all). In addition no patient in either cohort had a positive pivot shift test. Arthrometer evaluations revealed that with maximum manual stress, the side-to-side difference was <3 mm in all but 1 patient in each group; the mean side-to-side difference was 1.4 mm in the older cohort versus 1.3 mm in the younger cohort.

Conclusions: When allograft BPTB tissue is used to perform primary ACL reconstruction, there is no difference in terms of laxity or subjective results in patients aged ≥40 years versus those aged <40.

Reviewer's Comments: This study suggests that, in the setting of primary ACL reconstruction surgery, if allograft BPTB tissue is used, patients can expect consistent results regardless of age. The study is limited by the small number of patients included, the relatively short-term follow-up, and the fact that patients chose the allograft tissue. (Reviewer-Adam J. Farber, MD).

© 2010, Oakstone Medical Publishing

Keywords: ACL Reconstruction, Allograft, Bone-Patellar, Tendon-Bone, Age Laxity, Outcome

Print Tag: Refer to original journal article
In the setting of hip fractures in elderly patients, patients in American Society of Anesthesiologists (ASA) class 3 or 4 have a significantly higher rate of medical complications than patients in lower ASA classes.

**Background:** The American Society of Anesthesiologists (ASA) classification system is commonly used to assess the general health of patients. The ASA class is rated 1 to 5: 1 is a normal healthy patient; 2 is a patient with mild systemic disease; 3 is a patient with a serious, systemic disease; 4 is a patient with a life-threatening, incapacitating systemic disease; and 5 is a moribund patient, with death expected in <1 day.

**Objective:** To determine if preoperative ASA class is predictive of postoperative medical or surgical complications in elderly patients undergoing surgery for hip fracture.

**Design:** Retrospective chart review. **Methods:** 197 patients >60 years (72 men, 127 women; mean age, 79.6 years) who underwent surgical treatment of a hip fracture from 2004 to 2008 in 1 health-care system were included in this study. The preoperative ASA class was obtained via chart review; postoperative complications, both medical and surgical, were also determined by chart review. Using statistical methods, the rate of complications was determined as a function of ASA class.

**Results:** The ASA class had no correlation with the rate of surgical complications. However, the rate of medical complications correlated significantly with ASA class. Patients in ASA class 2 or below had no increased risk of medical complications, but patients in ASA class 3 or 4 had significantly higher medical complication rates ($P<0.05$ for both). When compared to patients in ASA class 2, the risk of having a medical complication was 3.78 times greater in patients in ASA class 3 ($P<0.001$) and 7.39 times greater in patients in ASA class 4 ($P=0.001$). The rate of medical complications was similar in both ASA classes 3 and 4 ($P>0.05$). The rate of medical complications was unaffected by the surgical procedure performed (prosthetic replacement vs fracture fixation; $P=0.255$).

**Conclusions:** The ASA class of a patient is highly predictive of the risk of medical complications following hip fracture surgery. Patients in ASA class 3 or 4 have a significantly higher rate of medical complications than patients in lower ASA classes.

**Reviewer's Comments:** This study is limited by its retrospective nature, and the fact that it may be underpowered. Despite these limitations, the study reinforces what previous studies have shown us; patients with more preoperative comorbidities are at greater risk for postoperative medical complications. The authors suggest that patients in ASA class 3 or 4 be monitored carefully by a medical service. (Reviewer-Adam J. Farber, MD).

© 2010, Oakstone Medical Publishing

Keywords: Hip Fracture, Comorbidity, Complications

Print Tag: Refer to original journal article
Undue tension on medial row anchors of a suture bridge rotator cuff repair may lead to failure at the musculotendinous junction.

**Background:** Retear, after surgical repair of a rotator cuff (RTC) tear, can compromise outcomes. A suture bridge technique has been popularized in an attempt to maximize healing at the tendon footprint interface.

**Objective:** To evaluate retear patterns in cases with structural failure after arthroscopic primary repairs of RTC tears with the use of MRI as an imaging modality, to compare the patterns between a single-row technique and a transosseous-equivalent (suture bridge) technique, and to analyze the factors affecting the retear patterns of arthroscopically repaired rotator cuff tears.

