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## Arthroscopy for Arthritis

ABSTRACT & COMMENTARY

**Synopsis:** *A prospective, randomized, placebo-controlled trial found arthroscopy no better than sham surgery for treatment of arthritis of the knee.*

**Source:** Moseley JB, et al. *N Engl J Med.* 2002;347:81-88.

ALTHOUGH ARTHROSCOPIC DEBRIDEMENT IS A COMMON PROCEDURE for knees with degenerative arthrosis, most of the evidence regarding its efficacy is based on retrospective, noncontrolled trials. Moseley and colleagues at the Houston Veterans Affairs Medical Center developed a carefully controlled trial to specifically examine the effectiveness of arthroscopy for arthritic knees.

Approximately 60 patients were prospectively randomized into 1 of 3 groups. These included: 1) simple arthroscopic lavage with at least 10 liters of fluid; 2) the same arthroscopic lavage plus debridement of any meniscal, impinging chondral, or synovial lesions; or 3) a sham operation in which incisions were made, the patient was anesthetized, and the OR environment made to mimic a surgical experience from the patient's perspective but no instruments were introduced into the knee. For the lavage-only group, if the surgeon encountered an entrapped bucket handle tear it was resected. For the debridement group, no abrasion chondroplasty or microfracture was performed, but only shaving of rough articular cartilage and meniscal tears. Impinging osteophytes that blocked extension in the intercondylar notch were removed. All observers and patients were blinded as to treatment group. They were assessed at multiple time points ranging from 2 weeks to 2 years with the use of 5 different self-reported scores, 3 of which involved pain and 2 of which involved function. Additionally, they were timed for maximal speed walking and stair climbing.

At no time point did either of the arthroscopic treatment groups show any improved outcomes over the placebo group that had sham surgery. Furthermore, at some of the earlier time points the arthroscopic treatment groups had even worse scores than the placebo groups for some of the variables. Through a careful statistical analysis Moseley et al conclude that their study methods and rating scales

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had sufficient power to detect any differences that would have been evident. They conclude that arthroscopic treatment for arthritic knees does not show any clinical benefit and should not be performed.

#### ■ COMMENT BY DAVID R. DIDUCH, MS, MD

This paper has already gotten a lot of press and attention from the public, and like other papers we have seen published in nonorthopaedic journals, the orthopaedic issues have already been misrepresented. To its credit, this was a well-conducted study with careful statistical analysis. There was a pilot study to determine statistical power and size of treatment groups needed, patients and observers were all blinded, it was prospective, it was controlled, it was randomized, and very few patients were lost in follow-up. One concern is the validity of the scoring systems used to evaluate differences among patients. Most scoring systems were components of other larger scales and involved just a few questions per scale. None of the conventional orthopaedic scoring systems were used, such as HSS scores or knee society scores. Nevertheless, I do believe that their assessment and, certainly, their sample size, was sufficient to detect any major differences among treatment groups. In fact, there were no differences.

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So should this change what we do? I think it should just reinforce what we do but perhaps change the way we present things to patients. Arthroscopy to treat mechanically impinging meniscal, chondral, or loose body lesions is well established. This paper does nothing to affect our recommendations of arthroscopy for these proper indications. We have known from other retrospective studies that the outcome for arthroscopic debridement for an arthritic knee is not very predictable. Indeed, we need to get weightbearing (preferably flexion) views of the knee to carefully assess for arthrosis before going straight to arthroscopy. I know I see a problem in the managed care environment with the primary care physician going straight to a MRI that will always show meniscal and chondral pathology in an arthritic knee. The focus then becomes the meniscal pathology and the patient gets arthroscopy before a proper assessment on the amount of arthrosis is done. That is the patient that does not get better and the type of patient that this study analyzed.

There do remain appropriate indications for arthroscopy in patients with arthritic knees, however. The patient too young for joint replacement, and without malalignment to require osteotomy, and with mechanical type symptoms of catching, giving way, locking and effusions, who has failed other nonoperative measures to include NSAIDs, exercises, and injections is certainly an appropriate candidate. These patients should be properly counseled as to the unpredictable nature of the outcome, but when everything else has failed arthroscopy can be of benefit. Unfortunately, the lay press has misrepresented this study and people are questioning the value of arthroscopy in general. It is important to remember that this study only looked at arthritic knees and really is information that we already knew and should have been presenting to our patients in honest fashion all along. ■

## Strike Three You're Out? Maybe for Your Career!

ABSTRACT & COMMENTARY

**Synopsis:** Increased pitches per game and per season, as well as throwing curves or sliders, were associated with increased incidence of shoulder and elbow pain in young players.

