

SPORTS MEDICINE REPORTS™

The essential guide to developments in sports medicine and orthopaedics

American Health Consultants Home Page—<http://www.ahcpub.com>

CME for Physicians—<http://www.cmeweb.com>

EDITOR

David R. Diduch, MS, MD
Assistant Professor,
Department of Orthopaedic
Surgery, University of
Virginia School of Medicine,
Charlottesville, VA

ASSOCIATE EDITORS

Letha Y. Griffin, MD, PhD
Adjunct and Clinical
Faculty, Department of Kinesiol-
ogy and Health, Georgia State
University, Atlanta, GA

Stephen B. Gunther, MD
Assistant Professor of Clinical
Orthopaedic Surgery, UCSF
Department of Orthopaedic
Surgery, San Francisco, CA

Christopher D. Harner, MD
Blue Cross of Western
Pennsylvania Professor
Director, Division of
Sports Medicine
UPMC Health System
Center for Sports Medicine
and Rehabilitation
Pittsburgh, PA

Clayton F. Holmes, EdD, PT, ATC
Assistant Professor,
University of Central Arkansas,
Department of
Physical Therapy,
Little Rock, AR

Mark D. Miller, MD
Associate Professor,
UVA Health System,
Department of Orthopaedic
Surgery, Charlottesville, VA

David H. Perrin, PhD, ATC
Dean, School of Health and
Human Performance, University
of North Carolina—Greensboro

Robert C. Schenck, Jr., MD
Deputy Chairman,
Department of Orthopaedics,
University of Texas Health
Science Center,
San Antonio, TX

James R. Slaughterbeck, MD
Associate Professor,
Department of Orthopedic
Surgery, Texas Tech University
Health Sciences Center,
Lubbock, TX

James P. Tasto, MD
Associate Clinical
Professor, Orthopaedic Surgery,
University of
California—San Diego, CA

Sudden Cardiac Arrest in Athletes

A B S T R A C T & C O M M E N T A R Y

Synopsis: *Sudden cardiac arrest survival rates can be improved with decreased response times by trained target responders.*

Source: Terry GC, et al. Sudden cardiac arrest in athletic medicine. *Journal of Athletic Training* 2001;36(2):205-209.

Sudden death in athletes can result from direct or indirect causes. Direct causes are traumatic, such as closed-head injury, while the major indirect cause is from an arrhythmia resulting in sudden cardiac arrest. In this article, Terry and associates emphasize the importance of decreasing response time by a trained-target responder to increase survival rates among athletes experiencing sudden cardiac arrest.

Sudden cardiac arrest in athletes is unusual, yet typically occurs in the absence of pre-event symptoms. The majority of cases of sudden cardiac arrest occur during or immediately after a training session or athletic event. The primary causes of sudden cardiac arrest are hypertrophic cardiomyopathy (36%); hypertrophic cardiomyopathy-like structural changes (10%); anomalous origin of the left main coronary artery (10%); other coronary anomalies (9%); myocarditis (6%); ruptured aortic aneurysm (5%); tunneled left anterior descending artery (5%); aortic valve stenosis (4%); dilated cardiomyopathy (3%); and arrhythmogenic right ventricular dysplasia (2%).

Prevention of cardiac causes of sudden cardiac arrest should include a thorough history and cardiac examination as part of the preparticipation examination.¹ Risk factors deserving of more thorough evaluation, such as a 12-lead electrocardiogram and/or echocardiogram, include history of chest pain; shortness of breath or arrhythmia; history of cardiac problems requiring medication; and family history of death due to sudden cardiac arrest at a young age.

The effective treatment of sudden cardiac arrest depends on a sequence of events known as a “chain of survival.” This chain includes: 1) prompt emergency medical system activation; 2) early

INSIDE

How does position of immobilization affect stability following shoulder dislocation?
page 50

Groin strains in hockey players
page 51

Preventing patellar tendinitis
page 52

Osteochondral grafts
page 53

Bone bruises
page 53

Volume 3 • Number 7 • July 2001 • Pages 49-56

NOW AVAILABLE ONLINE!
Go to www.ahcpub.com/online.html for access.

cardiopulmonary resuscitation (< 2 minutes); 3) early defibrillation (2-4 minutes); 4) early advanced life support (< 8 minutes); and 5) late advanced life support. The first 4 links are especially important to the sports medicine team, and survival rates can be significantly increased with prompt activation of this chain.

