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Arthroscopic Rotator Interval Repair in Glenohumeral Instability

ABSTRACT & COMMENTARY

Synopsis: *Rotator interval plication can be performed and visualized arthroscopically for isolated cases of shoulder instability.*

Source: Gartsman G, et al. Arthroscopic rotator interval repair in glenohumeral instability: Description of an operative technique. *Arthroscopy* 1999;15:330-333.

Gartsman and colleagues present a concise and straightforward technique for arthroscopic repair of rotator interval lesions. Their technique emphasizes a direct intra-articular visualization without entering the subacromial space. The advantage of this technique is purported to be intra-articular visualization of the repair. This differs from other arthroscopic rotator interval plication techniques that view the closure from the bursal surface through the subacromial space.

COMMENT BY STEPHEN B. GUNTHER, MD

Shoulder instability is a multifactorial process of dysfunctional laxity that leads to one of several different clinical scenarios. The direction, chronicity, degree, volition, and mechanism of instability are a few of the important factors. The rotator interval is a triangular area between the supraspiatus and subscapularis tendons that contains the superior glenohumeral ligament and the coracohumeral ligament. Warner and colleagues[1] and Harryman and associates[2] performed anatomic, cadaver studies that elucidated the importance of the rotator interval in providing static shoulder stability in positions of flexion, extension, and adduction with external rotation.

Rotator interval plication is a standard adjunct to capsular shift procedures for anterior-inferior instability if a rotator interval defect is present. However, the role of isolated rotator interval plication as a shoulder stabilization procedure is controversial. While Gartsman et al describe a technique for arthroscopic rotator interval plication, its value as a stand-alone procedure is unknown. ❖

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1. Warner JJP, et al. Static capsuloligamentous restraints to superior-inferior translation of the glenohumeral joint. *Am J Sports Med* 1992;19:675-685.
2. Harryman DT, et al. The role of the interval capsule in passive motion and stability of the shoulder. *J Bone Joint Surg Am* 1992;74:53-66.

Overuse Injuries in Children and Adolescents

ABSTRACT & COMMENTARY

Synopsis: *Several factors contribute to a number of overuse injuries in children and adolescents, including growth and inadequate conditioning.*

Source: DiFiori JP. Overuse injuries in children and adolescents. *Phys Sportsmed* 1999;27(1):75-89.

Although there are many positive benefits from sports participation by our youth—increasing self-esteem, acquiring leadership skills and self-discipline, developing general fitness and motor skills, and enhancing peer socialization—DiFiori reminds us that these activities are not without the risk of injury. Commonly seen overuse injuries in children and adolescents include the following, in order of frequency: patellar pain, Achilles tendonitis, infrapatellar tendonitis, enthesopathies, Osgood-Schlatter's disease, and osteochondritis. Factors contributing to such injuries include growth, prior injury, inadequate conditioning, anatomic malalignment, too rapid training, incorrect equipment or sport technique, and peer or adult pressure. Guidelines for evaluation and treatment of common overuse injuries in children and adolescents are suggested.

COMMENT BY LETHA Y. GRIFFIN, MD, PhD

Unfortunately, the lack of participation in regular physical activity by our youth is impressive. Despite efforts to increase youth fitness, enrollment in high school physical educational classes between 1991 and 1995 dropped from 42% to 25%, and according to a report of the surgeon general on physical activity and health published in 1996,[1] half of American youth are not vigorously active on a regular basis. Approximately 14% of young people participate in no physical activity.

Hence, an emphasis on youth fitness seems reasonable despite the potential risk of injury. Although DiFiori addresses a number of physical injuries that may occur to young athletes, he does not address the issue of sports "burnout" masquerading as sport injury. Young athletes may feel pressured by well-meaning parents and coaches to win. They may be forced to forgo participation in peer activities such as the school newspaper, yearbook, student government, and chorus as well as give up social times with friends. Occasionally, adolescents feel trapped in a sport in which they have lost interest or for which they feel their abilities or bodies are no longer suited. For example, a gymnast who grows six inches and gains 25 pounds during puberty may not be able to perform as effectively as when she had a smaller, leaner body. Young people, in order to avoid telling parents or coaches that they no longer wish to participate in a sport for which they have been groomed, may instead develop a series of overuse injuries that prevent sports participation. It is our job as sport physicians to look beyond the immediate injury and help these young people resolve the larger issue of their continued participation in a particular sport, emphasizing to them that giving up organized, competitive sports should not make one reject continued participation in recreational fitness activities. ❖

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Reference

1. US Department of Health and Human Services, National Centers for Chronic Disease Prevention and Health Protection. Physical Activity and Health: A Report of the Surgeon General. Pittsburgh, PA: Superintendent of Documents, 1996.