**Source:** Lyman S, et al. *Am J Sports Med.* 2002;30:463-468.

**E**LBOW AND SHOULDER PAIN IS THOUGHT TO BE AN early sign of injury to a pitcher's arm. Some

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#### Questions & Comments

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elbow pain can be a sign of permanent injury to the elbow and may prematurely end a child's throwing career. This prospective study evaluates the association between pitch counts, pitch types, and shoulder and elbow pain in Little League pitchers. Approximately 450 young baseball pitchers were followed for one season and throwing data were collected. Half of the pitchers experienced elbow or shoulder pain. Pitchers throwing a curveball were associated with a 52% increased risk of shoulder pain and those throwing a slider were associated with an 86% increased risk of elbow pain. Additionally, a significant association between the number of pitches thrown in a game and during the season and the rate of elbow pain and shoulder pain was identified.

Lyman and colleagues conclude that pitchers in this age group should be cautioned against throwing curveballs and sliders because of the increased risk of elbow and shoulder pain. Limitations on both the number of pitches thrown in a game and during a season can reduce the risk of pain.

#### ■ COMMENT BY JAMES R. SLAUTERBECK, MD

Little League baseball is exciting to participate in, to watch our kids play and to coach, but poor throwing techniques can be injurious to kids' elbows and shoulders. Sore elbows, ice packs, and Tylenol are common maladies of the game but may have long-lasting effects on the children pitching in youth baseball.

Although this article does not address the association between curveballs and sliders and apophysal or epiphyseal elbow radiographic changes resulting from throwing errors, an association between certain pitch types, number of pitches, and pain were identified. It is important that Lyman et al take the next step to identify if pitchers throwing breaking balls are more likely to sustain career ending or modifying injuries.

For now this article should serve as a possible warning among those physicians and parents who have or are responsible for Little League pitchers on the mounds. We should consider meeting with the local Little League officials and present suggestions to the leagues as to increased pitching limitations. Some of the recommendations in this article may be a bit stringent but certainly offer a platform for discussion. Maybe it is time to revisit the current throwing limitations placed upon our future Major League pitchers to make the game safer. Perhaps a solution may be to place a limit the number of pitches in a game and season and have youth pitchers perfect an off speed pitch like the change up over the curve ball or slider. ■

## Fasciotomy for Exertional Compartment Syndrome—Cutting Edge?

ABSTRACT & COMMENTARY

**Synopsis:** *Fasciotomy reduces pain and allows most athletes to return to sports, but often they are not pain-free and may not return to their preinjury level of sports activity.*

**Source:** Slimmon D, et al. *Am J Sports Med.* 2002;30:581-588.

CHRONIC EXERTIONAL COMPARTMENT SYNDROME IS A relatively common exercise-related injury of the lower leg in young athletes. Increased intramuscular pressures are believed to be the etiology of this syndrome, and measurement of compartment pressures are an essential part of the diagnostic work-up. Although short-term success has been reported for this procedure, there have been no long-term independent results published regarding the outcome of these procedures.

A total of 62 of 140 patients who had fasciotomies for chronic exertional compartment syndrome over a 5-year period responded to a questionnaire sent by Slimmon and colleagues. The surgical technique involved release of the fascia and removal of a strip of fascia and/or periosteum overlying the affected compartment. Follow-up was done at an average of 51 months (just over 4 years) with a range of 24-107 months. Good-to-excellent results were reported in 60% (37/62) of patients. Pain was recorded on a 10-point visual analog scale with low scores signifying less pain. Pain improvement was related to compartments involved/released with the best results in patients who had posterior releases (8.2 pre-op to 1.3 at follow-up) and the worst results in patients who had anterior and posterior releases (9.1 pre-op to 5.1 at follow-up). Exercise levels improved following compartment releases, with 74% reporting a return to preinjury levels at some point. At final follow-up, however, the number of patients who returned to preinjury levels declined to 42%. Patients with anterior compartment fasciotomies had more pain and problems than those with posterior fasciotomies. The duration of preoperative symptoms was important in the anterior compartment releases with delays over 12 months associated with worse results.

#### ■ COMMENT BY MARK D. MILLER, MD

This study has several flaws, namely, it is retrospective and was based on questionnaires with only a 44% recruit-

ment rate. Nevertheless, it does represent one of the only reports of intermediate to long-term results of fasciotomies for exertional compartment syndrome. Slimmon et al reported less than encouraging results, especially in patients with anterior compartment releases. They suggest several reasons for this including difficulty in making the diagnosis, secondary delayed effects of surgery (such as scarring), and possibly intrinsic structural defects.