■ **COMMENT BY DAVID H. PERRIN, PhD, ATC**

The chances of survival of a person experiencing sudden cardiac arrest declines by 5-10% each minute the condition is left untreated. The most important components of early treatment are early CPR and early defibrillation by a first responder trained in basic life support. It has been reported that 95% of patients receiving defibrillation shock in the first minute of cardiac arrest survive.

Automated external defibrillators (AED) should be readily available in every athletic medicine program. The cost of a basic LIFEPAK 500 (Medtronic Physio-Control, Redmond, Wash) AED is approximately \$3000. Terry et al recommend that the athletic medical staff, including certified athletic trainers and team physicians, be involved in target-responder training as a satellite target-responder group in the EMS plan of the school and community. They further recommend that this plan include availability of automated external defibrillators

that ensure response by the athletic medical team's target responders with an AED in less than 2 minutes. They also recommend that the cost of the plan, to include acquisition of AEDs, should be a financial project of the university or school, and not a budget item of the athletic department.

This paper is a further reminder of the importance of a well-designed and rehearsed medical emergency plan for every athletic care medical team. As related to sudden cardiac arrest, the first 4 components of this plan should proceed with near simultaneous activation of EMS with a practiced response time of less than 8 minutes to early advanced life support. Not all cases of sudden death in athletes can be prevented, but team physicians and certified athletic trainers must be properly trained and prepared to deal with the rare, but potentially devastating occurrence of sudden cardiac arrest in athletes. ❖

Reference

1. American Heart Association. Cardiovascular preparticipation screening of competitive athletes. *Med Sci Sports Exerc.* 1996;28:1445-1452.

Sports Medicine Reports, ISSN 1524-0991, is published monthly by American Health Consultants, 3525 Piedmont Rd., NE, Bldg. 6, Suite 400, Atlanta, GA 30305.
VICE PRESIDENT/GROUP PUBLISHER:
 Donald R. Johnston.
EDITORIAL GROUP HEAD: Glen Harris.
MANAGING EDITOR: Robin Mason.
ASSOCIATE MANAGING EDITOR: Neill Larmore.
SENIOR COPY EDITOR: Robert Kimball.
MARKETING PRODUCT MANAGER:
 Schandale Kornegay.
GST Registration Number: R128870672.
 Periodical postage pending at Atlanta, GA.
POSTMASTER: Send address changes to *Sports Medicine Reports*, P.O. Box 740059, Atlanta, GA 30374.

Copyright © 2001 by American Health Consultants. All rights reserved. No part of this newsletter may be reproduced in any form or incorporated into any information-retrieval system without the written permission of the copyright owner.
Back issues: \$37. Missing issues will be fulfilled by Customer Service free of charge when contacted within one month of the missing issue's date.
 This is an educational publication designed to present scientific information and opinion to health professionals, to stimulate thought, and further investigation. It does not provide advice regarding medical diagnosis or treatment for any individual case. It is not intended for use by the layman.

AMERICAN HEALTH CONSULTANTS

THOMSON HEALTHCARE

Statement of Financial Disclosure

In order to reveal any potential bias in this publication, and in accordance with Accreditation Council for Continuing Medical Education guidelines, we disclose that Dr. Diduch serves as a consultant to DePuy Orthotech. Dr. Tasto serves on the surgical advisory boards of Arthrocare, Orthopedic Biosystems Limited, and receives royalties from Don Joy Dr. Griffin, Dr. Gunther, Dr. Harner, Dr. Holmes, Dr. Miller, Dr. Perrin, Dr. Schenck, and Dr. Slaughterbeck report no consultant, stockholder, speaker's bureau, research, or other financial relationships with companies having ties to this field of study.

Subscriber Information

Customer Service: 1-800-688-2421.
Customer Service E-Mail Address:
 customerservice@ahcpub.com
Editorial E-Mail Address: robert.kimball@ahcpub.com
World-Wide Web: http://www.ahcpub.com

Subscription Prices

United States
 \$269 per year (Student/Resident rate: \$108).
Multiple Copies
 1-9 additional copies: \$197 each; 10-20 copies: \$175 each.
Canada
 Add GST and \$30 shipping.
Elsewhere
 Add \$30 shipping.
Accreditation

American Health Consultants (AHC) designates this continuing medical education (CME) activity for up to 20 hours of category 1 credit toward the AMA Physician's Recognition Award. Each physician should claim only those hours of credit that he/she actually spent in the educational activity. This CME activity was planned and produced in accordance with the ACCME Essentials. AHC is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.
For CME credit, add \$50.