The Measurement of Subacromial Contact Pressure in Patients with Impingement Syndrome

ABSTRACT & COMMENTARY

Synopsis: *Impingement syndrome of the shoulder has a complex and, at times, unclear pathogenesis.*

Source: Nordt WE 3rd, et al. The measurement of subacromial contact pressure in patients with impingement syndrome. *Arthroscopy* 1999;15(2):121-125.

Twenty-five patients who underwent an arthroscopic subacromial decompression and acromioplasty for impingement syndrome after failing conservative care were evaluated postoperatively by the UCLA scoring system. The morphology of the acromion was also assessed radiographically. Perioperatively, a catheter was placed beneath the anterior component of the acromium under arthroscopic visualization, and contact pressures were recorded through a normal arc of motion. Mean pressure was recorded, and the results were statistically evaluated. Mean pressures prior to acromioplasty were measured at 0°, 90°, and 180° of abduction as well as hyperabduction (which was defined as force-passive abduction to the maximum) and cross-arm adduction. All five measurements diminished significantly following the decompression.

At 90° of abduction, pressure always decreased with internal rotation and always increased with external rotation. Maximum contact pressure developed in either hyperabduction or cross-arm adduction in all patients except two. In general, the preoperative findings of maximum impingement pain generally correlated with the position of maximum contact pressure.

Nordt and colleagues concluded that while acromioplasty significantly decreases anterior edge subacromial contact pressures, the correlation between symptoms and acromium type appears to be much more complex. They also concluded that there are at least two types of impingement pathogenesis according to arm position and rotator cuff contact pressure and that further evaluation is necessary to increase our understanding of this complex process.

COMMENT BY JAMES P. TASTO, MD

Impingement syndrome has become a popular diagnosis in the hands of orthopedists, as well as those dealing with musculoskeletal problems in general. We have found over the last few years that it is a condition that is grossly overdiagnosed. It has become the most common shoulder diagnosis entering the sports medicine physician's office. Many of these patients have rotator cuff tears, partial or complete; acromioclavicular joint pathology; subtle glenohumeral instability; or, in many cases, an early adhesive capsulitis. Therefore, before a surgical procedure is to be recommended to a patient, the conservative management symptoms should have failed and specific physical examination criteria must be met.

The greatest error that we see as consultants in the field of orthopaedics is the early frozen shoulder syndrome being diagnosed as an impingement syndrome. The classical definition by Neer mandates that the patient have an almost full range of motion before this diagnosis can be made.[1] He also implicated the anterior edge of the acromium as the causal factor in impingement pathology.

This study points out a unidimensional analysis of contact pressure only and does not take into consideration other factors such as sheer forces and other causes of pain such as bursitis, which can be intrinsic to any type of cuff tendonapathy. Surgically, we have always concentrated on removing the anterior component of the acromium, but we should also pay close attention to the lateral acromial morphology, which can also be an important factor in increasing contact stresses. The cause of residual pain in patients after an apparently adequate subacromial decompression can be difficult to define. Scarring or intrinsic changes within the cuff may be the cause. Nordt et al clearly point out that subacromial pressure may not directly correlate to acromial morphology. They also point out that rotator cuff contact on the acromium in the position of hyperabduction, as well as cross-arm adduction, may each represent a different pathogenesis. In this study, a cross-arm adduction test, generally thought to be indicative of acromioclavicular joint pathology, did generate high subacromial pressures. Findings of supraspinatous partial cuff tears were quite consistent in the group that had increased pressure with hyperabduction. It is also to be noted that these studies were done with active range of motion rather than passive range of motion, which does not adequately simulate the clinical condition in the functionally active patient.

Shoulder pain that falls within the general diagnosis of impingement syndrome continues to be an intriguing diagnostic dilemma. As in other areas, such as the patellar tendon and the Achilles tendon, osseous encroachment is not a factor, and pain is often the result of microtears and degradation of the tendon itself. Further studies in this area, as well as further improvement in our diagnostic skills, are imperative to formulate an appropriate treatment program for many of these patients. ❖

Suggested Readings

1. Neer CS. Anterior acromioplasty for the chronic impingement syndrome in the shoulder: A preliminary report. *J Bone Joint Surg Am* 1972;54:41-50.
2. Neer CS. Impingement lesions. *Clin Orthop* 1983; 173:70-77.
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4. Hawkins RJ, Kennedy JC. Impingement syndrome in athletes. *Am J Sports Med* 1980;8:151-158.
5. Bigliani LU, et al. The relationship of acromial architecture to rotator cuff disease. *Clin Sports Med* 1991; 10:823-838.