This report is interesting because it reflects my own clinical practice. Rarely is compartment release for exertional compartment syndrome a “home run.” We need to counsel our patients of that fact. I perform only a few of these procedures a year, and sometimes dread seeing these patients back in clinic postoperatively. I cannot imagine what the Slimmon’s clinic must be like after performing 260 of these procedures through 1997! The message is clear: Proceed with caution, and don’t promise great results. ■

## Heat Illness in Athletes

ABSTRACT & COMMENTARY

**Synopsis:** *Sports medicine practitioners must be able to differentiate exercise-associated muscle (heat) cramps, heat syncope, exercise heat exhaustion, exertional heat stroke, and exertional hyponatremia to reduce the severity of heat illness in athletes.*

**Source:** Binkley HM, et al. *Journal of Athletic Training*. 2002;37:329-343.

THIS STATEMENT PROVIDES PREVENTIVE STRATEGIES to reduce heat-related illness, identifies the factors associated with early detection of heat illness, provides guidelines for on-site first aid and emergency management, and discusses return-to-play procedures. The thermoregulation and physiologic response to heat are reviewed, and the special concerns associated with special populations, such as children, older adults, and athletes with spinal cord injuries are discussed.

The statement points out that the traditional classification of heat illness includes heat cramps, heat exhaustion, and heat stroke, but that this system omits several other heat- and heat-related illnesses. In this statement, exertional heat illnesses are defined under the categories of exercise-associated muscle (heat) cramps, heat syncope, exercise (heat) exhaustion, exertional heat stroke, and exertional hyponatremia. The signs and symptoms of each illness are presented and guidelines for treatment discussed.

Strategies for prevention of exertional heat illness

include education of athletes and coaches, a thorough preparticipation medical screening, appropriate adaptation (acclimatization) to exercise in the heat, and proper sleep in a cool environment. The environmental conditions should be checked, and appropriate guidelines for participation, modified participation, or cessation of activity in extreme heat and humidity should be developed. Adequate and unrestricted access to water by athletes is essential, and high-risk athletes should be weighed before and after practice to monitor water lost and replaced. An emergency plan for treatment of heat illness should be developed and implemented prior to the start of practice.

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

This statement, supported by 230 references from the scientific literature, is an excellent resource for physicians and allied health care providers involved in the prevention, recognition, and treatment of athletic injuries and illnesses. It provides the relevant physiology of thermoregulation in support of the definitions of exertional heat illness, and the recommendations for prevention, recognition, and treatment of these illnesses.

The statement discusses the nonenvironmental and environmental risk factors associated with heat illness, and lists the predisposing medical conditions that add to the risk of heat illness. An understanding of this information is essential for the prevention of exertional heat illness and the establishment of appropriate guidelines for safe return to competition.

The need for appropriate guidelines in the care of competitive athletes at the high school, intercollegiate, and professional sport levels is obvious. One should be mindful that special populations of physically active individuals have special needs with regard to prevention and treatment of heat illness. For example, the physiology of prepubescent children, older adults, and spinal cord injured athletes may predispose them to exertional heat illnesses. The statement identifies some of the physiological factors and correctly identifies the need for additional research with these special populations.

Each form of heat illness is serious, but the elevated core temperature (> 40°C or 104°F) associated with exertional heat stroke is life threatening and can be fatal if not promptly recognized and treated. The statement explains that contrary to some common misconceptions, the fastest way to decrease body-core temperature is immersion of the trunk and extremities into a pool or tub filled with cold water between 1°C (35°F) and 15°C (59°F).

To obtain a copy of this position statement on exertional heat illness, contact: National Athletic Trainers’ Association, Communications Department, 2952 Stemmons Freeway, Dallas, TX 75247. ■

# Hamstring vs. Patellar Tendon Grafts

ABSTRACT & COMMENTARY

**Synopsis:** *There were no significant functional differences in patients treated with either graft at a minimum of 5 years. Hamstring grafts were slightly looser initially but equal at later time points, and patellar tendon grafts had more arthritic changes.*