Questions & Comments

Please call **Robin Mason**, Managing Editor, at (404) 262-5517; or e-mail: robin.mason@ahcpub.com or **Robert Kimball**, Senior Copy Editor, at (404) 262-5513; or e-mail: robert.kimball@ahcpub.com between 8:30 a.m. and 4:30 p.m. ET, Monday-Friday.

How Does Position of Immobilization Affect Stability Following Shoulder Dislocation?

ABSTRACT & COMMENTARY

Synopsis: *Immobilizing the arm in a position of external rotation improved approximation of a Bankart lesion and capsule to the glenoid in the desired position following both initial and recurrent shoulder dislocation.*

Source: Itoi E, et al. Position of immobilization after dislocation of the glenohumeral joint. *J Bone Joint Surg Am.* 2001; 83-A(5):661-667.

Historically, we have treated patients with the assumption that the method and duration of immobilization following anterior, traumatic shoulder dislocation did not influence outcome. Itoi and colleagues now challenge that notion with a study using MRI to assess the position of the labrum and capsule with varying positions of arm rotation. They studied 19 shoulders including 6 with an initial anterior dislocation

and 13 with recurrent dislocation. Patients were scanned with the arm in an internally rotated position that corresponded to the use of a sling with the forearm against the abdomen. Next, they externally rotated the arm as far as comfortably possible (mean, 35°) and a repeat MRI was performed. If the MRI was performed more than 2 weeks out from initial injury, then intra-articular dye to improve the MR resolution was used. The labrum and Bankart lesion position relative to the glenoid neck, including the amount of displacement, separation, and lift-off were all assessed. The actual amount of shoulder rotation was also assessed quantitatively by MRI. Patients with bony Bankart lesions or no Bankart lesion were excluded.

In a position of external rotation, the shoulders had significantly less separation and displacement of the labrum and Bankart lesion. The capsule was found to be better opposed along the anterior aspect of the glenoid with a shorter, detached length. Basically, the labrum and the capsule were closer to the normal anatomic position. These results were statistically significant for both acute and recurrent shoulder dislocations.

■ COMMENT BY DAVID R. DIDUCH, MS, MD

Although young patients have a high likelihood of recurrent anterior shoulder instability following dislocation, not everyone develops further dislocations. Also, some patients with chronic instability can spontaneously stabilize. It is possible that some patients with either a fresh or chronic Bankart lesion can somehow heal this in a position that is functional, preventing further instability. Itoi and colleagues in Japan have used the MRI to document for the first time the position of these anterior shoulder stabilizers as they relate to the rotation of the arm following dislocation. They found that when the shoulders were rotated an average of 35° externally, which is where patients were able to maximally rotate it within their degree of comfort, that the labrum and the anterior capsule were much closer to their original anatomic position. The external rotation tightened the anterior capsule as well as the subscapularis, squeezing any hematoma posteriorly in the joint and producing improved coaptation against the glenoid neck. Also, the Bankart lesion was less retracted medially along the neck of the scapular as can be seen when it heals there with an ALPSA lesion.

If we carefully look at the numbers, there is a lot of variability, and the standard deviations are sizeable. However, all of their measurements did reach statistical significance. I think we can conclude from this that not all patients will respond the same, but there seems to be a measurable benefit to immobilize patients with the arm

in an externally rotated position if you look at the population as a whole. How this is practically done is another matter. Whether this produces a clinically measurable decrease in the rate of recurrent dislocation is also another matter. These are 2 shortcomings of the study that definitely need to be addressed as we try to apply this information to our patient population. Nevertheless, this paper does provide meaningful information, and if supported by other studies may well change the way shoulder dislocations are treated by all members of the sports medicine team. ❖

Groin Strains in Hockey Players—Strength or Stretch Problem?

ABSTRACT & COMMENTARY

Synopsis: *Muscle strength proved to be more important than flexibility in preventing muscle strains in hockey players.*

Source: Tyler TF, et al. The association of hip strength and flexibility with the incidence of adductor muscle strains in professional ice hockey players. *Am J Sports Med.* 2001; 29(2):124-128.