Chondrocyte Implantation in the Repair of Chondral Lesions of the Knee: Economics and Quality of Life

ABSTRACT & COMMENTARY

Synopsis: *Cartilage cell implantation improves patient quality of life and is an appropriate, cost-effective treatment for cartilage lesions of the knee.*

Source: Minas T. Chondrocyte implantation in the repair of chondral lesions of the knee: Economics and quality of life. *Am J Orthop* 1998;27(11):739-744.

Minas presents some of the economic issues associated with autologous chondrocyte implantation (ACI), one of several available techniques used by orthopedists to restore hyaline cartilage in areas of full thickness articular cartilage loss. He estimates that the cost for this procedure per additional quality-adjusted year of life is $6791, a cost he believes is comparable to other therapies for chronic illnesses. Direct in-hospital costs for this procedure ranged from $17,607 to $38,400, including facility and physician charges for the initial biopsy procedure and the subsequent implantation surgery.

COMMENT BY LETHA Y. GRIFFIN, MD, PhD

In the past, cartilage abrasion or abrasion with drilling of the subchondral bone has been done to treat areas of articular cartilage loss, but these techniques result in the development of fibrocartilage rather than hyaline cartilage. Stone and Walgenback have developed a technique reported to enhance hyaline-like cartilage development in knees by adding to drilled areas growth factors delivered as a "paste" of morelized hyaline cartilage taken from the non-weight-bearing notch area.[1]

Others, such as Hangody and colleagues[2] and Bobic,[3] have developed techniques to graft hyaline cartilage defects occurring in young active individuals with autologous bone plugs harvested from either the femoral notch or the lateral trochlear border. The technique of autologous cell implantation is the most expensive of the procedures available to try to fill hyaline cartilage defects in young, active people. Advocates of ACI feel that of all the procedures presently used, it alone truly results in new autologous type II cartilage.[4] Minas reports "a success rate of over 80%." However, not only does this technique require two operative procedures, the second of which is done open rather than arthroscopically, it also necessitates growing cells harvested during the initial procedure in tissue culture to obtain a sufficient quantity of cells for grafting to the area of cartilage loss; therefore, it is not ideal. Looking to the future, one hopes that scientists will soon be able to recommend the proper combination of growth factors mixed with the appropriate collagen scaffold that will, when added to mesenchymal cells derived from drilling of articular cartilage defects, result in true hyaline cartilage healing. ❖

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1. Stone K, Walgenback A. Surgical technique for articular cartilage transplantation to full-thickness cartilage defects in the knee joint. *Operative Techniques in Orthopaedics* 1997;7(4):305-311.
2. Hangody L, et al. Osteochondral plugs: Autogenous osteochondral mosaicplasty for the treatment of focal chondral and osteochondral articular defects. *Operative Techniques in Orthopaedics* 1997;7(4):312-322.
3. Bobic V. Arthroscopic osteochondral autograft transplantation in anteriour cruciate ligament reconstruction: A preliminary clinical study. *J Bone Joint Surg Br* 1966;78:Suppl I,59.
4. Minas T, Nehrer S. The treatment of articular cartilage defects. *Orthopaedics* 1997;20(6):525-538.

Snowboarding: Defining the Injury Spectrum

ABSTRACT & COMMENTARY

Synopsis: *Comparisons were made to data detailing injuries of patients hospitalized after downhill skiing accidents. Head injuries in snowboarding are generally less severe and upper extremity fracture is more common among snowboarders than skiers.*

Source: Shorter NA, et al. Snowboarding injuries in children and adolescents. *Am J Emerg Med* 1999;17:261-263.

A recent paper from shorter and colleagues at Dartmouth-Hitchcock Medical Center adds to the growing body of literature detailing the range of injuries associated with snowboarding. Shorter et al extracted data retrospectively from the charts of admitted patients over a six-year period; the population (n = 27) included 13 patients presenting directly to Dartmouth-Hitchcock ED and 14 others received in transfer.