**Source:** Pinczewski LA, et al. *Am J Sports Med.* 2002;30:523-536.

THE DEBATE OVER HAMSTRING VS. PATELLAR TENDON grafts for ACL reconstruction continues to escalate. With improved fixation methods, hamstring grafts have seen resurgence in popularity. What has been lacking to this point are good prospective, comparative studies to help determine the differences in outcome with the 2 methods. Pinczewski and colleagues have provided us with an outstanding paper that follows 2 separate groups of 90 patients for a minimum of 5 years. The methods were prospective but not randomized. They began with all patellar grafts and then made a switch to hamstring grafts hoping to randomize patients. However, when patients heard from each other how much more rapid the recovery was with hamstring grafts they could no longer talk patients into randomization and went to hamstring grafts only. Strengths of this study include the long-term, prospective follow-up, single-surgeon team, consistent surgical technique, and exactly the same fixation for both grafts. Seven  $\times$  25 mm RCI soft-threaded titanium screws (Smith & Nephew Endoscopy, Andover, Mass) were used to fix all grafts proximally and distally regardless of graft size. Only isolated ACL tears were included, and meniscal pathology was comparable between groups. No patients were braced postoperatively. Evaluations at varying intervals by an independent examiner included Lachman and pivot shift testing, IKDC and Lysholm knee scores, KT 1000 arthrometry, assessment of thigh atrophy and weightbearing radiographs.

IKDC scores, Lysholm knee scores, level of activity, and range of motion were not statistically different. Hamstring grafts were slightly more loose at 1 year, with roughly 70% of patients having a stable exam and less than 3 mm of side-to-side difference on KT testing vs. 90% of patella tendon graft patients. Interestingly, over the 5 years of follow-up, the hamstring grafts appeared to gradually tighten so that the final laxity was very similar with a mean side-to-side difference of 1.7 mm with

hamstrings and 1.3 mm for the patellar group. The subset of female patients with hamstrings seemed to be most responsible for the increased laxity at the early time points. This has been noted by other investigators and may be related to bone density and fixation strength. Patella patients were more likely to complain of donor site pain and difficulty with kneeling which persisted even to 5 years (41% vs 12%).

A notable finding is the difference in the rate of arthritic changes noted on weightbearing x-rays. The patella group at 5 years had mild arthritic changes in 18% compared to just 4% of the hamstring group. With this was seen a gradual loss of extension for the patella group. With the exception of differences in arthritic findings and extension, Pinczewski et al feel that both grafts are comparable and both are acceptable.

## ■ COMMENT BY DAVID R. DIDUCH, MS, MD

This paper, though lengthy, merits reading as it is packed with information. I think we can say with confidence that hamstring and patellar tendon grafts are both acceptable for our patients. What was fairly interesting to note was a difference in arthritic changes with the patellar tendon grafts. The only clue Pinczewski et al provide is that the native patella tendons shortened about 10% in the patients receiving that graft while the hamstring group did not see any patella tendon shortening. Patella baja is associated with increased joint contact pressures and arthritic changes so this may be the culprit. The patellar tendon defects were not closed in any of these patients.

It was notable that the hamstring grafts were looser in the first 1-2 years, especially for the women. Whether this is related to inherent tissue differences or bone fixation remains to be studied. What is even more remarkable is that the hamstring grafts appeared to tighten while the patellar grafts gradually loosened with time so that both ended in a comparable range. How the grafts could tighten is unclear. A recent study demonstrated myofibroblasts on sheep tendon grafts that may be responsible and should be an area of further research.<sup>1</sup> This also may be the gradual remodeling of the graft and repopulation with host cells that allows the graft to function more like a native ACL. It is important to note that Pinczewski et al used aperture fixation with an interference fit screw that should result in a stiffer graft construct than suspensory fixation. The results are remarkably good with a single screw diameter and no attempt at tunnel compaction. Compared to other studies, this paper offers the longest follow-up with the largest numbers and the most carefully designed methodology to date. It is well worth reading and outlines very clearly the differences that do exist between the grafts and the long-term success that can be expected with each. ■

## Reference

1. Weiler A, et al. *J Orthopaedic Res.* 2002;20:310-317.

# Meniscal Arrows: Hitting the Target

ABSTRACT & COMMENTARY

**Synopsis:** *Approximately 40 patients with combined ACL reconstruction and meniscal repair with the Bionx Arrow were retrospectively evaluated at an average of just over 2 years following surgery. The study reported a success rate of just over 90%.*

**Source:** Gill SS, Diduch DR. *Arthroscopy.* 2002;18:569-577.

THE BIONX MENISCAL ARROW WAS ONE OF THE FIRST commercially available bioabsorbable “all-inside” meniscal repair devices. Until recently, independent clinical evaluation of the arrow has not been presented or published. The present article represents one of several recent reports of clinical success with this device.