Adductor strains are among the most common injuries sustained in skating athletes. In hockey players, the powerful eccentric contraction of the adductor muscles during the skating stride places the muscle group at high risk for injury. Other strength imbalances are responsible for injuries in other sports, such as the hamstring in sprinting athletes. The purpose of this study was to determine if hip flexibility and surrounding muscle strength are related to adductor strains in hockey players.

This is a prospective study of players on 1 NHL team over 2 seasons. During preseason screening exams, hip flexibility and strength measurements were recorded. The team physician made the diagnosis of an adductor strain. Injury was defined as any event that kept a player out of practice, or a game, or that required medical attention. Hip strength was measured by an instrumented manual muscle-testing device (Nicholas Muscle Tester). Hip flexibility was measured by a goniometer.

Eighty-one players were tested over the 2 seasons and 34 were cut from the team. Therefore, injury data were available on 47 players. Eleven adductor strains occurred in 9 players. Preseason hip adductor strength

was equal right-to-left, but 18% lower in those with injury than those without. Hip flexibility was not associated with adductor injury.

■ COMMENT BY JAMES R. SLAUTERBECK, MD

So how many times have we told our athletes to stretch and stretch more so they will not “pull a muscle?” So which is better, to stretch or to strengthen? I believe both are important. This article demonstrates the importance of strengthening the agonist and antagonist muscles around the hip.

In a sport like hockey, in which anaerobic, high-speed, powerful bursts are common, the strength differences between large muscle groups are likely to become quite relevant, especially as fatigue becomes a factor late in the game. The important eccentric contraction of the adductor muscle group is paramount to the skating stride. Injury to the group is immediately evident as the agility of the athlete is greatly affected. Some adductor strains can end seasons or significantly decrease the effectiveness of the athlete.

Stretching still has many potential benefits for athletes. Stretching has been shown to increase muscle blood flow, thus increasing warmth and likely increasing muscle recruitment. Muscle flexibility increases range of motion and will increase power production. Therefore, as in muscle strains, a balance of stretching and strengthening will likely produce the best results for the overall health of our athletes.

However, for muscle strains we need to pay more attention to the adductor strength and set up our off-season training programs to increase the strength of the adductor muscles. This study should be remembered as we counsel our strength coaches and athletic trainers as to the importance of setting up balanced muscle strengthening programs for injury prevention. ❖

Preventing Patellar Tendinitis

ABSTRACT & COMMENTARY

Synopsis: *In a prospective study, quadriceps tightness was the leading predictor of athletes developing patellar tendinitis.*

Source: Witvrouw E, et al. Intrinsic risk factors for the development of patellar tendinitis in an athletic population. *Am J Sports Med.* 2001;29(2):190-195.

Patellar tendinitis symptoms are common in athletes, and numerous intrinsic and extrinsic fac-

tors have been assessed for contributing to its development. However, prospective studies are lacking, until now. Witvrouw and colleagues from Belgium used a captive audience of 480 students that were involved in an aggressive physical education program that included 12-14 hours of sports per week. The physician and therapist prospectively followed the patients after initial assessment. Numerous measures were obtained, including leg alignment, any leg length discrepancy, Q-angle, muscular tightness, muscular strength with isokinetic testing, and history. Patients with a history of prior patellofemoral problems were excluded. After these exclusions plus any patients that were noncompliant with the program, Witvrouw et al were left with 138 student-athletes who were followed over 2 years. Sports participation was carefully documented as well as any outside activities beyond the scope of the study.

During these 2 years, 19 of the 138 athletes developed patellar tendinitis. This was diagnosed by tenderness and pain localized to the patellar tendon insertion on the patella and was confirmed by ultrasound. Of all the variables measured, only muscular tightness reached statistical significance. Those athletes developing patellar tendinitis had quadriceps flexibility of only 86° compared to those who did not develop symptoms having a mean flexibility of 132°. A similar though less striking result was seen for hamstring tightness with 84° vs. 101° for the popliteal angle. Strength, Q-angle, alignment, gender, and sports-specific activities all did not reach statistical significance.