Most injuries resulted from falls, with at least 25% of injuries being a consequence of jumping; collisions did not generally result in serious injury. Head injury (12) and long bone fracture (12) were the most common types of injury; solid intra-abdominal organ injury (5) and vertebral fracture (3) followed. The head injuries were relatively minor (none required operative intervention), and 75% of the long bone fractures involved the upper extremity. Two of the three spinal fractures were lumbar burst fractures. Seven patients had multiple system injuries; there were no fatalities. Shorter et al proceeded to make comparisons to data published earlier by their group[1] detailing injuries of patients hospitalized after downhill skiing accidents. Comparisons of hospital costs and lengths-of-stay are not valid due to time differences in data collection, but injury profiles may be, although evolution in equipment technology could be a confounding variable. Noteworthy comparisons included the following: head injuries in snowboarding are generally less severe, and upper extremity fracture is more common among snowboarders than skiers (although the reader must recall that the population included only admitted patients in both studies).

COMMENT BY RICHARD A. HARRIGAN, MD, FACEP

This article appears nearly simultaneously with another describing spinal injuries in skiers and snowboarders.[2] Although both articles offer insight into the spectrum of injury associated with this emerging sport, both suffer from serious methodological flaws. The paper by Shorter and colleagues does serve to raise our awareness of intra-abdominal and spinal injuries, but the reported incidences of the various injuries are not reliable. For example, a patient could be admitted for a fractured vertebra, yet also have an upper extremity fracture. The latter injury would be included in the database, and yet the (perhaps) numerous cases with lone upper, or lower, extremity fractures discharged to home would be excluded due to study design.

The paper appearing in the *American Journal of Sports Medicine* on spinal injuries[2] found 34 spinal fractures in skiers and 22 in snowboarders (over two seasons); notably, jumping was again the primary mechanism of injury in snowboarders. The thoracolumbar spine was the predominant area of vertebral fracture. The flaw is the conclusion that the rate of spinal injuries is increased "fourfold" over that of skiers; the denominator is based on the estimate that 15% of users of the resort were snowboarders. This estimate is contrary to the referenced statement in the paper by Shorter et al that 25-75% of ski resort customers are now snowboarders. Incidence of disease should not be based on population estimates. ❖

References

1. Shorter NA, et al. Skiing injuries in children and adolescents. *J Trauma* 1996;40:997-1001.
2. Tarazi F, et al. Spinal injuries in skiers and snowboarders. *Am J Sports Med* 1999;27:177-180.

When Should Hamstring Injuries be Repaired?

ABSTRACT & COMMENTARY

Synopsis: *The vast majority of hamstring injuries are partial tears that do well with nonoperative management. However, patients with severe swelling, pain, and ecchymosis should be re-examined for a palpable defect proximally and profound weakness to resisted knee flexion. Ideally, complete ruptures should be repaired early to facilitate mobilization and accelerate rehabilitation.*

Source: Cross MJ, et al. Surgical repair of chronic complete hamstring tendon rupture in the adult patient. *Am J Sports Med* 1998;26(6):785-788.

Hamstring tears are one of the most common injuries faced by the sports medicine physician. The vast majority of hamstring injuries involve partial

tears. These respond to a conservative regimen of rest, stretching, ice followed by heat, and ultrasound, although symptoms may persist for several months and reinjury is common. A small percentage of athletes experience a complete tear of the hamstring tendons from the ischial tuberosity. The generalized swelling and discomfort that comes with an acute injury make the diagnosis, at first, quite difficult. However, as pain and swelling subside, a palpable defect is evident proximally.

Cross and colleagues encountered nine patients with complete hamstring ruptures over a 15-year period. Interestingly, five of the nine occurred in water skiing accidents, with the skier suffering an acute flexion of the hip while being pulled from the water with knees extended. Patients were referred an average of 36 months (range, 2-104 months) after injury because of persistent difficulty running, difficulty walking downhill, leg weakness, and intermittent sciatica despite extensive physical therapy. MRI was helpful to define the tear location if there was any doubt as to the diagnosis. Serous fluid collections were frequently noted.

Repair was performed through a midline approach with the patient prone. A careful neurolysis of extensive scar tissue around the sciatic nerve was necessary in all cases. The proximal end of the tendon was reapproximated to the cuff of tissue on the ischium at the location of the tear using #5 nonabsorbable sutures and suture anchors. Patients kept the knee flexed at 90° in a brace for eight weeks before initiating therapy, but they regained full extension by six more weeks in all cases.