Gill and Diduch retrospectively evaluated 38 patients with 39 meniscal tears repaired with meniscal arrows with concurrent anterior cruciate ligament (ACL) reconstruction. An average of 2.5 arrows were used per case, and central 1/3 patellar tendon autografts were used for all ACL reconstructions. Evaluation, at an average of 2.3 years (range, 18-39 months) was accomplished in 32 patients with formal IKDC ratings, visual analog scores, KT-2000, and subjective history. Twenty-four patients were re-examined, and all 32 patients completed subjective evaluation. Repeat arthroscopy was only done in 1 patient for an unrelated problem. IKDC evaluation (which did not include all parameters for those patients who were not examined) demonstrated normal (A) results in 11 patients, nearly normal (B) results in 18, and 3 failures. Visual analog scores, recorded on a scale of 0-10 with lower scores indicating no problem with vigorous return to sports, were reported to be an average of 1.1-1.3. KT-2000 evaluation demonstrated that no patients had a side-to-side difference of over 3 mm. Gill and Diduch emphasize that careful technique and patient selection are keys to successful meniscal repair using the Bionx arrow.

### ■ COMMENT BY MARK D. MILLER, MD

This paper reflects the growing consensus that meniscal repair can be successfully accomplished with “all-inside” devices. These devices have become enormously popular because of the ease of insertion and

marked reduction in the time required for meniscal repair. The Bionx meniscal arrow is representative of an entire generation of these devices that have a head and barbs that can be inserted into a meniscus to reduce and stabilize a meniscal tear. It is important to emphasize, however, that there have been a number of case reports that have described numerous complications associated with the use of these devices. These complications include migration, cyst formation, breakage, and, perhaps of most concern, articular cartilage damage. It is also important to recognize, as Gill and Diduch have pointed out, some meniscal tears cannot be successfully fixed with these devices. Additionally, again as recognized by Gill and Diduch, the meniscal repairs reported in the present study were done under ideal conditions—peripheral tears with concurrent ACL reconstruction. In all other cases, the use of arrows, or any all-inside technique, should be done with caution, and the gold standard remains inside-out vertical mattress sutures. A new generation of meniscal repair devices (Smith & Nephew’s Fas-T-Fix and Mitek Worldwide’s Rapid Loc) are attractive because they allow tensioning of the meniscal repair. However, we recommend caution with these devices as well until laboratory and clinical studies of these devices have been accomplished. New research into more rapidly dissolving polymers, sutures, and techniques will likely result in another generation of devices in the near future. Once again, however, all of these devices must be compared to vertical mattress sutures. ■

# Effects of Valgus/Varus Knee Alignment on Functional Balance Control

ABSTRACT & COMMENTARY

**Synopsis:** *This study found that subjects with either genu valgus or genu varus at the knee compensate with a more rear-foot directed center of pressure and greater plantar forces. This suggests that subjects with greater valgus or varus rely more on the subtalar and mid-tarsal joint control function of the ankle plantar flexor muscle group for lower extremity postural control.*

**Source:** Nyland J, et al. *Med Sci Sports Exerc.* 2002;34:1150-1157.

ATHLETES THAT ARE EITHER POSITIONED IN GENU valgus or genu varus must compensate with com-

pendent alignment changes at the ankle, subtalar and midtarsal, or hip joints. Either genu valgus or varus alters foot plant position and frontal plane sway during running. Genu valgus or varus alignment may alter the quadriceps' effectiveness at stabilizing the joint and possibly altering strain on the anterior cruciate ligament.

Nyland and colleagues studied 56 male and female intercollegiate athletes with either neutral, varus, or valgus alignment. They monitored center of pressure (COP) of the foot using an insole foot pressure system and the measured knee alignment using a video camcorder. Nyland et al's first hypothesis was that the COP of the foot in subjects with neutral tibiofemoral geometry would be more anterior and lateral than compared to subjects with greater genu valgus or genu varus. The hypothesis was founded on a second hypothesis that a forefoot shift in AP COP and a lateral shift in ML COP would be suggestive of increased ankle plantar flexor group function. They observed a posterior shift of the COP in subjects with greater than 5° of varus or valgus, but they did not observe a medial shift.

#### ■ COMMENT BY TIMOTHY E. HEWETT, PhD

Nyland et al observed a posterior shift in the COP in valgus or varus subjects and suggest that these observations demonstrate movement away from a plantarflexor ankle strategy of postural control. They suggest that these athletes use the plantar flexor musculature more for subtalar and midtarsal joint control than do athletes with more neutral alignment.