■ COMMENT BY DAVID R. DIDUCH, MS, MD

Patellar tendinitis is a common complaint of athletically active individuals. Although numerous intrinsic factors have been assessed, such as leg alignment or muscular imbalance, as well as extrinsic factors such as variations in training surfaces, methods, or footwear, little data exist that have been obtained in a standardized, prospective fashion. Witvrouw et al are to be congratulated for constructing a prospective study that, I am sure, was difficult to perform with these large athlete numbers over 2 years. The data appear convincing. Athletes with quadriceps tightness definitely appear to be at risk for developing patellar tendinitis.

The take-home message is clear. During screening physical exams, as well as at any opportunity that we have, we should look for quadriceps tightness and, to a lesser degree, hamstring tightness in our athletes. Those should be addressed early with an appropriate stretching program in hopes of preventing patellar tendinitis that would cause them to miss participation. ❖

Surgical Technique Considerations for Osteochondral Grafts

ABSTRACT & COMMENTARY

Synopsis: *Osteochondral autograft transplantation (OATS) is a surgical technique used for reconstruction of cartilage defects or osteochondral defects in the knee. This study characterizes the donor and recipient sites with respect to articular cartilage contact pressure, articular surface curvature, and cartilage thickness.*

Source: Ahmad CS, et al. Biomechanical and topographic considerations for autologous osteochondral grafting in the knee. *Am J Sports Med.* 2001;29(2):201-206.

This study characterizes osteochondral donor and recipient sites with respect to articular cartilage contact pressure, articular surface curvature, and cartilage thickness. Five fresh-frozen cadaveric knees were evaluated with stereophotogrammetry, and kinematic data were obtained for flexion angles from 0-110°. Potential donor sites in the intercondylar notch, lateral trochlear ridge, and proximal-medial trochlear ridge demonstrated small areas of low-contact pressure (relatively nonweightbearing). However, donor sites in the distal-medial trochlear ridge were completely nonweightbearing. The medial and lateral trochlea curvatures best matched the medial and lateral femoral condyle recipient sites. The intercondylar notch donor sites best matched the curvature of the central trochlea. The cartilage thickness for each of the donor sites was very similar, with an average of 2.1 mm, while the average thickness of the recipient sites was 2.5 mm.

Ahmad and colleagues suggest graft harvest from the medial or lateral trochlear ridge for femoral condyle lesions in order to match surface curvature. They prefer using the distal-medial trochlea area since this study showed no weightbearing contact at all during range of motion from 0-110°. For lesions in the trochlea, they suggest using the intercondylar notch as the preferred donor site.

■ COMMENT BY STEPHEN B. GUNTHER, MD

Cartilage lesions that cause symptoms such as pain, swelling, or locking may require operative treatment. The clinical prognosis for these lesions depends upon the size, depth, and location of the defect. Also, the chronicity of the lesion and the quality of the surrounding cartilage are important. There are multiple surgical options for treatment of chondral lesions such as abra-

sion arthroplasty, microfracture, autologous chondrocyte implantation, autologous osteochondral transplantation, and allograft implantation. This study evaluates the technical factors associated with matching donor osteochondral plug autografts to minimize morbidity and maximize anatomic replacement of host anatomy.

The surface contact area and pressure, measured with stereophotogrammetry, demonstrate that certain areas (intercondylar notch, lateral trochlear ridge, and proximal-medial trochlear ridge) have only limited weight-bearing, and that the distal-medial trochlear ridge is completely nonweightbearing. This is important information that will allow surgeons to minimize donor site morbidity by avoiding graft harvest from weightbearing areas. Also, Ahmad et al measured important clinical parameters for matching surface contour and articular cartilage depth. They therefore conclude that the best donor site for femoral condyle lesions is the distal medial trochlear ridge, and the best donor site for a central trochlea lesion is along the intercondylar notch. These data compliment another study in the same journal issue by Bartz et al, which measured the topographic anatomical relationships between condylar lesions and graft sites. They also concluded that the most medial or lateral aspects of the trochlear area adjacent to the intercondylar notch, which they named “medial and lateral edge of the patellar groove,” offers the best contour for osteochondral grafting to the medial or lateral femoral condyle.¹ ❖

Reference

1. Bartz RL, et al. Topographic matching of selected donor and recipient sites for osteochondral autografting of the articular surface of the femoral condyles. *Am J Sports Med.* 2001;29(2):207-212.

Bone Bruises: Do They Go Away?