**Design:** Retrospective cohort study.

**Participants/Methods:** Consecutive patients who underwent repair of a full-thickness RTC tear at a single institution were included. A single-row technique had been performed in 84 cases and suture bridge technique in 96 cases. All patients had a routine follow-up MRI at least 6 months after surgery. Nineteen of 84 cases (22.6%) in the single-row technique group and 27 of 96 cases (28.1%) in the suture bridge technique group had retears. Therefore, a total of 46 cases that revealed retear on the MRI were enrolled for this study.

Preoperative and postoperative subjective pain scores were measured with the visual analog scale (VAS).

**Results:** The subjective pain score (VAS) improved significantly to a similar level for both groups both at rest and during motion. Both groups reported similar statistically significant improvement in clinical assessments. Compared with preoperative measurements, both groups had no significant differences in all motions and strength measurements at the last follow-up. Retears in the single-row repair group tended to fail at the tendon-tuberosity interface, while those in the suture bridge group tended to fail at the musculotendinous junction. In addition, increased fatty degeneration or muscle atrophy in the suture bridge group increased the chance of failure at the tendon-tuberosity interface. **Conclusion:** A suture bridge technique tended to better preserve the cuff tissue repaired to the insertion site of the RTC than a single-row did, but nonetheless, the retear in cases with a suture bridge technique were mainly observed at the musculotendinous junction.

**Reviewer's Comments:** The authors highlight a developing understanding of the difference in failure patterns between single-row and suture bridge RTC repairs. The tendency to fail at the musculotendinous junction in suture bridge repairs may be due to undue tension placed at this site when using this technique, suture passing instruments that penetrate the tissue at this level, as well as the native weakness of this tissue. It is important to keep these factors in mind when performing this procedure as re-repairs at the musculotendinous junction may be more difficult than at the tendon edge. (Reviewer-Carl H. Wierks, MD).

© 2010, Oakstone Medical Publishing

**Keywords:** Suture Bridge, Double Row, Retear

**Print Tag:** Refer to original journal article
Microfracture of the Shoulder Is Gaining Acceptance as Tx Modality

Clinical Outcomes After Microfracture of the Glenohumeral Joint.
Frank RM, Van Thiel GS, et al:

In cases of symptomatic articular defects of the glenohumeral joint, pain, function, and range of motion gains are seen after microfracture of the shoulder.

**Background:** Chondral lesions of the glenohumeral joint can be a source of shoulder pain. The treatment options for chondral defects of the shoulder remain poorly defined. Microfracture has been established as an effective therapeutic solution for full-thickness cartilage defects of the knee but has not been well studied in the shoulder.

**Objective:** To report the short-term clinical outcomes of microfracture for symptomatic articular defects of the glenohumeral joint.

**Design:** Retrospective cohort study.

**Methods:** Charts of patients who underwent arthroscopic microfracture of the glenohumeral joint by 1 of 4 shoulder surgeons at a single institution were reviewed. Follow-up was at least 1 year. Patients were excluded if they had concomitant labral or rotator cuff repair. Sixteen patients (17 shoulders) were included. At the follow-up evaluation, each patient completed shoulder surveys including the Simple Shoulder Test (SST), American Shoulder and Elbow Score (ASES), visual analog score (VAS), and the University of California–Los Angeles Shoulder Scale. Of the eligible patients, 13 patients completed the written surveys; however, only 8 patients were available for clinical evaluation. Shoulder examination included active and passive range of motion and shoulder muscle strength testing with an Isobex (Cursor, Bern, Switzerland) device. The average time to follow-up was 27.8 months (range, 12.1 months to 7.4 years).

**Results:** Of the 15 shoulders, microfracture was performed on the humeral head in 9 cases (60.0%), on the glenoid surface in 5 cases (33.3%), and on both surfaces in 1 case (6.7%). The average size of humeral defects was 5.07 cm² (range, 1.0 to 7.84 cm²), while that of glenoid defects was 1.66 cm². VAS, ASES, and SST scores improved significantly ($P < 0.05$). Twelve of the 13 patients (92%) claimed that they would repeat the surgery. Significant gains were seen in shoulder abduction and external rotation. A trend toward increased forward flexion was seen. Four patients had an isolated microfracture procedure. In these patients, scores on the VAS, SST and ASES all improved. Two patients required subsequent resurfacing or replacement shoulder surgery. The time between the microfracture and the subsequent surgery was 16.4 months and 2.5 months, respectively. One patient required arthroscopic debridement and capsular release 3 years after microfracture.

**Conclusions:** Isolated chondral defects of the shoulder treated with proper microfracture techniques can yield results similar to those reported for the knee. Patients can expect improvement in pain, function, and range of motion.