This was a very well done study. The testing methods were documented to be reliable and reproducible. The ideas were original. The study design was well thought out. Nyland et al did not present an analysis of their data with athletes grouped into valgus and varus subgroups. This may have proven very important for their analysis. Why did Nyland et al not observe the medial shift in COP that they postulated? Perhaps because the varus and valgus individuals shifted their weight in opposite directions and canceled each other out. Another problem with the study is that Nyland et al extended their conclusions too far from their findings. They use their findings to draw conclusions about plantar flexor control patterns that may or may not have been present. A more proximal strategy could underlie the observed posterior shift in COP.

In summary, it appears that increased knee angulation leads to altered strategies for postural sway control. Nyland et al suggest that this shift is more toward a subtalar or midtarsal joint control strategy. However, we cannot rule out a shift to a more proximal joint control strategy. ■

## Dynamic Motor Control Strategies: A New Hypothesis

ABSTRACT & COMMENTARY

**Synopsis:** *This study describes a potential solution for the problem of motor control variability. The hypothesis addresses the question of why an athlete cannot, for example, control the trajectory of a ball in exactly the same way, every time he or she performs the task.*

**Source:** Latash ML, et al. *Exercise and Sports Science Reviews*. 2002;30(1):26-31.

LATASH AND COLLEAGUES REVIEWED THE UNCONTROLLED manifold hypothesis of motor control. Motor Control Variability is the term that describes the phenomenon that several attempts at the same task always lead to different performance patterns, including differences in kinematics, kinetics, and muscle activation during the movement. For example, when you attempt to sink a 10-foot putt from the exact same spot on the green, you often perform this putt in slightly different ways and most concerning, with slightly different results. The question is why? Latash et al believe that motor control variability is not bad (unless you want to sink 10 free throws in a row). At the very least, it gives us a way to look at motor control patterns.

Motor redundancy likely underlies motor control variability. Motor redundancy is present when many more elements contribute to the performance of a task than are necessary to complete the task. Earlier hypotheses to explain motor redundancy are the Principle of Minimal Interaction and the Principle of Abundance. The Principle of Minimal Interaction states that the controller (the brain) organizes elements and dictates the task. If one element errors, the other elements correct the error without consulting the controller. The Principle of Abundance dictates that all elements participate to assure stability and flexibility of performance. This principle renders redundancy irrelevant because no degrees of freedom are ever frozen or eliminated.

The new hypothesis, the Uncontrolled Manifold Hypothesis, states that the controller (Brain) attempts to stabilize a particular variable by setting a subspace in which the control components are allowed to function. The Hypothesis predicts the relation between the con-

troller and the allowed variability in the subspace. Following practice of the desired task, variability may increase or decrease, but must remain within the subspace designated by the controller. The presence of a multi-element system may stabilize several variables simultaneously within the subspace.

#### ■ COMMENT BY TIMOTHY E. HEWETT, PhD

Latash et al should be commended for taking on a complex topic and making it understandable with the use of a few salient examples. They reviewed a few studies involving whole-body motion, bimanual task coordination, and joint and finger coordination. Much of it was Latash's work. The sit-to-stand studies showed differences in the horizontal and vertical motion of the center of mass and suggest an envelope of acceptable variability. The bimanual pointing study provided support for the hypothesis that the joints of the 2 arms were united in bimanual synergy, again within a subspace of variability. Latash et al state "the hypothesis and associated computational apparatus have great potential for application in the areas of motor rehabilitation and motor skill acquisition." They may be correct in their conclusion. However, the uncontrolled manifold hypothesis remains just that, a hypothesis.

In summary, this hypothesis is similar to Principal Component Analysis, except it tests hypotheses about variability within a subspace. As of yet, the hypothesis has only been tested on some simple motor tasks. Athletic maneuvers can be much more complex. Questions that remain include, how do we use this hypothesis to help athletes address dynamic joint control for both the pursuit of athletic perfection and prevention of joint injury? In addition, how does this hypothesis fit with theories of muscle agonist-antagonist synergy for the attainment of technique perfection and dynamic joint control? Until our athletes can readily exceed the performance of a Michael Jordan on the basketball court or a Tiger Woods on the golf course, this hypothesis and new ones will continue to be tested in order to better our understanding of motor control variability and motor redundancy. ■