ABSTRACT & COMMENTARY

Synopsis: *Patients with MRI-confirmed bone bruises associated with ACL tears were re-evaluated with repeat MRI 2-5 years after their original injury. Most nonfocal bone bruises completely resolved; however, focal lesions (type III lesions) were still present on follow-up scans.*

Source: Costa-Paz, M. Magnetic resonance imaging follow-up study of bone bruises associated with anterior cruciate ligament ruptures. *Arthroscopy.* 2001;17(5):445-449.

Bone bruises, or trabecular microfractures, are highly associated with ACL injuries and are said

to be present in about two-thirds to three-quarters of MRIs in patients with acute ACL tears. They were originally described and classified by Vellet and associates in 1991.¹ They recognized the importance of characterizing the bruises as either focal (geographic) or diffuse. The present study by Costa-Paz and associates highlights this important point. A cohort of 21 patients with isolated ACL injuries with MRI-detected bone bruises and no cartilaginous injury at the time of arthroscopy were studied. MRIs were repeated 24-64 months (average, 34) following the original injury and compared with the original MRI. Bone bruises were characterized as diffuse (type I), focal (type II), or with associated disruption or depression of the normal contour of the cortical surface (type III). On follow-up MRI, all type I lesions and 10/11 type II lesions completely resolved. However, all 5 patients with type III lesions had “. . . evidence of persistent abnormality on MRI scans. . .” The clinical outcome of the ACL reconstruction had no correlation with the type of bone bruise or the results of the follow-up MRIs. Costa-Paz et al conclude: “Although long-term clinical implications of these findings are uncertain, a severe occult osteochondral lesion sustained at the time of ACL rupture seems to be persistent on MRI, even after a successful outcome.”

■ COMMENT BY MARK D. MILLER, MD

Although this study is limited by the relatively small number of patients evaluated (21 patients and only 5 with type III bone bruises), it does provide some helpful information. The bone bruise is the result of an impaction injury involving the middle third of the lateral femoral condyle on the back of the tibia. When the ACL tears, the knee actually subluxes or dislocates anteriorly and, much like a Hill-Sach lesion in the shoulder, has an impaction injury. Johnson and colleagues have shown us that focal bone bruises are severe and result in local chondrocyte death!² Fortunately, nonfocal, diffuse bone bruises do not have adverse outcomes. In fact, in a study published 3 years ago, we noted that these lesions completely resolved as a result of gradual diffusion over a period of 2-4 months.³ What is interesting, and certainly merits additional study, is the type III bone bruise. Perhaps this is a sentinel lesion and may represent a knee that is at risk for adverse sequelae down the line. Only additional study and research will provide this answer. ❖

References

1. Vellet AD, et al. Occult post-traumatic osteochondral lesions of the knee: Prevalence, classification and short-term sequelae evaluated with MR imaging. *Radiology*. 1991;178:271-276.

2. Johnson DL, et al. Articular cartilage changes seen with magnetic resonance imaging-detected bone bruise associated with acute anterior cruciate ligament rupture. *Am J Sports Med*. 1998;26:409-414.
3. Miller MD, et al. The natural history of bone bruises. A prospective study of magnetic resonance imaging-detected trabecular microfractures in patients with isolated medial collateral ligament injuries. *Am J Sports Med*. 1998;26:15-19.

Nitric Oxide and Tendon Healing . . . Relevance to Sports Medicine

ABSTRACT & COMMENTARY

Synopsis: Nitric oxide expression was increased following achilles tendon injuries and appeared to play a role in stimulating wound healing and remodeling.

Source: Lin JH, et al. Temporal expression of nitric oxide synthase isoforms in healing Achilles tendon. *J Orthop Res* 2001;19(1):136-142.

Nitric oxide is a free radical that is involved with tissue healing. It is expressed after injury in many tissues including bone. Nitric oxide may be involved in tissue remodeling by stimulating inflammatory cell-programmed cell death (apoptosis), producing angiogenic and vasodilatory functions, and stimulating wound collagen production. This study was designed to evaluate the expression of nitric oxide production in surgically severed Achilles tendons in rats. Semiquantitative polymerase chain reaction (PCR) and Western Blotting were used to assess the gene expression and protein production. Tissue healing was recorded on days 4, 7, 14, and 21 after surgery to assess the inflammation, granulation, and remodeling phases of tissue remodeling.