**Reviewer’s Comments:** Although limited by its retrospective design, short follow-up, and small numbers, this study provides a lot of clinical follow-up data on a procedure that is gaining acceptance as a treatment for cartilage damage in the shoulder. The authors provide a nice description of their surgical technique. It will be important to see second look arthroscopic findings to confirm the restorative potential of this procedure. (Reviewer-Carl H. Wierks, MD).

© 2010, Oakstone Medical Publishing

Keywords: Glenohumeral Joint, Articular Defects, Arthroscopic Microfracture, Clinical Outcomes

Print Tag: Refer to original journal article
Double-Row Repairs of Tears Less Than 1 cm Have Lower Retear Rate

Which Method of Rotator Cuff Repair Leads to the Highest Rate of Structural Healing? A Systematic Review.
Duquin TR, Buyea C, et al:


The relative risk of retear for single-row methods in comparison to double-row methods is 3.94 in tears measuring 1 to 3 cm.

Background: Various approaches (open, miniopen, or arthroscopic) and various techniques (transosseous [TO], single row of suture anchors [SA], double rows of suture anchors [DB], or suture bridge [SB]) have been used to repair rotator cuff (RTC) tears.

Objective: To determine whether a specific repair method is associated with significantly higher structural healing rates and to determine whether the surgical approach (open, miniopen, or arthroscopic) is associated with a difference in healing rates for a given repair method.

Design: Literature review.

Methods: A search of MEDLINE and PubMed, the evidence-based medical review databases Cochrane Database of Systematic Reviews, American College of Physicians Journal Club, Database of Abstracts of Reviews of Effects, and Cochrane Central Register of Controlled Trials was performed to find relevant articles on RTC repair. Subjects with degenerative joint disease of the glenohumeral joint and those with subscapularis tears were excluded. Results were analyzed according to tear size (<1 cm, 1 to 3 cm, 3 to 5 cm, and >5 cm).

Results: 23 articles met our inclusion criteria and were the basis for this study. These 23 articles included extractable data for 1252 RTC repairs. There were 114 repairs of tears <1 cm, with a retear rate of 17% for single-row methods (TO and SA combined) and 7% for the double-row suture anchor method (not significant; P =0.09). The 295 tears classified as being from 1 to 3 cm had a retear rate of 30% for combined single-row methods (TO + SA) and 8% for the double-row suture anchor method (P <0.001). The retear rate for single- or double-row repairs was not affected by the surgical approach. In the 238 tears characterized as either 2-tendon tears or as measuring from 3 to 5 cm, the retear rate was 44% for combined single-row methods (TO + SA) and 24% for combined double-row methods (DA + SB; P <0.002). A total of 122 tears were characterized as either 3-tendon tears or as being >5 cm and had a retear rate of 69% for combined single-row methods (TO + SA) and 41% for combined double-row methods (DA + SB; P <0.01).

Conclusions: A systematic review of the literature on the effect of RTC repair method on the retear rate found a significantly lower retear rate for double-row repairs for all tears >1 cm. No difference between arthroscopic and nonarthroscopic approaches for any repair method was found.

Reviewer's Comments: This excellent review article demonstrates the increased risk of retear with increasing size of the tear and the benefit of double-row fixation in tears >1 cm. The review does not, however, examine clinical outcomes of these patients. (Reviewer-Carl H. Wierks, MD).

© 2010, Oakstone Medical Publishing

Keywords: Open, Mini Open, Arthroscopic, Single Row, Double Row, Suture Bridge

Print Tag: Refer to original journal article
Younger patients have superior results with both matrix-associated autologous chondrocyte implantation and the original periosteal flap technique.

**Background:** Autologous chondrocyte implantation (ACI) is one option to treat chondral lesions. ACI is indicated for cartilage defects of Outerbridge grades III and IV, sized 3 to 10 cm².

**Objective:** To compare matrix-associated ACI (m-ACI) and the traditional ACI technique using a periosteal flap (ACI-P) in terms of clinical efficacy and safety in the treatment of articular cartilage defects of the knee.