## CME Questions

28. Arthroscopic debridement for an arthritic knee only showed a benefit over sham surgery at:
- 2 weeks.

- 6 months.
  - 1 year.
  - 2 years.
  - no time point.
29. Young pitchers skilled with throwing curve balls have:
- greater incidence of shoulder pain, compared to pitchers not throwing curveballs.
  - less incidence of shoulder pain, compared to pitchers not throwing curveballs.
  - no difference in elbow pain, compared to pitchers not throwing curveballs.
  - no difference in shoulder pain, compared to pitchers not throwing curveballs.
30. Results of fasciotomy for exertional compartment syndrome:
- are universally good for both anterior and posterior compartment releases.
  - are better for anterior than posterior releases.
  - are better for posterior than anterior releases.
  - are universally bad for both anterior and posterior compartment releases.
31. The most efficient and appropriate manner of decreasing body core temperature in an athlete with exertional heat stroke is to:
- remove all clothing.
  - wipe with cold sponges.
  - spray with a hose.
  - immerse in a tub of cold water
32. Which of the following differences between hamstring grafts and patellar tendon grafts were statistically significant at 5 years?
- Rate of arthritic changes over time.
  - IKDC scores.
  - KT 1000 arthrometry scores.
  - Lysholm scores
33. Varus or valgus knee alignment leads to movement of the center of pressure of the foot in what direction in athletes during single-leg stance?
- Anterior
  - Posterior
  - Medial
  - Lateral
34. The uncontrolled manifold hypothesis incorporates which of the following components?
- A controller
  - A Subspace
  - Variability
  - All of the above
35. Meniscal repair with the Meniscus Arrow in patients undergoing concurrent ACL reconstruction resulted in a success rate of approximately:
- 10%.
  - 50%.
  - 70%.
  - 90%.

## In Future Issues:

Scope vs. No Surgery for First Time Shoulder Dislocators

# PHARMACOLOGY WATCH



## High-Dose Rofecoxib Confirmed Prothrombotic, Study Shows

Debate over the cardiovascular effects of COX-2 inhibitors has raged for more than a year since a special communication was published in *JAMA* last August (*JAMA*. 2001;286: 954-959) suggesting an increase in cardiovascular events with rofecoxib (Vioxx). As the argument goes, unlike nonselective NSAIDs, COX-2 inhibitors have no effect on thromboxane thus they do not inhibit platelet aggregation. However they do inhibit vascular prostacyclin—an effect that may be prothrombotic. Nonselective NSAIDs inhibit both thromboxane and prostacyclin. Whether COX-2 inhibitors are prothrombotic or merely lack the antiplatelet action of nonselective NSAIDs is at the crux of the debate. Now a large retrospect, the cohort study from the Tennessee Medicaid program seems to confirm the prothrombotic effects of rofecoxib, at least in high dose. Researchers from Vanderbilt University reviewed the records of 202,916 patients who did not use anti-inflammatories, 151,728 patients who used “other” anti-inflammatories, and 24,132 patients on rofecoxib over the 18 months between January 1999 and June 2001. Participants were between 50 and 84 years of age and had no life-threatening noncardiovascular illnesses. Users of high-dose rofecoxib (50 mg/d) were 1.7 times more likely than nonusers to have serious CHD (95% CI, 0.98-2.95;  $P = 0.058$ ). Among new users of high dose rofecoxib, the rate increased to 1.93 (1.09-3.42,  $P = 0.058$ ). There was, however, no increase risk of CHD with lower doses of rofecoxib or with use of other NSAIDs (*Lancet*. 2002;360:1071-1073). This study supports the hypothesis that high-dose COX-2 inhibition may be prothrombotic. This evidence is supported by a study in genetically engineered mice. Mice that lack the prostacyclin receptor (a defect that is similar to the effects of COX-2 inhibitors) overproduce thromboxane A<sub>2</sub>—and are likely to form arterial clots (*Science*. 2002;296:539-541). A recent “Clinical

Implications of Basic Research” elegantly depicts the eicosanoid balance and the effects of these drugs on clotting (*N Engl J Med*. 2002;347:1025-1026).

### **Losartan Better Than Atenolol for LVH Treatment**

Losartan is a better option than atenolol for treating isolated systolic hypertension in patients with left ventricular hypertrophy according to a new study. More than 1300 men and women with systolic hypertension and ECG evidence of LVH were randomized to treatment with losartan or atenolol with hydrochlorothiazide added as a second agent as needed. The main outcome measure was a composite end point of cardiovascular death, stroke, or myocardial infarction. After a mean of 4.7 years of follow-up, the main outcome was reduced by 25% with losartan compared with atenolol. There were 25.1 events per 1000 patients years in the losartan group vs. 35.4 in the atenolol group (relative risk [RR] 0.75; 95% confidence interval, 0.56-1.01;  $P = 0.6$ ). There was no difference in the rate of myocardial infarction; however, cardiovascular mortality was significantly decreased in the losartan group as was nonfatal and fatal stroke. Total mortality was also significantly lower than the losartan group (21.2 vs 30.2 events per thousand patient-years; RR, 0.72; 95% CI, 0.53-1.00;  $P = .046$ ). New onset diabetes was also significantly reduced in

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the losartan group, a finding that has been seen in other studies of ARBs. Losartan was also better tolerated than atenolol (*JAMA*. 2002;288:1491-1498).