At an average follow-up of four years (range, 6-156 months), all patients subjectively were improved and asymptomatic, with return to activities. All repairs were intact clinically. Strength and endurance testing for the repaired hamstrings were about 60% of the noninvolved side. Sciatic nerve symptoms resolved in all cases.

COMMENT BY DAVID R. DIDUCH, MS, MD

A complete rupture of the proximal attachment of the hamstring tendons is unusual. The vast majority of hamstring injuries are partial tears that do well with nonoperative management. However, patients with severe swelling, pain, and ecchymosis should be re-examined for a palpable defect proximally and profound weakness to resisted knee flexion.

Ideally, complete ruptures should be repaired early to facilitate mobilization and accelerate rehabilitation. Other studies in the literature are mainly case reports or focus on a few cases in the acute setting.[1] Surgical repair of an avulsed ischial apophysis in the skeletally immature patient has been shown to do well.[2] This study, however, is the first series of chronic, complete hamstring ruptures treated surgically. Although the series is small, Cross et al clearly demonstrate that clinical success is possible with repair even as late as 104 months after injury. Although patients still had measurable hamstring weakness after surgical treatment, they were all improved subjectively with resolution of preoperative symptoms, and all had returned to activities. ❖

References

1. Ishikawa K, et al. Avulsion of the hamstring muscles from the ischial tuberosity. *Clin Orthop* 1988;232: 153-155.
2. Wootton JR, et al. Avulsion of the ischial apophysis. The case for open reduction and internal fixation. *J Bone Joint Surg Br* 1990;72:625-627.

The Effect of Anterior Cruciate Ligament Trauma and Bracing on Knee Proprioception

ABSTRACT & COMMENTARY

Synopsis: *The use of braces or sleeves for cruciate-deficient knees is of questionable value, at least with respect to proprioceptive input.*

Source: Beynnon BD, et al. The effect of anterior cruciate ligament trauma and bracing on knee proprioception. *Am J Sports Med* 1999;27(2):150-155.

For several years, standard care for many clinicians regarding chronic cruciate-deficient knees has included the use of some type of neoprene sleeve and/or functional knee brace. The rationale for the use of these braces includes biomechanical and proprioceptive considerations. The main purposes of this study were to determine if wearing a neoprene sleeve or a functional knee brace makes a difference in proprioception and if a relationship exists between clinical measures of knee joint laxity (anterior-posterior knee laxity and pivot shift) and the individual's ability to detect passive knee motion (proprioception). There were 20 subjects—13 males and seven females. The mean age was 40 years (range, 26-53) and the average time from anterior cruciate ligament (ACL) disruption to study was 5.5 years. Inclusion in the study required a 3-mm difference (injured to uninjured knee) as measured on a KT-1000. The primary measure-

ments were passive knee motion and knee position as measured by their modification of an apparatus designed by Barrack et al.[1] The reliability of this method has been reported in a previous study. Passive knee flexion was measured on three separate occasions (three testing conditions): 1) ACL deficient and contralateral knee; 2) ACL deficient knee with brace and contralateral knee (the Bledsoe ACL knee brace was used); and 3) ACL deficient knee with sleeve (the Bledsoe Sport Max Brace was used). Analysis here included paired students' t-tests with Bonferroni correction done on the three. The KT-1000 measurement for anterior-posterior laxity was done at 133-N of anterior load. In addition, pivot shifts were measured clinically and graded from A to D, with A being normal stability and D representing gross instability.

Results indicated that there was a significant difference between the ACL deficient knee and the uninjured knee with respect to the threshold of detection of knee passive motion (proprioception), with the ACL deficient knee being "worse." This difference, while statistically significant, was only 0.28°. Neither bracing nor sleeve use significantly improved the individual's ability to detect passive motion.

COMMENT BY CLAYTON F. HOLMES, EdD, PT, ATC

As Beynnon and colleagues point out in their discussion, several studies have indicated a proprioceptive benefit from braces and sleeves with a variety of diagnoses. However, no one has looked at anterior cruciate deficient knees. In fact, the findings of this study seem to confirm that the use of braces or sleeves for cruciate deficient knees is of questionable value, at least with respect to proprioceptive input. With regard to braces, there is still the question of a biomechanical benefit; however, the evidence of such a benefit in my mind is at best contradictory. It is important to note that Beynnon et al did not establish reliability of the KT-1000 measures, obviously a crucial measure in the study, other than to say that all measures were done by the same orthopaedic surgeon. This fact notwithstanding, this study should create questions regarding the cost-benefit ratio, particularly of expensive functional braces. Perhaps the neoprene sleeves could remain a part of postinjury knee care because they are inexpensive. ❖