Prior to injury, minimal if any nitric oxide synthase mRNA, protein, or enzyme production was present. After Achilles transection, nitric oxide mRNA, protein, and enzyme production all increased.

■ COMMENT BY JAMES R. SLAUTERBECK, MD

Ligament and tendon injuries occur frequently in the athletic population. Remodeling of injury ultimately determines safe and effective return of athletes to sport. Soft tissue remodeling is the process by which injury is repaired. Control of this process will alter the quality and quantity of repaired tissue. Understanding the remodel-

ing process and the relationship to nitric oxide production following injury may help to develop methods that decrease healing time or increase quality of soft tissues after injury.

Many of the standard modalities including heat, ice, and electrical stimulation effectively decrease morbidity and facilitate early return after injury. However, if we want to better influence remodeling of the injury to favor repair, we must look more carefully at the molecular aspects of the process. Gene regulation of inflammatory mediators, matrix proteases, and collagen production could alter the timing and effectiveness of tissue repair.

Nitric oxide is a potent mediator of tissue repair that is involved with the remodeling process at the molecular level. Control of the nitric oxide production or delay of its degradation will likely increase the effects of its presence. Further study in this area may bring us closer to building stronger repaired tissues in a quicker fashion. This could decrease the time after injury and return athletes to sports sooner with stronger tissues and may add another tool to the sports medicine caregiver's bag. ❖

Arthroscopic Acromioplasty and the Distal Clavicle, 'All in One'

ABSTRACT & COMMENTARY

Synopsis: *A retrospective review of 31 consecutive patients undergoing simultaneous arthroscopic distal clavicle excision and concomitant acromioplasty shows remarkably good results with all patients satisfied with their surgery and 22 of 25 athletes returning to overhead sport activity.*

Source: Martin SD, et al. Arthroscopic resection of the distal aspect of the clavicle with concomitant subacromial decompression. *J Bone Joint Surg* 2001;83-A(3):328-335.

This study documents the functional outcome associated with the arthroscopic approach to the symptomatic AC joint in the presence of subacromial impingement. The patients were reviewed from 1988 to 1991 during which 241 subacromial decompressions were performed by Martin and colleagues. Thirty-nine (or 16%) of these 241 patients underwent a concomitant arthroscopic distal clavicle excision and made up the initial database for this study. Seven patients were lost to follow-up, leaving 32 patients to be included in the retro-

spective review. The study used only simplistic measures of shoulder symptomatology and patients were specifically asked whether they were satisfied with the result, whether shoulder function had returned to its previous level, and whether they would have the procedure again. Functional strength testing showed no difference in strength between the involved and uninvolved shoulders postsurgery, but time to testing was not clearly identified. No outcome-measurement tools were used, nor were numeric pain scales such as the visual analog scale used. Preoperative and postoperative radiographs were used and showed evidence of hypertrophic ossification in 1 patient with mild pain on direct palpation of the AC joint. No superior migration of the clavicle was noted in any of the patients. The mean amount of distal clavicular resection was 9 mm (range, 7-15) on radiographic evaluation.

Their technique for such a demanding arthroscopic procedure begins with a routine shoulder EUA and glenohumeral arthroscopy in the lateral decubitus position using an arthroscopic pump. Once glenohumeral pathology was corrected (10 partial cuff and 2 SLAP tears requiring debridement were noted), the subacromial space was entered with the 30° scope posteriorly. The lateral portal was used for acromial spur decompression to the coronal level of the anterior edge of the distal aspect of the clavicle. Once the undersurface of the distal clavicle was burred level with the subacromial decompression through the lateral portal, the 5.5 mm burr was then switched to the anterior portal, while a 70° scope was placed through the posterior portal to allow improved upward visualization of the AC joint. Exposure was enhanced by depressing the distal clavicle manually during resection and switching the scope to the lateral portal for a more direct view of the distal clavicle excision.