### **Lisinopril, Not Losartan, Improves Myocardial Perfusion**

In a related study of patients with hypertension and LVH, long-term treatment with lisinopril but not losartan improved myocardial perfusion in maximal coronary blood flow. In this small study, 17 patients with hypertension and LVH (9 treated with lisinopril, 8 treated with losartan) were evaluated with positron emission tomography at baseline and after coronary vasodilation with dipyridamole. The same studies were done on 8 normotensive control patients. After treating with lisinopril, maximal coronary blood flow and myocardial perfusion reserve increased significantly compared with pretreatment values ( $P = 0.02$ , and  $P = 0.002$  respectively). Post-treatment hyperemic flow in patients treated with lisinopril was not significantly different from corresponding measurements and control patients. No difference in either measure was noted with losartan. The authors postulate that angiotensin converting enzyme inhibitors potentiate endogenous bradykinins, which in turn improve myocardial perfusion reserve. Losartan, like other angiotensin receptor blockers, has no effect on bradykinins, which may explain the lack of improvement in this measure. The authors postulate that ACE inhibitors may be more effective in repairing the coronary microangiopathy associated with hypertension-induced LVH (*J Am Coll Cardiol*. 2002;40:703-709).

### **New Fluoroquinolone Study**

It seems that every year there is a new study linking antibiotic use with a reduction in coronary disease. The most recent is a Dutch study of Type 2 diabetics. Using a national hospitalization database from 8 cities, researchers found a significantly reduced risk of CHD in patients who had used at least 14 days of a fluoroquinolone in the 3-year study period (odds ratio = .30; 95% CI, 0.12-0.75). No other antibiotic was associated with a reduction in CHD including tetracyclines, macrolides, cephalosporins, or penicillin derivatives (*Eur Heart J*. 2002;23:1575-1579). And while the explanation for such improvement is still elusive, ongoing research is looking into the CHD/inflammation/infection connection.

### **Warfarin After MI Better Than Aspirin Alone**

Warfarin, with or without aspirin, is better than aspirin alone in preventing vascular events after myocardial infarction according to a new study. In a

randomized, multicenter trial, 1216 patients received warfarin (target INR 2.8 to 4.2), 1206 received aspirin 160 mg per day, and 1208 received aspirin 75 mg per day combined with warfarin (target INR 2.0 to 2.6). The mean duration of the study was 4 years and the primary outcome was a composite of death, nonfatal reinfarction, or thromboembolic cerebral stroke. The results showed a recurrence rate of 20% in the aspirin group (241 of 1206), 16.7% in the warfarin group (203 of 1216), and 15% in the combined warfarin in aspirin group (181 of 1208). The difference between the warfarin and warfarin/aspirin group was not statistically significant. There was a statistically significant increase in major, nonfatal bleeding in both warfarin groups compared to the aspirin group (0.62% vs 0.17%, respectively [ $P < 0.001$ ]). The authors conclude that warfarin given alone or in combination with aspirin is superior to aspirin alone in reducing the incidence of composite vascular end points after myocardial infarction; however warfarin therapy is associated with a higher risk of bleeding. No difference in mortality was noted between the 2 groups (*N Engl J Med*. 2002; 347:969-974).

### **FDA News**

Valacyclovir (Valtrex-GlaxoSmithKline) has been approved for the treatment of cold sores (herpes labialis). The approval was based on studies that showed that valacyclovir 2 g twice a day for 1 day shortens the duration of cold sore outbreaks by about 1 day.

The FDA is one step closer to approving tiotropium (Spiriva-Boehringer Ingelheim), a new long-acting anticholinergic agent for the treatment of COPD. The drug was reviewed by the FDA's Pulmonary Allergy Drugs Advisory Committee and endorsed for the treatment of bronchospasm, however there was no support for the proposed indication of dyspnea.

The agency has strengthened its warnings on mefloquine (Larium-Roche) because of concerns of CNS side effects. Mefloquine is used in the treatment and prevention of malaria. The FDA specifically stated that mefloquine is contraindicated in patients with psychiatric disorders including active depression, recent history of depression, generalized anxiety disorder, psychosis, schizophrenia, or other major psychiatric disorders, or with a history of convulsions. The FDA also warns that patients taking the drug for prophylaxis should discontinue it immediately if psychiatric symptoms should develop. Roche has recently issued a "Dear Dr. letter" regarding these warnings. ■