Reference

1. Barrack RL, et al. Proprioception in the anterior cruciate deficient knee. *Am J Sports Med* 1989;17:1-6.

Oral Creatine Supplementation: Separating Fact from Hype

ABSTRACT & COMMENTARY

Synopsis: *No evidence is given to support an ergogenic effect of creatine supplements in sporting activities such as running, swimming, or cycling. Potential complications are noted from the use of creatine as a dietary supplement.*

Source: Juhn MS. Oral creatine supplementation: Separating fact from hype. *Phys Sportsmed* 1999;27(5):47-50ff.

Juhn provides an excellent review of the current thinking with regard to use of oral creatine supplementation to enhance athletic performance. He notes the small number of good scientific articles that exist in the literature. While there is some evidence that these supplements can enhance performance in repeated short bursts of stationary cycling and weightlifting, there is no evidence to support an ergogenic effect on other sporting activities such as running, swimming, or even cycling on the road. He clearly identifies some potential complications from the use of creatine as a dietary supplement. It has been repeatedly shown that a modest weight gain occurs after the typical loading dose is taken over a five-day period and that this weight gain is probably due to water retention and not to an acute gain in muscle mass. Muscle cramping, gastrointestinal complaints, renal dysfunction, and dehydration all have been reported as complications of the use of creatine. The weight gain due to water retention may decrease performance, offsetting any potential ergogenic effect of the creatine. Juhn concludes this excellent review by stating, "…the evidence that creatine improves running and swimming performance is

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not convincing…[and]…creatine has not been shown to be ergogenic outside the laboratory setting."

COMMENT BY JAMES D. HECKMAN, MD

This is an excellent review of a controversial subject. The enthusiastic endorsement of creatine dietary supplements by celebrity athletes has led to their common consumption among athletes at all levels. Juhn provides a comprehensive list of references that will facilitate anyone's study of this subject. The actual number of well-performed clinical studies on the effect of oral creatine supplementation is quite sparse, and little is known about the specific ergogenic mechanisms if, indeed, they do exist. Juhn clearly points out that there have been no studies performed in the pediatric population with regard to the effect of creatine oral supplementation. Yet, young athletes may be more susceptible to the influence of the advertising campaigns and take the supplement despite the fact that there is little or no evidence that it can be helpful. This is an article that should be read by all trainers and sports medicine physicians who wish to be informed about the benefits and effects of creatine in their athletes. ❖

CME Questions

40. The rotator interval contains the:
a. infraspinatus tendon.
b. superior glenohumeral ligament.
c. inferior glenohumeral ligament.
d. glenoid labrum.

41. The osseous structure that is the most relevant in producing the classic shoulder impingement syndrome is the:
a. lateral acromium.
b. anterior acromium.
c. acromioclavicular joint.
d. greater tuberosity.

42. An appropriate technique used to treat less than 2 cm hyalin cartilage defects in the knees of young athletic individuals is:
a. chondrocyte transplantation.
b. abrasion and drilling.
c. abrasion, drilling followed by "pasting" the area with autologous, morelized hyaline cartilage.
d. autologous bone plugs.
e. All of the above

43. Snowboarding injuries found in admitted patients appear to
a. be frequently fatal.
b. more frequently involve the lower extremity than the upper extremity.
c. be more commonly associated with collision rather than with falling.
d. frequently include head injuries requiring nonoperative management.

44. Complete hamstring avulsion injuries from the ischial tuberosity:
a. are usually asymptomatic after the acute injury symptoms subside.
b. may be healed effectively by surgical repair even many months after injury.
c. usually heal without residual weakness of knee flexion.
d. are often associated with avulsion of the sciatic nerve.

45. Commonly seen overuse injuries in youth sports include:
a. ACL tears, growth plate fractures, and ankle sprains.
b. cervical spine injuries, patella pain, and ankle sprains.
c. patella pain, Achilles tendonitis, and Osgood-Schlatter's disease.
d. ankle sprains, Salter fracture, and patella pain.

46. Any ergogenic benefit of oral creatine supplementation in running or swimming may be offset by:
a. obligatory weight gain.
b. decrease in alkaline phosphatase.
c. creatine phosphokinase inhibition.
d. alteration in the performance of fast twitch muscle fibers.

Introducing Psychiatric Medicine in Primary Care

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