■ COMMENT BY ROBERT C. SCHENCK, Jr., MD

Little controversy remains over clinical decision-making in the management of the AC joint in conjunction with symptoms of impingement. If the AC joint is asymptomatic, it should be left untouched, or as Martin et al recommend, only the osseous excrescences on the undersurface of the joint need be removed. In addition, exact delineation of symptoms attributable to the AC joint should be made with specific radiographs of the joint (50% underpenetration with a 10° cephalic tilt on AP radiographs), tenderness on direct palpation, tenderness on cross arm adduction, and a diagnostic lidocaine injection (which was performed in 28 of the 29 patients treated by Martin et al and was positive in all 28). Routine treatment of an asymptomatic AC joint has been shown to decrease the overall success rate of an

acromioplasty in the management of impingement syndrome. Once the decision is made to proceed with both the distal clavicle and anterior acromial pathology, the surgical approach is varied and ranges from all open to combined approaches (arthroscopic acromioplasty and open distal clavicle excision) to this reviewed technique (arthroscopic distal clavicle excision and concomitant arthroscopic acromioplasty). Nonetheless, one advantage of an open distal clavicle excision lies in the ability to test for impingement in the resected joint in cross-arm adduction, which also allows for palpation of the under-surface of the completed acromioplasty.

I found the technical aspects of the paper very useful and was pleasantly surprised to find it published in the *Journal of Bone and Joint Surgery*. Use of Martin et al's stepwise technique can be applied to the beach chair position, which is more convenient for the routine shoulder arthroscopy. I would caution that the learning curve for this combined approach will be surgeon-dependent, and I would recommend having the patient in the beach chair position for a straightforward conversion to an open distal clavicle excision for the first 10-20 patients. The orthopaedic surgeon should monitor fluid extravasation and surgical time in determining the need for abandoning an all-arthroscopic approach while gaining experience. Certainly, this all-arthroscopic approach is the "next level," but the surgeon should be cautioned to ensure that an adequate decompression of the distal clavicle, especially posteriorly, is performed. ❖

CME Questions

- The ideal donor site for osteochondral graft harvest for a femoral condyle lesion is:**
 - patella.
 - distal medial trochlear ridge/edge of patellar groove.
 - intercondylar notch.
 - proximal lateral trochlear ridge/edge of patellar groove.
- Which of the following correctly describes the goals of the chain of survival for successful management of sudden cardiac arrest?**
 - Early defibrillation in 2-4 minutes
 - Early defibrillation once at the hospital
 - Early defibrillation in less than 8 minutes
 - Early advanced life support once the ambulance arrives
- Positioning the arm in external rotation following shoulder dislocation compared to internal rotation was found to:**
 - decrease the displacement of the labrum.
 - decrease the separation of the labrum.

- decrease the length of detached capsule.
- bring the Bankart lesion closer to its original anatomic position.
- All of the above

- Hockey athletes at greatest risk for hip adductor muscle strains are:**
 - athletes with tight adductor muscles.
 - athletes with loose abductor muscles.
 - athletes with strong adductor muscles.
 - athletes with weak adductor muscles.
- Which factor was statistically correlated with the development of patellar tendinitis?**
 - Lack of muscle strength
 - Quadriceps tightness
 - High Q-angle
 - Leg length discrepancy
- Focal ACL bone bruises with cortical disruption or depression seen on initial MRI studies will appear as follows in follow-up MRIs done 2-5 years later:**
 - No injury or evidence of prior injury
 - A diffuse, enlarged, nonfocal area will be present in the medullary component of the distal femur.
 - Persistent abnormalities (cartilage thinning or cortical depression) will be present.
 - Advanced arthrosis is present in every case.
- The production of nitric oxide:**
 - increases after injury to the Achilles tendon.
 - decreases after injury to the Achilles tendon.
 - is unaffected by injury to the Achilles tendon.
 - None of the above
- Decision making in performing a distal clavicle excision is best described by which of the following clinical findings?**
 - Radiographic findings of AC joint arthritis, regardless of symptoms
 - Superior shoulder pain resistant to conservative treatment
 - Local tenderness to palpation, pain on cross arm adduction, and improvement with a differential AC joint injection
 - Subacromial excrescences in the area of the distal clavicle seen at arthroscopy

Readers are Invited. . .

Readers are invited to submit questions or comments on material seen in or relevant to *Sports Medicine Reports*. Send your questions to: Robert Kimball, *Sports Medicine Reports*, c/o American Health Consultants, P.O. Box 740059, Atlanta, GA 30374. For subscription information, you can reach the editors and customer service personnel for *Sports Medicine Reports* via the internet by sending e-mail to robert.kimball@ahcpub.com. ❖

In Future Issues:

Marfan's Syndrome and Athletes