**Design:** Prospective, randomized, controlled trial.

**Participants/Methods:** Inclusion criteria were patient age between 16 and 50 years, with isolated cartilage defects between 2.5 and 6 cm² detected by MRI and verified with arthroscopy and localized at the medial or lateral femoral condyle. Chondrocytes were harvested from the lateral aspect of the lateral femoral condyle. Cultivation of chondrocytes and preparation of m-ACI (BioSeed-C [BioTissue Technologies]) and ACI-P was performed by BioTissue Technologies (Freiburg, Germany). The chondrocytes were reimplanted using standard procedure for the 2 techniques. An independent musculoskeletal radiologist blinded to the treatment groups assessed the postoperative MRI scans at 6, 12, and 24 months. The primary outcome parameter was the postoperative change in subjective knee function as assessed by the International Knee Documentation Committee (IKDC) score at 12 months. Secondary outcome parameters were health-related quality of life (Short Form 36 Health Survey [SF-36]), knee functionality (Lysholm and Gillquist Score), and physical activity (Tegner Activity Score [TAS]) at 3, 6, 12, and 24 months.

**Results:** 21 patients were treated with either m-ACI or ACI-P and had completed a follow-up of 24 months. Cartilage defect size was, on average, 4.3 cm² in the m-ACI group and 4.1 cm² in the ACI-P group. The IKDC scores increased similarly for both groups with regard to the postoperative change in subjective knee function 24 months after ACI (P =0.4994). Knee function in the ACI-P group, however, was superior to that of the m-ACI group at 24 months. Lysholm and Gillquist score changes also favored the ACI-P group at both 12 and 24 months of follow-up. There was no difference in the postoperative change of TAS between the 2 ACI methods at 24 months. No difference in MRI findings existed between the 2 groups at 12- and 24-month follow-up. Better treatment results were found in younger patients.

**Conclusions:** Superiority of either the m-ACI or the ACI-P technique with respect to the primary outcome measure (ie, IKDC score) was not evident. But a significant difference was found for the secondary outcome measure of postoperative change in the Lysholm and Gillquist score 12 and 24 months after ACI. Age might be the main factor influencing the clinical outcome.

**Reviewer's Comments:** Matrix-associated ACI is not yet approved for use in the United States. It does, however, have technical and theoretical advantages over traditional ACI. (Reviewer-Carl H. Wierks, MD).

© 2010, Oakstone Medical Publishing

Keywords: Knee, Articular Cartilage Defects, Autologous Chondrocyte Implantation, Techniques

Print Tag: Refer to original journal article
The medial and lateral side of the achilles tendon has better blood supply than the posterior aspect.

**Background:** Wound healing complications are high following open repair of Achilles tendon rupture.  
**Objective:** To define the blood supply of the integument surrounding the Achilles tendon.  
**Design:** Experimental investigation.  
**Methods:** A lead oxide-gelatin mixture was injected through the right femoral artery into 5 fresh human cadavers from donors who had an average age of 65 years at the time of their death. The anatomical dissection was done in 10 legs. The skin was dissected away from the Achilles tendon, and the position, presence, and size of cutaneous perforators were documented. The Achilles tendon and paratenon were removed. The vascular anatomy of the different areas was identified and visualized on the basis of dissection and angiography. The angiograms were scanned and analyzed with a digital picture statistical software analyzer. Pixel maps were created based on the radiopacity of the vessels of the integument.  
**Results:** The pattern of vascularity was very consistent in the 10 dissected legs. In each angiogram, a longitudinal hypovascular shadow was identified over the posterior cutaneous midline covering the Achilles tendon. Better patterns of vascularity were noted on the medial and lateral areas adjacent to the Achilles tendon. The posterior tibial artery provided the arterial supply of the medial portion of the paratenon and integument. The peroneal artery directly provided the lateral arterial supply of the paratenon and skin. The blood supply to the posterior zone arose directly from main perforating arteries coming from each side of the tendon and also from small arterioles that communicated with the subcutaneous tissue and skin by means of the posterior paratenon.  
**Conclusions:** Posterior incisions performed through a less vascular zone may predispose to wound complications because of its hypovascularity, but this hypothesis needs to be tested in a clinical study.  
**Reviewer's Comments:** This useful study aids in planning the incision for a repair of the Achilles tendon. The authors add in their discussion that a medial-based incision should be placed 1 cm medial to the Achilles tendon to protect the integument blood supply. A clinical study would be useful to establish the practicality of this cadaveric investigation. (Reviewer-Carl H. Wierks, MD).  

© 2010, Oakstone Medical Publishing  

Keywords: Achilles Tendon Rupture, Repair, Healing, Complications, Integument, Blood Supply  

Print Tag: Refer to original journal article